



Aristotle University of Thessaloniki
Faculty of Agriculture, Forestry and Natural Environment
School of Agriculture
Laboratory of Food Microbiology and Hygiene



Effect of hyper-gravity on microbial heat resistance and motility

Z. Aspridou, M. Kakagianni, D. Dimakopoulou-Papazoglou, K. Koutsoumanis

1st Symposium on Space Educational Activities
9-12 December, Padova

Effect of hyper-gravity on microbial heat resistance and motility



“Spin Your Thesis 2015”
ESA campaign

Microbiology and
Hygiene Team (MAH)



Effect of hyper-gravity on microbial heat resistance and motility



Aristotle University of Thessaloniki



Dep. Food Science and Technology



Lab. Food Microbiology and Hygiene

Effect of hyper-gravity on microbial heat resistance and motility

Microbiology and Hygiene Team (MAH)

Scientific Interests

- Microbiological quality and safety of fresh and processed food products
- Predictive microbiology
- Quantitative microbial risk assessment



Hyper -gravity



MAH team proposal

Effect of hyper-gravity on microbial heat resistance and motility

The **effect of hyper-gravity** on

- i) the **heat resistance** of **vegetative mesophilic** cells and **spores of thermophilic** bacteria and
- ii) the microbial **swimming motility**

Microbial resistance

- Heat
- D value
- Microorganism specific

Microbial swimming motility

- Microorganism specific
- Microscopic examination
- Various types of motility

- Invasion and virulence of the pathogens
- Sensitivity to other stresses
- Biofilm formation
- Cross protection phenomena

- Dispersal and colonization of niches
- Competition phenomena
- Virulence factor
- Biofilm formation

Effect of hyper-gravity on microbial heat resistance and motility

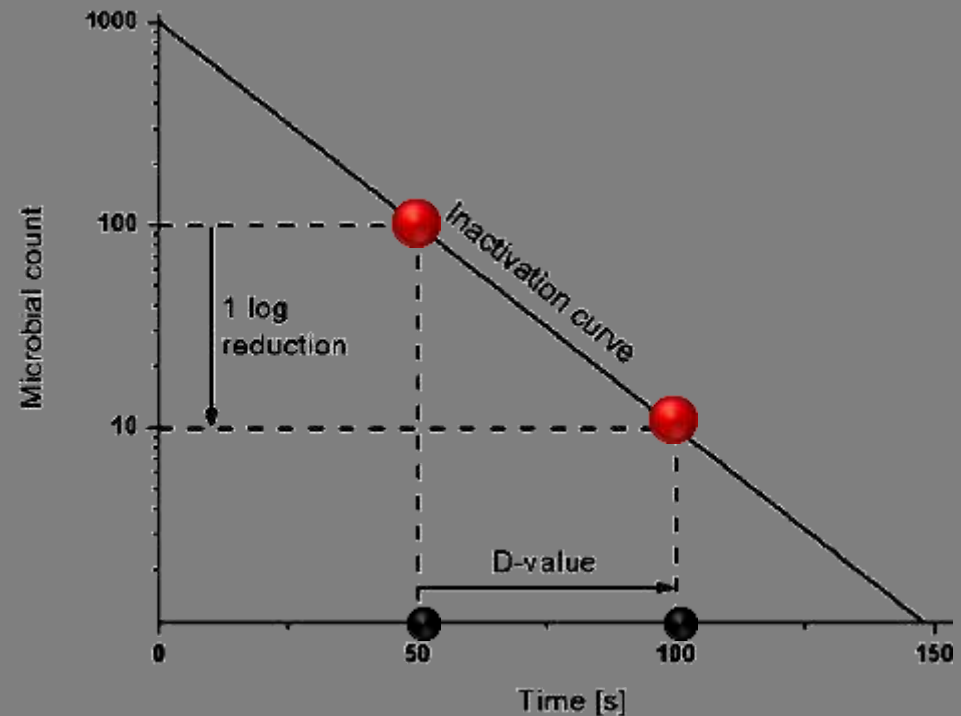
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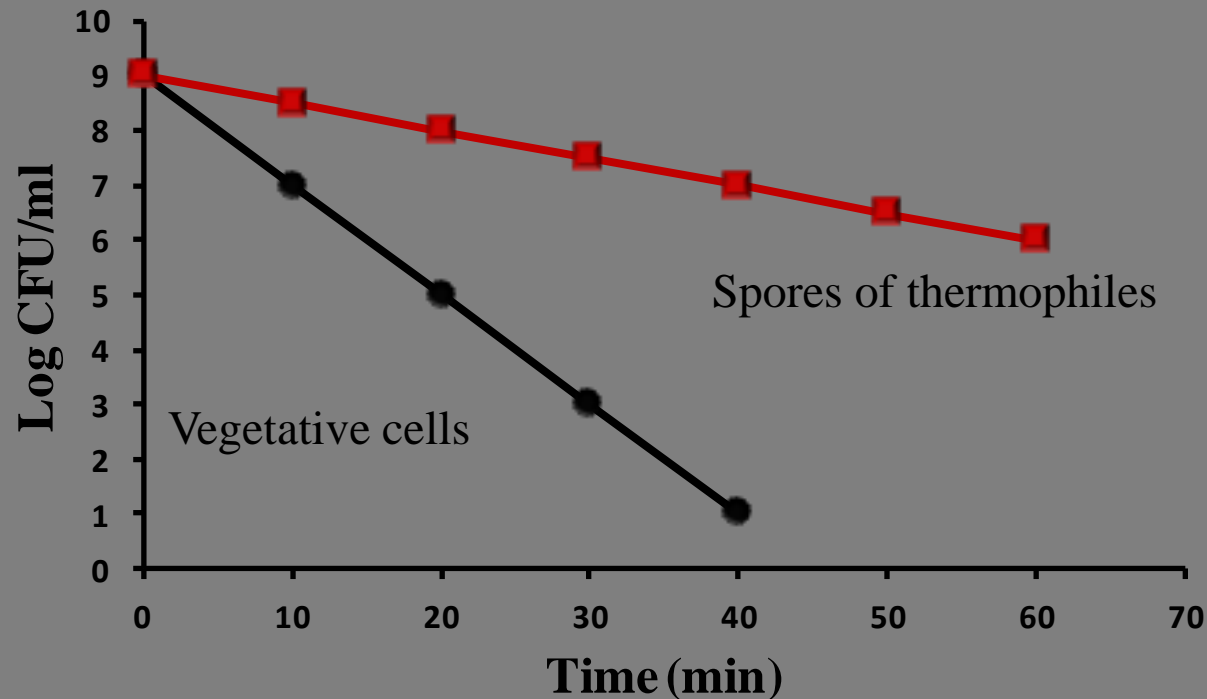
$$D = t / (\log N_0 - \log N_t)$$



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Microbial swimming motility

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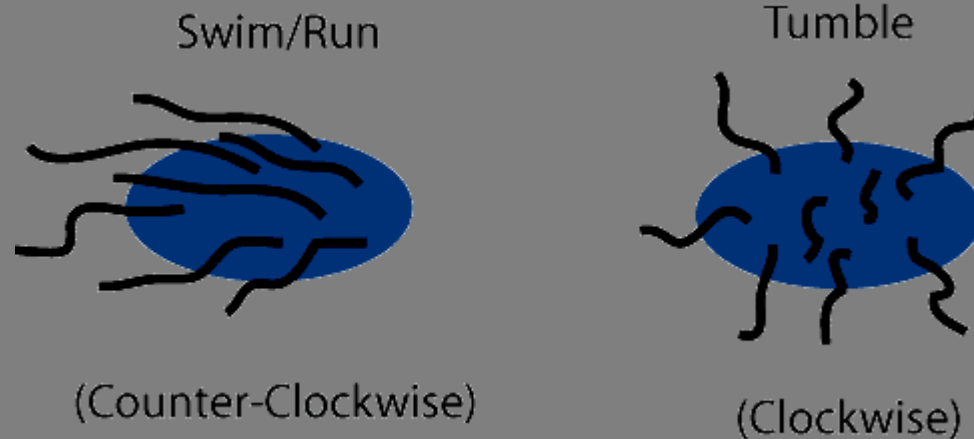


- Dispersal and colonization of niches
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Effect of hyper-gravity on microbial heat resistance and motility

Objective 1: Heat resistance

- ✓ *Salmonella enterica* ser. Agona
- ✓ *Geobacillus stearothermophilus*



Type of microorganism	Temperature	Gravity
Mesophilic (planktonic)	57 and 65°C	10xg, 20xg
Thermophilic (spores)	121 °C	20xg

Survival data

Initial population: N_0

Final population: N_{residual}

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Objective 2: **Motility**

✓ *Pseudomonas fluorescens*



Type of microorganism	Temperature	Gravity
Mesophilic (planktonic)	ambient	1-20xg

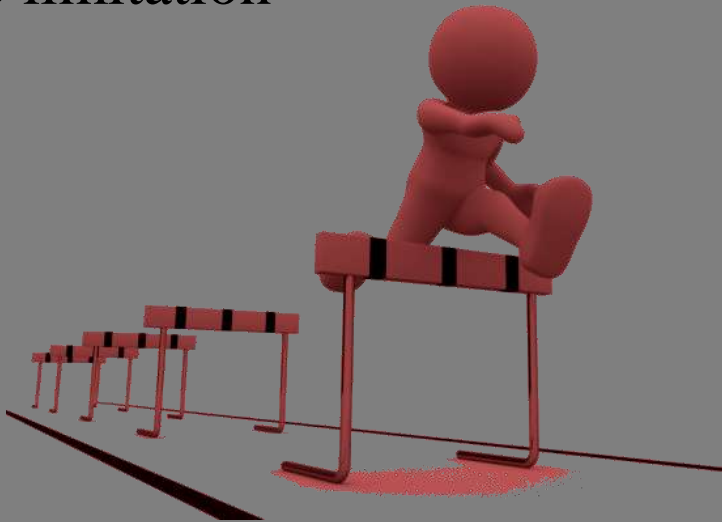
Time lapse videos

Cells' speed, displacement distributions

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Objective 1

Need for consumables
Shipment
Proper storage
Need for equipment
Time limitation



- ✓ Organization
- ✓ Collaboration

Objective 2

Experimental set up
Check of the system functionality
Sample preparation inoculum and integrity
Time limitation

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Objective 1: Heat resistance



Difference in the survival under various g levels

Different behavior of the survivors

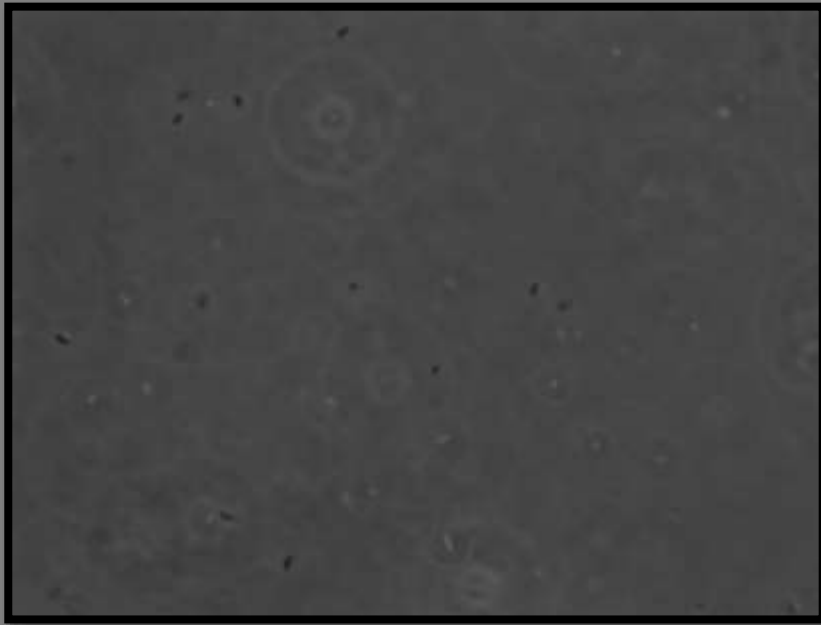
Sequential exposure - Gravity to Heat stress



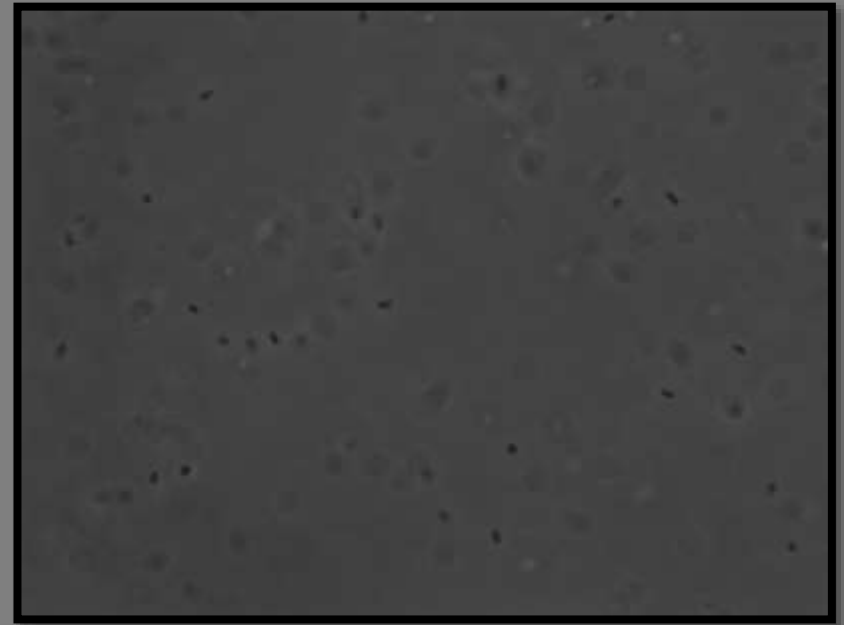
Low to moderate hyper-gravity levels as a **stress**

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Objective 2: Motility



1g



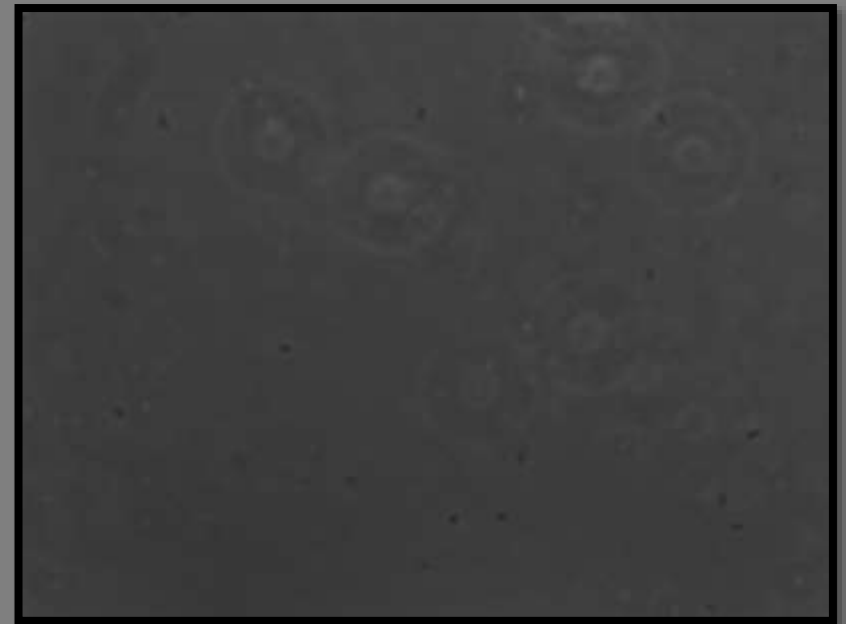
2g

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Objective 2: Motility



8g



2g sequential

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Objective 2: Motility

- ✓ Speed
- ✓ Direction
- ✓ Step



- ✓ Tumbling
- ✓ Runs
- ✓ Energy

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Effect of hyper-gravity on microbial heat resistance and motility

Low to moderate levels of hyper-gravity

- Stress for the microorganisms
- Microbial response mechanisms
- Microbial energy



- Explanation of microbial behavior
- Design new processes (Disinfection)
- Selection of microorganisms-
Technological and functional properties
- Terrestrial and extraterrestrial application

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MAH Team – Spin Your Thesis 2015

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Acknowledgements

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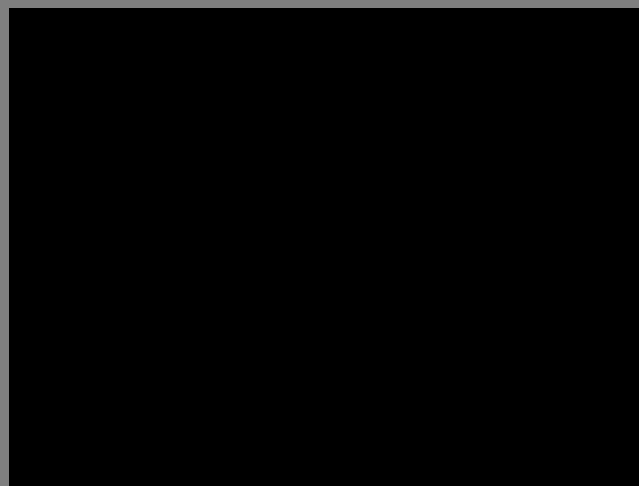
Members of the **ESA LDC** and **LIS laboratory** for their help



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Thank you for your attention

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