

Multiscale description of biofilms

Outreach and Closure event of the NILS Science and Sustainability Programme

May 26th 2016



Institutions



HÁSKÓLI ÍSLANDS



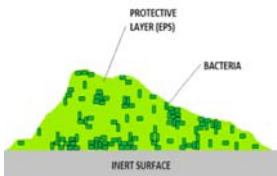
UNIVERSIDAD COMPLUTENSE
MADRID

Researchers

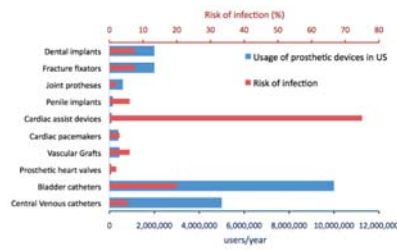
Björn Birnir, University of Iceland
Baldvin Einarsson, University of Iceland (now Air Worldwide)

Ana Carpio, Universidad Complutense
David Rodríguez, Universidad Complutense (now National Center of Biotechnology – CSIC)
Perfecto Vidal, Universidad Complutense

What are biofilms?



Proc Nat Acad Sc 110, 4345, 2013



Expert Rev Pharmacoecon Outcomes Res. 9, 417, 2009

- Biofilms are bacterial communities anchored on surfaces and enveloped in a self-produced polymeric matrix that shelters them from antibiotics and disinfectants.
- The majority of HAI (hospital acquired infections) and deaths by septicaemia are caused by biofilms installed in medical equipment, implants, prostheses and ventilation systems.

Project Goals

Mathematical modeling of the evolution of biofilms

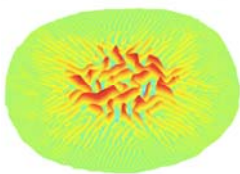
Calibration to clinical data

Numerical simulation

Environmental influence and controlling parameters

Results

- Model to quantify antibiotic effects on *P. Aeruginosa* biofilms
- Mathematical basis to understand the spread of wrinkled *B. Subtilis* biofilms on air/agar interfaces
- Computer reproduction of *P. Aeruginosa* biofilm filaments in curved microchannels



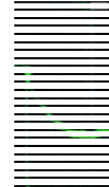
Phys Rev 2015



Wilking et al, MRS 2011



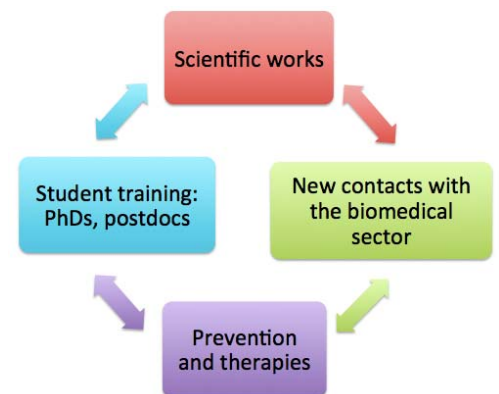
Procs ECMI 2014



R. Rusconi et al,
J. R. Soc. Interface 2010

- 'A Dynamic Energy Budget model for antibiotic effects on biofilms', Birnir, Carpio, Cebrián, Vidal, preprint, 2016
- 'Differential growth of wrinkled biofilms', Rodríguez, Carpio, Einarsson, Phys Rev E 91, 022710, 2015
- 'Dynamics of bacterial aggregates in microflow's, Carpio, Einarsson, Rodríguez, in Progress in Industrial Mathematics at ECMI 2014, Springer, to appear, sequel to 'Biofilm growth on rugose surfaces', Rodríguez, Einarsson, Carpio, Phys Rev E 86, 061914, 2012, financed by a previous NILS grant

Benefits



Future perspectives

- Collaboration to develop a branch on Applied Mathematics in the University of Iceland (summer courses)
- Involvement of both parties in ITN Marie Curie proposals
- Pursuit of current research within Spanish MINECO grant MTM2014-56948-C2-1-P

Acknowledgements

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