SEVENTH WORKSHOP DYNAMICAL SYSTEMS APPLIED TO BIOLOGY AND NATURAL SCIENCES

BOOK OF ABSTRACTS

ESCOLA DE CIÊNCIAS E TECNOLOGIA, UNIVERSIDADE DE ÉVORA, PORTUGAL

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The Seventh Workshop DSABNS was held at Escola de Ciências e Tecnologia of Évora University in Portugal, from February 2 to 5, 2016.

The workshop has both theoretical methods and practical applications and the abstracts included in the program cover research topics in population dynamics, eco-epidemiology, epidemiology of infectious diseases, molecular and antigenic evolution and methodical topics in the natural sciences and mathematics.

Workshop Organizers:

Maíra Aguiar, UL; Russell Alpízar-Jara, UE; Carlos Braumann, UE; Fabio Chalub, UNL; Peyman Ghaffari, UL; Bob Kooi, VU; Luis Mateus, UL; Paula Rodrigues, UNL; Nico Stollenwerk, UL; Ezio Venturino, TU

UL: Universidade de Lisboa, Lisboa, Portugal; UE: Universidade de Évora, Évora, Portugal; VU: Vrije Universiteit Amsterdam, The Netherlands; TU: Turin University, Turin, Italy

Sponsors:

The organizers are grateful for the sponsorship and support of the Universidade de Évora and its Escola de Ciências e Tecnologia, who have hosted the Workshop, to the participant research centers CMAF-CIO (Universidade de Lisboa), CIMA (Universidade de Évora), CMA (Universidade Nova de Lisboa, NovaID) and to CIM (Centro Internacional de Matemática). They also gratefully acknowledge Fundação para a Ciência e a Tecnologia (FCT, under the FACC program), European Union FP7 program (under the DENFREE project) and Câmara Municipal de Évora and its Tourist Office for their support.

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SCIENTIFIC PROGRAM

Escola de Ciências e Tecnologia, Universidade de Évora, Portugal

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SEVENTH WORKSHOP

"DYNAMICAL SYSTEMS APPLIED TO **BIOLOGY AND NATURAL SCIENCES"**

2-5 FEBRUARY 2016

CIMA | ÉVORA UNIVERSITY

PROGRAM

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CMAF-CIO|LISBON UNIVERSITY CIMA|ÉVORA UNIVERSITY CMA|NOVA UNIVERSITY

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C Sergei Petrovskii	16:20 - 16:50		Avant-garde mosquito repellent Technologies based on nano- technology and micro capsules in combating vector-borne diseases	Peter Mpasho Mwamtobe	Mathematical analysis of a lymphatic filariasis model with quarantine and treatment	Anuj Kumar	Role of optimal screening and treatment on infectious diseases
C Sergei Petrovskii	16:50 - 17:20			Coffee	Coffee Break		
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	17:20 - 18:10		Statistical mechanics of individual an imal movement				
18:10 - 18:20 Closing	18:10 - 18:20		D	closing			DSABNSZU16

PULMONARY TRANSPORT AND DEPOSITION OF INHALED PARTICLES

Antonio F. Miguel

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ABSTRACT

Breathing is the way that the respiratory tree interacts with the outside environment. The large surface area of tree available for gas exchange is also exposed to particles suspended in the inhaled air. A two-fold justification exists for studying particle transport and deposition in the respiratory tree [1,2]: *(i)* Assessment of the health hazards of particles (some viral infections such as influenza, pneumonia, involve the upper airways; inhalation anthrax (spores of the bacteria *Bacillus anthracis*) is considered to be the deadliest form of anthrax); *(ii)* Improvement of drug delivery (Pharmaceutical inhalation particles play a vital role in the health and well-being because are the best first-line therapy for asthma and chronic obstructive diseases. Inhalation route drug delivery for the treatment of systemic diseases, such as diabetes mellitus, is also a good option).

Knowledge of particle transport and deposition in the respiratory tree and the sites, where particles of different sizes deposit, is essential to understanding subsequent biological response [3]. Here a 3D computational simulation is used to examine particle transport and deposition in the bronchial tree. A four-generation bifurcation (Weibel model [1]) is considered. At each generation, the branching is dichotomous, and obey to the relationship known in physiology as the Hess-Murray law [4]. This study offers a spatial accurate

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analysis that gives us insight into the particle dynamics under steady and pulsatile flow fields. Among the results obtained in this study, Figure 1 highlights the dependence of particle deposition with respect to the Stokes number and to the Reynolds number (breathing frequency 14/min).

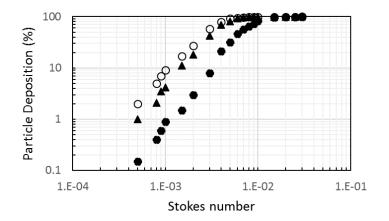


Figure 1. Particle deposition versus the Stokes number and to the Reynolds number (\bullet Re=2000 \blacktriangle Re=750 o Re=550)

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