

Program

Computational Fluid Dynamics (CFD) in Medicine and Biology II

August 30-September 4, 2015
Albufeira, Portugal

Conference Chair

Prof. Josué Sznitman
Israel Institute of Technology
Israel

Conference Co-Chairs

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Erasmus University Medical Center
The Netherlands

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USA

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University of Toronto
Canada



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Previous conference in this series:

***Computational Fluid Dynamics (CFD) in Medicine and Biology
in conjunction with the
Seventh International Biofluid Mechanics Symposium***

March 25 – 30, 2012

Crowne Plaza Dead Sea, Ein Bokek, Dead Sea, Israel

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Sunday, August 30, 2015

16:00 - 18:00	Conference check-in
18:00 - 19:00	<u>Plenary I:</u> Integrated computational biomechanics of the flow phenomena in the living body Takami Yamaguchi, Tohoku University, Japan
19:00 - 20:00	Welcome Reception
20:00 - 22:00	Dinner

NOTES

- Technical Sessions will be held in Sala Grande Real.
- Poster Sessions will be held in Grande Real Foyer.
- Most meals will be in the Restaurante do Real. Changes will be announced.
- The conference banquet on Thursday will be held in the Restaurante Santa Eulalia.
- Audiotaping, videotaping and photography of presentations are prohibited.
- Speakers – Please leave at least 5 minutes for questions and discussion.
- Please do not smoke at any conference functions.
- Turn your cellular telephones to vibrate or off during technical sessions.
- After the conference, ECI will send an updated participant list to all participants. Please check your listing now and if it needs updating, you may correct it at any time by logging into your ECI account.
- Please do not smoke at any conference functions.
- Please write your name in the front of this program booklet so it can be returned if misplaced.

Monday, August 31, 2015

07:30 - 09:00 Breakfast

09:00 - 09:15

Opening Remarks

Josué Sznitman, Israel Institute of Technology, Israel
Beth Junker, ECI Liaison, USA

Session 1: Aneurysms

Session Chair: David Steinman, University of Toronto, Canada

09:15 - 09:35

Identifying effective metrics to quantify CFD simulations of blood flow in intracranial aneurysms

Madhavan L. Raghavan, University of Iowa, USA

09:35 - 09:55

Intracranial aneurysm vulnerability index by simulation and medical imaging

Franck Nicoud, University of Montpellier, France

09:55 - 10:15

On the assumption of laminar flow in the cerebrovasculature: Implications for CFD insights into aneurysm initiation and rupture

Kristian Valen-Sendstad, Simula, Norway

10:15 - 10:35

A semi-automated method for computational modeling of intracranial aneurysm hemodynamics

Jung-Hee Seo, Johns Hopkins University, USA

10:35 - 11:05

Coffee break and networking

11:05 - 11:25

Clinical application of CFD simulations in treatment of cerebral aneurysms

Kenichi Kono, Showa University Fujigaoka Hospital, Japan

11:25 - 11:45

Evaluation of hemodynamic changes after virtual flow diverter treatment with a dedicated prototype system

Christof Karmonik, Houston Methodist Research Institute, USA

11:45 - 12:05

The 2015 Aneurysm CFD challenge, preliminary results: Is CFD ready for clinical use?

Kenichi Kono, Showa University Fujigaoka Hospital, Japan
Kristian Valen-Sendstad, Simula, Norway

Monday, August 31, 2015 (continued)

Session 2: Respiratory I

Session Chair: Josué Sznitman, Israel Institute of Technology

- 12:05 - 12:25 **The mechanics of surfactant replacement therapy in newborns and adults**
Marcel Filoche, Ecole Polytechnique, France
- 12:25 - 12:45 **Advanced CFD Studies of aerosol deposition in the human airways**
Stavros Kassinos, University of Cyprus, Cyprus
- 12:45 - 13:05 **Aerosol therapeutic delivery through the lung: Deposition predictions with multi-domain in silico models**
Jessica Oakes, University of California Berkeley, USA

13:05 - 14:45 Lunch

Session 2: Respiratory I (continued)

Session Chair: Josué Sznitman, Israel Institute of Technology

- 15:00 - 15:20 **Acoustic probing of the lung in acute lung injury**
Noam Gavriely, Technion, Israel
- 15:20 - 15:40 **Mechanisms of ultrasound quantification of pulmonary edema**
Joseph L. Bull, University of Michigan, USA
- 15:40 - 16:00 **A fully resolved volumetrically constrained fluid-structure interaction model of the human respiratory system**
Christian J. Roth, Institute for Computational Mechanics, Technical University of Munich, Germany

16:00 - 16:30 Coffee break and networking

Session 3: Fluid-Structure Interactions and Multiphysics

Session Chair: Rajat Mittal, Johns Hopkins University

- 16:30 - 16:50 **Continuum modeling of rheology and aggregation of red blood cells**
Daegeun Yoon, POSTECH, South Korea
- 16:50 - 17:10 **Progress toward experimentally validated immersed boundary models for cardiovascular device design applications**
Boyce E. Griffith, University of North Carolina at Chapel Hill, USA
- 17:10 - 17:25 Short break
- 17:25 - 17:45 **A coupled chemo-fluidic model for the prediction of left ventricle thrombus risk**
Rajat Mittal, Johns Hopkins University, USA

Monday, August 31, 2015 (continued)

- | | |
|---------------|---|
| 17:45 - 18:05 | Windkessel optimization in STAR-CCM+ using the SHERPA algorithm
Alistair Brown, CD-Adapco, United Kingdom |
| 18:05 - 18:25 | Fluid-structure interaction models of aortic coarctation and repair:
Lessons to be learned for hemodynamic analysis
Patrick Segers, Ghent University, Belgium |
| 19:00 - 20:30 | Dinner |
| 20:30 - 21:30 | Poster Session and Social Hour |

Tuesday, September 1, 2015

07:30 - 09:00 Breakfast

Plenary II:

09:00 - 10:00 **Brain transport phenomena, the glymphatic system and multicompartamental poroelasticity**
Yiannis Ventikos, University College London, United Kingdom

Session 4: Respiratory II

Session Chair: Stavros Kassinos, University of Cyprus

10:00 - 10:20 **Flow characteristics of the upper human lung airways**
Katrin Bauer, TU-Bergakademie Freiberg, Germany

10:20 - 10:40 **Unsteady diffusional screening in 3D pulmonary acinar structures**
Philipp Hofemeier, Technion - Israel Institute of Technology, Israel

10:40 - 11:00 **Validation of mono-disperse glycerin-based aerosol deposition simulation in a realistic cast of human respiratory tract**
Markus Nordlund, Philip Morris International R&D, Switzerland

11:00 - 11:30 Coffee break and networking

11:30 - 11:50 **Multi-scale model of liquid obstruction formation and clearance in the lung**
Jason Ryans, Tulane University, USA

11:50 - 12:10 **Gas flows in micro channels: A study inspired by insect respiratory systems**
Annie Staples, Virginia Tech, USA

12:10 - 12:30 **Airflow dynamics in tracheas with compressive goitres**
Alister J. Bates, Imperial College London, United Kingdom

12:30 Box Lunch - Optional Tour

19:00 Dinner on own

Wednesday, September 2, 2015

07:30 - 09:00 Breakfast

Session 5: Cardiovascular Devices

Session Chair: Alison Marsden, University of California San Diego, USA

09:20 - 09:40 **In silico and in vitro simulations of a novel surgical approach for first-stage single ventricle heart palliation**
Richard Figliola, Clemson University, USA

09:40 - 10:00 **Patient-specific computational fluid dynamic simulation of intraventricular hemodynamics: introducing mitral valve motion as prescribed boundary condition**
Alessandra Maria Bavo, Ghent University, Belgium

10:00 - 10:20 **Patient-specific virtual stenting in coronary bifurcations: From medical images to fluid dynamics**
Francesco Migliavacca, Laboratory of Biological Structure Mechanics, Politecnico di Milano, Italy

10:20 - 10:50 Coffee break and networking

10:50 - 11:10 **Hemodynamic characterization of aneurysmal geometry effects on endovascular treatment outcomes**
Priya Nair, Arizona State University, USA

11:10 - 11:30 **A clinical method to quantify blood stasis in the left ventricle**
Pablo Martinez-Legazpi, UCSD, USA

11:30 - 11:50 **Influence of distal angle and side branch stenosis on the fractional flow reserve in coronary artery bifurcations: a computational fluid dynamics study**
Jolanda J. Wentzel, ErasmusMC, Netherlands

Session 6: Multiscale Modeling

Session Chair: Alison Marsden, University of California San Diego, USA

11:50 - 12:10 **Strategies for cardiovascular and respiratory multiscale modeling parametrization**
Irene E. Vignon-Clementel, INRIA, France

12:30 - 14:30 Lunch

Wednesday, September 2, 2015 (continued)

Session 7: Multiscale Modeling (continued)

Session Chair: Alison Marsden, University of California San Diego, USA

- 14:30 - 14:50 **Multi-scale modeling of deformable platelets and fibrin networks**
Mark Alber, University of Notre Dame, USA
- 14:50 - 15:10 **A patient-specific multi-scale surgical planning framework to assess exercise physiology of fontan patients**
Zhenglun Wei, Georgia Institute of Technology, USA
- 15:10 - 15:30 **On pressure-flow condensation in cardiovascular modeling**
Daniele E. Schiavazzi, University of California, San Diego, USA

15:30 - 16:00 Coffee break

Session 8: Microfluidic Applications in Cell Mechanics and Mechanobiology

Session Chair: C.T. Lim, National University of Singapore, Singapore

- 16:00 - 16:20 **Separation of motile bacteria using drift force near a wall**
Takuji Ishikawa, Tohoku University, Japan
- 16:20 - 16:40 **Single circulating tumor cell protease activity assay through jetting microfluidics**
Chia-Hung Chen, National University of Singapore, Singapore
- 16:40 - 17:00 **Microfluidic devices for mechanical characterization of circulating cells**
Jaap den Toonder, Eindhoven University of Technology, Netherlands
- 17:00 - 17:15 Short break
- 17:15 - 17:35 **Real-time deformability cytometry: On-the fly mechanical phenotyping for label-free functional cell assays**
Oliver Otto, Technical University of Dresden, Germany
- 17:35 - 17:55 **Two-dimensional transient model for prediction of NO/O₂ diffusion in an arteriole: Aggregation effect**
Sangho Kim, National University of Singapore, Singapore
- 17:55 - 18:15 **Cell mechanics based microfluidics for cancer diagnosis**
Chwee Teck Lim, National University of Singapore, Singapore
- 18:15 - 18:35 **A CFD-enhanced nonlinear theoretical model for the capturing of circulating tumor cells in microfiltration chips**
Yi-Kuen Lee, Hong Kong University of Science and Technology, Hong Kong

Wednesday, September 2, 2015 (continued)

19:00 - 20:30

Dinner

20:30 - 21:30

Poster Session and Social Hour

Thursday, September 3, 2015

07:30 - 09:00 Breakfast

Session 9: Atherosclerosis

Session Chair: Frank Gijsen, Erasmus University Medical Center

09:20 – 09:40 **Direct numerical simulations unfold fluctuations in the cerebrospinal fluid hydrodynamics in Chiari I malformation**
Kartik Jain, University of Siegen, Germany

09:40 – 10:00 **Brain water transport and astrocyte networks**
Vartan Kurtcuoglu, University of Zurich, Switzerland

10:00 - 10:20 **Functional and anatomical measures for outflow boundary conditions in atherosclerotic coronary bifurcations**
Frank Gijsen, Erasmus University Medical Center, Netherlands

10:20 - 10:40 **Image-based non- and minimally-invasive physiological and haemodynamic characterization for diagnosis and follow up**
David R. Hose, University of Sheffield, United Kingdom

10:40 - 11:10 Coffee break and networking

11:10 - 11:30 **Hemodynamic assessment of the carotid bifurcation in an atherosclerotic mouse model using FSI simulations**
David De Wilde, Ghent University, Belgium

11:30 - 11:50 **Phenotypic differences in human coronary artery disease progression and dependence on a focal oscillatory hemodynamic environment**
Lucas H. Timmins, Georgia Institute of Technology, USA

11:50 - 12:10 **A novel method to study permeability of endothelium chronically exposed to different shear stresses in vitro**
Peter D. Weinberg, Imperial College London, United Kingdom

12:10 - 13:40 Lunch

Session 10: Micro- and Macro-Locomotion

Session Chair: Takuji Ishikawa, Tohoku University, Japan

13:40 - 14:00 **Trypanosomes complex cell design and deadly swim**
Davod Alizadehrad, Institute of Theoretical Physics, Technical University of Berlin, Germany

14:00 - 14:20 **Simulations of a swimming microorganism near an fluid-air or an fluid-solid interface**
Junichi Manabe, Tohoku University, Japan

Thursday, September 3, 2015 (continued)

- 14:20 - 14:40 **Modeling mechanical behavior of precession of bacterial flagella**
Yuji Shimogonya, Tohoku University, Japan
- 14:40 - 15:00 **Computational haemodynamics of small vessels using a stabilized implicit formulation of the moving particle semi-implicit (MPS) method**
Alberto Gambaruto, Barcelona Supercomputing Center, Spain
- 15:00 - 15:30 Coffee break and networking
- 15:30 - 15:50 **A simulation study of hydrodynamic sperm rheotaxis**
Kenta Ishimoto, Kyoto University, Japan
- 16:50 – 16:10 **Simulating the hydrodynamics of bacterial swimming in confined geometries**
Eamonn Andrew Gaffney, University of Oxford, United Kingdom
- 16:10 - 16:30 **Swimming of a spermatozoon in shear flow near non-slip boundary**
Toshihiro Omori, Tohoku University, Japan
- 16:30 - 16:50 **Computational analysis of lymphatic valves**
Raoul van Loon, Swansea University, United Kingdom
- 16:50 - 17:05 Short break

Session 11: Reproductive Flows

Session Chair: Megan Leftwich, The George Washington University

- 17:05 - 17:25 **Investigations of spermatozoon flagellum structural mechanics and energetics**
Eamonn A. Gaffney, Mathematical Institute, University of Oxford, UK and Centre for Human Reproductive Science, University of Birmingham, UK
- 17:25 - 17:45 **Sperm progression - biochemical signals and fluid flow**
Sarah D. Olson, Worcester Polytechnic Institute, USA
- 17:45 - 18:05 **Simplified fluid dynamic models for human birth**
Megan Leftwich, The George Washington University, USA
- 19:00 - 21:30 Banquet

Friday, September 4, 2015

07:30 - 09:00 Breakfast

12:00 Lunch and departures

Poster List

1. **Numerical modeling of flow-diverter stents in cerebral aneurysms**
Augusto Fava Sanches, University of Heidelberg, Germany
2. **Large-eddy simulation of three-dimensional vortex structures and micro-particle transport and deposition in an idealized mouth-throat model**
Ali Farnoud, University of Heidelberg, Germany
3. **Transport and deposition of anisotropic aerosols in pulmonary acinar shear flows**
Yan Ostrovski, Technion - Israel Institute of Technology, Israel
4. **Enhancing pulmonary acinar deposition using magnetic particles: Insight from CFD simulations**
Yan Ostrovski, Technion - Israel Institute of Technology, Israel
5. **A macroscopic model to study mucociliary clearance in complex geometries: Predicting optimal ciliary forcing patterns**
Michail Manolidis, University of Michigan, USA
6. **Aerosols in healthy and emphysematous in silico acinar models**
Jessica Oakes, University of California Berkeley, USA
7. **Respiratory therapies of the developing lungs: Inhaled aerosols delivery during early childhood**
Janna Tenenbaum-Katan, Technion - Israel Institute of Technology, Israel
8. **Wave propagation-based cardiovascular monitoring and assessment**
Nikos Stergiopoulos. EPFL, Switzerland
9. **Morphometry and hemodynamics of porcine coronary venous tree**
Hao Wu, Peking University, China
10. **Hemodynamic analysis of patient-specific internal mammary artery bypass grafts**
Tingting Fan, Peking University, China
11. **Hemodynamic analysis of patient-specific vertebro-basilar junction and basilar bifurcations**
Yundi Feng, Peking University, China
12. **Hemodynamics at different stages of patient-specific stenotic carotid artery bifurcation**
Yunlong Huo, Peking University, China
13. **Biomedical microfluidic devices by using low cost fabrication techniques: A review**
Alberto Gambaruto, Minho University, United Kingdom
14. **Uncertainty quantification of boundary conditions for CFD simulations of a rabbit aorta**
Michael McElroy, Manchester Metropolitan University, United Kingdom

15. **The parametric study of a spiral-inducing bypass graft using computational fluid dynamics**
Michael McElroy, Manchester Metropolitan University, United Kingdom
16. **A numerical model for inert gas transport in the lung based on a fractal airway morphology**
David Hasler, University of Bern, ARTORG Center, Switzerland
17. **Interventional planning and outcome prediction for arteriovenous malformation therapy**
Sabrina Frey, University of Bern, Switzerland
18. **On transitional flow in intracranial aneurysms - critical Re, cyclic variations, vasculature and aneurysm morphology**
Kartik Jain, University of Siegen, Germany
19. **On the data assimilation problem in blood flow simulations**
Telma Guerra Santos, CEMAT, IST- University Lisbon, Portugal
20. **An assessment of 3D ultra-sound derived geometry versus computerized tomography techniques for abdominal aortic aneurysms**
Benjamin Owen, The University of Manchester, United Kingdom
21. **Assessment of the mixing performance of a biomimetic micromixer using the lattice Boltzmann-immersed boundary method**
Joseph M. O'Connor, University of Manchester, United Kingdom
22. **Automated microfluidic optimization to reduce blood cell activation**
Giulia Mazza, Danube University Krems, Austria
23. **Blood perfusion in microfluidic models of pulmonary capillary networks**
Hagit Stauber, Technion-Israel Institute of Technology, Israel
24. **Patient-specific planning for cerebral aneurysm treatment using CFD with finite element endovascular device models**
Priya Nair, Arizona State University, USA
25. **Process of cell-free layer formation after arteriolar bifurcation and its effect on NO/O₂ diffusion**
Yan Cheng Ng, National University of Singapore, Singapore
26. **Particle-based simulation study of red blood cell flow in capillary bifurcations using open inflow/outflow boundary conditions**
Kirill Lykov, University of Lugano, Switzerland
27. **4D phase contrast MRI derived hemodynamics of the rabbit aortic arch**
Lucas Timmins, Georgia Institute of Technology, USA