



Online Workshop

## Mathematical modelling in biomedicine

October 25-29, 2021 (Moscow time zone, GMT+3)

### October 25

9.45-10.00 Opening

**Plenary lecture:** (Chairman: V. Volpert)

10.00-10.40: G. Bocharov Mathematical immunology: emerging challenges and novel approaches

**Session: Viral infection and immune response** (Chairman: V. Volpert)

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|-------------|--------------|---|
| 10.45-11.15 | J. Moore     | <i>Antigen Transport and Information Delivery through the Lymphatic System</i>                      |
| 11.20-11.50 | A. Bouchnita | <i>Seroprevalence modulates key epidemiological characteristics in COVID-19</i>                     |
| 11.55-12.25 | R. Savinkov  | <i>Modeling individual cellular dynamics using cellular automata and artificial neural networks</i> |
| 12.30-13.00 | C. Leon      | <i>Modelling of the innate and adaptive immune responses to SARS viral infection</i>                |

13.00-14.00 Break

**Plenary lecture:** (Chairmen: A. Sequeira, S. Simakov)

14.00-14.40: Yu. Vassilevksi Personalized computational 3D hemodynamics and clinical applications

**Session: Cardiovascular system** (Chairmen: A. Sequeira, S. Simakov)

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|-------------|----------------|--|
| 14.45-15.15 | I. Chernyavsky | <i>Structural determinants of function in complex microvascular tissues</i>                          |
| 15.20-15.50 | G. Abi Younes  | <i>Mathematical modeling of inflammatory processes of atherosclerosis</i>                            |
| 15.55-16.15 | J. Garay       | <i>Parameter estimation in fluid flow models from aliased velocity measurements</i>                  |
| 16.20-16.40 | C. Carcamo     | <i>Error analysis of pressure reconstruction from discrete velocities</i>                            |
| 16.45-17.05 | J. Aguayo      | <i>An inverse method for obstacle identification in Navier-Stokes flow using a permeability term</i> |

## October 26

### Plenary lecture: (Chairman: A. Bratus)

10.00-10.40: A. Chupakhin Energy functionals in the hydroelastic system of a fusiform aneurysm

### Session: Cancer modelling (Chairman: A. Bratus)

- 10.45-11.15 M. Kuznetsov *Combined influence of nutrient availability and tissue mechanical properties on non-invasive tumor growth as revealed by mathematical modeling*
- 11.20-11.50 K. Wertheim *The first multi-cellular model of neuroblastoma*
- 11.55-12.25 R. Aboulaich *Tumor growth simulation using partial differential equations and agent-based modeling*
- 12.30-13.00 A. Stephanou *Mathematical modelling of cancer cells metabolism*

### **13.00-14.00 Break**

### Plenary lecture: (Chairmen: A. Panfilov, A. Tsaturyan)

14.00-14.40: A. Tsaturyan Structural biology of muscle contraction: experiments and mathematical modeling

### Session: Cardiac modelling (Chairmen: A. Panfilov, A. Tsaturyan)

- 14.45-15.15 F. Syomin *Mathematical model of myocardium electromechanics: simulation of the force response to changes in stimulation frequency and muscle length*
- 15.20-15.50 A. Okenov *Reconstruction the region of fibrosis based on LAT and ECG*
- 15.55-16.25 P. Konovalov *Wave rotation around an infarction scar at presence of gray zone (study on 2D model of the cardiac tissue)*
- 16.30-17.00 D. Mangileva *Factors determining the period of cardiac arrhythmias in an anatomical model of the human heart with myocardial infarction*
- 17.05-17.35 A. Fraguera Collar *Some mathematical models of the mechanical and electrical activity of the heart: forward and inverse problems*
- 17.40-18.10 R. Arostica *On Chorin-Temam schemes for the incompressible Navier Stokes equations in moving domains and its application to left ventricular FSI*

## October 27

### Plenary lecture: (Chairman: G. Bocharov)

10.00-10.40: M. Adimy      Modeling the relationship between antibody-dependent enhancement and disease severity in dengue infection

### Session: Viral infections and epidemics (Chairman: G. Bocharov)

10.45-11.15    M. Banerjee      *Disease progression in a two-group epidemic model: model validation with COVID-19 epidemic*

11.20-11.50    K. Allali          *Global analysis of a multi-strain SEIR epidemic model with general incidence functions: application to COVID-19 disease*

11.55-12.25    M. Khristichenko    *Optimal disturbances of periodic solutions of viral infections models*

12.30-13.00    D. Grebennikov      *Mathematical modeling of intracellular life cycle of HIV-1 and SARS-CoV-2*

### **13.00-14.00 Break**

### Plenary lecture: (Chairmen: Yu. Vassilevski)

14.00-14.40: A. Sequeira      Progress in the description of near-wall transport and hemodynamic parameters in cerebral aneurysms

### Session: Blood flow and coagulation (Chairmen: Yu. Vassilevski)

14.45-15.15    S. Simakov      *Computational evaluation of the effectiveness of coronary revascularization*

15.20-15.50    A. Belyaev      *Mechano-biology of von Willebrand factor: multiscale computer simulations*

15.55-16.25    A. Masalceva      *Initial wall shear rate may determine microvascular thrombus occlusion scenario*

16.30-17.00    E. Bershadsky      *In silico analysis of platelet aggregates embolization under arterial shear using particle-based model*

17.05-17.35    T. Salikhova      *Modeling of shear-induced platelet activation in patient-specific arteriovenous fistula for hemodialysis*

## October 28

### Plenary lecture: (Chairman: A. Tokarev)

10.00-10.40: D. Fedosov     Intricate journey of micro- and nano-carriers for drug delivery in the blood stream

### Session: Blood coagulation and molecular mechanisms (Chairman: A. Tokarev)

- 10.45-11.15    A. Shibeko     *In silico model of composite thrombus dissolution*  
11.20-11.50    A. Mozokhina   *Blood clotting due to thromboinflammation in the lungs decreases the pulmonary circulation*  
11.55-12.25    A. Megalinsky   *Initiation of coagulation reactions under the arterial flow is supported by the immobilized phospholipids*  
12.30-13.00    I. Eltsov       *Brownian dynamics simulation of temperature-dependent assembly and disassembly of tubulin microtubules*

### **13.00-14.00 Break**

### Plenary lecture: (Chairman: M. Adimy)

14.00-14.40: L. Pujo-Menjouet    Neuron scale modeling of prion production with the unfolded protein response

### Session: Infectious diseases and clinical trials (Chairman: M. Adimy)

- 14.45-15.15    A. d'Onofrio     *Mathematical Physics of Vaccinations: the interplay behavior-information-space when the disease is absent in the target population*  
15.20-15.50    D. Neverova     *Mathematical modelling of immunnodominance*  
15.55-16.25    K. Zhudenzkov   *Modeling continuous longitudinal biomarkers and events in the analysis and prediction of clinical trial outcomes*  
16.30-17.00    V. Volpert       *Viral infection spreading in cell culture*

## October 29

### Plenary lectures: (Chairman: V. Volpert)

10.00-10.40: G. Panasenko    Diffusion equation with Dirac-like potential: model of a periodic set of small cells in a nutrient

### Session: Nonlinear dynamics (Chairman: V. Volpert)

- 10.45-11.15    A. Ducrot            *Threshold effects for a one-dimensional bistable equation with diffusion*
- 11.20-11.50    S. Petrovskii        *Long transients in population dynamics*
- 11.55-12.25    E. Crooks            *Travelling waves and minimality exchange in smectic C\* liquid crystals*
- 12.30-13.00    B. Ambrosio         *Complex Networks and Dynamical Systems: a few Mathematical Perspectives with Applications to Neuroscience*

### **13.00-14.00 Break**

### Plenary lecture: (Chairman: L. Pujol-Menjouet)

14.00-14.40: J. Clairambault    From mathematical modelling of cancer cell plasticity to philosophy of cancer

### Session:

- 14.45-15.15    A. Bratus            *Mathematical model of pancreatic cancer*
- 15.15-15.30    Closing              *Journal announcements*