

Molecular Infection Biology Estonia presents:
Conference „Arboviruses“, hybrid format

13.-14. June 2022 Tartu hotel, Tartu, Estonia

13. June

9.30 – 11.00 Arbovirus RNA replication I

9.30 Arbovirus replicases: activities of viral and cellular components

Professor **Andres Merits** (*Tartu University*)

Andres Merits has been working on area of virus replication since 1994. His research is multidisciplinary with primary areas of study being RNA replication, host-virus interactions and development of antiviral approaches. The main research objects are alphaviruses (Semliki Forest virus, chikungunya virus), flaviviruses (Zika virus) and more recently also SARS-CoV-2.

10.00 – 10.30 Structures of alphavirus replicase proteins and replicase complex

Associate Professor, Infection and Immunity **Luo Dahai** (*Nanyang Technological University*)

(online)

Luo Dahai's lab studies the molecular events involved in the battle between host and pathogens, in particular between RNA viruses and humankind. Using various methods ranging from biochemistry, biophysics, structural biology, and cell biology, the team has successfully answered interesting and demanding questions in the fields of viral replication and host defense systems. The long-term goal of the research team is to better understand the conflict between host and pathogens and improve the well-being of humankind. Team of Luo Dahai was one of the first ever to resolve structure of RNA virus replication complex at high resolution.

10.30 – 11.00 Architecture of the chikungunya virus replication organelle

Associate Professor **Lars Anders Carlson** (*Umeå University & Molecular Infection Medicine Sweden*)

The research group of Lars Anders Carlson studies human viruses and the molecular mechanisms that they use to replicate themselves. The main research focus is how viruses reshape the cells they infect; the main interest is the drastic rearrangements of host-cell membranes that positive-sense RNA viruses carry out within hours of entering a cell. Team of Lars Anders Carlson was another team that resolved structure of RNA virus replication complex supporting and complementing findings made by team of Luo Dahai.

Coffee break

11.15- 12.30 Arbovirus RNA replication II

11.15-11.45 Molecular architecture of TBEV at 3.3 Å resolution **(online)**

Professor **Sarah Butcher** (*University of Helsinki*)

Professor Sarah Butcher has worked with viral proteins and virus particles over several decades. Her research interests have been diverse including bacteriophages, plant viruses as well as viruses infecting

humans. She has authored over 100 publications on these topics and has acted as leader of numerous research projects/consortia making her one of the most prominent structural biologists in Finland.

11.45-12.00 Properties of eastern equine encephalitis virus replicase

Laura Sandra Lello, PhD student (*Tartu University*)

12.00-12.15 G3BP/Rin binding to nsP2 supports Chikungunya virus RNA replication

Sainan Wang, PhD student (*Tartu University*)

12.15-12.30 The structural proteins of tick-borne flaviviruses studied using low pathogenic chimeric viruses

Ebba Rosendal, PhD student (*Umeå University & Molecular Infection Medicine Sweden*)

12.30- 13.30 Lunch

13.30- 15.00 **Arbovirus vectors**

13.30-14.00 Dcr2: understanding the first steps in the antiviral exogenous siRNA pathway

Professor **Alain Kohl** (*University of Glasgow*) (**online**)

Primary areas of investigation of team led by professor Alain Kohl include studies of arbovirus infection and their interactions with their mosquito vectors. He has worked on replication of alphaviruses (Semliki Forest virus and others), flaviviruses (Zika virus, dengue virus) and bunyaviruses (Bunyamwera virus). The areas of study include basic analysis of mosquito innate immune system and how viruses interact, circumvent and utilize host immunity.

14.00-14.30 Engineering reduced vector competence.

Professor **Luke Alphey** (*The Pirbright Institute*)

Prof Luke Alphey is known for his pioneering studies in the area of mosquito genetics, more specifically in the area of application of transgenic and synthetic biology approaches to the mosquitoes. He is founder of company Oxitec that developed, tested and commercialized sterile insect technique for Aedes aegypti mosquitoes, a principal vector for multiple viruses including yellow fever virus, dengue virus and chikungunya virus. These developments resulted in new concepts that are used for mosquito control. Subsequent studies of team led by professor Alphey have been dedicated to the development of new approaches aiming for reduction of ability of mosquitoes to transmit arbovirus infection. These studies have had major impact on understanding of molecular bases of virus-vector interaction and resulted in development of unique sensors that can detect virus infection and generate response preventing virus dissemination and transmission

14.30-15.00 Arbovirus infection at the vector-vertebrate interface

Associate professor **Clive McKimmie** (*University of Leeds*)

Research team of Clive McKimmie conducts studies that define fundamental processes and functions of innate immunity, chemokines and leukocyte migration in the initiating stages of arboviral infections. Arboviruses are viruses spread by biting arthropods, such as mosquitoes, and represent an important class of emerging infections that constitute an increasing threat to human and animal health. However, one of the most important aspects of their transmission is often overlooked – what is the role of mosquito bite in infection of vertebrate host? Studies of Clive McKimmie have shown that by no means the mosquito acts

as simple transmission agent. Mosquito saliva was shown to have properties that specifically enhance the virus infection following the mosquito bite and one of principal components, responsible for this effect, has been identified. These studies also have clear practical value allowing new perspectives to prevent/reduce infection by mosquito-borne viruses

15.00-15.15 Vector Competence of Wild-Caught Swedish Mosquitoes for Sindbis Virus

Research engineer **Olivia Lwande** (Umeå University & Molecular Infection Medicine Sweden)

It is common misunderstanding that mosquito-borne diseases are only problems for tropical countries. Mosquitoes are abundant in temperate climate zone and have been found to carry multiple viruses. However, this may be just a tip of iceberg. Studies of vector competence of mosquitoes from temperate climate zone are therefore crucial to understand likelihood of spread of vector-borne viruses in these areas

15.15 - 15.45 Coffee break

15.45 - 18.00 **Arboviruses and their hosts**

15.45-16.15 Mechanisms of Urban Arbovirus Emergence

Professor **Scott Weaver** (University of Texas) (online)

Professor Scott Weaver is leading expert of arbovirus molecular biology with emphasis on studies of factors causing outbreak. In 21-st century these have occurred at high frequency – chikungunya virus at 2005-2007 in Indian Ocean region and 2013 in Americas, 2015-2016 Zika virus in Americas to name most prominent ones. Each of these outbreaks have occurred at unprecedented scale and revealed new and typically alarming properties of emerging viruses. Team of professor Weaver has been on frontline of studies that have revealed what molecular mechanisms have allowed viruses to achieve explosive increase of spread and acquire abilities to cause severe forms of disease in humans.

16.15-16.45 G3BP/Rasputin mediates O'nyong nyong virus manipulation of Anopheles antiviral immunity

Solène Cottis PhD student (Institut Pasteur) (online)

16.45-17.15 Viral and Host Determinants of Arbovirus Viremia and Dissemination

Professor **Thomas Morrison** (University of Colorado) (online)

Team led by professor Thomas Morrison focuses on an in vivo infection of arboviruses. Though most arboviruses behave similar in cell culture their behavior in vertebrate hosts is drastically different. The outcome of arbovirus infection is affected by numerous host defense mechanisms including clearance of arboviruses from blood, innate and acquired immune responses. Arboviruses themselves utilize different mechanisms to circumvent these defenses, to target different organs and, at the case of chikungunya virus, establish long-lasting chronic infection. Unique combination of host defenses and viral counter-mechanisms result in different diseases and pathologies. Studies of their molecular bases are crucial for development more effective countermeasures (drugs and treatments) for diseases caused by arboviruses

17.15-17.30 nsP2 interferes with RNA replication of homologous and heterologous alphaviruses

Liubov Cherkashchenko, PhD student (University of Tartu)

17.30-17.45 Effects of subcellular localization of nsP3 BFV on replication and pathogenicity

Ailar Omler, PhD student (*University of Tartu*)

14. June

9.00 - 11.00 Arbovirus infection and virus evolution

9.00 -9.30 Collective dynamics in virus populations. Probing flavivirus population biology at the virus-host interface using molecularly barcoded viruses

Professor **Gregory Ebel** (*Umeå University & Molecular Infection Medicine Sweden*)

Research team of professor Ebel is based in Colorado State University, USA. Professor Ebel has wide research interest and experience, from virus detection and epidemiology to anti-viral immunity in mosquito vectors. He is also working on emerging virus infections. His studies have resulted in findings that challenge current paradigm of dynamics of virus population. As virus outbreaks are linked to emergence, selection and evolution of virus variants (and populations) with altered, often unique, properties the understanding of processes that lead to these results has utmost importance.

9.30-10.00 Revealing the tropism of tick-borne flavivirus in the brain using whole tissue ex vivo imaging

Professor **Anna Överby Wernstedt** (*Umeå University & Molecular Infection Medicine Sweden*)

The lab of professor Överby is focusing on studies of different aspects of tick-borne encephalitis virus from molecular virology and host pathogen interactions to pathogenicity and innate immunity by combining different in vivo and in vitro systems. One of crucial, and yet poorly understood aspect of infection by this virus is the tropism of virus and how it is linked with pathology. Revealing cellular targets of virus inside of host organism is very challenging. Team of professor Överby has developed unique methodology to visualize infected cells in entire mouse brain and, using this method, achieved breakthrough results in understanding pf distribution and tropism of tick-borne encephalitis virus.

10.00-10.30 How Zika virus RNA gets into action

Associated professor **Margus Varjak** (*University of Tartu*)

Associated professor Margus Varjak is new group leader in University of Tartu. During his post-doctoral studies in Glasgow University he worked different alpha- and flaviviruses. His work has been focused on multiple functions the viral RNA genome has in the virus infection.

10.30-11.00 Antiviral RNAi in mammals: a game of hide-and-peek

Pierre Maillard (*Queen Mary University of London*)

Research in the Maillard Lab aims to understand the mechanisms by which cells defend themselves against viruses. It has been well established that RNA interference (RNAi) is crucial mechanism for antiviral defences in invertebrate. RNAi also exists in vertebrates, however its role in antiviral defences is not well understood due to existence of interferon (IFN) response The Maillard Lab aims to characterize the cell types and contexts in which RNAi plays a role in the mammalian antiviral defence system and the cellular mechanisms that regulate interactions of RNAi and the IFN response.

11.-11.15 Coffee break

11.15- 13.00 **Antiviral approaches**

11.15-11.45 Antiviral strategies towards alphaviruses: an update

Professor **Jolanda Smith** (*University of Groningen*) **(online)**

Research group of professor Jolanda Smith is active in different research directions including basic and molecular virology, studies of mosquito-borne viruses, virus-host interaction and viral pathogenesis. She has worked with different antiviral compounds affecting replication of positive-strand RNA viruses and identified several promising hits that can be used in subsequent drug development.

11.45-12.15 Host cell targeted antivirals against arbovirus infection.

Professor **Magnus Evander** (*Umeå University & Molecular Infection Medicine Sweden*) **(online)**

Research of professor Magnus Evander is mostly focused on studies of zoonotic viruses; his research group has identified numerous viruses present in mosquitos in Sweden and carried out studies of arboviruses spread in Africa. He is involved in studies of infection process of these viruses and performing screening for chemical compounds that inhibit virus infection and have potential to be developed into novel antiviral drugs.

12.15-12.45 Broad-spectrum antivirals

Associated professor **Denis Kaynov** **(online)** (*University of Tartu*)

Research of associated professor Denis Kaynov is dedicated to the development of novel modalities against viral diseases. He is well known for his works dedicated to discovery of new antiviral compounds that affect replication of multiple viruses and combinations of existing antiviral drugs that have synergistic effects against virus infections

13.00- 14.00 lunch