

2021

Dec 13-16 | Columbus, OH, USA

3rd Conference on Biomotors, Virus Assembly, and RNA Nanobiotechnology

Conference Registration: <https://u.osu.edu/rnanano/registration/>

Meeting Zoom: <https://uncc.zoom.us/j/91389114083>



Hosted by
The Ohio State University
University of North Carolina Charlotte

Welcome Letter

Dear colleagues,

It's our great pleasure to welcome you to the 3rd Conference on Biomotors, Virus Assembly, and RNA Nanobiotechnology (<https://u.osu.edu/rnanano/>). The first two conferences held in 2017 and 2019 each attracted more than 80 distinguished invited speakers, with more than 200 participants from many different countries. They were great successes in bringing together leading scientists working in the diverse fields of chemistry, biochemistry, biophysics, structural biology, microbiology, cell biology, materials, single pore technology, RNA nanotechnology, pharmacology, cancer biology and nanotechnology to drive this fascinating inter-disciplinary scientific endeavor.

As a continuation of the first two conferences, we are excited to bring together more than 60 distinguished speakers from over 15 countries again for this third conference. While the COVID-19 pandemic has created unusual circumstances for the conference, moving to a virtual platform has allowed us the unique opportunity to bring together a vast international community for this conference. Our hope is to facilitate the translation of knowledge from fundamental studies on biomotors, viral structure, viral assembly, DNA/RNA structure and chemistry into practical nanotechnology applications. We believe this conference will foster communication between researchers from many different backgrounds, so please take the opportunity to interact with the leading scientists in the field and establish collaborations to promote this field into new and exciting directions.

Each day the conference will be hosted by Zoom, using (<https://uncc.zoom.us/j/91389114083>). We ask that you ask all questions using the chat function of Zoom and they will be addressed at the end of each presentation either verbally or through Zoom chat by each speaker. We also ask that you respect the confidentiality of this meeting and refrain from recording or taking pictures of any presentation, as all material presented during this conference is privileged to its attendees and intended to only be shared during the conference.

We sincerely hope that you will find the presentation insightful. If you feel there is anything we can do to make the conference more interesting or enjoyable, please feel free to contact the conference organization staff. Thank you for taking the time to attend this meeting.

Sincerely,

Conference Chair:

Peixuan Guo, The Ohio State University, USA

Conference Co-chair:

Kirill Afonin, University of North Carolina-Charlotte, USA

Gino Cingolani, Thomas Jefferson University, USA

Wah Chiu, Stanford University, USA

Sara Woodson, Johns Hopkins University, USA

3rd Conference on Biomotors, Virus Assembly, and RNA Nanobiotechnology

Conference Committee

Peixuan Guo (Chair)

The Ohio State University, USA

Kirill Afonin (Co-Chair)

University of North Carolina Charlotte, USA

Gino Cingolani (Co-Chair)

Thomas Jefferson University, USA

Wah Chiu (Co-Chair)

Stanford University, USA

Sara Woodson (Co-Chair)

Johns Hopkins University, USA

Host Committee

Daniel Binzel

The Ohio State University, USA

Peter Blanco Carcache

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University of North Carolina at Charlotte, USA

Leyla Danai-Noldner

University of North Carolina at Charlotte, USA

Scientific Program (Dec. 13 – 16, 2021)

All times listed in Eastern Standard Time (EST)

Zoom link for virtual meeting presentations - <https://uncc.zoom.us/j/91389114083>

MONDAY, DECEMBER 13, 2021

Viral Nanomachines and Vaccines

09:00 am – 09:20 am	<i>Opening Remarks: The dialectic relationship between fundamental and application studies of biomotor, viral assembly, and RNA nanotechnology</i> Peixuan Guo ; Sylvan G. Franks Endowed Chair, College of Pharmacy, OSU, USA
9:20 am – 9:30 am	<i>Meeting Logistics</i> Daniel Binzel ; The Ohio State University, USA
SESSION 1: Biomotors, RNA, CoV-19 and Vaccines	
Session Chair: Yao-Gen Shu	
9:30 am – 9:50 am	Jianliang Shen ; Chinese National Academy of Sciences, China <i>Engineering functional inorganic-organic hybrid system advances in triple negative breast cancer therapeutics</i>
9:50 am – 10:10 am	Cong-Hui Liao ; Sun Yat-sen University, China
10:10 am – 10:30 am	Wei Feng ; Chinese National Academy of Sciences, China <i>Coiled-coil I-mediated fastening of the neck and motor domains for kinesin-3 autoinhibition</i>
10:30 am – 10:50 am	Yang Wang ; Chinese Academy of Sciences, China
10:50 am – 11:00 am	Break
KEYNOTE TALK: Zihe Rao ; Tsinghua University, China	
11:00 am – 11:30 am	<i>Living in the cell: understanding SARS-CoV-2 replication and transcription from structures</i>
SESSION 2: Viral Assembly and Anti-virus Drug & Vaccine Design	
Session Chair: Zihe Rao	
11:30 am – 11:50 am	Xiangxi Wang ; Chinese Academy of Sciences, China <i>Virus structures and vaccine design</i>
11:50 am – 12:10 pm	Haitao Yang ; ShanghaiTech University, China <i>Development of inhibitors targeting Mpro from SARS-CoV-2</i>
12:10 pm – 12:30 pm	
12:30 pm – 12:50 pm	
12:50 pm – 1:00 pm	Break

SESSION 3: SARS-CoV-2 Frameshifting: RNA Mechanism and Anti-viral Drug Targeting	
Session Chair: Liqun (Andrew) Gu	
1:00 pm – 1:20 pm	Christopher Jones ; National Institutes of Health, USA <i>SARS-CoV-2 frameshifting pseudoknot structure reveals multiple sites for small molecules</i>
1:20 pm – 1:40 pm	Satheesh Ellipilli ; The Ohio State University, USA <i>Proof of concept for the development of rapid and simple at-home diagnosis for early detection of mutant COVID-19 infection</i>
1:40 pm – 2:00 pm	Jonathan Dinman ; University of Maryland, USA <i>Programmed ribosomal frameshifting: a potential broad range target for antiviral therapeutics</i>
2:00 pm – 2:20 pm	Junjie Guo ; Yale University, USA <i>Targeting programmed -1 ribosomal frameshifting in SARS-CoV-2</i>

TUESDAY, DECEMBER 14, 2021

RNA Biology, Nanotechnology, & Therapeutics

SESSION 5: RNA Nanotechnology, & Therapeutics	
Session Chair: Peixuan Guo	
9:00 am – 9:20 am	Hiro Saito ; Kyoto University, Japan <i>Synthetic RNA switch technologies: Possible applications as mRNA drugs</i>
9:20 am – 9:40 am	Jong Bum Lee ; University of Seoul, Korea <i>Engineered RNA-based Platform for Diagnosis of Coronavirus by RNA-directed RNA Transcription</i>
9:40 am – 10:00 am	Peixuan Guo ; The Ohio State University, USA <i>Ushering in the spring of RNA therapy as the third milestone in pharmaceutical drug development</i>
10:00 am – 10:20 am	Jørgen Kjems ; Aarhus University, Denmark
10:20 am – 10:30 am	Break
KEYNOTE TALK: Kirill Afonin ; University of North Carolina Charlotte, USA 10:30 am – 11:00 am <i>Nucleic Acid Nanoparticles (NANPs) as Molecular Tools to Direct Desirable and Avoid Undesirable Immunological Effects</i>	
SESSION 6: RNA Computational Biology and Therapeutic Applications	
Session Chair: Shi-Jie Chen	
11:00 am – 11:20 am	Tamar Schlick ; New York University, USA <i>The complex conformational landscape of the SARS-CoV-2 frameshifting RNA element</i>
11:20 am – 11:40 am	Yaoqi Zhou ; Griffith University, Australia

	<i>End-to-end prediction of RNA base pairing structures and contact maps through deep transfer learning of evolution and co-evolution information</i>
11:40 am – 12:00 pm	Janusz Bujnicki ; International Institute of Molecular and Cell Biology, Poland <i>Structure computation of RNA</i>
12:00 pm – 12:20 pm	David Mathews ; University of Rochester Medical Center, USA <i>Using conservation to determine RNA secondary structure</i>
12:20 pm – 12:40 pm	Petr Sulc ; Arizona State University, USA <i>Strand displacement in RNA and DNA:RNA hybrids</i>
12:40 pm – 12:50 pm	Break
SESSION 7: The Building Blocks of RNA Structure	
Session Chair: David Lilley	
12:50 pm – 1:10 pm	Eric Westhof ; Institut de Biologie Moleculaire et Cellulaire, France <i>Non-Watson-Crick Base Pairs, Modules and Tautomers in RNA</i>
1:10 pm – 1:30 pm	Zasha Weinberg ; Leipzig University, Germany <i>Natural catalytic RNAs: strange structural variants in mysterious organisms</i>
1:30 pm – 1:50 pm	Robert Batey ; Colorado University Boulder, USA <i>Structure studies of RNA by crystallization</i>
1:50 pm – 2:10 pm	Jeffrey Kieft ; Colorado University Anschutz, USA <i>Cryo-EM reveals conformational dynamics in a multifunctional viral RNA</i>
2:10 pm – 2:20 pm	Break
SESSION 8: RNA Therapeutics Delivery	
Session Chair: Bruce Shapiro	
2:20 pm – 2:40 pm	Anu Puri ; National Cancer Institute, USA <i>Stealth oxime ether lipid vesicles promote delivery of functional dsRNA in human lung cancer A549 tumor bearing mouse xenografts</i>
2:40 pm – 3:00 pm	Gaurav Sahay ; Oregon State University, USA <i>Boosting intracellular mRNA delivery</i>
3:00 pm – 3:20 pm	Koen Breyne ; Harvard Medical School, USA <i>Assembly of biomolecules into extracellular vesicles</i>
3:20 pm – 3:40 pm	Anastasia Khvorova ; University of Massachusetts Chan Medical School, USA

WEDNESDAY, DECEMBER 15, 2021

Modeling Nanostructures for Health and Life

SESSION 9: Designing Biomachines

Session Chair: Hiroyuki Noji

9:00 am – 9:20 am	Ryota Iino ; National Institutes of Natural Sciences, Japan <i>Engineering linear molecular motor kinesin-I</i>
9:20 am – 9:40 am	Ken'ya Furuta ; National Institute of Information and Communications Technology, Japan <i>Engineering motor proteins to move on DNA nanotubes for programmable molecular transport</i>
9:40 am – 10:00 am	Ting Zhu ; Tsinghua University, China <i>Mirror-image biology systems</i>
10:00 am – 10:20 am	Zev Bryant ; Stanford University, USA <i>Engineering cytoskeletal motors</i>
10:20 am – 10:30 am	Break
SESSION 10: Nanozymes: The Next Generation of Artificial Enzymes	
Session Chair: Hui Wei	
10:30 am – 10:50 am	Xingfa Gao ; National Center for Nanoscience and Technology, China
10:50 am – 11:10 am	Lizeng Gao ; Chinese Academy of Sciences, China
11:10 am – 11:30 am	Vincent Rotello ; University of Massachusetts Amherst, USA <i>Nanoparticle-and polymer-based nanozymes: Harnessing the power of transition metal catalysis for bioorthogonal chemistry</i>
11:30 am – 11:50 am	Arkady Karyakin ; Lomonosov Moscow State University, Russia <i>'Artificial Peroxidase': Nanozymes based on the most advantageous (electro)catalyst</i>
11:50 am – 12:00 pm	Break
SESSION 11: RNA Nanotechnology for Cancer Therapies	
Session Chair: Xiaoting Zhang	
12:00 pm – 12:20 pm	Xing-jie Liang ; National Center for Nanoscience and Technology, China <i>Key parameters to support efficient delivery in vitro and in vivo</i>
12:20 pm – 12:40 pm	David Lilley ; University of Dundee, Scotland <i>Application of RNA kink turns in RNA nanotechnology</i>
12:40 pm – 1:00 pm	Daniel Binzel ; The Ohio State University, USA <i>Rational design for delivery and controlled release of siRNA from RNA nanoparticles via tumor targeting extracellular vesicles</i>
1:00 pm – 1:20 pm	Bruce Shapiro ; National Cancer Institute, USA <i>An efficient means for circularizing RNA nanoconstructs for enhanced sustainability</i>
KEYNOTE TALK: Sarah Woodson ; Johns Hopkins University, USA 1:20 pm – 1:50 pm <i>How chaperones make RNA go round</i>	
1:50 pm – 2:00 pm	Break

SESSION 12: Computational Methods for the Modeling and Design of RNA Structures and Interactions	
Session Chair: Janusz Bujnicki	
2:00 pm – 2:20 pm	Shi-Jie Chen; University of Missouri, USA <i>VfoldMCPX: Predicting multistrand RNA complexes</i>
2:20 pm – 2:40 am	Marta Szachniuk; Polish Academy of Sciences, Poland <i>Bugs in RNA 3D structure prediction</i>
2:40 am – 3:00 pm	François Major; University of Montreal, Canada
3:00 pm – 3:20 pm	Ivo Hofacker; University of Vienna, Austria <i>Prediction of RNA folding during transcription</i>
3:20 pm – 3:40 pm	Giovanni Bussi; Scuola Intenazionale Superiore di Studi Avanzati, Italy <i>RNA structural dynamics combining solution experiments and molecular simulations</i>

THURSDAY, DECEMBER 16, 2021

Biomotors and Transporters

SESSION 13: Recent Advances in Nanopore Biosensing	
Session Chair: Haichen Wu	
9:00 am – 9:20 am	Giovanni Maglia; University of Groningen, Netherlands <i>Detection and quantification of protein rhamnosylation using nanopores</i>
9:20 am – 9:40 am	Shuo Huang; Nanjing University, China <i>Engineered protein nanopore for sequencing, structural profiling and reaction monitoring</i>
9:40 am – 10:00 am	Jia Geng; Sichuan University, China <i>Functional biological nanopore for molecular diagnostics</i>
10:00 am – 10:20 am	Abdelghani Oukhaled; CY Cergy Paris Universite, France <i>Polymers in confined geometry: from polymer sizing towards protein sequencing and protein fingerprinting</i>
10:20 am – 10:30 am	Break

SESSION 14: Nanopore Biosensing and Biomotor Imaging	
Session Chair: Haichen Wu and Youdong Mao	
10:30 am – 10:50 am	Sai Li; Tsinghua University, China <i>In situ architecture and neutralization of SARS-CoV-2</i>
10:50 am – 11:10 am	Michael Mayer; Adolphe Merkle Institute, Switzerland <i>Watching single enzymes and biomotors at work</i>
11:10 am – 11:30 am	Nicolas Burns; The Ohio State University, USA <i>Macromolecule sensing and tumor biomarker detection by harnessing terminal size and hydrophobicity of viral DNA packaging motor channels into membranes and flow cells</i>
11:30 am – 11:50 am	Aleksandr Noy; Lawrence Livermore National Laboratory, USA <i>Ion diffusion and ion transport in small diameter carbon nanotube pores</i>

11:50 am – 12:00 pm	Break
KEYNOTE TALK: Wah Chiu; Stanford University, USA	
12:00 pm – 12:30 pm	CryoEM of Vo Proton Channel
SESSION 15: DNA Ejection and Machines that Mediate DNA Delivery into Cells	
Session Chair: Gino Cingolani	
12:30 pm – 12:50 pm	Fred Antson; University of York, United Kingdom <i>Structural insights about the DNA-packaging machine of the thermostable virus P23-45 and its applicability for nanotechnology</i>
12:50 pm – 1:10 pm	Marc Morais; University of Texas Medical Branch at Galveston, USA <i>Lord of the Broken Rings, Part One: how ATPase ring motors drive genome packaging in dsDNA viruses</i>
1:10 pm – 1:30 pm	Hong Zhou; UCLA, USA <i>Multiple states of genome packaging portal in the human cytomegalovirus</i>
1:30 pm – 1:50 pm	Gino Cingolani; Thomas Jefferson University, USA
1:50 pm – 2:00 pm	Break
SESSION 16: Structure, Functional Dynamics and Mechanism of ATPase Motors	
Session Chair: Xiaolin Cheng	
2:00 pm – 2:20 pm	Ivaylo Nikolaev Ivanov; Georgia State University, USA <i>Molecular mechanism of Rad26-assisted rescue of stalled RNA polymerase II in transcription-coupled repair</i>
2:20 pm – 2:40 pm	Tianmin Fu; The Ohio State University, USA <i>Human V-ATPase: a sugar coated proton pump</i>
2:40 pm – 3:00 pm	Wen Ma; University of California San Diego, USA <i>Molecular mechanism of a nucleic acid unwinding motor</i>
3:00 pm – 3:20 pm	Chenxi Liang; The Ohio State University, USA <i>Identification of Arginine Finger as the Starter of the Biomimetic Motor in Driving Double-Stranded DNA</i>
3:40 pm – 3:50 pm	<i>Closing Remarks</i> Peixuan Guo; Sylvan G. Franks Endowed Chair, College of Pharmacy, OSU, USA

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