Capturing RNA Sequence and Transcript Diversity, From Technology Innovation to Clinical Application

May 24-26, 2022

Draft agenda

Day One – May 24, 2022

Opening Remarks

11:00 a.m. Welcome and introduction to the workshop, presentation of workshop purpose and goals. NHGRI/NIEHS staff, Eric Green (NHGRI), Rick Woychik (NIEHS), Carolyn Hutter (NHGRI)

Scientific Session 1: Setting the Stage

11:45 a.m. Keynote presentation summarizing the state of the science, future directions, and unmet needs limiting progress. **Presenter:** Anna Pyle

12:15 p.m. Questions and Discussions. **Moderator:** Vivian Cheung

12:45 Break

Scientific Session 2: Impact of Nucleotide Sequence on RNA Structure and Biological Roles

1:35 p.m. Scientific presentation (describe state of the science, address unmet needs, roadblocks, and opportunities). **Presenter:** Yunsun Nam

2:00 p.m. Discussion of scientific area. **Moderator:** Traci Hall

2:15 p.m. Concurrent Breakout Rooms

Breakout 2A: Association with RBPs

Moderator: Samie Jaffrey
Primary Participants: Kathy Liu and Chris Burge

- How does RNA structure impact stability/function/RBP interaction and its response to environmental challenges/stimuli?
- How can we measure the dynamics of RBP interactions with RNA?
- How can we distinguish functional binding interactions with non-functional interactions and understand potential RNA interaction by non-classical RBPs?
- How does phase-separation contribute to RNA-binding properties?

Breakout 2B: Implications of Heterogeneity and its Impact on Stress

Moderator: Lydia Contreras
Primary Participants: Tom Begley and Yu-Ying He

- What are impacts of environmental exposures, oxidative stress (ROS/alkylation) on RNA structure and disease?
- How does stress impact different RNA species, e. g., tRNAs, mRNAs?

Breakout 2C: Influences of Modifications on RNA Structure and Dynamics

Moderator: Blanton Tolbert
Primary Participants: Dave Mathews and Xiao Wang

- What methods exist for studying the impacts of modifications on RNA structure and dynamics?
- Are there methods to probe protein-RNA and small molecule-RNA interactions?
- How close are we to overcoming the requirement of large RNA sample size?

2:45 p.m. Break

3:10 p.m. Breakout Reports and Discussion (Closing)
Moderator: Traci Hall
Breakout Moderators: Samie Jaffrey, Lydia Contreras, and Blanton Tolbert

4:00 p.m. End of day one

Day Two – May 25, 2022

11:00 a.m. Welcome and recap of day one

Scientific Session 3: RNomics Applications from Research to Clinic

11:10 a.m. Scientific presentation (describe state of the science, address unmet needs, roadblocks, and opportunities). **Presenter:** Jeannie Lee

11:35 a.m. Discussion of scientific area. **Moderator:** Wendy Gilbert

11:50 a.m. Concurrent Breakout Rooms

Breakout 3A: RNA Therapeutics

Moderator: John Cooke
Primary Participants: Li Li and Samie Jaffrey

- What are implications for therapeutics, e.g., mRNA vaccines for COVID and subsequent potential pandemics?
- How will modifications affect targeting, specificity, and affinity? (Immune response?)

Breakout 3B: RNA Diagnostics

Moderator: Matt Disney
Primary Participants: Jason Watts, Blerta Xhemalçe, and Tao Pan

- What are emerging utilities for using RNA sequence for diagnostics?
- How could we augment current technologies for RNA sequencing to better apply this technology?

Breakout 3C: Viral RNome

Moderator: Marcos Morgan
Primary Participants: Stacy Horner and Dirk Dittmer

- What do we want from a Viral RNome project?
- What does the viral transcriptome offer as a potential focus for direct RNA sequencing efforts?

12:20 p.m. Break

12:40 p.m. Breakout Reports and Discussion
Moderator: Wendy Gilbert
Breakout Moderators: John Cooke, Matt Disney, and Marcos Morgan

1:10 p.m. Break

Scientific Session 4: Technologies for Direct Sequencing

1:45 p.m. Scientific presentation (describe state of the science, address unmet needs, roadblocks, and opportunities). **Presenter:** Meni Wanunu

2:10 p.m. Discussion of scientific area. **Moderator:** Chuan He

2:25 p.m. Concurrent Breakout Rooms

Breakout 4A: Technologies on the horizon

Moderator: Jens Gundlach
Primary Participants: Pat Limbach and Ben Garcia

- What are the key technologies at the early innovation and development stage?
- What other technologies hold promise?

Breakout 4B: Leveraging existing technologies – opportunities for further innovation

Moderator: Stirling Churchman
Primary Participants: Chris Mason and Qi Chen

- Which technologies are ready for application to direct RNA analysis?
- What innovations of existing technologies are needed?

Breakout 4C: Unmet challenges and needs

Moderator: Vivian Cheung
Primary Participants: Tatjana Trcek and Hagen Tilgner

- What are the current roadblocks to progress in the field?
- What critical questions are in need of new analysis strategies and tools?

2:55 p.m. Break

3:15 p.m. Breakout Reports and Discussion (Closing)
Moderator: Chuan He
Breakout Moderators: Jens Gundlach, Stirling Churchman, and Vivian Cheung

4:00 p.m. End of day two

Day Three – May 26, 2022

11:00 a.m. Welcome and recap of day one

Scientific Session 5: Infrastructure, Bioinformatics, and Critical Resources: What is Needed?

11:10 a.m. Scientific presentation (describe state of the science, address unmet needs, roadblocks, and opportunities). **Presenter:** Chris Burge

11:35 a.m. Discussion of scientific area. **Moderator:** Phil Bevilacqua

11:50 a.m. Concurrent Breakout Rooms

Breakout 5A: Infrastructure and Bioinformatics

Moderator: Angela Brooks
Primary Participants: Manolis Maragkakis and Kin Fai Au

- What tools or datasets are necessary for analysis of direct RNA sequencing data?
- How can AI/ML machine learning approaches be used to support direct RNA sequencing?

Breakout 5B: Critical Computational Resources

Moderator: Tom Begley
Primary Participants: Avi Ma'ayan and Phil Bevilacqua

- What are cloud computing needs (data integration + other omics)?
- What is the current state of RNA databases?
- What are upstream data processing and downstream data analysis needs?

Breakout 5C: Critical Biological Resources

Moderator: Pete Dedon
Primary Participants: Yinsheng Wang, Sara Rouhanifard, and Harald Schwalbe

- What is the state of synthetic RNA standards for known RNA modifications?
- Are they needed? How would they be used?
- How do we prioritize RNA modifications for standards generation? Who/how generates standards?

12:20 p.m. Break

12:35 p.m. Breakout Reports and Discussion
Moderator: Phil Bevilacqua
Breakout Moderators: Angela Brooks, Tom Begley, and Pete Dedon

1:00 p.m. Break

Scientific Session 6: Facilitating Technology Dissemination and Adoption

1:30 p.m. Scientific presentation (describe state of the science, address unmet needs, roadblocks, and opportunities). **Presenter:** Brent Graveley

1:55 p.m. Discussion of scientific area. **Moderator:** Mark Adams

2:10 p.m. Concurrent Breakout Rooms

Breakout 6A: Technology Dissemination and Adoption

Moderator: Kate Meyer
Primary Participants: Mark Adams and Mark Akeson

- What are the major factors that limit the widespread adoption of new RNomics technologies?
- What strategies can be used to broadly drive new technology adoption?
- How should RNomics technologies and expertise be disseminated?
- What new knowledge dissemination platforms (government, academic, industry) are needed?

Breakout 6B: Training

Moderator: Mike Summers
Primary Participants: Brent Graveley and Jamie Cate

- How can training facilitate developing the expertise needed for RNomics research?
- How do we assure workforce diversity?

2:40 p.m. Break

2:55 p.m. Breakout Reports and Discussion
Moderator: Mark Adams
Breakout Moderators: Kate Meyer and Mike Summers

3:25 p.m. Break

Wrap-up Session

3:45 p.m. Addresses guidance to the NIH. Summary of workshop, key themes, and feedback. Final discussion. **Moderators:** Executive Committee members

4:30 p.m. End of day three

American Disabilities Act Accommodations Requests

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