

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Forum on Regenerative Medicine

**Understanding the Role of the Immune System in Improving
Tissue Regeneration: A Workshop**

November 2-3, 2021

Virtual Workshop

TIMELINE:

November 2, 2021: 11:30 AM – 4:30 PM

November 3, 2021: 12:00 PM – 4:00 PM

WEBCAST: <https://www.nationalacademies.org/event/11-02-2021/understanding-the-role-of-the-immune-system-in-improving-tissue-regeneration-a-workshop>

STATEMENT OF TASK: The Forum on Regenerative Medicine will hold a public workshop to explore potential promising approaches to modulate the immune system and/or the regenerative medicine product for improving the clinical outcomes of tissue repair and regeneration in patients.

Workshop discussions may examine:

- lessons learned from other fields (e.g. organ or bone marrow transplantation) about the role of the host's immune system in accepting a graft to inform whether manipulation of a graft can impact the acceptance or rejection of it;
- topics such as potential approaches for modulating critical immune system pathways and communication mechanisms between the immune system and damaged and/or diseased tissues;
- the application of these lessons learned to the development and use of regenerative medicine products, for example:
 - what immune factors and pathways play a role in regeneration;
 - biomarkers that may be useful for assessing a patient's immune status or response to regenerative medicine therapies;
 - scaffolds, biomaterials, and other bioengineering tools that may modify immune responses; and
 - imaging technologies to leverage immune surveillance in patients and evaluation of the results of regenerative therapies.

A planning committee of the National Academies of Sciences, Engineering, and Medicine will organize the workshop, select and invite speakers and discussants, and moderate the discussions. Proceedings of the presentations and discussions at the workshop will be prepared by a designated rapporteur in accordance with institutional guidelines.

11:30 a.m. ET **Welcome from the Forum Co-Chairs**

Tim Coetzee, *Forum Co-Chair*
Chief Advocacy, Services, and Science Officer
National Multiple Sclerosis Society

Kathy Tsokas, *Forum Co-Chair*
Vice President
Regulatory, Quality, Risk Management and Drug Safety
Janssen Inc. Canada

11:40 a.m. **Introduction and Charge to the Workshop Speakers and Participants**

Nadya Lumelsky, *Workshop Planning Committee Co-Chair*
Chief, Integrative Biology and Infectious Diseases Branch;
Program Director, Tissue Engineering and Regenerative Medicine Research
Program
National Institute of Dental and Craniofacial Research (NIDCR)
National Institutes of Health (NIH)

Kimberlee Potter, *Workshop Planning Committee Co-Chair*
Scientific Program Manager
Biomedical Laboratory R&D Service
Office of Research & Development
Department of Veterans Affairs

11:50 a.m. **Keynote: Tissue Homeostasis, Inflammation, and Repair**

Ruslan Medzhitov
Sterling Professor of Immunobiology
Yale School of Medicine
Investigator, Howard Hughes Medical Institute

12:10 p.m. **Comment from the Patient Perspective**

Sherilyn George-Clinton
Leader
Multiple Sclerosis: You Are Not Alone (M.S. Y.A.N.A)

**SESSION I. LESSONS LEARNED ON IMMUNE TOLERANCE AND GRAFT
ACCEPTANCE**

Moderator: Soheli Talib, California Institute for Regenerative Medicine

Session Objectives:

- Discuss the current state of knowledge about immune tolerance mechanisms and what lessons have been learned from other areas of research, including: transplant immunology, cancer immunotherapy, maternal-fetal interface, and the microbiome.

12:20 p.m. **Lessons Learned from Transplant Immunology**

Megan Sykes

Michael J. Friedlander Professor of Medicine and Professor of Microbiology & Immunology and Surgical Sciences (in Surgery)
Director, Columbia Center for Translational Immunology
Columbia University

12:35 p.m. **Microbiome and Immune Tolerance – If we can't Live Without it, How Best to Live with It? Lessons Learned from Allogeneic Hematopoietic Cell Transplantation**

Robert Jenq

Deputy Department Chair, Genomic Medicine
Associate Professor, Genomic Medicine
Associate Professor, Stem Cell Transplantation
MD Anderson Cancer Center

12:50 p.m. **Q&A with the Speakers and Participants**

Additional Panelist:

Ruslan Medzhitov
Sterling Professor of Immunobiology
Yale School of Medicine
Investigator, Howard Hughes Medical Institute

1:25 p.m. **Break**

SESSION II. ENGINEERING OF ALLOGENEIC DONOR CELLS FOR ACCEPTANCE BY THE HOST'S IMMUNE SYSTEM

Moderator: Rachel Salzman, American Society of Gene & Cell Therapy

Session Objectives:

- Explore recent advances in engineering of allogeneic donor cells for acceptance by the host's immune system (e.g., gene editing approaches, immune silent, universal donor cells).

2:00 p.m. **Protecting Transplanted Cells from Immune Rejection is the Key to Unlocking the Potential of Regenerative Medicine**

Sonja Schrepfer

Head of Hypoimmune Platform
Sana Biotechnology
Adjunct Professor, Department of Surgery
University of California, San Francisco

2:15 p.m. **Challenges to Using Mesenchymal Stem Cells in Immunomodulatory Therapies**

Katarina Le Blanc

Professor of Clinical Stem Cell Research
Karolinska Institute

2:30 p.m. **Off-the-Shelf Engineered iPSC-derived NK and T Cells for the Treatment of Cancer**

Bob Valamehr
Chief Research and Development Officer
Fate Therapeutics

2:45 p.m. **Q&A with the Speakers and Participants**

SESSION III. ENDOGENOUS REGENERATION AND THE ROLE OF THE LOCAL ENVIRONMENT IN REPAIR

Moderator: Steven Becker, National Cancer Institute

Session Objectives:

- Examine what “proper healing” looks like at the level of the local environment, and discuss relevant research gaps.
- Consider the effects of aging, gender, and other variables and pathological changes on the local environment, endogenous repair, and wound healing.

3:10 p.m. **Reversing Aging: Proinflammatory Metabolite Prostaglandin E2 Augments Muscle Regeneration**

Helen Blau
The Donald E. and Delia B. Baxter Foundation Professor
Director, Baxter Laboratory For Stem Cell Biology
Professor, by Courtesy, of Psychiatry and Behavioral Sciences
Stanford University

3:25 p.m. **Biomaterials for Modeling Immune Mediation in Wound Healing**

Erika Moore
Rhines Rising Star Larry Hench Assistant Professor
Department of Materials Science and Engineering
University of Florida

3:40 p.m. **Endogenous Pro-Resolution and Pro-Regenerative Mechanisms in the Periodontal Tissue**

George Hajishengallis
Thomas W. Evans Centennial Professor
Department of Basic and Translational Sciences
University of Pennsylvania

3:55 p.m. **Q&A with the Speakers and Participants**

4:20 p.m. **Reflections on Day 1 and Preview of Day 2**

Nadya Lumelsky, *Workshop Planning Committee Co-Chair*
Chief, Integrative Biology and Infectious Diseases Branch;
Program Director, Tissue Engineering and Regenerative Medicine Research
Program
National Institute of Dental and Craniofacial Research (NIDCR)
National Institutes of Health (NIH)

Kimberlee Potter, *Workshop Planning Committee Co-Chair*
Scientific Program Manager
Biomedical Laboratory R&D Service
Office of Research & Development
Department of Veterans Affairs

4:30 p.m. **Adjourn Workshop Day 1**

DAY 2: November 3, 2021

12:00 p.m. ET **Welcome and Overview of Day 2**

Nadya Lumelsky, *Workshop Planning Committee Co-Chair*
Chief, Integrative Biology and Infectious Diseases Branch;
Program Director, Tissue Engineering and Regenerative Medicine Research
Program
National Institute of Dental and Craniofacial Research (NIDCR)
National Institutes of Health (NIH)

Kimberlee Potter, *Workshop Planning Committee Co-Chair*
Scientific Program Manager
Biomedical Laboratory R&D Service
Office of Research & Development
Department of Veterans Affairs

SESSION IV. MODULATING THE HOST IMMUNE SYSTEM TO CREATE A PRO-REGENERATION ENVIRONMENT

Moderator: Candace Kerr, National Institute on Aging

Session Objectives:

- Discuss the goal(s) of host immune modulation and consider what the correct molecular targets are for creating a pro-regenerative environment.
- Examine recent research advances of the role of innate and adaptive immunity in cell engraftment and endogenous tissue regeneration, and approaches for immunomodulation of the structure and function of stem cell niches for goals of tissue regeneration.

12:10 p.m. **Cellular Senescence, Senolytics, and Organ Regeneration and Transplantation**

James Kirkland
Director, Robert and Arlene Kogod Center on Aging
Noaber Foundation Professor of Aging Research
Mayo Clinic

12:25 p.m. **Mapping the Immune and Tissue Environment in Healing and Non-Healing Wounds**

Jennifer Elisseeff
Jules Stein Professor, Biomedical Engineering
Morton Goldberg Professor, Ophthalmology
Professor, Materials Science & Engineering, Chemical and Biomolecular Engineering
Director, Translational Tissue Engineering Center
Johns Hopkins University

12:40 p.m. **Resolution of Acute Inflammation Stimulates Tissue Regeneration**

Charles Serhan
Endowed Distinguished Scientist & Director of the Center for Experimental Therapeutics and Reperfusion Injury
Brigham Women's Hospital
Professor of Anaesthesia
Harvard Medical School

12:55 p.m. **Q&A with the Speakers and Participants**

1:20 p.m. **Break**

SESSION V. DEVELOPING TOOLS AND PRECLINICAL MODELS FOR MONITORING AND OPTIMIZING THE HOST'S PRO-REGENERATIVE ENVIRONMENT

Moderator: Sadik Kassim, Vor Biopharma

Session Objectives:

- Explore recent advances in monitoring and imaging of the immune system as well as the potential implications of these new approaches for clinical translation of regenerative medicines.
- Discuss challenges and opportunities with regard to preclinical models for studying the immune system involvement in response to regenerative medicine.

1:40 p.m. **Tools for Immune Profiling and Monitoring**

Garry Nolan
Rachford and Carlota Harris Professor
Department of Pathology
Stanford University

1:55 p.m. **Engineered Immunity as a Model for Regenerative Medicine**

Michel Sadelain
Stephen and Barbara Friedman Chair
Director, Center for Cell Engineering
Memorial Sloan Kettering Cancer Center

2:10 p.m. **Basic Immunology to Guide Regenerative Therapeutic Design**

Kaitlyn Sadtler
Earl Stadtman Tenure-Track Investigator
Chief of Section on Immunoengineering
National Institute of Biomedical Imaging and Bioengineering

2:25 p.m. **Q&A with the Speakers and Participants**

2:50 p.m. **Break**

SESSION VI. FINAL PANEL: WHAT ARE SOME POSSIBILITIES TO HARNESS THE IMMUNE SYSTEM TO IMPROVE OUTCOMES FOR PATIENTS?

Session Objectives:

- Explore areas of clinical therapeutic need amenable to being clinical trial candidates that could demonstrate not only proof of principle of a specific therapeutic for a clinical indication but also ways to address the immune system's role in improving tissue regeneration.

3:05 p.m. **Panel Discussion**

Moderator: Richard McFarland, Advanced Regenerative Manufacturing Institute

Speakers:

Sherilyn George-Clinton
Leader
Multiple Sclerosis: You Are Not Alone (M.S. Y.A.N.A)

Thomas Wynn
Vice President, Discovery
Pfizer

Edward Botchwey
Associate Professor
Department of Biomedical Engineering
Georgia Tech

Sonja Schrepfer
Head of Hypoimmune Platform
Sana Biotechnology
Adjunct Professor, Department of Surgery
University of California, San Francisco

Danielle Brooks
Biologist
Office of Tissues and Advanced Therapies
Division of Clinical Evaluation and Pharmacology/Toxicology
Center for Biologics Evaluation and Research
Food and Drug Administration

Jennifer Elisseeff
Jules Stein Professor, Biomedical Engineering
Morton Goldberg Professor, Ophthalmology
Professor, Materials Science & Engineering, Chemical and Biomolecular Engineering
Director, Translational Tissue Engineering Center
Johns Hopkins University

3:35 p.m. **Summary of Key Points from Discussion**

Richard McFarland
Chief Regulatory Officer
Advanced Regenerative Manufacturing Institute

3:45 p.m. **Reflections from the Workshop and Final Comments**

Nadya Lumelsky, *Workshop Planning Committee Co-Chair*
Chief, Integrative Biology and Infectious Diseases Branch;
Program Director, Tissue Engineering and Regenerative Medicine Research Program
National Institute of Dental and Craniofacial Research (NIDCR)
National Institutes of Health (NIH)

Kimberlee Potter, *Workshop Planning Committee Co-Chair*
Scientific Program Manager
Biomedical Laboratory R&D Service
Office of Research & Development
Department of Veterans Affairs

4:00 p.m. **Adjourn Workshop Day 2**