Closing the Loop on the Plastics Dilemma:
A Chemical Sciences Roundtable Workshop

The National Academies of Sciences, Engineering, and Medicine
500 Fifth Street NW, Washington, DC 20001
E Street Conference Room

May 9-10, 2019

Plastics today are used in various industries to produce lightweight, corrosion-resistant, durable materials. Unfortunately, the characteristics that make plastics valuable materials also make them environmentally unfriendly; no plastic that is commonly used today is biodegradable. Furthermore, few plastics are recycled; most are landfilled or discarded into the environment. Given the urgent need to reimagine plastics and waste management practices, this workshop will focus on better connecting the product design with end-of-use stages of the plastics life cycle. Specifically, the workshop will discuss new polymer options and approaches that reduce the impacts of plastics that enter the environment and that improve recycling of plastics, through both mechanical and chemical methods. Ultimately, the overall goal of the workshop is to provide a venue for the chemistry and chemical engineering communities and related fields to identify opportunities to reduce the environmental impact of plastics by enhancing plastics recycling and by reducing the lifetime of plastics that enter the environment.

Day 1: May 9, 2019

8:30 AM **Welcome and Opening Remarks**
Mary Kirchhoff, *American Chemical Society*

8:40 AM **Keynote — The Plastics Dilemma**
Eric Beckman, *University of Pittsburgh*

Session I: Mechanical Recycling Challenges and Opportunities

9:10 AM **Introduction to Session I**
Timothy Patten, Moderator
National Science Foundation

9:15 AM **Overview of Mechanical Recycling: Methods and Challenges**
Brian Riise, *REMADE Institute*

9:40 AM **Enhancing Mechanical Recycling with Spectroscopic Methods**
Andre Bendard, *Michigan State University*

10:05 AM **Enhancing Mechanical Recycling with Compatibilizers**
Megan Robertson, *University of Houston*

10:30 AM Break/Mingle to Identify Discussion Questions

10:45 AM **Panel Discussion with Keynote Speaker and Session I Speakers**
Jill Martin, Additional Discussant
Dow Chemical Company

11:30 AM **Lunch**

Session II: Chemical and Biological Recycling of Today's Plastics

12:30 PM **Introduction to Session II**
Kathryn Beers, Moderator
National Institute of Standards and Technology

12:35 PM **Chemical and Biological Recycling: Methods and Challenges**
Jeannette Garcia, *IBM Research*

1:00 PM **Thermal Depolymerization**

Reaction Engineering Fundamentals
Paul Dauenhauer, *University of Minnesota*
Scaling Industrially
Jennifer Le Roy, *BioCellection Inc.*

Day 1: May 9, 2019 (continued)

1:50 PM **Catalytic Depolymerization**

Adapting Transition Metal-Based Heterogeneous and Homogeneous Catalysts for Polymer Disassembly
Susannah Scott, *University of California, Santa Barbara*
Molecular Catalysis: Evolution of Organic Catalysts for Chemical Recycling of PET
Robert Allen, *IBM Research*

2:40 PM Break/Mingle to Identify Discussion Questions

2:55 PM **Biological Depolymerization**

Biocatalysis
Richard Gross, *Rensselaer Polytechnic Institute*
Microbial Degradation
Eric Boyd, *Montana State University*

3:45 PM **Life Cycle Implications of Managing Plastic Wastes**
Ming Xu, *University of Michigan*

4:10 PM Break/Mingle to Identify Discussion Questions

4:30 PM **Panel Discussion with Session II Speakers**

5:15 PM **Poster Session — Reception**

7:00 PM **Adjourn Day 1**

Day 2: May 10, 2019

Session III: Designing Plastics for the Future

8:30 AM **Introduction to Session III**
Gregg Beckham, Moderator
National Renewable Energy Laboratory

8:35 AM **Leveraging Biomass Conversion for Depolymerizing and Producing Plastics**
David Hodge, *Montana State University*

9:00 AM **New Building Blocks for Plastics**
Geoffrey Coates, *Cornell University*

9:25 AM **Chemically Recyclable Polymers**
Eugene Chen, *Colorado State University*

9:50 AM **Modeling or Predictive Analyses**
Linda Broadbelt, *Northwestern University*

10:15 AM **Life Cycle Assessment and Technoeconomic Analysis on Sustainable Plastics**
Michael Wang, *Argonne National Laboratory*

10:40 AM Break/Mingle to Identify Discussion Questions

11:00 AM **Panel Discussion with Session III Speakers**

11:45 PM **Closing Remarks**
Mary Kirchhoff, *American Chemical Society*

12:00 PM **Workshop Concludes**

About the Chemical Sciences Roundtable

Established in 1998 by the Board on Chemical Sciences and Technology, the Chemical Sciences Roundtable's vision is to be recognized as the premier resource to inform on developing issues in chemistry and chemical engineering. The mission of the Chemical Sciences Roundtable is to provide a science-oriented, apolitical forum to enhance understanding of critical issues in chemical sciences and technology affecting the government, industrial, and academic sectors.

Chemical Sciences Roundtable Staff

Ellen Mantus, *Chemical Sciences Roundtable Director and Scholar*
Jeremy Mathis, *Board Director, Board on Chemical Sciences and Technology*
Jessica Wolfman, *Research Assistant*

CHEMICAL SCIENCES ROUNDTABLE