

Boris Martinac · Charles D. Cox
Kate Poole · Sara Baratchi
Daryan Kempe *Editors*

Mechanobiology

Proceedings of the 4th International
Symposium on Mechanobiology. 6th -
9th November 2022. Sydney, Australia.



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Preface

The 4th International Symposium of Mechanobiology, held in Sydney, Australia, in November 2022, marked the occasion where pioneering minds from across the globe converged to explore the intricate interplay between mechanics and biology. This volume presents a collection of several studies serving as a testament to the current knowledge, innovation, and international collaboration in the mechanobiology research field.

Mechanobiology, a cutting-edge multidisciplinary field combining physics, biology, bioengineering, and medicine, has witnessed remarkable growth in recent years. The symposium provided an ideal platform for over 200 scientists from 14 countries and regions around the world to share their groundbreaking work and unravel how mechanical forces shape biological phenomena at multiple scales. It offered common ground to researchers from various cultures in their pursuit of advancing mechanobiology, fostering a global network of like-minded scientists united by a shared vision for the future of their research. The several chapters contained within this volume showcase a selected cross section of research, each contributing to a deeper understanding of mechanobiology's multifaceted complexities. With contributions spanning from fundamental discoveries to innovative applications, this volume is intended to capture the breadth and depth of the symposium's discussions. The chapters presented here highlight several representative topics, including ion channel signalling in cellular mechanotransduction (Chaps. 1 and 2), biomaterials for tissue engineering (Chap. 3), intramolecular fluorescence-based force measurement in protein unfolding (Chap. 4), mechanical forces in cancer development (Chap. 5), and cardiac pressure-volume relationship known as the Frank-Starling Law (Chap. 6). The symposium's agenda sought to address both fundamental questions and practical implications of mechanobiological research, highlighting the potential to transform medical diagnostics, therapeutic interventions, and regenerative medicine.

We extend our gratitude to the symposium organizers, all the speakers and attendees, as well as numerous sponsors whose contributions and support made this event a resounding success. Their collective efforts have enriched the field of mechanobiology and paved the way for future discoveries that hold the promise of transforming basic and clinical science and reshaping our understanding of life itself.

In closing, this volume stands as a lasting testament to the remarkable research and discussions that took place during the 4th International Symposium of Mechanobiology. As the world continues to witness rapid advancements in the captivating mechanobiol-

ogy field, we hope that the findings presented here will inspire future generations of mechanobiologists to continue unravelling the mysteries of life's mechanics.

Sydney, NSW, Australia	Kate Poole
Melbourne, VIC, Australia	Sara Baratchi
Darlinghurst, NSW, Australia	Charles Cox
Sydney, NSW, Australia	Daryan Kempe

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This montage of 18 images shows the phases of the total lunar eclipse on November 8, 2022, over Sydney Harbor, Australia. The lucky amateur astrophotographer who took the images was Professor Jeffrey R Holt from Harvard Medical School, a keynote speaker at the 4th ISMB Symposium. (An article about the event that was published in *Sky & Telescope* can be accessed at https://skyandtelescope.org/observing/fortune-favors-the-prepared-astrophotographer/#.Y_fvoUAD004.twitter)



Group Photo to wrap up the 2nd day of the 4th International Symposium on Mechanobiology, Sydney, Australia #ISMB2022@AuSMBsSoc

Symposium Program

4th International Symposium on Mechanobiology
Sydney Nanoscience Hub, The University of Sydney, Australia
PROGRAM OVERVIEW

Day 1: Sunday 6 November, 2022 (All times in AEDT, GMT+11) @ Messel Lecture Theatre, Sydney Nanoscience Hub

2:00pm – 2:15pm	WELCOME TO COUNTRY	
2:15pm – 2:30pm	WELCOME TO CONFERENCE	Boris Martinac
2:30pm – 3:20pm	PLENARY TALK: Martin Chalfie	Chair: Boris Martinac
3:20pm – 3:55pm	KEYNOTE TALK: David Beech	
3:55pm – 4:20pm	Afternoon break with refreshments	

MECHANICS IN CANCER session Chair: Yu Suk Choi

4:20pm – 4:45pm	INVITED TALK: Chwee Teck Lim
4:45pm – 5:10pm	INVITED TALK: Geraldine O'Neill
5:10pm – 5:35pm	INVITED TALK: Adam Engler
5:35pm – 6:00pm	INVITED TALK: Dennis Discher

Day 2: Monday 7 November, 2022

9:00am – 9:05am	ACKNOWLEDGEMENT OF COUNTRY @ Messel Lecture Theatre, Sydney Nanoscience Hub	
9:05am – 9:55am	PLENARY TALK: Rong Li	Chair: Sara Baratchi
9:55am – 10:30am	KEYNOTE TALK: Satyajit Mayor	
10:30am – 10:55am	INVITED TALK: Samantha Stehbens	
10:55am – 11:25am	Morning break with refreshments	

NON-MAMMALIAN MECHANOBIOLOGY session

@ Messel Lecture Theatre, Sydney Nanoscience Hub	Chair: Boris Martinac
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MECHANOSENSITIVE CHANNELS session

@ Lecture Theatre 2, Room 424, Physics Building	Chair: Charles Cox
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11:25am – 11:50am	INVITED TALK: Joshua Coomey	INVITED TALK: Eric Honoré
11:50am – 12:15pm	INVITED TALK: Jean-Marie Frachisse	INVITED TALK: Ruhma Syeda
12:15pm – 12:30pm	SELECTED TALK: Linda Kenney	SELECTED TALK: Sarah Boyle
12:30pm – 12:45pm	SELECTED TALK: Kenjiro Yoshimura	SELECTED TALK: Jonathan A. Garcia Contreras
12:45pm – 1:45pm	Lunch break	

MECHANO-IMAGING I session

@ Messel Lecture Theatre, Sydney Nanoscience Hub	Chair: Daryan Kempe
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MECHANO-IMAGING II session

@ Lecture Theatre 2, Room 424, Physics Building	Chair: Peter Su
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1:45pm – 2:10pm	INVITED TALK: Medha Pathak	INVITED TALK: Anne Lagendijk
2:10pm – 2:35pm	INVITED TALK: Delphine Delacour	INVITED TALK: Kathryn Stok
2:35pm – 2:50pm	SELECTED TALK: Keng-hui Lin	SELECTED TALK: Barry Thompson
2:50pm – 3:05pm	SELECTED TALK: Andrew Holle	SELECTED TALK: Vidhyalakshmi Acharya
3:05pm – 3:20pm	SELECTED TALK: Thomas Cox	SELECTED TALK: Qiutan Yang

3:20pm – 3:50pm	Afternoon break with refreshments	
3:50pm – 4:25pm	KEYNOTE TALK: Gary Lewin @ Messel Lecture Theatre	Chair: Jessica Richardson
4:25pm – 5:05pm	FLASH TALKS (11 x 3 min) @ Messel Lecture Theatre	Chair: Jessica Richardson
5:05pm – 5:15pm	GROUP PHOTO	
5:05pm – 8:00pm	POSTER Session with drinks/refreshments	International Society of Mechanobiology
Board meeting 5:15pm – 6:15pm @ ROOM 4001		

Day 3: Tuesday 8 November, 2022

9:00am – 9:05am	ACKNOWLEDGEMENT OF COUNTRY	@ Messel Lecture Theatre, Sydney Nanoscience Hub
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THEORY session Chair: Maté Biro

9:05am – 9:55am	PLENARY LECTURE: Stephan Grill	
9:55am – 10:20am	INVITED TALK: Richard Morris	
10:20am – 10:45am	INVITED TALK: Madan Rao	
10:45am – 11:15am	Morning break with refreshments	

SENSORY TRANSDUCTION session

@ Messel Lecture Theatre	Chair: Charles Cox
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TISSUE MECHANICS session

@ Lecture Theatre 2, Room 424, Physics	Chair: Charles Cox	Yu Suk Choi
11:15am – 11:40am	INVITED TALK: Valeria Vásquez	INVITED TALK: Misato Iwashita
11:40am – 12:05pm	INVITED TALK: Uhtaek Oh	INVITED TALK: Masahiro Sokabe
12:05pm – 12:20pm	SELECTED TALK: Martin Fronius	SELECTED TALK: Amy Gelmi
12:20pm – 12:35pm	SPONSOR TALK: MAWA 10 min	SELECTED TALK: X. Frank Zhang
12:35pm – 12:45pm	SPONSOR TALK: TAIHOYA Sponsor Video 10 min	SPONSOR TALK: LUMICKS 10 min
12:45pm – 1:45pm	Lunch break	AuSMB Annual General Meeting @ ROOM 4001

CELLULAR MECHANOSENSING session		EXTRACELLULAR MECHANICAL SIGNALS session	
@ Messel Lecture Theatre	Chair: Kate Poole	@ Lecture Theatre 2, Room 424, Physics	Chair: Jan Lauko
1:45pm – 2:00pm	SELECTED TALK: Benjamin Dalton	SELECTED TALK: Jennifer Young	
2:00pm – 2:15pm	SELECTED TALK: Massimo Vassalli	SELECTED TALK: Marco Enriquez	
2:15pm – 2:30pm	SELECTED TALK: Michelle Peckham	SELECTED TALK: Iris Doolaar	

2:30pm – 2:45pm	SELECTED TALK: Arnd Pralle	SELECTED TALK: Remi Peyronnet
2:45pm – 3:00pm	SELECTED TALK: Yuanyuan Zhang	SELECTED TALK: Woei Ming Lee
3:00pm – 3:15pm	SELECTED TALK: Julio F. Cordero-Morales	SELECTED TALK: Dietmar Oelz
3:15pm – 3:45pm	Afternoon break with refreshments	
3:45pm – 4:20pm	KEYNOTE TALK: Peter Kohl	Chair: Sara Baratchi
4:20pm – 4:55pm	KEYNOTE TALK: Peter Yingxiao Wang	
4:55pm – 5:20pm	INVITED TALK: Rob Parton	

5:45pm – 6:00pm	Coaches will depart at 6:00pm from Fisher Library (5 min walk from Sydney Nano) to conference dinner site
6:30pm – 11:30pm	CONFERENCE DINNER at the Harbourside Room, Museum of Contemporary Art, The Rocks, Sydney

Day 4: Wednesday 9 November, 2022

9:00am – 9:05am	ACKNOWLEDGEMENT OF COUNTRY	@ Messel Lecture Theatre, Sydney Nanoscience Hub
9:05am – 9:55am	PLENARY TALK DAY 4: Michael Sheetz	Chair: Kate Poole
9:55am – 10:30am	KEYNOTE TALK: Jeffrey Holt	
10:30am – 10:55am	INVITED TALK: Eduardo Perozo	
10:55am – 11:20am	Morning break with refreshments	