The Multiscale Modeling Consortium celebrates 20 years of IMAG:

**June
28 & 29
2023**

**Natcher Conference
Center, NIH**

Lessons from the past that guide the future

IMAG

Interagency Modeling and Analysis Group

With Gratitude to:

MSM Co-Chairs	IMAG	IMAG Wiki
Jason Haugh	Julia Berzhanskaya, NHLBI	Roberta Albert, NIBIB
Denise Kirschner	Joshua Elliott, DARPA	Deb Davis, NIBIB
Bruce Y. Lee	Elizabeth Ginexi, NCCIH	Che Figueroa-Rodriguez, NIBIB
Herbert Sauro	Ilana Goldberg, NHLBI	Muktar Mohammed, NIBIB
MSM Session Chairs	Raj Gupta, DoD-BIRCO	**Meeting Support**
Gary An	Orlando Lopez, NIDCR	NCCIH Office of Communications and
Ahmet Erdemir	David Miller, NCI	ICF International for assisting with the Travel Awards
Suvranu De	Jerry Myers, NASA	REEL IMPACT for assisting with Meeting Logistics
Guy Genin	Virginia Pasour, ARL	
Victor Barocas	Grace Peng, NIBIB	
George Karniadakis	Mauricio Rangel-Gomez, NIMH	
Feilim Mac Gabhann	Asif Rizwan, NHLBI	
Elsje Pienaar	Reed Shabman, NIAID	
Kyoko Yoshida	Elena Sizikova, FDA	

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National Institute of Biomedical Imaging and Bioengineering

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National Institute of Allergy and Infectious Diseases

Society for Mathematical Biology

Logistics

Welcome to the 2023 Past2Future Meeting – The Multiscale Modeling Consortium celebrates 20 years of IMAG! Lessons from the past that guide the future. We look forward to everyone's interactive participation throughout these two days.
Enjoy the meeting!

Check-In

7:30 AM NIH Gateway Center (Bldg. 66): Proceed through security to obtain a visitor badge, please bring a government-issued photo ID.

Walk directly from Bldg. 66 to Natcher (Bldg. 45) see yellow highlight in NIH Visitor Map.

8:00 AM Registration opens in the lower level, outside the Ruth L. Kirschstein Auditorium. Obtain badge and tent card.

Posters

All posters should be displayed in the **Atrium** level for the duration of the 2-day meeting. All Early Career Investigators will participate in the **Early Career Investigator Forum on June 28th**. See Poster schedule in Agenda and click on Posters in the wiki.

Wireless Access & IMAG wiki login

Wireless internet is free and can be accessed using the network **NIH-Guest.**

We strongly encourage you to interact with the IMAG wiki **(SEARCH: imag wiki),** https://www.imagwiki.nibib.nih.gov/ . Login using your **IMAG wiki username** and **password**.

If you forgot your IMAG wiki login, please go to the registration desk to look up your IMAG wiki username. After logging in, click on the CURRENT IMAG MEETING tab.

To **add your questions and comments**, just click on the links in the Agenda!

For informal chat use:

- **Slack** #msm-2023-consortium-meeting
- **Twitter #IMAGPast2Future**

Logistics continued

Videocast

The meeting will be videocast on both days to allow remote access attendees to participate and contribute feedback to the discussions (through the Agenda links). The videocast and future archive will be available on https://videocast.nih.gov/.
Click link below for corresponding days.

Videocast Day 1

Videocast Day 2

Breaks and Lunch

Refreshments in the AM will be set up in the Lower Level near registration, outside of the Auditorium. **Food and Drinks cannot be brought into the Auditorium.**

Refreshments in the PM will be set up in Atrium, across from the Posters.

Pre-ordered lunch boxes will be ready for pick-up outside the Natcher Auditorium**.**

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<tr><td align="center">**Day 1 Lunch
Networking**

**Breakout Rooms
(Lower Level)
Atrium
Outside Picnic Tables**.</td><td align="center">**Day 2 Lunch
Breakout Room
Discussions**

**Breakout Rooms
(Lower Level)**</td></tr>
</table>

*The Natcher Building cafeteria and general store are closed!

Special Thanks to the Society for Mathematical Biology
for providing refreshments!

IMAG
Past2Future Meeting
2023
Agenda

(use Slack and Twitter #IMAGPast2Future for informal chatter)

Day 1 Videocast

Day 1: Evolution and Success of the IMAG/MSM
June 28, 2023

Time & Location	Activity	Organizers
8:00-8:30am Natcher Lower Level **Atrium** (Ground Level)	Arrive at NIH Security Check-point Check-in at Registration Set up posters	Registration Desk
8:30-8:40am **Auditorium** (Lower Level)	# Welcome	**IMAG** co-chairs: Grace Peng, Liz Ginexi, Reed Shabman **MSM** Organizers: Jason Haugh, Denise Kirschner, Bruce Y. Lee, Herbert Sauro
8:40-9:20am **Auditorium**	**The History of IMAG - 20 years!** **Keynote - Lessons from the past**	Grace Peng Denise Kirschner
9:20-10:20 **Auditorium**	Plenary Session 1.1 – **Journeys of Early Funded MSM PIs**	**MSM:** Ahmet Erdemir, Denise Kirschner **IMAG:** Stephanie George (NSF)
10:20-10:50am **Outside Auditorium**	AM Coffee/Tea Break	Refreshments Courtesy of the Society for Mathematical Biology
10:50-12:15pm **Auditorium**	Plenary Session 1.2 – **The Path to Model Credibility**	Grace Peng Denise Kirschner
12:15-1:45pm Breakout Rooms (Lower Level) **Atrium** **Outside Picnic Tables**	Lunch and Networking (pick up box lunch outside auditorium)	Box Lunch Options

Agenda Continued

Day 1: Evolution and Success of the IMAG/MSM June 28, 2023		
Time & Location	**Activity**	**Organizers**
1:45-2:15pm **Auditorium**	Plenary Session 1.3 – In Remembrance	**MSM**: Herbert Sauro **IMAG**: Grace Peng
2:15-3:15pm **Auditorium**	Plenary Session 1.4 – **Present Day MSM - Current Projects**	**MSM:** Denise Kirschner **IMAG:** Reed Shabman
3:15-3:45pm **Atrium**	PM Snack Break	Refreshments Courtesy of the Society for Mathematical Biology
3:45-5:00pm **Atrium**	Poster Session 1 – **Early Career Investigator Forum**	**MSM:** Guy Genin, Jason Haugh, [Victor Barocas] **IMAG:** Ilana Goldberg, Liz Ginexi
5:00pm	Adjourn Day 1	Dinner on your own (with new connections!)

IMAG

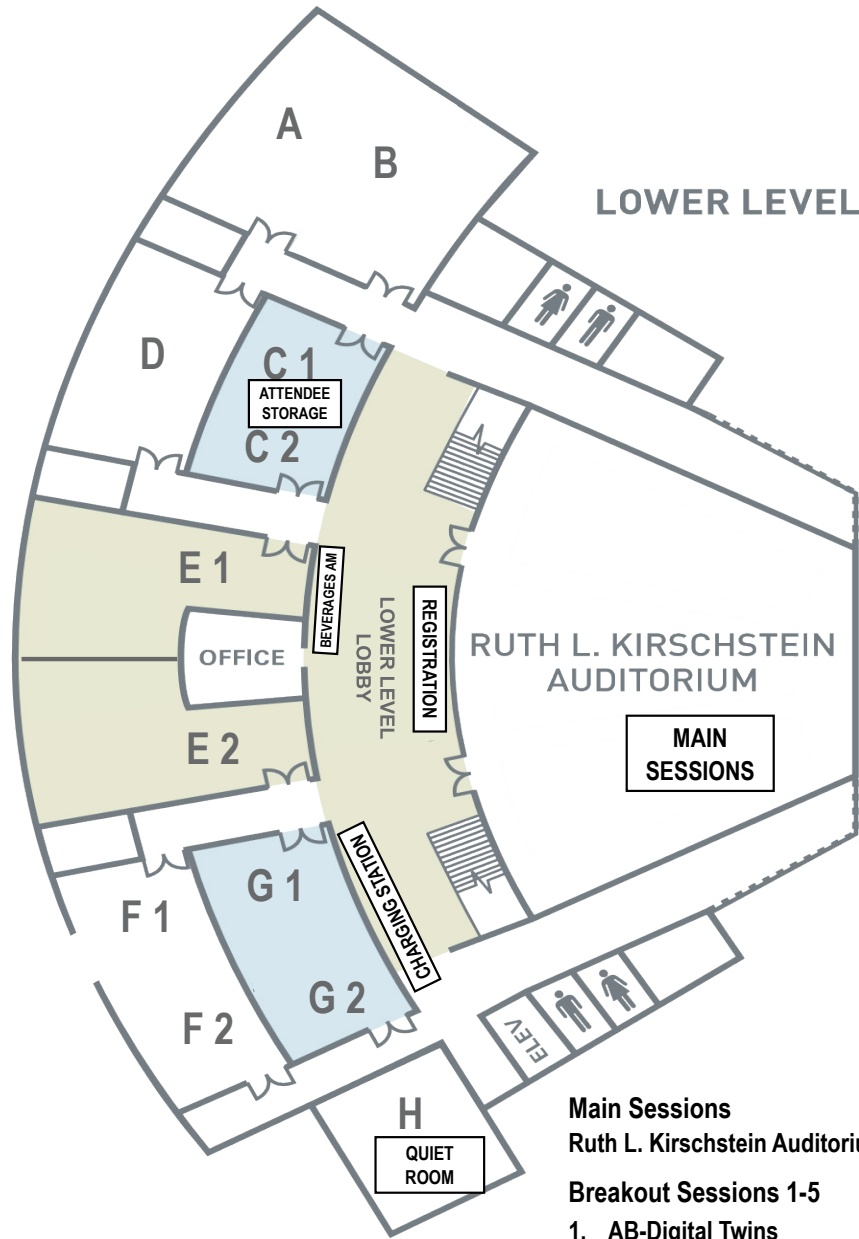| Day 2: The *Future* of Multi-Scale Modeling June 29, 2023		
Time & Location	**Activity**	**Organizers**
8:00-8:30am Natcher Lower Level **Atrium** (Ground Level)	Arrive at NIH Security Check-point Check-in at Registration Set up posters	Registration Desk
8:30-8:40am **Auditorium** (Lower Level)	# Welcome Back Recap from Day 1, Plan for Day 2	**IMAG** co-chairs: Grace Peng, Liz Ginexi, Reed Shabman **MSM** Organizers: Jason Haugh, Denise Kirschner, Bruce Y. Lee, Herbert Sauro
8:40-9:00am **Auditorium**	**Keynote - A vision for the future of the MSM**	Peter Hunter
9:00-10:00am **Auditorium**	Plenary Session 2.1 – **Current IMAG Initiatives (IMAG Roundtable)**	**MSM:** Bruce Y. Lee **IMAG:** Emrin Horgusluoglu, Grace Peng
10:00-10:30am **Outside Auditorium**	AM Coffee/Tea Break	Refreshments Courtesy of the Society for Mathematical Biology
10:30-11:45pm **Auditorium**	Plenary Session 2.2 – **Opportunities for Multiscale Modeling to Address Health Disparities and Move Toward Health Equity**	**MSM**: Elsje Pienaar, Kyoko Yoshida, Jason Haugh **IMAG**: Asif Rizwan
11:45-12:00pm **Auditorium**	Plenary Session 2.3 – **Synergizing MSM with the Future** 2023 MSM Mission Statement Introduce Breakout Session Ideas	**MSM**: Bruce Y. Lee **IMAG**: Reed Shabman Breakout Session Leads
12:00-12:15pm **Outside Auditorium**	Pick up Boxed Lunches Bring Lunch to Breakout Sessions	Boxed Lunch Options

IMAG

Agenda Continued
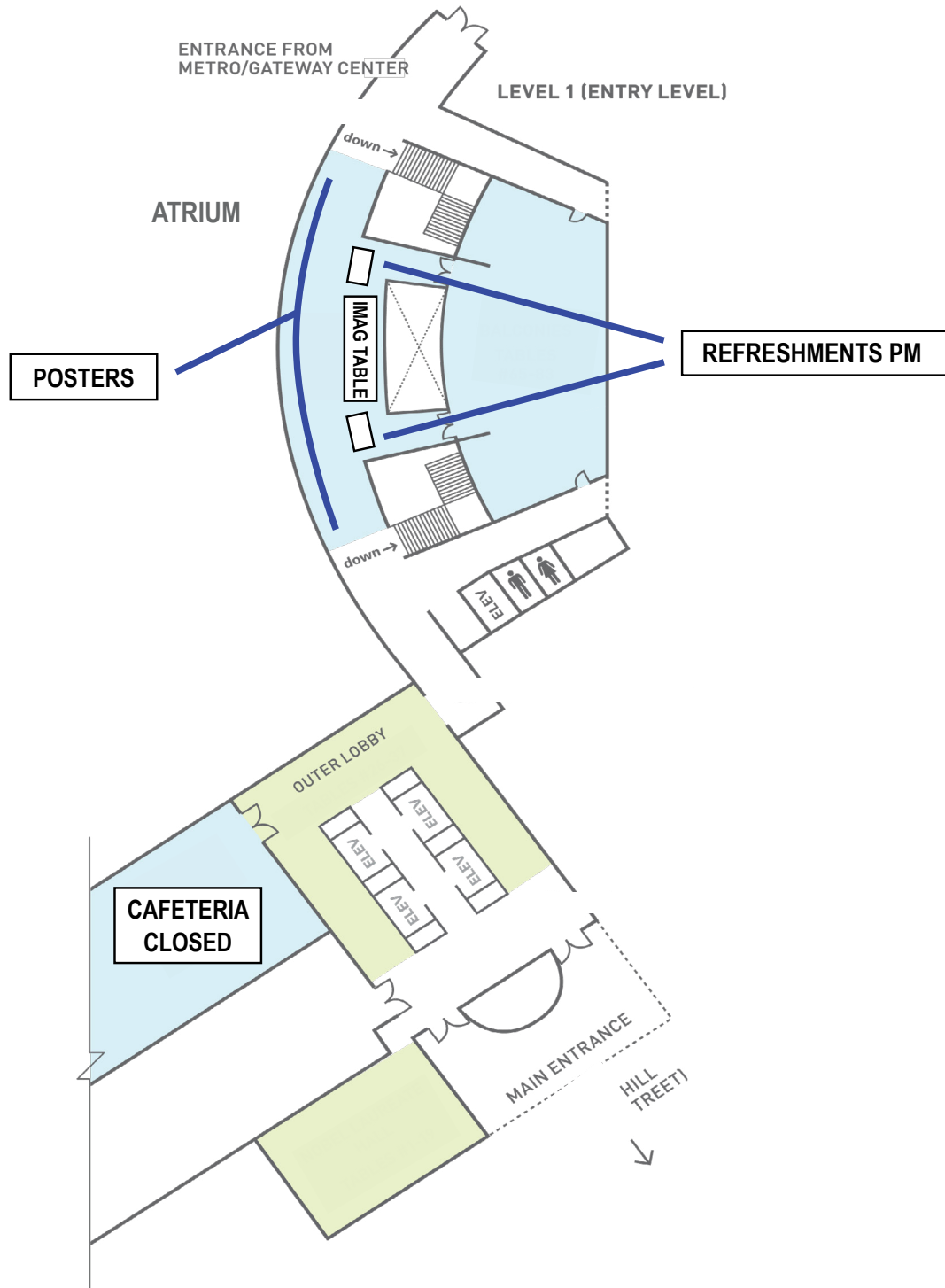
Day 2: The *Future* of Multi-Scale Modeling June 29, 2023		
Time & Location	**Activity**	**Organizers**
Round 1: 12:15-1:00pm **Round 2**: 1:00-1:45pm **Breakout Rooms** 1. Room AB 2. Room D 3. Room E1 4. Room E2 5. Room F1/F2	**BREAKOUT SESSIONS** 1. **Digital Twins**: whole person, mental health models 2. **New Mechanistic-ML Methods**: PINN, transformer, XAI, Large Language models 3. **Sociobehavioral and Social Determinant of Health (SDoH) models**: network, probabilistic, stochastic models 4. **Quantum computing and other technologies for modeling**: quantum sensors, neuromorphic chips. emerging compute capabilities 5. **Translation and Incentivization**: regulatory models, models for medical device development	**MSM/IMAG** Breakout Leads: 1. Gary An, Liz Ginexi 2. George Karniadakis, Mauricio Rangel-Gomez, Ilana Goldberg 3. Leads of Session 2.3, Bruce Y. Lee, Julia Berzhanskaya 4. Suvranu De, Orlando Lopez, Raj Gupta 5. Feilim Mac Gabhann, Elena Sizikova
1:45-2:15pm **Atrium**	PM Snack Break	Refreshments Courtesy of the Society for Mathematical Biology
2:15-3:15pm **Atrium**	Poster Session 2 – All MSM Investigators	**MSM**: Victor Barocas, Guy Genin **IMAG**: Liz Ginexi
3:15-4:15pm **Auditorium**	Plenary Session 2.4 – Summary of Breakouts	**MSM/IMAG** Breakout Session Leads
4:15-4:30pm **Auditorium**	MSM Consortium Next Steps & Moving Forward Closing Remarks	**MSM** Organizers: Jason Haugh, Denise Kirschner, Bruce Y. Lee, Herbert Sauro **IMAG c**o-chairs: Grace Peng, Liz Ginexi, Reed Shabman
4:30pm	Adjourn	

IMAG

Auditorium and Breakout Rooms Map

LOWER LEVEL

A

B

D

C 1
ATTENDEE STORAGE

C 2

E 1

BEVERAGES AM

OFFICE

LOWER LEVEL LOBBY

REGISTRATION

RUTH L. KIRSCHSTEIN AUDITORIUM

MAIN SESSIONS

E 2

G 1

CHARGING STATION

G 2

F 1

F 2

ELEV

H
QUIET ROOM

Main Sessions
Ruth L. Kirschstein Auditorium

Breakout Sessions 1-5
1. AB-Digital Twins
2. D-New Mechanistic-ML Methods
3. E1-Sociobehavioral and Social Determinants of Health
4. E2- Quantum computing and other technologies for modeling
5. F1/F2 Translation and Incentivization

Atrium

Special Speaker

Grace C.Y. Peng, Ph.D. – Program Director

Grace C.Y. Peng, Ph.D. is the Director of Mathematical Modeling, Simulation and Analysis at the National Institute of Biomedical Imaging and Bioengineering (NIBIB) within the National Institutes of Health (NIH) in the US Department of Health and Human Services (DHHS). In this capacity she has programmatic oversight of extramural activities in these areas.

Dr. Peng received the B.S. degree in electrical engineering from the University of Illinois at Urbana, the M.S. and Ph.D. degrees in biomedical engineering from Northwestern University. She performed postdoctoral and faculty research in the department of Neurology at the Johns Hopkins University. In 2000 she became the Clare Boothe Luce professor of biomedical engineering at the Catholic University of America. Her research focused on developing computational models of the vestibular system in control of the head and neck, and analytical tools for studying the oculomotor system in patients with vestibular dysfunction. Since 2002, Dr. Peng has been a Program Director in the NIBIB, overseeing various programs promoting the development of mathematical and statistical modeling and analysis methods; medical simulation tools; and next generation engineering systems for rehabilitation, robotics, neuroengineering, and surgical systems. In 2003, Dr. Peng led the creation of the Interagency Modeling and Analysis Group (IMAG), which now consists of program officers from multiple federal agencies of the U.S. government. Since 2004, IMAG has supported funding initiatives targeted to multiscale modeling of biomedical, biological and behavioral systems. Since 2006, IMAG has facilitated the activities of the Multiscale Modeling Consortium of investigators. Dr. Peng also has served in leadership roles in the NIH SPARC (2014-2016), BRAIN Initiative (since 2014), Bridge2AI Program (since 2020) and ComPASS Program (since 2022).. Dr. Peng is committed to promoting the development and use of intelligent tools and reusable data and models to accelerate biomedical research and translate scientific knowledge to the clinic and community. Grace was elected to the AIMBE College of Fellows in 2020.

Special Speaker

Denise Kirschner, Ph.D. – University of Michigan

Dr. Kirschner has been a professor in the dept of Microbiology and Immunology at the University of Michigan for 25 years. She received her Bachelors, Masters and PhD in applied mathematics from Tulane University. She did graduate work also at Los Alamos National Labs and a postdoctoral fellowship at Vanderbilt University joint with the departments of Mathematics and Infectious Diseases. For the past 25 years, her research focus has been on building multi-scale models to describe the host immune response to M. tuberculosis at multiple spatial and time scales and in multiple physiological sites including lung, lymph nodes and blood.

To date she has worked and collaborated with experimentalists generating data on TB with mouse, non-human primate and human studies. Dr. Kirschner currently serves (and has for the past 20 years) as Editor-in-Chief of the Journal of Theoretical Biology. She serves as the founding co-director of The Center for Systems Biology at the University of Michigan, an interdisciplinary center at the University of Michigan aimed to facilitate research and training between wet-lab and theoretical scientists. Dr. Kirschner is both an SMB and SIAM Fellow.

Special Speaker

Peter Hunter, Ph.D. – Auckland Bioengineering Institute

Prof Hunter completed an engineering degree in 1971 in Theoretical and Applied Mechanics (now Engineering Science) at the University of Auckland, New Zealand, a Master of Engineering degree in 1972 (Auckland) on solving the equations of arterial blood flow and a DPhil (PhD) in Physiology at the University of Oxford in 1975 on finite element modeling of ventricular mechanics. His major research interests since then have been modelling many aspects of the human body using specially developed computational algorithms and an anatomically and biophysically based approach which incorporates detailed anatomical and microstructural measurements and material properties into the continuum models. The interrelated electrical, mechanical and biochemical functions of the heart, for example, have been modelled in the first 'physiome' model of an organ. As the recent co-Chair of the Physiome Committee of the International Union of Physiological Sciences (IUPS) he has been helping to lead the international Physiome Project which aims to develop model and data encoding standards (CellML, FieldML, BioSignalML) and to use computational methods for understanding the integrated physiological function of the body in terms of the structure and function of tissues, cells and proteins. He is currently a Professor of Engineering Science and Director of the Bioengineering Institute at the University of Auckland, co-Director of Computational Physiology at Oxford University and holds honorary or visiting Professorships at a number of Universities around the world. He is on the scientific advisory boards of a number of Research Institutes in Europe, the US and the Asia-Pacific region. He is an elected Fellow of the Royal Society (London and NZ), the World Council for Biomechanics, the American Institute for Medical and Biological Engineering, and the International Academy of Medical & Biological Engineering (IAMBE). He has recently been President of the Physiological Society of New Zealand and is currently Secretary-General of the World Council for Biomechanics, Acting Vice-President of IUPS and Chair-Elect of IAMBE. Recent awards are the Rutherford medal and the KEA (Kiwi Expats Abroad) 'World Class NZ' Award in Research, Science, Technology & Academia category.

Peter has received numerous accolades for his work and in 2010 was appointed to the NZ Order of Merit. In 2009, he was awarded the Rutherford Medal, New Zealand's top science award, as well as the KEA World Class NZ award in Research, Science, Technology and Academia. He was elected a Fellow of the Royal Society of New Zealand in 1994 and a Fellow of the Royal Society (London) in 2006.scientists.

Poster Layout

UPPER LEVEL ATRIUM
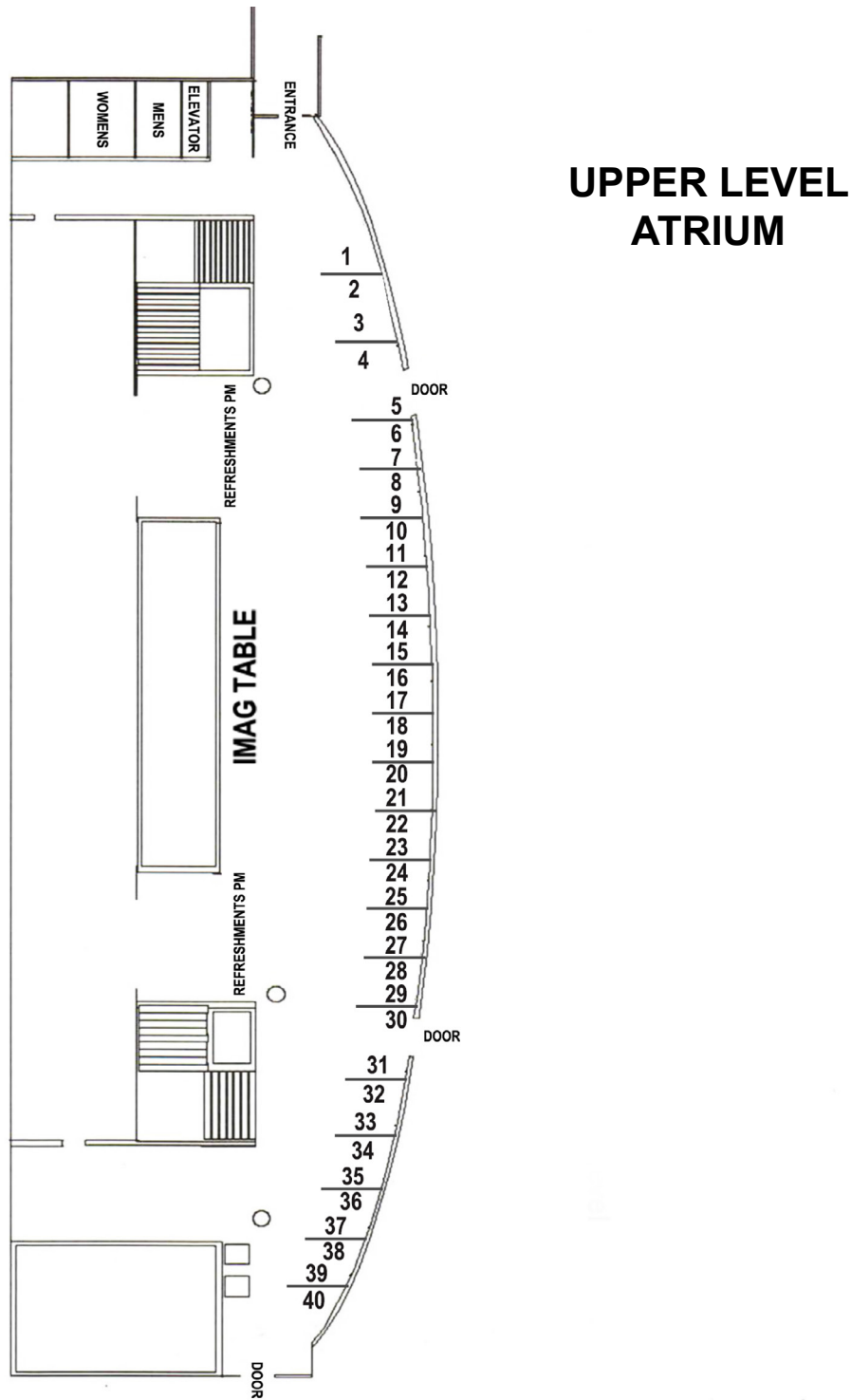
Poster Numbers & Group Assignments

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● **Early Career Investigators**

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● **Early Career Investigators**

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● **Early Career Investigators**

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History of IMAG

In April 2003, the Interagency Modeling and Analysis Group (IMAG) was formed; starting from a working group comprised of program staff from nine Institutes of the National Institutes of Health (NIH) and three directorates of the National Science Foundation (NSF). IMAG now represents over 100 program staff from multiple government agencies in the United States. Since its creation, this group has convened monthly through virtual meetings and at various locations of the IMAG participants. All IMAG participants are involved in managing research programs in biomedical, biological and behavioral systems that require the development of new and novel modeling and analysis methods.

The purpose of the IMAG is to provide an open forum for communication among government representatives to share updates on individual programs from the various IMAG agencies, and to plan trans-agency activities that will have a broad impact on the communities served by the IMAG.

In 2003, the IMAG recognized that the modeling community was on the forefront of thinking across the biological continuum, rather than just focusing at one scale or level of resolution. In addition, the IMAG identified a strong desire among modelers to form multi-disciplinary partnerships across varied research communities. This led to the development in 2004 of the Interagency Opportunities in Multiscale Modeling in Biomedical, Biological, and Behavioral Systems Solicitation. The 24 awardees from this solicitation subsequently formed the Multiscale Modeling (MSM) Consortium in 2006. The MSM Consortium has now grown to include over 100 projects relevant to multiscale modeling, supported from multiple IMAG interagency funding initiatives for multiscale modeling (which had active receipt dates from 2004-2018). IMAG coordinates the MSM Consortium.

From the IMAG wiki, https://www.imagwiki.nibib.nih.gov/content/history-imag