ATP·Bio℠

Public Annual Report
Year Three

A National Science Foundation
Engineering Research Center

Our Mission

ATP-Bio℠'s mission is to make transformative discoveries, train a diverse workforce, and connect resources and partnerships to ethically translate technologies for the storage and distribution of living biological systems.

Our Vision

ATP-Bio℠'s vision is to stop biological time, allowing living products to be readily available across the globe to advance healthcare, biodiversity, and food supply and sustainability.

Our Pillars & Components

diversity & culture of inclusion

engineering workforce development

convergent research

innovation ecosystem

ethics & public policy

Contents

Message from the Director

"And you're just getting started." These words, which were an offhand remark from a fellow scientist after hearing one of my talks about ATP-Bio, gave me pause. For the past year, I've watched as the amazing ATP-Bio community keeps exceeding all expectations:

On the **Convergent Research** front, ATP-Bio drove the first-ever successful transplants of vitrified and rewarmed organs (and made the cover of Science, no less), new breakthroughs on the preservation of vascularized composite allografts (like digits, hands, and limbs), scalable preservation of coral for biodiversity, and many more advances.

Our **Innovation Ecosystem** now boasts 27 active members (with several more pending), new patents and disclosures, and several new opportunities for trainees and faculty to work directly on industry projects.

Engineering Workforce Development and **Diversity and Culture of Inclusion** have developed a thriving national REU program and is establishing multiple STEM pipeline groups both within ATP-Bio (at Texas A&M and UCR, both minority serving institutions) and with HBCU's, community colleges, and organizations like STEM NOLA. And we're beginning to have a strong track record of ATP-Bio graduates finding industry and academic jobs in biopreservation.

Our unique **Ethics and Public Policy** group has been tremendously productive in engaging nationwide experts in discussions around the societal adoption of new biopreservation technologies. This dedicated group has created webinars, published papers, and jumped in as collaborators on several scientific papers – showing clearly how ethics and public policy work should be woven into all scientific research.

As you'll see in the following pages, I could go on and on. On some days, it feels like I can hardly keep up.

Our Administrative Director Alyssa Burger recently reminded me, though, that ATP-Bio's Year 4 comes with the added challenge of planning for a five-year renewal. I naturally started thinking about all the ways that ATP-Bio will increase its impact on academic, industrial, and medical communities in the next decade. And I had to agree with my fellow scientist: we are, indeed, just getting started.

Societal Benefits

ATP-Bio[SM] is a visionary engineering research center leading the field of biopreservation and developing a diverse and inclusive STEM workforce to continue to drive this important field. ATP-Bio[SM]'s vision is to accelerate technologies that enable widespread preservation and distribution of cells, microphysiological systems, tissues and organs, and whole organisms. These advancements will eliminate barriers that currently prevent biological systems from providing massive societal benefit through the biomedical, aquaculture, and several other global industries.

ATP-Bio[SM] will accomplish this through three focused areas of research:

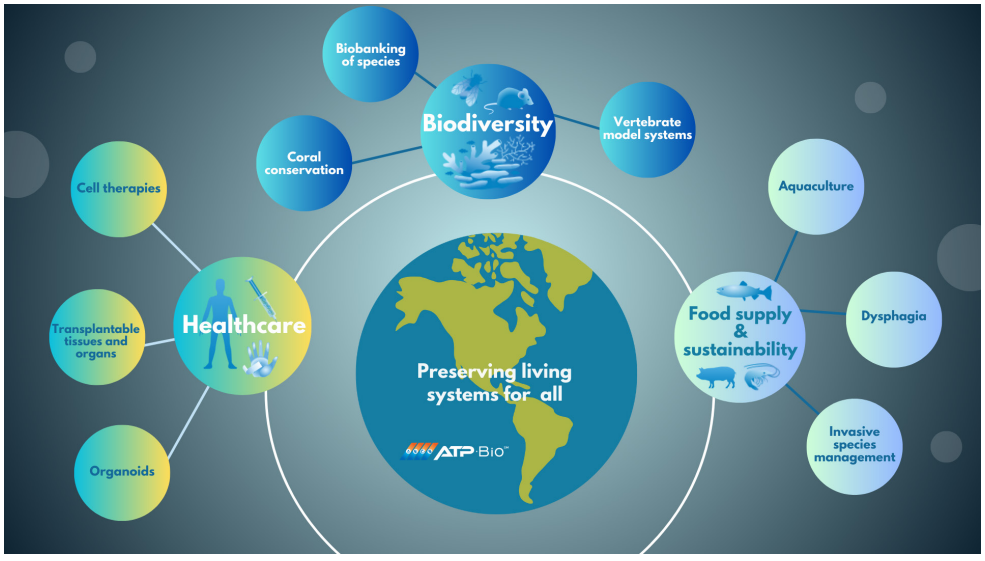
- **Thrust 1, Biological Engineering**: Preparing the biological testbed to survive preservation by cooling or "cryopreservation."
- **Thrust 2, Multiscale Thermodynamics of Water**: Entering a cryopreserved state by cooling the testbed to a subzero temperature.
- **Thrust 3, Rapid and Uniform Warming**: Rewarming the system to physiological temperatures for restored biological function.

At each stage, convergent engineering research will aim to:

- eliminate or control ice
- mitigate toxicity from cryoprotective agents
- prevent thermal and mechanical stress

Through transformative biopreservation technology, ATP-Bio[SM] is:

- Building a sustainable STEM workforce in biopreservation and developing a culture that fosters inclusivity and diversity.
- Using and sustaining STEM education research and best practices to develop programs, curriculum, and experiences that reach diverse groups currently underrepresented in STEM.
- Incorporating the ecosystem's priorities through our scientific and industry advisory boards.



- Commercializing and translating technologies to revolutionize cell therapy, regenerative medicine, aquaculture, and organ and tissue markets.
- Mitigating risk through rigorous bioethical analysis to secure societal benefits.

Leadership & Advocacy

Academic institutions

ATP-Bio℠ is a world-class partnership between engineering, medicine, science, education, business, and ethics at six premier research universities. It supports the crucial advancement of biopreservation technologies and enables innovation, commercialization, and diverse workforce development. Across ATP-Bio℠, the institutional resources are abundant.

University of Minnesota (UMN) is the lead institution as ATP-Bio℠ headquarters. UMN's expertise includes heat transfer, nanomedicine, cryobiology, particle technology, aerosols, 3D printing, cell therapies, physiology, bioelectronics, chemistry, advanced manufacturing, STEM education, psychology, bioethics, law and policy, business, innovation and commercialization.

Massachusetts General Hospital (MGH), ATP-Bio℠'s co-lead institution, is a world leader in every facet of cryobiology including biopreservation, biomineralization, biostabilization, microfluidics, tissue engineering, cryopreservation, BioMEMS, chemical engineering, organ reengineering, organ preservation, and metabolomics.

Texas A&M University (TAMU) is a core partner (as of Y3) and the biggest university in America and has recently become an HSI. TAMU brings expertise in optics, laser nanowarming, molecular systems biotechnology in inflammatory diseases, microfluidic model systems, and intersections of thermodynamics and metabolic engineering in biopreservation and conservation biology.

University of California-Riverside (UCR) is a core partner and a Hispanic-Serving Institution (HSI) and one of America's most successful at graduating students from underrepresented and disadvantaged backgrounds. UCR brings expertise in nanofabrication, material science, nanostructures, nanoparticle development, laser technology, and optics.

University of California-Berkeley (UCB) is a core partner and a leading public research university providing provides pioneers in cryobiology, micro-physiological systems, micro and nano energy conversion, organoids, drug discovery, and thermal measurement technologies.

Carnegie Mellon University (CMU) is an affiliated partner and brings cryobiology, cryosurgery, and cryomedicine research to the Center.

Genesis of ATP-Bio℠

ATP-Bio℠ by the Numbers

SEPTEMBER 1, 2020 – JUNE 30, 2023

ATP-Bio℠ Personnel

35 Senior Personnel & Staff

30 Faculty

44 Research Staff & Technicians

127 Trainees

Postdocs, Graduate Students, Undergraduate Students, Technicians

Research Inputs & Outputs

79 Core Publications (peer-reviewed journals)

81 Associated Publications (peer-reviewed journals)

$30.8 MILLION Associated Project Funding

Formal & Informal Dissemination

100 Workshops, Short Courses, Trainings, Webinars

24 Innovation-Focused Events

87 Conferences, Symposia, Colloquia, Invited Talks

Education & Outreach

20 New Courses, or Existing Courses Modified with ERC Content

34 Research Experiences for Undergraduates (REU) Program

34 Pre-College Teacher Professional Development

65 High School Engagement Program (Young Scholars)

28 Graduates (PhD, Masters)

Innovation Ecosystem

30 ATP-Bio Partners (Industry, Innovation, NGO Members)

10 Core & Associated Inventions Disclosed

10 Core and Associated Provisional Patent Applications Filed

4 Core and Associated Patents Awarded

Center Diversity

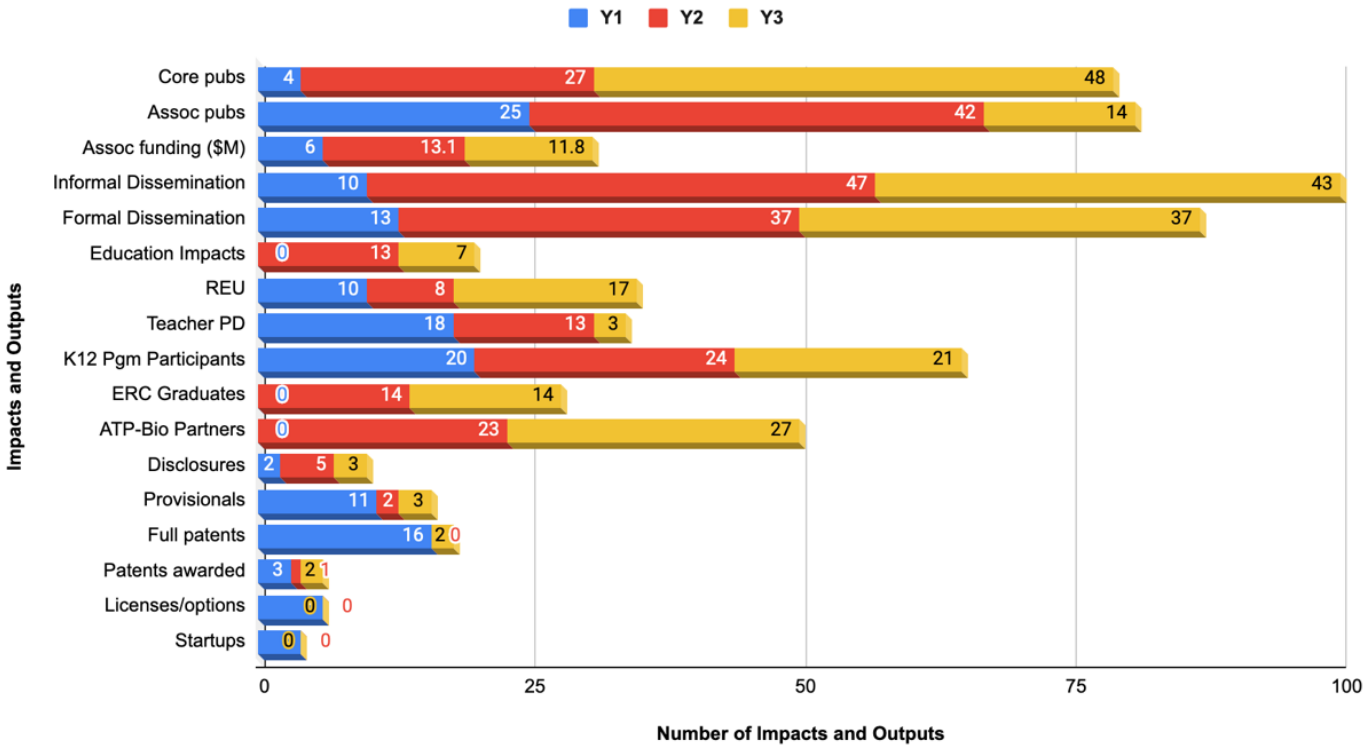
Women, Racial & Ethnic Minorities, Persons with Disabilities

Leadership Team	46%	14%	9%
Faculty	33%	10%	3%
Postdocs	29%	26%	0%
Trainees	36%	26%	9%
REUs	76%	36%	16%

By the Numbers Highlights

- ATP-Bio incorporated a high number of postdocs into its trainee framework
- Except for graduate students who are racial minorities, ATP-Bio exceeds all national averages for underrepresented persons in STEM
- ATP-Bio increased participation of women and underrepresented racial and ethnic minorities in the Center
- Substantial increase in core publications; majority co-authored with trainees
- Leveraged funding (associated) boosted research activity across the Center
- Center-wide dissemination activity
- Largest cohort of REU participants in Y3
- ATP-Bio graduates are increasing; many hired into the ATP-Bio relevant ecosystem
- Increased Member Partners by 42%

ATP-Bio Impacts & Quantifiable Outputs



Looking Forward

ATP-Bio Council of Deans

ATP-Bio is strengthening the partnership with ATP-Bio's Council of Deans to inform sustainability planning, engagement with institutional leadership in ATP-Bio's success, and maintain visibility and relevance to all our stakeholders.

ATP-Bio Annual Meeting

The Year 4 Annual Meeting will be hosted at Texas A&M on March 18-21, 2024.

ATP-Bio's Annual Meeting is an event for the biopreservation industry, academic community, and other collaborators in the NSF Center for Advanced Technologies for the Preservation of Biological Systems.

The event connects industry to academic resources and talent through technical and research presentations, networking opportunities, facility tours, and other special features. It also serves as host to closed-door meetings for the Industry Advisory Board (IAB), Scholar Leadership Council (SLC), Scientific Advisory Board (SAB), and the EWD-DCI Advisory Board (EWD-DCI-AB).

PILLAR

Diversity & Culture of Inclusion

DCI

ATP-Bio℠ is broadening participation from groups that historically have been underrepresented in STEM and we are increasing the potential for impact and innovation.

Although there are many ways that such increased diversity can be understood, our primary focus is on broadening participation with respect to race, ethnicity, gender, disability, socioeconomic status, veterans, and first-generation students.

We promote diversity, inclusion, and societal benefit across all ATP-Bio℠ institutions and levels of the Center, including leadership, faculty, staff, trainees, students, industry partners, and other stakeholders.

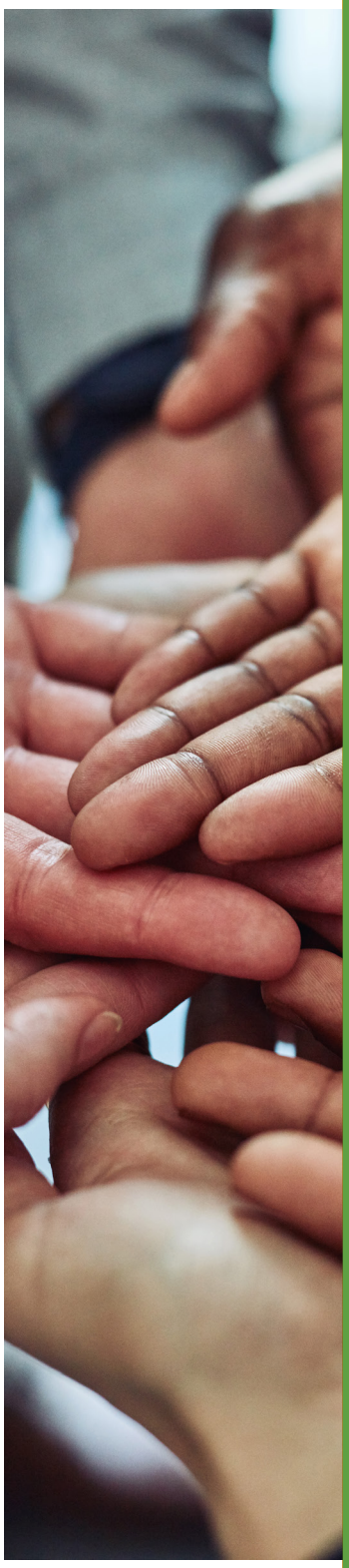
We build and sustain a culture of inclusion in which all members feel valued and welcomed, can contribute creatively, and can gain respect and mutual benefit from participating. This includes intentional accessibility practices that ensure facility, technology, and activity access for individuals with a wide range of disabilities.

DCI Year 4 Priorities

- Strategic recruitment efforts to improve representational diversity in the center through our partnerships with LSAMPs center-wide
- Strengthen partnerships with Community College, Minority Serving Institutions, and Historically Black Colleges and Universities
- Develop long-term action plans to continue to address needs of our organizational culture

Year Three Highlights

- **DCI launched DCI Cafés to create an informal space** for ATP-Bio members to engage in discussions about critical issues related to diversity, equity, and inclusion. Some of the meetings focused on creating inclusive labs, creating anti-racist labs, and making STEM accessible.
- **ATP-Bio industry partners, research faculty, trainees, and staff met to revisit the ATP-Bio Code of Conduct and Statement of Diversity and Inclusion.** These are living documents that shape the climate and culture of our center.
- **ATP-Bio's leadership formed new partnerships** with the GEM consortium, Southern Regional Education Board, and the Presidents' Postdoctoral Fellowship Program to advance our work to recruit and retain center members from historically underrepresented backgrounds.
- **The external evaluator and DCI pillar enacted a center-wide climate assessment** in order to understand experiences and identify perceptions of the organizational climate from diverse perspectives within the ERC.
- **DCI & LS-North Star STEM Alliance Research Partnership for Undergraduates** provided MN-local URM students with the opportunity to join ATP-Bio labs to develop engineering research experience during the academic year.
- **Societal and Broader Impacts Research** focuses on how societal and broader impacts are represented in ATP-Bio's research. This focus presents an example of the ways that ATP-Bio is striving to embrace excellence and reject complacency. DCI partners with EPP to focus extensively on ethical and public policy considerations around biopreservation so that ATP-Bio's technology can be effectively translated to public benefit. Our members are committed to promoting this focus in their work. The DCI pillar collaborates to elevate this aspect of ATP-Bio's research and innovations by intentionally providing guidance and feedback on societal and broader impacts.



DCI Programming

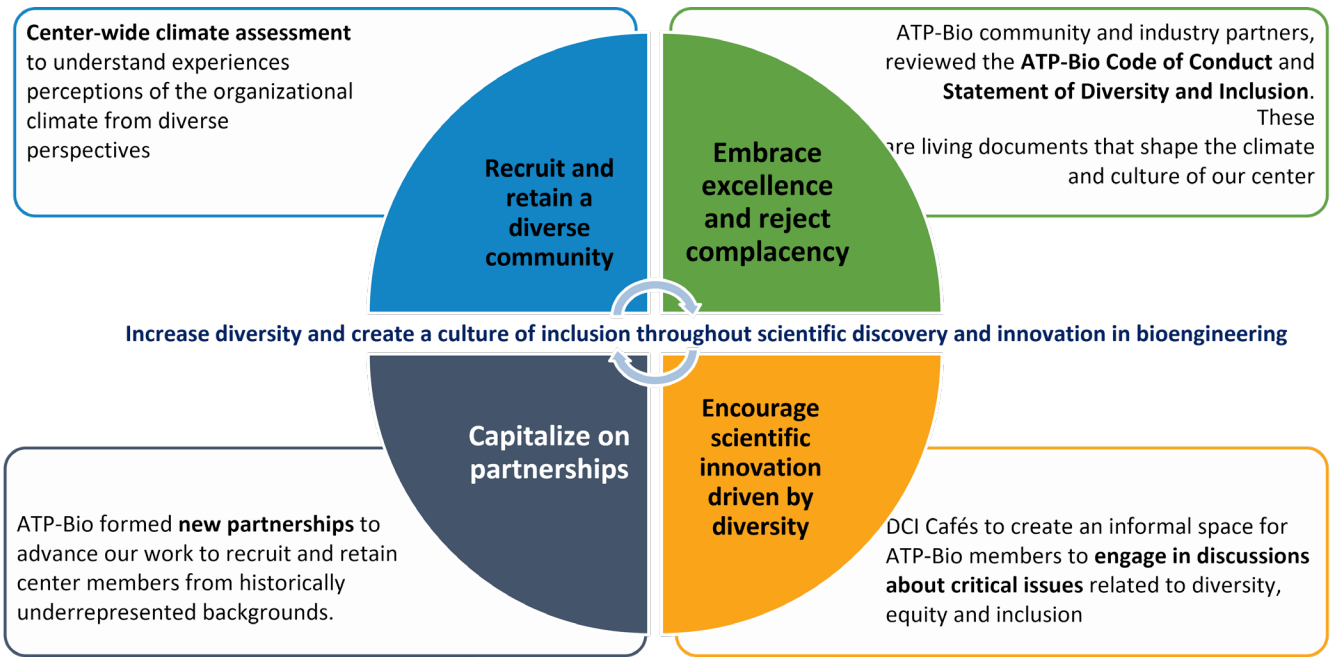
DCI supports a culture of inclusion throughout scientific discovery and innovation in bioengineering

Getting Involved

- DCI Climate Survey
- DCI Cafes
- Implicit Bias Awareness and Mitigation Training
- & more to come!

Past DCI Forums and Training Highlights

- Gender Equity Education
- Tools and Practice for Communicating through Conflict
- Racial Equity in Biomedical Technology
- Bridging the Gap Between Science and Equity



PILLAR

Engineering Workforce Development

ATP-Bio℠ educates a STEM workforce that is a demographic reflection of the nation and recognizes that diversity of perspective strengthens STEM fields.

EWD

Cell therapy, regenerative medicine, aquaculture, and organ and tissue markets are estimated to be between $300B–600B (US-World) and are predicted to grow substantially by 2025, making workforce development a critically important part of ATP-Bio℠.

ATP-Bio℠ is improving the quantity and quality of engineering intellectual capacity, diversifying the workforce to be representative of U.S. demographics by using inspiration from ATP-Bio℠'s science and engineering. "STEM identity" is a primary driver of sustained pursuit in the STEM disciplines, especially for those underrepresented in STEM.

EWD Year 4 Goals

- Continue to broaden access to undergraduate research opportunities through summer and academic year opportunities.
- Systematize and expand senior design project support for impacts on the curriculum and engagement in undergraduate research.
- Build robust partnerships with Community College, Minority Serving Institutions, and Historically Black Colleges and Universities to support recruitment.

Year Three Highlights

- **Hosted an eight-day introduction to research program for High School students from Washington Tech HS in St. Paul Minnesota.** The program focuses on introducing students to the engineering process through the lens of ATP-bio relevant experiences. For example, students engage in a design challenge where they need to design a cryopreservation container that can keep a hypothetical vaccine cold during transportation. 21 students participated in the program, all from underrepresented minority groups.
- **Launched a new REU orientation program at UC-Riverside** and hosted its largest ever REU program, with 17 student researchers placed across 5 different sites.

- **Piloted its Senior Design Capstone Program**, supporting 16 students across the center. With 3 unique teams at Texas A & M, Massachusetts General Hospital, and the University of Minnesota, the pilot proved to been high demand Based on this success it has been formalized into a center-wide program opportunity for Year 4.
- **Developed a new undergraduate bridge program** that supports students transferring between 2 years and 4 year institutions. The program is being piloted at UC-Riverside in the summer of 2023 with 5 student participants, with the goal of broadening implementation across the center.

Meet the Scholar Leadership Council

The primary role of the ATP-Bio℠ Scholar Leadership Council (SLC) is to advise ATP-Bio ERC.

The SLC also functions as a service organization, a social club, and a scholar government entity for all scholars of ATP-Bio. The SLC promotes inter-university and industrial collaboration directly with ATP-Bio scholars, provides scholars with opportunities to conduct outreach programs at their local universities, organizes scholar social events and seminars, and is also responsible for guiding the annual scholar retreat.

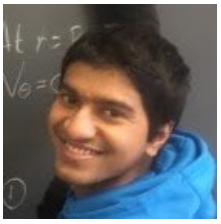
Each university nominates one scholar representative to serve on the SLC. The officers may be university representatives, but it is not required. The SLC serves as a liaison between the scholar body and the senior ATP-Bio leadership, voicing concerns and relaying important information between these two groups.

In Y3 the SLC built upon and improved based on insights from years 1 & 2. The SLC works to create a sense of community among scholars, improve engagement and participation, as well as identify individual and collective goals and means to achieve them.

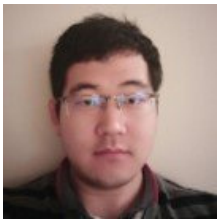
Co-Chair
Devarsh Vispute (CMU)

Co-Chair
Srivasupradha Ramesh (UMN)

Evaluation Lead
Ash Belamkar (UCR)



EWD Lead
Lakshya Gangwar (UMN)



CR Lead
Zonghu Han (UMN)

EPP Lead
Casey Kraft (UMN)

DCI Lead
Matthew Lawler (UMN)

Communications Co-Lead
Alexi Tchir (MGH)

Communications Co-Lead
Jazmin Velazquez (UCB)

Innovation Ecosystem Lead
Nik Zuchowicz (UMN)

PILLAR

Convergent Research & Engineering

CR

ATP-Bio℠ is accelerating technologies that enable widespread preservation and distribution of cells, microphysiological systems, tissues and organs, and whole organisms.

ATP-Bio℠ is "stopping biological time" and radically extending the ability to bank and transport cells, micro-physiological systems (MPS or "organs-on-a-chip"), aquatic embryos, tissue, skin, whole organs, and even whole organisms, using a team approach to build advanced preservation technologies. ATP-Bio℠ envisions a world a decade from now in which a vast range of biological systems are preserved in a high throughput manner for a wide range of benefits to humankind and the natural environment, with advances in nanotechnology, 3D printing, genetics, and numerous other fields. The convergent science of ATP-Bio℠ is developing the foundational knowledge base, which informs the technology base; together these are integrated at the testbed level. These Thrusts use enabling technologies to tackle barriers of ice formation, CPA toxicity, and thermal and mechanical stress

CR Year 4 Goals

- The goal is to continue efforts in healthcare, with an increased focus on biodiversity and food supply/sustainability.
- **Bringing in New Talent and Expertise.** In Y3 we launched RFPs and SIRPs and plan to continue in Y4 with new topics.

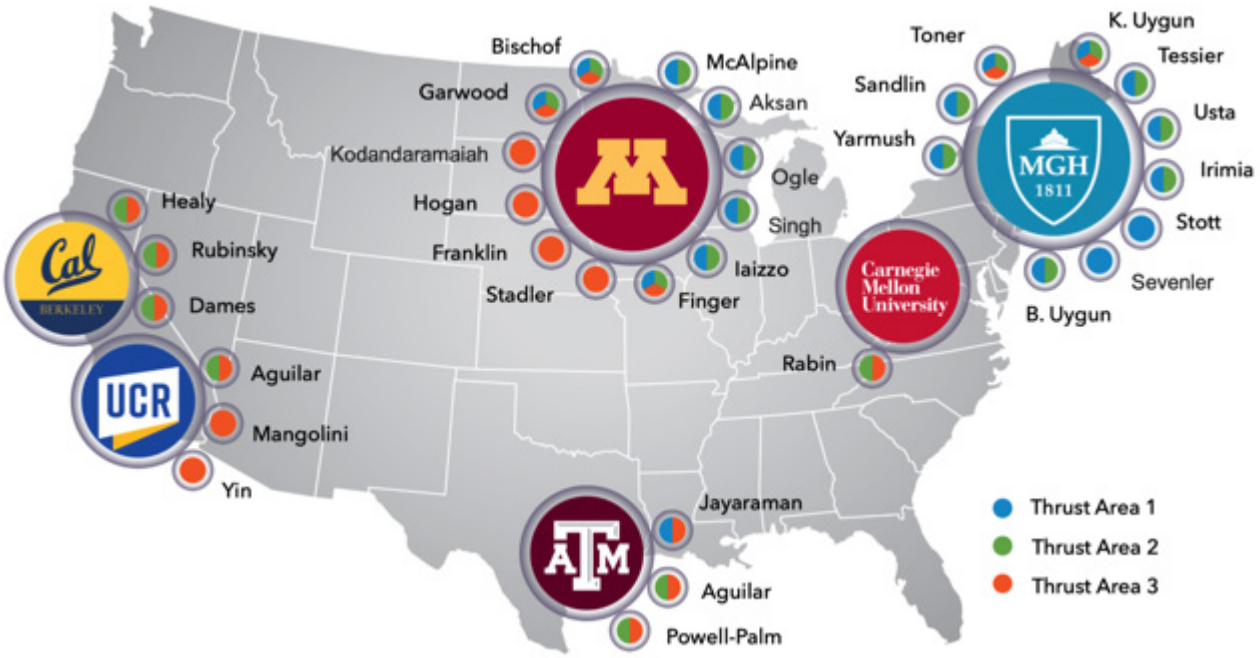
Year Three Highlights

- **ATP-Bio researchers demonstrated successful kidney transplant after long-term cryopreservation.** They achieved success in all steps from cryoprotectant loading, vitrification, storage of rat kidneys up to 100 days, and nanowarming as demonstrated by successful long-term survival in a rat transplant model. This work was featured on the cover of Science (Science, Vol 380, Issue 6652) and published in Nature Communications (Han, Rao et al., 2023, doi.org/10.1038/s41467-023-38824-8)

- **ATP-Bio researchers demonstrated successful 3D Temperature Controlled Cryoprinting (TCC) of food for patients with dysphagia.** The TCC technology, designed to freeze biological constructs as they are printed, provides a precise control of the structure of the object which led our researchers, in collaboration with the USDA, to use it to develop foods with complex microscale and macroscale texture that satisfy the requirements of the International Dysphagia Standardization Initiative. Such applications hold great promise in Global Health and resulted in a publication (Lou, L. et al., 2023, doi.org/10.1016/j.ifset.2023.103362)

- **ATP-Bio researchers demonstrated successful ex vivo perfusion based genetic modification of VCAs using machine perfusion.** The results lay the groundwork for genetic modification of transplant organs as a means to improve organs before transplantation or for ex vivo organ assessment. New sensor technology in assessing graft viability has led to a new patent filing and a new disclosure which has already gathered interest for licensing, and a clinical trial using our VCA machine perfusion protocol is under review.

ATP-Bio's Growing Research Network



"ATP-Bio is an Engineering Research Center that is pushing biopreservation "light years ahead"because of the cross-disciplinary and non-siloed nature of the Center. It is an impressive program addressing critical gaps in an innovative manner. They are advancing technology that works at scale from cells to whole organs and across species. This would not be possible without the resources and coordination of the ERC. They are developing the foundational technology for biopreservation that addresses the two major challenges of the ecosystem: a) simplifying the complexity of biopreservation processes and b) customization in biopreservation processes."

[ATP-Bio SAB SWOT analysis]

ATP-Bio Scientific Advisory Board

The Scientific Advisory Board (SAB) provides independent external peer evaluation and assessment of scientific research conducted by the Center. The SAB members are from organizations that are not members of ATP-Bio but have relevant knowledge of the topic and ability to devote sufficient attention to ensure a rigorous scientific research agenda. Appointments are by invitation from the Center Director and Deputy Director. The SAB convenes at least twice per year to evaluate the Center's research direction, including once during the Annual Meeting.

Anthony Atala, MD
W. Boyce Professor and Chair of Urology
G. Link Professor and Director
Wake Forest Institute for Regenerative Medicine

Beth Pruitt, Ph.D.
Chair, Biological Engineering
University of California Santa Barbara

Rashid Bashir, Ph.D.
Grainger Distinguished Chair in Engineering
Dean, College of Engineering
University of Illinois - Urbana-Champaign

Krishnendu Roy, Ph.D.
Bruce and Bridgitt Evans Dean of Engineering, School of Engineering
Vanderbilt University

Mary Hagedorn, Ph.D.
Research Scientist
Smithsonian National Zoo
Smithsonian Conservation Biology Institute

Gordana Vunjak-Novakovic, Ph.D.
University and Mikati Foundation Professor of Biomedical Engineering and Medical Sciences Laboratory for Stem Cells and Tissue Engineering
Columbia University in the City of New York

PILLAR

Innovation Ecosystem

IE

ATP-Bio℠ is building a healthy, self sustaining ecosystem that brings together all stakeholders to solve the most complex issues in the preservation of biological systems.

We produce a significant portion of the next-generation biopreservation workforce in both industry and academia. Our mission is to be a robust academia-industry consortium energized by ATP-Bio℠ leaders. We are developing dozens of biopreservation technologies that are breaking through existing bottlenecks and enabling companies of all sizes to bring their living products to market, no longer bound by limits on supply chain management issues such as shipment and storage.

IE Year 4 Goals

The process of commercialization is often hindered by the challenging translation from university research and invention to the real world production of new products.

ATP-Bio's IE activities are increasing technology push (university led) and market pull (industry led) as well as improving the innovation capacity within our ecosystem. Crucial to all of these activities are our ATP-Bio Partners and recruiting our founding members.

IE's focus into Y4:

- Building a Robust Start-up Ecosystem
- Continuing to increase ATP-Bio's member partners and prioritize representation from biodiversity and food supply/sustainability stakeholders
- Implementing Technology Assessment Workshops across technology spaces in the Center

Year Three Highlights

- ATP-Bio Partner membership grew to 27. Fifteen of those members are industry with two full, four sustaining, and nine associate level members. Nine of the partners are Non-profit/ Government members and three partners in the Innovation category.
- A new program was developed to directly obtain ATP-Bio Member input on convergent research direction. The Stakeholder Inspired Research Program was developed and funded three projects from member dues.
- Conducted the pilot Platform Technology Assessment workshop. Modeled off of an NSF I-corp program, we conducted the first of its kind workshop for researchers to consider the commercialization pathway for a technology with broad applications.

ATP-Bio Members & Partnerships*

INDUSTRY: Provide the voice of industry, end user, or customer voice to ATP-Bio as well as technical and strategic direction to the center, particularly with respect to tech transfer, commercialization, and industry priorities.

- **Sustaining Members**: AMF Life Systems; Instant Systems; Nevada Donor Network; ThermoFisher Scientific
- **Full Members**: American Type Culture Collection (ATCC); Boston Scientific; MidAmerica Transplant
- **Associate Members**: Allosource; Archive Sciences, Inc.; AutoIVF; BioChoric; CaseBiosciences; Evia Bio, Inc.; Expanse Bio; Heisenberg Inc; Iowa Donor Network; OmniLife Health; PanTHERA CryoSolutions; Recombinetics; Sylvatica Biotech Inc; The 2030 Group Advisors, LLC; The Elizabeth Crook & Marc Lewis Foundation; Tissue Testing Technologies LLC; VitriStor LLC

NON-PROFIT/GOVERNMENT: Provide end user or other voices in the value chain and/or ecosystem to ATP-Bio but due to tax status cannot accept IP benefits. They provide technical and strategic direction to ATP-Bio and participate in the IAB as nonvoting members.

- Agricultural Utilization Research Institute (AURI); Isthmus Foundation; LifeGift; Sea Grant Minnesota; Museum of Science, Boston; Organ Preservation Alliance; Smithsonian Institution; Society for Cryobiology; Taronga Conversation Society of Australia.

INNOVATION: These partners help get ATP-Bio technologies to the market (e.g. economic development orgs, incubators/accelerators, investors, etc.) They contribute to other center activities and events in targeted fashion, but do not participate in the IAB.

- Fogarty Institute for Innovation; gener8tor Management, LCC; MNSBIR Inc.; University Enterprise Laboratories, Inc.

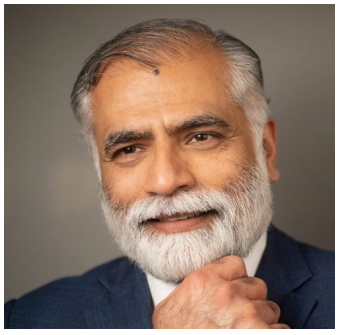
[* member/partners current as of Feb 1, 2024]

ATP-Bio Industrial Advisory Board

The Industrial Advisory Board (IAB) acts as an advisory body providing strategic review and counsel to the Executive Committee on research activities of the Center meeting semi-annually to review ATP-Bio's research programs and mechanisms for technology transfer, as well as assignments for action, disposition, and recommendations of IAB sub-committees.

The IAB meets quarterly, two of which happen at the fall Site Visit and spring Annual Meeting. IAB Chairs are Seb Giwa (Nevada Donor Network) and Uzair Rajput (Instant Systems), both Sustaining Members of the ATP-Bio Partners program. Its members include representatives of companies or organizations supporting ATP-Bio at various membership levels. Members provide guidance and perspectives on the Center's research strategy, future technology priorities, and the funding of ATP-Bio research projects. In Y3, the IAB launched **ATP-Bio RFP002 SIRP: Stakeholder-Inspired Research Program** to identify and sponsor areas of research of particular interest to members.

Sebastian Eriksson Giwa, Ph.D.
Co-founder of Elevian, Ossium Health, Sylvatica Biotech, and the Organ Preservation Alliance (incubated at SU Labs at NASA Research Park)
Nevada Donor Network



Uzair Rajput, M.S.
Chief Operating Officer
Instant Systems

IAB Board Members

Jason Acker
President & CEO
PanTHERA CryoSolutions Inc.

Jay Beyer-Kropuenske
Director of Operations
University Enterprise
Laboratories, Inc.

Kelvin Brockbank
CEO and Managing Partner
Tissue Testing Technologies LLC

Nilay Chakraborty
Principal Scientist
American Type Culture Collection (ATCC)

Dan Chen
Principal
The 2030 Group Advisors, LLC

Pierre Comizzoli
Project Leader of the Pan-Smithsonian Cryo-Initiative
Smithsonian Institution

Suzanne Conrad
CEO
Iowa Donor network

Jonathan Daly
Conservation Biologist
Taronga Conservation Society Australia

Pat Dillon
President
MNSBIR, INC.

John Downing
Director
MN Sea Grant

Ross Dunbar
President
Isthmus Foundation

Nicole Evans
Executive Director
Society for Cryobiology

Michael Floren
Director, AlloSource Innovation Center
AlloSource

Kevin Flynn
Chief Scientific Officer (CSO)
CaseBioscience

Bruce Forsyth
Sr. Fellow, R&D/Interventional Oncology
Boston Scientific

Robert Goldstein
Executive Director, Strategic Planning & Product Development
AMF Lifesystems, LLC.

Insoo Hyun
Director of the Center for Life Sciences and Public Learning
Museum of Science, Boston

Ravi Kapur
CEO
AutoIVF

Charles Y. Lee
Chief Operating Officer
VitriStor LLC

Rachel Leon
Director, Business Development
Evia Bio, Inc.

Jedediah Lewis
CEO
Organ Preservation Alliance

Marc Lewis
Owner, Co-Director
The Elizabeth Crook & Marc Lewis Foundation

Yue Liu
Assistant Director
Aquatic Germplasm and Genetic Resources Center (AGGRC)

Kevin Myer
President and CEO
LifeGift

Hunter Davis Ozawa
Head of Science
Heisenberg Inc

Michael Pettigrew
Founder and CEO
Archive Sciences, Inc.

Matthew Powell-Palm
CEO
BioChoric Inc.

Mark Powers
Vice President, R&D
Thermo Fisher Scientific/Life Technologies Corporation

Shannon Schlecht
Executive Director
Agricultural Utilization Research Institute

Dalton Shaull
CEO, President
Omnilife

Kurt Smith
VP, Strategic Innovation
Fogarty Institute for Innovation

Lindsey Speir
VP, Organ Operations
Mid-America Transplant

Troy Vosseller
Co-founder
gener8tor Management, LLC

Adrienne Watson
Recombinetics Inc.

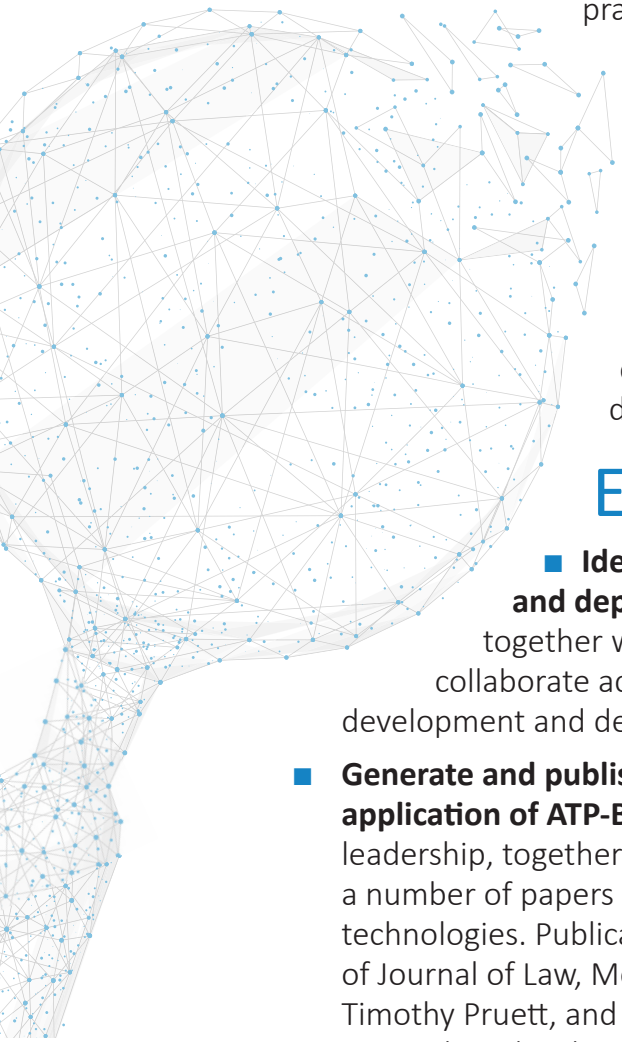
Brad Weegman
President, **Expanse Bio LLC**;
Chief Operating Officer, **Sylvatica Biotech Inc.**

COMPONENT

Ethics & Public Policy

EPP

Through ethics and public policy analyses, ATP-Bio℠ is establishing guidance for the responsible development and deployment of ATP-Bio℠'s breakthrough technologies for societal benefit.



ATP-Bio℠ advanced biopreservation technologies are transforming practices from organ transplantation to conservation biology. Achieving societal benefit and minimizing risk of misuse requires a clear understanding of the ethical and public policy implications of ATP-Bio℠'s discoveries, as well as strategies to mitigate potential ethical concerns. ATP-Bio℠ breaks new ground among ERCs by incorporating an explicit Ethics & Public Policy (EPP) component to identify and address the ethical, legal, and societal implications (ELSI) posed by ATP-Bio℠ research and its emerging technologies. This work enables the ATP-Bio℠ research community, and others, to responsibly research, develop, and deploy emerging biopreservation technologies.

EPP Year 4 Goals

- **Identify and analyze ethical and policy issues in the development and deployment of biopreservation technologies.** EPP leadership, together with the Ethics & Public Policy Panel (EP3) will continue to collaborate across the ERC to identify important barriers to the ethical development and deployment of ATP-Bio technologies.
- **Generate and publish analysis and guidance for ethical development and application of ATP-Bio technologies to achieve net societal benefit.** In Year 4, EPP leadership, together with EP3, ERC faculty, trainees, and other stakeholders will publish a number of papers that address the ethical and responsible development of ATP-Bio technologies. Publications will include a 10-article symposium in the Fall 2024 issue of Journal of Law, Medicine & Ethics. This symposium, guest edited by Susan Wolf, Timothy Pruett, and Korkut Uygun, is titled "Emerging Technologies to Stop Biological Time: The Ethical, Legal & Policy Challenges of Advanced Biopreservation."
- **Expose ATP-Bio investigators and trainees to EPP questions, methods, and processes.** In Year 4 EPP will offer two ATP-Bio EPP webinars for the ERC, both delivered by EP3 members. In the fall, Evelyn Brister, PhD, Professor of Philosophy, Rochester Institute of Technology, presented on "Using Advanced Biopreservation for Conservation: Ethics & Justice Considerations." In the spring, Paul Thompson, PhD, Professor Emeritus, Michigan State University, will present on "What Would a Bioethics for Agricultural and Food Applications of Cryopreservation Look Like?" EPP will also host a panel at the Annual Meeting on, "Challenges in Applying Advanced Biopreservation to Human Health Beyond Organ Transplantation."

- **Conduct cutting-edge analysis of the ethical challenges facing multi-team networks** like ATP-Bio that are conducting engineering research. NSF has funded EPP's "NetEthics" project to study the unique issues that arise in a multi-institutional and multidisciplinary research network, in order to generate much-needed recommendations and resources.

Year Three Highlights

- **Hosted two EPP seminars for the full ERC:**
  - Insoo Hyun, PhD (Boston Museum of Science; EP3 member) on "Emerging Technologies and Nascent Bioengineering Ethics: Why Public Engagement is Essential."
  - Gary Marchant, PhD, MPP, JD (Arizona State University; EP3 member) on "Governance Options for ATP-Bio Technologies: From Ethics and Guidance to Soft Law and Regulation."
- **Made progress on our related NSF grant project "NetEthics":** "Building Tools & Training to Advance Responsible Conduct in Complex Research Networks Pioneering Novel Technologies" (Wolf, Roehrig, Pruett, Varma, K. Uygun, PIs; 09/2022-08/2024). Using ATP-Bio as our laboratory and engaging our Ethics & Public Policy Panel (EP3), we have identified key values to guide network ethics, conducted semi-structured interviews across the ERC to inform the development of a survey assessment tool that ERCs can use to support network ethics, and made progress in developing educational case studies to advance the responsible conduct of research.
- **Hosted plenary panel of national experts at the 2023 Annual Meeting** on anticipating the challenges in using ATP-Bio technologies to build biorepositories.
- **Made progress on EPP papers.** Multiple papers were submitted; other EPP papers are in progress, including for our special symposium on, "Emerging Technologies to Stop Biological Time: The Ethical, Legal & Policy Challenges of Advanced Biopreservation" to be published in the Journal of Law, Medicine & Ethics .
- **Collaborated on multiple ATP-Bio articles** including those with Han et al. (2023) and Isiksacan et al. (2023).
- **Collaborated with NSF and Gen-4 ERCs on a stakeholder collaborative.** Prof. Susan Wolf co-chairs the NSF Gen-4 Stakeholder Engagement & Impact Collaborative (SEIC) to foster collaboration across the Gen-4 ERCs in order to secure societal benefit. Prof. Andrew Maynard, Arizona State University and EP3 member, also contributes to the SEIC.
- **ATP-Bio continued to participate in the UMN Consortium on Law & Values in Health, Environment & the Life Sciences**, founded by Professor Wolf. This Consortium links us to 20 other centers, including those focusing on stem cell and biotechnology research, conservation and healthy foods, translational science, and biosecurity. In Y3, ATP-Bio participated actively in all Consortium member meetings.

Ethics & Public Policy Panel (EP3)

The Ethics & Public Policy Panel (EP3) serves a critical function for the ERC and EPP component. ATP-Bio engages with EP3 members through three meetings each year devoted to EPP, three additional EP3 meetings devoted to NetEthics, the Annual Meeting, joint publications, and targeted consultations. Overarching goals are:

- analyze the ethics and policy challenges raised by ATP-Bio research, technology development, and application;
- guide ATP-Bio research and development to manage risk and secure societal benefit; and
- generate consensus guidance plus publications on cutting-edge issues in governance of ATP-Bio's emerging technologies.

EP3 Members

Evelyn Brister, PhD
Professor of Philosophy and Philosophy Program Director
Rochester Institute of Technology
Governing Board member, Public Philosophy Network

Shawneequa L. Callier, JD, MA
Associate Professor
Department of Clinical Research and Leadership
School of Medicine and Health Sciences
The George Washington University

Alexander Morgan Capron, LLB
University Professor Emeritus
Scott H. Bice Chair Emeritus in Healthcare Law, Policy, and Ethics
Gould School of Law
Professor Emeritus of Law and Medicine
Keck School of Medicine
Founding Co-Director, Pacific Center for Health Policy and Ethics
University of Southern California

James F. Childress, PhD
Professor Emeritus
Ethics and Religious Studies
Core Faculty, Center for Health Humanities and Ethics
School of Medicine
University of Virginia

Barbara J. Evans, JD, PhD, LLM
Professor of Law and Stephen C. O'Connell Chair
Levin College of Law
Professor of Engineering
Herbert Wertheim School of Engineering
University of Florida

Michele Bratcher Goodwin, JD, LLM, SJD
Linda D. & Timothy J. O'Neill Professor of Constitutional Law and Global Health Policy
Co-Faculty Director, O'Neill Institute
Georgetown University Law Center

Insoo Hyun, PhD
Director, Center for Life Sciences and Public Learning
Boston Museum of Science

Rosario Isasi, JD, MPH
Associate Professor of Human Genetics
Macdonald Foundation Department of Human Genetics
Hussman Institute for Human Genomics and Interdisciplinary Stem Cell Institute
University of Miami School of Medicine
Adjunct Professor of Law
University of Miami School of Law

Gary E. Marchant, PhD, JD, MPP
Regents Professor of Law and Faculty Director
Center for Law, Science, and Innovation
Lincoln Professor of Law, Ethics & Emerging Technologies
Lincoln Center Applied Ethics
Exec Dir & Regents Professor
Center for Cybersecurity and Trusted Foundations Affiliates
Sandra Day O'Connor College of Law
Arizona State University

Andrew D. Maynard, PhD
Professor
School for the Future of Innovation in Society
Senior Global Futures Scholar
Global Futures Scientists and Scholars
Arizona State University

Kenneth Oye, PhD
Professor of Political Science
School of Humanities Arts and Social Sciences
Professor of Data Systems and Society
School of Engineering
Director, Program on Emerging Technologies (PoET)
Massachusetts Institute of Technology

Timothy L. Pruett, MD
Professor
Division of Transplantation
Department of Surgery
Director, Liver Transplantation Program
University of Minnesota

Paul B. Thompson, PhD
Professor Emeritus
W.K. Kellogg Chair in Agricultural, Food and Community Ethics
Michigan State University

Susan M. Wolf, JD
Regents Professor
McKnight Presidential Professor of Law, Medicine & Public Policy
Faegre Baker Daniels Professor of Law
Professor of Medicine
Chair, Consortium on Law and Values in Health, Environment & the Life Sciences
University of Minnesota

Y3 Annual Meeting Highlights

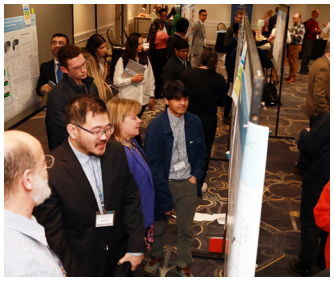
ATP-Bio Y3 Annual Meeting was hosted at the University of California - Berkeley on March 1-4, 2023 at the Claremont Hotel. This was ATP-Bio's first in-person annual meeting. The event kicked off with a successful Mix-and-Mingle.

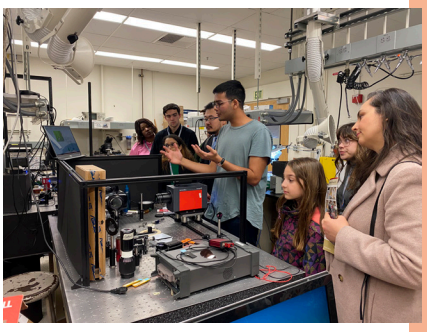
Agenda included:

- closed door programing for functional teams;
- SLC-hosted Trainee Forum;
- a quarterly IAB meeting; and
- strategic planning workshop of ATP-Bio leadership and administration.

The program included sessions from all Pillar groups and an exciting Three-Minute-Thesis (3MT) Competition and Poster Session (over 35 trainees presenting.

Other sessions included: an opportunity for discussion and engagement between academic members and ATP-Bio Partners and the SLC announced the new appointed leadership as well as UCB hosted lab tours on the final day (Chris Dames, Kevin Healy, and Boris Rubinsky).





Get Involved with ATP-Bio℠

ATP-Bio Public Webinar Series

The ATP-Bio Public Webinar Series is offered for members of the ATP-Bio community and the external public at large. Topics include biopreservation research and related content. The goal of the public webinar series is to be accessible to stakeholders beyond our inner community.

- Audience: ATP-Bio Community, Member Partners, Institutional Leadership, Public
- Frequency: Monthly. [Every other month, ATP-Bio will promote the Society for Cryobiology Public Webinars

ATP-Bio Closed Forums

The ATP-Bio Closed Forums are offered to ATP-Bio faculty, staff, students, postdocs, and ATP-Bio Member Partners. Topics include ATP-Bio research project progress and results, as well as other topics relevant to the ATP-Bio community.

- Audience: ATP-Bio Community, Member Partners
- Frequency: Monthly

ATP-Bio Trainee Tuesdays

The ATP-Bio Trainee Tuesdays are offered exclusively to ATP-Bio students and postdocs. Topics include skill building sessions as well as open forums for trainee exchange.

- Audience: ATP-Bio Trainees
- Frequency: Every 2 months

Visit **atp-bio.org/WHAT'S HAPPENING** for upcoming webinar information


CONNECT WITH US
Social Media
@ atp_bio
@ NSFERCATPBio
@ ATP_Bio
@ nsf-erc-atp-bio

atp-bio.org

Advanced Technologies for the Preservation of Biological Systems (ATP-Bio℠)
A National Science Foundation Engineering Research Center

University of Minnesota, Twin Cities Campus
420 Delaware Street SE
Mayo Memorial Building, Room A452
Minneapolis, MN 55455

General inquiries: **atp-bio@umn.edu**