



ATP·BioSM

Advanced Technologies for the Preservation of Biological Systems



Public Annual Report YEAR FIVE



NSF ATP-Bio is a National Science Foundation Engineering Research Center

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Our Mission

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

Our Pillars & Components

- ✧ Engineering Workforce Development
- ✧ Convergent Research
- ✧ Innovation Ecosystem
- ✧ Ethics & Public Policy

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PILLARS & COMPONENTS

Director's Message



This year has been one of progress, connection, and discovery for ATP-Bio. Together, our community of researchers, students, partners, and supporters has advanced our mission of making living systems accessible to all—improving lives, protecting biodiversity, and strengthening the security of our food systems. I am proud to share highlights from across the center which drive our impact.

LEADERSHIP & MANAGEMENT

Our leadership team has focused on strengthening internal communication between our 6 institutions, 43 faculty, and hundreds of trainees. We are also supporting our industry stakeholders to expand ATP-Bio's capacity for scientific breakthrough, translation, and ultimately societal impact in cryobiology.

CONVERGENT RESEARCH

Our convergent research efforts have brought in over \$81M in associated funding to advance organ, organoid/tissue, and organism preservation for transplantation, improved drug testing and cryoprotectant discovery, and novel tools for monitoring our testbeds with unprecedented precision.

WORKFORCE DEVELOPMENT

Our training programs have trained more than 330 trainees, with over 220 graduated to STEM professions and leadership in next-generation bioconservation. In addition to hands-on research, our students engage in professional development, mentorship, and outreach, equipping them with the skills and experiences needed to make an impact well beyond our center. We can highlight the advancement of our trainees including 43 now in graduate school or medical school, 24 postdocs or research professionals, 12 new faculty and 108 that have joined industry.

INNOVATION ECOSYSTEMS

Through strategic partnerships with more than 44 industry partners, startups, non-profits, and academic collaborators, ATP-Bio is accelerating the path from research to real-world application. With over \$14M in SBIR funding, multiple patents and licensing, and 6 start-ups, ATP-Bio technologies developed in our labs are moving closer to commercialization, opening pathways to improve healthcare, conservation, and food sustainability on a global scale.

ETHICS & PUBLIC POLICY

Our ethics and public policy initiatives continue to encourage thoughtful dialogue with stakeholders that include clinicians and patients, policymakers, and the public. These conversations, reflected in publications, symposia, and national meetings, are guiding regulatory pathways and the safe, equitable, and ethical adoption of our technologies.

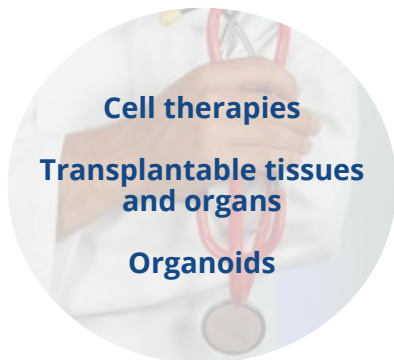
EXPANDING PARTICIPATION

This year, we expanded collaborations with community organizations, broadened recruitment efforts, and created new opportunities for students from historically underrepresented and rural groups. These efforts are building a more inclusive ATP-Bio network where every voice has the power to shape the future of bioconservation.

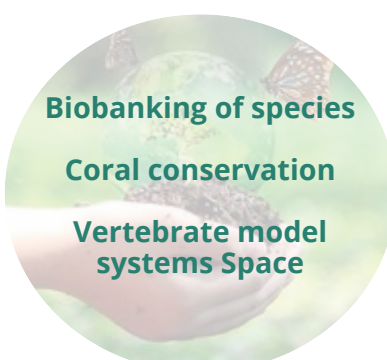
As we look to the future, our vision is clear: ATP-Bio will continue to push the boundaries of what is possible in bioconservation, fueled by the creativity, dedication, and collaboration of our community. Together with our stakeholders—scientists, students, industry partners, educators, policymakers, and supporters—we will continue to achieve breakthroughs that redefine what is possible for human health, environmental resilience, and global food security. The years ahead promise more scientific achievements and a resilient “cryosupply chain” to move living biological systems around the world for generations to come.

Societal Benefits

HEALTHCARE



BIOCONSERVATION



FOOD SUPPLY & SUSTAINABILITY



At ATP-Bio, our vision is to make biological time stand still, to ensure that:

- Organ transplant waiting lists are eliminated
- Type 1 diabetes is managed without daily insulin
- Personalized regenerative therapies are universally accessible
- Coral reefs are restored and thriving in oceans
- Food security improves as frozen crops preserve biodiversity
- Global biodiversity is safeguarded through tissue banks
- Frozen biological systems are shipped quickly and efficiently around the globe
- Cryopreservation warehouses are on the Moon or in space
- Space travel is enabled by preserved human tissues and organs.

The NSF Engineering Research Center for Advanced Technology for the Biological Systems (ATP-Bio) is radically transforming the ability to store and transport living systems by effectively “stopping biological time.” ATP-Bio is developing next-generation preservation technologies to make biological materials – including cells, spheroids, organoids and tissues, whole organs, and entire organisms – accessible on demand.

During its first 5 years, ATP-Bio successfully advanced several science and engineering “firsts” in bioconservation, including:

- preservation protocols for coral, insects, and fish
- scalable preservation for organoids (e.g., pancreatic islets to help treat diabetes); and
- whole organ preservation up to 100 days (compared to the current clinical limit from single to 10s of hours).

These successes have been featured in major publications including Nature, Science, and the NY Times.

Going forward, ATP-Bio will focus on translation of fundamental breakthroughs into commercial products for

societal impact. To support this translational focus, the Center is reorganizing the research into three Integrated Thrust Areas (ITAs):

- ITA1 Biological engineering to enhance the survival of living systems during cryopreservation
- ITA2 Advanced cryothermal technologies to minimize cooling and rewarming-related injury, and
- ITA3 Cryo-supply chain engineering to enable scalable distribution of preserved living products.

ATP-Bio envisions a future in which a wide range of living systems can be preserved, shipped, and applied both nationally and globally, enabling transformative advances in medicine, biotechnology, regenerative and gene therapies, agri/aquaculture, and bioconservation – and even plans for a lunar biorepository.

ATP-Bio collaborates with end-user stakeholders to consider ethical and legal implications of these innovations and translate technologies into relevant markets.



Leadership & Advocacy

Academic Institutions

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



University of Minnesota (UMN) is the lead institution as ATP-BioSM 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-BioSM'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 an affiliated partner and a leading public research university providing 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.

Broader & Societal Impact

ATP-Bio has significantly impacted the scientific community through its efforts in strengthening workforce representation, advancing technology translation, and fostering global scientific collaboration. In addition, ATP-Bio has made significant strides in advancing cryopreservation science and its applications, with notable impacts on society across several dimensions.

ATP-Bio Year Five Highlights of Significant Achievement

CULTURE

Building an Inclusive, Thriving Community: ATP-Bio's second Experience Survey showed record gains in collaboration, respect, belonging, and well-being — exceeding past scores and national benchmarks. Results highlight teamwork across institutions, new trainee engagement, and ATP-Bio's commitment to linking evaluation with workforce development and mentoring.

TEAM SCIENCE

Strategic Leadership & Integration: ATP-Bio's strategic plan emphasizes translational, hands-on training and cross-organizational integration. A new Cross-Functional Project Team Manager role connects all pillars to strengthen collaboration and execution.

Collegial Convergence Fuels Excellence: ATP-Bio's framework transforms institutional strengths into a cycle of expertise, investment, and innovation — advancing medicine, engineering, and biology through shared knowledge and coordinated action.

Global Cryo Leadership: Now a global hub for cryobiology, ATP-Bio has reached nearly 380,000 people through 175 activities and leadership roles in international societies. Partnerships with groups like the Society for Cryobiology drive cross-border collaboration, emerging fields, and global impact.

Sustainability Achieved Early: ATP-Bio met its sustainability goals four years ahead of schedule, securing new grants, funding, and philanthropic gifts to expand its network.

Ethical & Responsible Research: Through the NSF-funded NetEthics project, ATP-Bio serves as a model for studying and advancing network-level research ethics across institutions and disciplines.

Accelerating Cryotechnology Translation: A cross-pillar stakeholder committee aligns engagement with strategic goals — connecting industry, policymakers, healthcare, and conservation leaders to move cryo innovations into real-world use.

Stakeholder Ecosystem: ATP-Bio's 44-member network includes 59% industry, 27% government/nonprofits, and 14% innovation sectors — reflecting broad visibility and impact in cryopreservation innovation.

WORKFORCE ENGAGEMENT

Capstone Projects: ATP-Bio's SenDeR program supports student teams at UCR, UCB, and UMN — launching undergraduates into cryobiology careers.

Structured Mentorship: A postdoctoral mentoring program provides tailored guidance, leadership opportunities, and workshops to strengthen career transitions and networks.

Measuring Impact: Two standardized assessment tools streamline evaluation, helping ATP-Bio refine programs and demonstrate measurable workforce impact.

Inspiring Future Scientists: A free, open-source curriculum on organ transplantation, allocation, and preservation introduces students to cryoscience through accessible, interdisciplinary learning.

INNOVATION ADVANCEMENTS

From Startups to Giants: ATP-Bio is a growing hub for startup investment — uniting academic excellence with entrepreneurial agility to accelerate technology translation and attract collaborators.

IP & Commercialization: With nine patent applications, one new license, and one full commercialization, ATP-Bio increased its average Technology Readiness Level from 3.7 to 4.0, showcasing strong innovation and market potential.

ETHICAL CONSIDERATIONS FOR SOCIETAL BENEFITS

Collaborative Research & Publications: ATP-Bio's partnership with experts in ELSI (Ethical, Legal, and Societal Implications) has led to groundbreaking work, including a symposium issue in the Journal of Law, Medicine & Ethics, articles in the American Journal of Transplantation and Annual Review of Biomedical Engineering (von Reiterdank et al., 2025). These contributions advance ethical guidance for the responsible development and application of cryopreservation technologies.

Ethical Guidance: ELSI analyses and recommendations produced by ATP-Bio inform ethical technology development and translation — impacting both ERC and broader research communities.

TECHNOLOGY TRANSFER

Integration as a Bridge: ATP-Bio's integration model connects strategy to impact, driving convergence across disciplines and institutions. With over 200 joint publications — many co-authored by ERC students — ATP-Bio demonstrates how collective expertise accelerates innovation beyond individual capabilities.

High-Impact Research: ATP-Bio has produced 37+ highly cited papers (FWCI >2), with one achieving a score of 10.29 — thousands of citations above the global average — underscoring the center's scientific influence and relevance.

Transforming Healthcare: ATP-Bio continues to achieve major breakthroughs in organ cryopreservation using all three regimes — partial freezing, isochoric supercooling, and vitrification — advancing toward clinical translation and the future of organ transplantation.

ATP-BioSM by the Numbers

SEPTEMBER 1, 2020 – JUNE 30, 2025

ATP-BioSM Personnel

32

Leadership &
Administration
& Management
Faculty & Staff

36

Faculty

17

Postdocs

45

Administrative
& Research Staff
& Technicians

105

Trainees

Graduate and
Undergraduate Students,
Visiting College
Students, REUs

Research Inputs & Outputs

166

Core
Publications

34 Conference
Proceedings

118

Associated
Publications

11 Conference
Proceedings

\$81

MILLION

Associated
Project
Funding

Formal & Informal Dissemination

130

Workshops, Short
Courses, Trainings,
Webinars

45

Innovation
Focused
Events

171

Conferences, Symposia,
Colloquia, Invited Talks

Education & Outreach

55

New Courses,
or Existing
Courses
Modified with
ERC Content

66

Research
Experiences for
Undergraduates
(REU) Program

34

Pre-college
Teacher
Professional
Development

105

High School
Engagement
Program (Young
Scholars)

90

Graduates
(undergraduates,
Masters, PhD)

Center Diversity

Women, Racial & Ethnic Minorities,
Persons with Disabilities

Leadership Team	34%	22%	13%
Faculty	31%	8%	6%
Postdocs	41%	24%	0%
Trainees	40%	36%	4%
REUs	60%	67%	3%

Innovation Ecosystem

44

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

24

Core &
Associated
Inventions
Disclosed

27

Core &
Associated
Provisional
Patent
Applications
Filed

34

Core &
associated
full patent
applicants
filed

8

Core &
associated
Patents
Awarded

9

Licenses
& options
issued

13

New
surgical
or other
medical
technologies

Technology Transfer

6

Core &
Associated
Start-ups

By the Numbers Highlights

Scientific & Technological Advances

- Advanced all major cryopreservation regimes (supercooling, vitrification, isochoric) to human organ models.
- Achieved first-ever re-transplantation of a kidney in a pig after 10 days of preservation.
- Developed high-throughput cryotechnologies (AI-driven CPA optimization, robotic microinjection, nanowarming).
- Advanced ATP-Bio research project TRLs from 3.5 to 4.0.

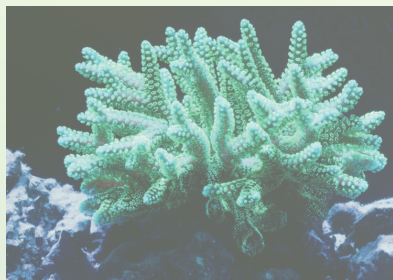


Commercialization & Innovation

- Launched Cryofoundry start-up incubator.
- Spun off 2 new companies in Y5 (6 total to date; 17 start-ups supported overall).
- Filed multiple IP: 4 full patents, 1 provisional, 8 invention disclosures.
- Launched a Commercialization Readiness framework to prioritize high-impact projects.

Funding & Sustainability

- Achieved sustainability goals 4 years ahead of schedule.
- Secured \$80M+ in associated funding, \$14M+ in SBIRs/contracts, and \$1.2M in philanthropic gifts.



Education & Workforce Development

- Supported 336 trainees across all levels.
- Piloted postdoc mentoring program with co-leadership opportunities.
- Developed new Organ Transplant Curriculum for middle school education.
- Engaging with multiple K-12 outreach groups (MESA, OIC, etc.)

Partnerships & Stakeholder Engagement

- Expanded testbed-focused stakeholder engagement (FDA, ARMI, USDA, CORDAP, etc.).
- Grew Industrial Advisory Board to 44 members (10% increase).
- Engaged ~380,000 people through 175 dissemination activities since inception.
- Partnered with Society for Cryobiology on webinars and international collaboration.



Ethics & Societal Impact

- Published 10-article symposium on ethics of cryopreservation in Journal of Law, Medicine & Ethics.
- Co-developed educational tools (case studies, convergence assessment) through NetEthics project.

Anticipating Where We Go From Here

In a few short years, ATP-Bio will become a self-sustaining research consortium. The Center's goal is to create a self-sustaining ecosystem maintained through a centralized network of established connections.

Value of ATP-Bio to Cryopreservation Community and Stakeholders

ATP-Bio delivers value to stakeholders through a powerful combination of collaboration, innovation, and impact. Our network connects leading researchers, industry partners, and policymakers across disciplines to accelerate breakthroughs and drive collective progress. We advance technology and innovation by developing transformative tools and methods that push the boundaries of what's possible in cryopreservation and beyond. Through education, we invest in the next generation of scientists and engineers, equipping them with the knowledge and skills to lead future discoveries. Finally, our leadership and advocacy ensure that ATP-Bio not only shapes the research agenda but also champions responsible, ethical, and inclusive practices that benefit the broader scientific and global community.

Transition into Self Sufficiency

ATP-Bio's leadership and organizational framework in our formative years enabled the Center to become a premier global pioneer in cryopreservation science and technology development. In our next phase, ATP-Bio's network management will focus on four interrelated goals and guiding principles to support the Center's progression toward self-sufficiency:

- sustaining an organizational model that balances distributed leadership and governance
- enhancing continuous feedback loops that inform strategic decisions
- deepening integration to ensure that research, innovation, workforce, and policy efforts advance together; and
- translating groundbreaking science to advance ATP-Bio technologies through regulatory approval to application

Leadership, Management, and Governance

ATP-Bio's leadership and governance drives innovation, integration, and impact while staying sufficiently agile to respond and react to an evolving strategy. Beginning in Y6, we will implement a new enhanced co-leadership structure for ITAs and Testbeds composed of faculty, trainees, and industry members. This will deepen cross-sector engagement and mentorship, fostering the next generation of translational leaders. Key new milestones will include:

- a detailed transition plan for post-NSF operations
- partner institutional collaboration agreements that extend beyond NSF funding
- expanded industry-academic co-development of projects.

Program Integration

High-level integration of programmatic initiatives is a defining strength of ATP-Bio's current organizational structure and culture. Impactful examples are the Trainee (ATEP) and Visiting Researcher (VIEP) Exchange Programs, CRYOFOUNDRY, the REU Program, 10-article published symposium, the Y6 public conference on ethical research in ERCs and other research networks, and coordinated planning, progress, and performance tracking. In Y7-10, we will build on this foundation by launching "CryoCharFac", a characterization and instrumentation facility that serves both academia and industry. The facility will enable characterization and act as a hub for education and skill development. We aim to develop an industry consortium framework that will help develop sustaining members that will engage in several ATP-Bio activities.



**ATP-BIO Y6
ANNUAL MEETING**

APRIL 20-22, 2026

Hosted at the
University of Minnesota - Twin Cities Campus

**SAVE THE
DATE!**

QUESTIONS?
ALYSSA BURGER
ATP-BIO-AD@UMN.EDU

ATP-Bio Annual Meeting Save the Date | April 20-22, 2026

ATP-Bio Y6 Annual Meeting will be hosted at the University of Minnesota.

ATP-Bio's Annual Meeting is an event for the cryopreservation industry, academic community, and other stakeholders. The event connects industry to academic resources and talent through technical and research presentations, networking opportunities, facility tours, and other special features. The event also serves as host to closed-door meetings for ATP-Bio advisory boards.

Engineering Workforce Development

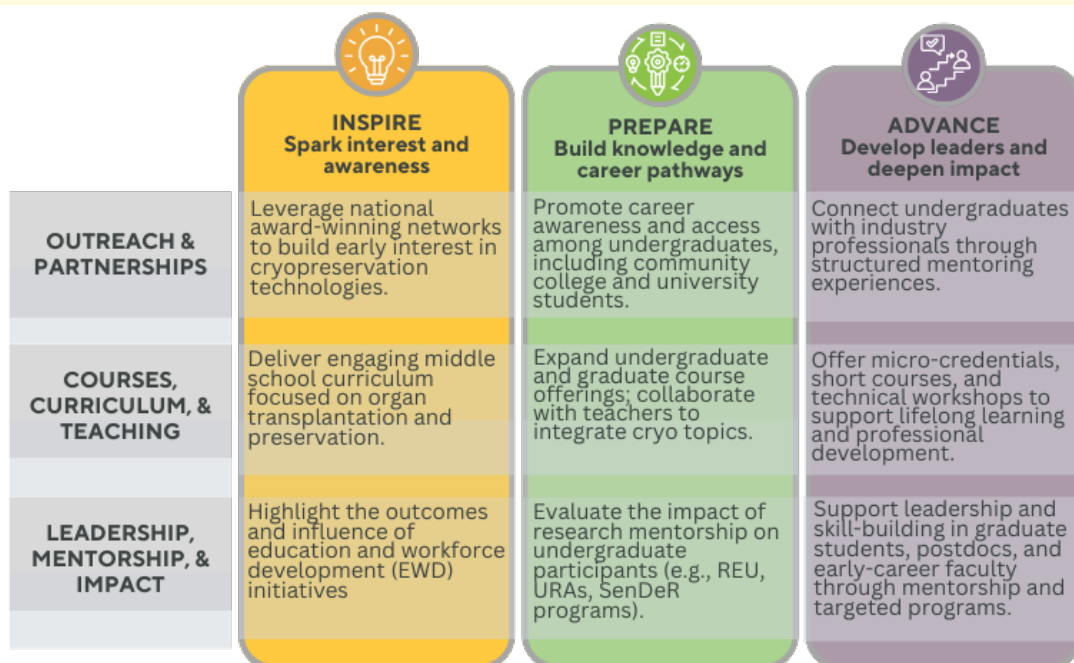
PILLAR EWD

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

Ultimately realizing the potential of new cryopreservation technology requires a diverse and skilled workforce for implementation and to continue to support a culture of innovation for future advancements. ATP-Bio strives to change the face of biopreservation by providing opportunities for a diverse population to be involved in biopreservation. ATP-Bio is committed to recruiting, engaging and retaining a diverse audience in its programs: university faculty, undergraduate and graduate students; pre-college students and teachers; and students of all ages through its outreach activities. In doing so, ATP-Bio will educate an engineering workforce that is a demographic reflection of the current and future nation to maximize the relevance and benefits of cryopreservation technology on society.

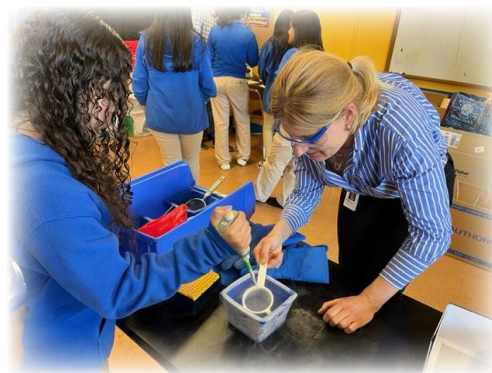
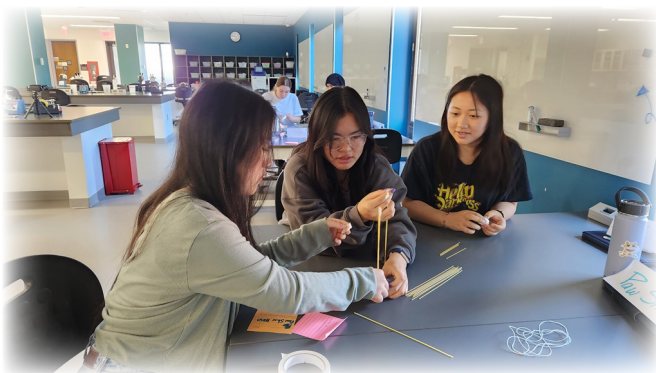
The Engineering Workforce Development (EWD) Pillar is at the heart of ATP-Bio's mission to inspire, prepare, and advance the next generation of cryopreservation innovators. EWD connects education, mentorship, and professional development to build a technically skilled and socially responsible workforce ready to lead in both academic and industrial sectors.

Through outreach programs, curriculum design, undergraduate research, and leadership training, EWD provides pathways into science and engineering careers. From high school classrooms to postdoctoral mentoring, this work ensures that the promise of cryopreservation technologies is matched by the talent and vision of those who will carry them forward.



Year Five Highlights

- **Inspiring K–12 Learners:** Developed five outreach modules for grades 6–12 covering key cryobiology concepts such as ice crystal formation, thermodynamics, rewarming methods, and organ transplantation. Partnered with schools and community programs—including, MGB Youth Program, the Learning Center for the deaf, and Twin Cities STEM Fest—broadening impact.



- **Undergraduate Research Opportunities:** The Research Experience for Undergraduates (REU) program brought students from across the U.S. into ATP-Bio labs for immersive 10-week research projects, while the Senior Design and Research (SenDeR) program engaged students in hands-on cryopreservation research during the academic year.

REU students from the 2025 summer program started their internships with a “bootcamp” in Minneapolis, MN



- Career Development**

Legend:

 - Red arrow: Junior faculty hires
 - Blue arrow: ATEP trainee exchanges
 - Green arrow: VIEP investigator exchanges

The diagram illustrates a network of career development opportunities across the United States, connecting various universities and international regions. Key nodes include Cal, UCR, UCSD, MCH, P, Stanford, G, LSU, and TM. Arrows indicate the type of exchange or hire: red for junior faculty, blue for ATEP trainee, and green for VIEP investigator.

Year Five Priorities

- 14 / NSF ATP-Bio

- Mentorship Scaling: Expand the Mentoring Program, matching postdoc and graduate fellows with cross-institutional mentors and offering leadership opportunities.
- Strengthening Partnerships: Deepen collaborations with national STEM organizations, leveraging networks to broaden participation and diversify the pipeline into cryopreservation careers.

Year Six and Beyond Goals

- National Education Model: Disseminate ATP-Bio curriculum nationally through the Educator Fellows Program, creating a network of teachers who integrate cryopreservation content into classrooms and provide feedback to refine teaching strategies.
- Integration of REU, SenDeR, and SLC: Ensure undergraduate and graduate trainees move seamlessly across programs, with mentorship and leadership support at every stage.
- Career Preparation for Postdocs: Expand service, teaching, and leadership roles for postdoctoral scholars, preparing them for independent careers while strengthening ATP-Bio's mentoring culture.
- Evaluation & Impact: Use the new ATP-Bio Programmatic Impact Survey to assess outcomes across all programs, ensuring continuous improvement and measurable societal benefit.

Special Activities and Notable Achievement

- REU Success Stories: Over five years, ATP-Bio's REU program has welcomed students from diverse institutions—including community colleges—with several alumni going on to graduate study and professional roles in cryobiology.
- Postdoctoral Development: Year 5 piloted the Postdoctoral Mentorship Program, providing fellows with faculty mentors, teaching opportunities, and CV-building experiences. Participants reported stronger career preparation and increased research productivity.
- National Recognition: ATP-Bio EWD representatives were invited to present at major STEM education forums, showcasing ATP-Bio's innovative model for convergent workforce development.

ATP-Bio's EWD Pillar is creating a comprehensive education and workforce pipeline—from inspiring the youngest learners to preparing postdocs for leadership. By combining outreach, curriculum innovation, research opportunities, and mentorship, EWD is laying the foundation for a diverse, skilled workforce that will advance cryopreservation science and its applications for generations to come.

Meet the Scholar Leadership Council

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

The SLC 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.

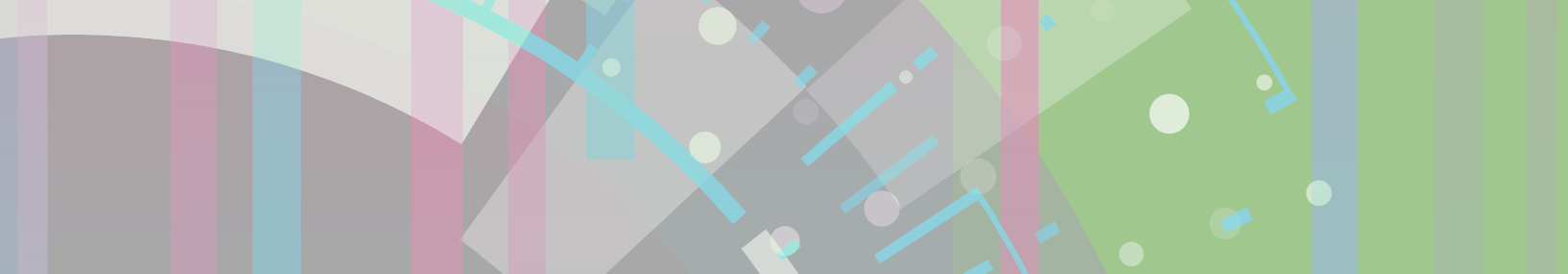


Top left>right: Co-chairs: Maxwell Johnson, UCB, and Alexander Ulate, UMN.

Bottom left>right: Communications Lead: Soheil Kavain, TAMU.

Career Development Lead: Rasha Al-attar, MGH.

Networking Lead: Julio Aurelio Sarabia Alonso, UCR.



Spotlights

Spotlight: Inspiring the Next Generation

“STEM in Action”

Year 5 brought cryobiology to classrooms with five hands-on modules for grades 6–12. Students learned about ice crystal formation, rewarming challenges, and organ transplantation through engaging, lab-inspired activities.

- Pilots reached schools in Boston and STEM festivals in Minneapolis.
- New partnerships launched with Bunker Hill Community College and Twin Cities STEM Fest.

Spotlight: Research Experience for Undergraduates (REU)

“Opening Doors to Discovery”

The REU program continues to provide transformative summer research experiences:

- Students from across the U.S. engaged in 10-week lab placements focused on cryopreservation challenges.
- Many came from community colleges, expanding access to underrepresented groups.
- Alumni have continued into graduate programs and professional roles in cryobiology.

This pathway builds the diverse workforce needed for the future of biopreservation.

Spotlight: Scholar Leadership Council (SLC)

“Trainees Leading Trainees”

ATP-Bio’s SLC represents and empowers scholars across all partner universities. In Year 5, the SLC:

- Doubled participation in training awards (ATEP & SenDeR).
- Led outreach at events like STEM Fest Twin Cities.
- Organized career development, networking, and mentoring opportunities for peers.

The SLC is a cornerstone of ATP-Bio’s community, ensuring trainee voices shape the Center’s future.

Spotlight: Innovative Mentorship

Mentorship in Action”

Launched in Year 5, the Postdoctoral Mentoring Program connects postdoctoral fellows with additional skills training and leadership opportunities to advance their careers.

- Provided cross-institutional mentorships, teaching opportunities, and professional development networks
- Trained on key skills like grant writing, manuscript publication, and presentation skills.

Spotlight: Looking Ahead – Micro-Credentials

“Short Courses, Big Impact”

ATP-Bio is developing micro-credential programs to expand technical training beyond traditional classrooms.

- First launch: an online course in *Drosophila* cryopreservation.
- Participants will earn certificates of completion and hands-on training opportunities.
- Additional modules will expand into zebrafish embryos and other emerging areas.

These credentials will provide flexible, scalable training for tomorrow’s cryopreservation workforce.

ATP-BioSM is accelerating technologies that enable wide-spread preservation and distribution of a wide variety of biological systems, from cells, organoids, tissues, organs, to whole organisms.

ATP-Bio aims to “stop biological time” and radically extend the ability to bank and transport cells, organoids, tissues, whole organs, and even whole organisms, such as aquatic or terrestrial embryos and larvae, using a team approach to build advanced preservation technologies. ATP-Bio envisions a world 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 bioengineering, nanotechnology, 3D printing, genetics, and numerous other fields.

Year 5 marked a pivotal transition for ATP-Bio’s Convergent Research (CR) pillar, characterized by a structural reorganization to support the shift from fundamental discovery toward translational research and real-world applications. The original Thrust Areas were consolidated into Integrated Thrust Areas (ITAs):

- ITA1: Biostabilization Engineering- Scaling up and standardizing processes under regulatory purview to precisely prepare the biology of the products for preservation.
- ITA2: Cryothermal Processing- Developing tools to address the complex thermal changes that biosystems undergo when cooled, stored, and rewarmed.
- ITA3: Cryo-Supply Chain Management- Translating research into components of operational cryo supply chains.

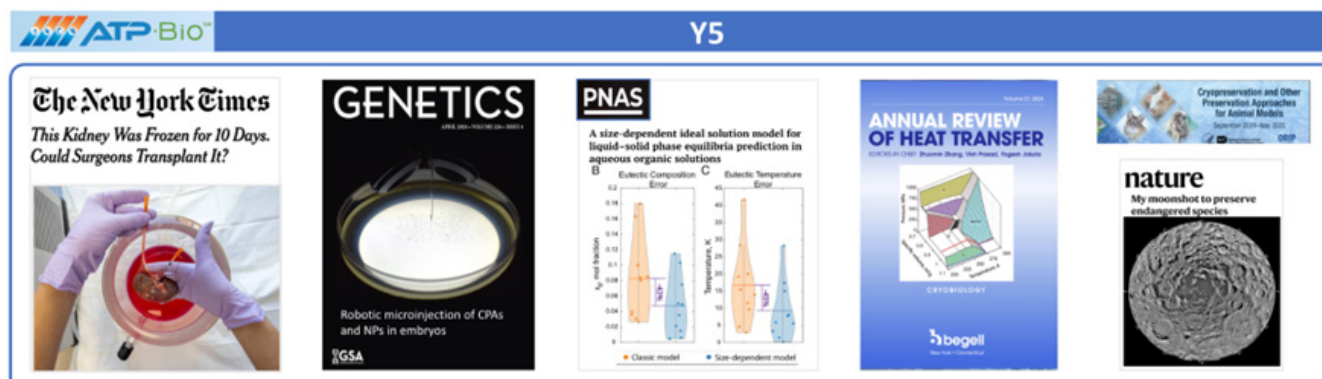
ATP-Bio’s testbeds were also consolidated in Year 5 to expand translational capacity, serving both as platforms for technology testing and as sources of commercializable products:

- Cells, Spheroids, and Organoids- Enabling off-the-shelf therapeutic and diagnostic tools, including CAR-T cells for cancer treatment, islets for treating diabetes, organ slices for aging and neurodegenerative disease research, and mitochondria to fundamental studies.
- Organs- Advancing toward clinical translation through ATP-Bio spin-offs and other stakeholders, with strategic expansion into gene-edited pig organs for xenotransplantation, an area poised for clinical and societal impact.
- **Organisms- Supporting translational research animal models in collaboration with biorepositories and NIH**, food applications in aquaculture, and year-around production of agri/aquaculture products, and long-term genetic conservation of critical species.

The restructured framework proposes shared leadership of ITAs and testbeds between PIs, trainees and industry leaders from the Innovation Ecosystem Advisors Program (see IE section) whose early intervention in the project selection and research direction will accelerate shared decision-making, co-creation and ease commercialization pathways.

Year Five Highlights

Year Five highlights attest to ATP-Bio's progress in all areas of societal impacts including some early translational successes, and also describes integration successes with other pillars:



CR highlights of Y5 from advances in cryopreservation of organs (NYT) and organisms (Genetics), collaborative publications in fundamentals sciences related to cryopreservation (PNAS and Annual Review of Heat Transfer) and partnerships with NIH and NASA

- **Healthcare: extending organ viability from days to weeks**

ATP-Bio researchers achieved a world-first by partially freezing kidneys and livers, extending preservation from days to up to 30 days in pig models. The first retransplantation of a partially frozen pig kidney was a historic step toward solving organ shortages and was covered in the New York Times.
- **Bioconservation: next-generation high throughput tools for organismal cryopreservation**

ATP-Bio researchers developed robotic microinjection of CPAs and nanoparticles for embryos—enhancing reproducibility, and scalability for real-world adoption. ATP-Bio's leadership role in 5 NIH ORIP workshops in the past year alone reflects its growing influence in the critical space.
- **Food supply and sustainability: freezing milk, feeding the future**

Using isochoric freezing, ATP-Bio scientists extended the shelf life of raw milk from just days to five weeks while suppressing bacterial growth. This innovation has enormous potential for food safety and distribution and offers a scalable alternative to refrigeration in resource-limited regions worldwide.
- **Fundamental discovery: breakthroughs in fundamentals of cryoprotectant design**

ATP-Bio published a PNAS paper introducing a size-dependent model for solution thermodynamics and thereby enabling the rational design of cryoprotectant cocktails. This foundational advance, a powerful collaboration between UC Berkeley and Texas A&M University, also strengthens protocols from cells to organs.
- **Collaborative science as a driver of innovation**

In Y5, CR investigators published 47 peer-reviewed papers (166 since Year 1), submitted 12 invention disclosures, and filed five patent applications. These collaborative advances are internationally recognized, with 9 chapters in an invited volume of the Annual Review of Heat Transfer summarizing ATP-Bio's breakthrough technologies and establishing the Center's leadership in the science of cryobiology. Collaborations with ethics and policy scholars produced a 10-article symposium in the Journal of Law, Medicine & Ethics. These achievements were rewarded with the ASME Edward Grood Interdisciplinary Team Science Medal, national media coverage in The New York Times, and multiple prestigious faculty awards.

Year 5 also witnessed a major growth across ATP-Bio's research network:

- Texas A&M emerged as a powerhouse site for CR innovations.
 - UC Riverside launched new cryopreservation programs.
 - Partnerships expanded with industry leaders, other NSF centers, and international societies.
- **Trainees recognitions**
ATP-Bio trainees are increasingly being recognized, not only within ATP-Bio but also globally. In Y5, several took part in CRYOFOUNDRY, ATP-Bio's startup incubator and took on leadership roles (e.g., presidency of the International Cryobiology Young Researchers society) and all were offered opportunities to mentor younger students. Twelve transitioned into faculty at prestigious universities or booming industries, underscoring the strength of CR's mentoring model (EWD section).

Year Six Priorities

- **Transition to Translational Science:** Implementation of our new strategic plan involves steps such as (i) refining milestones with industrial leaders to hit rapid commercialization priorities; and (ii) defining, monitoring, and evaluating progress of the newly defined core projects, of which some will be co-led by the industrial advisors in ITA3.
- **Develop high-throughput screening and processing approaches for** (i) AI- Enhanced, high-throughput screening for CPA toxicity, enabling rapid cross-application translation; (ii) Large-scale synthesis of nanoparticles and CPAs; (iii) High-throughput platforms for evaluating cooling and rewarming processes; and (iv) Practical, rapid, and non-invasive biological and physical assessment tools.
- **Advance the field of bioconservation** by developing training modules, coursework, and other online and in-person workshops to train resource center personnel in the U.S. and beyond on insect and fish preservation protocols. Strategies will be adapted for coral larvae and aquatic species, supporting coral reef restoration and contributing to a proposed lunar biorepository in collaboration with the Smithsonian and CORDAP in Y7 and beyond.
- **Strengthen collaborations with the Innovation Ecosystem (IE)** around several new IE initiated programs: Industrial Advisor Program and the Commercialization pipeline as well as securing regulatory approvals
- **Develop cross-pillar synergy:** Work closely with the Ethics & Public Policy (EPP) component, ensuring that scientific advances are guided by ethical frameworks and market readiness.
- **Empower engineering workforce development:** Expand postdoctoral mentorship programs, trainee exchanges, and cross-site collaborations to build the next generation of cryopreservation leaders.

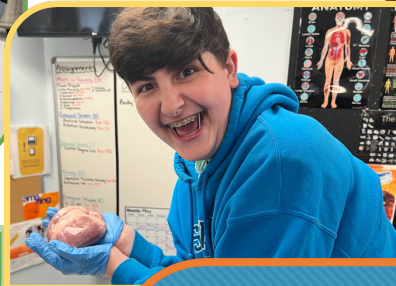
Year Seven and Beyond Goals

- **Enabling universal availability of cryopreserved biosystems:** Lay the foundation for a global infrastructure to store, ship, and distribute living systems—supporting medicine, conservation, and food security.
- **Clinical and commercial translation:** Advance partial freezing, nanowarming, and cryomesh platforms toward clinical trials and scalable industrial deployment.
- **Sustainable partnerships:** Expanding the research network to new institutions and international collaborators, strengthening ATP-Bio's position as a hub for global cryopreservation innovation.
- **Trainee impact:** Accelerate trainee progression into leadership roles across academia, industry, and professional societies, demonstrating ATP-Bio's success as a workforce engine.
- **Responsible innovation:** In collaboration with the Ethics & Public Policy component, ensure that ethical, legal, and social considerations (ELSI) inform technical innovation, supporting equitable access and global sustainability.

MGB Youth Programs



The Learning Center for the Deaf (TLC)



National Student Leadership Conference (NSLC)

Boston Public Schools



Educational journey

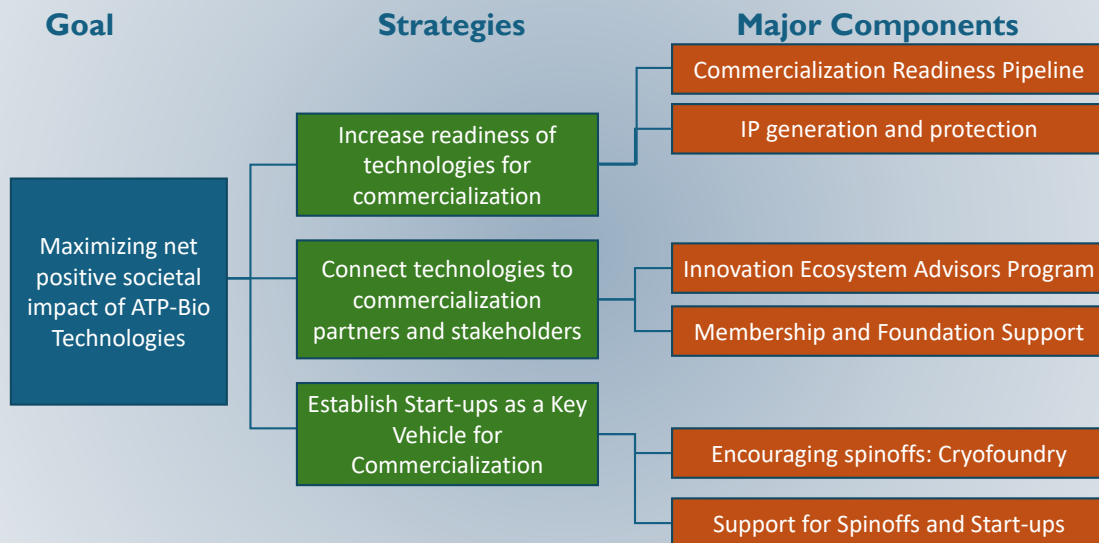
- Gap year: hospital experience, becoming ski teacher, volunteering
- Medicine (6 years)
 - Law courses
 - Founding real estate management company
 - Dutch Surgical Society for Medical Students
 - member □ regional chairman □ national chairman
 - Founding StudentsAgainstCorona
- Working as a resident, department of Surgery
- Moving to Boston: PhD

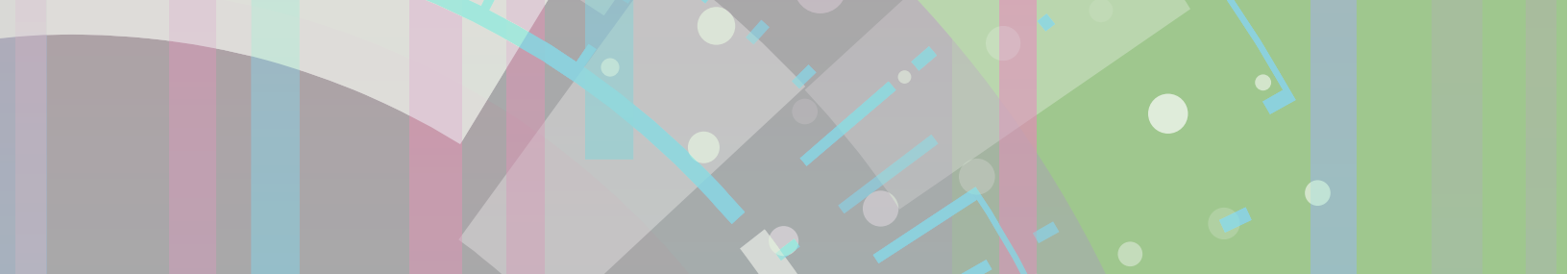


The Innovation Ecosystem (IE) Pillar connects ATP-Bio research with the world where we live. Our mission is to translate cryopreservation breakthroughs into societal impact by advancing commercialization readiness, strengthening partnerships and fostering start-up companies. Our overall strategy is shown in the goal tree.

In Year 5, IE sharpened its strategies and deepened its partner network, ensuring that the technologies emerging from ATP-Bio's labs are supported by the infrastructure, funding, and mentorship they need to succeed. By combining research, entrepreneurship, and stakeholder engagement, IE is helping to turn ideas into innovations that will transform medicine, conservation, and food systems.

Innovation Ecosystem Goal Tree





Year Five Highlights

- **Advancement of CR Projects Towards Commercialization:** The average technology readiness level (TRL) for all the CR projects advanced from 3.5 to 4.0, representing the shift from experimentation to proof of concept.
- **Commercialization Readiness Framework:** Launched a new system that ranks projects not just by TRL, but also by market potential, IP strength, translational pathways, and team expertise. The prioritization of these projects will lead to a robust and sustainable commercialization pipeline.
- **Expanded Partnerships:** Grew our member base from 40 to 44, adding key partners like Cryoport Systems (cryogenic supply chain leader) and the Advanced Regenerative Manufacturing Institute (ARMI), strengthening national biomanufacturing ties.
- **Supporting Startups:** Introduced CRYOFOUNDRY, a unique forum for trainees and PIs to pitch early commercialization concepts in a supportive environment, leading to ideas such as *CryoVox* (3D cryoprinting), *Cool Blood* (extended blood storage), and *Neurovault* (neurological material preservation).
- **Spin-off Success:** The spin-off NorthStar Cryo (NSC) advanced its islet cryopreservation technology for type 1 diabetes, securing 3 major contracts with multinational pharmaceutical companies.
- **Intellectual Property Growth:** Year 5 saw 12 new invention disclosures, 9 patent applications (provisional and full), one executed licensing deal, and three more in progress, marking steady momentum in technology transfer.

Members & Partnerships

ATP-Bio's Innovation Ecosystem thrives on collaboration. By the end of Year 5, IE counted 44 partners, representing industry, government, foundations, and non-profits. Of particular note:

- **17 of our members are start-up companies**, which will be important commercialization drivers in the cryopreservation industry
- **The Elizabeth Crook and Marc Lewis Foundation** contributed over \$500,000 to support research in organ cryopreservation. Foundation support is emerging as an important resource for ERC sustainability.
- **Innovation Ecosystem Advisors Program**, is a new program linking industry partners directly with Integrated Thrust Areas (ITAs) and testbeds. This effort will result in the co-creation of new projects and shared decision making on research directions for ATP-Bio investigators. This model strengthens the ERC's stakeholder engagement.
- **Industry Advisory Board**, is led by Uzair Rajput, Chief Operating Officer for Instant Systems, and Rob Goldstein, Director of Engineering for AMF Life Systems, and provides important guidance from an industry perspective. A link to our current members is here: <https://atp-bio.org/current-atp-bio-partners/>

Year Six & Beyond Priorities

- **Scale Commercialization Readiness Assessments** to identify projects closest to near-term application and build a sustainable commercialization pipeline, visible to all of our stakeholders.
- **Deepen Industry Integration**, with partners co-leading ITAs and testbeds to align science with market needs.
- **Expand Start-up Support**, ranging from idea incubation to lab space, strategic advisory services, and funding mentorship.
- **Strengthen Member Value Proposition**, focusing on recruitment and retention of large-scale industry partners.
- **Advance Stakeholder Engagement** in collaboration with the Ethics & Public Policy component (EPP), particularly with patient groups, regulatory bodies, and foundations.
- **Workforce Development:** Continue equipping postdocs and trainees with entrepreneurial skills alongside research expertise, preparing the next generation of leaders.
- **Societal Impact at Scale:** Work with EPP to ensure that ATP-Bio innovations are accessible, ethical, and globally relevant, advancing both health equity and sustainability



Spotlight: Startups in Action

Cryopreservation is widely used in certain industry segments, but at ATP-Bio, we are leading the development of new applications in organoids, organs and organisms. These applications will result in the creation of not only new products and services, but also entirely new markets and market players.

ATP-Bio is playing a key role in industry development, with six spin-off companies emerging from the ERC in Y1-5, companies which have attracted over \$20M of funding from both government and private sources. The **NorthStar Cryo (NSC)** spin-off is commercializing advanced islet cell cryopreservation for diabetes treatment and has secured evaluation contracts with three major pharmaceutical companies.



In addition, ATP-Bio is playing a key direct role in spin-off companies, through **CRYOFOUNDRY**, which is an incubator activity designed for PIs and trainees to present their ideas to the Innovation Ecosystem partners. The benefits include:

- Informal collaboration, rather than a competition
- Opportunity to connect to industry mentors
- A means to vet an idea at an early stage.

Some of the CRYOFOUNDRY ideas pitched in Y5 include

- *CryoVox* – 3D cryoprinting of biological products.
- *Cool Blood* – extended blood product storage.
- *Neurovault* – preservation of neurological tissues.

We expect some of these ideas to turn into spin-off companies and then into commercialized products and services, expanding ATP-Bio's long-term impact.

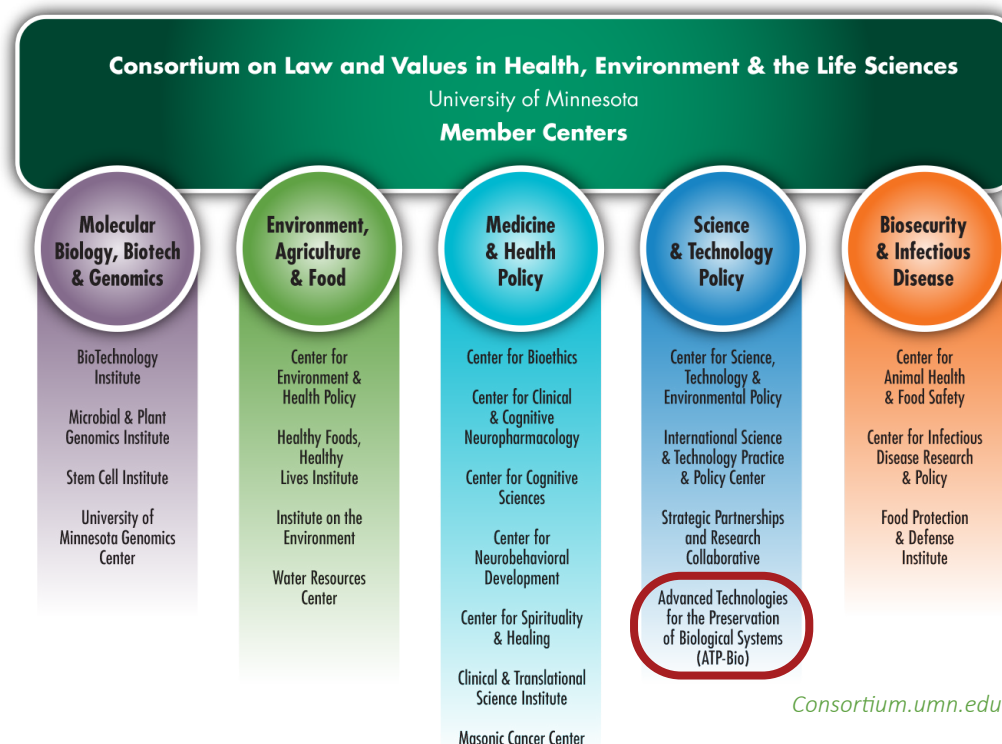
Through ethics and public policy analyses, ATP-Bio is establishing guidance for the responsible development and deployment of ATP-Bio's breakthrough technologies for societal benefit.

ATP-Bio's advanced biopreservation technologies have the potential to transform fields ranging from organ transplantation to conservation biology. To ensure these innovations deliver broad societal benefit and minimize risk, ATP-Bio integrates a dedicated Ethics & Public Policy (EPP) component.

EPP anticipates the ethical, legal, and societal implications (ELSI) of emerging cryopreservation technologies and helps shape policies that promote responsible innovation. By embedding ethicists, lawyers, clinicians, and social scientists into the research enterprise, EPP ensures that ATP-Bio's breakthroughs are not only technically successful but also socially responsible.

EPP is led by Director Susan M. Wolf, JD, and Co-Director Timothy L. Pruett, MD. Wolf is a Regents Professor and McKnight Presidential Professor at the University of Minnesota, Chair of the Consortium on Law and Values in Health, Environment & the Life Sciences, and an elected member of the National Academy of Medicine, among other honors. Pruett is Professor of Surgery and Director of the Liver Transplantation Program at the University of Minnesota, a former President of both UNOS and the American Society of Transplant Surgeons, and a consultant to the World Health Organization.

Together with the Ethics & Public Policy Panel (EP3)—a distinguished group of 13 experts in ethics, law, and governance—EPP provides independent guidance and thought leadership to ensure ATP-Bio's technologies advance responsibly and for the public good.



Consortium.umn.edu

Year Five Highlights

- **Landmark Analyses and Guidance Published:** Released a special symposium issue of the Journal of Law, Medicine & Ethics (10 papers plus an introduction) examining the ethical, legal, and societal challenges of “stopping biological time,” along with additional articles in the American Journal of Transplantation and Annual Review of Biomedical Engineering.
- **EP3 Meeting Engagement:** Convened multiple meetings addressing governance, stakeholder engagement, and future biorepositories. ATP-Bio investigators and trainees participated, gaining exposure to the ethical and societal dimensions of responsible innovation.
- **Annual Meeting Panel:** Hosted a plenary session, “Advanced Biopreservation for Medical Hibernation & Space Travel,” featuring experts discussing scientific and ethical implications in medicine and exploration.
- **Public Webinars:** Delivered two webinars through the ATP-Bio Public Webinar Series—one on risk innovation for emerging biotechnologies and another on the promise and perils of pathogen biopreservation—now archived in ATP-Bio’s public library.
- **Stakeholder Engagement (SE):** Partnered with the Innovation Ecosystem Pillar to gather input from future users, regulators, and beneficiaries of ATP-Bio technologies. EPP Director Susan M. Wolf also co-chaired NSF’s Stakeholder Engagement & Impact Collaborative (SEIC) across all funded Engineering Research Centers.

Year Six Priorities

- **Survey Analysis & Publication:** Complete and publish results from the EPP survey of ATP-Bio personnel assessing anticipated applications, timelines, and ethical, legal, and societal implications (ELSI) of ATP-Bio technologies.
- **Governance & Regulation:** Advance work on regulatory and policy challenges related to organ allocation, supply chains, and the development of large-scale biorepositories.
- **Advancing Stakeholder Engagement:** Launch structured engagement with organ transplantation stakeholders, including clinicians, patient advocacy groups, and regulatory bodies.
- **Terminology & Standards:** Publish recommendations on harmonized terminology in cryopreservation to improve reproducibility, regulatory consideration, and commercialization.
- **Continued Education & Outreach:** Offer at least two EPP webinars annually, plus plenary sessions at ATP-Bio’s Annual Meeting, ensuring broad exposure to ELSI expertise and approaches.
- **NetEthics Impact:** Share widely the analyses and tools developed by our NSF-funded NetEthics project to support the ethical and responsible conduct of research in ERCs and other big, multi-institutional research networks.



Year Six and Beyond Goals

- **Deepen Integration Across ATP-Bio:** Continue to work closely with all pillars to anticipate ethical and policy issues as technologies move toward translation and commercialization.
- **Stakeholder and Public Engagement:** Continue to engage key stakeholders to shape ATP-Bio technology development, translation, and deployment for societal benefit. Consult and share with other ERCs on best practices for stakeholder engagement and delivering societal benefit.

- **Global Relevance:** Address international regulatory and ethical considerations, particularly as technologies scale to global supply chains and conservation initiatives.
- **Workforce Development:** Continue mentoring trainees and postdocs, embedding them in interdisciplinary projects that shape the next generation of leaders in cryobiology research, ethics, and policy.
- **Pioneering Work to Support Research Networks:** Expand the capacity of ERCs and other research networks to conduct ethical and responsible research by sharing tools from the NSF-funded NetEthics project, including survey instruments and educational case studies.

Special Activities & Notable Achievements

- **EP3's Impact:** The Ethics & Public Policy Panel (EP3) continues to be an invaluable asset to ATP-Bio. Year 5 meetings directly informed published papers, ERC strategy, and renewal planning.
- **NetEthics Project:** This NSF-funded initiative advances responsible research and innovation across large, complex scientific networks. The project is producing multiple publications and organizing a national NetEthics Conference (Nov. 2025) to share tools supporting ethical research practices.
- **Cross-Pillar Integration:** EPP collaborated with the Convergent Research (CR) and Innovation Ecosystem (IE) pillars on publications, abstracts, and presentations, including contributions to CRYO2025 (Hannover, Germany) and the World Transplant Congress (San Francisco, CA).
- **Thought Leadership:** EPP leaders contributed to NASA's Decadal Survey on Astrobiology through a white paper exploring the creation of a lunar biorepository—highlighting how ethical and policy perspectives can shape bold scientific frontiers.

Guiding Responsible Innovation: Through its publications, collaborations, stakeholder engagement, and trainee mentorship, EPP continues to build the ethical and policy framework ensuring ATP-Bio's groundbreaking science advances responsibly and for the public good.

Ethics & Public Policy Panel (EP3)

The Ethics & Public Policy Panel (EP3) is composed of top experts from across the country. EP3 serves a critical advisory and collaborative function for EPP and the ERC more broadly. ATP-Bio engages with EP3 members through consultative meetings each year, the Annual Meeting, and joint publications. EP3 works to:

- 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 and publications on cutting-edge issues in governance of ATP-Bio's emerging technologies.

EP3 Members

EP3 Member	Expertise
Evelyn Brister, PhD—Professor of Philosophy and Philosophy Program Director, Rochester Institute of Technology	National expert on philosophy of science and environmental philosophy, with a focus on values in ecology and conservation science. Her work also engages public philosophy and environmental applications of biotechnology.
Shawneequa Callier, JD, MA —Associate Professor, Department of Clinical Research and Leadership School of Medicine and Health Sciences, The George Washington University	National expert on the ethical, legal, and social implications of emerging technologies, including genomics and data science. She has particular expertise in bioethics, life sciences law, international law, and issues concerning underrepresented populations. She has also served as an organ transplant donor advocate. On the NIH NExTRAC panel.
Alexander Morgan Capron, LLB—University Professor Emeritus; Bice Chair in Healthcare Law, Policy & Ethics; Professor of Law & Medicine, Keck School of Medicine; Co-Director, Pacific Center for Health Policy & Ethics, Univ. of Southern California	International expert on health policy, law and science, and medical ethics. Past-Director of Ethics, Trade, Human Rights & Health Law, WHO; past-member, Nat'l Bioethics Advisory Commission; past-President, Int'l Assoc. of Bioethics. Member, Nat'l Academy of Medicine and American Law Institute.
James F. Childress, PhD—Professor Emeritus, University Professor, Professor of Ethics and Religious Studies, Univ. of Virginia	Founding Director, Inst. for Practical Ethics & Public Life. Co-author, Principles of Biomedical Ethics (with Beauchamp). Past-Vice Chair, Task Force on Organ Transplantation; past-member, Board of Directors, United Network for Organ Sharing (UNOS); past-member, Nat'l Bioethics Advisory Commission. Member, Nat'l Academy of Medicine.
Barbara J. Evans, JD, PhD, LLM—Professor & O'Connell Chair, Law School; Professor, School of Engineering, Univ. of Florida	Research funded by NIH, NSF, FDA, Greenwall Foundation. Past member of multiple committees for the Nat'l Academies and FDA. Member, American Law Institute; Senior Member, Institute of Electrical & Electronics Engineers. Expert on law and biomedicine, law and engineering, FDA law, privacy law.
Michele Bratcher Goodwin, JD, LLM, SJD—O'Neill Professor of Constitutional Law & Global Health Policy, Faculty Director, O'Neill Institute, Georgetown University	Member, American Law Institute; fellow, American Bar Foundation; fellow, The Hastings Center. Constitutional and health law scholar. Past member of multiple committees for the Nat'l Academies. Books include Black Markets: The Supply and Demand of Body Parts (2006).
Insoo Hyun, PhD—Inaugural Director, Center for Life Sciences and Public Learning, Museum of Science, Boston	Fulbright Scholar, Hastings Center Fellow. Expert on ethical and policy issues in stem cell research and biotechnologies. Projects have been funded by NIH and Greenwall Foundation, including formulating a bioengineering ethics framework for research with multi-cellular engineered living systems. On NExTRAC.
Rosario Isasi, JD, MPH—Director, Institute for Ethics & Health Policy; Associate Professor, Dep't of Human Genetics, HUSMAN Institute for Human Genomics, and Interdisciplinary Stem Cell Institute, Univ. of Miami School of Medicine	Expert on comparative law & ethics of genetic engineering. Ethics/Policy Advisor, European Commission's Human Pluripotent Stem Cell Registry; member, American Soc. for Human Genetics Task Force on Gene Editing; Academic Secretary, Int'l Stem Cell Forum Ethics Working Party; Co-Chair, "All of Us" Resource Access Board; President's Int'l Fellow, Chinese Academy of Sciences (CAS); Adjunct Professor, CAS Institute of Zoology.
Gary E. Marchant, PhD, JD, MPP—Regents Professor of Law; Director, Center for Law, Science & Innovation, Beus Center for Law & Society, College of Law, Arizona State Univ.	Expert on legal aspects of genomics and personalized medicine, use of genetic information in environmental regulation, risk and the precautionary principle, and governance of emerging technologies. Has served on Nat'l Academies committees, as PI on major grants, and as an organizer of national conferences on law and science.
Andrew Maynard, PhD—Professor, School for the Future of Innovation in Society; Senior Global Futures Scholar, Global Futures Scientists and Scholars, Arizona State Univ.	Director, ASU Risk Innovation Lab. Trained as a nanoparticle physicist. Has served on World Economic Forum Global Agenda Councils, Global Future Councils, and Nat'l Academies committees. Expert on emerging technologies and responsible innovation.
Kenneth Oye, PhD—Professor of Political Science Emeritus; Professor Emeritus of Data Systems & Society, School of Engineering; Director, Program on Emerging Technologies, MIT	Expert on international relations, political economy, and technology policy, including adaptive management of risks associated with multiple technologies. Faculty affiliate, MIT Synthetic Biology Center, Center for Biomedical Innovation, and Internet Policy Research Initiative. Chair, biosafety committees, iGEM and Broad Institute Biofoundry. On NExTRAC.
Paul B. Thompson, PhD—Professor Emeritus; previously inaugural W.K. Kellogg Chair in Agricultural, Food and Community Ethics, Michigan State Univ.	Depts. of Philosophy, Community Sustainability & Agriculture, Food & Resource Economics. Expert on ethical and philosophical issues in food and agriculture. Advisory boards, National Research Council, Nat'l Academy of Engineering, Genome Canada. Past-President, Agriculture, Food & Human Values Society.
Terrence R. Tiersch, PhD—Professor, School of Renewable Natural Resources; Director, Aquaculture Germplasm & Genetic Resources Center (AGGRC), Louisiana State Univ.	Expert in cryobiology and cryopreservation of aquatic species, aquaculture genetics, commercial aquaculture, sustainable aquaculture, politics of water use, and science ethics.

Spotlights

Spotlight: Landmark Publications

“Shaping the Ethics of Cryopreservation”

ATP-Bio EPP leaders published a special symposium issue of the Journal of Law, Medicine & Ethics with 10 papers on the challenges of “stopping biological time.”

- Additional collaborative articles appeared in the American Journal of Transplantation and Annual Review of Biomedical Engineering. These works place ATP-Bio at the forefront of global ethical and policy discourse.

Spotlight: EP3 – Independent Guidance

“Expert Insight at the Cutting Edge”

EP3 composed of 13 distinguished experts, continued to guide ATP-Bio research.

- Addressed governance of ATP-Bio technologies and applications.
- Explored ethical implications of organ allocation and other issues in cryopreservation.
- Opened participation to ATP-Bio trainees, giving them a seat at the policy table.

Spotlight: Public Engagement

“Big Ideas in the Public Eye”

Year 5 featured public-facing events that brought ethical issues to wide audiences:

- Annual Meeting Plenary: “Advanced Biopreservation for Medical Hibernation & Space Travel.”
- Public Webinars: Topics included pathogen biopreservation and risk-innovation frameworks.
- Stakeholder Engagement: Working with ATP-Bio’s IE to ensure consultation with researchers, policymakers, regulators, and the public to guide development and application of ATP-Bio technologies.

Spotlight: NetEthics Project

“Advancing Responsible Research in Large Research Networks like ATP-Bio”

NSF-funded NetEthics made major progress in Y5, producing tools to embed ethics into scientific networks.

- Publications: NetEthics generated empirical and normative publications on ethics in research networks.
- Tools: NetEthics created survey instruments and training resources for other ERCs and research networks.
- Conference: NetEthics will present a National Conference in Nov. 2025.

Spotlight: Looking Ahead

“Ethics for the Next Frontier”

EPP’s Year 6 and beyond goals include:

- Forecasting the Future of ATP-Bio Technologies: Surveying ATP-Bio ERC experts on risks, benefits, and timelines for ATP-Bio technologies.
- Advancing Harmonized Terminology in Cryobiology: Leading efforts to establish consensus on standard terminology in cryobiology to support reproducibility, replicability, and progress in the field.
- Stakeholder Engagement: Deepening engagement with clinicians, patient groups, regulators, and industry collaborators.
- Building an Ethical Workforce: Continuing to mentor the next generation of ethicists, lawyers, and scientists through collaboration and embedded training opportunities.

Year Five Annual Meeting Highlights

ATP-Bio's Annual Meeting brought together the biopreservation industry, academia, and stakeholders to enhance connections through technical presentations, networking, and facility tours.

Looking Ahead: From Fundamental to Translation—What's Next?

The **Year Five Annual Meeting** was held March 3–6, 2025, hosted by the University of California–Riverside (UCR), brought together more than 65 participants from across academia, industry, and government to explore ATP-Bio's future research directions and its expanding societal impact. The two-day event combined forward-looking presentations, ethical discussions, trainee engagement, and community-building activities that reflected the Center's growing integration and vision for renewal.



The **Meet & Mingle Mixer**, held on March 3 at the historic Mission Inn, offered a dynamic start to the week. Attendees enjoyed meaningful conversations in a relaxed setting, complemented by a popular photo booth that added a lighthearted element and lasting memories.

The combination of productive discussions, engaging events, and collegial atmosphere made this year's meeting a memorable milestone in advancing ATP-Bio's mission and partnerships.



ATP-Bio Year Five Annual Meeting

March 4–5, 2025 | Riverview Convention Center & University of California–Riverside

Day 1 – Tuesday, March 4, 2025

The meeting opened with **John Bischof**'s *"ATP-Bio Welcome & Vision for the Event."* Center Research Leads followed with *"Looking Ahead: From Fundamentals to Translation – What's Next?"* highlighting new Integrated Thrust Areas that unite nanotechnology, materials science, and regenerative medicine.

Korkut Uygun presented *"ATP-Bio Strategic Research Priorities Y6–10,"* and UCR leaders **Lorenzo Mangolini**, **Yadong Yin**, and **Jin Nam** outlined the university's alignment with those goals.

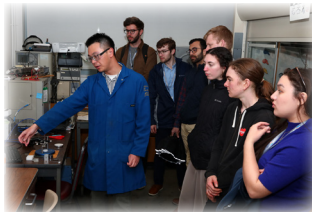
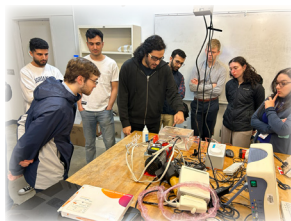
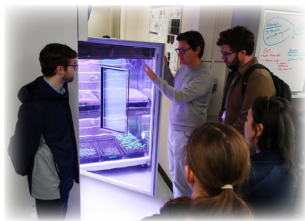
Invited talks in *"Featuring Expertise at UCR Aligned with ITAs and Renewal Vision"* showcased research by **Juan Pablo Giraldo**, **Sihem Cheloufi**, **Kaveh Laksari**, **Peter Atkinson**, **Mona Eskandari**, and **Jernej Murn**.

The afternoon focused on translation:

- *"The Role and Importance of the Cryo Supply Chain in Achieving Scalability of ATP-Bio Technologies"* — **Dan Chen**, **Dominic Clarke (Cryoport)**, **Greg Fahy (21st Century Medicine)**
- *"Vision, Collaborations & Funding Opportunities"* — **Mehmet Toner**
- *"Advanced Biopreservation for Medical Hibernation & Space Travel: Prospects & Challenges"* — **Susan Wolf**, **Tim Pruett**, **Aline Ingelson-Filpula**, **Kelly Drew**, **Rosario Isasi**
- *"The Future of Cryopreservation: Innovations and Challenges Ahead"* — **Dan Chen**, **Matthew Powell-Palm (Biochoric)**, **Allison Ting (Gaia)**

The evening reception and Trainee Poster Competition celebrated emerging talent across the ATP-Bio network.





Day 2 – Wednesday, March 5, 2025

The second day centered on education, integration, and community development. **Evaluator Emily Goff** opened with “ATP-Bio Organizational Ecosystem,” emphasizing strategies to strengthen Center collaboration and culture.

Engineering Workforce Development (EWD) leads **Keisha Varma** and **Sam Bullard** presented ATP-Bio’s **middle school curriculum** on organ preservation, followed by a hands-on working session on curriculum, partnerships, and practitioner training, with contributions from **John Bischof**, **Mehmet Toner**, **Berk Usta**, **Matthew Powell-Palm**, and others.

Integration Director Rhonda Franklin facilitated “*Breaking Down Barriers*,” an interactive discussion on overcoming integration challenges across pillars. Attendees later joined **UCR Laboratory and Facility Tours**, led by **Lorenzo Mangolini**, showcasing state-of-the-art research in cryopreservation and nanotechnology.

The event concluded with a reception, dinner, and awards ceremony, at the UCR Alumni Center where **Dean Lynch** and **Dean Atkinson** joined to celebrate the winners of the **NSF ATP-Bio Poster Competition** and the **Outstanding Trainee Leadership Award**.

Together, the sessions highlighted ATP-Bio’s continued progress in advancing cryopreservation science, ethics, and education—laying a strong foundation for the Center’s next phase of innovation and societal impact.

Get Involved with ATP-BioSM



ATP-Bio Public Webinar Series

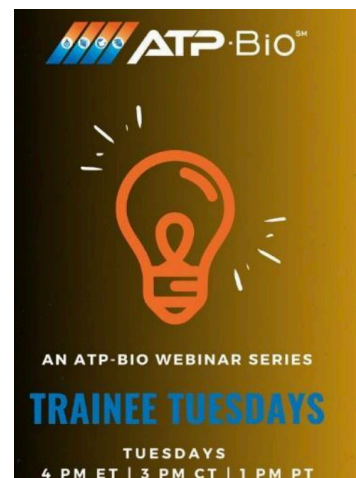
The ATP-Bio Public Webinar Series is offered for members of the ATP-Bio community and the external public at large. Topics include biopreservation research and related content. The goal of the public webinar series is to be accessible to stakeholders beyond our inner community.

- Audience: ATP-Bio Community, Member Partners, Institutional Leadership, Public
- Frequency: Monthly. [Every other month, ATP-Bio will promote the Society for Cryobiology Public Webinars]
- Visit atp-bio.org/WHAT'S_HAPPENING for upcoming webinar information
- Watch past public webinars on ATP-Bio's YouTube channel

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



ATP-Bio Website Relaunch

We launched a brand new website! Redesigned to better connect users with the science, people, and impact behind ATP-Bio cryoconservation research.

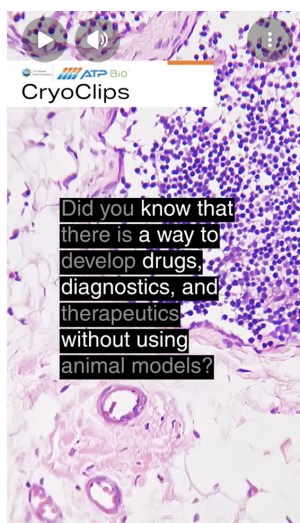
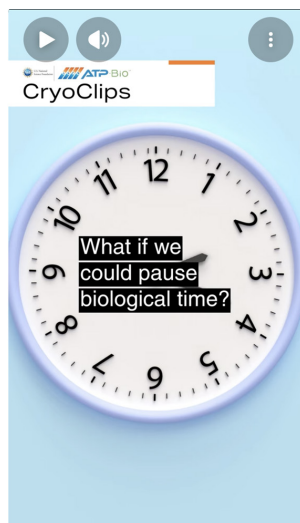
- Sleek new homepage
- Easier navigation
- Access to research, tools & events
- Stories spotlighting how ATP-Bio is shaping the future of healthcare, food sustainability, and biodiversity

A dynamic new hub for learning how ATP-Bio and NSF are

MAKING LIVING SYSTEMS ACCESSIBLE TO ALL



ATP-Bio CryoClips: Research Impact



ATP-Bio CryoClips deliver quick, engaging looks at the cutting-edge science and technology emerging from the NSF Engineering Research Center for Advanced Technologies for the Preservation of Biological Systems (ATP-Bio).

Each month, these short videos and animations break down key discoveries, breakthrough technologies, and high-impact publications—transforming complex research into clear, plain-language stories anyone can understand.

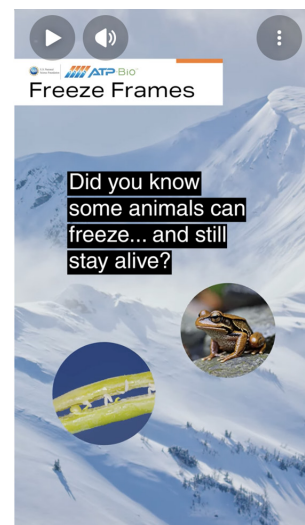
From cryopreservation innovations to next-generation biotechnologies, CryoClips highlight how ATP-Bio research is shaping the future of medicine, conservation, and global access to living systems

ATP-Bio Freeze Frames: People Impact

ATP-Bio Freeze Frames, are videos spotlighting the people driving innovation across the NSF Engineering Research Center for Advanced Technologies for the Preservation of Biological Systems (ATP-Bio).

Each month, our “Faces of ATP-Bio” interviews feature students, postdocs, faculty, and industry mentors whose work is advancing the science and technology of biopreservation—from breakthrough publications and collaborative projects to real-world applications and personal journeys.

These stories are drawn from across ATP-Bio’s community and programs—including highlights from our newsletters, events, research profiles, and partner networks—capturing the human impact behind the science.



**Watch ATP-Bio’s Public Webinars,
CryoClips and Freeze Frames on YouTube:**
<https://www.youtube.com/@atp-bioengineeringresearch5661>





Organs wait for patients ...
instead of patients waiting for
organs

Get Involved

atp-bio.org

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