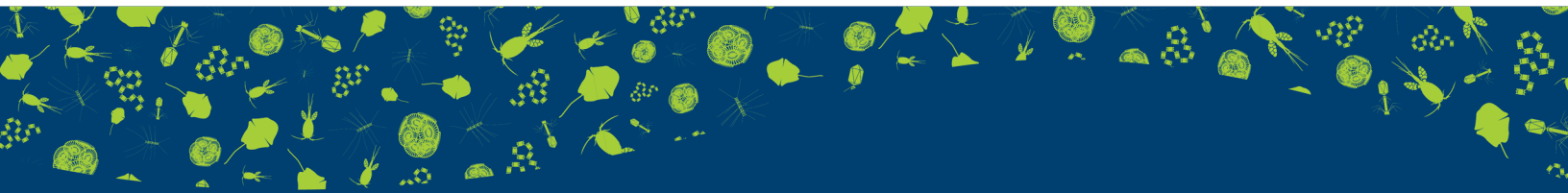


2020-2025 STRATEGIC PLAN





—

BOLD SCIENCE FOR OUR BLUE PLANET



CONTENTS

- 2** Our Mission and Vision
- 3** Introduction
- 4** Our Approach to Strategic Planning
- 5** Strategy Overview
- 6** Advance World-Class Science
to Improve the Future
- 12** Educate the Next Generation of
Ocean Leaders and the Public
- 16** Promote Organizational Excellence
in Support of Our Mission
- 21** Our Commitment

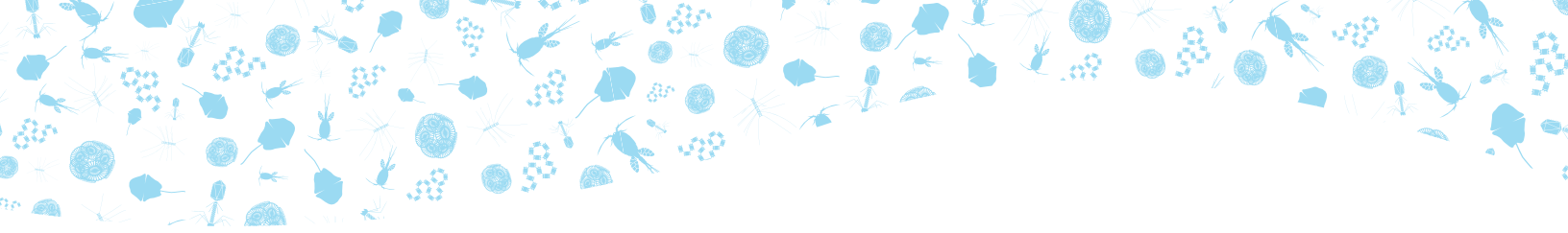
Our Mission

is to study the foundation of global ocean health and use our discoveries to improve the future for all life on the planet.

Our Vision

is a world where scientific understanding of the ocean turns the tide on global challenges and unlocks the full potential of the ocean to support our society.





How will our climate change? How will we adapt? How will we feed 10 billion people by 2050? These are some of the great questions of our time, and the ocean is central to all of them.

Bigelow Laboratory is an independent, nonprofit research institute that focuses on the marine life that underpins global ocean health, and its incredible potential. Many of these species are microscopic, but together they are a powerhouse that provides half the oxygen we breathe, feeds our oceans, cleans our atmosphere, and recycles nutrients vital to all life.

We fuse the interdisciplinary expertise of world-class scientists to discover new insights and develop new applications. Our science is key to the fundamental understanding of the ocean, how it impacts human and environmental health, and how it can provide solutions and innovations that address some of the world's most important opportunities.



Our Approach to Strategic Planning

Bigelow Laboratory's culture, financial model, and organizational structure make it unique among oceanographic institutes. It was designed from the ground up by scientists for scientists. It is an incubator for ideas that attracts leading researchers and fosters excellent research.

We do not have departments, believing that scientists of all disciplines need to interact directly to maximize discovery. We invest in shared Discovery Centers that facilitate science across our laboratory and around the world. All our scientists are responsible for obtaining competitive grants and contracts to fund their salary and their research, requiring all to remain at the cutting edge of their field.

To protect our unique strengths when we make new strategic decisions and define new policies and practices, we take three core approaches.

Focus on Excellence in Research

Bigelow Laboratory is built on excellence in basic research, and we recognize its proven value in long-term progress and discovery. Transformative science is like great art — it thrives in an environment that embraces creativity, collaboration and constructive criticism. Due to our intense focus and unique structure, we have been able to contribute to the creation of knowledge well beyond our apparent capacity.

Hire and Invest in Great People

Our greatest asset is our people — staff, trustees, advisory board, donors, students and volunteers — who are committed to our mission and our culture of excellence. We are committed to supporting each other as individuals worthy of support, acknowledging that a diversity of people and ideas pays dividends that strengthen our work. We promote a culture of mutual respect and responsibility, grounded in honest and open communication. We believe that every person, in every position, should have opportunities to continually learn, improve and innovate.

Operate with Financial Discipline

We are committed to operating in a financially sustainable manner by thoroughly vetting and adequately funding both on-going and new initiatives, seeking cost efficiencies and commercialization opportunities, creating reserves and adhering to a prudent, long-term fiscal operating and capital model. Building and maintaining a sustainable financial foundation allows the Laboratory to maintain its research independence, attract and retain the best people, weather financial downturns and government shutdowns, and invest in new ideas to keep the Laboratory at the cutting edge of its science.



Strategy Overview

During the last 45 years, Bigelow Laboratory has made transformative contributions to the understanding of our oceans and the tools used to study them, clearly demonstrating that our unique institutional model can achieve outstanding results.

As we move toward our 50th anniversary, this plan outlines mechanisms to bolster our research, encourage translation of our expertise into new applications, grow our education programs to equip tomorrow's ocean leaders in ways that amplify our mission, train future generations, and enable us to diversify funding sources. Our plan is highly aspirational.

Remaining at the forefront of science means that we must take manageable risks to accomplish bold and visionary goals. Over the next five years, we will advance our mission by focusing on three overarching strategies.

Advance World Class Ocean Science to Improve the Future (page 6)

As an independent, entrepreneurial nonprofit institute, Bigelow Laboratory must remain competitive in recruiting and retaining the world class scientists to conduct the cutting-edge research that keeps the Laboratory at the forefront of ocean science. We will strengthen our scientific leadership in understanding microbial ocean life and its genetic potential to learn how these organisms function and impact human and environmental health, and leverage this knowledge to provide innovative solutions to pressing environmental issues.

Educate the Next Generation of Ocean Leaders and the Public (page 12)

Today's environmental challenges require leaders in science, policy, and the general citizenry that understand the critical roles the ocean plays in our climate, economy, and well-being. Bigelow Laboratory's education programs provide unique experiential, inquiry-based learning in a professional research environment for students ranging from the high school level to postdoctoral, as well as providing skills-based certificate training for established professionals. Our goal is to expand our capacity to provide these educational opportunities, introduce more opportunities for professional certification and executive education, and broaden our outreach to and engagement with the public.

Promote Organizational Excellence in Support of Our Mission (page 16)

Over the last decade, Bigelow Laboratory's research programs have grown in number and become more complex and interdisciplinary. Increasingly, research grants are won collaboratively with outside partners. The best research often requires access to advanced technologies, which are shared across scientists. The ability to operate efficiently and effectively in this environment requires appropriate and consistent investment in both research and information technology and human resources. We are committed to attracting and retaining the most qualified people across the organization and to helping them develop the experience, skills and leadership to achieve their aspirations as well as those of the Laboratory.



ADVANCE WORLD-CLASS SCIENCE TO IMPROVE THE FUTURE

To ensure we continue to attract top scientists and maintain a robust pipeline for new ideas, Bigelow Laboratory will always be a place where researchers have freedom to follow their passion. Resources are limited, however. To maximize the benefit of our work to society and assure long-term financial sustainability, we prioritize institutional investment and growth in areas that have a demonstrable impact on planetary health and human well-being, and where our expertise is well-matched. Doing so helps us address societal challenges, attract talent, and increase philanthropic support for our work.

In this strategic plan, we highlight three fundamental research themes and two areas of applied research that have been identified as priorities. Funding for the research goals outlined in the themes below will come largely from grants written by and awarded to individuals or groups of scientists. Many of these activities have already received funding that will support them over the next three to five years.



Strategic Research Themes

The ocean relies on key species that drive its health and the global processes that sustain our planet. We focus on this critical sea life and the insights it offers to our three long-term areas of focus: **OCEAN HEALTH AND FUNCTION**, **OUR CHANGING PLANET**, and **THE OCEAN'S POTENTIAL**. For each of these areas, we've developed one **strategic research theme** that we aim to advance over the next five years.

OCEAN HEALTH AND FUNCTION | Foundation of Ocean Food Webs

Our goal is to understand the role of the microbial engine in the global ocean food web. The ocean is an important source of food for humans and a major economic sector, yet these services are threatened by increasing fishing pressure, nutrient and plastic pollutants, and occurrence of harmful algal blooms — all of which negatively impact the health of larger species. Over the next five years, our goal is to advance research that allows us to: 1) determine the variables that lead to outbreaks of invasive and harmful species and develop strategies that transform how we monitor toxicity and mitigate its effects, 2) develop approaches that use DNA in the environment (eDNA), combined with big data sets on environmental conditions, to understand how organisms are distributed and support sound environmental policy and management, and 3) reveal how food webs respond to changes in climate, biodiversity, and nutrient and microplastic pollution.

OUR CHANGING PLANET | Ocean Climate Interactions

Our goal is to understand the role of the ocean in global ecosystem health. The ocean is central to Earth's life support system, but anthropogenic climate change threatens the ocean's ability to moderate local and global climate, support societies and economies that have evolved along its margins, and serve as a source of food for billions of people. We conduct research on how ocean microbiology is responding to changing ocean conditions, how that feeds back on climate by altering ocean-atmosphere interactions, and how the consequences of those changes affect higher organisms and food security. Over the next five years, our goals are to: 1) quantify the causes and effects of environmental change and their impact on the microbial processes that underlie carbon and nutrient cycling in the ocean to better understand carbon sequestration and how to increase it, and 2) define and quantify feedbacks between the ocean and its boundaries — the atmosphere, the cryosphere (ice), and land.



THE OCEAN'S POTENTIAL | The Ocean Genome

Our goal is to understand the genetic basis of the ocean's role as a global life support system. Microbial life in the ocean is an untapped reservoir of genetic and functional potential that can be explored for natural products and enzymatic pathways that benefit humanity. Over the next five years, our goals are to: 1) develop new technologies, instrumentation and infrastructure to determine, at the level of individual microbial cells, the genes that cells possess (the genome) and how they effect the way a cell looks or functions (the phenome), 2) gain the ability to predict function from genomic information in order to predict climate change effects and to identify novel microbial processes for bioenergy, biotechnology, and pharmaceutical and nutraceutical applications, and 3) unlock novel functions and applications of marine genes through cellular genetic interrogation and engineering.

Impact Centers

Bigelow Laboratory is committed to using our collective expertise to contribute to real-world solutions and the economy through applied research and commercial ventures. Our Impact Centers serve to stimulate informed discussion on important societal issues and leverage our expertise to develop new research applications, solutions, and innovations.

Center for Seafood Solutions

Established in 2016, our Center for Seafood Solutions has catalyzed interdisciplinary research at the national and international level, integrated with the regional aquaculture industry, and attracted significant philanthropic funds to address climate change. The Center's goal is to partner with stakeholders around the globe to put our science to work, helping to feed Earth's growing population without destroying the oceans. Over the next five years, key initiatives will include:

- 1) developing ocean-derived feed supplements to reduce methane production in cows,
- 2) advancing sustainability and conservation through seafood forensics, and
- 3) establishing best practices to reduce, avoid, detect, and remove bioaccumulation of pollutants in seafood (metals, microplastics, toxins).



Center for Algal Innovation

The Center for Algal Innovation is a new Impact Center we are launching because microalgae and macroalgae can contribute in myriad ways to a more sustainable society while lowering our carbon footprint. Due to the expertise developed in Bigelow Laboratory's National Center for Marine Algae and Microbiota, we are world experts in algae and have unique assets for growing diverse species. This positions us to be leading algal innovators and entrepreneurs in aquaculture, nutraceutical, pharmaceutical, and bioenergy industries. Over the next five years, our goal is to connect researchers and entrepreneurs to translate knowledge, accelerate innovation, and foster the growth of a sustainable, ecologically sound, and profitable algal industry regionally and around the world.

New Research Investments

In addition to the largely scientist-funded research described above, Bigelow Laboratory will raise funds over the next five years to: 1) support our senior research scientists and postdoctoral researchers, 2) enhance early stage discovery, and 3) launch two new initiatives that represent important areas where we want to expand and strengthen our current research expertise and respond to critical societal needs.

Senior Research Scientists

In 2019, Bigelow Laboratory only provided seven weeks of annual salary support to our senior research scientists. This is not enough. Over the next five years, our goal is to increase that support to 12 weeks each year. We also must constantly look for new talent in response to the changing research landscape, and as part of succession planning for eventual retirements. Over the next five years, our goal is to hire six new senior research scientists to address retirements and new science needs.



Postdoctoral Program

Postdoctoral scholars recently received their PhDs and represent the immediate future of research. They work directly with senior research scientists and continually bring new ideas, expertise and approaches to the lab. To continue to attract the best candidates and support their professional growth, over the next five years, our goals are to: 1) initiate a formal marketing campaign that highlights opportunities at the Laboratory, 2) establish an institutionally funded postdoctoral scholar program, and 3) formalize our training program to provide support with grant writing, instruction on mentoring, and expanded opportunities to partner postdoctoral scholars with students so they gain experience as educators.

Support Early Stage Discovery

We will support early stage discovery across Bigelow Laboratory to catalyze discovery and to improve our success rates for grant proposals. To do so, we will seek support to: 1) provide seed grants for novel or high-risk research, 2) provide salary support to scientists engaged in writing large multi-institutional proposals or proposals to new funding programs, and 3) build a reserve for unrecovered indirect costs that allow scientists to take advantage of all available funding programs.

Big Data Discovery Initiative

Data and computational advances are revolutionizing the way science is done, allowing fundamentally new questions to be asked and answered. Bigelow Laboratory will create a data science and computational hub that accelerates our discovery and innovation while keeping us at the cutting-edge of ocean science. We are poised to advance this field due to our unique capabilities at the intersection of omics and geospatial data, and our high diversity of computational approaches and knowledge (e.g. artificial intelligence, informatics, geospatial statistics, mathematical modeling, and simulation). There is an increasing need to utilize and integrate multiple data types and computational methods for research, increasing interest in data science among the public, and increasing opportunity for big data to unlock new insights. This initiative will expand data and analytical support for researchers across the Laboratory and create a new competitive advantage for our scientists. Specifically, we will 1) assemble a visiting committee to advise us on opportunities in data science, 2) hire at least one senior research scientist in some area of data science, artificial intelligence or machine learning, and 3) upgrade and expand computer clusters and back-up and invest in integrative software and website development to support advances in this area.



Water Health and Humans Initiative

While our research is global, we take advantage of our proximity to the Gulf of Maine. The Gulf is warming faster than 99% of the ocean and experiencing dramatic increases in acidification and changes in currents. These attributes make it a valuable, local natural laboratory where we can study the changes in seawater chemistry, carbon storage, biological productivity, and ecology that are impacting the entire ocean. Our findings also provide vital insights to Maine's efforts to protect its environment and economy.

Increasing eutrophication, harmful algal blooms, and persistent contaminants threaten Maine's aquaculture industries, ocean- and lake-based tourism, and quality of life. Our goal is to support economic growth while preventing excess nutrients, harmful algal blooms, and contaminants in Maine's coastal ocean and lakes — sparing Maine the chronic water quality and harmful algae issues that plague other states. We are well-positioned to build on our expertise in microbes and water quality to help monitor and mitigate these issues. The research done within this initiative will be focused within the state of Maine but applicable to many systems throughout the world. Specifically, we will 1) hire a senior research scientist to launch the initiative, 2) establish a program to provide accurate, unbiased advice on nutrient, harmful algae, and toxin issues (fecal coliform, cyanobacteria, etc.) in Maine's coastal ocean and inland waters, and 3) develop relationships with state agencies, homeowner associations, and industry to identify problems and solutions.



EDUCATE THE NEXT GENERATION OF OCEAN LEADERS AND THE PUBLIC

Today's environmental challenges require leaders in science, industry, and the general citizenry to understand the roles the ocean plays in our climate, economy, and well-being.

Bigelow Laboratory has three specific strategies to address these needs: deliver transformative educational experiences that advance our science and train the next generation of ocean leaders, empower the economy with our knowledge, and inspire by getting our science out into the world.



Deliver Transformative Educational Experiences

Our core education strategy focuses on high-quality, personalized experiences that provide transformative impact. Through experiential, inquiry-based ocean science training, we inspire students from diverse backgrounds at the high school, undergraduate, and graduate level.

Our education programs are embedded within our research activities, and through immersion in a professional research environment, students learn to apply concepts to urgent real-world problems and to cutting-edge basic research, and to expand their professional network. We invest in extended, mentored relationships with students that align the interests of our scientists and students and foster the traits needed to lead in highly competitive and continually evolving professional environments, including the skills to communicate scientific knowledge to other scientists and the general public. Through this work, we build national and international capacity in ocean research, positioning our students to lead in areas of ocean research, management, communication and policy.

During the last decade, we have established a strong relationship with Colby College. Over the next five years, our goal is to continue to grow this partnership through a joint institute that supports undergraduate Colby students and implements a “4+1” Master’s degree program. We will also expand our reach to other universities through a program that will provide financial assistance to help non-Colby students participate through the Bigelow Scholars Program. One example is our new partnership with University of New England, which provides their undergraduate and professional science master’s students access to our courses and research opportunities. Finally, we will test opportunities to collaborate with universities on PhD student training, including through faculty appointments and hosting of graduate students from other universities. This will include a cohort of University of Maine students as part of the recently funded Maine eDNA project.



Empower the Economy with Our Knowledge

Bigelow Laboratory has a long history of excellence in education programs for the aquatic science community. These courses have enhanced our reputation with peer institutions and helped to advance science around the world.

There is now growing interest and opportunity to provide training in practical aspects of science and data processing for a much broader community. Over the next five years, our goal is to expand this work through skill-based certificate programs that address workforce development needs in aquaculture science (including ocean acidification and microplastic mitigation), harmful algal blooms, phytoremediation, bioinformatics, and seafood labeling and forensics. We envision partnering with other organizations to develop such programs, and we anticipate engaging internal and external instructors.

Inspire by Getting Our Science Out into the World

Bigelow Laboratory is committed to bringing ocean knowledge to the public to deepen their understanding of issues and potential solutions for ocean health and, more broadly, human and planetary health. For example, during the summer, we host an annual open house and run a weekly forum, Café Sci, which together brought 2,000 people to our campus in 2019.

Bigelow Laboratory's science is complex, varied, and nuanced, and we offer a great degree of autonomy to our scientists and staff, many of whom communicate directly



with external audiences. We have made major strides during the last few years to strengthen our messaging and present clear, compelling, unified communications that can engage and inform the public. To continue this trajectory, over the next five years, our goal is to refine the Bigelow brand and proactively assist our scientists in effective communication by investing in graphic and other visual communications that help us translate our science and connect with ever broader audiences — including videos, web features, illustrations, and animations. We will also continue to grow public awareness and understanding of our work through media coverage at the regional, national, and international levels.

In addition to getting our science out into the world, we want to bring the world to Bigelow. Over the next five years, our goal is to dramatically increase the number of people who visit our campus. Doing so will support our philanthropy, our local community and increase our impact. In addition to the education and workforce development activities in this plan, we will build a strong marine science network within Maine that has Bigelow as its nexus. We will work to partner with and empower other marine labs and nonprofits, by convening workshops, hosting symposia, and providing training opportunities.



PROMOTE ORGANIZATIONAL EXCELLENCE IN SUPPORT OF OUR MISSION

Bigelow Laboratory has grown rapidly over the last decade both in number of scientists and in the scale and sophistication of our facilities. Our research programs have grown both more complex and interdisciplinary. Additionally, the Laboratory increasingly seeks to support its research through the commercialization of its discoveries or the provision of technical services to third parties. To ensure a steady stream of new approaches that maximize our efficiency, make our research more cost effective, and transform our expertise and discoveries into solutions, Bigelow Laboratory will support its research mission through strategic investments in four key areas.



Discovery Centers

Our Discovery Centers develop and provide state-of-the-art tools that drive research, enable innovation, and serve as hubs for continued method and theory development. These platforms power the discoveries of our scientists, and those of many other researchers around the world who utilize their services.

Internally, they remove the need for individual scientists to support all of their own analytical facilities, and they allow our researchers to focus on ideas, rather than mastering a broad suite of analytical processes. These centers also educate students, scientists, industry members, and business leaders through classes, workshops, and professional short courses that power the economy. Bigelow Laboratory currently operates four of these centers:

The **Bigelow Analytical Services Center** maintains a suite of analytical equipment at Bigelow Laboratory that could not be supported by individual scientists and is an important part of the country's marine biotoxin monitoring capability. Over the next five years, our goal is to expand into analysis of freshwater (microcystins) and terrestrial (mycotoxins) toxins and to offer seafood-related trace metal analysis (e.g. arsenic/mercury/iodine).

The **Center for Aquatic Cytometry** was launched in 1983 with the world's first flow cytometer used in aquatic science. Over the next five years, our goal is to develop the next generation of aquatic flow cytometers with enhanced scatter, fluorescence, and imaging detection in order to facilitate new research and cell sorting capabilities, including the enumeration of nanoplastics.

The **National Center for Marine Algae and Microbiota (NCMA)** receives, maintains, and distributes living cultures of marine and freshwater algae, bacteria, and viruses. This National Center has been designated by the World Intellectual Property Organization as an International Depository Authority. Over the next five years, our goal is to modernize our patent holding facilities and increase revenue from patent deposits of microbes and seeds.



The **Single Cell Genomic Center (SCGC)** was pioneered by Bigelow Laboratory scientists and is the world's first and leading center for microbial single cell genomics. During the next five years, our goal is to expand use of the comprehensive suite of microbial single cell genomics services — from single cell separation through genome sequencing and bioinformatics.

In support of these four centers collectively, over the next five years our goal is to: 1) empower centers by developing a centralized model where business functions are done by accounting professionals, thus allowing center directors to focus on science, and 2) develop a unified marketing strategy to expand each Discovery Center's research capacity and increase revenue.

Financial and Administrative Operations

The efficient and effective function of the research enterprise depends on an appropriately scaled and professional administrative staff and infrastructure to provide support in both the “back office” (finance, grant administration, intellectual property, maintenance, IT, legal compliance, etc.) and “front office” (grant proposal review, advancement, communications, and commercial development).

In some areas, these functions have not matured or received the investment required to match the significant growth in size and complexity of the research enterprise. Over the next five years, Bigelow will invest in the people, facilities and IT resources to ease administrative burden on scientists and ensure that its leaders can make and implement sound business policies that increase efficiency and effectiveness.



People and Programs

We will continue to invest in our people and programs in a financially sustainable manner. We will not initiate long-term programmatic investments unless they are properly funded either through expense savings, known revenue streams (internal or external) or endowment.

The extensive list of priorities in this plan could potentially add up to a significant capital requirement. The Board and Laboratory management are committed to working with each other to prioritize the investments and match them with funding sources.

A New Research, Education and Commercialization Wing

To support the continued progress of our research, education, and commercialization activities, we will improve our infrastructure by adding a new wing. Bigelow Laboratory's building was originally envisioned with five wings; the first three opened in 2012. To accomplish the objectives of this strategic plan, we need to move forward with the construction of the next wing to address critical needs for:

Dedicated teaching labs Teaching lab space designed for 20 or more students would allow us to accomplish the expansion of our education objectives as outlined in this document. Currently, students in our high school and undergraduate programs are taught in the laboratories of our senior research scientists. This caps the students we can include in laboratory activities to less than 10, and the limited number of instruments can prevent each student from fully participating in each activity.



More common use laboratory space Our main laboratory was designed to maximize efficiency and contact between scientists. As a result, each scientist has a relatively small amount of lab space for their exclusive use. This can create challenges when scientists or students need to conduct experiments that need large amounts of lab space. The teaching labs will be designed to be multiuse so that they can support scientists' research when not in use by students.

Flexible multi-use forum The heart of the new wing will be a forum that represents an important transformation of Bigelow Laboratory from a building to a campus that will draw people from around the world. State-of-the-art education incorporates activities that require space beyond the confines of a traditional classroom. These activities include large study areas, areas suitable for group activities, role-playing, and team and leadership building. Anticipated needs for work-force development programs require lecture and activity space for 50 to 100 participants. To highlight Bigelow's scientific leadership and to bring the world's other scientific leaders to the Laboratory, Bigelow must have the ability to host scientific workshops and conferences of 100 to 200 participants. The 21st century library no longer includes books, but the need for inspiring, open, and adaptable workspaces to encourage creativity and collaboration will never change. Finally, discussions with community leaders in the surrounding region has uncovered an urgent need for conference space. If that space was at Bigelow Laboratory, it would generate revenue and bring people to our campus, which is challenging but critically important for fundraising.

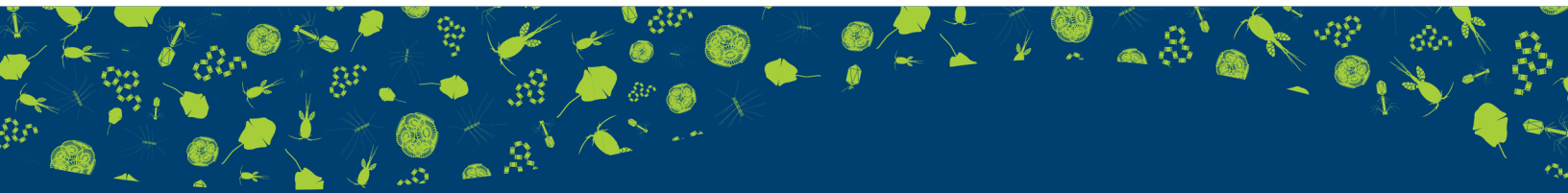
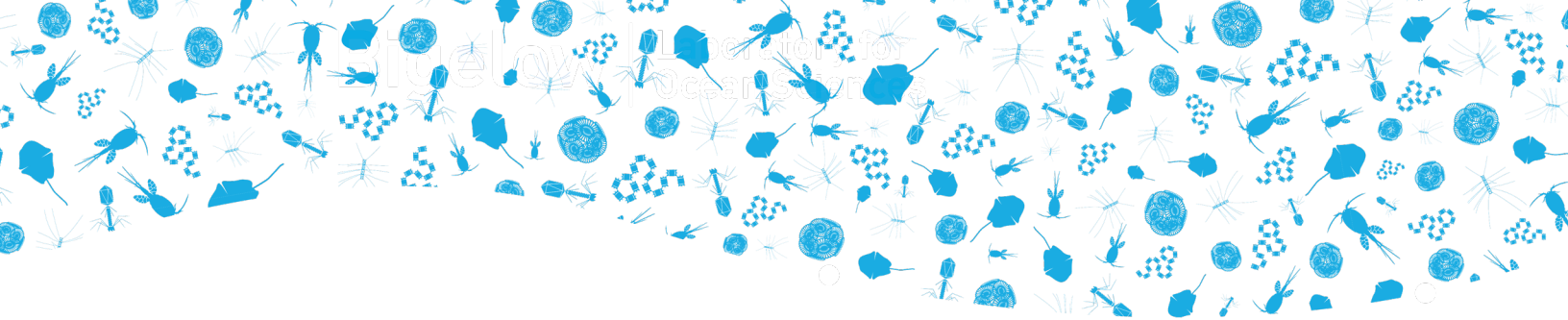
Space for commercial activities Bigelow Laboratory's main building consists of three wings, two of which cannot hold any commercial activities because of rules attached to the federal funds used to build them. To continue to grow our nascent commercialization program and support the entrepreneurial culture of the institute, Bigelow Laboratory needs additional office and laboratory space.

Space for our administrative foundation When the main laboratory building was designed, science was the sole priority. As a result, administrative and business operations are currently housed in temporary modular buildings. To fulfill our goal of being more strategic in our business operations, our staff must be fully integrated into daily operations in one building.

Our Commitment

The staff, students, trustees, and donors of Bigelow Laboratory are committed to advancing science and finding solutions. This is an ambitious plan to strengthen our work and to grow our impact at the state, national, and international level. Together, we will address the challenges facing our planet and unlock the hidden potential of our oceans.





Bigelow | Laboratory for
Ocean Sciences

60 BIGELOW DRIVE | EAST BOOTHBAY, ME 04544 USA
207 315-2567 | BIGELOW.ORG



PRINTED WITH
**CERTIFIED
WIND
POWER**