# 2021 Florida State University -Mayo Clinic Annual Report





# **ACCELERATING INNOVATION**



#### A Word of Thanks to A Founding Contributor

Dr. McRorie, as you close a remarkable chapter as Provost and Executive Vice President of Academic Affairs at Florida State University, we extend heartfelt gratitude for your vision and unwavering support for the FSU-Mayo Clinic Collaboration. Our achievements would not have been possible without you at the helm, lending thoughtful support as we turned our bold ideas into reality.

The path to our collaboration was sparked in optimism and possibility in a fortuitous meeting a few brief years ago. Through your diligent efforts and guiding hand, along with the overwhelming support from President John Thrasher at Florida State University and Dr. Kent Thielen, Chief Executive Officer at the Mayo Clinic in Jacksonville, Florida, a kernel of an idea was transformed into a Collaboration Agreement formally signed on January 1, 2020.

Only a few weeks after the signing of that agreement, the world went into lockdown with the quick spread of the SARS-CoV-2 virus as a pandemic gripped the globe. Both Mayo Clinic and FSU stepped up with significant contributions to the communities of Jacksonville, Tallahassee, and beyond. Both our institutions continue to be leaders in test development, patient care, community service, and research contributions.

Revisiting our strategic collaboration in January of 2021, we remained steadfast in our vision that together we can accomplish great things to advance health in the North Florida region. With personnel changes and ever-shifting viral caseloads, we persevered. We pivoted many of our joint initiatives for virtual participation. The unwavering vision of our leadership allowed us to continue.

We are proud of what we have accomplished together, are thankful for your constant support and encouragement, and are ever eager to see what we can continue to build together as we forge ahead.

Sincerely,

Emily Pritchard, PhD Founding Director and Faculty, Florida State University

Charles Bruce, MBChB, FCP (SA), FACC, FASE Founding Director and Chief Innovation Officer, Mayo Clinic Florida

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# I look through a half-opened door into the future, full of *interest, intriguing* beyond my power to describe... **J**

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Photo adjacent L-R (standing): Brian Zargham, associate administrator for Mayo Clinic; Nell Robinson, chair of Education Administration at Mayo Clinic; Layne Smith, director of state government relations at Mayo Clinic; Dr. Margaret Johnson, chair of the Education Committee at Mayo Clinic; Dr. Charles Bruce, professor of medicine at Mayo Clinic; Emily Pritchard, FSU researcher and director of the FSU-Mayo Collaboration. L-R (sitting): Christina Zorn, chief administrative officer at Mayo Clinic; Dr. Kent Thielen, CEO of Mayo Clinic; FSU President John Thrasher; Former FSU Provost Sally McRorie

- Dr. Will Mayo

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# Roadmap & Executive Summary

Florida State University (FSU) and Mayo Clinic Jacksonville (MCJ) are accelerating innovation. We seek to develop an interdisciplinary North Florida Innovation Corridor by focusing on the development of biotechnology and an enhanced workforce to meet the healthcare, research and development needs of the region and beyond. Cultivating an environment conducive to creating, attracting, and developing new market-driven ideas is essential for sustained economic growth. Through our collaboration, together we will train and secure the future workforce, ignite and embrace innovative ideas, play a significant role in maturing these ideas as part of an overall ecosystem of innovation, and provide faculty, staff and students opportunities to meaningfully engage in taking healthcare technology from the research space to clinical practice.

#### Simply put, we seek to bring together the best talent with the best ideas to benefit patients faster.

In the past, healthcare leaders were able to understand where things were heading and adapted as necessary. Now change comes quickly and healthcare leaders of today and into the future must anticipate and embrace that change. These accelerated changes are driven by advances in technology, availability of data, and increasing levels of consumerism. The future calls for staff who are innovative, empowered, and adaptable to change.

Multifaceted educational and research initiatives are being established to promote transformative collaboration between clinicians, researchers, and students from across FSU and Mayo Clinic. Four initial portfolios have been prioritized – Data Science, Engineering, Business and Entrepreneurship, and Professional Development of Mayo Clinic Staff. In the last year, programs in Data Science and Engineering have been successfully launched. Along with maturing these new programs we plan to launch programs in the remaining portfolios in the coming year.

Together, these initial programs will form a solid base to provide a holistic view of the innovation and commercialization process, enabling integration across programs and an integrated, interdisciplinary experience for participating faculty, staff and students.

#### **Data Science**. **Student Internships.**

29 Student applicants

events

42

6

Student

selected

6

#### **Nexus Event Series.**

3

FSU-Mayo Clinic Colleges Mingling of the Minds engaged

### **Engineering. Convergence Science Senior Design Projects.**

Mavo Clinic projects submitted

Projects selected

3

**Entrepreneurship.** 

New academic certificate launched

**2021 Annual Report** 

Scholarships allocated

18+





FSU faculty and graduate students

Mayo faculty

79



Undergraduate students engaged Mayo faculty engaged

5 FSU teaching faculty engaged





### **Data Science.**

Focus: We seek to develop targeted programming to provide students and faculty with collaborative opportunities while contributing to a robust pathway for Mayo Clinic to identify and acquire necessary talent in this space.

The Data Science vertical seeks to generate and advance innovative ideas by creating intentional "collisions" of clinicians, researchers, and students from within the FSU College of Arts and Sciences (including Departments of Scientific Computing, Statistics, Mathematics, and Computer Science) and Mayo Clinic while providing forums and resources to advance those ideas. Over the past year, two programs have been successfully launched: Biostatistics and Data Science Internship Program and the Nexus Series.

#### **Data Science Internship Program** Focus: Increase student engagement with clinicians

#### **29** Student applicants

6 Student selected

Designed as an individual internship (Masters or PhD level students) today, this program provides students valuable hands-on biostatistics, machine learning and artificial intelligence (AI) experience in a real-world healthcare setting. In partnership with data scientists at Mayo Clinic, students perform detailed analysis of large bodies of heterogeneous data in order to discover new patterns and insights having an impact on patient health and augmenting human capabilities. Students participate in tool selection, discovery, interpretation, and analysis of defined, active projects, gain a greater understanding of the challenges of working with structured and unstructured data, and define approaches to resolve. The internship is structured to provide a collaborative educational environment, with interaction across multiple disciplines at Mayo Clinic, working on a range of projects that span traditional uses of computer vision to novel approaches re-envisioning routine clinical data to bring a richer understanding of the relationships hidden within existing records.

Critical to the success of this program is the Mayo Clinic in Florida **Digital Innovation Lab**, a shared resource on the Florida campus to promote and support advances in machine learning and AI. The Lab works across specialties empowering discovery and collaboration to create new insights or ideas to improve patient care using novel AI applications and is an early adopter of Google Cloud Computing and Mayo's "AI Factory" computing platform. At the end of the semester-long internship, students showcase their work at the "Tea Time for Data Science" forum hosted by the Florida Digital Innovation Lab.

#### **Future Direction:**

While ensuring on-going success of the individual internship program, we are actively exploring options to implement a complementary student cohort model to provide students deeper engagement with Mayo Clinic clinicians and more direct involvement across the full lifecycle of an AI/ML project. Growth in these programs must be balanced with the level of expertise required for each project and paced with investments to ensure capacity of a strong mentor network.

**4** Mayo faculty engaged 6

Projects solving real-world problems

#### **Student Project Highlights**

#### **Bowel Preparation Score Prediction**

Refine an approach that allows for segmentation of high dimensional data.

**Student:** Mingyuan Wang, Ph.D. Candidate, Statistics **Mayo Mentor:** Rickey Carter, Ph.D.

#### **Detection of Pulmonary Hypertension**

Develop a computer vision model to predict which patients have pulmonary hypertension using a non-invasive echocardiogram.

**Student:** Abdullah Aurko, Ph.D. Candidate, Applied and Computational Mathematics **Mayo Mentor:** Rickey Carter, Ph.D.

#### **Total Knee Arthroplasty AI Project**

Develop an automated tool to measure body composition based on the distribution of soft tissue observed through CT scan.

**Student:** David Foster, M.S. Candidate, Statistical Data Science **Mayo Mentor:** Alex Weston, Ph.D.

#### **Pulmonary Function Testing**

Predicting lung age from pulmonary function testing using Machine Learning.

**Student:** Zhiyuan Yu, Ph.D. Candidate, Statistics **Mayo Mentor:** Alex Weston, Ph.D.

#### **Aortic Regurgitation**

Machine Learning Predicts Mortality in Patients with Severe Aortic Regurgitation.

**Student:** Hanwen Hu, Ph.D. Candidate, Statistics **Mayo Mentor:** Alex Weston, Ph.D.

#### **Sex Disparities and Regional Differences in COVID**

**Student:** Benjamin Russionello, M.S. Candidate, Statistics **Mayo Mentor:** Alex Weston, Ph.D.



This internship has inspired me to pursue a career as a data scientist. I feel more motivated because I now have a clear vision about what I can achieve in this role. This was a very valuable chance to witness the applications of machine learning and deep learning in modern medical diagnostics.

- Hanwen Hu



Launched in September 2021, the Nexus Series is a foundational element in establishing our collaboration as a driving force for biotechnology development within the North Florida Innovation Corridor, benefiting the cities of Tallahassee and Jacksonville, the surrounding region, and beyond. Several over-arching goals for the program have been defined:

- 1. Develop faculty-to-faculty level relation complementary expertise,
- 2. Identify joint work in applied science solving healthcare related problems,
- 3. Secure external funding to accelerate advancement, and
- 4. Develop the talent required for future success.



1. Develop faculty-to-faculty level relationships to identify areas of common interest and

olving healthcare related problems, dvancement, and uccess.



The series consists of four primary components:

#### **1. Mingling of the Minds**

Educate each other on capabilities, interests, and key priorities; sparking identification of common areas of interest for further exploration. These sessions launched September 15, 2021.

#### 2. Joint Workshops

Nurture deeper understanding of faculty engagement in selected topics, including determining whether to pursue joint project(s)

#### **3. Joint Project Selection and Funding**

Competitive process, gathering proposals from collaborating faculty, assessing ideas and awarding seed funding

#### 4. Showcase

Share results of our collaboration, establishing our collaboration as leading in biotechnology and workforce development

In 2022, we expect to fund the inaugural round of Nexus Series sponsored projects. To achieve that milestone, our efforts will focus on launching two additional components with the Series: Workshops and Funding Program.

**Nexus Series - Workshops:** FSU and Mayo staff who have identified areas of mutual interest through the on-going Mingling of the Minds sessions will be offered the opportunity to collaborate in a focused workshop tailored to their needs. Currently under development, these workshops are intended to be smaller "hands-on" joint events to dive deeper into their identified topic, confirm alignment of capabilities, and determine whether to further pursue collectively. Upon agreement to pursue, teams would have the option to submit a proposal for seed funding to advance their idea.

**Nexus Series - Seed Funding Program:** The funding program will be competitive and intended to advance supporting capabilities to drive thematic priorities and accelerate efforts using applied science to solve targeted clinical problems.

With Mingling of the Minds, Workshops and Funding Program components all launched, the seeds will have been planted laying the groundwork to support establishing our collaboration externally as a leader in biotechnology and workforce development in North Florida, the State of Florida, the Southeast region and beyond.

#### Mingling of the Minds: Highlights

**September 15, 2021:** Mingling of the Minds: Data Science Nexus Series Kickoff: Mayo Clinic Perspectives and Q&A included Dr. Charles Bruce, Chief Innovation Officer, Dr. Rickey Carter, Professor of Biostatistics and Chair of the Department of Quantitative Health Sciences Research in Florida, Drs. AJ Forte and Chris McLeod who lead the High-Definition Phenotype Lab, and Dr. Alex Weston, Senior Data Science Analyst in Quantitative Health Sciences.

**September 29, 2021:** Mingling of the Minds: Data Science Nexus Series Kickoff: FSU Perspectives included FSU's new Dean of the College of Nursing, Dr. Jing Wang, Dr. Gordon Erlebacher, Chair of Scientific Computing, and Dr. Monica Hurdal, Associate Chair, Mathematics and lead in the biomathematics program.

**October 8, 2021:** Mingling of the Minds: Individualized Medicine: Roundtable discussion with Dr. Sanjay Bagaria, Mayo Clinic Professor of Surgery, Director for the Center for Individualized Medicine, and Chair of the Center of Digital Health for Mayo Clinic Jacksonville.

#### **Convergence Science Program** Focus: Introduce students to real-world clinical problems with clinicians





During the two-semester long program, students have the opportunity for several site-visits to Mayo Clinic Florida for face-to-face time with their mentors. They also can observe clinical activity and surgical procedures relevant to their project, interview staff, and complete simulation testing in the Mayo Clinic Florida Simulation Center. Prototyping activities are performed in engineering labs with the FAMU-FSU College of Engineering in Tallahassee, Florida. At the end of the program, students showcase their work at the "Convergence Science Final Presentation" forum hosted by the Mayo Clinic Florida Innovation team and at the FAMU-FSU College of Engineering Design Day.

Through this program, students obtain valuable hands-on experience partnering with Mayo innovators to design practical solutions for patients and Mayo innovators benefit by strengthening their business case to secure funding for continued development.

### **Engineering.**

### Focus: We seek to create novel solutions to real healthcare problems.

The Engineering vertical seeks to cultivate an environment conducive to creating, attracting, and developing new market-driven ideas essential for sustained economic growth. We are connecting clinical expertise at Mayo Clinic in Florida with existing and emerging engineering expertise at the FAMU-FSU College of Engineering. All engineering disciplines are in-scope in our collaboration and include chemical and biomedical, civil and environmental, electrical and computer, industrial and manufacturing, and mechanical engineering. Over the past year, FAMU-FSU College of Engineering students have been integrated into Mayo Clinic in Florida's Convergence Science Program. 14 Students



FSU Faculty Leads



Officially launched in August 2021, cohorts of FAMU-FSU senior undergraduate engineering students in their capstone course are paired with clinical and nonclinical mentors (innovators) from Mayo Clinic to advance ideas addressing unmet needs and gaps that have the potential to transform the practice of medicine. Framed as design challenges, the goal is to advance selected concepts to a prototype stage. Students identify critical product features, create initial prototypes, perform product testing, define the market need at a high level, estimate the market potential, and suggest next steps in development based on the results of their work.

#### Engineering

#### Future Direction:

The interdisciplinary North Florida Innovation Corridor envisioned through this collaboration will only be successful if it contributes to sustained economic growth. The Convergence Science Program is intended to create an environment to effectively teach the healthcare workforce of the future in an interdisciplinary way and share ideas with existing staff and faculty across our organizations. These are the foundational seeds to the creation of this Corridor. Long-term success will only come if graduating students have an attractive and supporting environment in which to thrive and if talent is attracted to the area.

Our next phase seeks to support students who have shown an entrepreneurial spirit and talent with an interest in establishing a start-up company. This program provides funding to those who meet the following criteria; (1) have worked on a project at Mayo Clinic through the FSU-Mayo Clinic Collaboration, (2) the project resulted in a successful proof-of-concept and fills a significant market need, (3) the student is interested in pursuing as a start-up business. The funds would support the student for a defined period to pursue robust prototype development and attract investor funding to get to market.



#### **Student Project Highlights**

#### Tracheobronchial Pepsin, Bile, and pH Monitoring Stent

Mayo Innovators: David Abia-Trujillo, M.D., M.B., Sebastian Fernandez-Bussy, M.D. FAMU-FSU Students: Rachel Dale, Jacob Boykin, Justice Ene, Julia Hartzog, Casey Cargill FAMU-FSU Faculty Lead: Stephen Arce, Ph.D. *Biomedical Engineering* 

#### **Improving Oscillatory Ventilation**

Mayo Innovators: Michelle Freeman, M.D., Kevin Riutort, M.D., M.S., Klaus Torp, M.D. FAMU-FSU Students: Stefano Cassino Musmanni, Drake Faris, Ryan Harris, Alani Person, Willy Santoyo

FAMU-FSU Faculty Lead: Shayne McConomy, Ph.D. Mechanical Engineering

#### Light Hoop - Laser-Based Imaging of Upper Extremity

Mayo Innovators: Antonio Forte, M.D., Ph.D. FAMU-FSU Students: Peter Christian, Benjamin Marmoll, Alexandra Puckett, Madeline Schuh FAMU-FSU Faculty Lead: Oscar Chuy, Ph.D. *Electrical and Computer Engineering* 

#### Future Direction:

Our priority is to together build and grow integrated, collaborative, and interdisciplinary programs enabling students to tackle real world problems in the healthcare industry. Overall, the Innovation and Entrepreneurship pillar will connect the individual programs within this and other pillars, providing a holistic view of the innovation and commercialization process. As an example, an FSU Entrepreneurship cohort may work on a Mayo Clinic project previously completed by or in tandem with an FSU Engineering cohort. Rather than primarily focusing on prototyping, the Entrepreneurship cohort may focus on detailed usability, feasibility, and refined market potential ultimately delivering a business pitch to secure funding for further development. Going even further, opportunities to leverage expertise and opportunities within the Jim Moran School of Entrepreneurship will be explored. Only as approaching as a union of forces will be meet our goals of educating and training the workforce of the future while also accelerating delivery of novel solutions to benefit patients everywhere.

A collaborative framework for our work is under development at a student, professional learner, and faculty level. Our Master Collaboration Agreement established that FSU will lead development of curriculum and enrollment in jointly developed academic Education Programs. Concurrently, opportunities to leverage collaboration with the growing Mayo Clinic Innovation Exchange are being actively explored.

# Innovation & Entrepreneurship.

#### Focus: Foster scientific advances and generate intellectual property; Launch medical technology products and companies

Innovation and entrepreneurial pathways are essential for success in both institutions. Launching the Entrepreneurship vertical is a focus for 2022. The vision for initial programming is to expose students to the administrative processes and work associated with innovation. Projects are expected to encompass one or more of the following phases for specific, individual projects and/or for campus-wide innovation related initiatives.

- Collecting insights
- Generating and screening ideas
- Converting ideas to innovation
- Executing on providing unique solutions to end users.



Innovation & Entrepreneurship

#### Biomedical Entrepreneurship Academic Certificate.

Bringing the expertise of FSU's College of Medicine (COM) and the Jim Moran College of Entrepreneurship (JMCE), FSU has developed a new interdisciplinary certificate program designed to meet the unique needs of biomedical innovation and entrepreneurship. All coursework will be piloted and delivered online, except for internships which may be remote or in-person. Mayo Clinic may contribute in various ways, including via guest lectures in areas of expertise and in clinically relevant internships offerings. This certificate program is expected to launch January 2022. Programs launched to date signify the first tangible step toward the creation of an interdisciplinary North Florida Innovation Corridor and directly supports efforts to develop an enhanced workforce to meet the healthcare, research, and development needs of the region and beyond.

## Long-Term Vision.

As initial programs mature and gain momentum, the Corridor seeks to play a significant role as part of an overall ecosystem supporting continuous innovation. Programs launched this year are intended to create an environment to effectively teach the healthcare workforce of the future in an inter-disciplinary way and share ideas with existing staff and faculty across our organizations.

Long-term success will only come if graduating students have an attractive and supporting environment in which to thrive and if talent is attracted to the area and contributes to economic growth.

# ... if we excel in anything, it is in our capacity for translating idealism into action.

- Dr. Charles H. Mayo



strategiccollaboration.fsu.edu