

**Overview**

The College of Sciences is home to people and programs in the biological, mathematical and physical sciences at NC State. The eight-year-old college continues to be one of the largest and most research-intensive units at the university, with more than 4,000 students, 370 active research projects and \$39 million in annual research expenditures. The college seeks to advance science through groundbreaking research, creative teaching, quality mentoring, strong collaborative partnerships and high-impact public engagement.

The college's vision is to be the world's most trusted, innovative and inclusive scientific community. This annual report reflects the priorities laid out in NC State's strategic plan and supported by the college's leadership.

**Responsiveness to Universitywide Strategic Goals****1. Enhance the success of our students through educational innovation**

The rapid shift to online instruction necessitated by the onset COVID-19 pandemic in Spring 2020 brought about a number of innovations that continued into the last academic year. These included instructional changes and new curriculum developments. Some of these activities will continue as the college returns to in-person instruction, and some will be incorporated into our distance education classes.

Examples include work in the Department of Physics, where faculty redesigned the structure of online courses in a modular format designed to help students analyze and solve problems by thinking holistically about underlying concepts and principles and to build online learning communities to help distance students connect. The work was aided by a grant from NC State's Digital Education and Learning Technology Applications (DELTA) unit. In the Department of Chemistry, Maria Gallardo-Williams continued to earn national attention for her virtual reality organic chemistry labs that were developed in collaboration with DELTA.

To capitalize on increased interest in paleobiology and the college's historical strengths in this area, a new minor in paleobiology was developed that integrates cross-departmental courses

from the Departments of Biological Sciences and Marine, Earth, and Atmospheric Sciences. The minor launched in Spring 2021.

## **2. Enhance scholarship and research by investing in faculty and infrastructure**

Growing our faculty is a top priority. To that end, 15 new tenured, tenure-track and professional faculty arrived on campus in 2020-21, and 13 more plan to start in 2021-22.

Planning began in earnest for the \$160 million Integrative Sciences Building that will rise on the former Harrelson Hall site on North Campus. The building will be a unifying force for faculty and students in chemistry, biochemistry, biotechnology and engineering, and it will also be home to the burgeoning Chemistry of Life training and research program. Construction is scheduled to begin in 2023, with the opening slated for 2026. This building will be managed by the university, but College of Sciences faculty and staff will be the primary occupants.

The renovation of the Bureau of Mines building, also on North Campus, has created modern workspaces for dozens of Sciences employees and new work and study spaces for students. The building is home to many of the college's administrative offices.

## **3. Enhance interdisciplinary scholarship to address the grand challenges of society**

The college continues to be a leader in the Chancellor's Faculty Excellence Program cluster hiring initiative. As of Summer 2021, Sciences is home to 14 of these cluster hires, the second-most of any college at NC State.

The interdisciplinary Chemistry of Life training and research program continued to develop. In its first year, Chemistry of Life developed research programs and secured a Beckman Scholars Program undergraduate research training grant and a National Institutes of Health T32 training grant. A minor and several courses are also under development.

For undergraduate students, the National Science Foundation funded a three-year joint Research Experience for Undergraduates in the Departments of Mathematics and Statistics. The program engages students in interdisciplinary research projects during the summer and fall. The projects' applications include COVID-19 disease modeling and machine learning.

#### **4. Enhance organizational excellence by creating a culture of constant improvement**

College leadership continued work that began in 2018 to develop a new budget model based on data and cost drivers. Several models have already been implemented, with operating and capital budgeting components remaining to be addressed. Once fully implemented, the model will ensure that resource allocation is data-driven, fair and equitable.

Other administrative improvements include the development of a robust position control system, an integral component to budget management since personnel costs represent a large percentage of a budget. Staff have also developed a budget development and spending plan system to control expenditures and minimize fiscal risk.

#### **5. Enhance local and global engagement through focused strategic partnerships**

The Graduate Industrial Traineeship Program in the Department of Statistics is a key connection to industrial partners, including SAS, United Therapeutics and the Effective Altruism Foundation. Trainees assist industry partners with research, consulting and training programs.

The State Climate Office, along with local and regional partners, was awarded a project by the National Oceanic and Atmospheric Administration to map urban heat islands in Raleigh and Durham using community science volunteers. The group is using the lead-up to the volunteer mapping campaign to educate North Carolinians on the dangers of extreme heat and how these risks are changing in a warming world.

### **Progress in 2020-21**

#### **1. Changes in service environment**

College operations continued to be significantly impacted by the coronavirus pandemic that began in North Carolina during the Spring 2020 semester. All classes were moved online, faculty and staff began working remotely, and research operations were greatly reduced. For administrative functions, service levels working remotely have remained equal to or exceeded service levels working in person due to increased use of technology.

As caseloads declined during the Spring 2021 semester, activity on campus picked up, though many classes were still taught remotely and the on-campus student population remained

relatively small as many faculty and students chose to teach and learn from home. Given current projections, NC State and the college are planning for a normal Fall 2021 semester.

## **2. Initiatives**

The college is working with Tidal Equality, a consulting firm that focuses on diversity, equity and inclusion, on crafting its strategic plan. During 2020-21, the process included virtual listening and learning sessions with faculty, staff and students and individual micro-sessions that focused on vision, strategic priorities and behavioral aspirations. The college hopes to finish the process and launch the plan during the coming academic year.

Planning began for the college's inaugural Research Symposium, which will be held in November 2021. The event will include oral presentations by trainees from each academic department, poster presentations, lunch and learn activities, alumni meet and greets, and graduate student recruitment activities aimed at advancing diversity, equity and inclusion.

The college's annual State of the Sciences event took place virtually in March 2021. The speaker was Todd Siler, author of the book *Think Like a Genius*. The event was sponsored by alumnus Joe Bridger and had nearly 300 registrants.

## **3. Diversity and Inclusion**

The college made significant strides in 2020-21 toward boosting diversity, equity and inclusion (DEI) by combining strong existing programs with bold new efforts to create a welcoming environment for all. In the wake of several police-involved killings of Black men and women in 2020, the college held a listening session so faculty and staff of color could share their concerns. And in July 2020, the college held a virtual town hall on race, diversity and equity that was attended by more than 170 faculty and staff.

Since last summer, the college's Leadership Team has engaged in regular discussions around DEI issues and participated in training on the topic. This work is continuing in the college's new Committee on Diversity, Equity and Inclusion — which will receive ongoing funding from the Dean's Office — as well as DEI committees in each of the six academic departments. The college also added a prominent DEI section to its website.

For students, the college has been developing strategies to include more DEI content in first-year courses, including reviewing syllabi and supporting inclusive teaching opportunities. Key to student support efforts is the College of Sciences Diversity Program Endowment, which helps fund diversity and inclusion programs and services including recruitment events for underrepresented students, career panels, student club activities and professional development and leadership workshops. The fund has raised around \$85,000 since it launched in early 2020.

The college held its annual Diversity in STEM event virtually in February 2021 thanks to an ongoing commitment from event sponsor BASF. The event was attended by more than 130 alumni, students, faculty, staff and BASF employees. The keynote speaker was alumna Andrea Duhon, an assistant professor of mathematics at Marshall University. BASF also hosted a student networking mixer with 45 attendees prior to the event.

Sciences staff continue to lead NC State's Women in Science and Engineering program, which brings together first- and second-year female students and upper-class mentors in Lee Hall. The program has grown from 56 students in 2003 to about 360 students in 2021. WISE offered a total of 205 in-person and virtual programs during the year.

#### **4. Instructional program advances**

Recognizing that transfer students will be the main source for enrollment increases at the university, the college developed a course for new transfer students designed to facilitate career readiness and a successful transition into the college and university communities. The course was first offered online during Fall 2020 and will be offered in person in Fall 2021.

The Department of Biological Sciences is beginning the process of evaluating its curriculum on several levels, including reviewing prerequisites to determine whether they are appropriate and reviewing learning outcomes for programs and how required courses are addressing these outcomes. This will be a longer-term project with the goal of ensuring that programs and courses are aligned with respect to learning outcomes and that there aren't unnecessary obstacles to students fulfilling programmatic or personal interests and goals.

The Climate Change and Society master's program and Climate Adaptation Certificate continued evolving. The master's program recorded its highest-ever enrollment in 2020-21 and applications for the coming year look strong. The program will have a fully online version in future years.

In the Department of Mathematics, a group of faculty is developing a data science minor and concentration for the applied mathematics program. The work will involve revising some courses and creating others. This project is in early stages of development.

College programs continue to rank highly among their peers. They include the statistics program, which ranked 24th in the world and second-highest among all NC State programs in the 2021 Shanghai Global Ranking of Academic Subjects.

## **5. Research**

Between July 1, 2020, and June 30, 2021, Sciences faculty submitted more than \$283 million in proposed projects and received 373 awards totaling \$39 million in funded projects. Proposal submissions were up 28 percent compared to the same period last year, due in large part to a substantial increase in submissions to the National Institutes of Health (NIH). Some research highlights from our academic departments and units:

Biological Sciences: Jun Ninomiya-Tsuji received a five-year, \$1.8 million grant from NIH to investigate how certain signaling pathways contribute to inflammatory diseases. The grant was made as part of the Maximizing Investigators' Research Award (MIRA) program.

Chemistry: A multi-university partnership that included Phil Castellano, Elena Jakubikova and Paul Maggard was awarded \$40 million over five years from the U.S. Department of Energy to support the Center for Hybrid Approaches in Solar Energy to Liquid Fuels. \$3.3 million is coming to NC State.

MEAS: Ruoying He was among a group of scientists awarded a National Science Foundation grant for a new research institute on artificial intelligence and environmental prediction. NC State will receive \$2.5 million.

Mathematics: Alun Lloyd co-authored a study that found bidirectional contact tracing is twice as effective as forward tracing, the contact tracing method currently in use. Contact tracing is an important component of mitigating the spread of infections like COVID-19.

Physics: Mary Elting received a five-year, \$1.8 million grant from NIH to investigate a tiny cellular machine that plays a key role in cell division and disease. The grant was made as part of the MIRA program.

Statistics: Research from Marie Davidian and Anastasios Tsiatis proposed a framework for statistical inference on the durability of vaccine efficacy for the COVID-19 vaccine trials.

State Climate Office: Director Kathie Dello, in conjunction with researchers at the North Carolina Institute for Climate Studies and the College of Natural Resources, will be the new lead for the National Oceanic and Atmospheric Administration's Carolinas Regional Integrated Sciences and Assessments (RISA) program, a 5-year, \$5.4 million dollar grant to help communities build climate resilience.

## **6. Extension**

The college enhanced outreach efforts to continue programming during the pandemic. The Science House, which marked its 30th year of serving students and teachers across the state, created The Science House Express, a weekly virtual learning program that covers a wide variety of STEM subjects for K-12 students. The Science House also received two grants totaling \$4 million that focused on rural schools and supporting students with autism.

Among the Science House's programs is Imhotep Academy, a year-round middle school enrichment program that introduces students to STEM with a particular emphasis on reaching underserved and historically underrepresented students. The program delivered more than 60 hours of integrated STEM virtual programming to 101 middle school students representing 14 rural and urban North Carolina counties and school districts.

The N.C. Science Olympiad, which is part of the Science House, transformed its middle and high school tournaments to suit a virtual world. Instead of hosting tournaments across the state, staff consolidated tournaments by region to provide three large tournaments. The program also

pivoted its elementary tournaments to online programming to support remote learning for students at home. In addition, the Olympiad distributed 2,100 virtual reality headsets to almost every county in the state. The headsets were a \$1 million donation from Lenovo originally to be given out at the 2020 National Science Olympiad Tournament, which was canceled due to COVID-19.

Faculty throughout the college continue to reach out beyond their fields to communicate their work. One noteworthy example is physicist Katie Mack, who published a popular science book, *The End of Everything, Astrophysically Speaking*, that was among *The New York Times'* 100 Notable Books of 2020.

## **7. Faculty**

Faculty in the college received many prestigious awards this year. Four faculty members were recognized at the 2020 Celebration of Faculty Excellence, an annual event that honors faculty who won prestigious state, national and international awards. In addition, several faculty were honored with prominent university teaching, research and extension awards; two were named University Faculty Scholars; and four were named Goodnight Early Career Innovators. Among our faculty award highlights:

Biological Sciences: Carlos Goller, NC State Libraries Faculty Award

Chemistry: Phil Castellano, AAAS Fellow; Caroline Proulx, NSF CAREER Award; Brian Space, AAAS Fellow

MEAS: David McConnell, National Association of Geoscience Teachers Transformation Award; Lewis Owen, AAAS Fellow

Mathematics: Mohammad Farazmand, Lloyd Hamilton Donnell Applied Mechanics Reviews Paper Award, *Applied Mechanics Reviews*

Physics: Harald Ade, Highly Cited Researcher, Web of Science Group

Statistics: Marie Davidian, Marvin Zelen Leadership Award in Statistical Science, Harvard T.H. Chan School of Public Health; David Dickey, 2020 Citation Laureate, Clarivate Web of Science; Rui Song, Institute of Mathematical Sciences Fellow; Anastasios Tsiatis, appointed to the Data and Safety Monitoring Board for COVID-19 vaccine clinical trials



## **8. Students**

The college's total student population in Fall 2020 was 4,095, including 3,085 undergraduates and 1,010 graduate students. The first-year class had a weighted high school grade point average of 4.32 and an average SAT score of 1,317. Fifty-one percent of the freshmen were in the top 10 percent of their high school classes.

Two students, physics and computer science major Ana Sofia Uzsoy and genetics and computer science major Nikhil Milind, were named NC State's third-and-fourth-ever Churchill Scholars and will study at Cambridge University in Fall 2021. Noah Wolfe, a senior in physics and mathematics, was named to the 2021-22 class of Astronaut Scholars. Physics major Jack Featherstone won a Goldwater Scholarship.

Two students, Sasha Pereira in Biological Sciences and Loulou Batta in Chemistry, won Mathews Medals. The award, named for Walter J. Mathews, NC State's first student, honors graduating seniors who are leaving the university a better place because of their leadership.

## **9. Fundraising**

The college logged another strong fundraising year. Gifts and new commitments totaled \$5.8 million, which put the college about \$7 million above its \$60 million Think and Do the Extraordinary campaign goal. The campaign ends on Dec. 31, 2021.

Highlights included \$3.3 million raised during the September 2020 and March 2021 Day of Giving events. The college also received a \$1.5 million planned gift to endow undergraduate scholarships in the Department of Biological Sciences.

The college named Alina Chertock, head of the Department of Mathematics, as the LeRoy B. Martin, Jr. Distinguished Professor. The professorship was created by NC State alumnus Jim Goodnight and his wife, Ann, to honor Martin, a longtime mathematics professor at the university and a Distinguished Alumnus of what is now the College of Sciences.

## **10. Administration**

There were some changes to the college's Leadership Team during the past year. Ed Bowden, head of the Department of Chemistry, retired, and Gavin Williams was named interim

head. Brock Matthews, assistant dean for advancement, left the university and a search is under way for his permanent replacement.

The Instrument Shop, a full-service machine shop specializing in the fabrication, construction and design of research equipment. was transitioned from the college to the Department of Physics.

## **11. Recommendations and concerns for the future**

To capitalize on existing strengths, the university should consider an Academy of Environment and Climate to help foster and further this area. Creating the academy would help address infrastructure challenges, build faculty, enhance training opportunities, foster collaboration and elevate the prominence of our already strong research and community engagement in the area of environmental and climate health.

The college continues to be constrained by its aging infrastructure as well as limited space for offices and laboratories. The planned Integrative Sciences Building will help alleviate these problems, but the space-related challenges will remain significant. Notably, the college is critically low on animal space as well as space in the Toxicology Building for already-funded projects. Chemistry also continues to suffer from outdated infrastructure.

Another pressing issue facing many college units are low levels of faculty and staff. Small faculty cohorts weaken our reputation and rankings in many areas and hold back student recruiting efforts. Faculty departures are one reason why the once prominent Keck Center for Behavioral Biology was disestablished and other programs are similarly at risk of folding. Information technology is particularly understaffed, which puts a disproportionate administrative burden on faculty. Adding more faculty and staff is among the college's highest priorities, pending the availability of resources and space, but low compensation and competition from the private sector make this challenging.

Graduate student stipends across the college continue to be low relative to our peers and hinder recruiting efforts. This problem is exacerbated by student fees that are high when compared to those at competing institutions.