### School of Natural Sciences Ten-year Strategic Plan: Phase II September 27, 2020

### Background

During its first seventeen years, the UC Merced School of Natural Sciences (SNS) has overcome myriad challenges to achieve many accomplishments. Many of our founding faculty hired as new assistant professors have been promoted to full professor based on the strong research programs they have built. These faculty have published in top tier journals and have been awarded both individual and large center grants. SNS undergraduate alumni have gone on to top graduate schools or professional schools, and many are having impacts in our community as teachers, medical professionals, or in other STEM careers. Our doctoral and post-doctoral alumni are in tenure-track faculty positions across the nation or STEM jobs at government laboratories such as Lawrence Livermore National Laboratory and top companies including Google and IBM.

These successes have occurred in an environment of constant change. Starting with just a handful of faculty hired in summer 2003, SNS has grown to 120 ladder-rank faculty and numerous scientific staff, teaching faculty, and continuing lecturers. From a couple of graduate students in provisional "independent graduate programs" in 2004, SNS's four CCGA-approved graduate groups now have more than 250 students (exclusive of students supervised by SNS faculty in non-SNS-managed graduate groups). Similarly, students in SNS undergraduate majors have grown from a few hundred in 2005 to more than 2000 in fall 2020, with SNS also teaching thousands of SOE and SSHA students in service classes every year. In addition to this dramatic growth, SNS has evolved from a single academic unit, to "Bylaw 55" units responsible for academic personnel cases, and finally to full departments with broad responsibilities for their administration and planning.

### Introduction to 2020 SNS Plan

This history of success gives us confidence that we will achieve the new goals and milestones over the next decade that will take the SNS departments to full strength and on par with many programs at top-tier universities. While there are significant challenges, there are also many new opportunities including new laboratories and computational spaces in the Project 2020 buildings, emerging "centers of excellence" in several research areas, and strong regional support for new programs in areas like medical training and STEM K-12 education.

Over the next decade, SNS aims to achieve a number of goals that have been established by both UC Merced's senior management as well as the school's Dean and faculty leaders. These cover a range of areas, including: significant growth in our undergraduate programs; expanding the size and extramural funding base for our graduate programs; increasing diversity and inclusion in our research and academic programs; raising national and international recognition of our faculty; increasing research funding; improving retention and post-graduate success of our undergraduate and graduate students; and building strong synergistic links to our community.

We aim to achieve these milestones during a time of meager budgets and a decreasing number of high school graduates, as well as the economic downturn from the pandemic which will likely affect the ability of potential students to attend UC. Therefore, to reach these milestones in the face of challenges, they must be organized into visionary **strategic initiatives** that motivate the energies and creativity of our faculty and staff. In this plan we describe nine strategic initiatives that together will allow SNS to achieve the goals and milestones set out by both SNS and campus senior management. The specific mapping between our strategic initiatives and these underlying goals is given in the attached spreadsheet and diagrammed in the accompanying figure. These strategic initiatives have been discussed and vetted with the SNS faculty leadership who confirmed that these would elicit significant faculty interest and that they personally would be willing to lead these initiatives.

#### **SNS Mission and Vision Statements**

In addition to the strategic initiatives, the SNS faculty leadership has written mission and vision statements describing their near- and long-term aspirations for the school.

**Mission**: Through innovative, multidisciplinary approaches we advance the frontiers of science and educate the workforce of the future while embracing diversity, equity, inclusion, and justice.

**Vision**: Be a world-class institution that provides exceptional and equitable STEM education and establishes the Central Valley as a hub for integrative, transformative, and translational research and sustainable development.

### **Strategic Initiatives**

The Faculty and Staff leadership within the School of Natural Sciences developed nine Strategic Initiatives that articulate the intersections of many individual goals and reinforce the characteristics embedded in our mission and vision statements. The process of working through these initiatives as a community will improve our performance metrics and, of equal importance, further solidify the identity of the School and its individual departments and programs. This and future iterations of the "strategy-action" cycle will enhance the reputation of the School and campus at local and global scales.

Our vision of the role of these strategic initiatives is illustrated in the attached figure, which illustrates how these endeavors will provide the foundation for our goals for the next decade. At the highest level, the goals of faculty and student success, and program growth, are the basis for SNS's mission and vision. These top-level goals are themselves comprised of more focused Goals and Milestones, such as increasing the number of faculty grants and publications and recruiting more students (see attached spreadsheet). Supporting those goals and milestones are our strategic initiatives. Each initiative constitutes a framework for multiple outcomes. For example, the initiative to create research centers is meant to result in a succession of new

institutes (potentially of different scales) over the next 5-10 years. Each initiative will be led by task forces composed of faculty and staff in consultation with the Dean. As specific plans are developed within each initiative, they will be reviewed by SNS and prioritized for administrative assistance, internal resources, and fund-raising. Many of the initiatives will require dedicated leadership by individual or a small team of faculty, so ideas for appropriate incentives for these leaders will need to be developed as part of the plan.

Although described separately in the section below, the SNS Strategic Initiatives are interdependent and elements of each will be performed in parallel (see attached spreadsheet). For example, increasing high-impact publications and fostering success in extramural funding will lead to improved graduate programs and aid in the establishment of research Centers and Institutes. Likewise, the process of establishing "signature skill sets" for our students will inform the development of new majors, tracks, minors, and MS programs and can be coupled with modernizing existing curriculum and pedagogical methods. The success and well-being of staff and fundraising support both the research and teaching missions. The principles of diversity equity, inclusion, and justice act as a common thread that binds all of the initiatives.

### **1.** Comprehensively interweave concepts and practices of diversity and justice into all academic and personnel functions.

The location of our campus, the times in which we live, and the generation of students we are educating have given UC Merced a special mission to embrace diversity, equity, inclusion, and justice into our research and academic programs. We embrace that mission because it is just; it also improves the quality of science by broadening the pool of talent and perspectives, and brings recognition and distinction to our campus. To fully achieve our vision of providing exceptional and equitable STEM education, we must acknowledge, identify, and take action to eradicate bias and structural discrimination within the academy. In doing so, UC Merced can become an exemplar for university education nationwide despite our size and youth. Change at this scale is difficult because it must address real socioeconomic and racial disparities as well as presuppositions and expectations that can undermine commitment to teaching students of all backgrounds and ensuring the success of all our faculty and staff. UC Merced faculty have made substantial progress in bringing inclusive excellence to the classroom through individual actions as well as funded collaborative projects, and efforts to increasing the diversity of our faculty have yielded some positive results. Lasting change in these and other arenas in which discrimination is manifest is a challenging task that requires us to bring honest introspection, humility and intentionality to all of our endeavors. For that reason, interweaving concepts and practices of diversity and justice into our academic functions is the foundation on which all of our initiatives are built. This foundational initiative will begin with the creation of a task force of SNS faculty to identify practices we can adopt to help recruit more diverse faculty, to ensure that participation in all aspects of undergraduate and graduate education is equitable, and to develop pathways to share information about what works and what doesn't between departments and graduate groups.

#### 2. Establish Research Centers, Institutes, and ORUs in existing and emerging areas of strength.

Highly visible research Centers, Institutes, and Organized Research Units (ORUs) are a hallmark of mature institutions and draw the attention of other universities, national laboratories, granting agencies, donors, and the general public. During our brief history, SNS faculty have had remarkable success in winning large multidisciplinary Center grants, establishing the Center for Computational Biology (2004), the Merced nAnomaterials Center for Energy and Sensing (2015), and the Center for Cellular and Biomolecular Machines (2016). Based on those experiences and the remarkable success of individual faculty in other areas, SNS Faculty Leadership identified five broad areas of research in which we are poised for success in creating new centers: Computational & Data Science, Materials, Biomedical Sciences, Sustainability & Environment, and STEM Education. The School has unique strengths in each of these areas that will emerge as points of distinction on a national scale. Research Centers, Institutes, and ORUs (institutes formally designated by UCOP) will provide research opportunities and fellowships for graduate students, lead to high-profile publications and extramural funding, and focus attention on our outstanding faculty. They are critical to fulfilling our vision of being a world-class research campus that is a hub for integrative, transformative, and translational research and sustainable development. A faculty-led task force will assess readiness to compete for extramural funding in these areas, thereby identifying the sequence in which we will address them. Preparing Center, Institute, and ORU proposals is a monumental effort that requires logistical and clerical help, and we will work with the campus to provide that support. This task force will consider the investments that are required to enable organization, planning, and writing of proposals, and possible incentives for faculty to get together and develop ideas and proposals, such as seed grants to develop ideas, teaching release to develop invited large center grants, etc. The task force will also consider how research and center-related services including pre- and post-award support must be augmented for these increased activities.

### **3.** Develop deliberate strategies to increase high-impact publications, promote awards and prestige appointments for faculty, and foster success in extramural funding.

Becoming a successful researcher requires a host of learned skills that range from determining the right sequence of realistic projects to crafting crisp, incisive manuscripts that are widely cited, writing proposals that return ample extramural funding, as well as converting new knowledge into patented intellectual property. Faculty in Natural Sciences have had extraordinary success given the many challenges of being on a new campus, but we believe that our performance can be further enhanced through deliberate actions. For our faculty to achieve the level of success and recognition that is on par with our sibling campuses, we must focus not simply on improving our mentoring of junior faculty through tenure but extend our efforts to mentoring all faculty throughout their careers. It requires attention to individual needs, help in planning for merit and promotion, and active development of strong professional networks that include influential external colleagues who will nominate individuals for the National Academies and other prestigious honors and awards. We will establish a task force to identify and prioritize school-wide programs that may include new approaches to mentoring, writing retreats, and building powerful networks that will increase high-impact publications, extramural funding, and election to preeminent scientific organizations. Moreover, the task force will identify steps we can take to further foster a culture of research at all levels in SNS and work with the

development task force on related funding needs including more endowed chairs. These activities will help us achieve our vision of being a world-class research campus with R1 status.

## 4. Identify "signature skill sets" essential to success in STEM fields and incorporate them into our existing majors through cross-disciplinary courses.

In designing the SNS majors we were guided by careful analysis of the knowledge and skills expected of college graduates in each field. We now plan to augment these discipline-based skill sets with additional training in high demand in STEM careers, such as data science, environmental sustainability, and applied health sciences. These will include an emphasis on skills sets that employers consistently list as important in their hiring, such as general analytical skills, communication and teamwork. Such "signature skill sets" will help distinguish our students and increase the value of our discipline-based majors to students in their careers. They will also highlight the depth of our collective technical skill base across all of our disciplines. As a first step, we will create a task force to work with the departments and programs to identify skill sets that could augment our majors and plan the best ways to weave these into our programs. This initiative will be carried out in coordination with other schools and disciplines across campus. A related challenge that this task force could address is the current time-consuming and cumbersome processes for proposing, approving, and modifying courses. We will also consider developing cross-disciplinary courses to teach these skill sets across the SNS disciplines. Similar courses, such as "Data 8" at UC Berkeley have proven to be extremely popular and effective at giving students a common skill base.

### 5. Develop new majors, tracks, minors, MS, and/or combined BS/MS programs in highdemand areas.

To continue to provide relevant and in-demand STEM educational programs, we must be nimble in response to the shifting needs of the region, state, and nation. Although a fraction of our students plan to pursue discipline-based graduate programs with the aim of research careers, most of our undergraduates seek a college education to better prepare for well-paid careers either directly after graduation or after applied professional training in areas like teaching, allied health professions, or applied environmental science. There are also emerging new areas where large workforce needs are predicted that currently have few training pipelines, such as quantum computing and communication. Therefore, we will consider a range of new majors, minors, and degree tracks, as well as combined BS/MS programs that more directly feed into the careers most of our current and future students are looking for and are needed in our region. Additionally, we will investigate ways to incorporate internships and related activities into our major curricula.

### 6. Systematically modernize our courses and pedagogical methods throughout our curricula.

New technologies and research are fostering interest in improved pedagogical methods at even the very top universities, but the implementation of these practices is especially urgent at UC Merced. Many students arrive at UC Merced lacking the academic background or study skills to be successful in a traditional teaching format. This puts the onus on the student to recognize what fundamental knowledge they are missing and to understand the larger context that makes individual pieces of information seem relevant or compelling. Moreover, many of our current and potential students have heavy work or family obligations that make the traditional college schedule with course components spread across the week difficult to attend. The switch to remote learning in response to the Covid19 pandemic has made everyone familiar with tools for remote education, which may offer a unique opportunity to incorporate new technologies into post-Covid19 teaching. Finally, there is a great deal of enthusiasm for innovative teaching methods, especially among newer SNS faculty and instructors. A first step in this strategic initiative to develop and implement improved, more inclusive, teaching practices across our curricula, will be to assemble the faculty expertise across SNS (as well as other sources, such as CETL) who are already using these practices individually or as part of an established program (for example, through the HHMI Inclusive Excellence initiative). This group will identify which practices are currently working best with our students as well as which courses would be best impacted by these improved methods. This initiative will be coordinated with our strategic initiative #4 to emphasize "signature skill sets" in our curricula.

### 7. Improve our doctoral programs to achieve R1 size and research productivity.

Growth of our graduate programs, as well as increasing the fraction of our students with research funding, are a key prerequisite for UC Merced achieving Carnegie R1 ("Very high research activity") status. Bridging these gaps will require sustained efforts in several areas, including broader and much more proactive recruitment to increase the size and quality of the applicant pool, support for graduate groups to be competitive for training grants, and garnering resources so that a much higher fraction of students are funded by GSRs than by teaching assistantships. We can also improve recruitment yields and student outcomes by redesigning elements of our graduate curricula to include high-demand skill sets (as in initiative #4 for undergraduates), enhancing faculty mentorship skills, making a deliberate effort to encourage and help students apply for fellowships, and creating an inclusive culture that supports the exploration of careers outside traditional research tracks. This initiative is strongly coupled to other strategic initiatives related to the development of research centers with associated GSR funding, and increased support for faculty success. This strategic initiative will commence with a working group that includes members from all SNS graduate programs as well as other graduate groups with large SNS faculty membership (such as Environmental Systems) who will identify metrics and highpriority actions to achieve the goal of improving our graduate programs.

### 8. Focus on staff training, development, and professional advancement in an atmosphere that fosters mutually respectful and productive working relationships among staff and faculty.

It is impossible to achieve our vision for the School without staff and their success is as crucial as that of our faculty and students. Staff are the engine of the academic enterprise and, like an engine, require careful attention and investment to ensure sustainable, peak performance. The SNS Staff Council and Managers identified professional development and exposure to opportunities for advancement as important areas for focus. This could take the form of acquiring skills by cross-training between units, participating in shadowing and mentoring programs, and being given opportunities to learn new technologies. Success will also require that Managers take an active role in discussing professional goals and pathways with their staff. During the course of planning, both staff and faculty expressed a desire to collaborate more closely and to develop open channels of communication around their needs and expectations.

This will require mechanisms for faculty and staff to get to know one another and to feel safe in discussing their needs and identifying barriers to success. The taskforce for this initiative will include front-line staff, managers and faculty. Together they will develop plans for advancing each of these areas and developing measures of success that will include climate surveys and new evaluation tools as well as metrics.

# 9. Develop our donor base to support faculty research programs, research infrastructure, student and postdoctoral fellowships, and relationships that build pipelines to employment and professional programs for alumni.

A strong portfolio of philanthropic investments raises the status of an institution and is a crucial source of funding, especially in the face of uncertain state and federal investment. Each of our initiatives makes a compelling case that should interest philanthropists, foundations, and industries – our focus on equity and justice, research centers, faculty development, Endowed Chairs, "signature skillsets", curricular reform, enhancing graduate programs, and fostering a respectful and inclusive workplace. Our focus on "signature skillsets" will open the door to pipeline programs that move our students into satisfying careers that benefit their communities. In collaboration with Department Chairs and faculty, the Dean will further refine the School's priorities and work with Development to share our vision with alumni and individuals and entities of means who share our values and can connect us to robust networks of like-minded people. A strong donor base is critical to our vision of being a world-class research campus that provides exceptional and equitable STEM education and establishes the Central Valley as a hub for integrative, transformative, and translational research and sustainable development.

