

MPS Academic Planning and Faculty Recruitment

(Excerpt from June 30, 2011 memo to Provost Hexter *with 2013 updates.*)

The Division of Mathematical and Physical Sciences (MPS) is comprised of 5 departments (Chemistry, Geology, Physics, Mathematics, and Statistics). As a prologue to the development of a vision statement for the future, the campus was evaluated by the Washington Advisory Group (WAG). One of their observations was that the performance of MPS “will be a major determinant in how the higher education community views the College and, more importantly, the UC Davis campus as a whole. The departments in the Division have the know-how and ambition to rise in national ranking.”

Fundamental to discovery in the physical sciences is the deep-seated human longing to find the order of the universe around us. The discovery, dissemination and application of knowledge in the mathematical and physical sciences is fundamental to the progress of engineering, biological, and medical sciences. People well-trained in the mathematical and physical sciences are key to the scientific innovations that are essential to changing life in California, the U.S. and around the world.

The mission of MPS is to provide a foundation of discovery at the Frontiers of Science, and to disseminate and apply those discoveries in the mathematical and physical sciences. Both are fundamental to the scientific and technical innovations in these disciplines. MPS departments have advanced the Frontiers of discovery, from the most primary structure of the subatomic world, to the complexity of novel materials for clean energy and for health care, and from the realm of the universe (cosmology) to fundamental processes that control and influence processes above and within the earth (geology). *A prominent and successful Division of MPS benefits the campus as a whole.*

Each of our departments has developed a strategic plan to increase its visibility and accomplishments over the next decade. In particular, there is a concerted effort by all departments to join the elite programs in the country, by breaking national rankings of 20 by 2020 (as determined by the US News and World Report, USNWR). The 2010 rankings are: Geology #17, Physics #26, Statistics #31, Mathematics #36 and Chemistry #38. The Geology Department has already exceeded the MPS goal, and will strive to be listed among the top 10 Earth Science departments by this target date.

✚ What significant changes will your school/college/division see by 2020?

We expect to see an increasing level of student interest in the sciences and engineering; therefore, we predict increasing enrollments in all of the MPS departments, as well as an increased number of majors and a need to sustain the critical mass of faculty required to address the demand.

✚ What significant strengths will the division continue to support and build upon?

The departments within MPS are the fundamental sciences that interface with the life, agriculture and environmental sciences, engineering, and medicine. In recent years MPS departments have recorded a steady upward trend and with campus leadership, we are convinced that the scientific talent in our MPS departments can catapult all of those groups into the nation’s top 20 by 2020 mentioned above with Geology already there.

- ✦ **Is there an emergent sub-discipline or interdisciplinary constellation that you (or we at Davis more broadly) are not yet appropriately engaged in that you believe will become essential in the next 5-10 years?** All departments have identified emerging areas where their science will play an important role. For example, novel materials synthesis and characterization methods, the mining of extremely large and complex datasets (“Big Data”). The necessity of a sustainable energy future is one driver, along with human health issues and climate change. Strategic hiring in these areas will enable the departments within MPS to make advances towards their goal of reaching 20 by 2020. [The “Big Data” is no longer an “emergent” area, the White House has it launched late last year--2012. We have just completed spear-heading a campuswide “Data Science Initiative”. The campus cannot afford to wait to inaugurate it.]

- ✦ **What collaboration with other schools/colleges/divisions will be necessary for yours to attain its goals?** The departments in MPS have significant research overlap within the division and between the College of Biological Sciences, Engineering, College of Agriculture and Environmental Science, the School of Medicine, Education and the Graduate School of Management. Many of our faculty are members of larger groups such as the *Nanomaterials in the Environment, Agriculture, and Technology (NEAT)*, the *UC Davis Energy Institute*, the *Cancer Center*, *Universe@UC Davis initiative*, etc. Physics has a collaborative program with the McClellan Nuclear Research Center for education and research in the nuclear energy area. Geology has collaborations with Organized Research Units such as *Bodega Marine Lab*, *John Muir Institute of the Environment* and the *Tahoe Environmental Research Center*. Geology is also working with the Department of Land, Air & Water Resources to establish a new cross-college major in Earth System Science. Mathematics and Statistics, for example, play an even more central role in the analysis of vast amounts of data being generated across the campus. As mentioned above, we spear-headed the campuswide Data Science Initiative. Chemistry is partnering with SOM Biochemistry and Molecular Medicine to build upon its strengths in Chemical biology with two assistant professor hires (one completed and the other underway).

- ✦ **How will your school/college/division participate in emerging, multidisciplinary foci of excellence (energy/environment, water, food, society, health to name a few general areas)?** The departments in MPS are fundamental to many emerging areas of science and are already contributing to sustainable and green solutions. Almost all emerging areas require increasing amounts of sophisticated mathematical and statistical analysis tools, and the handling of large datasets. Faculty in MPS are active in, and will continue to participate in foci of excellence according to their expertise. MPS has a substantial investment in the energy/environment, water, and health with faculty who are recognized as experts in these areas. For example, chemistry faculty are active in a number of large Center grants and are actively engaged with the School of Medicine (SOM) with two joint assistant professor hires. The necessities of a sustainable energy future are a driver of geoscience research, and indeed of all MPS fields.

- ✚ **What specific strategies will your academic units employ to maintain excellence in undergraduate education? In graduate education?** In particular, Chemistry, Mathematics, and Statistics face pressure in their ability to cover their curriculum because of insufficient faculty numbers and classroom size, particularly as enrollments at both the undergraduate and graduate levels increase. All departments are under pressure to increase class size at all levels, with limited facilities to physically house the rising number of students attempting to receive a world class education in the sciences. Despite these pressures, our departments have superb educators who have received local and nationally recognized awards in teaching. A hallmark of MPS departments is the development of innovative teaching concepts such as our new series of biology oriented calculus, new designated emphases such as pharmaceutical chemistry, or out-of-the-box web-based innovations such as the Chemwiki. In graduate education, MPS has seen increased numbers of graduate student fellowships such as the NSF graduate fellowship. Departments structure their curriculum to provide students with a depth and breadth in their field of study while exposing them to research as early as possible.

- ✚ **What opportunities does your plan offer to advance diversity at Davis and what strategies will you employ to capitalize on those opportunities?** MPS has made significant progress in all departments as a leader in gender diversity among the STEM faculties. In order to make an impact in the broader area of diversity, more efforts are necessary to make UC Davis a fertile environment for highly qualified candidates, using the new ADVANCE-STEM program, identifying Target-of-Excellence hires to make senior appointments, working closely with the university's Partner's Opportunity Program to address the needs of dual-career couples; using the UC President's Postdoctoral Fellowship to recruit faculty, and placing minority and women faculty into leadership roles in the department and on hiring committees. The departments also have a number of programs that increase outreach to graduate students from under-represented groups such as the Sloan grant in Chemistry, the UC/CSU Alliance in Physics, and Mentorship for Undergraduate Research Participants in Physical and Mathematical Sciences (MURRPS) in MPS. Faculty actively apply for funding to enhance their departments, such as the NSF REU grants in physics and chemistry. Even with resources stretched thinly, the faculty in MPS strongly believe in outreach and the training of next generation scientists. These faculty participate in many programs without significant support, and make cutting-edge research available to students through the many undergraduate research programs that exist on this campus.

In summary, MPS plans to support and promote strategic hires, improvement in facilities and infrastructure and to assist its departments in reaching their goals.

- Our success is the collaborative nature of our faculty and graduate groups which allows us to easily cross departments, schools and colleges boundaries. This interdisciplinarity approach then allows us to contribute to center grants and other collaborative funding opportunities.

- Our challenge is to identify faculty to assume the role of leadership in these large grants. In addition, we also have issues associated with our current facilities and the need for renovations. In particular, there is a great need for a modern “Chemistry of Life” (synthetic chemistry) building. We also face challenges in managing the heavy teaching loads placed upon the division. As noted in the WAG Report, “Chemistry and Mathematics carry a very high load of service course teaching negatively affecting research time and productivity.”

All of the MPS departments will benefit from strategic hires in order to augment their research programs as we begin to re-build back from the return of faculty FTE to the central campus as a result of the current budget situation. For example, for the Departments of Mathematics, Physics and Statistics, a key senior hire in each of these units could make a significant difference in their overall department NRC rankings. In addition, each department also recognizes the need to more aggressively nominate their faculty, including junior faculty for local, national, and international awards. Critical to these objectives will be identification of adequate resources needed to ensure a continued upward trajectory.

Excerpt submitted in response to the Chancellor’s Office request for Vision/Strategic Planning documents on March 22, 2013.