College of Science Strategic Plan Spring 2010

June 22, 2010

This document is the result of much discussion and planning over the past two years (starting with the Academic Master Planning Process in mid-2008) and consists of the Strategic Plan for the College of Science for 2011-2015.

It consists of eight parts:

1. An introduction to the College of Science
2. The research strengths of the College of Science
3. The teaching and learning strengths of the College of Science
4. The engagement strengths of the College of Science
5. The five overarching goals
6. Relationship of goals to Vision 2020 Imperatives
7. Relationship of goals to Academic Master Plan overarching Themes
8. Relationship of goals to Academic Master Plan Roadmaps

Mission Statement

The mission of the College of Science at Texas A&M is to 1) push back the frontiers of knowledge in our disciplines and in multiple disciplines across campus 2) to provide an extraordinary education to virtually every Texas Aggie (including our own undergraduate and graduate majors), and 3) use our expertise to engage the world at large, particularly in the public's knowledge of science.

Assumptions and basic goals of this plan

After many discussions and mindful of the Vision 2020 imperatives and the roadmaps and overarching themes of the Academic Master Plan, the college has indentified five "overarching goals". In simplest terms, the five goals are in (priority order) 1) quality and quantity of space, 2) quality and quantity of graduate students, 3) hiring senior faculty, 4) expanding diversity, and 5) enhancing undergraduate experiences. All of these areas are interconnected but looking at them individually is useful and helps establish our priorities. The details of the goals are in section five. In later sections of the plan we describe how these goals relate to Vision 2020 imperatives and the elements of the academic master plan.

While the faculty reinvestment and increased enrollment programs mandated by former President Gates enhanced one aspect of the university and the college, namely the number of faculty, the inadequate level of funds for startup, renovations, and graduate students had an especially harsh impact on the College of Science because of our extraordinary (perhaps unique) needs in all three of these areas.

Our plan assumes essentially level central funding. On the other hand, we have been allocated significant resources from the Initial University Multidisciplinary Research Initiatives (IUMRI's), and we assume that President Loftin's often-expressed desire to

attack the problems of inadequate graduate student funding and deferred maintenance and renovations will bear fruit. Our plan also assumes that the plan being discussed with the university to help correct the financial damage caused by reinvestment will be implemented.

We have tried to develop these overarching goals in a way that we as a college can address by ourselves (except of course for the items in the previous paragraph) and/or in partnership with university wide initiatives.

1. Introduction to the College of Science

The college comprises five large departments — Biology, Chemistry, Mathematics, Physics and Astronomy, Statistics — and a wide variety of interdisciplinary centers and institutes at both the college and departmental levels. The departments range in size (tenured and tenure-track faculty) from 34 in Statistics to 83 in Mathematics, with 48 each in Biology and Chemistry, and 67 in Physics and Astronomy, for a total of 280. We have 2335 undergraduate and 851 graduate students (all of these data are for Fall 2009).

The college plays a unique role in the university:

- We have the largest funding in fundamental research on campus and a very large number of research collaborations across campus and around the world.

- We teach more than one sixth of student credit hours taught in the university. In addition to our majors, this represents the very large impact of our service courses for the entire university. We have the third-largest undergraduate major (biology), the department that produces more Ph.D.s than any other (chemistry), the department that teaches more students per year than any other (mathematics), and the department that teaches more graduate students per year than any other (statistics).

- The college has unarguably the most distinguished faculty in the university. For example in Fall 2009, we had 24 of the university's 53 distinguished professors while in Fall 2010 five of the seven new distinguished professors are in our college. (The next highest college in 2009 was Liberal Arts with eight, followed by Agriculture, Business, and Engineering with five each.)

- One measure of the strength of our departments relative to the rest of the university is the National Research Council (NRC) Rankings of Doctoral Programs, most recently released in the mid-1990s. Of the 26 fields rated at Texas A&M, only one (chemistry) was in the top 10 percent of departments nationally, being 15th of 165, while statistics (10th of 65) was fourth at Texas A&M in percentile rank; physics, eighth; and mathematics, 15th. (The fragmentation of life sciences in the list of fields makes it difficult to find a single percentile for biology.) Chemistry also is among the top five in inorganic chemistry and the top 20 in analytical chemistry. Because all of our departments have added many

outstanding faculty under the reinvestment program, we expect to do well in the soon-to-be-released new NRC rankings.

- In the latest (Spring 2010) U.S. News and World Report rankings of Ph.D. programs, chemistry is again very highly rated (19th overall, eight among publics), only two public statistics departments (Berkeley and Seattle) are ranked higher than our statistics department, while math and physics and astronomy are now in the top 25 of public universities. Again, the sub-disciplines that make up biology departments vary so widely that their rankings are difficult to determine.

Introduction to Departments, Centers, and Institutes

The **Department of Biology** elucidates processes that affect the growth, development, survival, reproduction, and evolution of organisms. In providing the fundamental knowledge and theoretical basis for solutions to society's grand problems, biology faculty generate tools, technologies, and targets that enable improvements in agriculture, medicine, and other practical applications of biology.

The **Department of Chemistry** is organized around the traditional sub-disciplines of analytical, biological, inorganic, organic, and physical/nuclear chemistry; however, the research programs best fit the categories of synthetic chemistry and studies (experimental and computational) of chemical-physical properties of matter. The department's research strength in molecular organic, inorganic, organometallic, chemical-biology, biophysics, and materials as well as the development of next-generation analytical technologies assure leadership roles in environmental monitoring and remediation, green chemistry, biosecurity/defense, disease diagnostic/imaging, drug discovery, and nanotechnology.

The **Department of Mathematics** provides the fundamental theoretical and computational tools used to help formulate, analyze, and solve problems in science and engineering. Often, research in mathematics is inspired by specific applications. At other times, mathematicians study the subject on the basis of its own interesting merit, and surprising applications reveal themselves later. Independent of motivation or possible result, expertise in mathematics is vitally important for the success of any technically-oriented university.

The **Department of Physics and Astronomy** tackles the fundamental understanding of nature for the purpose of shedding light on how the Universe around us behaves. Physics can be considered the "fundamental science," given that many other disciplines (biology, chemistry, geology, engineering, and medicine, to name but a few) deal with particular subsets of material systems that obey the laws of physics. Physics is the birthplace of the new technologies that completely revolutionize our society, including nuclear power, television, computers, radiation therapy, electron microscopes, and magnetic resonance imaging (MRI).

The **Department of Statistics** deals with the science of learning from data. It is grounded in a still-growing core of knowledge that reflects its roots in probability and mathematics and also the more recent influence of computer science. Statistics both draws from these

roots and feeds back to them new mathematical and computational questions. As such, it is an unusually interdisciplinary field. Indeed, applications are its lifeblood; they stimulate research on new theories and methods while providing valuable outlets for established techniques.

Institutes and Centers Administered at the College Level

(An inspection of departmental Web sites will show a large number of other centers and institutes as well.)

The **Cyclotron Institute**, designated as one of five Centers of Excellence by the U.S. Department of Energy, conducts nuclear science research as part of a nationally and internationally recognized interdisciplinary program that features faculty members in the chemistry and physics departments. Basic and applied research includes strong theoretical and experimental teams focused on nuclear science and a radiation testing facility for electronic components that attracts a large number of industrial users. The centerpiece of the Institute's in-house research program is a K500 superconducting cyclotron, one of only four such university-based accelerators in the world. Through a DOE-supported upgrade project now underway, the Institute has re-commissioned its original K150 cyclotron and is coupling the two cyclotrons to produce accelerated radioactive ion beams (RIBs).

The **Institute of Quantum Science and Engineering (IQSE)** is making groundbreaking discoveries in both fundamental physics and applied programs. Efforts extend from expanding upon the foundations of quantum mechanics to combating bioterrorism. The IQSE is involved in vibrant multidisciplinary activities in both the physical and biological sciences.

Under the **Institutes for Computational Sciences** umbrella, the College of Science is home to the following interdisciplinary institutes and academies.

- The *Institute for Scientific Computation (ISC)* is a multidisciplinary research center devoted to the design, analysis, and implementation of innovative computational tools to advance scientific and engineering research and education.

- The *Institute for Applied Mathematics and Computational Science (IAMCS)* is a state-of-the-art, multidisciplinary computational research base with a robust infrastructure that enables large-scale scientific computation research, advanced multidisciplinary learning and education, and a large number of applications in diverse areas of science and engineering of interest to Texas, Saudi Arabia, and the world. IAMCS combines the expertise of world renowned researchers and collaborators in mathematics, statistics, and computer science to approach science and engineering issues from different perspectives, thus providing more comprehensive solutions by maximizing flexible model development, predictive

assessment, and the ability to handle problems with either excessive or sparse data.

- The *Academy for Advanced Telecommunications and Learning Technologies* was established to recognize, help develop, and coordinate the various telecommunications and information technology efforts and expertise at Texas A&M University. The Academy fosters collaboration for academic programs and technology research, development, and deployment. It pursues interdisciplinary research and partnership opportunities that promote the aggressive use of cyber-infrastructure.

The **Center for Mathematics and Science Education (CMSE)** oversees a large number of educational research and outreach activities primarily led by members of the College of Science. Examples include the Aggie Teach program, which is one of the leading programs nationally in the production of secondary mathematics and science teachers.

2. The Research Strengths in the College of Science

Research represents the lifeblood not only of the College of Science but of all scientific professions and pursuits. Our research plan centers on hiring outstanding faculty, who are dedicated to pushing back the frontiers of knowledge in their disciplines and advancing our primary missions: to create new knowledge and to train the next generation of scientists. Many of our faculty also collaborate on interdisciplinary projects that lead to society-transforming technologies of the future. We continually seek to add faculty who excel at fundamental science and can work on broad teams to address the grand challenges of the state, nation, and world. Because of the intimate integration of research and education, these faculty will also be keys to the transformation of our undergraduate and graduate teaching.

The College of Science has very broad and deep research strengths. We next give the greatest strengths of each department and their multidisciplinary strengths, and finally the rare strengths of the entire college.

Department of Biology
Specific research strengths in the Department of Biology include:

- Circadian biology in a wide variety of model organisms.

- Neurobiology at all levels, from genetics to behavior.

- Epigenetics, or the study of how non-genetic changes in chromatin structure affect gene expression.

- Eukaryotic microbiology, with particular emphasis on fungi as model organisms and as pathogens.

Department of Chemistry
Specific research strengths in the Department of Chemistry include:

- Molecular engineering, or the targeted synthesis of organic and inorganic compounds with novel materials, biological, or theoretically important properties.

- Molecular separation and characterization using state-of-the-art experimental methods, including development of new methods.

- Theoretical and computational chemistry, including in-depth interfaces with experimental studies and the development of new methods.

- Large inventory of cutting-edge instrumentation and expert staff to support basic and applied chemical research.

Department of Mathematics
Specific research strengths in the Department of Mathematics include:

- Applied mathematics, which is associated with the Institute for Scientific Computation, and the Institute for Applied Mathematics and Computational Science.

- Analysis, the study of sequences of a wide variety of mathematical objects and their limiting behavior.

- Algebra and combinatorics, the study of abstract structures and how to quantify them.

Department of Physics and Astronomy
Specific research strengths in the Department of Physics and Astronomy include:

- Texas A&M astronomy is a founding partner in the Giant Magellan Telescope (GMT) and takes a major role in HETDEX (Hobby-Eberly Telescope Dark Energy experiment).

- The nuclear science program based within the Cyclotron Institute includes nationally and internationally recognized theoretical and experimental research programs as well as an electronics testing facility that attracts a large number of industrial users.

- The high energy physics program plays a key role in the Tevatron at Fermilab and in the Compact Muon Solenoid (CMS) project for the Large Hadron Collider (LHC) at CERN. The Accelerator Research Laboratory (ARL) also has been instrumental in technical developments that enable high energy physics.

- The quantum optics research program focuses on studying atomic interference phenomena in radiation-matter interactions.

Department of Statistics
Specific research strengths in the Department of Statistics include:

- Bioinformatics/biostatistics, or the creation of new methodologies to deal with the incredibly large and complex data obtained from a host of biological problems, such as genomics, population genetics, systems biology, etc.

- The analysis of space/time data, developing new methodologies and numerical algorithms for analyzing the many scientific and engineering problems resulting in massive data sets observed both in time and in space.

- Nonparametric and semiparametric methods, the development of new statistical methods that allow researchers to test theories without restrictive assumptions.

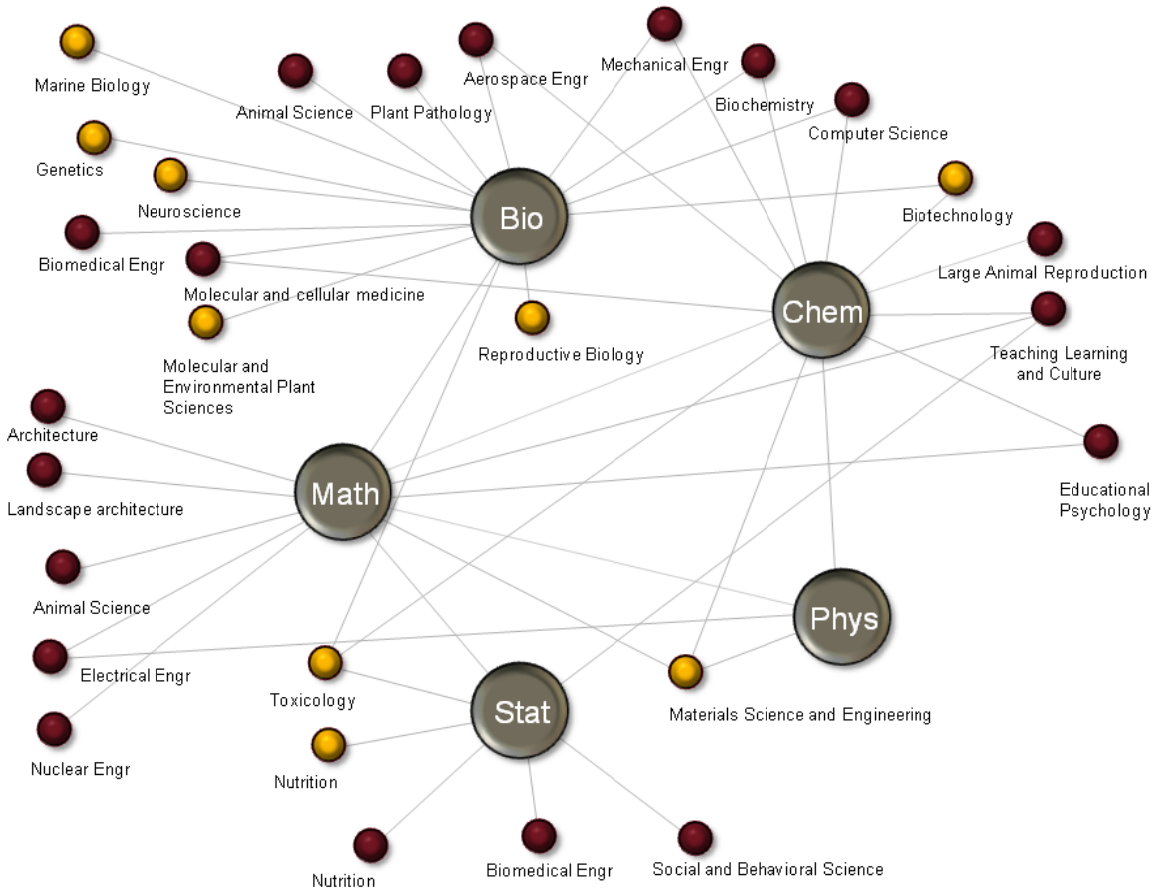
- Bayesian statistical methods, developing complex algorithms based on the principle of updating prior beliefs or theories on the basis of new information that provides solutions to problems which were intractable just a few years ago.

Interdisciplinary Strengths and Grand Challenges

The research activities in the College of Science are inherently multidisciplinary as well as symbiotic. The fruits of our fundamental discoveries are the input to the other technological disciplines in the university, while questions asked by other disciplines give our researchers problems to consider. Our faculty are involved in leadership roles of departmental, college, and university importance as well as societal grand challenges.

We have faculty involved in many inter- and intra-college activities that are multidisciplinary. Some faculty are involved in formal interdisciplinary faculties, while others facilitate their collaborations through institutes or base them on less formal relationships around common research questions.

The breadth of our interdisciplinary efforts is demonstrated by the diversity of projects our faculty are involved in, as shown in the figure below. The yellow (small light) circles represent the formal interdisciplinary faculties in which the college has participating members. Lines connect to the respective home departments of these faculty. The maroon (small dark) circles indicate other departments across Texas A&M with which our faculty had joint grants in calendar year 2008.



Many of our basic advances become tools that are vital in the investigation of grand challenges. We can categorize this multidisciplinary strength in three major, broad-impact areas:

- **Measurement and Detection**

The College of Science is home to research infrastructure facilities with state-of-the-art instrumentation. Our portfolio spans detectors that measure the subatomic building blocks of nature, to facilities that measure molecular and materials properties, to our developing telescope instrumentation capabilities. Faculty in the college are developing exquisite devices and methods for physical examination of interesting science questions. In many cases, fundamental science advancements are necessary to push the forefront of detection technology, and this technology allows us to answer many of nature's most fascinating questions.

- **Modeling and Interpretation of Data and Uncertainty**

The College of Science has a long history of mathematical and statistical modeling and computation. From bioinformatics (where members of Statistics first began working with microarray experiments more than 15 years ago) to computational algorithms (where members of Mathematics are leaders in developing publicly available code for efficient solutions of complex problems),

the college is providing leadership in this increasingly important domain. Our faculty are actively engaged in developing and delivering computational solutions to problems in cancer prevention, drug discovery, environmental modeling, materials science, predictive science, and alternate forms of energy, among many others. In addition to providing fundamental advances that can enable translational science, this broad expertise can ensure the creation of a community capable of cross-fertilization, allowing advances in one field to impact many.

- **Synthesis and Manipulation of Matter**

From the transformation of the elements, through the synthesis of drugs and nano-structured material, to the manipulation of the genetic code, the College of Science faculty are at the forefront of making matter and material never before seen in nature. These new materials are the building blocks for future solutions to grand challenge problems in health, energy, security and the environment. From new devices to new medicines, the synthesis of new material and the manipulation of natural material are the fundamental keys provided by the College of Science.

Rare Strengths

Although the college has many nationally and internationally renowned faculty driving outstanding research programs, there are areas where the college has truly rare research strengths. Below we present examples of the areas where Texas A&M would be among the top programs in the country:

Biological Clocks

The biological clocks group at Texas A&M was founded in the early 1990s. In 2001 they were awarded the first National Institutes of Health (NIH)-PO1 Program Project grant on campus, which subsequently was renewed through 2011. Texas A&M is the world-wide leader in circadian biology, and our researchers have perfected the use of the newest genetic techniques to analyze clocks in organisms from bacteria to mammals, opening new windows into diagnosis and treatment of chronobiological disorders associated with sleep and wakefulness and their possible causes.

Catalysis

An extraordinary number of faculty contribute to our strength in catalysis which cuts across traditional disciplinary lines involving physical, analytical, organic, and inorganic chemists. Catalytic activity, both biological and chemical, can enhance reaction rates in a variety of systems and hence has application to a vast array of global challenges.

Modeling and Computational Science

The College of Science has expertise in modeling and interpretation of data and uncertainty throughout our departments. This represents an incredible strength, both in terms of theoretical developments and computational applications of these methods to scientific inquiry across the university. This expertise can be a vital component of any grand challenge initiative.

Inorganic Chemistry and Materials
The inorganic group in Chemistry is a comprehensive, discipline-spanning group who are each leaders in their respective disciplines. In addition, other faculty play important roles in our strength in materials and condensed matter science.

Instrumentation
The College of Science has nationally and internationally unique capabilities in measurement and detection. We excel in the design and development of next-generation experimental tools. These developments are driven by advances in the underlying science and will be important to enable the study of many of both the university's and the world's grand challenges.

Mathematical Analysis
Mathematical Analysis including operator theory, dynamical systems, and complex variables, are areas of great utility across science and technology, particularly engineering and computer science.

Molecular Design and Synthesis
The Chemistry department has long been a national leader in molecular engineering, the synthesis and analysis of novel molecules. Biology plays a related key role in the study of the design and the manipulation of the genetic code. Many of these new molecules and genes have unique physical, chemical, or biological properties and will be the basis of medical discoveries and advanced technologies.

Nuclear Science
The Cyclotron Institute represents a rare strength, both in terms of the facility and the faculty who strive to understand nuclei which constitute the core of matter. Research strength ranges from probing the quark gluon plasma to the heaviest elements. It is already recognized as a Center of Excellence by the U.S. Department of Energy.

Quantum Science
The Institute for Quantum Science and Engineering focuses on studying atomic interference phenomena in radiation-matter interactions. Investigations include lasing without inversion, electromagnetically induced transparency, resonant enhancement of the index of refraction, and slow light.

Cosmology
The college has invested heavily in building an astronomy program at Texas A&M. These investments, coupled with the strength of our existing elementary particle physics theory group, lead us to consider cosmology as a developing rare strength.

Math and Science Education Policy
The college is heavily involved at the state and national level in working to understand various factors influencing PreK-12 STEM education.

The Initial University Multidisciplinary Research Initiatives (IUMRI's)
A measure of our great research strength is the fact that our faculty were leaders in five of the eight IUMRI's, namely:

1. Nuclear Solutions Institute
2. Institute for Quantum Science and Engineering
3. Institute of Applied Mathematical, Statistical, and Computational Science
4. Texas A&M Institute for Neuroscience
5. Institute for Renewable Energy

These five IUMRI's contain funding for many multidisciplinary senior faculty, at least seven or eight of whom will have their administrative location in the College of Science.

3. The Teaching and Learning Strengths of the College of Science.

The College of Science has extraordinary strengths in teaching and learning at all levels from Pre-K through primary, middle, and secondary school, and throughout all levels of higher education. In this section we briefly describe our efforts at the undergraduate and graduate levels. Despite some obvious overlaps, we will describe our PreK-12 efforts in the engagement sections.

Undergraduate education

- Science is fundamental to the education of nearly every Aggie. In just one semester - the fall of 2009 - 29,543 College of Science SCH's were taken by undergraduates from other colleges.

Majors courses

- In addition to the large service load, we teach 2,335 of our own majors.

Special topics and honors courses

- The college prides itself on trying to meet the needs of all Aggies which means we offer honors courses and a large variety of special topics courses to enhance the educational experiences of the very best students.

Undergraduate research

- The College of Science believes that hands-on learning is a very important complement to learning in the classroom and hence strives to provide forefront research opportunities to undergraduate as well as graduate students. While many students understand the value of this type of activity and engage in it without formally registering for research hours, there were 357 undergraduate research opportunities that College of Science students took advantage of as 291 or 491 courses in 2008-09.

Special programs

- AggieTeach: One of the largest university-based programs in the nation in the production of secondary STEM teachers.
- Undergraduate Program in Biological and Mathematical Sciences (UBM),

a collaboration between the departments of Biology, Mathematics and Statistics with broad participation among faculty in several Colleges across campus. The goal of this program, funded by the National Science Foundation, is to train students in quantitative approaches, including mathematical, statistical, and computational techniques, to fundamental problems in the life sciences.

- Various tracks within departments (math education, applied physics, applied mathematical science with options in statistics, actuarial science, economics/finance, computer science, and biology. Five year bachelors/masters programs, chemistry programs in biological, environmental, and education areas.

Graduate education

Service courses

- The College of Science serves the needs of students from other colleges at the graduate level as well. In the fall of 2009 965 college of science courses were taken by students enrolled in the graduate degree programs of other colleges.

Majors courses

- Courses for our own graduate students – including special topics courses in cutting edge science.

Learning through research

- Hands on learning through research is at the core of many of the College of Science graduate degree programs. In 2008-9 over 500 students were engaged in graduate research through 691 each term.

Learning through Teaching

- Another aspect of the educational opportunities made available to our graduate students is the teaching experience they gain by being Teaching Assistants's.

Distance learning / technology enabled education

- The college has a long history in using technology to better serve a diverse array of students. In 1999 chemistry 107 was the first telecourse broadcast over KAMU. Today the Statistics and Mathematics departments offer complete distance masters programs, among the very few in the nation.
- **Textbooks by faculty**
  Another mark of excellence in the teaching strengths of our college is the number of faculty in the college who have written textbooks. Some of these books at both the advanced level and introductory level have become standards – completely dominating the national market (Cotton: Inorganic Chemistry and Group Theory, Brown: Introductory Chemistry for Engineers, for example). Over the next five years we will create a complete database of these books.

4. The Engagement Strengths of the College of Science

As we said in our mission statement we have the important goal of using our subject matter expertise to enhance the public's knowledge of science and to prepare and encourage future students to have a greater understanding and appreciation of the wonders of the universe.

The College of Science plays an important role in not only educating current Aggies, but also in fostering the scientific curiosity of future Aggies and the population at large. We engage in a multiprong approach to this tremendous challenge, including outreach to K-12 students and the public, teacher preparation and training, as well as activities aimed at current undergraduates to encourage them to continue their studies in science beyond the Bachelors degree. These activities are based both in our departments and in the college.

We also engage organizations and entities that expedite transfer of TAMU's intellectual property to private sector commercialization of products and services that benefit society and engage industry, government and non-profit organizations especially in the urban areas of Texas. Here is a list of some of our engagement activities, each of which is described on our website.

Administered by CMSE
The Center for Mathematics and Science Education – a joint collaboration with the College of Education and Human Development – having received over $21 million in extramural grants and private support (NSF, USDA, Texas Education Agency, Texas Higher Education Coordinating Board, Sid W. Richardson Foundation, Shell)

- Science Textbook Review for the State of Texas
- Advisory capacity to Senator Hutchison and The Academy of Medicine, Engineering and Science of Texas (TAMEST) in K-12 policy suggestions
- Key player in both the Math and Science Initiatives from the Governor's Office and the Texas Education Agency
- Serve on review panels for the Texas Essential Knowledge and Skills in Science, the Master Mathematics and Science Teacher Standards and qualifying exam
- Chair National Council of Teachers of Mathematics Curriculum Focal Points for K-8 Mathematics
- Lead Developer of Texas' Response to National Focal Points
- Lead Developer for Texas-Middle School in Texas Algebra-Ready Program
- Lead state in university-trained secondary mathematics and science teacher production (peer-reviewed national model for research-one institutions)
- Actively engaged in high-quality, sustained professional development throughout the area
- Advanced Placement Institutes in Biology, Chemistry, Mathematics, Physics and Statistics
- Providing data to policy makers on Advanced Placement and college success and teacher retention

- Scholarly research on teaching and learning in STEM (articles, materials for teachers, rubrics to analyze professional development and curricular materials)
- Partner with Education Service Centers to develop and review inquiry-based curriculum for dissemination throughout Texas and beyond

Administered by the College of Science Dean's Office

- Women in Science and Engineering
    - Susan M. Arseven 'Make A Difference' Memorial Award
    - Ethel Ashworth-Tsutsui Memorial Lecture & Awards
    - Women in Science and Engineering Annual Conference
- Expanding Your Horizons
- Texas A&M Junior Science Bowl
- Texas A&M Regional Science Bowl
- Texas Junior Academy of Science
- Texas Junior Science & Humanities Symposium
- Texas Science Olympiad
- SSTEM grant – 2+2 with Palo Alto Junior College
- Summer Scholars – Research Experience for Undergraduates supplement program

Administered by Departments

- Chemistry Open House
- Physics Extravaganza
- Saturday Morning Physics
- Research Experiences for Undergraduates Programs (Chemistry, Cyclotron, Math)
- High school math contest
- Mini math fair
- Integral bee
- Summer Mathematics Research Training High School Camp
- Mentoring through Critical Transition Points program
- Summer Educational Enrichment in Math

In terms of government and non-profit organizations each of our departments are working toward official relationships with industry. For example, chemistry has IUCCP (Industry University Cooperative Chemistry Program), while statistics has been very successful in starting an "Industrial Affiliate Program".

In terms of commercializing intellectual property, the college is working closely with the TAMU System Office of Technology Commercialization. Further, we have been very active on committees and task forces since the inception of the OTC, most recently a member of the Intellectual Property Constituent Committee.

5. The Five Overarching Goals

The College of Science will continue all of the efforts we have addressed in the previous three sections (research, teaching and learning, engagement), but we have identified five specific, measureable goals for 2011-2015.

Goal 1: Improve quality and quantity of space

- There is a good chance that by 2015 the issues identified in the 2006 A&M System sponsored study of the chemistry complex will have to be seriously addressed. The College of Science will use whatever resources and powers of persuasion it has to mitigate the situation.
- In order to accomplish goal 3 (increase the quality of our faculty) the college must have additional space and the ability to renovate existing space, particularly in chemistry and biology. We must leverage the faculty hiring goal to help address the space problem.
- The members of the math department are now almost equally split between the Milner and Blocker buildings, a very harmful condition on many levels. We will petition the Council on the Built Environment to move the faculty from Milner into space vacated by English and Agricultural Economics when the Arts and Humanities Building and the Agriculture Headquarters Buildings are complete over the next five years.

Goal 2: **Increase quality and quantity of graduate students**

- Despite some new funds for TA's to help with the increased enrollment program, our departments do not have enough TA's. This is especially true in mathematics because of their huge service teaching load. We have been particularly hard hit because of the unanticipated growth of engineering enrollments in the increased enrollment plan. We will emphasize acquiring research funding to pay for teaching (especially in the interdisciplinary areas represented by the several IUMRI's in which college plays a heavy role) to help address this problem.
- In terms of the quality of graduate students, we must find funding to raise stipends to competitive levels, especially because Texas, unlike many of our peers, does not award tuition and fee waivers. We will conduct a very careful survey of how researchers are supporting students, and each department will create strategies for most effectively using current funds and to find additional funds, either by grants, philanthropy, etc. We must assume that the university will help in this regard as well.

Goal 3: **Increase the quality of our faculty**

- Our best estimate of the new senior faculty to be administratively located in the College of Science from the research roadmap and IUMRI process is 7 or 8 with at least one in each department. We will seek faculty who will bring great strength to our disciplines who have also shown a strong commitment to collaborating with the other faculty in their IUMRI.
- We will also use replacement positions to add a similar number of additional senior hires and a similar number of junior hires. This will total approximately 20

to 25 new faculty in five years, with most of them being senior hires who will raise the level of our faculty and help us attract top graduate students.
- This goal will be coordinated very carefully with goals 1, 2, and 4, as we can only attract the type of people we are looking for if we have attractive space and good graduate students, and this faculty hiring will provide the opportunity to attract women and minorities.

Goal 4: **Increase student and faculty diversity**
- While we have done extremely well in increasing faculty gender diversity over past several years (nearly doubling the number of female tenured and tenure/track women since 2002), have done well in ethnic diversity in our largest undergraduate major (biology), and have efforts in place such as our relationship with Palo Alto Junior College, the next two bullets contain specific ideas of how we will seek additional female faculty as well as ethnic minorities for our faculty.
- Our main strategy is to continue the process we developed at the beginning of reinvestment, namely the dean's office certifying short lists, etc. Additionally, the college will provide some bridge funding for highly qualified candidates who would increase the diversity of the college.
- We will continue to look for dual career opportunities. This helped us attract remarkable people during reinvestment. We hope the university will continue to support this.
- Each department will create a list of the top females and ethnic minorities in their discipline and use this list as part of their searches for the faculty in Goal 3. Each department will also develop lists of schools that are tops in producing minority and women faculty and will make concerted efforts to visit these schools to create long term opportunities. We can do this same thing with schools that are leaders in producing students who go on to seek PhD's in our disciplines.

Goal 5: **Enhance the undergraduate experience**
- While we do not have large undergraduate major enrollments (except for biology), and statistics has no undergraduate major, one of our top priorities is to provide each of our majors with an "enhancing experience", which will vary from department to department. For some this will be to ensure a meaningful "research experience", for others it could be a "capstone experience", or a significant international experience. Each department is working to determine the exact nature of this experience.
- Each of our departments will investigate ways to increase the number of students who can have a meaningful international experience.
- A major role our departments play is in the area of service courses to the rest of the university, ranging from the first year programs in biology, chemistry, math, and physics (ranging from headcounts of 5,000 to 15,000 per year), through areas such as organic chemistry, sophomore, junior and senior level math and stat, through the large number of non-statistics students who take graduate courses in statistics. Over the five year period covered by this plan we will carefully study (including conferring with our client departments and outside experts) to ensure our service program is effectively covering the needs of students in the classes.

6. The Relationship to Vision 2020 Imperatives

In this section we will briefly identify how closely aligned our goals are to the Vision 2020 Imperatives.

1. Elevate Our Faculty and Their Teaching, Research, and Service
    - All of our goals address this imperative.
2. Strengthen Our Graduate Program
    - This is Goal 2
3. Enhance the Undergraduate Academic Experience
    - This is Goal 5
4. Build the Letters, Arts, and Sciences Core
    - This imperative in Vision 2020 primarily describes desired enhancements to liberal arts, but our goals will strengthen the core of Texas A&M.
5. Build on the Tradition of Professional Education
    - Our work on our service courses in our Goal 5 will enhance the goals of this imperative which is primarily to enhance the quality and reputation of professional programs such as engineering. Additionally, our work in strengthening the pre-professional program in biology (and chemistry) will also contribute to the goals of this imperative.
6. Diversity and Globalize the A&M Community
    - The diversity program in our Goal 4 specifically addresses this imperative. Further, our second bullet in Goal 5 addresses the global awareness aspect of the imperative.
7. Increase Access to Knowledge Resources
    - While none of our goals specifically address this imperative, the college continues to increase its use (and creation) of technology driven knowledge resources.
8. Enrich Our Campus
    - Certainly the Mitchell Buildings enhanced the Vision 2020 goal of "Planning buildings and physical facilities that are recognized for their excellence" (pg. 53).
9. Build Community and Metropolitan Connections
    - This imperative is a university-wide program.
10. Demand Enlightened Governance and Leadership
    - While none of our goals specifically address this imperative, the participation of members of our college in campus governance (particularly Faculty Senate) continues to grow.

11. Attain Resource Parity with the Best Public Universities
    - Much of this imperative must be addressed at the highest levels of the university and the Texas A&M System, but our college will continue its very strong efforts in obtaining research and private funds.
12. Meet our Commitment to Texas
    - A look at the long list of engagement strengths in section 4 above shows how our college is enhancing this imperative.

7. Relationship to Overarching Themes of Academic Master Plan

In this section we briefly discuss how our goals (and to some extent existing processes) align with the five overarching themes of the Academic Master Plan.

Theme 1: Develop human potential and diversity at Texas A&M to ensure the highest quality environment for workplace productivity, learning, and discovery.

Strategies:

1. Recruit, mentor, and professionally develop a diverse and high-achieving community of faculty, staff, and students through an environment that fosters quality of life and work/life balance and encourages the campus community to have broad knowledge of and be engaged in updating and developing comprehensive campus plans, such as:
   - Campus Diversity Plan
     - This is our Goal 4.
   - Comprehensive Enrollment Management Plan
     - Our study of service courses in Goal 5 should be an important part of the university's enrollment plan.
   - Faculty Merit and Advancement Plan
     - The College of Science consistently commits funds for proactive retention of our outstanding faculty.
   - Student Enrichment and Retention Plan
     - This is Goal 5.
   - Taskforce on Strengthening Our Graduate Programs
     - This is Goal 2.
   - Staff Retention and Advancement Plan Report from Task Force on Enlightened and Shared Governance
     - Retention and advancement of our extraordinary staff is always of importance to the College of Science. We strive to do everything possible in this area.

2. Modify the evaluation process for faculty to give appropriate credit to pedagogical achievement and to participation in multidisciplinary programs and the scholarship of engagement.

- Each of our departments has done this in the past few years.

Theme 2: Expand the global perspective of students, faculty, and staff through involvement in international initiatives and exposure to international experiences that enhance scholarship and experiential engagement.

Strategies:

1. Facilitate and expand a menu of credit-bearing opportunities, varied in duration and credits, led by Texas A&M faculty and offered by U.S. and international partners.
    - This is part of the study in Goal 5.

2. Expand the collaborative efforts across academic affairs and student affairs to offer greater opportunities for students to engage in a variety of experiences that enhance their well being, intellect, and responsibility to serving the global society.
    - This is part of the study in Goal 5.

3. Facilitate the opportunities for scholars to initiate and develop academic and research collaborations to enhance Texas A&M's progress in research and pedagogical excellence.
    - The College of Science is a leader in this area - almost every faculty member has international collaborations. We have started a survey to determine the full extent of these collaborations.

Theme 3: Enhance facilities and infrastructure to support the learning, discovery, and work environments across campus.

Strategies:

1. Ensure that organizational structures and participation processes promote strategic and timely decisions on infrastructures that support excellence in pedagogy, research, and engagement.
    - We look forward to VPR Seemann's study of research infrastructure. Our PreK-20 activities will continue to go on.

2. Develop an organizational structure that enhances a culture of responsible and innovative decisions with respect to developing new facilities and renovation, maintenance, and reallocation of existing facilities.
    - This is part of Goal 1.

Theme 4: Marshall financial resources to provide the best value in teaching and learning, research, and engagement opportunities.

Strategies:

1. Develop an organizational structure that considers both groundwork and communication to enhance funding growth from all possible sources and for all missions of the university.
    - We will continue to be part of this university wide activity, particularly in research funding, philanthropy, distance education, etc.

2. Develop an organizational structure that enhances a culture of responsible resource allocation and accountability and that ensures stability in activities and allows for nimble organizational response to new opportunities.
    - The College of Science retains 20% of IDC which it uses as matching dollars and for research infrastructure support to increase faculty success at obtaining extramural funding. The college also centrally holds 10% of IEEF funds for new opportunities in the educational arena.

Theme 5: Provide comprehensive programs that increase the breadth of excellence in the discipline while continuing to maintain and strengthen existing disciplinary excellence.

Strategies:

1. Evaluate the feasibility of and make recommendations about existing and new educational programs that add excellence and capitalize on the strengths of Texas A&M University.
    - We will continue to work toward our PhD in Astronomy, as well as developing an interdisciplinary program to produce secondary STEM teachers.

2. Ensure the full mental, physical, and emotional development of all stakeholders of Texas A&M University.
    - An ADVANCE proposal was submitted to the National Science Foundation to advance women in STEM fields by promoting a psychologically healthy workplace.

8. Relationship to Academic Master Plan Roadmaps

In this section we briefly describe the alignment of our plan with the Teaching and Learning, Research, and Engagement Roadmaps.

Teaching and Learning Roadmap
Goal: Texas A&M will foster a learning environment and enriched educational experiences conducive to the development of responsible, reflective, and respectful lifelong learners as demonstrated by their achievement of common learning outcomes.

Strategies:

1. Define a rich set of pathways toward achievement of identified and recommended

university undergraduate and graduate student learning outcomes.
    - This is part of Goal 5.

2. Support faculty innovations and enriched, high impact, curricular options for all students.
    - This is part of Goal 5.

3. Enhance graduate and professional learning and development experiences.
    - This is part of Goals 2 and 5.

4. Enhance opportunities for faculty members to strengthen existing and develop new approaches and skills for teaching, particularly in ways that incorporate scholarly findings in pedagogy and technological innovation.
    - The new instructional faculty titles will give recognition to non-tenure track faculty. The College is always pursuing grant opportunities to pursue pedagogy (Math STEP). We strive to recognize all of our faculty activities by nominating them for both TAMU and external awards.

5. Design and implement plans for assessing teaching effectiveness and student achievement of the University Learning Outcomes.
    - This is part of Goal 5.

6. Promote continuous improvement through appropriate administrative structures.
    - The College of Science will implement a plan by which departmental administrators are evaluated and rewarded (ie held accountable) for effective management of their teaching programs.

7. Enhance scholarship support and preserve the university's reputation for a best-value education in order to actively recruit and advance a high-achieving student body that reflects the diversity of the state and nation.
    - We have been very successful in this area over the past ten years and will redouble our efforts.

Research Roadmap

Goal: Texas A&M will achieve preeminence in discovery, creativity, and in the advancement of fundamental understanding—both across and within disciplines—to improve lives and society in the 21st century.

Strategies:

1. Employ a continual dynamic process, which considers existing strengths, emerging priorities, and commitment to the comprehensive research mission of Texas A&M, to identify multidisciplinary research areas for targeted personnel and infrastructure investments that can achieve worldwide recognition and impact.
    - A major part of our Goal 1 will be devoted to this.

2. Improve disciplinary representation in research administration to include the sciences, social sciences, humanities, and related areas.
    - We have two faculty on the TAMU System task force on research administration and we expect to continue to be involved in a significant way.

3. Support institutional mechanisms to promote excellence in multidisciplinary and multimodal research, especially those that simultaneously reinforce the disciplinary excellence of the colleges and schools.
    - This is a major focus of Goal 1.

4. Reinforce the importance of being a comprehensive research university by recruiting and retaining a diverse community of world-class scholars in areas of existing and emerging strengths.
    - This is Goal 4.

5. Increase and enhance the involvement of graduate and undergraduate students in fundamental discovery.
    - This is part of Goal 5.

6. Enhance the physical, virtual, human, and organizational infrastructure to support the discovery mission
    - All of our goals directly impact this.

Engagement Roadmap

Goal: Texas A&M University will elevate its land-, sea-, and space-grant mission by enhancing the quality of and recognition for the scholarly engagement in professional and university service, outreach and practice of its faculty, staff and students

Strategies:

1. Expand the current paradigm of service to an inclusive, mutually beneficial, proactive pursuit of scholarly engagement.
    - We are constantly trying to do this (see item 3 below).

2. Develop administrative support mechanisms to facilitate and articulate the engagement enterprise.
    - The College of Science already has an annual reporting mechanism coupled with an extensive database that highlights achievements in engagement and other realms.

3. Recognize and reward faculty for appropriate contributions to scholarly engagement.
    - We are fortunate to have many faculty serving on grant reviews panels as

well as chairing important state and national advisory committees, etc.

4. Promote elements of the models used successfully by the agencies in agriculture and engineering to focus upon community needs-based, high-impact, self-sustaining engagement programs.
    - This would fall primarily in our many Educational Outreach activities.