

COMPACT FOR THE SCHOOL OF NATURAL SCIENCES AND MATHEMATICS

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I. Introduction

The School of Natural Sciences and Mathematics (SNSM) comprises six departments (Biology, Chemistry, Geosciences, Mathematics/Statistics, Physics, and Science/Math Education), six externally funded centers/institutes (Space Sciences, NanoTech Institute, Lithospheric Studies, Sickle Cell Disease Center, Applied Biology, and Quantum Electronics), and the recently launched Institute for Biomedical Science and Technology. There are 80 T/TT faculty and 18 Senior lecturers, representing 14% of the University total. Seven of UTD's 33-chaired professors are in SNSM. The School offers 31 degrees across all levels (BA, BA, MA, MS, MAT, PhD) that account for approximately 22% of the University's total student semester credit hours (SSCH) in recent years. In SNSM these are distributed approximately as follows: UG (26%), Masters (10-15%), PhD (20%). Headcount distributions (as % of University totals) for Spring 2003 were 10% (UG), 5% (Masters), and 17% (PhD). The SNSM faculty attracted > \$13.3 MM in externally funded contracts and grants (C&G) in FY2003, which represented 47% of the University's total.

SNSM must play an important role in UTD's quest to achieve Tier I status in the next decade. Its contributions will come at the school level, through interactions with other schools at UTD, and through enhanced connections with UTSW. The underlying strategy requires growth in faculty, student numbers, and C&G, as well as larger and improved facilities. Without all of these, UTD's ascendancy to Tier I will be unacceptably delayed. A key factor will be enhancement of interdisciplinary research thrusts. Growth and resources will be focused in several targeted areas compatible with UTD's stated themes for research excellence including modern materials and instrumentation, biochemical/biomedical areas, and science education, all of which will rely upon recent and future initiatives. An Associate Dean for Interdisciplinary Programs has recently been appointed in SNSM to coordinate these efforts across and between the School(s).

II. Goals and strategies

A. Faculty hires

Over the next ten years, SNSM needs to double its faculty size, including replacement of retirements. Future faculty hires must be a strategic balance between senior and junior levels with adequate resources provided at both. Hiring at the senior level has the advantages of immediate credibility, leadership, mentorship of existing and future junior faculty, and substantial C&G productivity. The addition of Alan G. MacDiarmid (Y2K Nobel Laureate in Chemistry) as the James Von Ehr Distinguished Chair in Science and Technology and Professor of Chemistry and Physics instantaneously elevated UTD's visibility in the scientific community. *Future senior hires will be in areas that span disciplines within SNSM, especially materials, and bioscience and technology; across schools (Electrical Engineering/Computer Science, and Brain and Behavioral Sciences); and across institutions (UTSW).* Although such hires require substantial initial investments in terms of facilities and instrumentation, "start-up" funding, and

chaired positions, they can nevertheless jump-start targeted research thrusts. This approach was followed in the highly successful model by which UTD launched the NanoTech Institute (NTI) two years ago. Under the leadership of two world-class senior faculty hires, Ray Baughman (Robert A. Welch Chair Professor of Chemistry and director of NTI) and Anvar Zakhidov (Professor of Physics and co-director of NTI), this young Institute has already established itself as a center for interdisciplinary research with faculty from Chemistry, Biology, Physics, and Electrical Engineering focusing on the synthesis and processing of advanced nanostructured materials, the structure and property characterization needed for materials optimization, the fabrication of sophisticated structures, and device testing in such diverse areas as energy harvesting, storage, transmission, and conversion, as well as carbon nanotube artificial muscles, carbon nanotube/biological molecule composites, and carbon nanotube composite fibers. Continuing this trend, two senior hires in Biology made in 2002, Professor Steven R. Goodman (C. L. Amelia A. Lundell Professor of Life Sciences) and Professor Betty Pace, have led to the establishment of the NIH-funded Sickle Cell Disease Center (joint with UTSW) and the Institute for Biomedical Science and Technology that comprises researchers from the Schools of Natural Sciences and Mathematics, Brain and Behavioral Sciences, Management, and Engineering and Computer Sciences.

Action item: (*Short term*) Over the course of the next two years we will fill the second (already funded) Welch Chair in Chemistry with a researcher who works at the interface of Chemistry, Biology, and Engineering. A hire at this level would require approx. \$1MM for start-up and instrumentation. Space will become available in Berkner, as described below, but would require renovation.

Action item: Up to 50% of the 40 new chaired professors that the Erik Jonsson School of Engineering/Computer Science will be adding will also hold joint appointments in SNSM, most likely in Chemistry, Physics and Biology, and will work in “interface areas” between the Schools, such as Materials Science and Engineering, and Bio (medical) Engineering. These faculty members will occupy space in the planned Natural Sciences and Engineering Research building.

Action items:

- (*Long term*) The size of the Chemistry faculty (currently at 15 T/TT) will be doubled over the course of 10 years, which requires adding approximately 20+ new faculty total (senior and junior), taking into consideration likely retirements. Hires at the senior and junior levels will be made, guided by the focus areas for SNSM. It is anticipated that several of these hires will be joint appointments with EE/CS as Materials Science comes online. The rate of these hires will be controlled by several factors including student enrollment and space. Until new facilities become available thus releasing space in the Chemistry building (*vide infra*), housing new faculty there will be problematic. Partial relief is anticipated with the relocation of Biology, Geosciences, and Physics personnel currently in Berkner into facilities under consideration at Waterview Plaza. Expansion of Chemistry, where appropriate, into the planned Natural Sciences and Engineering Research Building is anticipated. *Major relief in space constraints in Berkner, however, would require relocation of the UG teaching laboratories into another facility.*

- (*Short term*) At least one faculty member in Chemistry will be added per year for the next 3 years. If made at the junior level, each would require approximately 600 – 1000 sf of renovated lab space and approx. \$250K in start-up funds.
- (*Long term*) The size of the Biology faculty (currently at 17 T/TT) will be doubled over the course of 10 years. It is anticipated that several of these hires will be joint appointments with EE/CS as Bio (medical) Engineering comes online. Others will be joint appointments with Chemistry or BBS, where appropriate. Space constraints on the rate of hiring into this department are severe as there is no room in Founders for new faculty.
- (*Short term*) At least one faculty member will be added per year for the next 3 years. If made at the junior level, each would require approximately 600 – 1000 sf of renovated lab space and approx. \$250K in start-up funds. Relocating MCB into Waterview Plaza over the next 2-3 years will then allow accelerated hiring at senior and junior levels.
- (*Long term*) The size of the Physics faculty (currently at 17 T/TT) will be doubled over the next 10 years. As numerous retirements of senior faculty are anticipated over this time period, this will require aggressive recruiting. Hiring at both the senior and junior levels in *focused thrust areas* including materials, biophysical, and engineering physics will be pursued. Hires into the Center for Space Sciences will be made primarily as replacements for retirements or as deemed necessary to support large projects. High-energy physics will not be a growth area.
- (*Short term*) Recruitment of a strong department head will be a priority over the next three years. A chaired position is anticipated. One faculty member will be added per year for the next two years. If made at the junior level, each would require approximately 600 – 1000 sf of renovated lab space and approx. \$250K in start-up funds. Relocating to Waterview Plaza over the next 12 months will allow accelerated recruitment.
- (*Long term*) The size of the Geosciences department (currently at 13 T/TT) will increase by 50%. Interdisciplinary interactions with EE/CS in areas such as parallel computation, 3-D graphics, simulation, imaging and signal processing will be engendered. (*Short term*) Over the next three years, one faculty member will be added in each of their identified thrust areas: reservoir characterization, remote sensing, and environmental geochemistry. If made at the junior level, each would require approximately 600 – 1000 sf of renovated lab space and approx. \$250K in start-up funds. A joint proposal with Social Sciences and EE/CS on GIS/GPS will soon be submitted and (joint) faculty hires into this area are anticipated.
 - One-to-two additional faculty will be hired into the Mathematics department in each of two areas: Statistics, and Bioinformatics/Computational Biology. Interdisciplinarity in these hires will be emphasized.
 - UTD has recently hired Professor Russell Hulse (1993 Nobel Laureate in Physics) as a Visiting Professor. He will work with the university's Science/Mathematics Education Department, in concert with local school districts – including the Dallas Independent School District – in an attempt to determine the best methods for teaching science and math to children. The Department of Science/Mathematics Education has a pending PhD proposal along these lines. It is anticipated that two new SciEd faculty will be added in the first few years of the program. The SciEd faculty will work closely with

Dr. Hulse to plan funding and program strategies. Space and facilities will be required. External recruitment of a Department Head is anticipated over the next 2 – 3 years. One of the shorter-term goals of the Sci/Math Ed department is the establishment of a Center for Science Education Research, which would involve reallocation of one faculty member to serve as director.

B. Graduate student recruitment

SNSM must increase both the quantity and quality of its graduate students. Attracting excellent students to SNSM is a multifaceted endeavor. The best strategy is to improve the quality of the faculty, especially in research, and to get the word out. Faculty will be strongly encouraged to disseminate their work as widely as possible through seminars, scientific meetings, and organizing symposia on campus. Graduate students need to be provided funding to attend and present at scientific meetings. Competitive stipends are a must as is tuition relief. Flexibility will be given to the Department Heads to determine TA stipend levels to make them more competitive (although the total available TA funds are anticipated to remain constant in the near term). Higher stipend levels should result in attracting better (albeit fewer) applicants. The University-provided Teaching Assistantships will be earmarked for recruiting incoming classes. Transitioning students to C&G support (*vide infra*) by the end of their second year at the latest will be the operating policy of SNSM. An Associate Dean for Graduate Student Affairs in SNSM has recently been appointed to develop recruiting strategies for the School. An expanded use of EEF funds, awarded on a competitive basis, to supplement stipends for the very best students is one strategy under consideration.

C. Increasing C&G

If UTD is to achieve Tier I status, it must dramatically increase the C&G attracted by the University and increase the production of high quality PhD's. Currently 47% of the \$28MM in C&G that the University attracted in FY 2003 came from SNSM. This total needs to be increased by a factor of 3-4. The targeted addition of new faculty in recognized growth areas will result in an increased reputation for the School. Senior level hires are expected to arrive with significant C&G in hand and the prospects of attracting much more through the initiation of larger (interdisciplinary) projects within and across the School(s). The policy of supporting graduate students after their second year on C&G will encourage faculty to seek more funding, and to use it to support the best graduate students. Thus quality and eventually quantity of graduate students will increase, as will the University's research reputation. The University can assist in this by returning to the PI's 100% of the overhead on that part of C&G used to support graduate students. These funds should be designated for use in enhancing the research program, especially in providing travel funds for graduate students to attend and present at scientific meetings.

D. Facilities and Infrastructure

SNSM occupies some of the oldest and least functional space on campus. The Founders Building, which was dedicated in 1964, still houses the original departments of the

Southwest Center for Advanced Studies (Space Sciences/Physics, Molecular Biology, and Geosciences/Geophysics) and is now woefully inadequate for its present occupants and unthinkable with respect to projected expansion of these departments. There are fire and life safety issues that require immediate complete renovation of ventilation, electrical and plumbing. Labs are antiquated. The Berkner building, dedicated some 10 years later, primarily houses Chemistry and the NanoTech Institute (NTI). Some 12,500 sf have recently been renovated to accommodate NTI but any serious expansion of this group or Chemistry in Berkner will be delayed until space can be released by relocating groups from Biology, Geosciences and Physics. In fact, this space will only allow us to accommodate the second Welch Professor and the planned labs of Alan MacDiarmid. Ultimately the only major space relief in Berkner will come from relocating the UG Chemistry teaching labs to another facility.

The present situation with regard to facilities for SNSM is grim. Several scenarios are being explored on how to provide modern facilities for SNSM and one current plan is to acquire the Waterview Plaza complex, some 0.9 miles from the central campus and relocate the occupants of Founders there. This complex has over 250,000 gsf spread over several buildings. Several departments in SNSM (Physics, Space Sciences, Geosciences) can be relocated there in a matter of months with relatively minor modifications to the facility. The construction of wet lab space for Biology, by far the most expensive proposition, would take 18-24 months to complete. A new Natural Sciences and Engineering Research Building is on the drawing boards. This approx. 200,000 gsf building is intended to be a state-of-the art research facility. The future occupants of this building have yet to be determined but it is envisioned that several SNSM groups that will be involved in the interdisciplinary programs with Engineering and can benefit from the research facilities therein (e.g., Materials: portions of Chemistry and Physics; Bio (medical): portions of Biology) are likely to be housed there. A move to the Waterview Plaza complex would represent a major, though not unworkable, shift in the center-or-gravity for the research efforts of SNSM, away from the central core of the campus. Eventually as UTD builds out toward the north, this will become less evident. This facility will not house any classrooms or UG teaching labs, so accommodations for these must be made. One potential solution is to completely vacate and then renovate the Founders building into a general classroom/laboratory facility for SNSM. UG teaching labs for Biology, Chemistry, Geosciences and Physics would thus be consolidated into one building as opposed to being spread across the campus. Modern AV capabilities, large lecture halls (with some equipped for lab demonstrations), and centralized support areas including stockrooms are desirable. The Mathematics department, which services the UG math program at UTD, could also be housed in this facility, thus releasing the space they currently occupy in ECS.