STRATEGIC PLAN

for the

ACADEMIC ENTERPRISE

at

VANDERBILT UNIVERSITY MEDICAL CENTER
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at Vanderbilt University Medical Center

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EXECUTIVE SUMMARY

Vanderbilt University Medical Center (VUMC) has engaged in a strategic planning process in support of its academic enterprise. Spectacular changes have occurred within our institution over the last decade that have allowed us to rise and sustain our position of one of the finest academic health centers in our country. The goal is to further improve our competitiveness and recognition in research, education, and technology transfer. It has been most helpful for the clinical enterprise to engage a large number of faculty and diverse medical center constituents in a grassroots process for defining a plan for positioning ourselves to deal with the changing environment. A similar strategic planning process for the academic enterprise of the Vanderbilt University School of Medicine was initiated to develop a plan to serve as a blueprint for future development. The charge was to identify goals and strategies to position VUMC among the top ten academic health centers in the nation in the next decade. Faculty, trainees, and staff participated in nine task forces, or work days and focus groups hosted by these task forces: 1) Basic Science Initiatives; 2) Basic Science Research in Clinical Departments; 3) Clinical Research; 4) Health Professional Education (preclinical, clinical and specialty training); 5) Graduate and Post-Graduate Education (basic Sciences); 6) Technology Transfer; 7) Faculty Evaluation, Promotion and Tenure; 8) Culture, Diversity & Infrastructure; and 9) Community Outreach. It was anticipated from the outset that the recommendations of the Strategic Plan for the Academic Enterprise would be linked with the outcomes of strategic planning for the clinical enterprise and the Vanderbilt University School of Nursing, while also exploring collaborative ventures with other schools of Vanderbilt University that would increase our research and educational portfolio and facilitate achieving our institutional objectives for the next decade.

An astounding number of faculty, fellows, students and staff contributed to the planning process at various levels, and have done so with enthusiasm. This broad-based participation has enhanced the breadth and creativity of new programs and cultural transitions recommended in this document. The extent of interest and time-consuming effort voluntarily contributed to this process by literally hundreds of individuals, including clinicians, basic science faculty, medical and research trainees, and staff honors Vanderbilt University Medical Center by this demonstration of institutional commitment and suggests that implementation of the recommendations in this strategic planning document will be facilitated by the grassroots origin of much of its content.

For clarity of presentation, the recommendations of the nine task forces have been grouped into four initiatives: Biomedical Research, Biomedical Education, Technology Transfer, and Academic Life. The goals for each initiative are followed by suggested strategies for accomplishing the goals.

The broad goals for biomedical research are to: 1) identify strengths and focus recruitment on key areas of greatest importance for future development; 2) improve our ability to retain
outstanding faculty through enhanced faculty support and incentives; 3) foster interdisciplinary research; and 4) enhance infrastructure that supports all areas of biomedical research, including special initiatives that support clinical research. The areas of biomedical research targeted for enrichment to assure our competitiveness in future decades are genetics, computational biology for enhanced utilization of genome databases, structural biology, neurosciences, developmental biology, signal transduction, and interdisciplinary centers that foster bench to bedside research. Recommended changes in infrastructure that would facilitate all biomedical research include the appointment of a senior administrative official with visionary and budgetary authority over both basic and clinical research, the fostering of additional interdisciplinary units such as centers and program projects, an expansion of core facilities with partial institutional support, the creation of an Informatics Core Facility for Biomedical Research, the establishment of intramural grant programs, an increase in the number of endowed chairs, and the institution of frequent reviews of departments, multidisciplinary research programs, faculty and core facilities involving intra- as well as extramural advisory teams. Infrastructure enhancements needed to specifically support clinical research include the creation of a Clinical Research Office, relocation of the General Clinical Research Center to a central clinical location, a facilitation of the approval processes for clinical trials, and improved access to high technology at a more affordable research cost.

Academic health centers possess unique opportunities, as well as responsibilities, to link new research knowledge to the betterment of human health. Proposals in this strategic plan that promote entry of MDs and MD/PhDs into investigative careers will foster the development of clinician investigators poised to assure the continuum of bench to bedside research. Greater medical student participation in basic and clinical research would be encouraged by an MD with thesis program, where an additional year of laboratory training is balanced with waiving the fourth year medical school tuition. Establishing Physician-Scientist Postdoctoral Training Programs in tandem with residency and fellowship programs, paralleling competitive salaries with intense research training opportunities under the mentorship of leading scientists, would attract clinically-trained individuals nationwide who discovered research late in their medical training as an attractive career path, and would position Vanderbilt Medical Center as the optimal training environment for disease and problem-oriented basic science and clinical research. Finally, attracting the best and the brightest physician scientists to Vanderbilt's faculty could be achieved by establishing a Physician-Scientists Faculty Scholar program that provides entry level faculty who bridge clinical medicine and basic research with three years of protected time, and resources, to initiate their research programs before engaging in clinical activities.

The overall goals for the enhancement of biomedical education at VUMC are to: 1) sustain and enhance an outstanding medical curriculum; 2) promote entry of physicians (M.D.s and M.D./Ph.D.s) into investigative careers, discussed above; 3) enlarge and enhance the interdisciplinary graduate program; 4) create new multi-disciplinary Ph.D. granting programs; and 5) improve quality of the postdoctoral training experience, including offering space and appointment opportunities to facilitate bridges to independence for our most talented post-doctoral trainees. Evaluation of the preclinical curriculum, including the possible utility of an interdisciplinary approach, was recommended. Changes in the clinical environment will require greater educational opportunities in ambulatory settings and preparation for the managed care environment. Fostering diversity in the medical school class is considered a significant priority, with development of scholarship aid as an essential component of this initiative.

To Enhance Our Interdisciplinary Graduate Program (IGP), we propose an increase in the number of IGP students to parallel growth in faculty and in diversity of career opportunities for broadly trained scientists emerging from discovery-based training programs. Since the IGP was established in 1991, the number of faculty preceptors, recruited to Vanderbilt in part because of their interest in mentoring junior scientists, has grown by 25% while the number of IGP students has remained constant. We also propose reinstatement and enhancement of summer research programs for undergraduates to aid in recruiting graduate students, including under-represented
minorities. Creating new multidisciplinary PhD-granting programs (e.g., in neuroscience and genetics), in parallel with departmentally-based programs, will facilitate our national visibility in these emerging areas of research opportunity as well as enhance our recruiting of talented students particularly interested in these interdisciplinary research areas, especially amenable to bench to bedside research. A more stable funding base for the graduate program is desperately needed.

Our biomedical education initiatives include the need to enhance our community outreach to establish a locally valuable and nationally utilized program in education and service in the biomedical sciences. It is important that we share our expertise with the community in order to encourage a positive appreciation of the roles and contributions of scientists and physicians and to encourage our youth to explore research and patient care as intellectually and emotionally gratifying careers. Suggested strategies to achieve these goals are to establish an Office of Outreach to facilitate community linkages and greater volunteer participation and to serve as the center for preparation of grant proposals for extramural funding of these programs.

Several goals are envisioned as key to advancing technology transfer at VUMC: 1) educate faculty and trainees that sharing the benefits of our advances in research, educational design, and clinical care is, ethically, an expectation; 2) utilize technology transfer as a source of goodwill in Nashville, regionally, and nationally; and 3) utilize technology transfer as a revenue source for facilitating research and education. Establishing a flexible and effective Office of Technology Transfer within the Medical Center; developing a Proof-of-Concept Fund to support the development of promising ideas or technologies for obtaining patents and transfer to industry; creating an infrastructure to facilitate technology transfer; developing local, regional and national commercialization networks; and prominently espousing technology transfer in the missions statement of the Medical Center are all recommended as important initiatives for advancing technology transfer at VUMC and contributing, as expected, our advances in research, education and clinical care to society.

In the area of academic life the issue of governance was addressed. The growth of our faculty, the continually expanding success of our research programs, and the rapidly changing clinical environment require increased leadership efforts not only to implement ongoing programs but to develop a cogent vision for the future and make hard choices about how to achieve that vision. We recommend that three senior administrative officials be appointed, preferably as a result of an aggressive national search, to provide visionary and financial oversight of biomedical research, biomedical education, and technology transfer. These individuals would report to the Vice-Chancellor of Health Affairs in parity with a single senior administrative official representing the clinical enterprise. Because of the need for better mechanisms to plan interdepartmental initiatives, we recommend that, on a quarterly basis, the chairs of the basic science and clinical departments and directors of centers with significant research and patient care responsibilities meet with the Vice-Chancellor and these four senior administrative officials, preferably in an off-site, day-long retreat. The purposes of these quarterly meetings are to recommend areas for growth and development, to react to consequences of intentional as well as unanticipated changes in the national and our local environment, and to become fully informed as to the status of ongoing trans-institutional initiatives and projections for the future.

The question of tenure received a great deal of attention. The recommendation was that tenure should be retained, primarily because it is needed for us to be competitive in continuing to recruit outstanding faculty. Importantly, it also is recommended that the practice of awarding tenure be modified so that appropriate recognition is given for contributions to all of our missions, including teaching, clinical care, clinical trials research, and technology transfer as well as for original basic research. This is consistent with current University policy on awarding of tenure; however, clarification of criteria for awarding tenure is needed to provide appropriate recognition for contributions that make a national impact in any and all of our important missions. The Institution has an obligation to tenured faculty and the task force recommended a better definition of this.
obligation; tenured faculty also have an obligation to the Institution. There are two noteworthy aspects to the balance of benefits and obligations: first, we should reward our highly productive faculty, and an annual performance review provides a means for affirming those who are contributing and how. Second, better mechanisms for counseling and assisting the very small percentage of faculty who are not meeting their obligations as tenured faculty are recommended, with explicit guidelines for addressing those faculty who fail, over the long term, to maintain the level of productivity appropriate for an academic medical center aspiring to the top ten of the nation.

There was strong sentiment among the faculty that we must enhance diversity (gender, race, ethnic background) among administration, faculty, students, and staff and foster appreciation for contributions to all of the missions of our institution. The recommended strategies to achieve these goals are to create an Office of Diversity to foster recruiting, retention and appreciation among the institution's constituents; and to develop resources and mechanisms to successfully implement minority student scholarships and minority faculty grants.

The desired outcome for the Strategic Plan for the Academic Enterprise is that it serve as a blueprint for development of research and education within the Medical Center over the next decade. In concert with strategic planning initiatives for the Clinical Enterprise and within the School of Nursing, this process will strengthen our efforts in accomplishing our three institutional missions: Research, Education, Clinical Care -- sharing our advances in these three missions with society at large via technology transfer. Vanderbilt University Medical Center has flourished over the past decade and a half under strong and visionary leadership with major investments in buildings and program development involving the recruitment of outstanding faculty, trainees and staff. This leadership-inspired growth and enrichment has made the development of this strategic plan possible; its implementation will place Vanderbilt among the top ten academic health centers nationwide.

In summary, the strategic plan for VUMC proposes a series of ambitious goals for the next five to ten years:

- develop a research and teaching approach that offers a unique perspective on life sciences, one whose interdisciplinary vision will create new research, educational and technology transfer opportunities for faculty as well as trainees;
- recruit faculty in key areas of modern biological research who will maintain the high standards that have characterized VUMC and provide new and existing faculty with the supportive environment that will encourage discovery;
- provide a senior administrative leadership and enhanced infrastructure that facilitates new research initiatives and permits us to compete even more successfully for increased research support;
- reward faculty for extraordinary research, educational and clinical productivity while protecting the academic mission;
- refashion the curricula and provide a powerful new model for biological and health professional education; and
- assume a leadership role in addressing the growing shortage of talented young men and women of all races entering professions in biomedical research and health care delivery.
Strategic Plan for the Academic Enterprise at Vanderbilt University Medical Center

OVERVIEW

I. Purpose

Vanderbilt University Medical Center (VUMC) has committed to engage in a strategic planning process in support of its academic enterprise. Spectacular changes have occurred within our Medical Center over the past several years and they have allowed us to rise to and maintain a position among the top medical schools in the country. The goal is to improve our competitiveness in critical aspects of research, education and technology transfer within the next few years such that we are recognized as being among the top ten medical schools in this country, serving as a national model for research, education, patient care and transfer of new knowledge to the betterment of human health. The rates of generation and acquisition of new knowledge are accelerating ever more rapidly, and we must position ourselves to not only take advantage of these advances but in fact contribute to and accelerate these advances as a leading academic health center.

It has been most helpful for the clinical enterprise to engage a large number of faculty and diverse medical center constituents in a grassroots process for defining a plan for positioning ourselves to deal with the changing environment. The Strategic planning effort for the clinical enterprise of the School of Medicine, completed in 1996, resulted in the formation of the Vanderbilt Medical Group (VMG) and explicit recommendations for improving the quality, while reducing the cost, of medical care. In addition, the Vanderbilt University School of Nursing (VUSN) completed a strategic planning process for all of its missions in 1995, and began its implementation this year. A similar strategic planning process for the for the academic enterprise of the Vanderbilt University School of Medicine was initiated to consider all aspects of current research, education, and technology transfer and to develop a plan to serve as a blueprint for future development.

II. An Integrated Approach

The charge to the Task Force on Strategic Planning for the Academic Enterprise acknowledged the decisive importance of unified planning. Though basic science and clinical research, clinical care, and education are distinct pursuits, they are mutually informing and interdependent. The continued excellence of each depends upon the health and well-being of the others. The Task Force was asked to consider the assets of VUMC as a whole - human and capital - in order to propose ways to nurture the best possible basic science and clinical research and to provide a first-rate educational experience for graduate and health professional trainees.

The success of our most distinguished programs results directly from the lab bench-to-bedside interaction that has characterized the Vanderbilt School of Medicine from its establishment on the
Vanderbilt University campus in 1925, not just in the obvious medically-related research activities, but in the most basic elements of our research. The national and international stature, research and educational awards that accompany our varied endeavors cannot be underestimated. Rankings in U.S. News & World Report and articles in the local press, as well as the international attention garnered by breakthroughs, all underscore the benefits of this integrated approach. Ensuring the continued excellence of both clinical and academic pursuits will require resource development and intentional integration of our constituent efforts including linking basic with clinical research, research programs with research education, and research education with education of health care professionals.

It is recommended that the Vice Chancellor appoint a special Advisory Group for Implementation and Ongoing Evaluation to examine concrete ways to link the initiatives of this Strategic Plan for the Academic Enterprise of VUMC with those recommended by the Clinical Enterprise of VUMC and by VUSN to assure that we remain an integrated academic medical center with a shared vision. Similarly, this Advisory Group for Implementation and Ongoing Evaluation would examine ways to bridge efforts with the College of Arts and Sciences, the School of Engineering, Owen School of Management, Vanderbilt University School of Law, and Peabody College to draw on the talent and the diversity of our own institution to achieve the missions of VUMC with excellence. Examples of potential integrative efforts are identified in subsequent sections of this strategic planning document.

III. Procedure and Topics

A. Task Forces and Members

At the invitation of Deputy Vice Chancellor Harry Jacobson and Dean John Chapman, in consultation with Vice Chancellor Roscoe R. Robinson, Drs. Lee Limbird and Hal Moses were asked to chair a Parent Committee and oversee the strategic planning process. Initially seven task forces were established, but ultimately nine task forces were assembled to identify initiatives and programs that need to be undertaken to move creatively and successfully into the future. Listed below are the names of the individuals who served as chairs and co-chairs of the task forces:

Graduate and Post-Graduate Education in the Major Basic Science and Disciplines:
- Elaine Sanders-Bush, Ph.D., Chair
- Jack Hawiger, M.D., Ph.D., Co-Chair

Technology Transfer:
- Lawrence J. Marnett, Ph.D., Chair
- Thomas O. Daniel, M.D., Co-Chair

Health Professional Education:
- Doyle G. Graham, M.D., Ph.D., Chair
- Gerald B. Hickson, M.D., Co-Chair
- Kenneth W. Sharp, M.D., Co-Chair

Basic Science Initiatives:
- Michael R. Waterman, Ph.D., Chair
- Daryl K. Granner, M.D., Co-Chair

Basic Research in Clinical Departments:
- Raymond N. DuBois, Jr., M.D., Ph.D., Chair
- Alfred L. George, Jr., M.D., Co-Chair
Clinical Research:  
David H. Johnson, M.D., Chair  
Martin P. Sandler, M.D., Co-Chair  
Joseph A. Smith, Jr., M.D., Co-Chair

Promotions, Tenure, Evaluation of Faculty Performance:  
Lynn M. Matrisian, Ph.D., Chair  
Martin J. Blaser, M.D., Co-Chair  
Neil E. Green, M.D., Co-Chair

Culture, Diversity, and Infrastructure:  
Mark Magnuson, M.D., Chair  
Agnes Fogo, M.D., Co-Chair

Community Outreach:  
Virginia L. Shepherd, Ph.D., Chair  
Jeffrey D. Fritz, Ph.D., Co-Chair

An astounding number of faculty, fellows, students and staff contributed to the planning process at various levels, and have done so with an enthusiasm and perspicacity that has enhanced the breadth and creativity of new programs and cultural transitions recommended in this document. The interest and time consuming effort voluntarily contributed to this process by clinicians, basic science faculty, medical and research trainees, and staff honors Vanderbilt University Medical Center by the extent of the commitment of the participants, and suggests that implementation of the recommendations in this strategic planning document will be facilitated by the grassroots origin of much of its content.

B. Methodology

The process began April 20, 1996, with a workday involving the chairs and co-chairs of the Task Forces and other invited participants. There was open discussion of the charges to each Task Force, additional issues to address, and potential interrelationships among these Task Forces. Multiple strategies of engaging broad-based input from faculty, students, staff, and administrators were recommended. This workday effort was facilitated by Dr. Richard Daft, Director of the Center for Leadership and Organizational Transitions in the Owen School of Management, Vanderbilt University. Chairs and Co-Chairs of the Task Forces then met bi-weekly with Drs. Limbird and Moses to coordinate efforts and exchange ideas useful for accomplishing the goals of multiple work groups; this group is referred to as the Parent Committee.

The individual task forces utilized a variety of means to obtain broad input, including one-day retreats and more informal widely advertised meetings in addition to conversations with individuals and receipt of telephone calls, email and letters. In most cases, Chairs and Co-Chairs enlisted the aid of others via establishing small sub-committees to gather information and formulate plans and reports. The activities of the task forces were widely advertised in news reports printed in the VUMC Reporter and at the School of Medicine General Faculty Meeting on June 6, 1996. A generally accessible web site was maintained during this phase of the planning process.

There was a two-day team workgroup on July 12-13, 1996 involving all members of all task forces and several other invited participants; this team activity served as a mechanism to create the outline of a rough draft of the strategic plan. There was also a consideration of how to prioritize the recommendations, and especially, the long-term consequences of the proposed programs and their implementation, finalized at an evening meeting of the Parent Committee, July 22. The reports of the individual task forces were submitted August 2nd. The Co-Chairs of the Parent
Committee integrated the individual reports into a draft of the strategic plan and invited input from those who had participated in the two day July 12-13 workday. This draft document was then reviewed by Chairs and Co-Chairs of the individual task forces with final discussion at an evening dinner meeting on August 13, 1996. A revised text of the strategic plan was submitted to the office of the Vice-Chancellor on August 22, 1996 as a draft document of the Strategic Plan for the Academic Enterprise.

After simultaneous distribution of the draft document to participants in the strategic planning process, enthusiasm for (as well as concern about) some of the recommendations was registered by a broad spectrum of clinical and basic science faculty, staff, and trainees. These comments were distributed to all Chairs and Co-chairs of the nine task forces and served as a starting point for revision of the draft document, which was finalized in concept at an evening meeting of the Parent Committee on November 5, 1996. This final version of the Strategic Plan for the Academic Enterprise prioritizes the initiatives and includes, in its Appendix, estimates of the financial, structural, and human resources needed to accomplish the agreed-upon initiatives, and is now presented to the Vice-Chancellor for Health Affairs, December 2, 1996.

IV. Environmental Assessment

A. National Environment

Biomedical sciences and academic medicine in general stand at a crossroads. Spectacular advances have occurred in our understanding of the molecular and genetic bases of cell growth, development and other processes. These advances, in turn, have opened new worlds for DNA diagnostics, gene therapy, organ transplantation, and rational drug design, to name a few. Advances in instrumentation and technology -- as well as the demands of the marketplace -- are changing the face of health care delivery, as well as the very nature of the missions of academic medical centers.

Despite these advances in biomedical research and health care delivery, it is increasingly difficult to recruit the most talented young students to careers in the biological sciences. The nation's continued preeminence in these areas will depend upon our ability to make biomedical research and academic health care a more alluring career.

Since World War II, the federal government has been the major supporter of basic and applied biomedical research in the United States. Although this situation is not likely to change in the coming years, the competition for funds will increase significantly, and opportunities for new project funding will decline. In terms of research, the challenge is to focus on areas of excellence, on key strengths and on strategic investments that provide adequate returns.

The changing environment and nature of clinical practice, in addition to scientific advances, have implications for curricular direction for education of both clinicians and basic scientists. The competitive environment characterized by aggressive, for-profit hospitals and the increased prevalence of managed care have profound effects on both financial resources and educational focus. Reduced clinical profit margins have decreased the ability of academic medical centers to use cross-subsidization to fund the various institutional missions, including undergraduate medical education. In addition, the decreased length of stay and increased acuity of hospitalized patients have changed the role of the inpatient setting as a site for undergraduate and graduate education.

Whether or not government-mandated health care reforms are implemented nationally and federal funding for research diminishes, the changes already underway have put basic research and academic medicine at significant risk. It has been suggested that 30 - 40% of existing academic medical centers will not survive because of their inability to adapt to a continually changing environment.
A variety of trends suggest the shape of this new environment:

- An increased emphasis on integration of basic and clinical sciences, thereby increasing the possibility of the application of basic research to patient care.

- Increased support for sophisticated and expensive core facilities to support these efforts, including genetic laboratories, antibody production facilities, transgenic animal laboratories, and facilities for the structural analysis of large molecules.

- More research, teaching, and health care activities carried out in multidisciplinary settings involving faculty from different departments and divisions of the Medical Center. Greater geographical distribution of interacting faculty and trainees, both in health care delivery and in multi-institutional research activities.

- New sources of financial support for research and teaching activities. In particular, academic medicine will be more aggressive in creating linkages with industry and the venture capital community -- within institutional safeguards against conflicts of interest.

- Preferential utilization of technological advances by those that can improve efficiency and cost-effectiveness.

- An increased emphasis on risk assessment and illness prevention, rather than the treatment of end-stage disease.

- An increased demand for the training of primary care practitioners.

- An increased emphasis on continuing health professional education to respond to the accelerated pace of the acquisition of new knowledge and new diagnostic and therapeutic strategies.

B. VUMC Environment

Vanderbilt University School of Medicine’s faculty is among the top tier of the academic health centers. Our success has depended upon a consistently outstanding faculty working in a supportive, multidisciplinary environment. In 1995, we were 23rd in terms of NIH funding ($67,700,000). Four of our basic science departments ranked in the top ten in the country in NIH total dollar awards (Pharmacology was number one out of 111 departments surveyed; Biochemistry number 2 out of 104; Molecular Physiology number 3 out of 107; and Cell Biology number 7 out of 96). Our income from NIH grants has increased consistently over the past several years in the face of increased competition for these funds. However, a comparison of our competitive extramural grant success with other leading academic health centers, such as Johns Hopkins University or Washington University in St. Louis, suggests that an opportunity for growth in extramural resources lies in enhancing the number and competitiveness of research proposals to the NIH emanating from clinical departments. Recommendations in this document to initiate and facilitate bench to bedside research and to enrich the clinical, translational, as well as basic science research exposure of clinical trainees at all stages of their careers would have the natural consequence of securing increased extramural support for this crucial venue of research in an academic health center.

Over the last several years, revenues from corporations have increased substantially. Though the income streams are several -- gifts, grants, contract research, clinical trials, licensing and royalty agreements -- they are all the product of two important realizations: 1) The products of
academic work have a value in the marketplace: "Intellectual property" is a capital asset that, properly protected and marketed, can be used to fund faculty and institutional activities; and 2) Corporate collaborations can be structured and monitored to ensure that the goals, the proprietary interests, and the intellectual integrity of the faculty and their commitment to academic pursuits are maintained.

Faculty have established strategic collaborations with a number of pharmaceutical, biotechnology, and medical equipment companies. These collaborations will continue to grow, and there is the opportunity for significant new income from licensure agreements and royalty fees from patents that have been filed. VUMC should serve as the hub institution for a Nashville-based biotechnology industry that would support basic research, provide a critical applied science resource, provide increased revenues, and create new equity. Furthermore, these strategic collaborations will facilitate our service to society by making our research successes more readily translated to the betterment of human health.

In parallel with the emphasis on Strategic Planning for the Clinical Enterprise over the past three years, continued development of the academic enterprise of VUMC has progressed vigorously. The first VUMC building devoted exclusively to research, Medical Research Building-I (MRB-I), was completed in 1989 and the second, MRB-II, in 1995. Other construction completed in the last five years important to the academic mission includes the Stallworth Rehabilitation Hospital with its associated research laboratories, and the Eskind Biomedical Library which also houses the Division of Biomedical Informatics. Growth in academic research space through new construction has almost been matched by renovation of research space in Medical Center North over the past five years (193,000 nsf). Similarly, the Vanderbilt University School of Nursing is about to break ground for a new research and education facility.

Recruitment also has been vigorous over the past five years, with over 95 new faculty involved in basic and clinical research joining VUMC during this time frame. Approximately 40% of these new faculty recruits have been to basic science departments; the remainder have been recruited to the School of Nursing (5) and to clinical divisions in the School of Medicine. Much of this growth in the School of Medicine has been based on initiatives of individual departments and divisions, with some recruitment related to interdepartmental thematic programs. As we move forward, interdepartmental and bench to bedside research initiatives are likely to assume greater importance in recruiting efforts.

With its collegial atmosphere, VUMC has a long history of success with multidisciplinary centers; there are currently 15 federally-funded centers. The first of these, the General Clinical Research Center (GCRC), was established in 1956, and is the longest funded center of its kind in the United States, bringing stature to Vanderbilt University Medical Center in a number of areas of clinical investigation and attracting extramural resources in excess of 50 million dollars to our institution. Similarly, the Center in Clinical Pharmacology was the first of its kind in the nation to propose and accomplish drug monitoring to provide a rational basis for the design of therapeutic regimens and for the explanation of the diversity of patient response to different drugs and drug combinations. Several of our Centers provide models for bench-to-bedside research approaches. The Diabetes Research and Training Center has a long history, and the newly-established Vanderbilt Cancer Center has recent success, in such critically important research. Often these Centers, like the Diabetes Research and Training Center, the Vanderbilt Cancer Center and the Center for Molecular Neuroscience, support the development and continuing infrastructure for Core facilities that expedite research advances in rapidly evolving scientific areas. Many also have substantial pilot project components that provide seed funding to faculty; during the 23 years of its existence, the Diabetes Research and Training Center has converted more that 75% of its funded pilot projects into successful peer-reviewed extramural grants while 54% of pilot projects awarded by the Center in Molecular Toxicology has led to subsequent NIH-R01 and other individual investigator-initiated grant funding.
As summarized above, spectacular developments in the academic enterprise have been fostered over the past 5-10 years. Important measures have been undertaken as a result of the Strategic Planning for the Clinical Enterprise to meet the challenges of a changing health care delivery environment. These developments have placed VUMC in an enviable position among the top tier of academic health centers. The plan that follows addresses the academic mission of VUMC, with emphasis on initiatives to enhance biomedical research, education, and technology transfer. With wise investment and careful integration of the strategic plans for the Academic Enterprise with those already developed by the Clinical Enterprise and the School of Nursing, VUMC will be in a position to move confidently into the next century and to improve our standing such that we are generally recognized as being among the top ten academic health centers in this country.
THE STRATEGIC PLAN FOR
THE ACADEMIC ENTERPRISE

A Focus on Our Missions: Much of this strategic planning document focuses on the missions of VUMC, providing explicit guidelines for new initiatives to achieve excellence, yet giving sufficient rationale for those guidelines to permit flexibility in responding to unanticipated changes without abdicating the premise of each of the initiatives. In this way it is hoped that this strategic plan will provide a dynamic source of insight to Vanderbilt University Medical Center for the next decade.

Traditionally, VUMC has espoused three missions: research, education, and patient care. In research, we reveal new knowledge along the continuum from molecules to human beings in an effort to improve human health. In education, we strive to train the next generation of health care professionals and scientific investigators who emerge as competent, creative and compassionate individuals. In the current climate of accelerated change, our educational mission also will include the retraining or redirection of the careers of mature health care professionals and scientists. In patient care, meeting the current needs of patients occurs in an intellectual environment that aspires to better understand the disease process and its origins, with the intention to improve therapy, and ultimately prevent disease.

Inherent in our missions of research, education and patient care is the premise that what we learn today, when shared, can serve as the basis for improved prevention, diagnosis and therapeutic intervention in the future. This translation of discovery to utility requires a transfer of our technology to commercial enterprises capable of completing the continuum, expediting their availability to society and minimizing our distraction from patient care, research and education by translational activities for which our faculty were not trained. One strong recommendation of this strategic planning effort is that an emphasis on technology transfer be infused into all three of the VUMC missions of education, research and patient care, and that the importance that technology transfer has for enriching all of our missions be explicitly added to the mission statement of Vanderbilt University Medical Center.

A Balanced and Interdependent Administrative Structure: A significant change in the administrative structure for the School of Medicine is outlined in Section IV of this strategic plan, such that each of the three missions of VUMC will be overseen with leadership and financial responsibility by a senior administrative official. The growth of our faculty, the continually expanding success of our research programs, and the rapidly changing clinical environment require increased leadership efforts not only to implement ongoing programs but to develop a cogent vision for the future and make hard choices about how to achieve that vision. The importance of assigning a senior official to the oversight of initiatives to enhance research from bench to bedside, to orchestrate the education of basic scientists and physicians alike at all stages of their training, and to guide technology transfer to increase our extramural resources is obvious. This must be achieved without perturbing faculty commitment to our three missions, and it must be assured that each of these senior administrative officials has the protected time to look toward the future in each of these areas and can rely on an infrastructure sufficient to implement their vision. We have chosen not to select or identify particular titles for these senior officials, but simply to clarify the breadth and importance of their roles; the Vice-Chancellor for Health Affairs appropriately will select the titles and structure needed to incorporate, or enhance, the roles of the recommended senior officials who will oversee research, education and technology transfer for the
academic mission, and who will integrate these efforts with those of the clinical enterprise, the School of Nursing and Vanderbilt University at large. Further discussion of governance, medical center culture, and academic life is provided in Section IV.

**Fostering Collegiality and Diversity:** Faculty, staff, and trainees affirm that the most treasured aspect of the academic environment at VUMC is the collegiality among the constituents of our institution. The ability of faculty and trainees to collaborate and learn from one another creates a setting often referred to by its participants as a “university without walls”. Like all traits that are cherished, however, this one needs nourishment. Our collegiality is threatened by the success, and hence growth, of the research enterprise in parallel with an unprecedented expansion of our clinical faculty to remain competitive in the managed care arena. Awareness of both the positive and negative consequences of growth underlie the above recommendations that research and education are each overseen by a single senior administrative official who is concerned with the continuum of clinical to basic issues. Widespread and emphatic support for a greater diversity within the constituents of VUMC also was raised by faculty, trainees and staff. Similarly, the sheer increase in the size and inherent complexity of our institution led to recommendations for greater input in planning and decision making by all constituents, and a governance structure that emphasizes the missions of the institution and favors the betterment of the entire institution over parochial interests or short-term solutions that do not foster long-term growth and emergence to greater national prominence.
I. INITIATIVES TO ENHANCE BIOMEDICAL RESEARCH AT VUMC

Vanderbilt University Medical Center currently ranks fourteenth (U. S. News and World Report, 1996) among academic health centers. This ranking is based on measurements that relate directly to the research mission: extramural support from peer-reviewed NIH grants, citation index of manuscripts published, and the quality of nationally recognized faculty. The initiatives recommended to enhance biomedical research are intended to create a scientific environment that will attract and retain the most outstanding investigators, exploring issues along the continuum of bench to bedside, and to foster the continued productivity of faculty and thematic research programs that have brought enormous recognition to Vanderbilt over the years.

A. Develop an Administrative Structure that Facilitates Research Initiatives and Provides Mechanisms for Fostering Multidisciplinary Research Ranging from Molecular to Clinical Investigations.

1. Appoint a senior official with intellectual and budgetary authority over the basic and clinical research enterprise. Consolidating the leadership of basic and clinical research efforts in one office will ensure that, as new programs are developed, they include intentional mechanisms to link basic science discoveries with clinical explorations and, conversely, clinical enigmas with appropriate research laboratory inquiries. Modern biomedical research has become increasingly interdisciplinary, meaning that future research programs often will be interdepartmental and thematic, and thus will require more centralized planning and resources. This integrated leadership also should facilitate the transfer of new knowledge, via appropriate technology transfer mechanisms, to translational research with accelerated application to advanced research technologies as well as to patient care (see Section III).

To provide the appropriate perspective for taking the best advantage of national financial and human resources, the individual selected to fill this position following a national search should have documented experience in defining new research initiatives, have prior success in identifying novel and significant financial resources, and have maintained the level of intellectual activity essential for fostering communication among participating scientists in the medical center and in other schools of Vanderbilt University. One role model would be an individual who performs this leadership role while maintaining a successful ongoing research career funded by extramural support, although the intellectual demands of this role may preclude combining research and trans-institutional leadership. This individual would have financial resources adequate to encourage new research initiatives and respond to proposals by Chairs of Departments or Center Directors concerning thematic programs that should be nurtured. This senior official would report directly to the Vice-Chancellor for Health Affairs.

2. Provide a mechanism for regular, rigorous evaluation of research programs in the context of departments, divisions, or interdisciplinary centers. In addition to proactive efforts in the development of problem-focused scientific programs, the administrative officer who oversees biomedical research would also assure that research units (departments, divisions, centers that transcend departmental lines) are rigorously evaluated at least once every five years by review committees composed of representatives from the medical center and university faculty and/or administration as well as appropriate luminary investigators from other institutions. This effort will provide objective evaluations of (1) productivity, (2) focus on appropriate research problems, (3) ease of undertaking key pilot experiments that foster discovery,
and (4) balance of commitment among research and other missions of the institution. Including external consultants as a part of this review process provides an excellent means for advertising our research strengths to the national community and for seeking advice about talented individuals whose recruitment to Vanderbilt would strengthen research objectives.

3. **Develop recurrent space review mechanism.** We recommend that regular review of space utilization be undertaken by the office of the senior official overseeing biomedical research. This space review would evaluate the fidelity with which space assignments parallel the productivity expected of our faculty and trainees for the research mission and whether current space assignments reflect the optimal utilization of institutional resources. An advisory committee composed of appropriate institutional officials and external consultants would assist in projecting space needs for new or expanding initiatives that are meeting with significant scientific success. Based on this information, space can be reassigned, giving adequate time for relocation, expansion, or regression.

4. **Engage a Science Journalist to give local and national visibility to our research programs.** At least one professional science writer would be engaged to provide news and information to the lay press and national/international science news journals. A scientifically-trained writer with documented experience at a leading academic center that routinely enjoys national press would be sought via a nationally advertised position. The scientific journalist would:

- Develop weekly mini-reviews of VUMC research advances for an entirely new local publication written in a style similar to the “Research News” section of the journal, *Science*. These articles would be intended for the faculty, students, and postdoctoral trainees as a means to increase awareness among the faculty about what their colleagues are doing. Articles could be posted on a WWW page announcing new research and/or new capabilities available in Core facilities. This electronic publication would intentionally involve science initiatives trans-institutionally, including research activities in the Schools of Medicine and Nursing, the College of Arts and Sciences, the School of Engineering, Peabody College, and the Kennedy Center.

- Seek opportunities to get national press coverage for discoveries at VUMC, including interviews on NPR, short segment reports in the *Wall Street Journal*, *New York Times*, and national news magazines, such as *Time* and *Newsweek*.

- Develop a liaison with a computer hardware firm to develop Science Kiosks that would be established within the institution to emphasize the breadth of exciting science advances that are occurring institution-wide, the clinical advances we are achieving, and the opportunities for technology transfer that basic and clinical research discoveries are fostering. Recommended Science Kiosk locations include the lobby entrances to all Vanderbilt University buildings, including the Vanderbilt Athletic Center, Dayani Center, the Vanderbilt Hospital and Clinics and other areas that non-University individuals frequent. These same kiosks, updated monthly in content, could be strategically placed around the city and its suburbs -- in lobbies of downtown banks and savings and loan associations; at the Davis Kidd Bookstore; at the Cumberland Science Museum; at large indoor malls such as Green Hills, Cool Springs, and Bellevue Mall; at selected tourist attractions; at the downtown and local libraries; at the downtown, Green Hills and Brentwood YMCAs, etc.
B. Develop Thematic Programs, Amplifying Current Strengths and Developing New Areas of Strength Essential for Future Biomedical Discovery.

In today's research environment, a university must have strength in many disciplines but cannot be dominant in all fields. Therefore it is essential to identify which programs are to be emphasized at Vanderbilt. Although a great deal of recognition is based upon the achievements of individual investigators, there also is a strong realization that individual faculty are attracted to and prosper in an environment where they have access to major equipment and core facilities, where they can share interests with their colleagues, and where trainees are attracted because of thematic programs.

In the next decade, there will be an extraordinary amount of basic biological information available that will be of immediate value to the design of better diagnostic or therapeutic strategies. For example, it is projected that by year 2006 the human genome will have been fully mapped and sequenced. This means that cDNA sequencing will be passé; instead the focus will be toward the functional analysis of all of the molecules that can be encoded by the human genome and the association of these molecules with particular regulatory pathways that control the function of individual cells, cell-cell interactions and integrated physiological systems. Genetics as a discipline will mature from identifying genes to computational analysis of the genome. The availability of the primary amino acid sequence for an array of new molecules will provide new reagents for study by analysis of their molecular structures. High resolution structures (< 2 Angstrom resolution) of soluble membrane proteins can be obtained using X-ray diffraction, and membrane-embedded proteins already can be resolved at a level of 5 Angstrom, utilizing image construction of electron microscopic data. One can only imagine what continuing advances in structural biology will provide in terms of further refinement of structures for both water-soluble and membrane proteins, and what dynamic measurements will reveal about protein-protein and ligand-protein interactions. With these advances, all biological fields will advance remarkably, due to the definitive dynamic and static structural insights provided. The field of developmental biology, for example, will mature from understanding developmental programs to an understanding of the molecules that participate in these programs; in parallel, molecular analyses of development will permit a better understanding of integrated functions, such as organogenesis. The field of neuroscience will manifest a similar maturation process. Understanding the molecules important for excitability of neurons and their maintained function will lead to an understanding of the molecules that coordinate synapse formation and contribute to the development of complex neural circuitry and feedback mechanisms. Informed by this broad-based information, studies of signal transduction will be able to unravel coordinated parallel or antagonistic regulatory pathways. For example, basic scientists will be able to move their intellectual dimensions from examining control of the cell cycle to complex processes of development, programmed cell death, differentiation and aging.

Given the insights that we can reasonably predict will be gained within the next decade, our investigators will have the opportunity to solve extremely important biomedical problems. Having greater insights into the complexity of the human genome will allow the understanding of the genetic and environmental origin of "multifactorial" diseases. Similarly, having the primary sequence available for all of the genes encoded by the human genome, in parallel with overproduction of those gene products (i.e., proteins), will allow more in-depth focus on "molecular recognition," the basis by which molecules recognize one another in protein-protein interactions, or, alternatively, in protein-ligand interactions; such understandings form the basis for rational drug design. With these advances, it is clear that productive collaboration with the biotechnical and pharmaceutical industries would allow us to accelerate and broaden our impact, permitting unprecedented advances in treatment for various diseases. Examples of areas where collaborations would be extremely powerful would be in the development of novel antibodies or of ligands by combinatorial chemistry based on insights gained at VUMC concerning molecular recognition. Similarly, collaboration with industries that focus entirely on the development of new vectors and strategies for introducing exogenous DNA into the human genome would be an extremely
powerful alliance to accelerate and advance our efforts in gene therapy. In parallel, these collaborations with commercial entities will permit application of novel biological insights to development of novel therapeutic strategies in partnership with VUMC faculty.

Two inter-related activities are required to assure that Vanderbilt scientists predictably participate in the most exciting and advanced biomedical discoveries: recruiting and supporting talented researchers and establishing core facilities that expedite the pace of discovery.

1. Areas to target for enrichment by faculty recruiting efforts. The efforts of the Basic Science Research program in which we invest at Vanderbilt University Medical Center have been selected based on the probability that new insights in these areas will inform clinical enigmas and solve current clinical problems. The areas of Genetics, Neuroscience, and Developmental Biology, which already have been targeted for greater investment in terms of faculty recruitment and development of core facilities, are enthusiastically endorsed for continued development. A new program in Computational Biology is recommended to permit us to take advantage of the wealth of data being generated by the Human Genome Project and similar efforts in other organisms. We must enhance our current Structural Biology program to provide the definitive information for advancing our molecular understanding of a diverse array of biological processes; investment in a limited number of new instruments, albeit significant in cost, will sufficiently broaden the spectrum of biological structures that can be resolved, such that Vanderbilt University will take its place as a world-class research and training center in integrated efforts in Structural Biology.

Bringing these areas of scholarship and technology to Vanderbilt will allow bold new areas to be explored: What is the interrelationship of the immune and nervous system? Is immunological memory programmed in a manner analogous to mental learning and memory? Are changes in plasticity of the central nervous system reversible, so that we can reasonably design therapeutic paradigms for the treatment and prevention of addiction or for adult onset neuro-degenerative disease? Is cancer a result of altered positive and negative growth control, cell cycle regulation, programmed cell death or defective immune responses, suggesting entirely novel approaches to therapeutic design and implementation? Are altered developmental programs reversible? If so, are some developmental defects, if detected prenatally, susceptible to correctable re-programming? Can diseases associated with advanced age, such as Alzheimer's and some forms of diabetes, be prevented due to new insights into the balanced coordination of growth versus differentiation? The collegial and collaborative atmosphere among the Vanderbilt scientific community will permit us to reasonably address these and other important problems that threaten the health of our nation.

To achieve the continuum between fundamental new concepts in the basic sciences and the solving of important clinical problems, several changes in infrastructure and culture within the institution are recommended. For example, patient databases already garnered as individuals enter Vanderbilt Hospital should be expanded to include descriptions of syndromes and symptomatic phenotypes (discussed in more detail in Section II C). This information should then automatically be routed to a registry of such information, coordinated by the Clinical Research Office at VUMC. When the genetic basis for a particular multifactorial disease or syndrome is postulated, our investigators could turn to this registry to identify patients and families who might serve as a basis for testing whether or not these inherited syndromes represent a particular genetic profile. Similarly, the Core facilities at Vanderbilt University Medical Center represent an opportunity to coordinate scientific knowledge and programs throughout the university. Workshops given by the core facilities (discussed in greater detail in section II D) would allow us to advertise the experimental capabilities which already exist within our own institution; making the workshops available for investigators at other institutions would heighten the national visibility of our scientific efforts at Vanderbilt University.
• Initiatives in Genetics

Currently, at least twenty faculty members within VUMC are geneticists by training and/or current research program focus; at least this many additional faculty are conversant with relevant genetic strategies and techniques and could be considered adjunct members of a Genetics Program. Lacking, however, are sufficient strengths in human genetics and genomics, experimental mammalian genetic systems, and simple genetically-tractable systems (such as zebrafish, fruit flies, worms and yeast) to take advantage of the explosion of new knowledge emerging from genome mapping and sequencing initiatives. In parallel with the development of a stronger research base in Genetics is a need for an enhanced educational base for medical and graduate students, post-graduate basic and clinical scientists, health care professionals, and senior faculty not introduced to this rapidly-emerging knowledge base during their training. Institutional resources and a recently-received institutional grant award from the Howard Hughes Medical Institute have provided key resources for recruitment of an additional 7-8 faculty in the area of human genetics and genetic model systems in the next five years, with projected growth in this area to continue for the next decade. The Human Genetics Initiative will be enhanced by an internationally-recognized senior human geneticist, and recruitment of such an individual already is underway.

• Initiatives in Genome Databases and Computational Biology

The Human genome contains an estimated 80,000 individual genes, collectively defining every aspect of human biology, embedded in a genome of about 3 billion nucleotides. The human genome project, which as indicated above is anticipated to be completed in 2006, already has moved from the initial phase of establishing a genetic/physical map of the genome to the direct acquisition of megabases of raw DNA sequence. As rapidly as possible, VUMC needs to invest in genomic research so that we can be a leader in identifying the proteins encoded by these genes and in defining their functions. There are many related technical questions that must be resolved, including how to organize sequences in relational databases to facilitate access for research scientists; how to identify genes on the basis of linear sequence information; how to identify particular functional motifs; how to assess the significance of sequence relatedness; and how to assign functions to the 80,000 human genes with reasonable, efficient strategies. These efforts would parallel similar advances in the genome analyses of smaller model organisms such as yeast (completed), C.elegans (advanced), Arabidopsis, and several disease-causing prokaryotes.

Inter-related areas must be strengthened at VUMC to assure our prominence in this exciting area, a research advance that will shift the intellectual paradigm and technology for biomedical research forever. An investment in computational biology, best met by the recruitment of at least two junior faculty in this area, will be necessary for predicting nucleic acid and protein structure from primary sequence, informed by the model structures continually evolving from the efforts of the expanded program in structural biology. In addition, our faculty need access to programs that compile information and make it accessible to research scientists; that provide computational means for identifying sequences and motifs; that scan the genome for sequence context, i.e.proximity to known genes, intron/exon boundaries, and cis-regulatory motifs. Finally, increased strength in human genomics, perhaps provided by the recruiting efforts in the Human Genetics Initiative (above), will be essential for devising and utilizing sophisticated methods for mapping human diseases due to single or multifactorial genetic mutations, genetic traits, and susceptibility genotypes.

• Initiatives in Structural Biology

We are near the state of the art in dynamic measurements achieved by fluorescence spectroscopy, fluorescence laser confocal and two photon microscopy and EPR spectroscopy. Vanderbilt University is steadily approaching a high level of recognition in X-ray crystallography
and has an internationally known presence in fiber diffraction and in the capabilities afforded by the Free Electron Laser. In the last decade, NMR has firmly positioned itself as the important complementary tool to X-Ray crystallography for structure determination and has continued to evolve as a very powerful tool for understanding the conformational flexibility of macromolecules. Recently, our study of structure obtained by NMR advanced from that of oligonucleotides to the study of ligand-protein interactions and membrane-embedded receptors. Although it remains difficult, if not practically impossible, to obtain diffraction quality three-dimensional crystals of membrane-embedded proteins, like cell surface receptors (e.g. for hormones, growth factors, or viruses) or ion channels (that control the functioning of the brain and heart and are important therapeutic targets) or neurotransmitter transporters (which are the current target of antidepressant therapy), our VUMC colleagues are discovering new versions of such molecules with alacrity, and we are positioned to make a substantive impact in this now structurally virgin area.

To bring complementary structural biology strengths to our institution and to create an enviable center for contemporary structural biology, the following faculty recruitments and investments in instrumentation are recommended.

- The recruitment of two new investigators who utilize NMR spectroscopy as a source of raw data is appropriate, and would fully utilize new instrumentation essential for this recruitment. Optimally, the recruitment of these faculty would involve a junior person and a more advanced scientist, such as an Associate Professor. A 600 MHz NMR instrument is under procurement by the College of Arts and Sciences; however, state of the art advances, both currently and in the future, also will require a research grade instrument of 750 MHz if we are to resolve the structures of molecules larger than 25,000 molecular weight. This investment in faculty and instrumentation would permit our faculty, via collaboration with these new investigators, to investigate the effect of ligand binding on protein conformation or on protein-protein interactions, providing critical insights for rational drug design. Unlike X-ray diffraction, NMR analysis permits determination of protein structure in solution for macromolecules and complexes up to 40,000 molecular weight in size.

- The recruitment of at least one person with expertise in membrane protein structure, using image reconstruction approaches.

- Recruitment of an individual using mass spectrometry for defining primary structure of proteins as well as enhanced investment in molecular dynamics and computation to complement efforts in genomics and computational biology (outlined above) and ongoing efforts in mathematical biology in the College of Arts and Sciences.

- The recruitment of an additional faculty member using X-ray crystallography should be considered within the next three to five years. Since our current crystallographers study soluble ligand binding proteins, such as those that bind retinoic acid, or protein-DNA complexes, ideally the third crystallographer would study other structural families of proteins, such as membrane proteins, bringing evolving technology to Vanderbilt.

- Develop an infrastructure that permits uninterrupted advancement of the individual research programs of the new and existing faculty in structural biology, while serving collaborative efforts that enhance the scientific advances of all of our faculty institution-wide. One model for accomplishing this goal is that employed at present by the X-ray crystallography unit: a Ph.D lab manager is supported by a consortium of individual faculty, centers and departments. This lab manager is a crystallographer who assists others in crystallization (an activity that is emerging as a Core Facility effort), analyzes crystals, collects diffraction data, and refines the data, leading ultimately to structure determination.

In the future, successful investment in the area of structural biology will reap paybacks in
enhanced competitiveness of the research programs of all collaborating faculty, accelerated
information acquisition amenable for technology transfer and for refined drug design, thus
facilitating collaboration with the biotechnology and pharmaceutical industry. In parallel, broad-
based excellence in structural biology research should result in the formation of an independent
degree-granting program in Structural Biology subscribed to by VUMC and other schools at
Vanderbilt University, again strengthening our research enterprise and national visibility. The
establishment of a University-wide *Center for Macromolecular Structure and Dynamics* that would
play on the strengths of our current world-class faculty, many of whom are still in the early phases
if their careers, in VUMC, the College of Arts and Sciences and the School of Engineering should
be considered.

- Initiatives in the Neurosciences

Significant strengths already exist transinstitutionally in the neurosciences that can be enhanced
to a greater level of international visibility. Pioneering contributions to new knowledge in the
neurosciences could be achieved via judicious recruiting of five to eight junior faculty in areas that
complement or, alternatively, augment strong existing programs in basic neuroscience. Current
areas of recruiting targeted by the Center for Molecular Neuroscience include neural development,
neurogenetics, biochemistry of macromolecular interactions (such as synapse formation), and the
molecular basis of inherited defects in the nervous system. Transinstitutional recruitments in
cognition, and behavior, in concert with recruitments in molecular neuroscience, will provide
opportunities to integrate basic science initiatives with the preclinical and clinical efforts, such as
those developed by the Center for Addiction or the Psychopharmacology Program. Similarly, new
insights into the molecular basis for neurodegeneration will provide an opportunity to link
neuroscience efforts with already extant campus-wide research strengths in cell cycle control,
growth control, programmed cell death and differentiation, to address developmental defects as
well as adult-onset neurodegenerative disease. A concerted effort should be made to seek
extramural and private foundation support for this bench to bedside research effort in the
neurosciences and to expand support for the training program in the neurosciences.

- Initiatives in Developmental Biology

Developmental Biology is a fast-moving and highly productive branch of basic science, with
proven and potential applications to many areas of clinical practice, including Pediatrics, Ob/Gyn,
Cardiology, Nephrology, Oncology, Orthopaedics, Dermatology, Immunology, Neurology,
Pharmacology, and Toxicology. Developmental Biology already is well represented at Vanderbilt
University, possessing a core group of internationally-recognized scientists that have a strong track
record of achievement and funding. Developmental biology is closely inter-related with, but
distinct from, the Genetics and Neuroscience initiatives. An independent program in
Developmental Biology is proposed to strengthen and coordinate basic research in this area, initiate
and foster interactions with physicians doing clinical research, promote education and training,
and co-ordinate efforts towards increased funding from government, commercial and private
resources. This program should oversee the recruitment of one new junior faculty member per year
for three years and one associate or full professor during this same three year period. In addition,
a highly visible seminar program should be established inviting internationally recognized
developmental biologists to present their state of the art advances in this field. A concerted effort
should be made to seek extramural and private foundation support for this research effort in
developmental biology and to expand support for the training program in developmental biology.

- Initiatives in Signal Transduction

Vanderbilt University is known for its strengths in the discovery of signal transduction
pathways, recognized, for example, by the Nobel Prizes bestowed on Dr. Earl Sutherland for his
discovery of cAMP and the concept of second messengers, and Dr. Stanley Cohen, for his
discovery of growth factors that elicit profound changes in cellular growth and division by interacting with bifunctional cell surface receptors. Although we have sustained our scientific leadership in the area of signal transduction, several areas of contemporary research are not well represented, and as such not only limit our advances in exciting areas of research, but limit our adventures in preclinical research and technology transfer in emerging areas of discovery. We recommend that ten new faculty over the next five years be recruited in the general area of signal transduction, with particular emphasis on integrated electrical and chemical signaling pathways, extracellular matrix and cell-cell communication (including cell adhesion), coordination of cellular signals at steady state and during cell division by cytoskeletal components and mechanical signals. These recruitments could occur in any of the basic science departments or clinical or under the auspices of a transinstitutional thematic initiative.

- **Initiatives in Bench-to-Bedside Research**

Disease-oriented centers such as the Diabetes Research and Training Center and the Vanderbilt Cancer Center represent critically important approaches for bringing the fruits of our basic science efforts to the benefit of patients. Commitments already made to the continued development of these centers remain as a high priority. In addition, the logical endpoint of much of our basic research, the movement to clinical research, needs major enhancement, as outlined in Section I.D.

2. **Increase the Number of Endowed Chairs.** Endowed chairs provide a means to both reward and motivate the most creative and interactive faculty to continue their risk-taking scientific inquiries and their generous contributions of time and energy to the highest level of excellence in our institution. In addition, recruitment of outstanding investigators to pioneer new thematic programs will require development of resources not only for their own research program but also for recruitment of additional (probably junior) faculty whose independent research programs synergize with the thematic effort. To attract the quality of senior faculty VUMC would wish to recruit as leaders of thematic initiatives requires that we offer an endowed chair as part of the recruitment package. Consequently, at least one endowed chair should be created by the commitment of institutional resources or the solicitation of large gifts for each new interdisciplinary effort that involves establishing a new thematic program via external recruitment. This increase in endowed chairs should be complemented by parallel enrichment of resources dedicated to endowed chairs for existing faculty who have demonstrated their capacity for discovery and sustained productivity. Regular evaluation of research programs (as indicated above) would require affirmation that those individuals benefiting from the availability of endowed funds were continuing to contribute to their area of research and to the institution in an exceptional way. We recommend that ten new endowed chairs be developed for faculty in the School of Medicine in the next five years, and another ten in the subsequent five years; this total is in addition to the endowed chairs that will accompany the development of new thematic initiatives. Currently, there are 32 funded chairs in the School of Medicine; this initiative should result in 52-60 endowed chairs, depending on the number of new interdisciplinary initiatives that are undertaken.

3. **Utilize Flexible Space to Create Additional Interdisciplinary Research Initiatives.** A fraction of VUMC research space should be committed to the development of interdisciplinary programs. Although, ultimately, the utilization of space occurs at the approval of the Vice-Chancellor, the senior official proactively overseeing the development and enrichment of biomedical research programs should develop a mechanism for reviewing space utilization (described above). Poorly utilized space would be reassigned for use by departments, divisions, or interdisciplinary centers whose development agendas had been authorized by the commitment of funds for recruitment or resource enrichment or, alternatively, for temporary use by new, competitively-awarded intramural interdisciplinary research units.

The senior official with authority over biomedical research would have annually-committed financial resources to initiate new interdisciplinary research programs and provide funds for
laboratory start-up. Space to foster this interdisciplinary research could be assigned to faculty teams wishing to operate in joint or contiguous laboratory space to facilitate collaborations or new interdisciplinary programs. An attractive start-up package for these interdisciplinary initiatives (e.g., $200,000) could be made available on a competitive basis to encourage formation of interdisciplinary research teams. Proposals for such teams might be in the format of an NIH Center or Program Project Grants, albeit abbreviated. Awards would consist of both space and equipment start-up funds. Renovation would be reserved for activities that can evolve into new core facilities to support a larger number of investigators. Faculty teams would be made up of basic scientists teamed with clinically-trained faculty to provide a means to "jumpstart" exciting new research opportunities that result in bench to bedside biomedical discoveries, such as application of new basic science insights to the prevention, diagnosis, or treatment of disease. Alternatively, the interdisciplinary effort could arise at the inspiration of a clinician frustrated by the lack of insights into a currently intractable disease, and involving a basic scientist with expertise appropriate to begin a concerted inquiry on the disease problem. Each investigator in a research team would be expected to be funded (or highly fundable) and to maintain his or her funding during this interdisciplinary exploratory initiative. Start-up funds would support initial purchase of shared equipment and costs for pilot studies, but not direct costs for long-term running of the research project. Research teams would be expected to submit applications for NIH or other extramural funding to support operation of the research program. This incentive package would encourage inter-departmental collaborations and closer working relations between basic and clinical scientists.

C. Infrastructure Initiatives that Strengthen All Aspects of Biomedical Research.

The infrastructure that supports biomedical research needs to be enhanced in a number of ways to ensure uninterrupted productivity of our current faculty and the initiation of new research programs.

1. Reorganize Grants Management Office and develop an enhanced grants management system. The Head of the Grants Management Office should be charged with coordinating all aspects of extramural research grant management. This administrative overseer would be responsible for creating a more user-friendly support service that strives to work together with investigators to increase research funding to the VUMC, including the duties currently assigned to this office and the direction of a new grant preparation support team. This new support team would be charged with assisting departmental administrators or their assistants in the preparation of NIH and other standardized research grant applications. The goal would be to streamline the grants submission and management processes, including access to a database of Other Support, Animal Care approval dates, IRB approval dates, CRC approvals, and other information essential for preparing grants and renewals. This information also would be made available on a local "intranet" (see Research Informatics Core Facility below). Finally, the Grants Management Officer would direct efforts to maintain a searchable computer database of all currently available research funding and make this information readily available to faculty via an intranet. This would supplement the newsletter that currently exists. Suggestions for improvement in the grants management process will regularly be solicited from the faculty.

2. Develop a Biomedical Research Informatics Core Facility with a director and staff devoted solely to the research enterprise. In 1991, VUMC made a substantial investment in Biomedical Informatics. Although a component of this activity is directed toward institutional service in behalf of informatics and the infrastructure that supports it, the Bioinformatics Initiative is also a major research facility whose mission is to create new strategies for handling and processing information, and for disseminating these new programs nationwide, in a manner analogous to the research activities of laboratory and clinical investigators. These informatics research initiatives will be especially valuable in preparing our investigators to take
advantage of the unprecedented advances in knowledge that will be permitted by the sequencing of the human genome, predicted for completion by the year 2006 (See earlier discussion about Human Genetics and Computational Biology as a new thematic research area for investment and development at VUMC.) Because Bioinformatics represents a research and information technology initiative, and not primarily a service mission (something rarely appreciated by the VUMC community at large), VUMC faculty, staff and trainees lack the infrastructure support necessary to exploit informatics and Internet system to maintain competitive research and administrative programs. It is imperative that an independent Bioinformatics Core Facility devoted to the research and training missions of VUMC be developed and integrated with the current Office for Bioinformatics, or that the Office for Biomedical Research partner with Biomedical Informatics to perform the following functions:

- Develop and Maintain

  - a searchable database of faculty research interests, expertise, important publications, and unique sharable reagents (faculty in all Schools of Vanderbilt University whose research activities are even remotely related to biomedical research initiatives)

  - a searchable database of available extramural research funding from government and private resources

  - a searchable database of research grant support in place for current faculty and trainees

  - a WWW page of Vanderbilt research news, postdoctoral positions, and other opportunities for those outside the institution interested in our research programs.

  - a WWW page with links to important on- and off-campus biomedical research informational services

  - a WWW page describing clinical research initiatives at VUMC, alerting the national public about patient populations uniquely served at our institution

- Obtain extramural support and engage in innovations in biomedical research informatics; share new systems and processes with other institutions via technology transfer

- Participate in the development and utilization of information technology to obtain and utilize new knowledge emerging from the human, and other species, genome project, in collaboration with efforts outlined in Section I.B.1.

Ideally, on-site support would be provided to investigators, including instruction and problem solving. Particularly valuable programs developed in support of integrating research activities, managing or analyzing complex research data, or interfacing multi-institutional research activities might be considered intellectual property worthy of forwarding to the Office of Technology Transfer for commercialization.

D. Infrastructure Initiatives Specifically Pertinent to the Performance of Clinical Research.

1. Create a Clinical Research Office (CRO) within a newly-structured Grants Management Office. The CRO would be headed by an experienced clinical investigator who engages in exciting clinical research that competes successfully for extramural research support. The CRO Director would understand, and foster the dissemination of the understanding, that a clinical research trial represents the best quality of care available, as it represents a 'guideline' for
the management of the disease process under study. In this sense, it is the quintessential 'practice guideline', as clinical trials protocols are developed by experts in the diagnosis and management of the disease process under investigation. Promoting this realization to managed care organizations, rather than hiding the unique role of academic health centers in clinical research, may provide a competitive advantage in the evolving medical milieu by offering patient access to innovative therapies still under refinement.

The CRO will function as the 'nerve center' for all clinical research activities within the institution. It should be overseen by an experienced physician clinical investigator knowledgeable of the nuances of clinical research and familiar with government and non-government sources of funding, and skillful at administration of diverse professionals. In addition, the Director should be capable of facilitating positive interactions with industry. At a minimum, the CRO should provide the following services:

- The CRO should operate as a proactive entity. Members of the CRO should actively promote Vanderbilt's clinical research capabilities and facilitate the development of 'transnational' research activities. Effective representation would require travel to meet with industry leaders. The CRO personnel should have the ability to speak knowledgeably about the research capabilities of the entire medical center and its faculty or at least have the ability to readily access this knowledge.

- The CRO should provide specialized personnel to assist clinical investigators in performing clinical research, including research nurses, clinical research associates (i.e. data managers), secretaries and administrative assistants. These personnel should be supervised by an experienced professional who may or may not be a physician but who has a broad background in clinical research and administration.

- The CRO should oversee a registry of patient information regarding syndromes, complex traits, or other clinical enigmas that may represent single or multifactorial inherited defects. This information would be automatically routed from selected input channels in electronic patient charts and organized in a retrievable database. This registry would provide an invaluable resource for testing hypotheses about the heritability, or not, of given syndromes or traits, based on genotyping patients and family members.

- The CRO should assist investigators in developing realistic budgets for proposed clinical studies, relying on an experienced financial administrator dedicated to the activities of the CRO. This financial administrator also would help negotiate contracts with industry and other potential contractors.

- The CRO should provide expertise in preparing IRB submission, submissions to the Cancer Center's CPRC or GCRC research committee and similar scientific committees in other research areas and disciplines. (See other issues re:IRB, below)

- The CRO should provide expertise in dealing with federal regulatory agencies, such as the FDA or NIH and preparation of INDs.

- The CRO should provide expertise in biostatistics. The biostatisticians should be capable of dealing with researchers interested in a broad variety of research questions, including epidemiologic questions.

- The CRO should assure that computer access and software expertise are readily available to assist clinical investigators in developing and maintaining important patient databases and in facilitating information flow among multi-institutional research sites. Ideally, there should be commonality among the databases to facilitate electronic communication. At the outset,
this effort will require a full time computer programmer(s) and a systems analyst(s) who will solely serve the efforts of the CRO, but work under the direction of the Biomedical Research Informatics Core Facility and in cooperation with the overall Biomedical Informatics Program at Vanderbilt.

- The CRO should provide dedicated space for outside study monitors to work.

2. Locate the General Clinical Research Center (GCRC) in the Vanderbilt Hospital. Having ready access to the GCRC in a managed care environment only increases its value to the investigator and the institution. Clinical research invariably requires some interdigitation with 'routine' patient care. Third party payors have found they can save money by denying payment for patient care provided in the course of a clinical research protocol even if the care in question is generally considered 'standard'. This problem is potentially negated by placing a patient in the GCRC in many circumstances. Furthermore, the insurer saves money under this arrangement, thereby encouraging a positive relationship. The GCRC is a unique resource not available in any other hospital in the region! It must be preserved and strengthened. However, the GCRC must be made convenient for the clinician. Since clinicians tend to be found where patients are located - i.e., the hospital and clinic, it makes imminent sense to place the GCRC in the hospital with satellite facilities in the TVC. In addition, since clinical research often involves critically ill patients, ICU beds should be available for GCRC research.

3. Additional policy and infrastructure initiatives to facilitate and enhance clinical research activities.

- Access time to high technology instrumentation should be readily available at markedly reduced rates (or for free) for patients entered onto investigator initiated trials. This should include the professional fees of radiologists required to interpret the studies. The allocation of this time should be under the control of a scientific research committee such as the Cancer Center's CPRC, the CICRC Committee or the V.A. Hospital's R&D Committee.

- Vanderbilt must be capable of providing inexpensive (free?) overnight housing for individuals on clinical research protocols approved by the IRB. The housing should be clean, staffed by 'hotel like' personnel and conveniently located - ideally this means on campus.

- A Web page on the Internet to 'advertise' clinical research opportunities to the public and to professionals is needed. The lay public increasingly avails themselves of medical information via the Internet, and we are losing valuable marketing access by not revealing the breadth of our clinical research initiatives to the lay public nationwide.

- The institution must change its policy on indemnification with respect to joint research activities undertaken with industry support. The current policy, deemed as too restrictive, drives away potential industry partners. The institution will have to share some of the risk entailed in clinical research if we are to compete successfully for more industry dollars.

- The IRB must be given the opportunity to continue its streamlining efforts. Turnaround time must be markedly reduced if we are to compete with non-academic institutions which are entering into clinical research activities as a profit making enterprise. At a maximum, turnaround time should be seven working days or less. As an example, clinical investigators should not be placed in 'double jeopardy' by having to have the clinical protocol reviewed twice, e.g. once by the V.A. Hospital R&D Committee and again by the Vanderbilt IRB. A mechanism needs to be developed to avoid this and other unnecessary delays.
E. Develop Institutional Support of Core Facilities Essential for Accelerated
Discovery and Continued Growth of Our Scientific Endeavors.

In addition to its superior physical plant, Vanderbilt possesses effective core laboratories
utilized by multiple investigators for research support. These include cores for DNA synthesis and
sequencing, protein sequencing, transgenic and embryonic stem (ES) cell targeting and blastocyst
implantation, cell imaging, mass spectrometry and bioanalytical measurements, animal surgery,
genotyping and chromosomal mapping, etc. These cores are vital to the health of the research
enterprise, providing cost-effective and timely research support and lessening the burden on
individual laboratories to engage in repetitive, expensive support tasks. In many cases (the
confocal microscopy core, the mass spectrometry core, the electron microscopy core), the cores
house instrumentation that is difficult to acquire or sustain from individual or collaborative grants.
Many investigators are attracted to Vanderbilt because of a perceived strength in this level of
research infrastructure. However, the present system of core support relies almost exclusively on
federal funding for operation. Such a plan, with its complete reliance upon precarious extramural
funding, limits the confidence of support personnel for employment security and places undue
burdens on center directors and faculty to sustain the Vanderbilt research infrastructure (rather than
focusing on how best to use the facilities to achieve scientific breakthroughs). In some cases,
cores are not allotted sufficient space to suitably undergird the research enterprise without
impinging on the core director's laboratories. Lapses in funding can cause a catastrophic
curtailment of service. Finally, a complete reliance on federal support for cores providing VUMC-
wide services reduces our leverage in recovering external support for core facilities.

To achieve a balance between institutional and federal commitment to research infrastructure,
we recommend the formation of a Vanderbilt Core Committee, overseen by the senior official
overseeing the continuum of biomedical research, charged with the task of assessing personnel,
space, and equipment needs for VUMC cores. This committee also would ensure that university
investments in core facilities are warranted and well utilized, and recommend inclusion of new
cores or deletion of cores that no longer serve trans-institutional needs.

1. New core facilities recommended for development:
   - Fluorescence In Situ Hybridization (FISH) analysis
   - Animal physiology and behavior, particularly for evaluation of genetically-modified mice. Consider the development of a national resource, akin to Jackson labs or the Oak Ridge laboratories, inviting support from the NIH for establishing this national resource for physiological and behavioral investigation of genetically-modified mice.

2. Core facilities that should be evaluated for expansion in breadth or quantity of services:
   - ES Core for tissue-specific gene knockouts-increase technical support and instrumentation to accommodate increased use by current faculty and trainees and projected faculty recruits
   - Microsequencing of peptides available in trace quantities
   - DNA sequencing- centralize resources to optimize quality control, turnaround time, and reduce costs to investigators
   - in situ hybridization
• Bioanalytical Resource, including mass spectrometry-facilitated infrastructure and enhanced instrumentation for routine analyses of samples for consortium studies under the auspices of Center and/or PPG grants, or for individual investigators.

• Flow cytometry (perhaps establish liaisons with local commercial firms).

• Protein Production (Baculovirus expression facility)

• Crystallization, for studies of the structure of soluble and membrane-embedded proteins.

• Phage Display Antibody and Peptide Production

3. Cores of special utility for clinical research needed to facilitate discovery:

• Dedicated MRI scanner time for clinical research projects

• Research clinical laboratory service capable of obtaining specimens of blood and other body fluids as well as a specimen preparation service (e.g., blood products for shipping in ice)

• Tissue acquisition and pathology slide preparation service

4. Core Facility-sponsored Workshops. An effective way to both facilitate trans-institutional communication among Vanderbilt scientists and their trainees and remain appropriately informed of new technologies (and intellectual advancements spawned by these technologies) would be to sponsor annual workshops given by core facility directors and personnel aimed at educating potential users. Ideally, the didactic aspect of these workshops would be held in Wilson Hall, which affords both a delightful learning environment and an opportunity to teach via traditional and computer-assisted methods. (These Workshops are envisioned as summer short-courses of variable duration, and would thus not interfere with assignment of classrooms for undergraduate and graduate teaching in the Department of Psychology, housed in Wilson Hall). Hands-on experience, if deemed an appropriate component of the Workshop, would then be hosted in the location of the institutionally-sponsored Core Facility. Institutional resources would support the planning and advertising of the Workshop. For some Workshops, regional or national advertisement might be desired, and would have the additional benefit of highlighting our research strengths to a larger audience, perhaps facilitating broader collaborations with, and scientific input from, the national scientific community. The development of the scientific program, workbook, references, and electronic materials for each Workshop might be delegated by the core director to an interested faculty member, for example in the College of Arts and Sciences to coincide with a summer respite from intensive teaching activities, and be funded mutually by VUMC and other Schools at Vanderbilt involved in the scientific activities of the Core facility featured in the particular Workshop. Alternatively, planning and coordinating a Workshop might be used as teaching and leadership opportunity for a senior post-doctoral fellow wishing to gain such experience.

F. Provide Exceptional Faculty with Institution-Derived Discretionary Funds to be Used to Enhance Their Research Programs

VUMC faculty are collectively and individually among the nation's leaders in research. Four of Vanderbilt's basic science departments (Biochemistry, Cell Biology, Molecular Physiology and Biophysics, Pharmacology) annually rank among the top ten in overall NIH support. Investigators in clinical departments similarly seek salary support for research endeavors while also participating
in clinical activities to sustain the patient care mission of the institution. Vanderbilt has invested significant resources in the recruitment of superior faculty and staff and in the development of state-of-the-art research facilities. Reinvestment of institutional resources derived from ongoing research productivity would not only sustain the high level of productivity and morale but also provide resources that serve to pilot new experimental initiatives that, in the future, will be the basis for new competitive proposals for extramural research support. It should be emphasized that this change in institutional policy was regarded by the Task Force on Basic Science Initiatives -- in parity with the focus on bench to bedside thematic programs -- as the key change that, if implemented, could assure our success in biomedical research and our advancement to the ranks of the top five academic health centers in the next decade!

At present, faculty in the School of Medicine engaged in laboratory research typically are expected to acquire 90% of their salary from external funds. Although many Vanderbilt faculty provide the expected level of salary (90%) support, and sometimes more, during their research career, the practical and psychological burden of this policy threatens to undermine Vanderbilt's investment in its academic enterprise. Caps on funding levels in renewals, overall budget constraints, and increased competitiveness dictate increased time spent developing proposals to attain the required support. Faculty who can contribute energy and innovation to our teaching mission have little time to do so since it requires the preparation of multiple grants to sustain their laboratories. The absence of institutional support lessens the commitment faculty feel toward Vanderbilt with eventual reluctance for service commitments. Finally, the ability of other institutions to reward investigators who achieve significant external salary support places Vanderbilt at a disadvantage in recruitment and retention. The extent to which the current expectations are depleting faculty reserves of energy, creativity and loyalty to the institution cannot be over-estimated; in fact, means to reward faculty for their extraordinary efforts in supporting the majority of their salary and research program costs from extramural grants while participating in other missions of VUMC was identified as the single most important priority of the Basic Science Initiatives Task Force for fostering basic science research in the next decade.

It is recommended that a formal policy to reward faculty for research productivity be instituted by establishing a formula to provide the exceptional investigator with institution-derived discretionary funds to be used to enhance their research efforts and/or to create a "reserve" against lapses in funding. This reward will be given to tenured faculty who exceed their goal in obtaining salary support for their research effort through extra-institutional funding, and the amount of the incentive is based on the difference between the salary support the investigator is expected to obtain from extramural funding sources and the amount actually obtained. The goal for expected extramural salary support will be determined annually by faculty in negotiations with their Departmental Chair. Of this financial incentive, 80% should be administered by the administrative unit for the use of the investigator, and 20% should be retained by the unit. Funds available to the unit will be used to enhance the research enterprise by providing funds to expand the support staff for research programs, purchase common equipment, etc. For the investigator, this discretionary money could fund pilot studies, allow expansion of laboratory personnel, cover supplementary salary expenses for trainees, be used for the recruitment of postdoctoral fellows, provide equipment or computers not obtainable from government grants, or provide resources to cover short-term lapses in funding. The institution thus invests in investigator-initiated research, enhancing the research programs of exceptionally productive faculty and, in concert, the national recognition of our institution.

G. Establish an Intramural Grant Program.

For biomedical research at VUMC to flourish, it is imperative that we develop means to fund biomedical research initiatives in a variety of ways. Intramural grants should be made available on a competitive basis to investigators at VUMC. These grants should be subject to a rigorous review
process that would involve external referees in the appropriate field or discipline for those proposals deemed appropriate for consideration by a committee of research faculty. These awards would not be intended to replace efforts to obtain extramural funding. A committee of faculty would be appointed each year to evaluate grant proposals and make funding awards. Several types of intramural grants are recommended to accomplish several goals:

1. **Pilot Project Grants modeled after the former NIH Biomedical Research Support Grant.** Awards would be for an average of $20,000 and not be renewable. The funds cannot be used to support an investigator's salary. Number available per year: 4, including the Vice-Chancellor's Awards.

2. **Minority Scholars Award.** Career development award for minority junior faculty providing two years of partial (50% effort) salary support and $20-25,000/year in research support. Number available per year: 1.

3. **Bridge funding awards modeled after the NIH Shannon Award.** Grants for $50,000 would be awarded to investigators with pending NIH-ROI grants who just miss the funding pay line. The awards are intended only to keep laboratory operations going while a revised application is processed. Investigators whose NIH grants received poor priority scores or were triaged would not be eligible.

The importance of establishing mechanisms for bridging funds cannot be over-emphasized. Even the most productive scientists at Vanderbilt can expect to have temporary funding lapses during their career. In some cases, new directions appear at the latter stages of a project, leaving renewal applications with little preliminary data to document the feasibility of a new initiative. Temporary lapses in funding place pressures on faculty not only to cover their salary but also to maintain the pace of their research programs; loss of well trained support staff or the loss of scientific momentum in competitive fields can result in irreparable damage to a research program. Currently, the wise investigator submits a cycle or two early or tapers back in spending to ensure continuity into an unfunded grant period, relying on NIH-permitted no-cost extensions of research grants. Even with these efforts it may require over a year to refund programs, particularly if teaching or administrative commitments reduce an investigator's window of opportunity for grant revision.
II. INITIATIVES FOR ENHANCING OUR EDUCATIONAL MISSION

A. Appoint a Senior Administrative Official to have Central Authority for the Educational Activities Involved in Training Physicians and Basic Scientists at all Stages of Their Career Development.

Surveys of medical school graduates place Vanderbilt University School of Medicine first in the nation in student satisfaction, particularly in serving its students by individualized attention. Similarly, the Interdisciplinary Graduate Program in Biomedical Sciences at Vanderbilt University has brought national recognition to our institution, serving as a model for similar programs under development nationwide. Currently, these two outstanding programs operate with little awareness of each other. The unification of educational leadership for the training of clinicians and basic scientists would strengthen both the medical and graduate training programs, and acknowledge that one of the consequences of the exploding knowledge relevant to human biology and disease is the disappearance of rigid lines separating biomedical disciplines. Interdisciplinary teaching activities will minimize duplicative teaching efforts and strengthen the continuum of research initiatives from bench to bedside.

The individual selected to oversee this educational continuum will report directly to the Vice Chancellor for Health Affairs. Education in the School of Nursing, which would continue to be the responsibility of the Dean (and the Associate Dean for Education) of the School of Nursing, should be integrated with programs in the School of Medicine when appropriate for enhancing the educational experience of students in both the School of Nursing and the School of Medicine. The responsibilities of the Dean of the School of Medicine concerned with implementation of the educational mission, including activities such as the evaluation and annual promotion of students, the handling of student grievances, the immigration status of housestaff and other trainees, and the general oversight of medical student affairs are critical duties that must not be overlooked during reorganization of the administrative structure for biomedical sciences.

Similar to the senior administrator who oversees the Biomedical Research continuum, the senior leadership official overseeing the educational mission of VUMC will be charged with focusing professional efforts on the future tense, identifying the educational needs of our trainees that will best prepare them to make outstanding contributions in patient care, research or academic life in the future. The visionary aspect of this role will permit Vanderbilt to incorporate the astounding changes in our basic understanding of human disease and its origins, accelerated by advances in the human genome project, into our medical curriculum while at the same time incorporating the knowledge base essential for participating in health care delivery in a managed care environment, or engaging in basic biomedical research in a variety of seemingly constantly-changing research environments. The optimal candidate to serve as the senior administrative official overseeing biomedical education will have documented credentials and experience in educational development in an academic medical center and will be recruited via a national search.

This Office of Biomedical Education will:

- Have financial oversight (with a direct budgetary responsibility) of institutional resources for medical education, the Interdisciplinary Graduate Program (IGP), and Medical Scientist Training Program (MSTP), and proposed programs to foster the career development of physician scientists, including some of the resources currently allocated through departmental budgets.
• Oversee and, when appropriate, integrate the curricular development for medical and graduate (Ph.D.) training.

• Oversee, enhance, and develop programs to promote faculty and trainee development in teaching, in evaluation of student performance, and in contributions to the literature of medical and research education.

• In partnership with the School of Nursing, foster linkages with the College of Arts and Sciences, the School of Engineering, and Peabody College in order to broaden course availability, minimize duplication of efforts, maximize talent available, and create new opportunities for innovations in teaching and/or course content. Linkages with Owen School of Management and Vanderbilt School of Law might also be fruitful for accomplishing some of the goals of the next decade; similarly, collaborative efforts in medical and graduate education with Meharry Medical College might enhance the diversity and achievements of both institutions.

• Support curriculum development, evaluation, and revision to take advantage of new knowledge and of new teaching methods (see Section IIB); oversee the selection and monitoring of faculty/student curricular committees.

• Oversee, enhance, and develop programs on Community Outreach and International Health.

B. Establish a Set of Formal Programs Designed to Promote Entry of Individuals Holding M.D. and M.D./Ph.D. Degrees into Investigative Careers, and to Insure Their Success.

As an academic health center, VUMC has an important mission to investigate the biological basis for human disease, and to translate this fundamental knowledge into the practice of medicine. Physician-scientists serve a vital role to bridge the gap between strict basic scientists and practicing clinicians. Unfortunately, there are local and national trends for decreased entry of clinically trained M.D.s into investigative careers, including: increased financial debt of medical school graduates; decreased need for physicians trained in subspecialty training; negative imprinting of medical students and housestaff regarding research careers; decreased contact of medical students and housestaff with physician-scientist role models; absence of a peer group at VUMC who actively participate in both basic science research and clinical care; and suppression of natural scientific curiosity during pre- and postdoctoral medical education as currently presented.

There is a strong desire among the VUMC faculty to preserve the role of the physician-scientist in basic disease-relevant investigation and in the translation of basic science discoveries to patient care. The following four initiatives are structured to promote the investigative career pathway at the pre-doctoral, post-doctoral, and junior faculty stages.

1. **Encourage greater medical student participation in biomedical research.**
   This initiative is needed in order to foster curiosity among medical students and to improve inquiry-based learning, as well as introduce medical students to possible careers as physician-scientists. Several recommendations are made to facilitate achieving this goal:

• Increase size of first year M.D./Ph.D. class from six to ten students in 1997/1998. A high percentage of M.D./Ph.D. graduates (84% nationally) achieve faculty positions in medical schools and these individuals serve as ambassadors for VUMC. The relatively small current size of our MD/Ph.D. program impedes our goal of becoming a national leader in training physician-scientists. Although institutional resources will be needed initially to achieve this
aim, the director of this program can seek government and foundation support to continue this recruiting effort among the medical student population in subsequent years.

- Recruit at least 10% of each entering class in the School of Medicine from the pool of applicants who profess an interest in combining patient care with clinical or basic science research, but who do not seek a combined M.D./Ph.D. degree. Provide motivational mechanisms to sustain this interest in participating in the continuum of bench to bedside research in their professional career.

- Involve more physician-scientists as role models in welcoming week of the entering medical school class, the current Introduction to Biomedical Research (IBR) program and in clinical correlations throughout the medical curriculum. For those whose interest in research is whetted by the IBR experience, develop an M.D. degree with thesis pathway (see below).

- Provide basic science research or coursework opportunities during the fourth year of the medical school curriculum.

- Consider alignment with other academic medical centers with strong physician-scientist research programs to provide summer research exchange opportunities for Vanderbilt medical students, such as Johns Hopkins University, Washington University, and UT Southwestern.

2. Develop an M.D. with Thesis Program. The goal of the educational programs of Vanderbilt Medical School is to produce leaders in research, teaching, and patient care. One critical aspect of achieving this goal is to provide physicians and physicians-in-training the opportunity to contribute to the process of discovery in basic and clinical research laboratories. Current mechanisms are poor at effectively integrating medical students into the process of discovery. Students who have an existing interest in research or those that develop an interest in research during medical school need the opportunity, encouragement, and incentives to effectively explore research in the medical center. The goal of the proposed M.D. with Thesis pathway is to identify students interested in research and place them in a suitable laboratory, supply these students with access to a group of peers and scientists who share common research interests, and support these students with a research stipend and tuition payment. The ultimate goal of this program is to foster the development of physicians who will be leaders in academic medicine and research.

Students who choose to participate in the M.D with Thesis Program will complete the first three years of Medical School. At the conclusion of year three, the students will enter a research laboratory and participate in basic or clinical biomedical research for at least one year. Thus, selection of the M.D. with Thesis pathway adds at least a year to the time of training for the M.D. degree. During this research year, the student will be paid at the Graduate Student stipend level ($14,500 as of September, 1997). Portions of Year 4 of Medical School may be structured to spend additional time doing research. Prior to the midpoint of Year 4, each student must present a written and oral summary of their research experience. If each of the above conditions are met, the student will be graduated with a M.D. degree with thesis (honors). Tuition for Year 4 of medical school will paid by the program if the student successfully completes the research year. The intent of paying the tuition for the fourth year of medical school for students participating in the M.D. with Thesis pathway is to provide an incentive to select this program, even though it adds a year to the training of these students and delays the time when they can begin to pay back their indebtedness for the cost of medical school.

Medical students who wish to participate in the M.D. with Thesis Pathway should identify a faculty mentor and research project during the first two years of Medical School. It is anticipated that many participants in this program may be unaware of their interest in combining research and patient care until after their IBR experience. Faculty mentors for the M.D with Thesis Program can be explored not only by evaluating IBR rotations but also by spending a summer in a Medical
Center research laboratory. Each student and his/her faculty mentor will prepare a short proposal outlining the research project, role of the student, and feasibility of completion of the project to the selection committee by the midpoint of the student's second year of Medical School. Projects will be evaluated as to their importance, feasibility, and training potential for the student; the training record of the faculty mentor also will be considered. Students in the program will attend regular meetings with their peers and faculty mentors to discuss the progress of their research and current research advances in the field of study happening worldwide.

3. Establish a Physician-Scientist Postdoctoral Training Program. We recommend that a physician-scientist postdoctoral training program be initiated in parallel with existing residency training programs in the Departments of Medicine, Pediatrics, Pathology, Surgery, and other clinical departments wishing to participate. There would be two phases (clinical and research) to the residency training. Participants in the program would complete an abbreviated clinical residency in one of the above described clinical departments, then engage in 2-3 years of fully-supported postdoctoral research in a laboratory of their choice (no departmental barriers). In many situations, there would be an additional clinical phase following the research phase to master a subspecialty. Ultimately, the participant would be deemed board eligible in the appropriate specialty and/or subspecialty areas and could apply for extramural research support (such as NIH Mentored-Scientist Award, AHA Clinician-Scientist Award, HHMI physician-scientist award, Burroughs-Wellcome Foundation Scholar Award, etc) to bridge between postdoctoral and junior faculty status. An intramural equivalent to the NIH Mentored-Scientist Award also should be established (see Intramural Grant opportunities in Section II G, Initiatives for Enhancing the Research Mission of VUMC).

Appropriate financial incentives should be created to increase interest in the program. A debt-forgiveness plan should be implemented to provide debt relief to promising physician-scientist trainees with substantial debt barriers to an investigative career. Such a plan would require a signed agreement between the trainee and VUMC stipulating repayment of debt relief if an investigative career was aborted prematurely. This stipulation would avoid entry of less committed trainees into the program. In the ideal situation, this program would attract M.D./Ph.D. graduates who are largely debt free.

The program should be coordinated with the existing residency program to adjust for clinical service needs. The size of the program would be 4-6 participants per year resulting in a steady-state research residency "class" size of 20-30 emerging physician-scientists. Several activities would be critical for establishing a peer group: annual research seminar presentations to faculty and other trainees; attendance at core curriculum lectures given by faculty or advanced trainees in the program dealing with modern research techniques and new areas of biology; an annual research day which receives institution-wide attention and attendance; and social functions.

4. Establish a Vanderbilt Physician-Scientist Faculty Scholar Program. Create a special transition support package for the most promising physician-scientists (either M.D., or M.D./Ph.D.) identified during late post-doctoral training stage of their careers. These individuals would be strongly motivated to pursue a career primarily in the laboratory and would have demonstrated superior research accomplishments during their post-doctoral training. These individuals would be recruited by a highly advertised national search, evaluated and ultimately selected by a special recruiting committee devoted specifically to this effort. Such individuals could be preferentially recruited from other institutions to protect against inbreeding and the diminishment in the diversity of the scholarship and scientific inquiry represented at Vanderbilt University. We would, however, keep track of our best M.D./Ph.D. graduates who chose to leave Vanderbilt after graduation, but who may be convinced to return at a later stage of their career.

Faculty scholars would be appointed to a three year, non-tenure track position with full salary and benefits in a clinical department. Scholars would have minimal clinical and teaching
responsibilities during the three year term. The support package also would include research funds sufficient to support the scholar and one additional support person. Participants in this training program would be given small laboratories strategically located near core facilities, shared equipment, and perhaps important collaborators. The scholars would have no responsibilities other than research. After three years, successful scholars (as determined by publications, preliminary data, emerging scientific contributions) could be recruited into tenure track positions of a specific department and would be highly competitive for federal research funding or more competitive career development awards sponsored by several private organizations (Searle, PEW, Culpepper, Burroughs-Wellcome).

Success of this initiative can be monitored by following the proportion of medical school graduates that ultimately select investigative careers, specifically comparing the straight M.D. with the M.D. with thesis participants. The postdoctoral training program can be evaluated by monitoring the proportion of “graduates” who have productive publication records, who secure NIH or other significant research funding or who facilitate health care advances through technology transfer. The time frame over which these monitoring activities would be most meaningful may be several years - especially for the medical school graduates (eight-ten years) vs. six-eight years for postdoctoral trainees.

C. Enhance our Interdisciplinary Graduate Program in the Basic Sciences

Our research-based training programs are key components of at least two missions of VUMC: education and research. The success of our research in fostering the continuum of bench to bedside insights also has direct impact on the third mission, patient care. Graduate and postgraduate trainees are indispensable to a thriving research enterprise and investment in their education pays off in higher quality research programs and increased grant dollars to the institution. In addition, students are the legacy of our institution and every effort should be made to improve their training and enhance their career development. The better outcome of their training will enhance the national and international standing of VUMC.

Vanderbilt’s Interdisciplinary Graduate program in Biomedical Sciences (referred to as the IGP) was established four years ago. In just a few years, the IGP has gained national prominence and is serving as a prototype for development of similar programs at other institutions. A foremost initiative of the School of Medicine should be to capitalize on this recent national recognition, with the goal of establishing Vanderbilt as a dominant force in graduate education in the biomedical sciences. Although the number of positions available as faculty members in research-intensive institutions are not predicted to increase, career opportunities for graduate and postgraduate students in the biomedical sciences are actually broadening. We maintain that training in logic and creative thinking and participation in scientific discovery serve as the optimal experience not only for careers in discovery in academia, biotechnology and the pharmaceutical industry, but also for creative leadership careers in government, teaching in science-intensive liberal arts colleges, science writing, patenting and technology transfer, and other areas where society is served by a realistic view of how discovery can change the world.

Improvements in our interdisciplinary graduate program are needed in four general areas: program size, facilities enhancement, support for summer research, and stabilization of funding. Specific recommendations are provided below.

1. Increase number of IGP students. We propose increasing the size of the IGP class from the current forty-five (45) to fifty-five (55) in the fall of 1997, to sixty-five (65) in the fall of 1998, and progressively thereafter to a goal of eighty (80) IGP students entering each fall. Five factors contribute to this recommendation:
• Expansion of our IGP class size will not compromise quality. A large number of highly qualified individuals continue to pursue graduate training in biomedical sciences; furthermore, the number and quality of applicants for graduate training in biomedical sciences at VUMC has increased substantially since the establishment of the IGP.

• Despite projections that there will be fewer academic positions for current graduates of our Ph.D. training programs, diverse career opportunities are expanding. We believe that we offer superior training opportunities at VUMC and thus should expand our program to the extent desired by the participating mentors, particularly since the collegial and interdisciplinary nature of the didactic and research phases of our graduate training are attractive investments for extramural funding programs. Educating our current faculty who participate as mentors in various Ph.D. programs will also be necessary, as they are not appropriately informed about these diverse opportunities, and often behave as if academia is the only worthwhile goal of our graduates.

• Faculty hiring has outpaced growth in the IGP. Faculty are selected, among many criteria, because of their interest in training students, and are enthusiastic about incorporating mentoring as part of their career aspirations. The IGP class has not increased since it was created in 1991, although the number of training faculty increased by at least 25%. As a consequence, mentor faculty are actively competing for a small number of graduate students. Future expansion into new research fields will generate even more faculty and new training opportunities. In addition, it is likely that at least two new interdisciplinary Ph.D.-granting programs (Neuroscience and Developmental Biology) will be in place by the fall of 1997. Thus, the number of programs offering degrees will increase from seven to nine and a proportionate increase in the number of students recruited is appropriate for matching the training opportunities provided by these programs. The Basic Science faculty view an increase in the IGP as a priority item that influenced their recruitment, and now their research success and retention, based on a recent faculty survey conducted by the IGP Evaluation Committee (report dated 3/24/96) and based on input to the Basic Science Initiatives Task Force as well as the Task Force on Graduate and Postgraduate Education.

• Vanderbilt University School of Medicine is in the lower third with respect to dollars spent on graduate education, as determined by a recent Task Force survey of public and private medical schools in the USA. Thus, a greater investment in graduate education would appear to be in balance with the status of our basic science departments in the top ten of medical schools in garnering extramural research support

2. Upgrade facilities for the IGP program. At present, the IGP suffers from a lack of adequate facilities and logistical support (classrooms, student study space and career development office). The IGP staff has been housed in extremely cramped quarters on the fifth floor of Light Hall where the lecture hall is inadequate due to poor sound and visibility. To maintain a flagship graduate program, new space should be identified to create adequate classroom and office space, and computer work stations. Significant changes have already been approved and funded by the Dean of the School of Medicine in the fall of 1996.

3. Reinstall and enhance summer research programs. The Summer Undergraduate Research Program organized by the IGP was extremely popular, but due to a shortage of funds, it was discontinued in 1995. In its last year, nearly 600 undergraduate students from across the nation applied to this program. Each undergraduate who comes to Vanderbilt for summer research serves as a spokesperson for the strength, diversity and congenial atmosphere at Vanderbilt, thus justifying renewed support for this program. Special efforts should be made to recruit minority undergraduate students for these summer research programs, an initiative that should be undertaken with the advice and support of the Director of the Office of Diversity at VUMC (see Section IV.D.)
We also recommend the development of a summer program for undergraduate science teachers, much like that in place in the Department of Molecular Biology for high school teachers. Such a program will permit the explosion of new knowledge in the biomedical sciences to be readily incorporated into the courses and laboratories of undergraduate programs as well as serve as an excellent advertising tool to increase awareness about the diverse graduate training opportunities at Vanderbilt.

The combined "ripple effect" of these summer programs for undergraduate students and faculty will increase our recruitment base and improve the overall quality of applicants. Because of a genuine desire to increase the racial and ethnic diversity of the student and faculty population, these summer efforts would specifically encourage participation by minority students and teachers. The Office of Diversity would serve an advisory role in facilitating effective recruiting efforts to accomplish this goal.

4. Stabilize graduate funding. A stable mechanism should be established to support graduate students in laboratories experiencing a lapse in funding. A temporary lapse in external grant funding is likely to occur, at one time or another, to almost every research program at Vanderbilt. Institutional resources should be made available to provide bridging support for the research and stipends of graduate students in those laboratories, as graduate students should not be penalized by the vagaries of extramural funding. Specific strategies to broaden research, salary, and stipend support are discussed in Section II.G., Intramural Research Funding initiatives and in Section II.F., Institution-Derived Discretionary Funds for Exceptional Faculty to Enhance Their Research Programs.

D. Creation of New Multidisciplinary Ph.D.-Granting Programs

The emergence of new areas of biomedical science and the trend toward collaborative and multidisciplinary research requires that Ph.D. training opportunities in the biomedical sciences be expanded to include interdisciplinary degree-granting programs that complement current department-based Ph.D. degrees. A combination of traditional and interdisciplinary Ph.D. degree programs provides flexibility in graduate training, while maintaining the identity and training missions of long-established departments. A system where departments are the sole Ph.D.-granting units, however, creates an inflexible structure, making it difficult to respond to the changing needs of research training as biomedical science evolves. The establishment of new Ph.D. degrees in emerging disciplines and new research fields will strengthen recruitment of faculty as well as graduate students, as this is a nationally-recognized trend that already has been adopted at other leading academic health centers. Students are drawn to new interdisciplinary themes that represent contemporary science, and these new research fields are attracting a significant share of research funds. This national move to broader, interdisciplinary training has been paralleled by a renewed interest of the NIH and the NSF in funding interdisciplinary training programs.

A formal mechanism should be established for the evaluation and inclusion of new, non-departmentally-based, interdisciplinary Ph.D. degrees in the training repertoire of Vanderbilt's basic science enterprise. The programs that will emerge will depend on the school's research strengths and the interests of faculty. Two programs (Neuroscience and Developmental Biology) are poised to move forward for a program-based Ph.D. degree, while others (e.g., Genetics) are less well-developed at present. The Task Force favors the establishment of a new, broad-based Faculty Committee to evaluate proposed new Ph.D. degree programs in the biomedical sciences, composed of faculty in the basic science departments of the School of Medicine and in relevant departments in the College of Arts and Sciences and/or the School of Engineering. These committees would be appointed by the senior administrative official overseeing Biomedical
Research. The approval of a new interdisciplinary Ph.D-granting program by this committee would then permit its consideration for approval by the Graduate Faculty Council and, ultimately, the Board of Trust. (In the interim, it should be remembered that a policy already is in place at the Graduate School allowing for the undertaking and completion of individually-designed Ph.D. degrees, and this avenue might be explored for those students already enrolled in our graduate program who seek an interdisciplinary rather than departmental degree until these new program can be developed, evaluated and implemented)

E. Enrich Our Outstanding Medical School Curriculum.

1. Evaluation of the preclinical curriculum. Limitations to curricular development and integration can occur in a department-based curriculum. The accelerated rate at which new clinically relevant information is becoming available suggests that a part of the educational process in the preclinical years should be to learn how to keep up with this information explosion throughout one's clinical career. In addition, faculty lament that problem solving skills are not taught in lectures where the content of the lecture, and more, is provided in thorough handouts.

The medical school curriculum has not undergone formal evaluation for nearly a decade. Given the national recognition that Vanderbilt School of Medicine recently has achieved in the outstanding appreciation for their medical school training by our graduates, we are compelled to continually examine our curriculum for means to ensure its continual enrichment. In particular, we need to identify opportunities to incorporate new basic knowledge about human biology and the origins of disease in parallel with information essential for the career development of the contemporary physician over the continuum of primary to specialty care. Individual aspects of the medical curriculum have been addressed annually by the Academic Programs Committee or special committees invited by the Dean and Associate Deans of Medicine, and the reports of these committees could guide the prioritization of issues to address.

2. Increase opportunities for clinical education in ambulatory settings. With patient evaluation and treatment increasingly occurring in ambulatory settings, paralleled by progressive reductions in the length of stay of patients in hospitals, there is a growing need for more medical education opportunities to occur in these ambulatory settings. In addition, VUMC medical students currently have few opportunities to observe or participate in the longitudinal care of patients. There are also insufficient opportunities for faculty to observe students in their interactions with patients and to individually mentor them in these interactions. Thus, we recommend that one or more specialized teaching clinics in ambulatory settings be designed around the needs of the learners, with suites and examining rooms supervised by faculty and containing opportunities for observation, such as video cameras or non-intrusive mirrors. Given the number of outlying clinics already established by the Vanderbilt University Medical Center, including the School of Nursing and its Nurse Practitioner Program, the opportunity for a collaborative effort between Vanderbilt School of Medicine and the School of Nursing exists. The opportunity to train medical students and nurse practitioners together in ambulatory settings, as individuals who ultimately will work as a clinical team, seems attractive.

3. Diversify the opportunities of the fourth year curriculum. The fourth year curriculum, in addition to clinical electives, allows considerable time for the evaluation of residency programs. As mentioned earlier, the expectation of medical students for this year could be modified to permit students who wish to participate in clinical or basic science research to do so during one or both semesters of the senior year of medical school. Alternatively, rotations at other institutions, primary care activities in indigent communities throughout our nation, or international clinical training opportunities could be encouraged to increase the diversity and breadth of the clinical and research experience of our medical trainees.
4. Broaden the dimensions of educational opportunities in concert with expanding clinical and biomedical research efforts. The current and evolving strengths at VUMC in research and clinical care create unique opportunities for our institution to develop complementary educational programs for undergraduate and postgraduate health care professionals. The development of these programs should be encouraged and supported with initial development funds by the senior leadership in biomedical education in concert, when appropriate, with recruiting and development efforts in biomedical research. As an example, a Center for International Health has been proposed by faculty members in Pediatrics and Infectious Disease that would foster our world leadership in International Medicine, drawing on research and clinical expertise and educational activities already emerging at our institution. The initial recruitment of a faculty member with leadership responsibility to focus and enhance this effort would permit the development of an internationally-available resource for educational programs, the training of clinicians specifically for involvement in International Medicine, and the creation of a para-curriculum for undergraduate medical trainees in International Health. As reputation and resources accrue, a Fellowship Program in International Medicine targeted toward faculty enrichment, postgraduate medical and basic science training, and graduate student research and education, with the intent of fostering the continuum of the “bench to the bush”, as it were, would be created. This activity to strengthen our national visibility in International Health has important consequences, as well, for our global outreach efforts as an educational institution, as addressed in Section IIJ.2.

F. Develop Criteria for Setting the Size of the Vanderbilt Medical School Class at VUMC.

Community, regional and national needs for health care professionals in the next decade must be evaluated and serve as major criteria for defining the size the medical school class whose participants are focused on a career in patient care. The size of the medical school and nursing school classes have grown in recent years, and sites for direct clinical placement are in competition with one another. Simultaneously, however, Meharry Medical College has expressed an interest in collaborating in clinical training and in providing primary care patients as well as OB/Gyn and pediatric patients for student and resident education. Consequently, the setting of class size in terms of national needs for health professionals with diverse career interests, spanning the gamut of primary practice physician to physician-scientist, will have to be in balance with our capacity to provide adequate clinical material to assure their optimal clinical training.

G. Provide Comprehensive Counseling Services for Trainees at VUMC.

Medical and graduate students, postdoctoral fellows and residents are not immune from the usual stresses of adult life, but also encounter particular stresses inherent in their training and ultimate transition to independent careers. Health professional trainees, for example, may experience chronic exhaustion but nonetheless make decisions that, if poorly conceived, threaten the health of their patients. Graduate students and postdoctoral trainees, like physician-scientists, are challenged by decreased financial resources available for participating in biomedical research, regardless of how important the outcome of that research might be, at a time when the cost of biomedical research is escalating. In addition, periods of depression may occur as a result of realizing that considerable intellectual aptitude and physical work may nonetheless not result in a pioneering discovery. Minority trainees face additional sources of stress, as peers and "role models" who can sometimes provide comfort and non-verbal reassurance essentially do not exist in our medical center environment.

Greater mental health in our trainees would have positive influences on the medical center as a whole. Furthermore, widely advertising no-cost counseling services to trainees affirms that we
care about who we train and how we serve them as individuals beyond their intellectual development.

Currently, considerable counseling of medical students about emotional and personal issues is skillfully undertaken by the Dean of Students; however, no similar service is provided for graduate students or for postdoctoral trainees in the health professions or in biomedical research. Nor is there sufficient career counseling or advice concerning the financial burden that protracted loans for tuition and living expenses will create for the future. Several possible solutions could be investigated: graduate and medical students could take advantage, under the auspices of their student insurance policies, of the psychological counseling services available to undergraduate students, perhaps calling for increased staffing of that resource; graduates of the various Schools of Vanderbilt University may agree to provide a designated annual number of no-charge consultations to Vanderbilt trainees concerning mental health, career, and/or financial counseling. Before matriculation, a formal mentor relationships with a Vanderbilt graduate in the home town or region of the entering medical students, graduate students, or residents could be established that would permit discussions of career development during the holidays or summer breaks, mirroring successful alumni-trainee mentoring programs at other academic health centers. Other career and personal counseling programs also could be explored, and should be encouraged under the auspices of the Office of Biomedical Education.

H. Establish an Endowment for Medical and Graduate Education.

1. Endowment enhancement for need-based financial aid for medical school. The current high tuition and inadequate financial aid package at Vanderbilt University Medical Center result in two undesirable consequences: (1) a minimization of economic, racial and ethnic diversity in the medical student body and (2) a high debt for many of our graduates. Increased financial aid in the form of low interest loans and need-based scholarships will result in a more diverse student body and less debt burden. A consequence, naturally, will be an increase in student gratitude and institutional loyalty that, in the future, should result in increased alumni giving to this and other endowments at VUMC. Alumni and friends of the School of Medicine could be solicited aggressively for endowments to fund this initiative. Tuition endowments in the names of faculty who have been exceedingly popular over the decades could be used as one mechanism for soliciting dollars. Allowing families to name student scholarships in honor of loved ones in their family provides yet another means to encourage giving. The parallel effort should be made to reduce tuition costs for all students, thus decreasing the debt burden of all graduates. In addition, the designation of 1% of medical school tuition for investment in an escrow account to grow to an endowment for medical school tuition would also accelerate the rate at which the needed size of the endowment is achieved.

There will be many positive impacts of any initiative which reduces the cost of medical school tuition and the related living expenses. Success of the initiative should be apparent in a more diverse student body. In addition, many more students may choose to opt for careers as physician-scientists, as a reduced debt burden would permit further research training and acceptance of perhaps lower salaries of physician-scientists post-training. Similarly, the accessibility of tuition assistance for students from low income families means that there should be an increase in the diversity of students who apply and accept Vanderbilt University Medical School. If this financial diversity is paralleled by racial diversity, an increase in the minority student population will mean that minority students will no longer feel quite so isolated, and recruitment and retention of minority students will gradually improve.

2. Endowment for the Interdisciplinary Graduate Program. The funding mechanism for the IGP is fragmented, and potentially unstable. At present, six basic science departments in the School of Medicine and the Department of Molecular Biology in the School of
Arts and Sciences contribute equally with the Dean for the cost of the first year of the IGP. However, as departmental recruiting has increased the size of the faculty by twenty-five per cent (25%), and interdisciplinary graduate programs in Neuroscience and Developmental Biology have been proposed, and programs and Genetics and Biophysics are under initial discussion, the origin of the resources to support a necessarily larger graduate student body is not clear. Furthermore, on a year-to-year basis the distribution of students is unequal, even though the cost of the IGP continues to be borne equally by the seven participating departments. Review of this issue by task force participants suggested that this inequity eventually may cripple or destroy the IGP, particularly as departmental budgets get tighter and availability of stipends for support of students on individual research grants also is threatened.

Institutions such as Johns Hopkins and Washington Universities have managed over the years to develop an endowment for graduate training and research. A similar endowment of the graduate program appears appropriate for VUMC.

I. Enhance The Training Experience And Career Competitiveness Of Postdoctoral Trainees

There is a nationwide trend that fewer college graduates are choosing careers in the sciences. The awareness that the financial resources for research, particularly our national investments in biomedical research, are declining, is contributing to a reduction in the number and quality of candidates applying for Ph.D. training in the sciences. Although our own experience at VUMC is an increase in the number and quality of graduate student applicants, our faculty are nonetheless experiencing increased competition for outstanding post-doctoral applicants to train in their laboratories and to contribute to their research programs. Since the two most important criteria for selection of a particular postdoctoral training site are the reputation of the selected faculty mentor and of the institution, strategic planning initiatives aimed at bolstering our research enterprise and increasing our national standing will have a positive impact on postgraduate trainee recruitment. In addition, our current postdoctoral fellows have identified a number of ways to increase our visibility and attractiveness as a post-doctoral training environment. At an open meeting held on June 20, 1996, post-doctoral fellows in the basic sciences said that fostering opportunities for their career development is the overwhelming issue of importance to them. Thus, efforts which enhance the mentoring experience of our post-doctoral fellows will contribute to the recruitment of increasingly more talented individuals as trainees.

1. Establish a career development network. Although there is an anticipated shortage of faculty positions available for basic scientists in academia for the next three to five years, due primarily to the suspension of a formal retirement age, there is an increase in the diversity of careers available for scientists trained in our competitive biomedical research environment, including public policy, scientific journalism, patent law, technology transfer, scientific administration or development for not-for-profit research foundations, to name a few career opportunities. Financial resources should be identified each year for the use by a committee of postdoctoral trainees to pay for the cost of visits and seminars by leaders in these emerging diverse careers. These visiting speakers could serve as mentors for our trainees about career development pathways as well as serve as a link to apprenticeships or additional training opportunities.

It is anticipated that a Career Development Network, including both personal contacts and an Internet-based linkage of relevant Websites, should be encouraged in its development to provide constantly-updated information about resources for postdoctoral training as well as for insights into diverse career opportunities. For example, our own Intranet could provide up to date information about individual grants that pre- and postdoctoral trainees could submit to fund their research, as well as application forms and submission information to facilitate the process. A variety of NIH-sponsored, Research America-sponsored and other information sources exist on
the WWW that identify diverse career paths and the talents needed to succeed in these careers, including information about what additional training and experience is needed to pursue diverse scientific professions. This network could be expanded, in concert with the Alumni Office and the Office of Development, to provide career mentoring and job contacts through faculty and alumni contacts world wide. Trainee organizations, such as a Vanderbilt Postdoctoral Consortium, for example, could schedule special programs and events, such as monthly career seminars by Ph.D.'s working outside academia (e.g., industrial scientists and managers; public policy or law consultants; government employees); career fairs; and special internships.

Since career development issues stood out as top priority for graduate and postgraduate trainees in various meetings with these constituents during the strategic planning process, we need to respond appropriately if we are to enhance the quality of applicants to our graduate programs and the quality and quantity of postdoctoral recruits. Given the interest of graduate students in these same issues of career opportunities and development, the Office of the Interdisciplinary Graduate Program may wish to serve as the administrative oversight of an appropriate Website and seminar/visiting speaker program to serve this need for all of our basic science trainees.

2. Establish transition space and mechanisms to foster postdoctoral bridges to independence. As the academic job market tightens, extended or second postdoctoral training experiences are becoming common. To be successful in academic job hunting, evidence of unique strengths, such as a submitted or particularly a funded research grant, are required to create a competitive edge. We recommend the creation of “Bridge to Independence” mechanisms to foster the development of outstanding postdoctoral trainees into independent scientists and to facilitate their movement into premier academic faculty positions. This initiative would provide a means for our faculty to attract superbly trained and highly motivated postdoctoral fellows who ultimately desire an independent research career, but who seek some additional training, mentoring and the opportunity to develop an independent research program in a protected environment. For talented postdoctoral fellows whom their mentors feel are suitably trained and sufficiently mature, VUMC would commit to sponsor grant applications (e.g., small grants, RO1’s or FIRST awards) by appointment of these senior postdoctoral applicants to Research Assistant Professor (non-tenure track) positions and the commitment of research space (typically 400 sq ft) in an environment with readily available core equipment and opportunities for intense scientific exchange.

These transition commitments would require that the original faculty mentor of the postdoctoral fellow agree to foster the independence of this individual, including confirming on the application to extramural funding agencies that the mentor will no longer participate as a co-author on manuscripts that emerge from these new independent experimental activities. In addition to the impact that this mechanism would have for attracting especially motivated postdoctoral trainees to participate in the research programs of our faculty, the institution is served by a reputation for developing the careers of young investigators. Space could be provided by a senior mentoring faculty member or designated by the senior administrative official for Biomedical Research. Consideration of requests for independent transition space will involve competitive review, focusing on the novelty of the research program, when compared to the postdoctoral experience, and the perceived importance of the proposed biological problem to be solved. We anticipate that, in most cases, recipients of these awards will utilize this success to garner a highly competitive faculty position elsewhere, positioning Vanderbilt as a national leader in placing its trainees in prestigious positions in biomedical research.

3. Normalize postdoctoral benefits. An issue of significance to Research Fellow Trainees (postdoctoral trainees on NIH training grants or individual NRSA's; about 50% of the total pool of postdoctoral trainees) was benefits. These individuals do not have staff benefits, while postdoctoral trainees supported on research grants do (e.g., access to life and disability insurance plans; child care facilities; recreation facilities; athletic events; IRS tax withholding, direct deposits; etc). An effort should made to rectify this discrepancy. It is recognized that Vanderbilt's
policy reflects the administration’s interpretation of NIH guidelines. However, a university financial officer should be given the charge to re-evaluate this decision and to contact local and NIH officials to explore means to make the benefits for postdoctoral fellows equivalent independent of the origin of their stipend. Importantly, postdoctoral trainees should be made fully aware of the benefits available to them in a Postdoctoral Handbook which includes other useful information dealing with rights and responsibilities of postdoctoral fellows and practical matters such as income tax issues, facilities, etc. The preparation of this Handbook could be undertaken by a Postdoctoral Trainee Consortium, perhaps in association with Departmental Financial Administrators who have had considerable experience with the funding of postdoctoral trainees from multiple extramural resources.

4. **Other initiatives to enhance the postdoctoral training experience.**

   - Enhance recruitment efforts - encourage support for interview visit and moving expenses; since these cannot be paid from government sources, allow faculty to use accounts created by incentives for faculty success in garnering extramural research support (See Section I.F.) or junior faculty development money.

   - Integrate postdoctoral fellows more fully into the academic community, including enhanced opportunities to present research seminars and to teach in graduate courses or small in-group sessions in medical school courses, in both cases under the direction of a teaching mentor.

   - Improve communications about career-development opportunities, administrative and funding issues, and other topics directly relevant to the postdoctoral community. Funding for the preparation and distribution of a postdoctoral handbook developed and used by postdoctoral fellows should be considered.

   - Explore low-cost and transitional housing for graduate and medical doctoral and postdoctoral trainees with developers in town (no use of VUMC financial resources--this recommendation intended to foster goodwill and interactive links between VUMC and local businesses).

J. **Initiatives for Enhancing Outreach in the Biomedical Sciences**

1. **Community outreach.** The goal of this initiative is to establish a locally valuable and nationally utilized program in educational outreach and service in the biomedical sciences. Although the short-term goals emphasized here focus on outreach activities within Nashville and the surrounding areas, the consequences of this leadership effort should have ramifications that could be shared nationally and world-wide.

   Vanderbilt has a strong tradition in research, teaching and clinical care. Coupled with this tradition of excellence has been a strong desire to increase awareness of important biomedical research and health-related issues within the local and global community. Currently, a variety of community education and community service programs related to the biomedical sciences have been implemented by a variety of VUMC departments, centers, individual investigators and students. These programs target individuals of all ages, ranging from elementary school through adults, and have been well-received by their target audience. Establishment of a centralized VUMC Office of Biomedical Outreach would maximize the impact of our current programs and position Vanderbilt and the Nashville community as a national leader in these kinds of outreach activities.

   On the national level, there is a growing concern that public awareness of science and research-
related issues is on the decline. With increased technology and dissemination of information to the lay public, and increased emphasis on preventive health care, it is absolutely critical that educators take an active lead in sharing the knowledge and information that will increase overall science literacy. Both federal agencies, such as the National Science Foundation and the National Institutes of Health, and private agencies, such as the Howard Hughes Institute, have initiated funding programs to specifically address the areas of science and health education partnerships to foster collaborations among community educators. Many universities across the country have already taken the initiative and have established strong active Outreach programs. The University of California at San Francisco and Washington University in St. Louis are two excellent examples of leading academic health centers that have recognized the need for science and health education outreach, and have established programs that have now been in existence for over 10 years. These programs have provided the models for other universities in the development of outreach activities. Vanderbilt must now take a lead in the Metro-Davidson county and midsouth region in making a strong and vigorous commitment to educational outreach.

VUMC is strategically in an excellent position to play a leading role in science and health education nationally, given the excellence of our Schools of Medicine and Nursing and the potential synergy that could evolve from cooperative educational efforts among these entities and other Schools at Vanderbilt University. In addition to our proposed efforts locally, we should also explore the feasibility of creating a national and even international market for distance learning and network-based health education (see section II.E.4 and below for examples of international impact).

Vanderbilt faculty, staff and students have participated in and initiated a wide range of successful outreach programs, particularly locally. Vanderbilt student volunteers have taught hands-on science to elementary students; VUMC has hosted several highly acclaimed career days for high school juniors and seniors; teachers from Davidson county as well as surrounding counties have participated in-service training sessions, hands-on workshops, and a summer Masters in Science program; VUMC students, staff, and faculty have talked to local schools and community organizations on a variety of science and health related issues such as AIDS, smoking, wellness, and preventive care. Individual faculty have obtained grants from Federal funding agencies to support research projects for teachers and minority students during the summer; to hold workshops for high school teachers covering such topics as genetics and immunology; and, to establish a Mobile Genetics laboratory that can be used by teachers in the local schools. Strong links already have been established in support of these efforts with other schools at Vanderbilt, including the School of Arts and Sciences and Peabody College. Outside partners might include the private and public secondary schools in the surrounding area, Cumberland Science Museum, the Public Library, and other colleges and universities in Nashville. The framework for a highly successful outreach program is already in place. What is needed is a central office to direct the efforts of this VUMC program.

The initial step in the implementation of this initiative is to establish an Office of Biomedical Outreach. Initially, a Director and Administrative Assistant would be hired and would report to the central authority on Biomedical Education. After extramural support is obtained, the staff would likely expand to include a Director, Program Coordinator, Community Liaison, and Administrative Assistant as described below. Two key initial efforts of this office would include the identification of existing programs at Vanderbilt, and the identification of community needs and community partners. Existing links within Vanderbilt and the community could be facilitated by the establishment of a VUMC Outreach Board, including representatives from VUMC administrative offices in the School of Medicine and the School of Nursing, and a Community Outreach Board including the VUMC Outreach Director; a representative of the outreach efforts of Vanderbilt University as a whole; the Metro Science Coordinator; representatives from the MLK magnet school for math and science, Cumberland Science Museum, the Public Library, other area Universities (Fisk, TSU, Belmont, David Lipscomb), Meharry Medical College, and interested
advocates from the Mayor's office, the Governor's office, the State Board of Education, the Metro Board of Education, Community Centers, Community Churches, and local industry (Junior Chamber and the Chamber of Commerce).

Long range efforts of this Office would concentrate on establishing a continually growing and forward thinking outreach program that will incorporate new ideas, examples from other cities and universities, and ongoing Vanderbilt programs. A major effort would be centered on establishing a strong link with the new Communications Division (staffed by Lovell Communications) to assist in implementing the best methods for communicating information from the Office of Outreach to the local and Vanderbilt communities, as well as insure that all materials communicate a unified image and message about VUMC. Links with VU libraries and public libraries will be established. Finally, a goal of this office would be to solicit and encourage funding from outside sources to supplement the budgetary needs as activities continue to expand.

Outreach programs in place at Vanderbilt have already had measurable results such as increased participation of VUMC faculty, staff and student volunteers as well as increased numbers of Metro students and teachers requesting outreach programs. With the establishment of a permanent Outreach Office and program, we would anticipate that a number of measurable goals would be reached, including increased student test scores, the use of the VUMC-initiated program by other universities and communities; increased participation in the VUMC program by teachers, students, and the public; increased participation in outreach activities by VUMC faculty, staff, and students; an increase in the number of students entering science careers, both at Vanderbilt and other universities; and, an overall increase and enhancement of working relationships with community partners.

2. International outreach. Awareness of the global community coupled with our strengths as an institution in research, education and patient care offers unique opportunities for Vanderbilt University Medical Center to extend its outreach missions worldwide. As an example, the Center for International Health, described in Section II.E.4, will provide the knowledge base for the training of health care professionals worldwide for patient care and research efforts targeted toward the prevention and treatment of international diseases, particularly those insurgent in third world countries. Information concerning issues in international health can be disseminated, as well, for the benefit of the lay public for their understanding of medical issues that have social and political impact, and for the further development of educational tools for use in K-12 schools nationwide.
III. INITIATIVES TO ENHANCE THE TECHNOLOGY TRANSFER MISSION

The transfer of technology from basic research to its application in health care is the ultimate goal and the responsibility of all biomedical research. Indeed, the Bayh-Dole Act makes commercial development of inventions arising from government-funded research a primary responsibility. The commercialization of research requires effective technology transfer to link the vision and commitment of inventors with the development of their discoveries into health care products. This process amplifies a major asset of university medical centers, the products of faculty research, into rewards for patients, faculty, university, and community alike. Through technology transfer, the research mission of the university can be closely integrated with local, state and regional businesses in relationships of great mutual benefit.

Recommended initiatives in this strategic planning document have been adapted and modified from the most successful strategies of leading medical centers similarly positioned within their university environments. Leading biotechnology entrepreneurs and the Southern Technology Council have provided additional input and advice about critical features of a successful technology transfer program, including the benchmarks needed to evaluate success.

Three interdependent components (initiatives) are viewed as critical in efforts to develop technology transfer at VUMC:

- Establish a flexible and effective Office of Technology Transfer at the Medical Center with resources and an infrastructure sufficient to link faculty advances in research, education and clinical care with commercial opportunities.

- Revitalize institutional attitudes and practices toward licensing and subsequent commercialization of intellectual property.

- Aggressively coordinate University linkages to local, state and regional entrepreneurial business support systems.

A. Establish a Flexible and Effective Office of Technology Transfer within VUMC

The establishment of an active technology transfer activity within VUMC is critical for the translation of research discoveries into improvements in human health. Similarly, advances in education and patient care that would facilitate these activities worldwide also might be appropriate for sharing via technology transfer. Institutions that are successful at converting new technology into commercial applications have active technology transfer offices that interact with investigators, university and hospital administrators, funding sources, legal consultants, and representatives of biotechnology and pharmaceutical firms.

1. Leadership. We recommend that a senior individual be recruited to oversee these activities within VUMC. This individual would report directly to the Vice-Chancellor for Health Affairs, and communicate with the Director of the Vanderbilt University Technology Transfer Office. Currently, all technology transfer at Vanderbilt University is handled through a central office. The Director of Technology Transfer currently reports to the Vice-Chancellor for University Relations and Office of the General Counsel. Outside expertise solicited by the Technology
Transfer Task Force advised that this is an inappropriate organizational structure: the activities of a successful Technology Transfer Office involve risk, whereas the responsibility of the General Counsel is to protect against risk, creating an inherent conflict in the operation of the Technology Transfer Office that could seriously limit its effectiveness for facilitating the translation of biomedical discoveries to improved research methodologies and application to patient care. Consequently, we recommend that Technology Transfer operate from an office independent of that for the General Counsel within the Medical Center, but in open communication with the central office for technology transfer at Vanderbilt University. In fact, given the current level of technology transfer activities emerging within the Medical Center, a conversation about the unification of these activities within Vanderbilt University, perhaps locating the office in the Medical Center, might be initiated among the offices of the Chancellor, Provost, and Vice Chancellor for Health Affairs at Vanderbilt.

The senior leadership of Technology Transfer should have the benefit of interacting with a Scientific Research and Technology Council composed of faculty, business leaders, administrators, trustees, and outside advisors with commercialization experience. This council should be created to assist and advise the Technology Transfer Office in the establishment of policy, identification and resolution of conflict of interest/conflict of commitment, etc. This Council would provide an important avenue for networking VUMC Technology Transfer with business and government leaders, serving an outreach function in parallel with its governance and advisory roles.

2. Protection against conflict of commitment. An important role of the scientific leadership of the medical center, in concert with the Office of Technology Transfer, will be to educate faculty and trainees about the appropriateness and importance of transferring key concepts and technology for their commercialization, thus permitting faculty and their collaborating trainees to return to discovery research and other academic pursuits. A concern among some faculty is that licensing or pursuing patent protection for novel concepts or methodology may distract them from the research activities that have led to their relevant discoveries, drawing them into a mode of translational research or business involvement for which they lack the appropriate training. It will be incumbent on institutional leadership in Technology Transfer to clarify the role of this effort, emphasizing that by appropriate transfer of concepts by licensing and/or patents, the academic program of the faculty member is not compromised, and often is facilitated by the reagents and technology afforded by reverse technology transfer.

3. Proof-of-Concept Fund. A separate budget should be available to the Technology Transfer Office to provide funding to demonstrate proof-of-concept for promising technologies. Many inventions generated in academic medical centers represent in vitro observations that may or may not be applicable in animal models or humans. The closer the technology is to being effective in human beings, the more favorable the licensing position of the institution. Given the breadth of research capabilities at VUMC, it is often relatively inexpensive to do a few pilot experiments in house (e.g., to demonstrate efficacy in rodent models). However, a source of funds for such studies often is difficult to identify. The successful execution of such pilot experiments will greatly enhance the royalty or equity position that VUMC can negotiate, because the risk to the industrial partner is reduced.

B. Revitalize Institutional Attitudes and Practices to Promote Technology Transfer

As indicated above, many of the "cultural" barriers to adopting technology transfer have evolved through perceived conflicts between academic objectives and commercialization of research. An aggressive effort to educate inventors about the benefit of commercialization to their research mission is critical, as is support of their academic careers while they expend effort toward
• Educate faculty to promote participation in invention disclosure, licensure AND provide an interface between university intellectual property and commercialization opportunities in the biotechnology and pharmaceutical industries.

  - Educational "Technology Transfer Forums" should be held to promote disclosure and inform inventors about the process.

• The Director of the Office of Technology Transfer should meet investigators and function in a facilitative role, promoting the faculty’s best interests.

  - Online protocols should be provided to give inventors estimates of the time commitment required for disclosure, prototype examples, and a step by step process they should take to protect inventions through disclosure application and potential patent application.

• A database identifying research activities of faculty and areas of potential application should be established to link researchers with commercialization opportunities. Policies should be established regarding the equity positions of University and inventor/developer in start-ups.

• Investigators should be permitted to direct their institutionally-determined share of the royalties from their inventions to their laboratories or to their personal use.

C. Develop Community, Regional and National Commercialization Networks

The Nashville area has been a national leader in entrepreneurial activities surrounding health care delivery. A major opportunity exists to integrate biomedical research opportunities at Vanderbilt with this local business community, through an aggressive educational campaign that illuminates shared opportunities. The Vanderbilt Medical Alumni, Trustees and local business leaders are a ready target for developing business relationships with VUMC, expanding on the usual mechanisms through the Chamber of Commerce, and other local and state agencies. A number of mechanisms have been used successfully in other cities and regions to develop business “incubators” and local sources of seed capital. It is particularly important to establish long term relationships with venture capitalists who understand the academic mindset. Alumni venture capital funds may be established. Participation of the Scientific Research and Technology Council will be crucial in developing a staged plan for these activities, as well as defined goals, or benchmarks for defining success. A committed individual in the Office of Technology Transfer should coordinate and oversee this combined outreach and development activity.

The performance of the Technology Transfer Office and its staff will be evaluated on a regular basis. Organizations such as the Southern Technology Council (STC) and Association of University Technology Managers (AUTM) have established guidelines for benchmarking technology transfer. Two independent benchmarks are needed: 1) outcome or performance benchmarking, targeting defined goals (such as numbers of disclosures protected, licenses granted, royalties received), and 2) practice or process benchmarking, focusing on key organizational functions necessary to maximize performance. Methods such as determining ratios of royalty income divided by R&D expenditures may be useful over the long term. The Office of Technology Transfer at VUMC should undergo an initial review after three years; subsequent reviews are then recommended for every five years.
IV. STRATEGIC INITIATIVES TO ENHANCE ACADEMIC LIFE

As indicated at the outset of this document, the growth of our faculty, the continually expanding success of our research programs, and the rapidly changing clinical environment require increased leadership efforts not only to implement ongoing programs but to develop a cogent vision for the future and make hard choices about how to achieve that vision. The importance of assigning a senior official to the oversight of initiatives for enhancing biomedical research, biomedical education and technology transfer is to assure that Vanderbilt has identified senior administrative officials with the protected time to look toward the future in each of these areas and with an infrastructure sufficient to implement institutional visions. These recommended changes in governance are paralleled by efforts to clarify the obligations of the institution to its faculty, and the obligations of the faculty to sustain excellence in serving the medical center missions throughout all phases of their careers. Recommended initiatives to foster diversity also will strengthen collegiality by increasing intramural institutional appreciation for the many roles required to achieve our missions with excellence.

A. Medical Center Governance

Unprecedented growth and continuing success in all three of the missions of the medical center has increased not only the size but also the complexity of our faculty. Also increased are the diversity of expectations of our institution by both our trainees and the patients we serve. With the trend toward interdisciplinary research and the unique responsibility of academic medical centers to participate in the continuum of discovery from bench to bedside, there is a need to identify transinstitutional leadership responsibility for developing a vision for contributing to the national portfolio of biomedical research, biomedical education, and technology transfer in such a way that we secure our reputation among the top ten academic health centers in this nation. We need not be apologetic that our growth and success now require additional senior administrative leadership to complement the existing administrative structure and facilitate the identification and achievement of institution-wide goals.

1. A new administrative structure. We recommend that three senior administrative officials be hired, preferably as a result of an aggressive national search, to provide visionary and financial oversight of biomedical research, biomedical education, and technology transfer, and to report to the Vice-Chancellor of Health Affairs in parity with a single senior administrative official representing the clinical enterprise. On a quarterly basis, perhaps at off-site retreats, the chairs of the basic science and clinical departments and directors of centers with significant research and patient care responsibilities would meet with the Vice-Chancellor and these four senior administrative officials to recommend areas for growth and development, to react to consequences of intentional as well as unanticipated changes in the national environment and our local institutional culture, and to become fully informed as to the status of ongoing trans-institutional initiatives and projections for the future.

Currently, the chairs of departments have responsibility and authority concerning the distribution of space and financial resources allocated to each department by the Vice-Chancellor for Health Affairs. Chairs also have responsibility for developing the vision for program development, and the creation of an intellectual environment necessary to foster excellence, including the mentoring of faculty and trainees throughout the many stages of their careers. When multidisciplinary efforts for recruiting or program development transcend departmental lines, authority for the use of space and financial resources will be overseen by chairs in conjunction with
the senior administrative leadership most involved in the recruiting or programmatic investment.

The creation of this new leadership overseeing research, education, patient care, and technology transfer from a trans-institutional perspective is intended to assure that, despite the capriciousness of our national environment, we maintain a focus on the future and a clarity about how to achieve our institutional visions. These recommendations assume that the infrastructure that has served us well will remain in place, and in some cases be enhanced by additional faculty and staff to accompany the growth and success of our efforts and to facilitate continued programmatic development.

2. Increasing the breadth of input into institutional decision-making processes. This strategic planning process demonstrated the greater creativity and rapidity of problem solving that can occur when broad-based input is solicited from faculty, trainees, and staff. The strong desire by our constituents for greater input into the future directions of the Medical Center should be viewed as a healthy consequence of their sense of personal and professional investment, rather than as a threat to the autonomy of the administration. Moreover, increased input from faculty, trainees, and staff would with certainty increase the sense of collegiality at VUMC, currently threatened by the growth of our institution, a consequence that can only enhance overall productivity and excellence. Finally, utilization of broader faculty, trainee and staff talents will enhance the leadership skills of these individuals and thus enhance their effectiveness as emissaries of our institution in their professional circles, locally and nationally. How this enhanced input is solicited or implemented should be considered by the departmental chairs and the senior leadership when a formal administrative and interdependent communication structure is defined. Broadening this input to involve representatives from other Schools of the university will be essential if we are to strengthen our research and educational portfolio institution-wide and thus maximize our strengths.

3. Create a mechanism for evaluation and modification of support services to optimize their functioning. All of the missions of VUMC rely on support services that, in turn, are paid for by income to the institution derived from indirect costs and clinical revenues. For these services to assure excellence in our efforts, they must serve our missions optimally. The accelerated pace of change in the national and local environment can make meeting the infrastructure needs of the institution a seemingly unattainable goal. However, it is anticipated that team planning among participants in the users, support and service groups would provide proactive means to plan for improved infrastructure and a mechanism for evaluation and revision of strategies, as appropriate.

The services cited most often by participants in the strategic planning process as essential for continual evaluation for their alliance with the mission and activities of VUMC are:

- Animal Resources
- Human Resources
- International Services
- Biomedical Communication
- Bioinformatics and provision of network and desktop services
- Medical Center Library (frustrations limited primarily to the limited hours of operation)

To permit creative and shared strategies for solving current frustrations, team planning between a committee of faculty users and staff representatives from the appropriate services should occur at least once a year, utilizing a user evaluation form as a guide for the issues that need the most attention. This evaluation process also will permit an affirmation of superb performance that influences merit raises, a mechanism for expressing gratitude for outstanding service that is lacking at present. This team mechanism for refining the services and infrastructure that support our mission should improve communication between functioning units of our institution, optimize
compliance with changes recommended for users and servers alike, and prevent adversarial relationships from developing that will diminish the excellence of our shared efforts.

B. Reaffirm that the Criteria for the Awarding of Tenure Include Recognition for Contributions that Make a National Impact in All Areas of the Institution's Missions: Research, Education, and Patient Care.

Discussions concerning tenure implicitly affirmed that we must reward faculty for their diverse contributions to the missions of the Medical Center, as the increased pace of each of our professions means that we cannot, as single individuals, contribute all of our efforts to all of the missions of the institution and remain competitive within our primary area of focus; instead, we are reliant on one another to create the desired and essential continuum linking our missions. Whether or not the concept of tenure should be maintained at Vanderbilt University Medical Center was an issue of considerable discussion during the strategic planning process, within the task force charged with the issue of tenure, during the open forums soliciting broad-based faculty input on this topic, and during focus groups hosted by other task forces. Despite all the faults with our tenure process, the elimination of the concept of tenure was perceived as a threat to recruiting and maintaining the most talented faculty for our missions as an academic health center. Consequently, an implicit recommendation of this strategic planning document is that tenure be maintained at the School of Medicine; a similar decision to retain tenure was reached by the strategic planning committee of VUSN.

Currently, Vanderbilt University awards tenure for “excellence in research, scholarship, or creative expression.” However, the university tenure policy has been developed with little attention to missions that are unique to faculty in the School of Medicine. Although tenure can be awarded for “scholarship and creative expression,” currently the awarding of tenure appears to focus on research achievements with no equivalent recognition of scholarship as it might relate to national impact in the areas of teaching and patient care. There is concern that not evaluating or considering performance in areas other than research may undermine faculty commitment to these other missions. As a result of tenure favoring those engaged in research, there has been an increase in the use of non-tenure track appointments for junior faculty who also have clinical responsibilities. Non-tenure track appointments are perceived, at least by some, to carry less prestige than tenure track appointments.

The strategic planning process led to an affirmation that the stature of Vanderbilt University Medical Center is enhanced by activities that result in national and international impact. It is recommended that tenure at VUMC be awarded for outstanding achievements and for contributions in research, teaching, patient care. This objective can be achieved by broadening the definition of "scholarship or creative expression" to include nationally-recognized contributions in the areas of teaching and patient care. Examples of such activities would include invited presentations at prestigious national meetings, prominent roles in national professional organizations, and development of programs that have been adopted by other institutions. The quality of contributions rather than quantity should be the overriding factor in evaluation for promotion and tenure. Current standards for sufficient contributions to scholarship, teaching, and service remain as minimal requirements for promotion and tenure in areas in which national recognition is not achieved.

Candidates proposed for promotion/tenure based on their participation in clinical research should be evaluated on the basis of their intellectual contributions to the research and individual recognition at the national level. Since many clinical research projects are by nature collaborative and require long periods of time to complete, it should be recognized that the number of senior-authored publications may not be comparable to that assembled by investigators in basic research.
The nontenure track should be retained to recognize contributions at the local level which enhance the environment and contribute to the institutional missions. Importantly, faculty should understand that the option exists for tenure to be granted from a nontenure track position if appropriate criteria for national recognition are met. In particular, it is recommended that faculty on the educator or the clinical track can be promoted from Associate Professor on the non-tenure track to Full Professor with tenure, in recognition for their nationally-recognized career-long contributions. This change would require consideration of an extension of the current time restriction required to meet tenure criteria for Medical School faculty with significant clinical responsibilities, consistent with the recognition by the A.A.U.P. of the divergent obligations of these faculty compared to faculty in undergraduate institutions. Precedent for an extension of this time limit for up to 15 years can be found at several peer Medical Schools. Finally, we recognize that the School of Medicine is part of Vanderbilt University and that any changes in tenure policy requires consideration by the VU Faculty Senate.

As part of their role as faculty mentor, the Chairs of Departments must take the responsibility of informing faculty of the various appointment and promotion tracks within our institution and the criteria for promotion, affirming the importance of all constituents of the institution for fulfilling its missions.

C. Faculty Life

The Faculty Manual for Vanderbilt University Medical Center guarantees “academic freedom” for all of its faculty. “Academic tenure at Vanderbilt refers to the university’s commitment to continue any faculty member appointed in that office, unless otherwise specified at the time of appointment, the faculty member voluntarily terminates the appointment, until retirement or permanent disability, or in the case of dismissal for cause.” What is problematic at present in the Medical School, however, is that Vanderbilt faculty differ in their assumptions regarding the financial guarantees associated with tenure. Note that no guarantees related to salary are described in the current Faculty Manual. Although a financial guarantee of salary is not currently associated with tenure, many faculty view a financial guarantee as a necessity for the competitive recruitment and retention of outstanding faculty at VUMC now and in the future. Explicit definition of the obligations of both administration and tenured faculty and mechanisms to assess productivity are recommended.

1. Departmental and faculty performance review. All departments or other administrative units should be evaluated by an External Advisory Committee on a schedule of approximately every five years. The goal of the external review is to ascertain the effectiveness of the contributions of the unit and its individual members, including the Chair or Director, to the missions of VUMC.

The performance of all faculty should be evaluated annually. It is the obligation of faculty to contribute to the missions of the institution with excellence. The Faculty Activity Report endorsed by the Executive Faculty and distributed June 17, 1995 provides a reasonable format for discussion of faculty contributions, but can be modified as appropriate for different units and for different needs. Tenured faculty have an implicit obligation to maintain productivity in research, scholarship, creative expression, teaching, and service. Rigorous documentation of faculty productivity and the Chair’s assessment and response to the quality and quantity of faculty contributions are required to document that both the faculty member and the Chair are meeting their obligations to the institution, and that the institution is engaging in equitable treatment of all of its constituents. It is anticipated that a well-implemented annual performance review not only provides documentation of outstanding performance but also offers concrete recommendations for revitalization and career enhancement, when appropriate.
2. Clarification of faculty benefits, obligations, and related salary structure. Under ordinary circumstances, the institution will maintain or provide cost of living increases in the salary of faculty who contribute in a productive manner to the missions of the institution. For faculty whose salary is derived principally from research grants, 100% salary support ordinarily will be sustained during lapses in funding when the faculty member makes diligent efforts to maintain a strong research program and to solicit outside salary support.

It is recommended that, each year, faculty members reach an agreement with their Chair concerning the relative percent of professional effort that will be committed that year to the various institutional missions and to institutional service, such as representation of the faculty on committees. The following specific recommendations are made.

- The temporal allocation is based on the quantity of contributions to each of these areas as a percentage of total professional effort.

- The quality of contributions to each of these areas will be reflected by the percent of salary increase granted for each activity, thus emphasizing meritocracy as a means for salary increments.

- Service to the Vanderbilt University community should in general constitute 10% of effort provided to faculty each year. Service contributions greater that 10% require exceptional and well-documented service, such as carrying out a significant administrative function. Service includes, but is not limited to, contributions on department, university and Medical Center committees; outreach activities; service to national organization; journal and grant review committees; and journal editorial boards.

- Teaching contributions should be documented according to a consistent, equitable system appropriate for the diversity of teaching activities performed by faculty of the Medical Center, and, when appropriate, be rewarded by raises or administrative supplements conferred by the Chair of the Department, perhaps derived from resources made available by the senior administrative leadership overseeing the continuum of biomedical education. Precise mechanisms for evaluating teaching contributions, both in quantity and quality, will be developed under the direction of the senior administrative official overseeing Biomedical Education. [discussed in Section II.A.]. The percent of professional effort designated to teaching should be compensated by resources allocated to the Biomedical Education budget. [This change in salary origin for percent effort in teaching eliminates concern that departmental chairs might undervalue the extent and/or quality of teaching contributions to didactic efforts performed in interdisciplinary teaching activities.]

- Contributions to salary based on patient care activities should be supported by clinical revenues. Clinical faculty will continue to receive incentives for patient care through the VMG revenue mechanism. (These clinical incentives are considered income, not salary).

- Percent effort of faculty contributions devoted to the research and technology transfer missions are, in general, to be supported by grants or other revenue streams from extramural sources. For tenured faculty, Vanderbilt University School of Medicine will make an institutional commitment of 20% of the amount of salary support dedicated to the research effort. This contribution is in addition to institutional support for contributions to service (10%) and teaching (variable %). This new 20% contribution to the research effort acknowledges that research productivity brings recognition to Vanderbilt University in addition to recognition to the individual investigator. Incentives for tenured faculty to exceed the expected level of extramural funding for research are accomplished by allowing the difference between the expected and obtained level of salary support for research to be returned to the faculty member.
and their department as detailed in Section II.F. Note that this institutional investment in investigator-initiated research is a benefit of tenure.

Occasionally, faculty fail to maintain their professional skills, their productivity declines, and their contributions to the institution’s missions fall to unacceptable levels. The chair and faculty member will discuss a plan to address deficiencies and a timetable (normally two years) by which improvement might be anticipated. The assessment, plan, and timetable will be documented in writing. In the event that productivity is not enhanced within the defined time frame, the salary for tenure faculty can be reduced by not more than 10% per year, but not below the level of the institutionally guaranteed salary (50% of peak salary). The chair may negotiate with tenured faculty members to assume partial load or part-time appointments with proportional reductions in salary for contributions to service or teaching. If these responsibilities are not met, the chair may recommend that the faculty member be dismissed according to guidelines defined in the Faculty Manual.

D. Initiatives to Foster Diversity at VUMC

VUMC should strive to have its demographics of student and faculty populations match those of the nation. For an historically white, southern university with a neighboring historically black medical institution, the task of achieving greater African-American representation is complex. Nonetheless, the desire to achieve greater diversity overall at VUMC far outweighs the burdens of any complexity to achieve specific initiatives.

To achieve the goal of significantly enhancing the diversity of VUMC, it is recommended that an Office of Diversity be established in close proximity to the office of the Vice-Chancellor for Health Affairs and Associate Vice-Chancellors for Biomedical Education, Research, and Technology Transfer. This central location would affirm that this initiative is vigorously supported at the highest levels of the VUMC administration; the Office would be overseen by a Director.

The Office of Diversity should be charged with actively aiding the recruitment and retention of minorities at both faculty and student levels. In addition, this person would serve as an advisor in efforts to develop collaborative health professional training and patient care programs with Meharry Medical College, when perceived to be mutually desirable by the leadership of both institutions. This office would centralize and facilitate various minority programs that are now ongoing while also fostering attitudes at VUMC that make it more comfortable for all individuals, independent of their differences, to work and excel. The Office of Diversity would also work in conjunction with Human Resources, taking advantage of expertise in counseling and advocacy that is tailored to enhancing the quality of the environment for under-represented minorities within our institution. The Office of Diversity should be a source of mentorship to all minority faculty, staff and students. While mentorship plans are in place for all new junior faculty hires within individual departments, advice to junior faculty from a nondepartmental, VUMC advocate also would be valuable.

A major objective of the Office of Diversity will be to substantially increase the number of basic science and clinical trainees at VUMC from minority groups under-represented in the biomedical profession. The Director should have the authority to recruit, hire and train staff to facilitate this recruiting effort. Evaluation of the performance of this Director will include evidence of reasonable and continued progress in the recruitment and retention of minority trainees at VUMC. The Director of the Office of Diversity should also serve in an advisory role to VUMC administrators and faculty concerning how Vanderbilt might better attract diverse student populations or better interface with Meharry Medical College or other minority institutions with whom Vanderbilt might choose to engage in collaborative educational efforts.
The issue of diversity is not limited to one minority or ethnic population, or to race alone. Issues of gender and of age still remain perceived impediments for advancement or career reinvestment. In addition, as the culture of American medicine and the biomedical research enterprise continues to change and evolve as distinct from its historic roots, VUMC will also need to recognize that there will inherently be an increase in the diversity of motives, interests, and expectations that will characterize those who join our institution as faculty, trainees, and staff. With time, the Office of Diversity may expect to adopt additional roles that will have, as their ultimate goal, the nurturing of a culture of inclusiveness such that we grow to appreciate the different strengths that each of us brings, and the multifaceted way in which these differences strengthen the fiber of our institution and poise us to contribute to society and the betterment of human health in unimagined ways.

It is anticipated that this activity to foster diversity, with success over time, ultimately can achieve its goals by oversight within other offices of VUMC, achieving coordination and ongoing evaluation by informal meetings among the leadership in education, patient care, research, and technology transfer dedicated to enhancing diversity. However, for five years, a separate, aggressive, and intentional effort to enrich our institution by enhancing the diversity of its constituents is essential.
V. SUMMARY

In summary, the strategic plan for VUMC proposes a series of ambitious goals for the next five to ten years:

- develop a research and teaching approach that offers a unique perspective on life sciences, one whose interdisciplinary vision will create new research, educational and technology transfer opportunities for faculty as well as trainees;

- recruit faculty in key areas of modern biological research who will maintain the high standards that have characterized VUMC and provide new and existing faculty with the supportive environment that will encourage discovery;

- provide a senior administrative leadership and enhanced infrastructure that facilitates new research initiatives and permits us to compete even more successfully for increased research support;

- reward faculty for extraordinary research, educational and clinical productivity while protecting the academic mission;

- refashion the curricula and provide a powerful new model for biological and health professional education; and

- assume a leadership role in addressing the growing shortage of talented young men and women of all races entering professions in biomedical research and health care delivery.