INFORMATION TECHNOLOGY STRATEGIC PLAN FOR THE UNIVERSITY OF MEDICINE AND DENTISTRY OF NEW JERSEY (UMDNJ)

VISION STATEMENT

To create, manage and fully utilize information resources as a strategic imperative in order to position UMDNJ as a national and international leader in professional education, research, health care and community service.

GOALS

1. BUILD

Develop a fully integrated, enterprise-wide information infrastructure and delivery system to meet the needs of a statewide educational, research and health care delivery system.

2. ACCESS

Increase access to, and utilization of, critical educational, research, clinical and administrative information resources.

3. INTEGRATE

Foster innovation in the integration of information resources in the scholarly, educational, clinical and research domains.

4. COORDINATE

Garner the research, educational and scholarly information resources of the University through the establishment of a Center for Health Informatics.

5. SERVE

Enhance the positive impact of the University on its peers and communities of interest.

RATIONALE, ASSESSMENT OF THE CURRENT SITUATION, STRATEGIES, OBJECTIVES AND TASKS

Goal 1. BUILD

Develop a fully integrated, enterprise-wide information infrastructure, delivery and technical support system to meet the needs of a statewide educational, research and health care delivery system.

Rationale

Information technology is rapidly becoming the backbone of education, research and service delivery in today's health care environment. It will enable an integration of the three arms of health professions education and act as a unifying force within the eight schools, health care units, affiliates and partners of the UMDNJ community, moving beyond the boundaries of traditional educational institutions. The information technology backbone facilitates collaborative work within the University and with colleagues at other locations throughout the world. Such a technology backbone promotes rapid dissemination of information to a very wide audience and brings together aspects of the educational community in ways previously unavailable to its members.

In the software arena, considerable economies of scale and support can be realized through centralized procurement. Although enterprise software acquisition is a complex and labor intensive matter, it should be pursued.

Users at all levels have the need for help desk assistance, regardless of the simplicity or sophistication of their informational needs. Informational issues cover a broad range of activities such as basic connectivity to the UMDnet, identification and use of appropriate search terminology to optimize retrieval and large data sets distributions among colleagues. Developing staff who can effectively analyze the true nature of a user request and rapidly refer the client to appropriate personnel is essential. Quick, accurate and responsive service is a cardinal ingredient in securing and maintaining user confidence in the system. Rigorous and intense staff training must include strong customer service skills, a broad but deep knowledge of systems, and trouble shooting and documentation skills. Such staff training is a University-wide endeavor.

Assessment of the Current Situation

The development, expansion, and maintenance of the network, computing resources and electronic resources are vital to the long-term viability of today's research universities and for the development of an integrated health care delivery system. The

current socio-economic climate demands increased efficiencies throughout the network enterprise to the desktop. The decisions regarding infrastructure support systems have significant short and long-term implications for the University and its viable response to the challenges wrought by managed care and the electronic communications revolution.

The design of the current UMDnet infrastructure was predicated upon a cable plant that would transcend at least several generations of its active components. This fundamental assumption has proven to have been wise. The initial cabling design, investment and integrity of the cable plant continues to be preserved and to meet the burgeoning demands of the university community. Strategic replacement of network electronics has allowed the University to adroitly incorporate new technologies in support of business-driven requirements. Experience to date has validated the University's decision to design and implement a high-capacity cable plant, which is consistently deployed across the University.

Challenges, however, still remain. Many University networks were designed and implemented in the early to mid 90's. Network designers and planners, while cognizant of the value of a robust, scaleable infrastructure, could not have imagined the impact of the World Wide Web, which would create unprecedented interest and demand not only for Internet surfing, but for all manner of networked computing applications. The concept of business-to-business transactions over the Web, a new phenomenon, was never a Web design consideration.

Currently, the University is exploring and implementing technologies such as ATM and/or gigabit Ethernet to meet increasing requirements in areas such as video-on-demand, on-line education, image stores, personal videoconferencing, telemedicine and access to full text journals. Anticipating usage demands requires careful budgetary planning and the appropriate management, deployment and use of the institution's information technology. Such oversight ensures the infrastructure's viability and its readiness for the next generation of applications.

The hiring, training and retention of highly skilled technical support staff continue to challenge the University, particularly in areas where competition for such personnel includes banking, pharmaceuticals and high tech businesses.

Of the six UMDNJ campuses, the network capacity between the two campuses of Newark and Piscataway has been increased by 600 percent. Specifically, the network capacity between these two campuses has been upgraded from a three megabytes per second line to 2400 megabytes per second. Internet capacity was increased by the addition of a ten megabyte connection, thus bringing the total Internet capacity to 13 megabytes per second. Further upgrading of the network capacity is planned during the first half of the year 2000. Upgrading will include adding an additional 12 megabyte per second capacity, thereby bringing UMDnet network capacity between the two campuses to 25 megabytes per second.

All campuses have been wired with fiberoptic cabling. By the end of the year 2000, the University's IST administrators project that upgrading will occur for ATM connections and 155 megabit per second transmission rates between and among all campuses. This upgrade will increase the capacity of the network by an estimated 1500%. The

upgrades to ATM for two other campuses (Stratford and Camden) are anticipated to be complete by the end of the year 2000. Also, bandwidth will be increased during the year 2000. An enhanced network management infrastructure (OpenView) is being developed to support the increased technology and services that have been installed.

Strategies

This goal seeks to provide the students, educators, researchers and clinical staff of the University with an information backbone from a University wide perspective. Those who need to access information, contact others, or make use of University computing resources should be able to do so seamlessly at any UMDNJ location in the state.

Objectives and Tasks

1.1 Expand the University's current information infrastructure to optimally meet the ongoing needs of the institution in the areas of research, education, patient care and community service.

1.1a Design and implement a high capacity, multi-services intercampus Wide Area Network infrastructure with flexibility and growth components to absorb rapid changes in technology and data composition.

1.1b Through the use of technology develop a virtual campus network that reduces the effect of the geographical distances between the University's dispersed campuses.

1.1c Provide to all campuses and to remote distant learners, consistent and uninterrupted access to the University network and educational content.

1.1d Implement high performance network technologies in support of capacity-demanding clinical and patient care applications, specifically for radiology, tele-imaging and tele-pathology systems.

1.1e. Preserve the integrity and security of research, educational and patient care data through the implementation of network protection devices, filters and adherence to security policies.

1.1f Implement University-wide IPTV services that augment existing telemedicine and distance learning video teleconference services.

1.1g Develop a video teleconference training program for faculty and support staff.

1.1h Support the educational mission by expanding Internet access capacity for distant asynchronous learning. Ensure high levels of performance and availability.

1.1I Collaborate with affiliates and partners of the University in developing inter-institution information technology services.

1.2 Strengthen the University's security posture in networking, systems, and data. Ensure adequate protection of electronic records, data and systems to safeguard the University's research, patient care, education and community service interests.

1.2a Conduct a Security Posture Assessment (SPA) for the entire UMDNJ network. SPA is an operational, comprehensive analysis of the security of the network. Results of the SPA will be used to address vulnerabilities.

1.2b Develop an incremental solution to enhance and ensure the security of the network, as well as critical clinical, academic, and administrative systems and applications from internal and external intrusion and vulnerabilities.

1.2c Develop and implement an enterprise-wide security education plan for faculty, staff, students, and employees.

1.2d Implement a disaster recovery plan for UMDNJ by ensuring consistency of the production and backup systems, and developing test strategies for fully functional business is critical.

1.3 Enhance the University's productivity through enterprise-wide networked information systems.

1.3a Develop and implement an Internet standards based messaging architecture built around enterprise directory services, high performance message stores and authentication/ encryption features required for secure communication wherever they are mandated or appropriate.

1.3b Develop a common electronic medical record (EMR) hosted on a scaleable hardware/software platform capable of supporting a wide range of patient care, research, education, imaging/archive and community service applications.

1.3c Develop and implement a geographic information systems (GIS) capability to support environmental studies, market research and other scientific disciplines that can benefit from access to GIS databases and computational facilities.

1.3d Continue the introduction of capabilities, e.g., WebCT, in support of on-line course development and delivery.

1.4 **Enhance the University's infrastructure by automated management of the institution's PC and server assets.**

1.4a Implement and provide continuous support of the University's PC inventory, remote device management and automated software distribution.

1.4b Implement and support enterprise-wide server management through the appropriate and current technology.

1.4c Implement an enterprise-wide process to protect server and computer assets from viruses.

1.4d Develop and implement a plan to proactively manage the soundness of the enterprise servers supporting mission-critical applications.

1.5 Support the institution's information technology users through the formation of a UMDNJ Service Center.

1.5a Develop and implement appropriate policies and procedures for accepting, resolving, and tracking client requests for IST services.

1.5b Develop and implement appropriate policies and procedures for accepting, resolving, and tracking calls on PC, server, network, application or voice problems. Integrate the use of appropriate automated procedures into the problem resolution process.

1.5c Develop and implement an enterprise-wide training program for clients relative to their interaction with the Service Center.

1.5d Establish annual customer satisfaction surveys with resulting plans for improving customer service.

Goal 2. ACCESS

Increase access to, and utilization of, critical educational, research, clinical and administrative information resources.

Rationale

It is essential to fulfill the University's research, education, patient care and community service goals and to meet the objectives articulated in the IAIMS Scholarly Resources Planning Committee Final Report, that scholarly information resources in the appropriate format be available to researchers, clinicians and educators when and where they are needed. In addition, providing needed information to external users (consumers and unaffiliated health care providers) has an impact on UMDNJ's ability to meet the needs of the diverse community it serves.

Data sharing, document transfer and other activities that foster collaborative research between individuals and institutions, are facilitated by computer technology. This integration is a quality encouraged by funding agencies. Efficient administrative systems have a positive influence on the University's ability to accomplish its mission of excellence in education, research, community service and patient care.

Assessment of Current Situation

Electronic scholarly resources, largely library-funded, are the most heavily-used "content" service utilized through UMDNJ's technology infrastructure. UMDNJ's researchers and clinicians are currently frustrated by inadequate on-line access to desired resources and lag times in obtaining key information. While the delivery of knowledge-based information relies heavily on increasing the capabilities of UMDnet, in order to position UMDNJ to meet the demand for faster and wider access to critical scholarly and other information resources, additional choices need to be infused into the existing menu of services. Just as major investments are being made in UMDnet's infrastructure, UMDNJ's menu of databases and electronic scholarly services needs to be significantly bolstered.

Few institutions can make the kind of needed investment in one step. Incremental increases of tested and evaluated services must be considered. The UMDNJ Libraries have shown leadership in the state-wide Virtual Academic Library Environment (VALE) initiative that has recently brought three new full-text databases to UMDNJ faculty, students and staff; the UMDNJ Libraries Web site provides access to more than 350 additional full-text health sciences electronic journals. The development of collaborative educational programs with UMDNJ's partner research universities in the state is also positioning the University to forge new cooperative acquisitions programs with its colleagues. A recent notable example is the establishment in 1998 of the

Newark Public Health Program at Science Park, offering a Master of Public Health degree program jointly sponsored by UMDNJ, the New Jersey Institute of Technology, Rutgers University and the Public Health Research Institute. Science Park is a partnership between the City of Newark, the four higher education institutions in Newark, and the business community to link knowledge, technology and job training to the development biotechnology products for commercial use.

The linkages of scholarly resources to the clinical, research and educational goals of UMDNJ are obvious, but other key types of information resources are critical to fulfilling the mission, including those in the administrative area. All of the schools and several central administration offices have Web pages on the UMDNJ Web site. While the Web pages show a wide range of sophistication and utility, the trend toward increasing use of this means of information exchange is clear. The combination of planned Banner Web page services with other existing and planned information and forms on the UMDNJ Web site is expected to provide a powerful tool for both current and expected students and employees.

The University Libraries have also assumed responsibility for the development of a key health information resource for the state's citizens, the HealthyNJ Web site. In addition to general health and wellness information, the site guides users to helpful local resources.

Strategies

This goal provides for significant enhancement in electronic resources for scholarly, administrative, clinical and research endeavors at UMDNJ. It reinforces UMDNJ's commitment to its strategic intent in research, education, service, community impact and image. The University Libraries constitute a major academic support service for scholarly resources. Collaborative work on developing a uniform interface, increasing support for needed scholarly resources, improving communication to reach the widest possible audience, and establishing the needed infrastructure and facilities to support this increased utilization are critical to reaching this goal. Finally, this goal has a strong customer service initiative as it reaches out to both internal and external constituents through a variety of support mechanisms.

Objectives and Tasks

2.1 Provide a uniform interface that supports seamless transitions ("one-stop-shopping") between the multiple information resources needed by the University community.

2.1.a Create a Web site with links for "one-stop-shopping" to critical scholarly, educational, research, clinical and administrative information resources, and publicize it widely to the University community. Establish an interdisciplinary team for its maintenance and updating; incorporate essential links between and within the sites in the various domains, to enhance visibility and serve as a gateway to key resources. As an example, links from within clinical information systems should be provided to relevant scholarly resources and clinical alert systems.

2.1.b Provide integrated access to full-text, image, bibliographic, and sequencing databases including on-line journals, textbooks and reference materials.

2.1.c Distribute via the Web electronic course reserves including syllabi, articles, handouts, study guides and images; where necessary, safeguard copyrighted materials by utilizing password access.

2.1.d Aggregate links to full-text Web sites that have been evaluated utilizing specified criteria and judged to be relevant and useful to the University community. These should include electronic versions of print resources, clinical guidelines, and a multitude of other authoritative sources.

2.2 Establish facilities, infrastructure and policies that ensure "anytime/anywhere" access to these needed resources in all venues where University-related activities are taking place.

2.2.a Make available access to key electronic resources in all University clinical areas including hospital wards, clinic exam rooms, dental operatory rooms, etc.

2.2.b Ensure that distance learners and other members of the extended University community in hospitals, ambulatory care and other remote sites have the means to access required electronic resources.

2.2.c Provide all UMDNJ constituents (students, advisors, faculty, employees, and alumni) with integrated Web access to relevant BANNER 2000 administrative information any time, any place, on any network, with any browser.

2.3 Support the acquisition and university-wide licensing of key scholarly electronic resources identified as critical to the educational, research and clinical endeavors of the University.

2.3.a Allocate and secure the financial resources required for acquisition of the scholarly electronic materials essential to support the University's educational, research and clinical missions.

2.3.b Provide full-text electronic access to all required and recommended educational materials for students in UMDNJ's academic programs.

2.3.c Develop and strengthen inter- and intra-institutional partnerships for group pricing and site licensing of scholarly electronic resources, in order to expand the University's purchasing power and access to needed materials.

2.3.d Ensure that licensing agreements obtained support access to needed resources for the widest possible UMDNJ audience, including those that are off-site.

2.3.e Protect interlibrary loan agreements with other institutions and publishers so that appropriate sharing and fair use of scholarly resources can be maintained under current law.

2.3.f Provide University faculty, students and staff with access to reasonably priced, unmediated full-text document delivery services when rapid turn-around time is essential.

2.4 Foster collaboration between individuals and institutions involved in education, research and clinical care through technology-enhanced administrative data handling and access.

2.4.a Formulate those clinical and technical criteria to assess those solutions which offer flexible, inexpensive means by which clinicians and researchers located at disparate health care facilities throughout UMDNJ can collect, disseminate, manage and share distributed computer resources, and conduct impromptu, interactive consultation. Implement the identified solutions.

2.4.b Develop Web-based means of supporting current and prospective students, faculty and staff in the achievement of their mission-related objectives by implementing and upgrading finance, human resources and student modules of the SCT Banner System.

2.4.c Encourage all of the schools and a number of support offices to increasingly mount information, publications and forms on their own home pages.

2.4.d Implement a document imaging and management system to store large quantities of documents and make them available throughout the organization.

2.4.e Identify and implement means and procedures to expedite a secure and efficient electronic purchasing process.

2.5 Develop and review on an ongoing basis information policies and procedures that ensure seamless access while safeguarding system and record security, and promote compliance with legal requirements.

2.5.a Establish a group composed of representatives from the University's academic administration, legal counsel, information services and technology department, libraries, faculty and health care providers to meet periodically to review those policies of the University governing the utilization of information technology.

2.5.b Create and empower an office of information technology security to establish procedures to ensure system security and policy implementation, including enforcement.

2.5.c Provide assistance to the University community in complying with copyright laws and intellectual property issues in a digital environment. Identify knowledgeable personnel to inform and educate faculty and administration on these topics, and develop a virtual copyright clearinghouse to provide consultation and sample forms.

GOAL 3. INTEGRATE

Foster innovation in the integration of information resources in the scholarly, educational, clinical and research domains.

Rationale

The more dynamic an academic environment, the more it is constrained by artificial boundaries imposed by discrete information systems. This goal seeks to exploit the robust technical infrastructure and content-rich resources outlined in Goals 1 and 2 to provide the UMDNJ community with new opportunities for interaction and new outlets for creativity.

Although the shape of the US health care system is still evolving, several essential features are becoming clear. One is the need for integrated information about personal health. Fragmentation of clinical records is wasteful, potentially harmful, and deprives providers of a collective memory on which to base future decisions. Fragmentation also limits patients, ability to understand the totality of their well-being and be informed participants in their own health care. Operationally, this translates into the need to gather information from disparate systems and sources, integrate it logically, and make it accessible at various hierarchical levels with appropriate security and confidentiality.

Health sciences universities have needs for integrated clinical information beyond those required by health care delivery systems. Aggregate data that define the profile of the population served by the institution should be used to inform educational program planning and curriculum design. Prototypical patient cases, enriched with multimedia information, are an invaluable resource for interdisciplinary and case-based teaching. The research enterprise is likewise enhanced by access to both robust clinical data repositories and the tools with which to manage them.

Health sciences education must strive to anticipate the health care delivery system of the future. Increasingly, this is a multi-professional endeavor, with an emphasis on case management rather than treatment of disease. As the venue shifts from the provider's setting to the patient's, there is an attendant mandate for improved patient education. The challenge for health sciences educators is first to transcend traditional disciplinary barriers and then to exploit the resources that integrated information systems offer for innovative curriculum design and delivery.

A further challenge to the health care system in general, and to the health sciences educators in particular, is declining interest in careers in the health professions. This is compounded by frequently inadequate science preparation in secondary schools and colleges, with the result that desired diversity among health professions students is

difficult to achieve. Innovative means such as distance learning and asynchronous multimedia instruction must be employed to attract interest, enhance motivation and strengthen prospective students, backgrounds earlier in the process if the health human resource needs of the State of New Jersey are to be met effectively.

In many respects, a health sciences university is defined by the robustness of its research enterprise. The ability to attract a nationally prominent talent pool is reflected in intangible measures such as reputation as well as very real measures such as revenue stream. UMDNJ has placed a strategic priority on strengthening its research mission. It is clear, however, that substantial growth cannot be achieved without investments in infrastructure. These include not only physical facilities but also high quality professional support. The challenge is to identify current needs and anticipate future ones within and efficient, cost-effective, service-oriented framework.

Assessment of the Current Situation

UMDNJ's core clinical facilities consists of UMDNJ-University Hospital in Newark and the affiliated but separately-governed Robert Wood Johnson University Hospital in New Brunswick, Cooper Hospital/University Medical Center in Camden, and Kennedy Memorial Hospitals-University Medical Center in Stratford. The University also owns and operates UMDNJ-University Behavioral HealthCare Centers in Newark and Piscataway, the clinics of New Jersey Dental School in Newark, and the community-based Eric B. Chandler Health Center in New Brunswick. Faculty practices are housed in the Doctors Office Center in Newark, the Clinical Academic Building in New Brunswick, and the Primary Care Center and Specialty Care Center in Stratford. Governance of the faculty practice plans of the three medical schools varies.

In 1994, a strategic decision was made to deploy an advanced, open-architecture, standards-based clinical information system at University Hospital. The Oacis system, which uses the HL7 protocol, was acquired and a universal workstation was developed. The current status of this system is described in detail in section IV.B.3 of the application. An Oacis Steering Committee consisting of clinicians and high-level administrators provide direction with regard to system components, implementation and rollout strategies.

The Logician Ambulatory Care Electronic Medical Record is widely deployed within the clinics of University Hospital and the faculty practices of the Doctors Office Center. A physician-driven Logician Operators Committee oversees implementation. The faculty practice plans of Robert Wood Johnson Medical School and the School of Osteopathic Medicine currently utilize the IDX physician billing and registration module. Plans are under development to populate Logician with information from the IDX system utilizing HL7 technology.

Technologic and professional support for the educational mission of UMDNJ comes from the Academic Computing Services (ACS) Division and the Telecommunications Division of Information Services and Technology (IS&T) as well as from the individual educational units and the University Libraries. The contributions of ACS and Telecommunications are described in detail in sections IV.B.1, IV.B.2, and IV.E.3 of the

application. ACS also jointly manages public computer facilities on each of the campuses.

Significant initiatives are underway in virtually all schools. The School of Health Related Professions has pioneered the use of distance and asynchronous web-based learning for many of its courses and has an extensive educational outreach program for high school students statewide. The New Jersey Dental School's model Clinical Management Information System (CMIS) integrates patient treatment tracking and monitoring of student clinical activities; the CMIS is currently being redesigned for greater functionality and ease of access. Robert Wood Johnson Medical School faculty are migrating to PowerPoint lecture presentations, which are then made web-accessible. NJMS is also exploring the use of wireless technologies for computer-based testing. The School of Osteopathic Medicine has been active in the development of multimedia materials for interdisciplinary and primary care education.

Collaborative projects are fostered through the Educational Mini-Grant program of the Academic Information Technology Advisory Committee (AcITAC). Supplemental funding from the Foundation of UMDNJ has allowed for recent expansion of the mini-grant program and increased professional support. The challenge for the future is to enhance multiprofessional faculty involvement in both the genesis of these projects and their incorporation into innovative curricula.

Central support for the research enterprise is provided by Academic Computing Services. ACS maintains a comprehensive library of statistical programs and supports gene sequence analysis, molecular modeling and image analysis on high-end workstations at several campuses. The research programs of certain individual investigators, e.g. Dr. David Foran and Dr. Frank Sonnenberg at RWJMS and Dr. Edward Arnold at the Center for Biotechnology and Medicine, are in the forefront of advanced applications. There remains a critical need to assure access to biostatistical consultation services by all investigators and to promote sharing of expertise and intra-institutional collaboration.

Strategies

The goal of integration is to be achieved through personal interaction as well as through technologic innovation. The principle of integration will guide all initiatives from University-wide strategic planning activities (section III.A.2) to implementation team efforts. Information Technology Advisory Groups (section III.A.3.d) will continue to play a vital role in identifying and coordinating all the activities of user groups and promoting further collaboration. User-driven operations committees are expected to assume greater importance in designing and deploying integrated clinical information systems. The new Center for Health Informatics will provide a critical link between the

user community and IS&T in developing new applications and mobilizing faculty resources to implement them.

Objectives and Tasks

3.1 Continue deployment of robust, open-architecture clinical information systems with embedded decision support tools and seamless access to scholarly information in support of clinical activities and training.

3.1a Continue developing and deploying links between the administrative, financial and clinical information systems (laboratory, pharmacy, radiology, medical records) at University Hospital via the Oacis HL7 interface. Implement electronic order entry and transcription features to create a fully electronic longitudinal patient record.

3.1b Integrate into clinical workstations access to the scholarly resources that are critical to patient care.

3.1c Accelerate deployment of the decision support and clinical protocol features of the Logician Ambulatory Care Electronic Medical Record. Establish enterprise-wide collaborative user groups for the Logician system that will, among other activities, augment the library of these features through faculty-initiated projects and/or vendor partnerships.

3.1d Refine and implement strategies for populating the Logician Ambulatory Care systems with information currently resident in other patient management and billing systems (e.g. IDX) so as to create a common medical record for all of the University's faculty practices.

3.1e Acquire and deploy a document management system that captures clinical information which exists in non-electronic form, streamlines patient accounting/business office operations, and integrates them into the Oacis repository and Logician electronic medical record, so as to create an enterprise-wide electronic patient management system.

3.2 Promote health sciences educational innovations through support for faculty development, courseware creation and curriculum redesign for both on-site and distance learning applications.

3.2a Consolidate, under the auspices of the Video and Telecommunications Committee, intermediate- and long-term plans for distance learning from all educational units of the University to facilitate a coordinated strategic approach to acquisition and deployment of resources.

3.2b Consolidate, under the auspices of the Educational Technology Subcommittee of the Academic Information Technology Advisory Committee (AcITAC), intermediate- and long-terms plans for on-site use of educational computing resources by all units of the University. Assess adequacy of current facilities and management arrangements and develop plans for optimizing standardization and coordinate replacement cycles.

3.2c Continue to strengthen the Instructional Technology Division of Academic Computing Services as a central resource for creation of multimedia courseware.

3.2d Enhance support for the Educational Technology Mini-Grant program so as to continue fostering innovation in media-based curriculum development.

3.2e Design and implement an on-going series of faculty development workshops at various levels of intensity and expertise. Secure extramural funding. Incorporate a travel fellowship component to permit faculty to attend national meetings and workshops at other institutions.

3.2f Sponsor frequent University-wide Symposia and Visiting Professorships to expose faculty to state-of-the-art uses of educational technology and promote further innovations in media-based curriculum design.

3.3 Create a library of interdisciplinary clinical teaching cases that utilize selected multimedia representations of data from the clinical information system and can be used by faculty and students in any of the schools of the University.

3.3a Implement within the University's patient information system robust search and retrieval protocols that facilitate access to disease-specific clinical and epidemiological data for educational purposes with appropriate protection of security and confidentiality.

3.3b Using encounter data from the University's patient information systems, identify conditions affecting the health of broad segments of the population of New Jersey. Convene interdisciplinary teams of faculty to create interactive, multimedia cases that integrate the roles of the various health professions in comprehensive management of these conditions. Distribute the cases in Web-based format via UMDnet.

3.4 Establish through technology linkages university-wide collaborative learning programs involving students, residents and faculty from a variety of health sciences disciplines.

3.4a Promote interprofessional learning and enrich the library of interdisciplinary cases via asynchronous, and to the extent possible synchronous, use by student groups in the different health professions disciplines.

3.4b Identify topics common to all health professions (e.g. ethics, health care financing, information retrieval, clinical epidemiology, population health) and delineate the specific learning objectives for each discipline at each level of achievement. Convene interdisciplinary teams of faculty to create hierarchical Web-based modules incorporating these learning objectives, with illustrative material drawn from the University's patient information systems. Enrich content via synchronous and/or asynchronous use by students of the different health professions.

3.5 Provide state-of the art scientific, technical and administrative tools to support the research enterprise.

3.5a Conduct a systematic assessment of the needs of the research community for advanced analytic tools (e.g. molecular modeling, image analysis, gene sequencing) and data management systems (e.g. index/query/retrieval for data repositories, clinical trials management, large scale survey analysis). Strategically prioritize deployment of these tools and systems, including provision of training workshops and ongoing technical support.

3.5b Augment the library of supported statistical programs to meet identified needs. Implement means of ensuring enterprise-wide access to statistical consultation services.

3.5c Create and maintain a Web-based directory of active clinical trials containing information on study protocol, eligibility criteria and on-line enrollment procedures that can be used by patients and physicians.

3.5d Compile and maintain a searchable University-wide directory of faculty research activities along with information to facilitate intra-institutional collaboration, e.g., technical expertise, access to core facilities, licensing agreements, etc.

3.5e Ensure on-line access by individual investigators to critical BANNER administrative systems including purchasing, accounting and human resources.

3.5f Provide Web-based instruction and training workshops, especially for junior faculty and graduate students, in the use of funding databases and grants alert services.

Goal 4. COORDINATE

Garner the research, educational and scholarly information resources of the University through the establishment of a Center for Health Informatics.

Rationale

The vast amount of research, educational and scholarly talent residing in the eight schools of the University can and should be enhanced through collaborative ventures, shared research on topics of converging interest and in the continuous improvement of the University's educational mission. The rapid growth of bio or biomedical informatics as a rigorous discipline is indicative of the almost daily breakthroughs in computer technology and the remarkable applications that can be brought to bear on health professions, psychosocial, epidemiological and basic sciences research.

Beyond the University but very much affecting it and all of higher education are sweeping economic and social changes which have shaped the expectations of students and their families. The most prominently mentioned characteristic of this change has been the introduction of personal computers, the explosive growth in the use of the Internet, and the development of the World Wide Web (George Keller, The Emerging Third Stage in Higher Education Planning, *Planning for Higher Education*, V.28, Winter 1999-2000, p.1). Students entering our colleges and universities have become accustomed to multi-media learning and are less text dependent. With the advent of Telemedicine and three dimensional computerized imaging, the ways in which we teach our students and conduct our research are in rapid transformation.

Assessment of Current Situation

The University is well poised to fulfill this goal under the proposed implementation IAIMS grant. Over the past several years, the University has expanded dramatically its information technology infrastructure and its technical support teams. The University has expended millions of dollars in system upgrades, advanced technology synchronous and asynchronous communication and educational systems. In addition, the University conducts academic programs in biomedical informatics at the post-baccalaureate, master's and doctorate degree levels. It is noteworthy as well that the University has just initiated a Master Educator program as a means through which faculty may be awarded system-wide recognition. The efficacious utilization of educational technology, including Web-based or Web-enhanced course teaching, is recognized in the broad criteria established for the recognition of a Master Educator. It is also germane to this goal that the University's Board of Trustees approved the development of a University-wide Center for Heath Informatics.

Notwithstanding these advances, there remain some serious challenges to be faced. For instance, there remains a lag between the availability of infrastructure support systems

and the best and fullest utilization of the tools at hand. Although the University sponsors graduate programs in biomedical informatics, these academic programs can not reasonably meet the present and continuing educational and training needs for faculty and students. Faculty development and student training programs are sorely needed to fulfill the intent of this goal. Programs for faculty development and student training in the theory and practice of informatics will be viewed as ongoing programs, given the rapidity of change in both technology and in the sciences. In other words, to rightly fulfill the intent of this goal, these activities must be incorporated as permanent changes in the way faculty are expected to perform and students are to learn.

Strategies

This goal seeks to open the University's faculty and students to opportunities for skills enhancements through a fundamental understanding of the theory and application of biomedical informatics, thus applying the science of informatics to specific disciplines to achieve an integrated model of research, patient care and health professions education. This goal, then, has the specific aim of forging coordinated efforts across the campuses of the University in its teaching/learning, research and scholarly pursuits. Clearly, the establishment of the Center can not be divorced from the development of a University-wide electronic medical record since the all but instantaneous accessibility to aggregate cases will provide far reaching opportunities for clinical research and education. Finally, implicit in this goal is the clear intent to serve the faculty and students of the University through a shared network of informational technology that will harness the individual strengths of each academic unit to create a team of scholars and learners.

Objectives and Tasks

4.1 Create an administrative and financial support structure with associated facilities to support collaborative research projects involving health informatics science.

4.1a Implement plans to establish the Center for Health Informatics as a scientific and professional resource for UMDNJ and as a regional resource for the network of academic and clinical affiliates of the University.

4.1b Create within the Center the capability for conducting independent and collaborative informatics research and for developing new informatics applications and technologies in areas critical to the University’s mission.

4.1c Develop within the Center appropriate resources to provide informatics consultation services and technical assistance to enhance the University’s research mission.

4.1d Coordinate postgraduate informatics fellowship programs in collaboration with UMDNJ's academic/clinical departments and its graduate programs in health informatics.

4.2 Design and conduct training programs which provide faculty with the competencies necessary to ensure that students are able to utilize defined sets of informatics skills in their professional activities.

4.2a Provide facilities and support staff from the Center for Health Informatics in furtherance of informatics training and its applications for students and faculty.

4.2b Ensure that programs for health professions students assist them in understanding the uses of emerging applications of technologies such as Telemedicine or the electronic medical record.

4.3. Plan, design and implement faculty development programs which provide faculty with informatics skill sets requisite for them to participate with increasing effectiveness in research, patient care services and education.

4.3a Conduct faculty development programs at multiple levels and in a variety of formats which best meet the needs of faculty in the schools of the University.

4.3b Continue to develop and offer new training programs to meet the needs of new researchers at UMDNJ or to meet changes in the applications of technology or informatics.

4.3c Establish training programs on each campus of the University to assist researchers in adapting technology, specifically the application of informatics, to enhance their research skills and broaden their base of informational services.

4.3d Develop programs comprised of both general and specific applications in such areas as bio-statistics, database creation and management, research databases and information retrieval sources.

Goal 5. SERVE

Enhance the positive impact of the University on its peers and communities of interest.

Rationale

The University's commitment to excellence in education, research, patient care demands service to a broad variety of communities: patients, students, faculty and staff, the people of the State of New Jersey, foundations and corporations that support our work, and the federal government. The communities themselves have layers of needs for information in diverse and intersecting health care arenas. Some needs are highly technical, even rarefied. Perhaps one person in ten thousand may have use for the information, but that contact can cascade into benefits for many. Other needs are common and everyday, but authoritative sources of information could be greeted as a welcome voice among the background din of information overload.

The University's service missions have all become information-based. This evolution demands careful shepherding and aggressive development of UMDNJ's resources. The ability to teach students and with them to serve, to learn, and to heal requires the creation and maintenance of effective access to established information and the capacity to contribute to new knowledge.

Fulfilling the requirement of managing an advanced information system is UMDNJ's obligation to the communities. The University propagates established (and create new) knowledge, skills, and services. These activities are its "products" and these products depend upon the careful creation, organization and distribution of information.

Assessment of Current Situation

Current University information outreach channels encompass a variety of media, both traditional and new. The challenge: UMDNJ is a very large institution supporting large and diverse communities. How does it nurture the best communications channels for optimized technology, content, and services?

The first channel is time-tested, and no information system will replace it. UMDNJ attends to the needs to the vast majority of its students and patients in person. The second channel is print: newsletters, flyers, magazines, professional journals. This is the major channel of the research mission. The third channel is electronic: voice, data and video. Most recently the electronic data channel has been honed into networked resources delivering email, web pages and new media streams. In places this channel is making inroads into more traditional modalities.

In the fall of 1998, 4,457 students were enrolled in UMDNJ's eight schools. In addition, the University participated in the advanced training of 1,455 medical, dental, and podiatric interns and residents. Comprehensive training was guided by 2,075 faculty expert in the entire range of biomedical disciplines. The University expanded its outreach in 1998-1999 through continuing education efforts in over 500 events reaching more than 18,000 participants. Information Services and Technology through its Academic Computing Services hosts over 12,000 user accounts. The IST Help Desk logged in excess of 40,000 calls in 1999. University Hospital (UH) in Newark is a 466-bed facility staffed by 300 full-time attending physicians handling over 17,000 admissions, 2,700 births, and 160,000 outpatient visits annually. UMDNJ's core affiliate hospitals, Robert Wood Johnson University Hospital, Cooper Health System, and the Kennedy Health System expand its outreach. UMDNJ looks to its integrated information systems to expand and to extend services to these communities.

The University and many of its units and health care partners publish reports, magazines and occasional broadsides intended both to market and inform. These include the UMDNJ Annual Report, HealthState, Research 2000, HealthExtra, and publications emanating from the schools, hospitals, alumni associations, and the Foundation of UMDNJ. Many of these publications also reside on the UMDNJ web site. Faculty members communicate with their peers through professional journals in hundreds of research projects also documented on the web site.

The UMDNJ Libraries are the recognized source of health information for the State of New Jersey through the State Library System. The University Libraries serve their communities through all channels. Their gate count exceeded 400,000 patrons during 1999. The Libraries house in excess of 212,000 bound books and journals, and 5,500 audiovisual items; users have access to a combination of over 1700 print or electronic full-text journal titles. Patrons have the full range of access from consultations with individual librarians to interactions with on-line literature indices and full text retrieval; there were in excess of 50,000 searches of its on-line catalog this past year.

As the Internet began to grow in the 1980s, Information Services and Technology at UMDNJ adopted systems and technologies that linked the people and information resources of the University to the world. The 1994 sea change marked by the first wave of World Wide Web sites saw the introduction of the first edition of the UMDweb. By the fall of 1999, the home page was receiving in excess of 4,500 hits per day and the most requested pages were for services from users seeking library, telephone and email address information. Since its inception, it has grown from an experimental technology platform into a structure through which the University is poised to deliver many of its educational, health care, research and community service needs as well as the internal network for administrative business.

Strategy

UMDNJ will serve its internal and external communities by facilitating the power of the Internet to deliver information and services.

Objectives and Tasks

5.1 Engage in regular reevaluation of the channels through which to fulfill the University's missions to seek the most appropriate medium to deliver its services.

5.1a Use IAIMS to reevaluate the strategic plan at regular intervals .

5.1b Redefine the strategic mission into tactical objectives.

5.2 Support the UMDNJ networked information systems including its Web site in the mission of disseminating information and providing service through its three newly defined portals: education, health care, research.

5.2a Increase the use of Web-based and Web-enabled teaching for traditional students and professionals engaged in continuing education.

5.2b Establish a common Electronic Medical Record to enhance the health care mission.

5.2c Develop and maintain a comprehensive consumer health Web site designed to address the health care information needs of the citizens of New Jersey.

5.3 Accelerate the establishment of joint ventures with commercial technology partners, by partnering UMDNJ's reservoirs of talent and resources.

5.3a Use information systems to maximize opportunities for collaboration between UMDNJ's clinicians and biomedical scientists and the pharmaceutical and biotech industries.

5.4 Develop and strengthen partnerships for affordable pricing of information tools services.

5.4a Leverage partnerships with vendors who have appropriate products working under the standards-based system established by UMDNJ.

5.4b Use the University as a model information management to showcase vendor products.

5.4c Provide vendors the opportunity of early exposure to tomorrow's leaders, UMDNJ's students.

5.5 Develop an information management culture that opens as many doors as possible to UMDNJ's communities while preserving and protecting the diverse data held from health care providers' patient records to University researchers' databases.

5.5a Include individuals with interests in technical systems security, legal mandate and customer access in the planning and implementation process.

5.5b Understand the "customer" as a student, health care professional, patient, researcher or member of the public.

5.5c Establish an accessible, secure information system.

5.5d Adapt authentication and encryption protocols appropriate to a transaction with decreasing burden on the end user.

5.6 Train communities in contributing to and benefiting from UMDNJ's information resources.

5.6a Integrate informatics into the curriculum including the strengths provided through the Health Informatics Program and the Center for Health Informatics.

5.6b Enrich classroom technology training programs with increased opportunity for any place, any time on-line education.

5.6c Establish larger faculty development programs aimed at established members of the community to maximize appropriate use of information technology, a goal in line with the University's recently established Master Educators Program.