COMMITTEE FOR THE STUDY OF PHYSICAL FACILITIES FOR THE HEALTH SCIENCES

Report of
Ancillary Subcommittee
December 12, 1966

Ancillary Subcommittee

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Report of Ancillary Subcommittee

The Ancillary Subcommittee was assigned the responsibility for a number of unrelated educational programs in the health sciences other than medicine, dentistry, nursing and public health. The common denominator for all of these programs is the relationship to comprehensive medical care. However, most of these programs relate more closely to a specific area of medical practice than they do to each other. For this reason the Ancillary Subcommittee has had to consider each program individually rather than considering all programs as a common group.

Each of these allied health sciences has been developed to meet a need for more extensive services or more specialized services in a limited aspect of comprehensive medicine than is provided in the undergraduate or graduate medical curriculum. These allied health services provide additional time, knowledge, and specialized skills as resources which enable the physician to extend more effective services to a greater number of patients. The increasing complexity of medical sciences will require an increasingly greater emphasis on training in the allied health sciences if the benefits of modern medicine are to be applied to the entire population. More extensive and more effective utilization of the allied health sciences will also extend the effectiveness of the physician in providing comprehensive medical care to his patients. In many phases of the practice of medicine the physician needs the specialized assistance of a trained

individual to participate in diagnostic or therapeutic procedures. There is considerable variation in the amount of training necessary, the degree of independence in activity, and the responsibility of these individuals. Some of the allied health professions have been established for many years; others are just emerging.

This subcommittee recommends that, for those allied health sciences which are already established, the University should plan to provide training programs of a size commensurate with the needs of physicians graduating from the Medical School for such personnel. In the following recommendations several additional weighting factors have received consideration: the current need for personnel in each of these allied health fields in this geographic region; other schools in this region with similar programs; and anticipated increase in demand for personnel. Insofar as it is possible to encourage other qualified institutions to establish similar training programs, this should be done.

For nascent allied health fields which, it is anticipated, will have greater importance in future years, the College of Medical Sciences should provide the leadership necessary to develop effective programs. For some of these fields the necessary knowledge and skills are fairly well defined and only the formally established training programs are lacking. In other areas where a need for specialized assistance is recognized but the desirable academic background and desirable

skills have not been ascertained exploratory programs may be indicated to provide this information.

If physicians are to use the allied health personnel effectively in their practice, they need to have this experience as a part of their medical education. This makes it desirable to have the allied health sciences an integral part of the program of comprehensive medical care at the teaching hospitals of the Medical School. Appropriate conjoint teaching of both the medical students and students in the allied health sciences will lead to more effective cooperation in practice after graduation.

Priority of effort should be given to graduate programs or other programs for students preparing for academic careers. Since these programs expand the capabilities for training it is undesirable to restrict their rate of growth. The major emphasis of the College of Medical Sciences should be on those educational programs leading to baccalaureate or advanced degrees. The size of the classes in these allied health sciences should be developed in proportion to the needs of the number of physicians graduating from the Medical School until such time as other educational institutions in this region begin to graduate significant numbers in these disciplines. Technical training and subcollegiate courses, as a generality, should be restricted to those programs which require facilities or faculty available only in the College of Medical Sciences. The College of Medical Sciences may initiate a subcollegiate

course as a pilot or research program to determine the requirements for such a course. Under certain circumstances it may be necessary to establish specific subcollegiate courses in order to meet the needs of the University or of the community. Insofar as possible this should be avoided or constitute only a temporary service.

A number of criteria might be used to estimate the need for the allied health professions. The need for personnel might be related to the population, the number of practicing physicians, the number of graduating physicians, the number of acute and chronic hospitals and nursing homes, or the number of beds in these facilities.

The population in the area for which the University of Minnesota is a primary training facility is:

Minnesota	-	3,413,864
North Dakota	-	632,446
South Dakota	-	680,514
Montana	-	674,767

In Minnesota there are:

Physicians 5269

Private practice 3232

Other (U of M, Mayo Clinic, V.A. Hospitals, etc.) 2037

Acute Hospitals, 185, with 17,281 acute beds

Chronic hospital beds 240

Nursing homes, 392, with 22,380 beds

State mental, mentally retarded and special hospitals 13,000 beds

It is estimated by the Surgeon General's Office that these will need to increase 3 per cent per year. For lack of specific information it is assumed that the needs in the other states are proportional to the population. The total population of the four state area is 5,401,591 of which Minnesota constitutes 60%.

Established Courses in the Allied Health Sciences

I. Medical Technology

A. Role.

The baccalaureate program in Medical Technology has been developed to provide Medical Technologists qualified (1) for work in clinical laboratories in hospitals, clinics, physicians offices, and other health agencies, (2) for work in research laboratories, and (3) for further training in the specialties. This program is the major source of Medical Technologists in this state.

The graduate program offering a M.S. in Medical Technology is designed to prepare graduate Medical Technologists for academic careers, or for administrative and consultative activities in laboratory methodology and teaching, or for work in a scientific specialty. This is the only graduate program in Medical Technology in this region.

B. Objectives:

1. B.S. Degree Program

The baccalaureate degree program in Medical Technology is designed to prepare young men and women to perform the duties and meet the responsibilities demanded in the practice of Medical Technology as an integral part of the total health care of the state. It has been

estimated by Dr. John Godwin, of Emergy University, that optimally there should be 1 medical technologist per 20 acute general hospital beds. Rappaport recommended that a ratio of 10,000 tests per year per medical technologist be used as the basis for calculating the need for training medical technologists.

In the Clinical Laboratories of the University of Minnesota in 1965-66 the following utilization of medical technologists existed.

Number of Medical Technologists	76	(35% development and teaching = 50 equivalent)
Number of Medical Laboratory Assistants	14	
Number of Hospital Beds	750	1 MT/15 beds[1]
Number of Laboratory Determinations	932,421	18650 tests/MT[2]

[1]Reflects effect of the Out-patient Clinic beyond number expected for the bed capacity

[2]Reflects effect of teaching institution

For Minnesota with 17,281 acute hospital beds, 240 chronic hospital beds (25% as active) and 22,380 nursing home beds (10% as active), 980 medical technologists are needed for optimal patient services. Although exact figures are unavailable it is estimated that this is about twice the number of medical technologists working in patient service laboratories at the present time.

Surgeon General William Stewart has estimated that the need will increase 3% per year indicating the following needs.

	Minnesota	4 State Area
1970 -	1100	1830
1975 -	1265	2100
1980 -	1455	2420
1985 -	1675	2620

Another ratio which might be of value is the proportion of medical technologists (980) to physicians (5,270) or 1:5. Since the average professional career of a medical technologist is about 5 years and that of a physician exceeds 35 years the ratio of graduating technologists to physicians should be 1.5:1 just to staff the service laboratories. Since research laboratories also use medical technologists the actual need is closer to 2:1. In 1959 a survey in Minnesota by the State Department of Health indicated 119 (33%) additional Medical Technologists and 57 (20%) additional Laboratory Assistants were needed to fill existing job openings in 145 hospital laboratories in Minnesota. (This report excluded University of Minnesota Hospitals, Mayo Clinic, St. Mary's Hospital at Rochester, and the Veteran's Administration Hospital).

APPROVED HOSPITAL SCHOOLS OF MEDICAL TECHNOLOGY

State	Number	Student Capacity
Minnesota, University of Minn.	1	60
Minnesota (Exclusive of Univ. of Minn.)	11	131
Montana	4	24

APPROVED HOSPITAL SCHOOLS OF MEDICAL TECHNOLOGY con't.

State	Number	Student Capacity
North Dakota	5	64
South Dakota	7	44
TOTAL	28	308[1]

(1) represents 100% capacity; exact numbers of students enrolled in the program are not available.

2. M.S. Degree Program

The graduate program is designed to provide the opportunity for additional study at depth in one of the scientific areas within Medical Technology in preparation for work in methodology and research in a specialty, for supervisory activities, and for teaching in schools of Medical Technology.

Virtually all of the graduate education in this region for medical technologists planning to go into academic careers is in the College of Medical Sciences. The sizes and proposed expansion of the graduate program is limited by the available staff and facilities and is less than the indicated need for academic personnel.

3. Continuing Education

This division cooperates with other University Departments, professional associations, and other agencies in providing opportunities for continuing education by special courses, workshops, seminars, refresher training, and institutes in the interests of community service.

4. Auxiliary Programs

The one-year program for Medical Laboratory Assistants, originally initiated as an experimental program to design and test an educational program to train young women for work as technical assistants with activities limited to specific laboratory tests of routine nature, is now discontinued. Since this program has been well accepted and established at other training institutions, this Division will no longer take an active role in training but rather continue to act in an advisory capacity to existing programs and to new programs as they develop.

C. Program

1. Trends

It is apparent that the present methods of teaching and the "apprenticeship" training programs will not meet the changing needs in Medical Technology. Such changes are resulting from the increasing complexity and utilization of laboratory diagnostic procedures brought about by the phenomenal advances in scientific knowledge, automation, and instrumentation.

To meet these changing needs, the present curriculum in Medical Technology is currently being revised to allow more effective use of faculty and facilities and to provide not only effective basic knowledge in science

but also in general education. The revisions are being planned:

a. to include more general education courses and to delete some overlapping science requirements.
b. to allow for more flexibility and less rigidity in the course requirements.
c. to include well-structured course offerings together with integrated laboratory exercises to strengthen and emphasize fundamental concepts in clinical laboratory science.
d. to de-emphasize student laboratory service requirements and practice.
e. to provide the student with a basic foundation of knowledge such that he can adapt to meet new situations and needs and that he can continue in advanced study.

It is important that increasing opportunity for graduate study is of prime importance. The present shortages of specialists and teachers in the field of Medical Technology is critical. At the present time there are only 10 universities offering graduate programs in Medical Technology. The graduate program here will have to be strengthened and increased to help provide personnel with additional education to meet the service and research needs in specialties and for teaching in schools of Medical Technology.

With the advent of automation and instrumentation into the clinical laboratory, there will be changing patterns of staffing, service and utilization of personnel bringing the need for changing education programs. It is the consensus that the effect of automation will not be to replace the technologist, but rather will be to require well educated and knowledgable personnel and will allow for expansion of services again requiring professional personnel. As stated by R. W. Coon, M.D., "It is easy to see that more, not less education and experience is needed to run one of these magnificent machines." Therefore, it can be anticipated that vigorous research programs in educational methods and procedures in laboratory methodology and service, and in personnel utilization will be and should be developed.

There are certain other areas within the field of Clinical Laboratory that are evolving and developing (and, indeed, some that are not even conceived at this point), that will require trained assistants and technicians. At the present time, the University does not have facilities to offer educational programs in these areas, for example, Cytotechnology, Histologic Techniques, Radioisotope work, etc. In fact, such programs can be well handled by other agencies. However, this division does have a responsibility to the state to assess trends and

needs, to assist in developing additional programs or to engage in experimental programs to establish educational patterns.

As new techniques, automation, instrumentation, and methodologies are developed, the Division will have to be able to offer more opportunities for continuing education. Certainly more than can be done now with existing faculty and facilities will be expected and demanded by the community.

With increasing scientific knowledge and methodology in each of the units (Hematology, Chemistry, Microbiology, etc.) comprising the whole of Medical Technology, it is apparent that the need for specialty programs will develop. Such specialty training will probably be best handled as a year of training at the post-baccalaureate level.

2. Needs

In order to accomplish the objectives of our program and to fulfill our obligations to the people of this state, space, faculty and facilities are all major requirements. The present space and facilities are extremely limited and a are inadequate to meet even our present demands much less to meet increasing enrollments, or changing service, research, and educational needs.

Because of the clinical aspects of the program, it is essential that certain teaching laboratories be in close approximation to the clinical laboratories.

The new curriculum will require more general purpose teaching laboratories and class rooms because the students will no longer be in the hospital service laboratories to the extent of the current program. Such facilities probably could be planned as multiple-purpose laboratories and these could be shared with other clinical departments as appropriate.

If, in the future, enrollments in the baccalaureate program exceed facilities here, affiliations for clinical laboratory experience in local hospitals, and other health agencies can perhaps be utilized to our mutual satisfaction.

The following tables represent needs as best can be estimated at this time. It should be noted that this report concerns Medical Technology alone and does not represent the needs for the Department of Laboratory Medicine.

YEAR	1966		1970	1975	1980	1985
SPACE[1]	CURRENTLY HAVE	CURRENTLY NEED				
Total sq. ft.	1590	5305	8105	11405	12425	13215
Laboratories						
Teaching	800	1380	2160	3000	3240	3480
Research	0	750	1100	1550	1700	1800
Classroom	400	800	1260	1750	1890	2030
Other						
Offices (faculty)	360	1500	2200	3100	3400	3600
Offices (clerical)	30	210	350	560	630	630
Locker Space	0	665	1035	1445	1565	1675
FACULTY						
Academic[2]	13	15	22	31	34	36
Non-academic	3	3	5	8	9	9
STUDENTS						
a) Undergraduates[3] 1 and 2 year	155		200	200	200	200
b) 3 and 4 year[4]	105		150	200	200	200
c) Specialties 5th year	0		10	20	30	40
d) Graduate Students	11		20	30	40	50
e) MLA[5]	60		0	0	0	0

1) Space estimated according to figures from the reference: Laboratory Planning, H.F. Lewis, Reinhold Publishing Corp., New York, 1962.

2) Faculty-student ratio of 1-8 (based on number of students in groups b, c and d.

3) With the expected increase in junior college facilities, it is anticipated that the number of students enrolling at the U of M in the first and second years of college will level off.

(4) It is probable that the enrollment of the B.S. degree program should be curtailed at this level to allow for the utilization of faculty and facilities for the growth and development of specialty and graduate program.

(5) The MLA program will be phased out because other community facilities and agencies are being developed to offer vocational training programs for the medical laboratory assistant. (There are "at present 113 CLA schools training 641 students in 34 states.")

JUSTIFICATION OF SPACE

I. Classroom space

a) Based on 7 square feet per student.

b) Plan includes not just one large room, but one to accommodate 100 students at a time and one or two smaller rooms for use for seminars and conferences for smaller groups.

c) Based on present usage and the projected plans for curriculum changes, it is anticipated that the "classroom" space would be utilized at least 75% of the time by the department.

	1970	1975	1980	1985
TOTAL SQUARE FEET	1260	1750	1890	2030
Number of students (all categories)	180	250	270	290
Hours per week	30	30	30	30
Quarters per year	4	4	4	4
Location need				
In department	10%	10%	10%	10%
Close to Dept.	90%	90%	90%	90%

II. Laboratory Space: Teaching and Research

a) Teaching space based on: $\frac{48 \text{ sq.ft./student}}{4 \text{ sections}} = 12 \text{ sq.ft./student}$

b) Laboratory exercises are an integral part of the instruction in all units of Medical Technology. Therefore, laboratory facilities are essential to any expansion of enrollment and curriculum changes.

c) Research space is based on 50 sq. ft. per faculty member. This figure represents a minimum estimate with sharing of facilities among several people.

d) Note: These figures fo not include clinical laboratory space for students during clinical service. These estimates should be included in the report from the Hospital Clinical Laboratory Service of the Department of Laboratory Medicine.

	1970		1975		1980		1985	
	T	R	T	R	T	R	T	R
Total sq. ft.	2160	1100	3000	1550	3240	1700	3480	1800
Number of students	180		250		270		290	
Number of faculty members		22		31		34		37
Period of use:								
hours/week	30	40	30	40	30	40	30	40
qtrs./year	4	4	4	4	4	4	4	4
Share with other departments to extent of time of	25%	0	25%	0	25%	0	25%	0

OFFICES

a) Estimates based on 100 sq. ft./faculty member
70 sq. ft./non-academic member

b) It is anticipated that some of this office space together with research laboratory space could be combined for office-laboratories for some faculty members and their graduate students

c) Non-academic category represents both clerical and technical personnel

	1970	1975	1980	1985
Number of faculty members	22	31	34	36
Number of non-academic personnel	5	8	9	9
TOTAL SPACE ESTIMATES SQ. FT.	3550	3660	4030	4230

LOCKER SPACE

a) Based on 5 sq. ft. per student and other personnel

	1970	1975	1980	1985
Number of students and personnel	207	289	313	335
Space Sq. Ft.	1035	1445	1565	1675

II. Occupational Therapy

A. Role

The course in Occupational Therapy was established to train occupational therapists to supply the personnel needed in this state. It is one of two accredited programs in Minnesota. Graduates of this course represent more than half of all occupational therapists working in this area. A number of these graduates have also become teachers in courses in occupational therapy or administrators or consultants to programs in occupational therapy. It is estimated that 75 per cent of the need for occupational therapists in this region will have to be provided by graduates from this program.

B. Goals

1. Expansion of training in occupational therapy.

At the present time there is need for more than four times as many occupational therapists as there are in practice. There is also increasing demand among students for an opportunity to major in occupational therapy. It is estimated that over the next 20 years the size of the class in occupational therapy will need to be doubled.

If the need for occupational therapists is calculated on the basis of bed population the following needs are indicated (this does not take into account the needs in psychiatric outpatient facilities, special schools, nor O.T. training programs):

Acute hospital beds, 17,281

In adequately staffed acute general hospitals approximately 15% of patients receive occupational therapy. One therapist can handle 10-15 patients per day.

17,280 x .15 x .067 = 172

Chronic hospital beds, 240

1 therapist per 20 patients = 12

Nursing home beds, 22,380

1 therapist (+ O.T. aides) per 50 patients = 450

State special hospital beds, 13,000

1 therapist (+ O.T. aides) per 50 patients = 260

	Minnesota	4 State Area
1966 total need	894	1490
1975 estimated need	1130	1880
1985 estimated need	1400	2340

This overwhelming need for occupational therapists will require revision of methods of treatment with more extensive training and utilization of subprofessional aides to extend the services of occupational therapists. It is not clear at this time what effect the utilization of occupational therapy aides will have on the requirements for occupational therapists. It may be possible to reduce these figures by 50 per cent.

2. Establish a graduate program in occupational therapy.

There are few universities throughout the country

which offer a graduate curriculum in occupational therapy. There is a large unmet need for occupational therapists who have graduate degrees as teachers in approved courses in occupational therapy. Likewise, there is a tremendous unmet need for research in all aspects of occupational therapy.

3. Post-graduate education should be directed toward extending and improving the competence of therapists in practice and providing short refresher courses for therapists who have retired from practice to become homemakers and now have the opportunity to resume occupational therapy again.

C. Program

1. Baccalaureate Program

The curriculum in occupational therapy is 4-1/4 years in length and leads to a degree of Bachelor of Science. The students spend the first 2 years in the College of Liberal Arts and as freshmen are assigned to advisers who are on the O.T. faculty. Three faculty members each counsel and advise approximately 40 students every quarter which requires about 1 hour per student. Juniors and seniors may at times require more frequent interviews with advisers.

The last two years are spent in professional training in the College of Medical Sciences and the entire curriculum becomes the responsibility of this

faculty. In these 7 quarters, 4 quarters are spent in didactic and laboratory courses and 3 quarters are spent in training in occupational therapy clinics in the University Hospitals or affiliated hospitals.

The present teaching laboratories are adequate in size for a class of 26-30 students. Expansion of the number of students in occupational therapy can be accomplished with the greatest conservation of space by arranging for two class sections beginning in different quarters of the year. This will result in the full utilization of the teaching laboratories throughout the year.

It is planned to double the rate of graduation of occupational therapists by admitting two classes each year beginning in different quarters. If the class size in the junior and senior years is increased beyond 50 students a major expansion of laboratory space will be required.

The classroom facilities, which are shared with Physical Therapy and Physical Medicine and Rehabilitation are in essentially full use throughout the academic year. The large classroom seats 60; the smaller, 30. These are adequate for classes of the current size. A number of courses are taught conjointly to the P.T. and O.T. students. As soon as either program increases the size of its classes a larger classroom will have to be found for those lectures.

Before 1975 a lecture room seating 100 students will be needed in close proximity to the clinics.

Increase in class size will require a proportionally greater increase in faculty for counseling a larger number of pre-professional students in CLA and in other Minnesota colleges as well as teaching the increased number of laboratories and courses required by a larger student population. Increased staff offices will be required for any increase in faculty. Clinical training will be carried out at the University Hospitals and affiliated hospitals without necessitating expansion of facilities for this increase in number of students. Since this is a clinical training program and since the didactic courses are correlated with the clinical training the teaching facilities need to be in physical proximity to the O.T. clinics.

2. Graduate Training and Research

At the present time there is no approved program in occupational therapy in the Graduate School in spite of the acute need. It is proposed that a graduate program leading to a Master of Science degree be established. The facilities of the Department of Physical Medicine and Rehabilitation are adequate for this except for additional office space.

The faculty in Occupational Therapy has been too small and too overloaded by its undergraduate program to become involved in research. It is essential for

faculty development that adequate staff and resources be made available so that the faculty members may participate in this essential aspect of academic activity. Some of the indicated increase in the size of the faculty represents this need to make some time available to each faculty member for research and academic growth.

3. Post-Graduate Education

For post-graduate education and refresher courses for occupational therapists who are returning to work, this division will cooperate with the American Rehabilitation Foundation which has facilities at the Kenny Rehabilitation Institute.

OCCUPATIONAL THERAPY

YEAR	1966	1970	1975	1980	1985
SPACE					
Total Square Feet	4,775	7,381	9,611	10,011	10,311
Increase over 1966		2,606	4,836	5,236	5,536
Laboratories					
Teaching	1,881	1,881	2,821	2,821	2,821
Classroom	1,053	3,400	4,200	4,200	4,200
	Shared with Physical Therapy				
Other					
Offices (faculty)	591	800	1,000	1,200	1,200
Offices (non-academic)	60	110	400	600	900
Lounges and lockers	1,190	1,190	1,190	1,190	1,190
	Shared with Physical Therapy				
FACULTY					
Academic	5	8	10	12	12
Non-academic	1	1-1/2	2-1/2	2-1/2	3
STUDENTS					
Undergraduate	52	60	80	90	100
Graduate	0	0	4	6	10

Justification of Space

I. Classrooms

A. Based on 12 square feet per student plus 200 square feet for teaching and aisle space in large lecture rooms.

B. Existing classrooms--used 3 quarters per year

30 students, 380 square feet, 20 hours per week

50 students, 670 square feet, 20 hours per week

C. Needs for expanded classes--used 3 quarters per year

30 students, 250 square feet, 15 hours per week

75 students, 800 square feet, 10 hours per week

150 students, 2000 square feet, 10 hours per week

D. The classrooms for 30-50 students need to be adjacent to the Department. The larger classrooms should be located close to the department.

E. Classrooms are shared by Occupational Therapy and Physical Therapy.

II. Laboratories

A. The existing teaching laboratories should be adequate until 1975 if scheduled to be in nearly continuous use. Further enlargement of class size will require increased laboratory space.

III. Other requirements

A. Offices estimated as:

100 square feet per faculty member

75 square feet per non-academic staff

65 square feet per graduate student

Non-academic personnel include clerical and technical staff devoting full time to teaching.

B. Locker space is currently existing space.

IV. Physical Therapy

A. Role

The four year course in physical therapy leading to a B. S. in physical therapy has been developed to meet the needs for physical therapists in Minnesota and adjoining states for which the University of Minnesota is an educational center. It is one of two accredited training programs in physical therapy in Minnesota. The other program is at the Mayo Clinic. There are no approved programs in North Dakota, South Dakota, Montana or Wyoming. This course provides more than half of all physical therapists working in this area.

The graduate program, which offers a Master of Science with a major in Physical Therapy, is designed primarily for physical therapists who wish to enter academic careers, or serve as consultants and administrators in organized health programs. It is the only graduate program in physical therapy in this region. Research in physical therapy, likewise, is confined to the University of Minnesota.

B. Goals

1. Baccalaureate Program

Beginning in 1967 it is planned to double the number of students accepted into the professional program in the third year, from 24 to 48 students. The maximal class size of 24 students in each of the

third and fourth years is necessitated by limited teaching laboratory facilities. By admitting new classes in the fall and spring quarters it will be possible to double the number of students accepted each year. Although the optimal class size is 24 students, it may be possible in future years to increase the size of each class to 26-30 students.

Health manpower estimates of the Department of Health, Education and Welfare report that there are four times as many available positions for physical therapists as there are therapists available. Estimation of the need for physical therapists in Minnesota in relation to hospital beds indicates the following need:

Acute hospital beds; 17,521

In an adequately staffed acute general hospital approximately 15% of all patients require physical therapy. The daily patient load of a physical therapist, depending upon the extensiveness of treatment required, varies from 6-14, averaging 8 patients per day. For 17,281 acute beds and 240 chronic beds:

17,521 x 0.15 x 0.125 = 330 Physical Therapists

Nursing home beds; 22,380

It is difficult to estimate the need for Physical Therapy in nursing homes. Probably 30-50% of all patients should be receiving

restorative or maintenance therapy. If the lower figure is used and each therapist treats 15 patients per day:

22,380 x 0.3 x .067 = 450 Physical Therapists

In the mental hospitals and other special state hospitals there is a largely unmet need for physical therapists. For 13,000 patients in the state hospitals, if 10 per cent need therapy and the daily load of a therapist is 15 patients:

13,000 x 0.1 x .067 = 87 Physical Therapists

	Minnesota	4 State Area
1966 therapists in practice	145	
1966 total need	867	1440
1975 estimated need	1100	1840
1985 estimated need	1360	2270

Doubling the number of students who graduate each year will not begin to meet the need. Further expansion of this program will require major expansion of space and faculty. Other educational institutions should be encouraged to establish approved training programs in physical therapy in cooperation with adequate medical facilities. However, this is a long range goal which will require the development of those medical facilities. It should be emphasized that the physical therapy program at the University of Minnesota must utilize virtually all of the adequately staffed clinical facilities in physical therapy in Minneapolis and St. Paul in order to carry out its present training program.

This demand for physical therapists so greatly exceeds the supply that major changes will need to be made in the practice of physical therapy to use subprofessional aides in order to extend the services of physical therapists. It is apparent that many activities of a physical therapist can be delegated to a person with lesser training if there is adequate supervision. The extent to which this will decrease the number of physical therapists needed is not known, but it may be as great as 50 per cent.

2. M.S. Degree Program

The graduate program is primarily for physical therapists entering a career of teaching and research. There are also demands for graduate training for physical therapists in public health, research, and physical therapy administration. Since this is a clinical training program, two years are required to obtain the clinical skills and graduate education qualifying for a Master of Science in physical therapy. Within the next five years, five or six graduate students will be in training. By 1980 there will be ten graduate students.

3. Research

Research will be emphasized and expanded in the teaching of graduate students in physical therapy. The amount of research in physical therapy has been small, but will be increasing with the increased

number of graduate students in physical therapy. There is a great unmet need for research in physical therapy. It is anticipated that over the next ten years the research facilities in the Department of Physical Medicine and Rehabilitation can be utilized cooperatively by the various graduate programs associated with that Department.

4. Postgraduate Retraining of Physical Therapists

Retraining of physical therapists who have retired from the field is also planned. Many graduate physical therapists, after a number of years of practice, retire to become homemakers. When their children are grown, they become available again to resume practicing physical therapy. They need an adequate retraining program before returning to physical therapy. The utilization of these personnel provides a valuable resource to meet the manpower shortage in physical therapy.

5. Training of Physical Therapy Aides

There is need to develop a program for physical therapy aides. The specific requirements for these programs are not yet fully developed. The required skills for aides include understanding of how to approach and relate to patients; understanding of the techniques of assisting patients in transfers and dressing; understanding of safety precautions in attending patients; assistance in the simpler

techniques of physical therapy; attending to patients during various activities. Much of this will be on-the-job training. The amount of academic training necessary will probably be small. The systematic use of aides in physical therapy may alter the course in Physical Therapy significantly.

C. Program

1. Baccalaureate Program

The curriculum in physical therapy at the University of Minnesota comprises four academic years leading to a degree of Bachelor of Science. In the first two years, students are in the College of Liberal Arts but are counseled by the faculty of the course in Physical Therapy. In the third and fourth years the students are in the College of Medical Sciences and the entire curriculum becomes the responsibility of this faculty.

The professional curriculum in physical therapy (the last two academic years) is made up of more than 30 separate lecture and laboratory courses plus assigned clinical practice at various affiliated hsopitals and clinics. Approximately 500 clock hours are spent in lecture, 700 clock hours in laboratory, and a minimum of 600 clock hours in clinical practice. The lecture and laboratory classrooms are in use exclusively for physical therapy courses from 16-20 hours per week from September to June. This includes

class time for combined Occupational Therapy--Physical Therapy lectures. The present space is adequate for 26-30 students and, with scheduling, it is possible to allow for the proper sequence of courses. With an anticipated increase to 50 students in each year of the professional program by 1985, it will be necessary to offer two separate sections of laboratory courses. This will necessitate an increase in teaching staff but laboratory space should still be adequate. For lecture courses which are combined with O.T. and will have more than 60 students it will be necessary to obtain larger lecture rooms. By 1975 two lecture rooms seating 100 and 60 students will be needed at least 20 hours per week throughout the year.

The training of physical therapists must be an integral part of the program of patient care at the University Hospitals. Physical therapists work directly with the patients throughout their working day. Patients are not used for preliminary laboratory training but the significant clinical training must be performed with patients. Therefore, the program should be in physical proximity to the clinical services of the Department of Physical Medicine and Rehabilitation.

Students in the pre-professional curriculum in the College of Liberal Arts are counseled by the faculty of the course in Physical Therapy. Up to

this time there have been approximately 100 student advisees in the freshman and sophomore classes. Advisors spend a minimum of one hour per quarter, and frequently much more, with each pre-therapy student in conferences and personal interviews. In addition, the educational director carries on correspondence and conducts personal interviews with other prospective students who are completing course requirements at other accredited colleges and universities. Approximately 10 to 20 per cent of the junior students have completed the first two years elsewhere. The increased enrollment in the last two years will result in an increased demand for counseling services in the first two years. This increased load will require increased faculty and increased office space to carry on this counseling.

2. Graduate Education and Research

It is anticipated that little additional space will be required for the graduate program in physical therapy. The didactic work in the major field will utilize the existing classroom and clinical facilities. The minor field will be completed in one of the basic sciences. Research studies will be conducted in the laboratories of the Department of Physical Medicine and Rehabilitation. A small amount of additional office space will be necessary.

3. Postgraduate education

Postgraduate education of physical therapists

will be carried out in cooperation with the American Rehabilitation Foundation utilizing the facilities of the Kenny Rehabilitation Institute.

4. Physical therapy aides

The program for training physical therapy aides remains to be developed. Insofar as possible other educational institutions will be encouraged to assume this responsibility. Because the practical training must be carried on in a physical therapy clinic a certain amount of participation by this faculty may be required. Moreover, because the requirements for training a physical therapy aide, the duties, and the necessary supervision by a qualified physical therapist have not been defined, a certain amount of research regarding the use of these personnel is needed.

PHYSICAL THERAPY

YEAR	1966	1970	1975	1980	1985
SPACE					
Total Square Feet	5,208	8,240	9,950	10,540	10,540
Increase over 1966		3,032	4,742	5,332	5,332
Laboratories					
Teaching	1,890	1,890	2,800	2,800	2,800
Classroom	1,053	3,400	4,200	4,200	4,200
Other	Shared with Occupational Therapy				
Offices (faculty)	925	1,200	1,200	1,400	1,400
Offices (non-academic)	150	560	560	950	950
Lounges and lockers	1,190	1,190	1,190	1,190	1,190
	Shared with Occupational Therapy				
FACULTY					
Academic	9	12	12	14	14
Non-academic	1-1/2	2-1/2	2-1/2	4	4
STUDENTS					
Undergraduate	50	80	90	100	100
Graduate	2	5	5	10	10

Justification of Space

I. Classrooms

A. Based on 12 square feet per student plus 200 square feet for teaching and aisle space in large lecture rooms.

B. Existing classrooms--used 3 quarters per year

30 students, 380 square feet, 20 hours per week

50 students, 670 square feet, 20 hours per week

C. Needs for expanded classes--used 3 quarters per year

30 students, 250 square feet, 15 hours per week

75 students, 800 square feet, 10 hours per week

150 students, 2,000 square feet, 10 hours per week

D. The classrooms for 30-50 students need to be adjacent to the Department. The larger classrooms should be located close to the department.

E. Classrooms are shared by Occupational Therapy and Physical Therapy.

II. Laboratories

A. The existing teaching laboratories should be adequate until 1975 if scheduled to be in nearly continuous use. Further enlargement of class size will require increased laboratory space.

III. Other requirements

A. Offices estimated as:

100 square feet per faculty member

75 square feet per non-academic staff

65 square feet per graduate student

Non-academic personnel include clerical and technical staff devoting full time to teaching.

B. Locker space is currently existing space.

V. Radiologic Technology

A. Role

The course in radiologic technology fulfills a dual role. A three month series of lectures on the basic aspects of x-ray technology are presented twice yearly to students enrolled in a number of A.M.A. approved hospital training programs for x-ray technologists.

The second major program involves 40 students enrolled in the two year training program in x-ray technology offered by the Department of Radiology.

B. Objectives

1. Basic lecture series in x-ray technology

This three month program provides the basic series of lectures for students enrolled in x-ray technology at the University of Minnesota and in other approved training programs in this region. These are basic lectures in all aspects of x-ray technology and are given twice a year, usually January 1st, and July 1st.

There are approximately 100 students in each class or 200 students each year. These students come to the University from all of the state of Minnesota and some of the surrounding states, where they have been accepted into two year training programs by local hospitals that are approved by the A.M.A. for training. Since most of these hospitals do not have staff who are equipped to give them the required lectures, they fulfill these requirements by attending the lectures at the University of Minnesota.

The estimated growth in demand for radiologic examinations is 10 per cent per year or an increase of 200 per cent in 20 years. Because of the shortage of x-ray technicians it is estimated that the number trained should increase 300 per cent over the next 20 years. The service function of providing this basic lecture series for students at other hospitals will continue.

2. The University's two year course for x-ray technologists will probably increase in proportion to the increased activity in the department.
3. There is need for special training in the area of radiation therapy, perhaps on two or three different levels of excellence and ability. There is no such program at this time, but it might be expected that in the next 20 years some training program on a much smaller scale will be developed in the Division of Radiation Therapy, with perhaps five to ten students involved over a two to four year period. The demands of space for such a small group will, of course, not be significant.

C. Program

The present school of x-ray technology is a part of the General Extension Division of the University of Minnesota. The director of the school is Mr. Charles Dopking, who is also the Chief of Technical Services of the Department of Radiology.

1. Basic lecture series in x-ray technology

Approximately 350 hours of lecture and laboratory time are utilized for each three month period.

There is presently no space which is designated for this training program. Rooms in various parts of the Medical School complex are used at different times during the two sessions of the year when lectures are given to large groups. These rooms include, #178 Jackson Hall, Powell Amphitheater, 1405 Powell, Todd Amphitheater, the Physics Lab of the X-ray Therapy Department, and Room 125 of the Mayo Auditorium. For the small group sessions of instruction the rooms of the Main X-ray Department are used primarily at night.

If we start with the base line of 100 students plus, in a class at the present time, we would anticipate 300 or more students in a class 20 years from now, if we were able to recruit people into this field. It would then be very desirable to have a lecture hall of sufficient size to accommodate 300 to 400 students, and one in which all of the lectures could be concentrated. For laboratory space, we would be utilizing the main department itself, and we would continue to draw instructors from the Chief Technicians in the Twin City area, plus physicians in the Department of Radiology, and assistants from the School of Nursing.

2. Two year course in x-ray technology

The second major training program involves those students who are obtaining their entire two-year program here at the University Hospitals. These students also take this same lecture course just mentioned, but in addition, spend 21 months on a full-time basis in the department. They are assigned in a rotating fashion to all of the registered, paid technicians, which, in a sense, would indicate that we have a faculty of about 20 to 22 technicians giving on-the-job type of training to those students. We have approximately 40 students in this capacity at the present time. At the end of their two year training program they are eligible for the examinations given by the American Registry of Radiologic Technologists.

The clinical facilities of the Department of Radiology are used for laboratory and clinical teaching. It would be desirable to have a classroom in the department for lectures.

CLASS SCHEDULE COURSE IN X-RAY TECHNOLOGY WINTER SESSION January 3 - March 18, 1966

HOURS	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
8:15	Physics JacH. 74		Physics JacH. 74			Equip. & Physics Lab Main X-Ray (8:00 A.M.)
9:15	Physics JacH. 178		Physics JacH. 178			Equip. & Physics Lab. Main X-Ray
10:15	Nursing Lecture Powell Amp.				Nursing Lecture Powell Amp.	Equip. & Physics Lab. Main X-Ray
11:15	Nursing Lecture Powell Amp.				Nursing Lecture Powell Amp.	
12:15	Nursing Lab 1405 Powell Section I				Nursing Lab 1405 Powell Section III	
1:15	Nursing Lab 1405 Powell Section II				Nursing Lab 1405 Powell Section IV	
2:15			Darkroom Owre 12	Darkroom Owre 12	Math of Exposure Owre 12	
3:15	Technique I Owre 12	Technique II Owre 12	Technique II Owre 12	Darkroom Owre 12	Math of Exposure Owre 12	
4:15	Technique I Owre 12	Technique II Owre 12	Technique I Owre 12			
5:15	Technique I Lab Main X-Ray	Technique II Lab Main X-Ray	Technique I Lab Main X-Ray			
6:15	Technique I Lab Main X-Ray	Technique II Lab Main X-Ray		Anatomy (6:30 - 8:30) Sections I and II, Todd Ampitheater Sections III and IV, Powell Hall Ampitheater		

INSTRUCTORS

ANATOMY: Dr. P. L'Heureux, Dr. C. Nicolette; PHYSICS: Dr. M. Loken; TECH I: Mr. G. Mansour; TECH II: Mr. K. Nyquist

DARKROOM: Mr. O'Reilly; MATH OF EXPOSURE: Mr. E. Inett; NURSING: Mrs. Smith; EQUIP. &PHYSICS LAB: C. Dopking.

RADIOLOGIC TECHNOLOGY

YEAR	1966	1970	1975	1980	1985
SPACE					
Total square feet	1,150	1,350	1,350	3,000	3,560
Increase over 1966					
Laboratories					
Teaching	X-ray Department and Nursing facilities will be used.				
Classroom	1,150	1,350	1,350	3,000	3,560
Other					
Offices (faculty)					
Offices (non-academic)					
Lounges and lockers	Lockers for 60 students.				
FACULTY					
Academic	1	1	1	1-2	2
Non-academic	22	25	35	45	50-60
STUDENTS					
Undergraduate	100	125	175	250	300-400
Graduate	0	1	1	2	2

VI. Vocational Rehabilitation Counseling

A. Role

This program provides clinical practice for graduate students in rehabilitation counseling of the Department of Psychology of the College of Liberal Arts.

B. Objectives

1. Clinical training for rehabilitation counselors.

The Rehabilitation Center of the University Hospitals provides the major facility for clinical training in rehabilitation counseling of patients. Students have an opportunity to work with patients who have physical or mental disabilities varying in degree and duration. They obtain an orientation to the cause, diagnosis, management and prognosis of diseases and disabilities impairing ability for self-care, ambulation, communication or vocational productivity. They participate in the vocational rehabilitation evaluation, planning, counseling, retraining, placement and follow-up.

Most of the students in this program are receiving traineeships from the Office of Vocational Rehabilitation. At the present time 15 traineeships are granted each year. This number will probably be increased to 30 by 1985.

2. Research

There has been only a limited amount of research carried out under this program. The research aspects should be increased. In future years more doctoral candidates in this field will increase the amount of research.

3. Postgraduate education

Continuation education is carried in cooperation with the American Rehabilitation Foundation at the Kenny Rehabilitation Institute.

C. Program

1. In the "second" year of a two year graduate program in Rehabilitation Counseling the student gains clinical experience by working under supervision in a number of counseling clinics. The Rehabilitation Center of the University Hospitals is the major teaching facility where these students can work with physically or mentally handicapped clients. In addition, it is the only facility in which the student has an opportunity to participate as a team member with all of the other rehabilitation professions. This constitutes the primary clinical training in this curriculum. It also provides the greatest breadth of experience with both patients and available services. Maximal efficiency in clinical training for these students would require

that they spend their full time working with rehabilitation clients. However, limitations of space and the necessary facilities restrict this experience to 25 - 50% of the available time.

2. Needs

The physical facilities for this program need to be improved. This training program has no planned facilities. It has utilized whatever space is temporarily unused in the Rehabilitation Center. Lack of adequate space for the number of students and lack of appropriate facilities impairs the effectiveness of training.

For optimal clinical training there should be interviewing rooms with one-way vision screens so that the student can be observed by the supervisor during the interview for training in interviewing and counseling techniques. Recording and review of interviews would also improve training. Closed-circuit television recording of interviewing and counseling has also been considered. A sufficient number of interview rooms are needed so that students can work with their clients as necessary during the clinic day.

A conference room adequate for clinical and teaching conferences is needed close to the Rehabilitation Center. The students also need desk space to sit to write case notes.

As the program expands further another psychometrist and additional stenographic help will be needed.

VOCATIONAL REHABILITATION COUNSELING

	1966 Existing	1966 Needed	1970	1975	1980	1985
E						
otal Square Feet	651	1,331	1,381	1,543	1,593	1 593
Increase over 1966		680	730	892	942	942
aboratories						
Teaching	238	518	518]	518	518	518
lassroom	---	300	300	300	300	300
ther						
Offices (faculty)	313	313	313	425	425	425
Offices(non-academic)	100	200	250	300	350	350
Lounges and lockers						
LTY						
cademic		3	3	4	4	4
on-academic		2	3	3-1/2	4	4
ENTS						
ndergraduate						
raduate		15	22	25	27	30

NEW TEACHING PROGRAMS PROPOSED FOR THE
COLLEGE OF MEDICAL SCIENCES

VII. Biomedical Data Processing, Bio-Engineering Reserach and Training, Information Retrieval, Laboratory and Hospital Automation

A. Role

1. Teaching

a. Biomedical data processing will be taught to graduate students and postgraduate medical specialists interested in Biomedical Computing. Introductory courses in machine programming and orientation to computer utilization will be taught to medical, paramedical, dental, and graduate students. In addition to the training provided to students in all of the basic science and clinical departments, Bachelors, Masters and Ph.D. degrees will be given in Biomedical Data Processing and Biomedical Computing Sciences. These individuals will staff departments of Biomedical Computing Sciences, and they will contribute to research programs in various departments.

b. Courses in Bio-Engineering will be taught to undergraduate, graduate and post graduate students. The graduate students will be either engineers who have developed an interest in Biology or physicians and biologists with an interest in the physical sciences. By 1975 we can foresee an

average annual output of 50 Bachelors, 25 Masters and at least a dozen Ph.D. degree holders in Bio-Engineering.

c. Courses in Information Retrieval and Library Mechanization will be taught to students in all of the Medical School departments and also in the Library School.

2. Research

a. Biomedical data processing and retrieval

b. Bio-Engineering

c. Biomedical Information Retrieval

3. Service

a. Biomedical data processing and retrieval

b. Bio-Engineering

c. Biomedical Information Retrieval

d. Laboratory Data Processing

e. Hospital data storage and retrieval

f. Regional Library of Medicine Medlars Computer

B. Objectives

1. To develop Biomedical Engineering and computer facilities and services adequate for the teaching and research programs of the College of Medical Sciences. The programs in Biomedical Engineering and Biomedical Computing Science are almost certain to expand in an exponential manner. It is possible that by 1975 the

College of Medical Sciences will have independent departments of Biomedical-Computing and Biomedical-Engineering. Each will have a probable staff of more than 20 academic personnel, with a probable distribution of five members at each of the professional levels--professor, associate professor, assistant professor and instructor. Each department will have approximately 40 non-academic staff and more than 30 graduate students working for advance degrees. It is somewhat difficult to predict the space requriements of this growth. Housing will have to be found for personnel and equipment in an amount perhaps ten to twenty-five times greater than currently available. In addition to staff in newly established departments, academic and technically trained personnel will be dispersed within existing departments in the same way that biochemists and electron microscopists are now dispersed throughout most of the departments of the College of Medical Sciences. Some of the growth will take place by cooperative involvement with other departments and hence some of the space needs will be reflected in the space requirements of these departments.

2. To train the personnel necessary for operating Biomedical Computer Systems.

3. To train Biomedical Engineers and Biomedical-Computing personnel to work in specific research projects in almost every department of the Medical School and to provide the personnel needed to operate and service the Laboratory Automation-Computer-Complex which will be a major component of the Minnesota Biomedical complex.

   Many Ph.D.s with primary training in engineering and the physical sciences will be actively engaged in biomedical research, not in the role of instrumentation, but they will play a vital role in the design and planning of the research to be undertaken. By 1975 up to one-fourth of the research personnel engaged in the biomedical fields may have their primary training in the physical sciences, including engineering and computer science, rather than in Biology or Medicine.

4. To train personnel in Information Retrieval and Biomedical Library Automation.

5. To establish a Regional Branch of the National Library of Medicine tied to the Medlars computer-based system. The National Library of Medicine is planning to decentralize its operation by establishing a number of regional branches. Each regional branch will have the full computer capabilities to handle Medlars, and they will likewise provide hard copy of most material currently available through the National

Library of Medicine. With the current work on Information Retrieval and training of biomedical scientists at Minnesota, we stand an excellent chance of becoming a regional branch of the National Library of Medicine, and this will greatly enhance our Biomedical Library resources. The University and the Biomedical Library Staff are extremely anxious to participate in this exciting new development, but it is obvious that adequate provision must be made for space.

6. To establish a National Diabetes Information Center which will become one of fifty or more National Information Centers, each dealing with a special field of Biology and Medicine. These will be tied together in a National Network of Information Centers through the National Library of Medicine.

7. To provide for an automated hospital-laboratory information system. The complete hospital data flow system would be monitored by a central computer. This would include records, laboratory reports, inventory, billing, scheduling, etc. On-line processing and evaluation of electrical measurements on humans such as electrocardiography and electroencephalography.

C. Program

1. General Structure: <u>The Impact of Laboratory Automation and Computers on Medical Research and Hospital Practice</u>:

The use of complex specialized equipment and computers in medical research, laboratory diagnosis and patient care is drastically changing biomedical research and the practice of medicine. The magnitude of this change and its impact on existing medical practice is almost beyond comprehension. We believe that these factors will produce as much change in the way medicine is practiced as did the Industrial Revolution on the development of industry more than a century ago. The mechanization of farming during the past several decades has brought about similar drastic changes, as evidenced by the fact that less than 8% of the population is so employed today; whereas half the population of this country was employed raising the national food requirement forty years ago. It is of interest that the mechanization of farming in the United States was brought about by our free enterprise system; whereas the attempt to collectivize farming in Russia through a planned economy was less than successful.

Advances in Bio-Engineering and Bio-Computing science will have an impact on almost every area of the hospital, including diagnosis, treatment and patient care. Automated laboratory diagnosis will eliminate most of the manual steps between the collection of biological specimens (blood, urine, feces,

sputum, etc.), and the interpretation of the laboratory findings by computer. The present stage of automation of the chemical laboratory (where a dozen determinations are carried out simultaneously, utilizing the autoanalyzer), is the mere beginning. The Kaiser Hospital Foundation has already demonstrated that it is less expensive to carry out twelve determinations on a single blood sample with the autoanalyzer than it is to do a single glucose tolerance test. In our judgment the present stage of laboratory automation is analogous to the "Tin Lizzy Stage" of the automobile technology. Developments and improvements in methods of physical separation (chromatography, electrophoresis, ultracentrifugation, etc.) and the availability of various detecting instruments (UV visible and infrared spectrophotemetry, mass determination, etc.) will make it possible (and economically profitable) to measure most chemical constituents of the body on a routine basis. The two-antibody immunoassay method (which is currently used to determine blood insulin and growth hormone levels) can be adapted to measure all of the proteinhormones and all of the serum proteins and tissue proteins; these determinations could be carried out automatically using small samples of

blood or tissue. The use of fluorescent antibody technics will permit the direct and automatic identification of all types of micro-organisms, it will be possible to quantitate the number and type of all micro-organisms present in the sample of blood, sputum or tissue without the use of present-day culture methods. Likewise the automatic scanning of tissue sections, when coupled with pattern recognition by computer will provide sophisticated hematologic and pathologic diagnoses without human intervention. The potentialities of microscopic scanning methods are such that it will be possible to automatically identify tumor cells under the microscope without human interposition. Many aspects of radiologic diagnosis will also be automated.

Preliminary hospital automation studies already carried out have demonstrated that computers will permeate every phase of hospital activity from admitting patients to scheduling x-rays and special laboratory tests, planning meals, work assignments, ordering supplies, preparing and distributing drugs and physiologic monitoring of the patient during and following treatment. The computer will be used to schedule the work load of physicians, nurses and the various paramedical personnel.

The newer methods of information handling will completely replace the hospital record, as we now know it. Each physician, through his own CRT terminal (which consists of a combined typewriter and television screen) will have all information about each patient at his fingertips, including the record of all previous hospital admissions anywhere in the United States. The magnitude of these changes is almost incomprehensible, and they will happen in the 1970's, not in the year 2000. In our judgment all previous estimations of manpower needs that do not take computers and bio-engineering into account are likely to miss their mark by several orders of magnitude.

It is not unlikely that with extensive automation of medical practice, present-day physicians will be able to handle twice as many patients per day, providing better medical care and more personalized attention to each. The recent experience of the Kaiser Hospital Foundation Group, where most laboratory determinations, x-rays and special diagnostic tests are performed during a three-hour pre-testing period prior to visiting the physician, demonstrated the great saving of manpower that can be achieved through automation. Under present circumstances when the physician sees a patient and

takes the history, he must often defer final diagnosis and treatment until various laboratory tests are completed and the patient returns on a subsequent visit, often several weeks later. At the time of the second visit, the physician must spend considerable time recapping the first visit and reinterpreting the earlier findings in light of the additional laboratory data. If all of the laboratory and diagnostic information had been available during the initial visit, the physician would have been able to prescribe immediate treatment in most cases. This time saved will unquestionably increase the doctor's effectiveness, and it could conceivably double his productivity. With extensive computerization and automation of medical practice, each physician could have more time "to listen" to the patient's complaints and give him the personalized attention he needs. One can make the case that automation can lead to <u>increased personalization</u> rather than to a lessening of the doctor-patient relationship.

The impact of the automation-computer-revolution is so drastic that it will have a profound effect on planning every aspect of our physical facilities. In our judgment the impending changes of this revolution are of such importance that they warrant a special study similar to the Upper Midwest Manpower

Survey recently carried out under a grant from the Hill Foundation.

2. Biomedical Data Processing Unit:

This unit has been recently established within the College of Medical Sciences, and it is supported by a grant from the Division of Resources and Facilities of the National Institute of Health, which provides approximately $300,000 a year for personnel and for a Biomedical Computing Facility. In order to use computers effectively, the biomedical scientist must have the opportunity to interact with trained personnel who are familiar with both Biology and computers; they help formulate the biomedical scientist's problems in terms that can be understood and analyzed by a systems engineer and computer programmer. The NIH grant also provides for the rental of a CDC 3100 computer which will be linked to the All-University CDC 6600, which is part of the Numerical Analysis Center. However, major expansion of the Biomedical Computing Facility is already required. We are in the process of obtaining a separate small computer which will be used exclusively for data acquisition and for analog to digital conversion. There will be a very marked increase in the number of "on line" studies, and the Biomedical Computing Facility must

provide time sharing capabilities for up to 50 individuals.

Teaching:

Undergraduate, graduate students and post graduate medical specialists will be trained in Biomedical Computing. Specific degree programs will ultimately develop when a formal department in Biomedical Computing Sciences is established. Many formal courses will be taken in other departments. Introductory courses in machine programming and orientation to computer utilization will be given to medical students, dental students, students in the paramedical area as well as to graduate students and staff. In addition to the formal program, training will be provided in the form of an internship or apprenticeship.

Research:

Physical Needs and Facilities Used:

An expanded facility (square feet) will be needed to house the computer and data acquisition systems. This requires special flooring, special air-conditioning and a heavy electrical load. Office space, consultation meeting rooms and equipment work rooms and research laboratories will be needed for the professional staff. Desired location of space requested: Central to hospital and research laboratories.

Departmental Status:

Eventually separate departmental status may be necessary, but there will be a close association with all research oriented departments in the College of Medical Sciences.

Interrelationship with Other Departments:

Consulting service will be provided to all departments with data acquisition, processing and analysis problems.

3. Bio-Engineering:

A professorship in Biomedical-Engineering has been established through a ten-year grant from the Hill Foundation. Initially this position will be part of the Biomedical Data Processing Center. At a later time we envision that the growth of Biomedical-Engineering will necessitate the establishment of a separate department. An appropriate candidate with a Ph.D. in physics and wide experience in the biomedical area has been selected, and he will form the nucleus of a developing program in Bio-Engineering. Joint appointments between the Institute of Technology and the College of Biological Sciences are envisioned. Many new research projects will be initiated with this new appointment, and it is probable that an NIH training grant in Bio-Engineering will be established. There is considerable interest

in Bio-Engineering at the national level.

Teaching:

Undergraduate, graduate and post graduate students will be trained, and by 1975 we estimate that an annual output will be 50 Bachelors, 25 Masters and a dozen Ph.D. degrees. In addition to the students majoring in Bio-Engineering, special training will be provided for post-doctoral personnel who are based in other departments in the College of Medical Sciences.

Research:

Separate research facilities will be required for the staff of the Bio-Engineering group. Although these will be closely related to the Biomedical Data Processing Center, there will be extensive space requirements for instrumentation and other specialized facilities.

4. Information Retrieval, Documentation and Library Automation:

Recent developments both in hardware availability and software capabilities have likewise opened new vistas in the Information Retrieval problem and these are almost beyond the range of human prediction. The projected delivery (within one year by IBM) of a trillion bit random access device will provide mass storage at low cost. With this device

it will be feasible to record the full text of all Biomedical articles published during the past ten years in machine-readable form in a single instrument. Developments in character recognition technology now permit the rapid reading of full English text by machine. This development will avoid the need for key punching, which is expensive, and it will provide full English text in a form that can subsequently be analyzed by computer. Computer typesetting is rapidly taking over the printing industry and most recent newspaper strikes have been over this issue of automation. When computers are employed to set the type used to produce the printed page, full English text is available in machine-readable form prior to the time of publication. The progress which we have made during the past six months in our Diabetes Literature Retrieval project demonstrates that the analysis of full English text by computer using statistical methods is not only feasible but that it effectively competes with man in the indexing and detailed analysis of scientific documents. The computer is not only capable of identifying the documents which answer a specific question but it can identify related documents (which contain synonyms or related concepts).

Furthermore, the computer can order these documents in accordance with their pertinence to the question and can likewise identify and print out specific paragraphs and sentences in these documents that best answer the question. Computer analysis of full-text is not only feasible but it will be economically competitive.

These current developments in the use of computers for Information Retrieval and Biomedical Data Processing, will have a profound impact on almost every research project now being carried out in the College of Medical Sciences (as well as the rest of the University). I believe that space allocated to these new developments can make the greatest contribution to the University of Minnesota on the basis of value received per dollar spent. During the past year a Center for Documentation and Information Retrieval has been established in the Graduate School to develop this area.

Teaching:

A committee of the Graduate School is projecting the establishment of interdisciplinary M.S. and Ph.D. programs in Information Science, to be administered by the Center. A three-course sequence (Lib. 241, 242, 243) was established in Library Mechanization

and Information Retrieval; these courses are designed primarily for students in the Library School, but they will be useful as service courses for many other units of the University. Many additional special courses in information handling will be established. A training grant from the National Library of Medicine and administered through the Library School now provides training in Biomedical Information Science. This grant ($80,000 per year) provides staff positions as well as stipends for graduate students. With the rapid development of this field we can project a further increase in the size of this training program, as well as the development of additional training grants in related areas.

Research:

The Diabetes Literature Project, which is supported by both the National Institute for Arthritis and Metabolic Diseases, and by the Resources and Facilities Division of the National Institutes for General Medical Sciences, is currently housed in the Department of Anatomy. This project has grown rapidly during the past five years; it is currently funded at the level of $350,000 a year. We employ systems engineers, programmers, physicians, biologists, librarians, various electronics and mechanical engineer-

ing supporting personnel and a large number of key punch and flexowriter operators. We have worked very closely with the Director of the National Library of Medicine to interrelate our Literature Retrieval Project with the plans for the National Library of Medicine. Research funds will also be provided by the National Library of Medicine to develop a relationship between the NIM and the specialized information centers, the university and departmental libraries and the information needs of individual scientists.

The National Institute of Arthritis and Metabolic Disease contracted with the University of Minnesota to provide the camera-ready copy needed for the publication of a monthly Current Awareness Bulletin covering the Diabetes-Related Literature. This bulletin is distributed to all diabetes research investigators, to all members of the American Diabetes Association, to university libraries and to other interested users. We are now in the process of developing a personalized alerting service which will automatically provide individual scientists with those documents which pertain to his special research interest. Once the procedures have been developed and tested, the National Insti-

tute for Arthritis and Metabolic Diseases plans to extend the contract to include a personalized alerting service for diabetes research investigators. Once our programs have become operational, other specialized groups of users at the University of Minnesota and throughout the country will be able to select appropriate configurations of the NIM MEDLARS subject heading entries and to develop current awareness and personalized alerting services for individual scientists. We envision the establishment of 50 or more National Specialized Information Centers, and these will eventually be integrated with a National Information Network. Minnesota has the opportunity to become the specialized Information Center for Diabetes. Because of the rapid expansion of this project, additional space is urgently needed. Likewise because of other developments in the Anatomy research programs, the present space occupied by the Information Retrieval Project is urgently needed for the orderly growth of the Department.

Desired Location of Space Requested:

First choice is a new building adjacent to Diehl Hall. Other choices are Walter Library after the move to the West Bank Library or space with the Library School when it moves to the West Bank.

Departmental Affiliation:

Library School, Biomedical Library, Anatomy, Biomedical Data Processing Center. It is likely that close relationships will develop with many other departments in the Medical School as work in this area progresses.

5. Laboratory and Hospital Automation:

The use of computers in Biomedical Data Processing and Laboratory Automation are at the very beginning phase of a period of logarithmic growth. The marketing experts of IBM estimate that in the next few years Laboratory Automation and Hospital Information Systems will necessitate the expenditure of over twenty billion dollars a year for computers, associated software and special instrumentation; this figure is more than ten-fold greater than the total amount now being spent by business and industry for all present-day computer applications. This is one of the most active areas of development of our economy and it is being vigorously pursued by the major computer manufacturers. Many of the programs which have developed for our Information Retrieval Project will be directly applicable to the problem of Hospital Records and Hospital Information, for these are only special aspects of the much larger bio-

medical information problem. Provision must be made for staff, which is likely to grow in a logarithmic fashion and for the possible development of a separate computer facility to handle patients' histories, hospital records, and laboratory automation.

(Research and Training)

	1967	1970	1975	1980	1985
Biomedical Computing Science:					
Staff Office and Administration	1100	2400	3600	4800	6000
Research Laboratories	(1000)*	2000	3000	4000	5000
Classroom	--	300	600	800	1000
Satellite Computer Facility	1400	1400	2400	2400	3600
Bio-Engineering:					
Staff Office and Administration	(500)*	2000	3000	3500	4000
Research Laboratories	(1000)*	4000	8000	12000	16000
Classroom, Seminar Room	--	600	1000	1200	1500
Biomedical Information Retrieval:					
Staff Office and Administration	1500	3500	5000	6000	7000
Research Laboratories	1000	4000	6000	7000	8000
Classroom and Seminar Room	(1600)*	1600	1600	2000	2000
Hospital Information Center:					
Staff	--	2000	3000	4000	5000
Additional Computer Facilities	xxx	xxx (To be determined)	xxx	xxx	xxx
National Library of Medicine (Regional Branch)	--	3000	4000	5000	6000
National Information Centers Diabetes Information Centers (Other Information Centers)	--	1000	2000	2500	3000
TOTAL SQUARE FEET	9,100	27,800 (Plus space for additional computer facilities)	43,200	55,200	68,100

*Space needed to establish or expand facility in the current year.

SUMMARY OF STAFF AND STUDENTS PROJECTION
Computing Science, Bio-Engineering, Biomedical Information Retrieval
(Research and Training)

	1967		1970		1975		1980		1985	
	Stf.	Stud.	Stf.	Stud.	Stf.	Stud.	Stf.	Stud.	Stf.	Stud.
Biomedical Computing Science										
Staff:										
Academic	4		8		16		20		24	
Non-academic	4		12		24		30		36	
Students:										
Undergraduates		-		10		20		30		40
Graduates		4		10		20		30		40
Post Graduates		2		5		10		12		14
Bio-Engineering:										
Staff:										
Academic	2		6		12		18		24	
Non-academic	4		10		20		30		40	
Students:										
Undergraduates		-		20		40		60		80
Graduates		4		20		30		40		50
Post Graduates		4		8		12		16		20
Biomedical Information Retrieval										
Staff:										
Academic	6		12		14		16		18	
Non-Academic	12		24		30		36		40	
Students:										
Undergraduates		-		10		20		30		40
Graduates		4		10		20		30		40
Post Graduates		1		5		10		12		14
SUBTOTAL:										
Staff:										
Academic	12		26		42		54		64	
Non-Academic	20		46		74		96		116	
Students:										
Undergraduates		-		40		80		120		160
Graduates		12		40		70		100		130
Post Graduates		7		18		32		40		48
TOTAL:	32	19	72	98	116	182	150	260	182	338

SUMMARY OF STAFF PROJECTION
Specialized Services
Computing Science, Bio-Engineering, Biomedical Information Retrieval
(Research and Training)

	1967		1970		1975		1980		1985	
	Ac.	Tech.	Ac.	Tech.	Ac.	Tech.	Ac.	Tech.	Ac.	Tech.
Regional Branch, National Library of Medicine										
Academic	-		3		5		8		10	
Technical		-		6		10		16		20
National Information Centers Diabetes Information Center (Other Information Centers?)										
Academic	2		3		5		8		10	
Technical		4		6		10		16		20
TOTAL:	2	4	6	12	10	20	16	32	20	40

II. Electroencephalography Technicians

A. Role

This course would supply subprofessional personnel trained to assist in electroencephalography laboratories.

B. Objectives

1. To establish a supply of electroencephalography technicians for this region. At the present time each major hospital in Minneapolis and St. Paul has at least one electroencephalography (EEG) machine. In addition, several private neurologists have machines. There are six EEG machines in use with patients (not counting those used in animal research) at the University of Minnesota Hospitals.

C. Program

The only training program available now in the Twin Cities for EEG technicians is a three month on-the-job training period with some informal talks, given at the University of Minnesota Hospitals EEG Laboratory. With growing sophistication of the specialty and of the techniques, it can be predicted that the present number of positions available for EEG technicians will increase rapidly in the coming years.

A formal training program for EEG technicians should include basic teaching in biology and electronics as well as instruction and practice in operation of EEG and related

equipment, including some computer operation, applicable to both clinical and research conditions.

The course should last two quarters each year. For the practical teaching, laboratory space and equipment will be needed. The faculty will be provided by members of the EEG Lab. (staff and technicians) and members of the Biomedical Data Processing Center.

Desired location: near the EEG laboratory

Departments of closest affiliation: Neurology and Laboratory Medicine.

Since this is a subprofessional program requiring primarily on-the-job training, which could be provided in any teaching hospital, the Ancillary Subcommittee does not recommend that it be given a high priority.

ELECTROENCEPHALOGRAPHY TECHNICIAN

YEAR	1966	1970	1975	1980	1985
SPACE					
Total square feet	---	1100	1100	1900	1900
Increase over 1966					
Laboratories					
Teaching		400	400	800	800
Classroom		400	400	800	800
Other					
Offices (faculty)		300	300	300	300
Offices (non-academic)					
Lounges and lockers					
FACULTY					
Academic		3	4	4	4
Non-academic		4	5	5	6
STUDENTS					
Undergraduate					
Graduate		10	15	20	25

IX. Inhalation Therapy

A. Role

To train inhalation therapists as sub-professional personnel to assist in a variety of techniques for treatment of patients with pulmonary diseases and complications.

B. Objective

It is proposed to develop training and service facilities and staff patterns which will free the physician and nurse from most aspects of Inhalation Therapy, and will extend better care to more patients. (Pulmonary complications lead in incidence of post-surgical problems.)

C. Program

1. Teaching

a. Major program: Classroom didactic and demonstration presentations covering principles of physiology, biochemistry, physics, anatomy, pharmacology, pathology and therapeutics pertinent to inhalation therapy, hyperbaric oxygenation and pulmonary function. Laboratory demonstrations and practice sessions involving mechanical and electrical apparatus, peculiar to the field, as well as animal experiments in pulmonary physiology, pharmacology and therapeutics.

b. Although the curriculum plan has not been developed as a teaching schedule it would follow the requirements of the American Association of Inhalation Therapists.

c. The space requested is additional to that requested for the Department of Anesthesiology. This would be multiple-use space for teaching nurse anesthetists, anesthesia technicians and medical demonstrations on resuscitation and therapy.

d. The Department of Anesthesiology feels obligated to begin training inhalation therapists to meet its own needs and the needs in this region.

e. Continuation education: Courses biennially with American Association of Inhalation Therapists.

2. Research

Design, testing and application of new therapy apparatus for intermittent positive pressure breathing, newborn resuscitation, humidification and drug aerosols; improvement of intensive care, post-anesthesia care and prolonged respirator care of patients; applications of hyperbaric oxygenation and decompression; improved anesthesia apparatus.

D. Department of closest affiliation: Anesthesiology

Interrelationship with other departments: Medicine, Surgery, Pediatrics, Physical Medicine and Rehabilitation.

Evaluation by Subcommittee:

The details of the curriculum have not been worked out and therefore the estimates for the additional space needed are crude. The requested space appears to be large in re-

lation to the number of students in the program, even though teaching laboratories with considerable equipment will be necessary.

This Subcommittee would give this sub-professional program a low priority for space.

Inhalation Therapy

YEAR	1966	1970	1975	1980	1985
SPACE					
Total sq. ft.	--	1800	1800		
Increase over 1966.					
Laboratories		1000	1000		
Teaching					
Classroom		400	400		
Other		400	400		
Offices (faculty)					
Offices (non-academic)					
Lounges and lockers					
FACULTY					
Academic	--	2	2		
Non-academic		1	3		
Students					
Undergraduate		5	10		
Graduate					

X. Medical Art and Photography

A. Role

To establish a fully accredited teaching program in the broad field of medical communications including medical illustration, photography, and television.

B. Objectives

1. To develop an accredited teaching program for medical illustrators and photographers.
2. To develop types of medical illustration not now employed due to lack of space: moulage, prosthetics, plastic fabrication, and model making.
3. To develop closed or open circuit television as a means of communication in medical education.

C. Program

1. Teaching

Mr. Parker was unable to present more concrete plans for the proposed educational program before the middle of December, 1966. Preliminary suggestions include:

a. Establish a program in medical illustration to prepare graduate students for professional careers in this field.

b. Provide elective courses for the medical school students, interns, and residents, in the proper use of medical visuals and in most recent and up-to-date

methods available.

c. Establish courses in close cooperation with the Biological Sciences for major programs in Biological Illustration.

2. Research: A graduate program, such as visualized above, would necessitate graduate research in one of the Biological or Health Sciences, along with a thesis and adequate examination. Two or three students would be admitted each year to the two year program. This would require a certain amount of space for research.

3. Location and interrelationships

Rooms should have a north exposure and be located in the main hospital reasonably close to the operating rooms.

4. An active teaching program would be closely affiliated with Anatomy, Surgery, Pathology and Biological Sciences. Interrelationships with other departments would include Medicine, Pediatrics, Art (Applied Art....Studio Arts.... Etc....) Languages, Graduate School, Audio Visual Services, Station KUOM, possibly Minneapolis School of Art, or Minneapolis Institute of Art.

Recommendation of Subcommittee:

More definitive information regarding this program should be obtained from Mr. Parker and considered in preparation of the final report.

MEDICAL ART AND PHOTOGRAPHY

YEAR	1966	1970	1975	1980	1985
SPACE					
Total Square Feet	3,150	5,550	5,750	5,950	5,590
Increase over 1966		2,400	2,600	2,800	2,800
Laboratories					
Teaching		1,600	1,600	1,600	1,600
Classroom		400	400	400	400
Other					
Offices (faculty)	150	550	750	950	950
Art Studios--service	3,000	3,000	3,000	3,000	3,000
FACULTY					
Academic	1	4	6	8	8
Non-academic	14	16	20	25	25
STUDENTS					
Graduate	0	4	4-6	6-8	8

Teaching Programs Which the College of Medical Sciences May Be Requested to Accept

Mortuary Sciences

A. Role

This is the only training program in mortuary sciences in Minnesota.

B. Objectives

1. To develop Mortuary Sciences from a non-degree program to a 4-year course leading to a baccalaureate degree.

It is anticipated over the period of the next 20 years that the current enrollment will increase from 125 students to 215 students. At the present time no graduate students are enrolled in the department. It is projected over the next 20 years that approximately 20 students per year would be in a graduate status.

2. To develop Mortuary Science by research

C. Program

There are currently 26 courses taught under the supervision of the administration and staff of the Department of Mortuary Science. Of these 26 courses only 5 are of such a nature that they would not be directly connected with a paramedical relationship.

The size of classes relates to the size of classrooms and laboratories together with the number of hours of use per

week of each classroom and laboratory. The classes currently average between 40 and 50 students which often makes it necessary to section a class into at least 2 sections. The desirable classroom size therefore for combined lecture purposes is 60 to 75 students projecting it over the period of 20 years with laboratories adaptable to 30 students per section. See the attached sheet for the classes now being offered and the number of hours per week.

The physical needs and facilities currently used are an example of the fact of the dire need for space. Currently we have no rooms that are adapted specifically to Mortuary Science teaching or laboratory technique. All facilities are shared with the Department of Anatomy and Pathology.

The Department of Mortuary Science cooperates closely with the Department of Anatomy and the Department of Pathology both in the use of materials and in the preparation of all material for use of the College of Medical Sciences in the study of anatomy and related subjects.

The department has, over the course of the past 18 years, offered annually or more often continuation courses in professional education in the area of Mortuary Science. One of the very definite limitations for the continuing education of the technical aspects of the profession has been the use of space which more often than not is already utilized by regular full-time day students and is not available for continuing education purposes.

Mortuary Sciences

YEAR	1966	1970	1975	1980	1985
SPACE					
Total Square Feet	1500	2894	3400	3800	4600
Increase over 1966					
Laboratories					
Teaching	600	1325	1500	1700	2300
Classroom	300	600	830	1030	1200
Other	600	970	1070	1070	1100
Offices (faculty)					
Offices (non-academic)					
Lounges and lockers					
FACULTY					
Academic	4	5	6	7	8
Non-Academic	2	2	3	4	4
STUDENTS					
Undergraduates	126	140	165	190	215
Graduate			5	15	20