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Physiology and Pharmacology: 1905-1977; Physiology: 1977-1983

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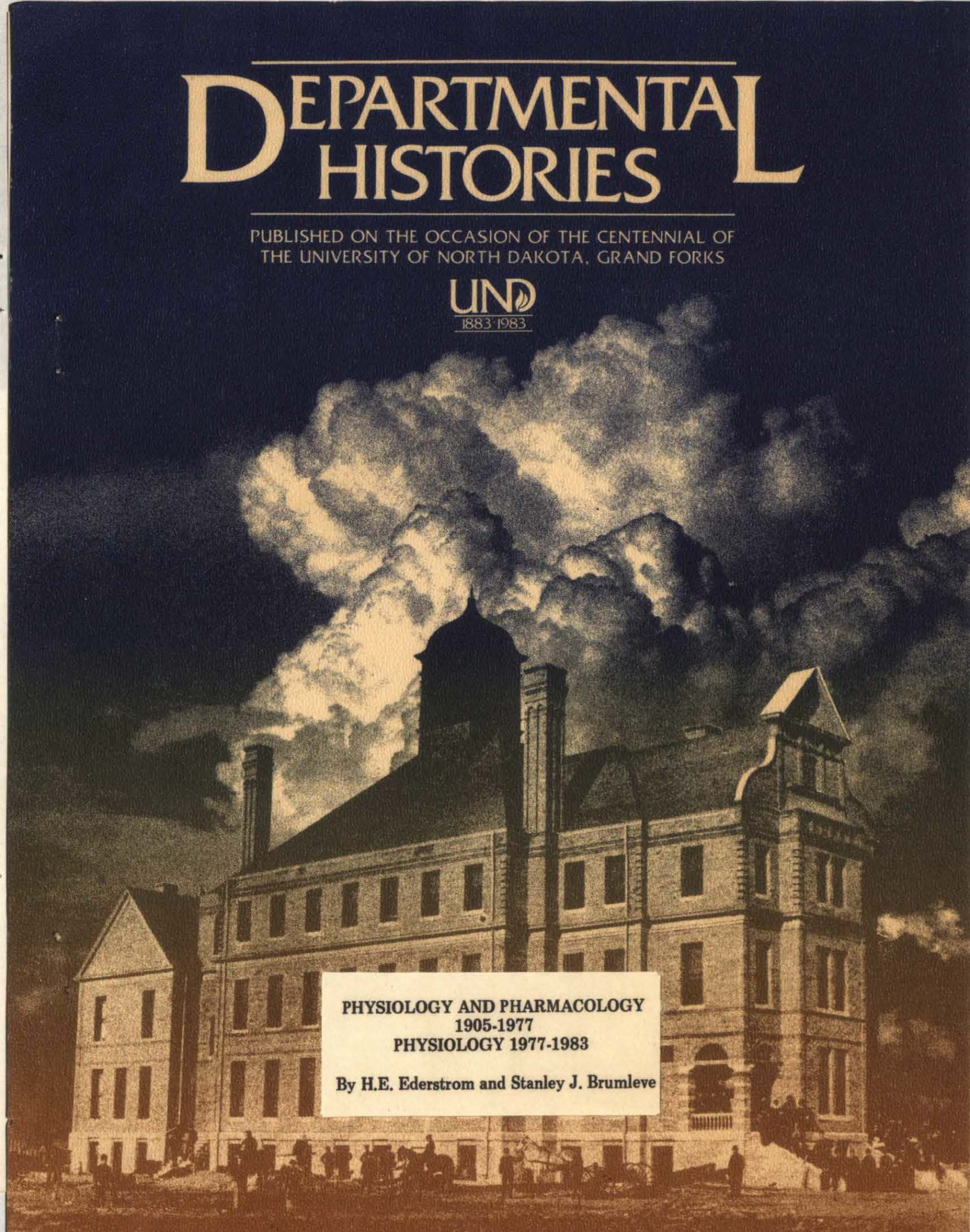

PHYSIOLOGY AND PHARMACOLOGY
1905-1977
PHYSIOLOGY 1977-1983

By H.E. Ederstrom and Stanley J. Brumleve

A HISTORY OF THE DEPARTMENT OF PHYSIOLOGY AND PHARMACOLOGY 1905-1977 AND THE DEPARTMENT OF PHYSIOLOGY 1977-1983

UNIVERSITY OF NORTH DAKOTA

SCHOOL OF MEDICINE

GRAND FORKS, NORTH DAKOTA 58202

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INTRODUCTION

At the time that the University of North Dakota (UND) began its program in the teaching of medicine, medical education in the United States showed great variations in academic standards. The following summary of the history of medical education in the United States was compiled by Abraham Flexner in 1910. His survey reveals in this brief outline the status of medical education at the time that the Medical School at North Dakota was established.

In Colonial times most physicians had been educated in European schools, located in Germany and Great Britain particularly. In 1790, the first school of medicine was established in the United States at the University of Pennsylvania. Several other U.S. medical schools were started in the early 1800's, and more and more became established as the population increased. By the year 1900 approximately, U.S. and Canada had a total of 457 medical schools. At the present time, the U.S. with a population of 200 million, has about 125 schools. Before 1900, and until about 1910, schools were established almost everywhere. For instance, in the state of Illinois there were 39 medical schools. The city of Chicago had a total of 14. The state of Missouri had 11. These are just a few examples of the great number of medical schools that had become established in various parts of the country when the U.S. population was 80 million. As a result, there was a great excess of physicians. For instance, in Burlington, Vermont, there was one doctor for each 300 people. At present, the U.S. average is about one physician to 700 people. In earlier days towns of 200 may have had as many as two or three physicians.

Some of these early schools were associated with universities, but in spite of this affiliation the standards of teaching were quite low. For almost a century the medical doctor frequently was trained at what was known as a propriatory or commercial medical school. These schools in many instances were operated by physicians on a spare-time basis. A few lectures were given from time to time in an old schoolhouse or other rented structure. Usually there were no laboratories or any type of practical teaching. The student sometimes merely served as an apprentice and did procedures that were beneath the dignity of his mentor. These schools clearly were run for profit. Anyone who had the price of tuition would be admitted and given a diploma entitling him to practice medicine after months or perhaps a year or so of going to occasional classes and doing some clinical procedures. These schools admitted people who had an eighth grade education or even less. There were few examinations or none at all before the student received a diploma.

In the year 1908 the Carnegie Foundation, the American Medical Association, and the American Medical College Association undertook a study of all medical schools. As indicated above, this study was led by Abraham Flexner, an educator who understood the basic standards of teaching better than most physicians. He personally visited some 150 schools and had many interesting stories to relate. One that was typical concerned a visit to a propriatory or commercial school operated by a few doctors in a town of medium size. Flexner had agreed to visit this school and was received at the railroad station by the dean in his buggy. The dean wined and dined Flexner all day and never took him to visit the medical school building. When the day of wining and dining was over, the dean returned Flexner to the train station. Flexner got aboard,

walked down a few cars and got off when the dean disappeared. He then was admitted to the medical school by the janitor whom he had previously contacted and bribed. The school was in an old dilapitated building and had a few benches but no laboratories, cadavers or skeletons, and a bare minimum of books. This was a typical example of the educational situations that Flexner frequently encountered.

Flexner published the results of his study in a book entitled Medicine and Society in the United States. In general the book indicated that the status of medical education was quite low in the United States. First, there was a great over-production of doctors. In fact, the U.S. had five times as many doctors per population as Germany. Secondly, many of these practitioners had no hospital training at all, nor contact with patients while in medical school. Sometimes they had served as apprentices for a doctor who was also poorly trained.

Into this melange of medical education arrived the UND School of Medicine, including the Department of Physiology and Pharmacology, in 1905. The purpose of this school was to train local persons to provide health care for the area. Also, students could attend a school close to home with low tuition and living expenses. Furthermore, a physician trained at UND would likely return to North Dakota to begin medical practice after graduation.

When the Medical School opened on September 26, 1905, the catalog described the university campus as having eight buildings heated by steam and lighted by electricity. Expenses for the year totaled $145.00, which included tuition, the use of a bath and laundry. When these costs were broken down, it was noted that the registration fee required a deposit of $3.00 which was returned; tuition amounted to $50.00; a room for 35 weeks was $1.35 per week; board for 35 weeks was $3.00 per week; books and other items were $15.00. The above fees were considerably lower than those cited by medical schools out of state, and it was estimated that the average savings of attending medical school at North Dakota was between $200 and $500 per student per year.

Entrance to the Medical School required completion of certain courses that were listed as follows in the catalog of 1905: A two-year attendance in liberal arts college was required for admission into the medical school. At the time of entrance to medicine, the student had to present a certificate showing completion of one year in each of these subjects: English, Literature, Algebra, Geometry, History, Latin through Cicero, Elements and Reading in German, and one semester of Greek. Botany, Zoology and Physics were required for one semester each. The requirements in terms of grades were as follows: Credit for all work had to be of D grade or better, provided the applicant had not more than three D's per term in the first two years, and two per term in the last two years of undergraduate training. Furthermore, the medical student in addition to achieving a grade of D or better, could not be absent from classes. If he missed four classes he would be called to account by the President. If he missed eight classes, parents or the guardian were notified, and if he missed twelve classes, he was liable to suspension. Each week there was a convocation of the medical students for inspirational and instructional talks by faculty members.

Until the year 1948 the medical school was housed in what is now the Old Science Building. The 3rd floor contained all the facilities for teaching Anatomy, Physiology, Pharmacology and related courses. The low-ceilinged

rooms, illuminated by dangling light bulbs, contained benches and dissecting tables as well as microscopes, microtomes, staining and embedding apparatus and other instruments used in biological procedures. There were models of organs, charts of the body, and a small library of selected books according to the catalog. Also on the third floor were skeletons, a museum of stuffed animals, and some embalmed cadavers. The latter were provided through the state law that made unclaimed bodies available to the medical school. The place also housed some of the animals used, but the larger ones such as dogs were held in a separate building on campus.

The Old Science Building is still standing on the campus marked with signs of age in spite of the modern lighting and some refurbishing.

The Teaching Program in Physiology and Pharmacology
A Historical Summary

In the early years of the Department of Physiology and Pharmacology, the courses contained only the basic knowledge that was required of the physician at that time. Many of the chemical and electrical activities of body organs and tissues were yet undiscovered, and at best were only suggested or speculated upon in the texts. Anatomy, long the major area of study in the medical curriculum, dominated the medical program.

Pharmacology and Materia Medica were given larger segments of time than at present, probably because these topics were more closely related to the practical aspects of medicine. During the early years of the Department these subjects were taught by local physicians on part-time appointments, or as a professional courtesy to the newly-established school. One of the practitioners who carried these lectures from the years 1908-1923 was Dr. John D. Taylor. Books used in classes were U.S. Pharmacopeia, National Standard Dispensatory, and supplementary reading in texts by Cushing, Collman, or Butler. Except for the long-standing teaching career of Dr. Taylor, only a few full-time faculty were at the Medical School for extended periods. Among these were Dr. Archie L. MacDonald (1905-1911), and Dr. Charles E. King (1915-1919). Outstanding among the many teachers in the Physiology and Pharmacology Department in its early years was Dr. George A. Talbert, who taught all or parts of every course that was offered, as well as serving as the department chairman from 1924 to 1944. Dr. Talbert introduced graduate studies in the areas of physiology and pharmacology, and directed the graduate programs for the Master of Science candidates over a long period. Comments from past UND graduates indicate that Dr. Talbert was a most competent teacher who contributed greatly to their understanding of bodily functions. Dr. Talbert remained as an emeritus faculty member until 1945. He then moved to Wisconsin and died there in 1948. Both of his sons attended UND Medical School, and were active in practice according to the alumni directory.

Following the retirement of Dr. Talbert, the chairmanship was taken over in 1944 by Robert V. Brown, Ph.D., who had been on the Department faculty since 1942. Dr. Brown held this position until he resigned in 1946. This position was then filled by Edward T. Ruud, M.D., for the following year, 1946-1947.

At this time Dean Harley French retired after serving as dean and chairman of the Department of Anatomy for 36 years. Selected as his successor was Alfred H. Lawton, M.D., Ph.D., who was retired from military service in World War II. Dr. Lawton had previous teaching and research experience in the area of physiology at Northwestern University Medical School, and was named chairman of the Department of Physiology and Pharmacology as well as Dean. After one year, Dr. Lawton resigned in order to accept an appointment to the Veteran's Administration Headquarters.

At the close of World War II, the Medical School finances were sorely depleted, since income from the Armed Forces training program (Army Specialized Training Corps) ended. At this time the need for physicians increased the number of medical applicants well beyond the capacity of the existing schools. As a result, in 1946-1947 the Medical School was requested to improve its facilities and staff or lose its already tentative accreditation. After much

consideration and debate by the University faculty, the North Dakota State Board of Higher Education, and State Medical Society, the North Dakota State Medical Center was established at the University. To support this, a levy of one mill on all property was voted into the state constitution. This produced about one half million dollars yearly for support of medical education in the state. With these funds and others, the University erected a new Medical Science building by 1948 and greatly increased the teaching staff. Also an addition to the medical building was opened in 1953, which doubled the space available to the Physiology Department as well as all other divisions. This building also provided more space for animals and some research rooms on the fourth floor. Recognition is given to Dr. Wilbur Potter, Ph.D., M.D. for his leadership in expanding the physical plant and obtaining full accreditation of the School of Medicine during his deanship from 1948 to 1953.

The area for research and office use was further enlarged by approximately 2000 square feet when the Ireland Laboratory for Cancer Research was completed in 1963. This space was allotted to the Department by Dr. W.E. Cornatzer of the Biochemistry Department, who had secured the building fund from the Guy and Bertha Ireland estate in 1953.

The medical physiology curriculum was quite conventional from its inception until 1953. The subject content was taught during the second semester of the freshman year and the first semester of the sophomore year. In 1953, Dr. Potter and physiology staff introduced the concept of clinical physiology for sophomore medical students. The emphasis was placed on the physiological interpretation of the disease process, with the instructional media working through case histories and clinical findings. This was an almost revolutionary idea in the early 1950's. The concept of correlating physiology with the clinical disease process is common in the 1980's.

The clinical physiology course was taught to the sophomore class and continued until 1976 when the school developed the four-year program and the material was incorporated into the clinical departments. In 1970 clinical physiology was also introduced by the Physiology Department to the freshman students. This early introduction of beginning medical students to the clinical problems was a new concept. It is common practice in medical education today.

The choice and use of textbooks have changed considerably, as has their content over the years that the Department has been in existence. For many years a single text provided all of the material needed to be learned in most subjects. These were authored by a single scientist, or compiled by several experts. Some past editions included those by Howell, Wiggers, Best and Taylor, Ruch and Fulton, and Guyton. Recent trends have been to use several smaller texts, each specializing in one area only. Many topics, especially those with clinical application, are now available on video tapes which can be viewed in the classroom or in the medical library.

In 1970 neurophysiology became part of a conjoint course called neuroscience. The neuroscience course was a combination of neurophysiology, neuroanatomy, and neurology. The concept of combining departments to teach an integrated unit was certainly initiated in clinical physiology, and reached a greater emphasis and success in the neuroscience course. Integrated courses are common in the medical schools in 1980.

In addition to changes in the principles that guided the medical education process, there were also important qualitative changes initiated in 1951, when Dr. Benjamin DeBoer was persuaded by Dr. Wilbur Potter to join the Department as a Professor of Pharmacology. Under the guidance of Dr. DeBoer some of the part-time faculty members continued work in the department and courses were improved considerably. The following year, 1952, Dr. H.E. Ederstrom, also with long academic experience, joined the department and likewise revamped physiology course work. Teaching was also improved in the fall of 1953 when Dr. Wilbur Potter, Ph.D., M.D., resigned as Dean and was able to devote full time to teaching and directing the departmental activities until his retirement in 1964.

Dr. Stanley J. Brumleve was appointed acting chairman for the department from 1964 to 1965.

In 1965, Dr. Russell Wilson was appointed chairman of the Department of Physiology and Pharmacology and served until 1972. During his chairmanship there was continued emphasis on the clinical correlation between physiology, the disease process and treatment by clinical methods.

In 1972, Dr. Stanley J. Brumleve was appointed chairman of the Department of Physiology by Dean Theodore Harwood after consultation with the faculty and a unanimous recommendation for the appointment. The subject content of the major medical physiology curriculum was revised, but the teaching methods remained traditional until 1977. In 1975 and 1976, Dr. Stanley Brumleve, as well as his physiology faculty, considered alternate modes of education, and after two years of study recommended that the Physiology Department adopt the mastery system with an evaluation process that supported a grading of satisfactory and unsatisfactory. The mastery system was presented to Dean Tom Johnson who granted the department permission to proceed for two years with the system. The faculty adopted six principles on which to build the medical curriculum: 1) Offer alternate modes of learning to the students. 2) Identify the physiology foundation (not all physiology) necessary for the student to enter the second and third year. 3) Clearly indicate the material to be mastered by the student. 4) Introduce more clinical material and clinical faculty into the physiology program. 5) Make the evaluation a learning process. 6) Evaluate the program by several evaluation instruments.

The faculty identified objectives for each presentation in the course. The faculty also prepared a "handout" that would be a companion to the objectives. In addition, the faculty identified the reading material that would be required and that which would be optional reading. As a guideline, the reading assignment was ten pages of reading material per hour of presentation or per two hours of general discussion.

After the material was prepared, the physiology faculty offered the objectives and the course outlines to the clinical faculty. These were sent to Family Medicine, Internal Medicine, Pediatrics, Surgery, and Neuroscience. The clinical faculty were asked to 1) identify the objectives that they felt were absolutely necessary for medical students to learn; 2) identify the objectives that they felt the student must learn in order to learn one of the objectives that is absolutely necessary for all studnets; 3) identify the objectives that are not necessary to be learned by a freshman medical student; and 4) add those objectives that are necessary for the medical students but are omitted.

The faculty of the five clinical departments returned the material to the basic science faculty with their comments and observations. The objectives and handouts were reorganized in accord with the comments from both basic and clinical science people. The reorganized material was incorporated as course content for the program in 1977 and subsequent years.

In order to correlate the basic science and clinical material to flow as a continuum, the clinical faculty were requested to participate actively in the physiology course. They were asked especially to present a clinical correlation that would demonstrate the need for utilizing the basic science into the solution of clinical problems.

As the clinical material was presented during the semester, the first correlations were minimal and to a great extent basic science because of the background of the students. As the basic material was presented, the clinical correlations became more and more important problem-solving tools with a stronger and stronger emphasis on the applied aspects of medicine.

The basic sequence of integration was to present the physiological concepts, for example, in muscle-nerve, and then present a clinical correlation. This was followed by cardiovascular physiology and two clinical correlations, respiratory physiology and two clinical correlations, renal and electrolyte physiology and one clinical correlation, endocrine physiology and three clinical correlations. There was a review by utilizing clinical cases that covered the many disciplines in physiology. Selected specifically was diabetes mellitus for one of the clinical conditions and the other was a patient that developed cardiac failure and shock. By the end of the 1979-1980 academic year the faculty had developed and selected about 80% of the clinical correlations that could be used as models.

In order to develop good test questions, the faculty attended several workshops and rewrote many of the questions to develop questions that were clear and provide a learning process for the students. A computerized system was used to help identify good questions and clearly indicate when the student was having difficulty because of the semantics of the question. Each question was analyzed in terms of its validity as an index of the student's knowledge. This has been extremely helpful to both the faculty and students.

A system was developed to evaluate the entire program. The faculty were concerned that delivery of the new curriculum be evaluated to see if it were a better teaching system than the one used prior to 1977. In order to evaluate the program, the faculty used several evaluation tools. 1) They utilized the testing process during the course itself. 2) They analyzed the student evaluations both written and verbal to the department faculty. 3) They utilized the student evaluations by an outside evaluater. Dr. Henry Slotnick of the Office of Medical Education was aksed to perform this function. 4) The faculty also asked the clinical faculty to evaluate the degree of preparation that the students received through the use of the mastery system. 5) Dr. Slotnick was asked to develop an instrument so that there could be a student input after the students had completed their third year. Some students transferred to other schools and others remained within the 2:1:1 system. 6) The faculty utilized national boards scores recognizing some of the limitations in these scores.

The evaluation prepared by Dr. Slotnick was used as an index of the success of the mastery system. Student consensus is briefly summarized in the following quotation:

> We have learned a lot through self-education with the Physiology Department's supplying guidance. We feel that we have a good grasp of the material, expect to use what we learned, and a clinical correlation was very important. We learned a lot through self-education with guidance of the Physiology Department. We have ownership of knowledge and experience. We see the material as ours, important, and clinical relevant. Any unhappiness relates to how the guidance of the department may be better provided.

Further success of the mastery system is attested to by the fact that in 1982 the entire first year of medicine utilized the principles and guidelines that had been developed through the foresight of Dean Tom Johnson and his approval in 1977 to experiment with a new curriculum. The freshman year in 1982 was "clothed" in terminology somewhat different than the mastery system, but the same principles of education were clearly utilized.

The undergraduate program in Physiology has been offered to a wide variety of students in the University. The students enrolled in the undergraduate course have included majors in physical education, chemistry, biology, psychology, nursing, occupational therapy, physical therapy, medical technology, cytotechnology, nutrition, home economics and sociology. The largest number of students come from physical education and the nursing programs. As many as a thousand students were registered in both the lecture and laboratory sections for an academic year.

The undergraduate teaching responsibilities generally have been assigned primarily to one faculty member with support from the other members of the department. Faculty members who have been very active in the undergraduate program have included Miss Alta Ray Gault, Dr. Teunis Vergeer, Dr. Stanley J. Brumleve, Dr. Alice Owen, Dr. Kathryn DeBoer, Dr. Carl Zogg, Dr. Thomas Akers, and Dr. H.E. Ederstrom.

The departmental medical and undergraduate programs have had many fluctuations, both in staff, hours and course content. The future outlook appears to indicate that theoretical subject matter taught in the physiological sciences will be continued and the applied aspects of this subject will be excellent background for the student to master a life-long learning process.

Pharmacology as a discipline at the University of North Dakota developed within the Department of Physiology and Pharmacology in the late 40's. Prior to the 1940's the subject content was taught in a course entitled "Materia Medica." However, in the late 1940's Dr. Wilbur Potter, who was then Dean of the College, had the foresight to identify full-time faculty members for Pharmacology. Dr. Sigwin Raska, M.D., and some part-time faculty with Dr. Wilbur Potter's assistance identified the subject content for a substantial pharmacology discipline. By 1951, the foresight of Dr. Wilbur Potter, brought Dr. Benjamin DeBoer, Ph.D., Dr. Carl Calman, M.D., Dr. Paul Potter, M.D., and Dr. R. Will Koons, M.D., as a nucleus for the discipline of pharmacology. Two of the men had short stays at North Dakota, but Dr. Benjamin DeBoer remained as a leader until his retirement in 1975. Dr. DeBoer was assisted by part-time faculty, guest lecturers and full-time faculty who were members of the Department of Physiology and Pharmacology for short periods of time. The full-time faculty that assisted Dr. DeBoer included Dr. Paul Potter, M.D., Dr. Alfred A. Richtarick, Ph.D., Dr. Gopal Sharma, Ph.D., Dr. Clayton Jensen, M.D., and Mr. Eaden Keith.

Dr. Theodore Auyong arrived in Grand Forks in April 1963 to accept a temporary position, and he has continued as a full-time faculty member since that time. Dr. DeBoer and Dr. Auyong, again with part-time people or people who remained for short periods of time, were responsible for the pharmacology in medical and undergraduate education.

The pharmacology educational program was changed by outside influences that markedly affecting the discipline of pharmacology. Some of the most significant changes that occurred in the teaching program include the reduction of the number of laboratories and the introduction of clinical material. By 1974, Dr. Theodore Auyong had taken the initiative to establish a two-day symposium on alcoholism that included the pharmacology of alcohol, the perspective of the law enforcement agency, Alcohol Anonymous group help for many patients, and the clinical problems encountered by the practicing physician. Certainly the symposium is common in the 1980's but was a revolutionary concept in 1974.

After Dr. DeBoer had retired in 1975, Dr. Syed Husain was encouraged to join the Department. Dr. Surendra S. Parmar was already aboard and with the support of Dr. Theodore Auyong they formed the trio that taught Medical Pharmacology in 1976.

In 1976 recognition of excellence in medical education in the Department of Physiology and Pharmacology was extended to Dr. Theodore Auyong by the sophomore class. They gave him the Golden Apple Award for "outstanding contribution to medical education." Dr. Stanley J. Brumleve was previously recognized with the same award in 1972.

By 1977 Dr. Stanley J. Brumleve had the foresight to see the need for expanding pharmacology in accord with growth of the medical school and took the leadership to divide the Physiology and Pharmacology Department into two independent departments. It is clear that the discipline is an integral part of the practice of medicine and requires the prestige of independence in each school of medicine and North Dakota is no exception. The new chairman was Dr. James N. Boelkins, who was formerly a faculty member of the Department of Physiology and Pharmacology. For an excellent account of the activities of the faculty who taught Pharmacology see the history of Pharmacology prepared by Dr. James Boelkins.

Graduate Programs and Faculty Research In Physiology and Pharmacology

Faculty and student interest in research was not much in evidence in the early years of the Department as indicated by the first graduate theses which did not appear until 1917. This first Master of Science degree granted from the Department of Physiology and Department of Anatomy was earned by Mr. Hjalmer A. Engh. Its title was, "The Source of Hydrochloric Acid in the Stomach." It contained this explanatory statement: "A Thesis Based Upon Investigation Conducted in the Anatomical and Physiological Laboratories of the University of North Dakota and presented in candidacy for the degree of Master of Science." Faculty who directed the research were Dean French and Dr. King. The investigator used guinea pigs, rabbits and three dogs. Typical procedures were to inject dye substances into veins or subcutaneously. Subsequently, samples were taken from the stomach, esophagus and other gastrointestinal tissues. These were fixed, sectioned and examined under the microscope. The dye, cyanin, was converted to red in all tissues but was most highly concentrated in the stomach tissue. Therefore, these cells were concluded to secrete hydrochloric acid. The thesis contained 19 pages including bibliography.

A second thesis was submitted in June 1923 by Raymond S. McCrady. The title was, "Some Studies in Colorvision; Effects of Color Fields of Varying Colored Backgrounds." Chairman of the committee was A. O. Bush; another member was A. C. Monaglin. This study of perception of color was done by using human subjects who were placed in a specially lighted room and presented with a color chart. The subject covered one eye and alternated vision from one side to another. Detection of color against a background of another color was the basic topic of study.

The first faculty member with a keen interest in physiological research was Dr. George Addison Talbert, whose investigations were in the area of heat adaptation and of the rate and volume of sweating. For this study he designed a vest lined with test tubes in which sweat from the upper part of the body was collected, then measured and analyzed. The anlyses measured the salt and other chemical compounds found in sweat. Also, he measured the content of these chemicals in blood and urine. One of his subjects frequently mentioned in theses was Fred Campos, a janitor in the medical school for some 30 or 40 years. Students also participated in experiments as subjects and research assistants. Dr. Talbert was at UND 20 years, during which time he directed many Master's Theses, and published research papers in national journals.

Several other Master's theses directed by Dr. Talbert are available in the UND Library. In 1931, for example, Joseph Bergmeyer conducted a study entitled, "A Study of PH of Blood, Its Relation to Profuse Sweating." Guiding this project were Drs. Talbert, French and Saiki. This research indicated that in profuse sweating CO_2 combining power of plasma decreased, and there was a fall in CO_2 content. Simultaneously, there was a rise in alkalinity of blood during sweating. There were considerable differences in the changes, however, depending upon volume of sweat lost and the person's ability to withstand heat exposure. This thesis contained 52 pages.

Another Master's Thesis produced in 1931 by Ralph C. Carpenter was entitled, "Simultaneous Study of the Carbondioxide Combining Power and Specific Gravity of Blood in Profuse Sweating." Calcium, magnesium and other contents of sweat were measured. This was also directed by Dr. Talbert. The study showed that there was a decrease in alkaline reserve of blood after profuse sweating. Specific gravity of blood increased, indicating hemoconcentration. There were few changes in other chemical contents of sweat that were measured. This thesis contained a total of 110 pages. Research projects for graduate degrees were apparently not undertaken in the years 1940 to 1952, probably because these included the years of World War II when the Department was occupied with training military medical personnel. After the War, medical school enrollment was swelled by returning military, who were subsidized by federal education grants. The faculty was much reduced in this period, and consisted mostly of part-time teachers engaged in medical practice, who had neither time nor interest in scientific research. Some 22 years elapsed before the next graduate degree was granted in the Department, a Master of Science Degree acquired by Jerome Hager in 1953.

By the fall of 1952, the departmental graduate program was being developed by Drs. DeBoer and Ederstrom. In addition to Medical and Undergraduate courses already established, the following courses specifically directed toward graduate studies were listed in University and Medical School catalogs under Physiology and Pharmacology:

415. Pharmacology of North Dakota Flora. One to two credits. First semester. Alternate years; not given 1952-53. One lecture a week, plus outside readings if extra credit is given. This course is a study of drugs and poisons found in North Dakota plants. Staff.

417-418. Readings in Physiology and Pharmacology. Credits and hours to be arranged. First and second semester. A resume of the literature in a particular field with a careful study of selected articles and discussion with the instructor. Articles in foreign languages may be included for qualified students. Since the literature to be reviewed will differ from year to year students may repeat the course with a maximum of 6 hours credit. Staff.

425. Neurophysiology. Three credits. First semester. Alternate years; not offered in 1952-53. One lecture and six laboratory hours a week. Discussions and laboratory procedures used in a study of the nervous system. Staff.

501. Physiology and Pharmacology of Autonomic Nervous System. Three credits. First semester. Alternate years; given 1952-53. Two lectures and three laboratory hours a week. A comprehensive survey of the physiology of the autonomic nervous system and a study of drugs which stimulate or depress autonomic ganglia or nerve endings. Staff.

502. Analgesics and Hypnotics. Three credits. Second semester. Alternate years; given 1952-53. Two lectures and three laboratory hours a week. A comprehensive survey of the physiology of pain and sleep and the drugs that stimulate and depress the centers in the central nervous system. Staff.

503-504. Advanced Physiology and Pharmacology. Credits and hours arranged. First and second semester. Assigned special topics and laboratory in physiology or pharmacology are designed to acquaint the student with the problems

and procedures of earlier investigators. "Classic" experiments will be performed. Staff.

505. Mammalian Surgery. One to two credits. First semester. Alternate years; given 1952-53. Three to six laboratory hours a week. Methods and procedures used in animal surgery for students in physiology. Emphasis is placed on aseptic techniques available and preoperative and postoperative care. Staff. (This course was also available to Medical Students)).

506. Problems in Pharmaceutical Research. Three credits. Second Semester. Alternate years; not given 1952-53. One lecture and six laboratory hours a week. A study of the methods used in determining the usefulness of a new drug. Emphasis will be on laboratory procedures and statistical analysis of data obtained. Staff.

507. Anesthesiology. Three credits. First semester. Alternate years; not offered 1952-53. Two lectures and three laboratory hours a week. A study of the physiology of anesthesia with a survey of anesthetic agents. Emphasis is placed on methods of administration using laboratory animals. Staff.

509. Toxicology. Two credits. First semester. Alternate years; not given in 1952-53. Six laboratory hours a week. A laboratory course in methods of determining toxicity of drugs and procedures in identifying common poisons. Staff.

511-512. Research in Physiology and Pharmacology. Credits and hours to be arranged. First and second semester. Assignments dealing with pertinent research problems in various aspects of physiology and pharmacology. Staff.

521-522. Seminar in Physiology and Pharmacology. One credit. First and second semester. These courses are designed to offer pertinent information on subjects of current interest in the field. Staff.

Beginning in 1954, several medical students who had completed the first year of medicine temporarily dropped out of the medical program and enrolled in graduate studies. These students also served as teaching assistants in the Department, for which they were paid and given free tuition. Often this program solved a student's financial problems. Usually it took the student two summers and one year of gradute study to complete the requirements for Master of Science Degree. Following completion of this degree, the students returned to the medical class and finished the second year of medicine at UND.

The first Doctor of Philosophy Degree was obtained by Eden Keith in 1956. Mr. Keith served as instructor in the Department for five years, during which time he conducted classes and also did graduate studies. Part of this time he was enrolled at the University of Minnesota studying Biochemistry and related courses. Following graduation, Dr. Keith obtained a position in the drug industry, and is still employed as an investigator.

In a typical graduate program the student was assigned a research project and was expected to begin by reading background material related to the topic. After collecting sufficient experimental results, these were presented to the faculty as a seminar. When data had been critically examined the student could start thesis writing. The completed research projects by graduate students were presented at local and national meetings.

In physiology, topics studied included body temperature, particularly with regard to the development of temperature regulation reflexes in the newborn dog. Circulatory research involved investigations of functions of autonomic nervous control of blood vessels. For example, rate of blood flow through the extremities before and after sympathetic control had been removed was monitored. Also, the effects of cold and heat on blood flow in various tissues were studied in dogs and in several other species.

In the 1960's much research was centered about a project started by Dr. Thomas K. Akers which was related to high pressure atmospheres. Animals were plced in steel chambers and atmospheric pressure at various levels was induced by a pump. The gas mixtures were oxygen-nitrogen, or in other experiments was an oxygen-helium atmosphere. Animals used included dogs, rats and rabbits. Compression chambers were cylinders about 45 x 90 centimeters (in diameter) and could withstand pressure of about 80 atmospheres. Factors studied were effects of pressure on conduction in nervous tissue, and the pathological effects of pressure following long-term exposure. Dr. Akers' research on pressure and oxygen toxicity is well known.

Dr. Russell Wilson, Ph.D., M.D., from the Veterans Administration in Dallas, Texas, was appointed chairman in 1965. His acquisition of highly sensitive electronic recorders for the teaching laboratories in 1965-1966 also stimulated the research activities of the faculty. New projects in many areas were begun, which in turn resulted in application for and receipt of many new research grants. Research areas that developed after acquisition of new recorders were in cardiovascular fields, temperature regulation, shock mechanisms, and respiratory reflexes. These investigations were planned by faculty members and carried out by graduate students. A number of Master's theses and several Doctoral Dissertations resulted from these studies. Publications in scientific journals, or presentations at national society meetings also were products of these research efforts.

Dr. Aker's research projects interested Dr. Wilson since they involved the pulmonary system. They applied to the Office of Naval Research for funds and after much negotiation obtained substantial grants, about 1.8 million dollars, which enabled them to build a large chamber and conduct animal experimentaion. This chamber was constructed with the help of mechanical and electrical engineering department faculties and shops. Two large spheres of heavy steel were assembled in the Engineering Building. The spheres were about 2 meters in diameter, and from each chamber extruded smaller chambers 50 centimeters in diameter and 60 centimeters long. In these smaller chambers animals could be exposed to various atmospheric pressures. Several people in the Department became interested in this research and carried out investigations in this facility. Dr. Carl A. Zogg, for example, studied nutritional needs of animals exposed to long-term high pressure atmospheres. For two years the funds from the Office of Naval Research were specifically awarded for this research. Dr. Zogg and students identified the nutrients necessary for normal growth and activity in a hyperbaric environment. Dr. Ederstrom and his graduate students had a project involving temperature control in dogs in helium-oxygen atmospheres at various temperatures. Most other investigators used rats as the experimental animal. The investigators included: Dr. William Bares, Engineering, Dr. Joe Hootman, Engineering, Mr. Francis R. O'Brien, Engineering, Dr. M.J. Mason, Engineering, Dr. Harold L. Dowell, Engineering, Dr. D.G. Barbee, Engineering, Mr. Kenneth K. Caughron, Engineering, Dr. Seng Y. Hwang, Engineering, Dr. James Waller, Microbiology, Dr. Donald L. Matthies,

Anatomy, Dr. Edward Halas, Psychology, Dr. J.B. Carman, Psychology, Dr. Benjamin DeBoer, Pharmacology, Dr. K.O. DeBoer, Physiology, Dr. Stanley Brumleve, Physiology, Dr. James N. Boelkins, Physiology, Dr. Thomas Nielsen, Physiology, Dr. Surendra S. Parmar, Physiology, and Dr. David L. Beckman, Physiology. When this grant expired in 1978, the chamber was dismantled in 1980. Some small chambers remain in the Department, as well as many other research items obtained with the Naval funds. The report by Thomas K. Akers submitted to the Office of Naval Research for Contracts N00014-68-A-0499 and N00014-76-C-0219 is an excellent summary of approximately 60 full-length papers published by the investigators.

Only one research project in the Department has involved human subjects. The research was part of the graduate program of Dr. Debbie Brennan (Allan) and supervised by Dr. Stanley J. Brumleve. It involved electrcardiographic changes associated with scuba diving to 90 feet under ice. Also oxygen consumption of persons who had just emerged from scuba diving at various levels was measured. Some of this work was done in the University swimming pool, but part was at a lake in Minnesota which is a favorable spot for scuba divers. This type of research has since been discontinued since it involved much specialized equipment.

Dr. Stanley J. Brumleve was appointed Chairman of the Department of Physiology July 1, 1972, and he set some new objectives for the Department as well as continued to support the excellent work of the faculty. The objectives included: 1) Continue to support the excellent work of Man-In-the Sea. It was initiated by Dr. Thomas Akers and expanded by Dr. Russell Wilson. 2) Expand the research area of Physiology in nonpressurized environments and broaden the areas of future research. 3) Formalize the guidelines for the graduate program and identify more clearly the expected outcomes of the graduate students efforts. 4) Expand the resources for the generation of new knowledge and develop a reputation of excellence in the scientific community. 5) Recruit new faculty as the occasion presented itself upon retirement of two faculty that had so ably served the Department of Physiology and Pharmacology in a very difficult and growing period. 6) Assist the faculty in the development, presentation and delivery of the programs that included medical students, graduate students and undergraduate students.

During the ten-year period from July 1972 to July 1982, most all of the objectives were accomplished and a brief summary of the accomplishments is presented as a tribute to the faculty of the department under the guidance and direction of Dr. Brumleve.

The Man-In-The-Sea project was operational from 1972 to 1978. Physiology contributors to the success of the project included Dr. Thomas Akers, Dr. Carl Zogg, Dr. James Boelkins, Dr. Stanley J. Brumleve, Dr. H.E. Ederstrom, Dr. Thomas Nielson and several graduate students. During that period of time, the faculty and students published 58 full length papers on the hyperbaric research. This certainly is a respectable average of 9.6 papers per year for the faculty.

During that same period of time, the faculty expanded their effort in non-hyperbaric research and published a total of 47 full length papers in new research areas. From 1977 to 1982, the faculty concentrated in non-hyperbaric areas and published a total of 87 full lnegth papers or almost 22 papers per year. A quick calculation indicates that 6 active faculty members published a

total of 192 full length papers in 10 years. This is truly an incredible record for a small faculty group which also had major classroom responsibilities while carrying out the research.

To more clearly identify the tremendous output by the faculty under the guidance of Dr. Stanley Brumleve, one need only to look at some of the other statistics. For example, the faculty presented abstracts at scientific meetings at the rate of 12.7 per year. Further, they attended scientific meetings at an average of 8.8 meetings per year. The Department of Physiology to date, 1982, awarded 27 Ph.D. degrees and 20 of the 27 degrees were awarded from 1972 to 1982, or 74% of all Ph.D. degrees were during this very productive period. In addition, the Department has awarded a total of 63 Master's Degrees and 30% of these degrees or 19 were awarded during the active years between 1972 and 1982.

It takes significant amounts of money to maintain an active research program and the faculty were no less energetic in obtaining extramural funding. The faculty had attracted over 1.7 million dollars to support the graduate research programs between 1972 and 1982. Within that funding was a training grant obtained by Dr. Stanley J. Brumleve from the National Institutes of Health that covered six years of the activity. This was a significant contribution to stabilizing the graduate and research efforts.

On the average there were six faculty members per year active from 1972 to 1982. Not all of the faculty members served during the entire 10 years. The members working during the ten year period included Dr. Stanley J. Brumleve, Chairman, Dr. Surendra S. Parmar, Dr. Thomas K. Akers, Dr. Carl A. Zogg, Dr. H.E. Ederstrom, Dr. Thomas Neilson, Dr. David Beckman, Dr. Scott Walsh, Dr. Benjamin DeBoer, Dr. Theodore Auyong, Dr. James Boelkins, Dr. Syed Husain, Dr. Alice Owen, Dr. Henry Stinnett and Dr. Jack T. Saari. These faculty members also directed the graduate students who received their degrees in the Department of Physiology. In addition approximately 10 post-doctoral faculty served for varying periods of time in this most active period.

In 1977, the Dean of the Graduate School, Dr. Alice Clark, at the Founder's Day Banquet on February 24, presented the University Award to the Department of Physiology and Pharmacology for excellence in research and creative work.

This award is given to an outstanding department in the University for the amount and quality of significant research relative to the number of faculty members. The graduate faculty members in the Department in 1977 were: Dr. Stanley J. Brumleve, Dr. Surendra S. Parmar, Dr. Theodore Auyong, Dr. Thomas K. Akers, Dr. Helge Ederstrom, Dr. Henry Stinnett, and Dr. Carl Zogg. These faculty members were nominated by the Dean of the School of Medicine, Neil Thomford, M.D., for recognition of excellence and research. In her remarks Dr. Alice Clark indicated that "through the capable chairmanship of Dr. Stanley J. Brumleve, the seven professors in 4½ years had published 92 full-length papers," attended 50 meetings and presented 76 papers at national and international scientific sessions. During the 4½ years, 11 Doctor of Philosophy Degrees were awarded and 11 Master of Science Degrees. In addition, 26 grants were funded which generated $1,176,942 in support of the departmental and university activity.

A grant from the Louis W. and Maude Hill Family Foundation supported a position known as the Hill Research Professorship in the Department of Physiology. It was obtained by Dr. Russel Wilson in 1967 for five years. An extension of the grant was subsequently obtained by Dr. Stanley J. Brumleve in 1975. The total research activities of the people appointed as Hill Research professors in Physiology and Pharmacology contributed significantly to the development of a national reputation for the Department.

Special recognition must go to Dr. Surendra S. Parmar who was appointed Hill Research Professor in 1975. The first goal of the professorship was advancement of new knowledge for the health and benefit of society. Dr. Parmar published scientific investigation in the area of physiology and pharmacology in 32 full-length papers in refereed journals. In addition, he presented at least 19 short papers at no less than six scientific national and international meetings.

The second goal of the Hill Professorship involved the teaching and enhancement of the school's curriculum, especially courses in the fields of physiology and pharmacology. Dr. Parmar centainly contributed to this goal by his outstanding teaching as identified by both faculty and students in his interaction with medical students and graduate students in physiology and pharmacology.

The third goal of the Hill Professorship was the tutelage of student researchers for enhancement of the school's curriculum. Dr. Parmar certainly is an outstanding researcher of international recognition and has been the chairman for the graduate committee of several graduate students as well as serving membership on many committees for students both within the university and outside the university structure.

Several of his students received research awards such as the Roger Denison Student Competition Award by Sigma Xi, the Outstanding Research Award by the School of Medicine, and the Outstanding Research Paper by the North Dakota Medical Association.

The Hill Foundation name was subsequently changed to the Northwest Area Foundation. The faculty is very proud of the accomplishments through the support of the Northwest Area Foundation, and due recognition is given to the board and Mr. John Taylor, the Executive Director, for their efforts to bring excellence in research to the upper northwest area.

Special appreciation must be expressed for the support of classified and technical personnel within the Department. These people include Bertha Opheim who served in the Department over 27 years and retired in 1973. Her support of faculty and students in research and education earned her a special place in the memory of all who worked with her. In the stockroom Bertha Opheim was the heart of that operation and after her retirement she was succeeded by Mrs. Barbara Evenson. The secretarial staff included Mrs. Sharon Dornheim, Ms. Mary Ann Scramstad, Ms. Beverly Thornes, Ms. Sheila Brossart, Mrs. Brenda Perry, Mrs. Cheryl Sterf, and Mrs. Lorraine Olson. Without these very efficient people the tremendous output of the department could not have succeeded. Each in their unique ways contributed to the success of the teaching, research and service activities of the Department.

It should also be mentioned that approximately two to six part-time undergraduate students participated each year in the activity within the Department. Their functions were both service and educational and were a significant part of the total departmental activity.

Not all of the activity as one might expect was related to the advancement of new knowledge and the education of the students. During that period of time, the department also developed under the able leadership of Harley Pakola, a winning softball team. Trophies were awarded to them in 1977 and 1978.

The Variety of Courses Listed in the 1979-81 Catalog Indicates the Changes in the Department of Physiology that have taken place since its start in 1905

Course for Undergraduate Students

301. Mechanisms of Human Physiology. Four credits.

Required Courses for Medical Students

602. Physiology for Medical Students. Nine credits.

604. Clinical Physiology. One credit.

701. Neuroscience. Four credits.

Elective Course for Medical Students

779. Animal Surgery. Two credits.

Advanced and Research Courses

501. Physiology of the Autonomic Nervous System. Three credits.

502. Physiology of the Central Nervous System. Three credits.

503. Advanced Physiology. Credits and hours arranged.

505. Mammalian Surgery. Two credits.

513. Physiology of Electrolytes. Two credits.

515. Biophysics and Systems Analysis. One to three credits.

521. Seminar in Physiology. One credit.

523. Physiology and Biophysics for Graduate Students. Eight credits.

524. Physiology Lecture Course for Graduate Students. Four credits.

525. Renal Physiology for Graduate Students. One to three credits.

526. Respiratory Physiology for Graduate Students. One to three credits.

527. Neurophysiology for Graduate Students. One to three credits.

528. Endocrinology for Graduate Students. One to three credits.

529. Cardiovascular Physiology for Graduate Students. One to three credits.

530. Physiology of the Alimentary Canal. To credits.

590. Problems in Physiology. Credits arranged.

591. Research in Physiology. Credits and hours arranged.

592. Readings in Physiology. Credits and hours arranged.

996. Continuing Enrollment. One to twelve credits.

998. Thesis

999. Dissertation.

Elective Courses for Fourth Year Medical Students

849.60 Physiology. UND School of Medicine.

Technical Services Provided by the Department of Physiology and Pharmacology

In addition to teaching and research duties performed by faculty, a number of other services were provided without compensation to the academic and medical community by Department members.

The University Health Service occupied rooms in the Rehabilitation Center in the McCannel Hall Building, adjoining the Medical School. Several technical procedures were carried out in the Department, since its laboratories had the only apparatus available in the city, or even the state for certain studies. One of the test frequently done was pulmonary function evaluation for the North Dakota Workman's Compensation Department. Patients from all parts of North Dakota and nearby areas who had pulmonary disorders from exposure to grain processing dust, coal mining or petroleum field employment were given appropriate tests in the Department. In addition to this, the Student Health Service required several other diagnostic procedures that were done in the Department by faculty members. These included basal metabolism determinations, electrocardiograms, visual and auditory function tests. Members of University athletic teams were frequently assayed for physical fitness by using exercise tests on a stationary bicycle, and measuring heart and respiratory responses to various levels of exertion.

With increased enrollment these services proved highly time consuming. However, in the past decade the University Health Service has expanded to the extent that most of this testing is done by its staff. Also, pulmonary function evaluation presently is done at several large clinics. Faculty members who were primarily interested in Pharmacology also devoted considerable time and effort to drug-related services. These involved testing and identifying the composition of substances collected from persons arrested by the local police, or found in drugged patients, or suicide cases. Each year members of the faculty have organized, or were prominent in, programs related to alcohol and drug abuse in the area. Many inquiries regarding medicinal products used by local physicians have also been investigated by the Pharmacology staff.

Members of Teaching Staff
(1905 to date)

Listing is by decades in which the staff member was appointed. Dates of appointment and termination of full-time service are given. Rank given at time of appointment, or final rank is included. Terminal degree(s) only are given. Part-time and occasional visiting lecturers, except those with long service records, are not listed.

1905-1910

Brannon, Melvin A., M.A., 19051914
Dean, Lecturer
MacDonald, Archie L., M.D., 1905-1911
Professor
Taylor, John D., M.D., 1908-1923
Lecturer
Young, Robert T., Ph.D., 1908-1909
Assistant Professor
Caldwell, George H., M.D., 1908-1913
Professor

1911-1920

Trimble, Harry C., 1918-1922
Assistant Professor
King, Charles E., Ph.D., 1914-1919
Professor
Bush, Arthur D., M.D., 1920-1923
Professor
Todd, John W., Ph.D., 1916-1919
Associate Professor

1921-1930

Goehle, Reinhold O., M.D., 1928-1929
Instructor
Hill, Frederick, B.S., 1924-1926
Instructor
Moss, Joseph, M.D., 1924-1926
Associate Professor
Duncan, James W., B.S., 1926-1928
Instructor
Talbert, George A., Ph.D., 1924-1945
Professor & Chairman, 1926-1945
Saiki, Arthur K., M.D., 1928-1930
Instructor
Finkle, Ralph, B.A., 1926-1928
Instructor
Sinclair, John G., B.S., 1922-1926
Assistant Professor
Jenkins, Frank L., B.S., B.A., 1925-1930
Instructor

Mobert, Clarence W., B.S., 1930-1933
Instructor

1931-1940

Heringer, Weston, B.S., 1934-1936
Instructor
Monserud, G. Ordell, B.A., B.S., 1934-1936
Instructor
Pond, Harold S., Jr., B.A., B.S., 1937-1938
Instructor
Simonson, Donald B., B.A., B.S., 1934-1935
Instructor
Werner, Harold W., Ph.D., 1938-1941
Assistant Professor
Maginn, Richard J., B.A., B.S., 1938-1940
Instructor

1941-1950

Brown, Robert V., Ph.D., 1941-1946
Professor & Chairman
Thomson, Duncan M., M.D., 1940-1942
Instructor
Barber, Tracy E., Jr., B.S., 1942-1944
Instructor
Reed, Emerson A., Ph.D., 1945-1948
Assistant Professor
Ruud, Edward T., M.D., 1946-1948
Assistant Professor
Lawton, Alfred H., M.D., Ph.D., 1947-1948
Professor, Chairman, Dean
Erickson, Oswald P., M.D., 1948
Assistant Professor
Graham, Charles M., M.D., 1948-1949
Assistant Professor
Potter, Wilbur F., Ph.D., M.D., 1948-1964
Professor, Chairman, Dean
Gault, Alta Ray, M.S., 1949-1957
Assistant Professor
Billing, Ervin L., 1949-1950
Instructor
Raska, Sigwin, Ph.D., 1950-1951
Associate Professor

1951-1960

DeBoer, Benjamin, Ph.D., 1951-1975
Professor
Calman, Carl, M.D., 1951-1952
Koons, Will R., M.D., 1951-1952
Wautat, Philip H., M.D., 1950-1951
Assistant Professor
Ederstrom, Helge E., Ph.D., 1952-1978
Professor

Potter, Paul H., M.D., 1952-1953
Assistant Professor
Keith, Eaden F., M.S., 1952-1956
Instructor
Nungesser, William C., Ph.D., 1953-1960
Assistant Professor
Vergeer, Tennis, Ph.D., 1953-1957
Assistant Professor
Brumleve, Stanley J., Ph.D., 1957-to date
Professor
Richtarick, Alfred A., Ph.D., 1959-1964
Instructor

1961-1970

Auyong, Theodore K., Ph.D., 1963-to date
Associate Professor
Wilson, Russell H., M.D., 1965-1972
Professor and Chairman
McMahon, John M., M.D., 1965-1968
Instructor
Akers, Thomas K., Ph.D., 1965-to date
Professor
Nielsen, Thomas, Ph.D., 1969-1974
Associate Professor
Boelkins, James, Ph.D., 1972-1975
Assistant Professor
Magness, John L., M.D., 1960-1964
Instructor
DeBoer, Katherine O., Ph.D., 1962-1968
Instructor

1971-1980

Boelkins, James N., Ph.D., 1972-to date
Associate Professor
Husain, Syed, Ph.D., 1976-to date
Associate Professor
Beckman, David L., Ph.D., 1973-1976
Assistant Professor

Technical Personnel With Long-term Service in the Department

Opheim, Bertha, Laboratory Storekeeper, 1948-1973
Hallada, William, Animal Caretaker, 1951-1964
Olma, Frank, Animal Caretaker, 1964-1974
Nefs, Frank, Animal Caretaker, 1964-1978
Everson, Barbara, Laboratory Storekeeper, 1973-to date

Office Personnel

Mrs. Bernice Matt - before 1950
Miss Marjorie Weiss - before 1950
Mrs. Doris Whinery - 1953
Mrs. Sandy Olson - 1965-1968
Miss Betty Solseng - 1968-1970

Mrs. Ruth Harmon - 1968-1970
Mrs. Rose Kemper - 1966-1977
Mrs. Sharon Dornheim - 1969-1978
Miss Mary Ann Scramstad - 1975-1977
Miss Beverly Thorness - 1977
Miss Sheila Brossart - 1977-present
Mrs. Brenda Perry - 1978-1980
Mrs. Cheryl Sterf - 1980-1981
Mrs. Lorraine Olson - 1981-present

Present Faculty 1981-1982

Brumleve, Stanley J., 1957-to date, Temporary chairman, 1964-1965, Chairman, 1972-to date, Ph.D., St. Louis University
Teaching: Medical Physiology; renal, acid base
Research: Temperature regulation, CNS and anticonvulsive mechanisms

Akers, Thomas K., 1965-to date, Ph.D., Loyola University
Teaching: Medical Physiology; muscle nerve, environmental, Neuroscience,
Focal Problems
Research: Effects of high atmospheric pressure on physiological functions

Owen, Alice K., 1966-to date, Ph.D., Iowa State
Teaching: Mechanisms of Human Physiology
Research: Embryology

Parmar, Surendra S., 1972-to date, Ph.D., Lucknow and McGill Universities
Teaching: Medical Physiology; endocrinology, autonomic nervous system
Research: Cellular actions of drugs affecting the central nervous system

Saari, Jack T., 1978-to date, Ph.D., University of Minnesota
Teaching: Medical Physiology; cardiovascular, temperature regulation, Focal Problems
Research: Microcirculation of the myocardium

Stinnett, Henry O., 1976-to date, Ph.D., University California, Davis
Teaching: Medical Physiology; respiration, exercise
Research: Cardiopulmonary function

Zogg, Carl A., 1963-to date, Ph.D., University of Illinois
Teaching: Mechanisms of Human Physiology, Medical Physiology; gastrointestinal
Research: Nutrition, Gastrointestinal functions

Emeritus Faculty

Potter, Wilbur F., 1948-1963, Chairman & Professor, 1953-1963, Chairman & Dean, 1948-1953, Ph.D., University Kansas, M.D., Rush Medical College, Deceased 1982.
Teaching: Medical Physiology; Physiology of the Nervous System; Digestive Functions, Clinical Physiology
Research: Artificial Heart

Ederstrom, Helge E., 1952-1978, Ph.D., Northwestern University
Teaching: Medical Physiology; Mechanisms of Human Physiology; Experimental Surgery
Research: Temperature, regulation; cardiovascular functions

Ph.D. Graduates of the Department of Physiology and Pharmacology

	Name	Year
1.	Keith, Eaden F., Jr.	1956
2.	House, Edwin W.	1965
3.	Passmore, John	1970
4.	Thompson, Robert	1971
5.	Bitter, Ronald	1971
6.	Keefner, Kenneth	1971
7.	Stetzner, Larry	1972
8.	Cromer, John	1972
9.	Reinke, Roderick	1972
10.	Hammond, Ronald E.	1974
11.	Jensen, Clyde B.	1974
12.	Spencer, Henry W.	1974
13.	Boerboom, Lawrence E.	1975
14.	Brennan, Deborah M. Allen	1975
15.	Ross, Brian K.	1975
16.	Syftestad, Glenn T.	1976
17.	Bergren, Dale R.	1976
18.	Athey, George R.	1977
19.	Settle, Stephen J.	1977
20.	Crittenden, Daniel J.	1978
21.	Pakola, Harley A.	1979
22.	Sepe, Frank J.	1979
23.	Yutrzenka, Gerald J.	1979
24.	Davis, John S.	1979
25.	Magnusson, Mark R.	1981
26.	Mitchell, Mark A.	1981
27.	Geiger, Jonathan D.	1982

Master's Degree Graduates of the Departments of Physiology and Pharmacology

	Name	Year
1.	Bergmeyer, Josef T. (M.A.)	1931
2.	Carpenter, Ralph C.	1931
3.	Smith, Paul N.	1931
4.	Hager, Jerome P.	1953
5.	Jensen, Clayton E.	1954
6.	Linfoot, John A.	1955
7.	Vick, James A.	1956
8.	McIntyre, Donald G.	1957
9.	Thompson, Stanley D.	1957
10.	Larson, Alvin L.	1958
11.	Bache, Robert J.	1961
12.	Nelson, Delbert R.	1961
13.	Hoekzema, Allan C.	1963
14.	MacDonald, Sara J.	1963
15.	Tasker, Fred L., Jr.	1963
16.	Van Den Berg, Christian J.	1963
17.	Ward, George R., Jr.	1963
18.	Greenan, James H.	1964
19.	Hamann, Paul R.	1965
20.	Pearson, Richard N.	1965
21.	Ponessa, Joseph T.	1965
22.	Rorem, David A.	1965
23.	Bratt, Lawrence P.	1966
24.	Pastoor, David L.	1966
25.	Harralson, Judith	1966
26.	Ries, John P.	1967
27.	Longpre, James	1967
28.	Boelkins, James	1968
29.	Davis, Donald	1969
30.	Green, Ray	1969
31.	Keefner, Kenneth	1969
32.	Nakomoto, Tetsuo	1969
33.	Reinke, Roderick	1969
34.	Ritter, Tibor	1969
35.	Thompson, Robert	1969
36.	Wang, Dou-Mei (Chaing)	1969
37.	Sherry, Stuart	1970
38.	Spencer, Henry	1970
39.	Stetzner, Larry	1970
40.	Szymankowski, Ronald	1970
41.	Stites, Dean	1971
42.	Olson, Robert	1972
43.	Carlson, Lawrence	1972
44.	MacCarter, Daryl K.	1972
45.	Brennan, Deborah M.	1972
46.	Jensen, Clyde	1973
47.	Geiger, Jonathan D.	1974
48.	Syftestad, Glenn T.	1974
49.	Baum, Kenneth F.	1975

50.	Bergren, Dale R.	1975
51.	Crittenden, Daniel J.	1975
52.	Nelson, Douglas B.	1975
53.	Sexton, James D.	1975
54.	Tofano, Michael E.	1975
55.	Davis, John S.	1977
56.	Pakola, Harley A.	1977
57.	Yutrzenka Gerald J.	1977
58.	Muza, Stephen R., Jr.	1977
59.	Isler, Jack R.	1977
60.	Stein, Paul M.	1978
61.	Whitley, Daniel, Jr.	1978
62.	Magnusson, Mark R.	1979
63.	Lame, Michael W.	1979

Honors and Awards to the Department and Staff

Department Awards:
University Award for Outstanding Research and Creative Activity, Presented at Founder's Day Banquet, February 1977

Publications: Total = 205 full-length papers published 1972-1982

Faculty Awards:
Honors Achievement Award from Angiology Research Foundation: H.E. Ederstrom and Walter Oppelt, 1965-1966

Golden Apple Award as Outstanding Medical School Teacher Presented by Medical Students:
Stanley J. Brumleve, 1971
Theodore K. Auyong, 1976

Faculty Lecture Series Presentations:
W.F. Potter, 1957
H.E. Ederstrom, 1966
Thomas K. Akers, 1977
Surendra S. Parmar, 1978

American Physiological Society Membership:
All Faculty Members: (as of 1982) Drs. Stanley J. Brumleve, Thomas K. Akers, Alice Owen, Surendra S. Parmar, Jack T. Saari, Henry O. Stinnett, and Carl A. Zogg

Sigma Xi Faculty Research Award:
Dr. Surendra S. Parmar, 1979

Hill Research Professorship:
Dr. Thomas Nielsen, 1969
Dr. David L. Beckman, 1972
Dr. Surendra S. Parmar, 1975

Fellow of American Association Advancement of Science:
Thomas K. Akers, 1967

William N. Creasy Visiting Professorship of Clinical Pharmacology:
Helmut M. Redetzki, 1980-1981

Student Awards:
Denison Undergraduate Awards:
Michael R. Towarnicky, 1978
Andrew Billon, 1981
M.D. Green, 1978

North Dakota State Medical Association Award:
Jonathan D. Geiger, 1981

Sigma Xi Graduate Research Award:
Frank Sepe, 1979-1980

Sources of Major Research and Teaching Grants
in the Department of Physiology and Pharmacology

Office of Naval Research

National Institute of Mental Health

National Institute of Drug Abuse

Hill Foundation (Northwest Area Foundation)

National Science Foundation

Bristol Laboratories

Hoffman LaRoche Foundation

Arthritis Foundation, Dakota Affiliate

American Heart Association (National)

American Heart Association (Dakota Affiliate)

National Heart, Lung and Blood Institute

Guy and Bertha Ireland Research Fund

American Parkinson's Disease Association

Burroughs-Welcome Fund

National Cancer Institute

Diamond-Shamrock Corporation

Fraternal Order of Eagles (Max Baer Heart Fund; Dakota State Aerie)

Merck, Sharp and Dohme