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THE EVOLUTION OF ANATOMY AT THE
UNIVERSITY OF MINNESOTA

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• Dean Diehl has requested that a brief historical account of each department be prepared as a part of the celebration in connection with the Fiftieth Anniversary of the Medical School. The development of the work in human anatomy at this institution may perhaps be divided roughly into three periods: (1) a preliminary period (1883-1887); (2) a pioneer period (1888-1912); and (3) a period of maturity (1913-1939). These three periods will be briefly considered in order.

Preliminary Period (1883-1887)

During this period the Medical Faculty at the University of Minnesota was established and functioned merely as an examining and degree-conferring body. Its influence was chiefly in the elevation of standards for the other existing medical schools of the state. The scanty records indicate that the examinations given were similar to those of the usual state licensing boards.

The records, parts of which are preserved in Dean Diehl's office, list the questions asked in the various branches at one of the meetings (minutes of May 5, 1884). The set for Anatomy was formulated by Dr. Perry H. Millard, who was secretary of the organization and who later became Dean of the Medical Department. The questions for Anatomy are as follows:

1. Give chemical composition and microscopic structure of bone.
2. Name the articulations of the sphenoid bone.
3. Give the origin, insertion and relations of the Sterno-Cleido-Mastoid muscle.
4. Name the branches forming the Circle of Willis.
5. Give the boundaries of the Fourth Ventricle.

6. Give the anatomy of the cornea.
7. Name and locate the valves of the heart.
8. Give the anatomy of the ovaries.
9. Give boundaries and contents of Scarpa's Triangle.
10. Name the anatomical regions of the abdomen.

Pioneer Period (1888-1912)

This represents a period of expansion from small beginnings. What we now recognize as Anatomy was originally grouped under two separate departments: (1) Gross Anatomy and (2) Histology and Embryology. Immediately after the union of the St. Paul Medical College and the Minneapolis Hospital College under the University in the Spring of 1888, there were few facilities available for medical instruction aside from those furnished by the constituent schools.

In *gross anatomy*, the conditions had doubtless improved somewhat over those cited by Beard (pamphlet on Unification, etc., 1908, p. 13) for an earlier period. At this time, according to the program of the Saint Paul Medical College in 1879-80, "The hours of study, six a day, were from 3:00 to 10:00 p. m., presumably to suit the convenience of the busy practitioner. The course of dissections began every evening at 9 o'clock, and possibly included a search for anatomical material in the hours when ghosts traditionally walk in the graveyards."

Beard (p. 32) likewise states that dissecting material was extra and scarce in the newly organized University school. Later, however, the state anatomical law (1905) yielded a more satisfactory supply. During the earlier years, the classes were small. According to the printed list of students in the Record Book of minutes (p. 66), the total enrolment for the year 1888-89 in the College of Medicine and Surgery was seventy-five. This in-

*Presented at the Anatomy Seminar, January 6, 1940.

cluded thirty-three juniors (first year), twenty-three middle class (second year), and nineteen seniors (third year). The College of Homeopathic Medicine and Surgery also had thirteen students, who took the same anatomy work as the other medical students. Separate courses in anatomy were provided for the College of Dentistry (twenty-two students). These figures agree with those in the printed bulletin (catalogue for 1888-89; announcement for 1889-90).

Gross Anatomy.—The building in which gross anatomy was taught at the University during most of this pioneer period was a rather small brick building, two-story and basement, which was built for the purpose. It was located near the present Pharmacy building, which was originally termed "Millard Hall." According to the "University Dictionary" (1913) this anatomy building survived three disastrous fires (1902, 1905, 1909), but the losses were largely covered by insurance. The teaching staff was headed by Prof. George A. Hendricks, a Michigan graduate, whose lectures on anatomy, according to tradition, were very popular. He was assisted by Dr. E. C. Spencer, Professor of Surgical Anatomy, and Dr. Burnside Foster, Demonstrator of Anatomy. Dr. A. F. Ritchie (Duluth) is also listed in the Medical Faculty as Professor of Anatomy for the first year of the school, but there is no other evidence that he actually served in this capacity. A little later, Dr. Charles A. Erdmann began a long term of service in this department. At first he was student assistant (1890-93), then demonstrator (1893-98), assistant professor and demonstrator (1898-99), professor of anatomy, succeeding Dr. Hendricks (1899-1909), professor of gross and applied anatomy (1909-13), and finally associate professor of anatomy (1913-36).

The first printed announcement (1888-89) indicated that gross anatomy was taught in the first year of the medical course, and repeated in the second year. A graded course was not adopted until some years later. It is stated that anatomy will be taught by lectures, dissections under the demonstrator, and recitations. The textbooks used were Gray's

Anatomy and Holden's Landmarks. Details concerning the various courses were not given. According to the revised medical curriculum adopted in 1892, gross anatomy was assigned two hours per week, first and second years, for didactic work; in practical anatomy (dissection), two courses ninety hours each; surgical anatomy, 1 hour weekly, 1st semester.

Microscopic anatomy (histology and embryology) was at the beginning (1888) associated with bacteriology and pathology rather than with gross anatomy. Dr. J. Clark Stewart, a Minneapolis surgeon, was in charge with title of Professor of Histology and Bacteriology. The original medical bulletin states that the course includes lectures and laboratory work. "The student will be taught to mount normal tissues and specimens containing bacteria. The course in Normal Histology and Bacteriology will cover a period of not less than six weeks. If possible, the student will provide himself with a microscope. Textbooks: Prudden's Practical Histology, Shaefer's Essential Histology." Beard remarks that "since there were practically no microscopes in use when the department began its work, there were no microscope fees to vex the impoverished pocket of the pupil."

After the arrival of Dr. Thomas G. Lee, trained at Pennsylvania and Harvard, the work in histology and embryology developed rapidly, but it did not become independent for some time. Lee was first appointed Instructor in histology, bacteriology and urinalysis (1891-92); then Professor of Histology, Embryology, Bacteriology and Clinical Microscopy (1892-93); then Professor of Histology and Embryology from 1893 on. In 1909, he became Professor of Anatomy and head of the consolidated departments of anatomy, histology and embryology. From 1913, his title was Professor of Comparative Anatomy.

The work in histology and embryology was housed in what was then called the "Medical Science Building" (now Westbrook Hall) which was completed in 1896 at a cost of \$65,000. This building also housed the department of physiology, and the medical library. Through the efforts of Dr. Lee, who acted as

medical librarian for several years, and of his colleagues, the medical library was rapidly developed. It formed a valuable asset in the later development of the medical school. He also established a separate departmental library for Anatomy. Both the departmental and the medical college libraries were ultimately joined with the biology library and transferred to the present quarters in the new University Library building.

A brief history of the development of American anatomy up to the year 1905 is given by Bardeen. Concerning the work at Minnesota at this time it reads as follows (p. 169):

"At the Medical School of the *University of Minnesota* anatomy is taught in two separate but coordinated departments, that of 'anatomy' and that of 'histology and embryology.' In the former there are a professor, a demonstrator, and a prosector. In the year 1901-02 the salaries of the staff of instruction amounted to \$3,300, and the appropriation for the laboratory to \$3,070.14. In the department of embryology and histology there are a professor, an assistant professor, an instructor and an assistant. In 1902, the salaries of the staff of instruction amounted to \$5,256.27 and the appropriation for the laboratory to \$2,490.49. A special janitor, and part of the services of a carpenter and a mechanic are at the disposal of the two departments. If \$1,500 be counted for service, the total amount appropriated for anatomy at this university, exclusive of heat, light, etc., amounted in 1901-02 to over \$15,000."

For comparison, it may be noted that with the later growth of the work in anatomy the departmental budget has correspondingly increased, until at present (1938-39) it includes (for the school year) as follows:

For salaries and wages.....	\$43,600
For supplies, expense and equipment..	5,750
Total	\$49,350

This does not include expense for janitors, summer session, extension classes, and individual grants from the Medical Research Fund.

At a slightly later time (1910), Abraham Flexner published his famous survey of American medical schools. As a result of his visit in 1909, he concludes that at the University of Minnesota the laboratory facilities (including those for anatomy) are ample, and that "excellent, exceedingly attractive and well organized

laboratories are provided for all the scientific branches." He further states that "Minnesota is perhaps the first state in the Union that may fairly be considered to have solved the most perplexing problems connected with medical education." This flattering statement was perhaps somewhat overly optimistic.

Bardeen was also chairman of the subcommittee on Anatomy (including histology and embryology) in the American Medical Association report on the "model medical curriculum." T. G. Lee and C. M. Jackson were members of this committee. The report contains much information (including data from Minnesota) on such topics as the place of anatomic sciences in the medical curriculum, required and elective subjects, qualifications of instructors, methods of instruction, necessary laboratory equipment, proportion of didactic to laboratory teaching, minimum number of hours in the various subjects, and cost of maintaining an anatomy department.

At the close of the pioneer period, the curriculum, staff and facilities for medical instruction at Minnesota had increased considerably. According to the medical bulletin, the enrolment for 1911-12 totaled 171, including 51 first year, 54 second year, 36 third year, 25 fourth year, and 5 graduate.

The faculty in Anatomy for the corresponding year (1911-12) included the following:

Thomas G. Lee, B.S., M.D., Professor and Director of the Department.
 Charles A. Erdmann, M.D., Professor of Gross and Applied Anatomy.
 John B. Johnston, Ph.D., Professor of Comparative Neurology.
 Winfield S. Nickerson, Sc.D., M.D., Assistant Professor of Histology and Embryology.
 Robert Retzer, M.D., Assistant Professor of Anatomy.
 E. T. Bell, B.S., M.D., Assistant Professor of Anatomy.
 Charles F. Disen, M.D., Demonstrator in Anatomy.
 C. F. McClintic, B.A., Assistant in Anatomy.
 F. M. Babcock, Departmental Assistant in Anatomy.
 Harold Aldworth, Departmental Assistant in Histology.

The *required medical courses in Anatomy* for 1911-12 were as follows: All except the Special Sense Organs and second half of Dissections were given in

the freshman year. The total number of hours required was 900; those for each subject are added in parentheses.

Osteology (54 hrs.), Erdmann.
General Vertebrate Morphology (72 hrs.), Lee, Nickerson, Retzer.
Dissections (324 hrs.), Erdmann, Bell, Disen, McClintic.
Splanchnology and Microscopic Anatomy (144 hrs.), Lee, Nickerson, Retzer.
Comparative Embryology (108 hrs.), Lee, Johnston, Nickerson, Retzer.
Mammalian and Human Neurology (144 hrs.), Johnston.
Special Sense Organs (54 hrs.), Johnston.

Other courses in gross and microscopic anatomy were given for students in dentistry. Apparently none were offered for other students, although it is stated in the bulletin that medical graduates may become candidates for the Master's or Doctor's degree, with majors or minors in anatomy. The graduate students were registered under the Graduate School, which was formally established at Minnesota in 1906.

Period of Maturity (1913-39)

During the preceding pioneer period the medical school had rapidly expanded in enrolment and equipment, with increased requirements for admission and improved facilities for routine medical training. The chief defect was apparently in the field of productive scholarship. This phase of the subject, however, received increased attention under President Vincent and Dean Lyon. Following the reorganization of the medical school (in 1913), graduate work in the medical sciences (both preclinical and clinical) was organized under the Graduate School with the assistance of Dean Ford, whose influence on medical research was stimulating and effective. Teaching staffs were improved. Library and laboratory facilities were increased. In the later years individual grants from the Medical Research Fund were exceedingly helpful.

In 1913, the department of anatomy had already outgrown its quarters in the old medical science building. The situation was greatly improved by the completion of the new Institute of Anatomy, at a cost of \$243,342 for the building and \$67,200 for equipment. Credit for planning this building goes chiefly to Dr.

Lee, who had the able assistance of Dr. Johnston and other colleagues.

The purposes of the new anatomy building are well stated in the medical bulletin for 1911-12 as follows:

"The Institute of Anatomy will provide the needed space and equipment of all kinds for the proper development of all that pertains to the subject of human and vertebrate anatomy in its several subdivisions, gross, microscopic and developmental, in courses for undergraduates, the training of teachers, and in graduate and research courses leading to the degree of M.A. or Ph.D."

The increase in staff corresponding to the greater number of students and the expanded scope of the work are shown by the present lists (medical bulletin for 1939-40). In the strictly medical courses in anatomy the number of required hours has decreased from 900 (in 1912) to 693 at present. This makes possible the large number of electives offered, which are also available for graduate students. There are also new courses in anatomy developed in other fields, such as embalming, nursing, and dental hygiene. By special arrangements rooms and facilities are provided also for courses taught by staff members from a few other departments, such as physical education, and surgical demonstrations in applied anatomy. The department of radiology coöperates by giving lectures and section demonstrations in x-ray anatomy for the regular freshman class in medical gross anatomy.

The faculty list for Anatomy in the anniversary year (1938-39) is as follows:

Professor (and Head) Clarence M. Jackson, M.S., M.D., LL.D.
Professor Edward A. Boyden, Ph.D.
Professor Hal Downey, Ph.D.
Professor Andrew T. Rasmussen, Ph.D.
Professor Richard E. Scammon, Ph.D. (Distinguished Service Professor in the Graduate School.)
Associate Professor Emeritus Charles A. Erdmann, Phm.G., M.D.
Assistant Professor Raymond F. Blount, Ph.D.
Assistant Professor Edith Boyd, B.A., M.D.
Assistant Professor Shirley P. Miller, Ph.D.
Instructor Edward L. Strem, B.S., M.D. (Also nine Teaching Assistants.)

According to the Registrar's report (President's Report for 1936-38, p. 186) the enrolment for the Medical School was as follows for the year 1937-38:

Interns 149, Seniors 130, Juniors 134, Sophomores 140, Freshmen 120, Un-classed 4, total 643. In addition, there were 87 enrolled in Medical Technology, 687 in Nursing, 296 in Dentistry, and 80 in Dental Hygiene. All of these students received instruction in Anatomy at some time during their course of study. According to the Commencement Program (1939), three students received the Master's degree in Anatomy, and two the Ph.D., during the preceding school year.

The current courses offered in Anatomy (as listed in the medical bulletin for 1939-40) are as follows. The hours and number of students enrolled in each course are indicated in parentheses; f = fall quarter, w = winter, s = spring, su = summer.

Required Courses

Anatomy for Embalmers (132 hrs. per quarter; enrolment: 80 f, 80 w, 75 s). Miller and assistants.
 Anatomy for Nurses (44 hrs. per quarter; enrolment: 260 f, 90 s). Blount and assistants.
 Anatomy for Dental Hygienists (44 hrs.; enrolment: 48 w). Blount and assistants.
 Systematic Anatomy (Dental) (121 hrs.; enrolment: 63 f, 8 su). Miller and assistants.
 Anatomy of Head and Neck (Dental) (132 hrs.; enrolment: 56 s, 10 su). Miller and assistants.
 Histology and Embryology (Dental) (132 hrs.; enrolment: 62 w, 9 su). Rasmussen and assistants.
 Gross Human Anatomy (Fr. Med.) (330 hrs.; enrolment: 100 f, 100 w, 30 su). Jackson, Blount, Boyden, et al.
 Human Histology (Fr. Med.) (165 hrs.; enrolment: 136 s, 8 su). Downey, Rasmussen, et al.
 Human Embryology (Fr. Med.) (99 hrs.; enrolment: 132 s). Boyden and assistants.
 Human Neurology (Soph. Med.) (99 hrs.; enrolment: 120 f, 16 su). Rasmussen and assistants.
 Hematology (Med. Tech.) (96 hrs.; enrolment: 47 f, 47 w, 40 su). Downey, et al.

Elective and Graduate Courses

in Anatomy (1938-1939)

History of Anatomy (22 hrs. per quarter; enrolment: 11 f, 13 w, 10 s). Miller.
 Experimental Embryology (hrs. ar.; enrolment: 3 w). Blount.
 Topographic Anatomy (33 hrs.; enrolment: 11 f, 11 w). Jackson.
 Anatomy of Newborn (88 hrs.; enrolment: 9 f, 12 w). Boyden.
 X-ray Anatomy (11 hrs.; enrolment ? s). Rigler.
 Special Topics (Seminar) in Neurology (hrs. ar.; enrolment: 11 f, 13 w). Rasmussen.

Prosection (hrs. ar.; enrolment: 2 f, 1 w). Jackson.
 Advanced Anatomy (hrs. ar.; enrolment: 18 f, 12 w, 7 s, 5 su). Staff.
 *Developmental Anatomy of Head (66 hrs.; enrolment: . . .). Boyden.
 *Histology-Neurology of Head (66 hrs.; enrolment 19 s). Rasmussen.
 Physical Growth (22 hrs.; enrolment: 5 w). Boyd.
 Statistical Work (hrs. ar.; enrolment: 1 f, 3 w, 4 s). Boyd.
 Seminar in Hematology (11 hrs.; enrolment: 10 s). Downey.
 Research in Anatomy (hr. ar.; enrolment: 14 f, 15 w, 10 s, 6 su). Staff.
 Anatomical Seminar (11 hrs.; enrolment: 10 f, 9 w, 8 s). Jackson and Staff.

Corresponding to the increase in size and quality of the staff and facilities, the department of Anatomy has improved in research as well as in teaching in various phases of the subject. Of the accomplishments by individual members of the staff, only a few of the outstanding can be mentioned briefly. The work in neurology (neuro-anatomy), founded by Johnston, has been developed and strengthened by Rasmussen, who has also done notable research in endocrinology (hypophysis). Scammon's work in human growth has established what is essentially a school of human biometry, which has received world-wide recognition and commendation. Closely allied is the valuable research in physical anthropology, ably conducted by Dr. Edith Boyd in coöperation with the Institute of Child Welfare.

Boyden has done outstanding work in embryology and notably in experimental morphology of the biliary tract. Downey's preëminence in the field of hematology is evidenced by the recent publication of his four-volume *Handbook of Hematology*, generally recognized as the best on this subject. The achievements by Blount in experimental morphogenesis of the hypophysis, and of Jackson (effects of malnutrition) may be cited, along with the investigations of numerous other staff members.

The reprints of publications by members of the anatomical staff have been collected and published by the University in a series of 15 volumes entitled *Contributions from the Department of Anatomy, University of Minnesota*. Volume

*NOTE: These two graduate courses are offered in alternate years.

16 is now in preparation. Although several published books by staff members are not included, the series gives a fair idea of the number and quality of the scientific investigations in the department of Anatomy.

An adequate appraisal of the general scientific strength is difficult for an organization such as the department of Anatomy. Perhaps the best available rating from outside, unprejudiced sources is that by Cattell in *American Men of Science*, 4th edition, 1927. This work (Table VI, page 1128) lists the ten strongest departments for each science in this country. In Anatomy, the University of Minnesota ranks third, being surpassed only by Chicago and the Wistar Institute of Anatomy (Philadelphia). Following Minnesota, in order, are the Rockefeller Institute, Johns Hopkins, Michigan, California, Wisconsin, Columbia, and Washington University (St. Louis).

More recently Zabel (1939) cites as Minnesota "starred" scientists in Anatomy: "Profs. C. M. Jackson, Boyden, Downey, Johnston, Rasmussen and Scammon." He states further (p. 17) that: "From the standpoint of its outstanding men, the University Anatomy Department has been referred to as one of the two leading departments of the United States." This flattering evaluation gives us something to live up to.

Future Needs.—In closing, it may be appropriate to cite and endorse, on behalf of the department of Anatomy, the following excerpts from Dean Diehl's report for the Medical School (in the President's report for the years 1936-38). He states (p. 237-238):

"Looking forward into the second half century of its existence it is essential, not only that the present standards of medical and scientific work be maintained, but also that these be advanced as necessary to keep abreast of the rapid progress which is being made in scientific medicine."

Among the needs for the future which concern the department of Anatomy are increases in staff and funds for medical research and graduate medical education. More specifically, there is an urgent need for completion of the south wing of the Institute of Anatomy. This need is expressed by Dean Diehl as follows:

"A teaching museum for anatomy and pathology. The lack of an adequate museum for teaching purposes is a definite handicap to the work in anatomy and pathology. In 1919 this was listed as one of the urgent needs of the Medical School. This need, still unfilled, has become increasingly urgent. The building to house this museum should complete the Anatomy-Pathology Building, and provide in addition to the museum some sorely needed laboratories for both graduate and undergraduate teaching in anatomy and pathology."

References and Sources

The Medical Faculty records (including minutes, committee reports, et cetera) are on file in Dean Diehl's office. The printed medical bulletins in the University Library date back only to 1898; but an earlier series is filed in the Engineering Library, University of Minnesota. Other publications containing information on the history of anatomical work at the University of Minnesota are as follows:

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