

Facilities in Experimental Psychology in the Colleges of the United States

William O. Krohn (1894)

Classics in the History of Psychology

An internet resource developed by

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York University, Toronto, Ontario

ISSN 1492-3173

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Facilities in Experimental Psychology in the Colleges of the United States

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First published in *Report of the Commissioner of Education for the year 1890-'91* (Vol. 2, pp. 1139-1151)

Posted August 2000

INTRODUCTION.

The first *laboratory* in experimental psychology was founded by Prof. Wilhelm Wundt at Leipzig in 1878, with very unpretentious aims and inauspicious beginnings. At first he received neither patronage nor recognition from the State and indeed his one room was no more than a little *Werkstätte*, for the psychological laboratory of that day was of necessity an experiment in itself. However, this little laboratory soon became widely known, and on account of its very novelty attracted many of the students of philosophy then attending the University of Leipzig. The value of their now experimental method soon impressed these students that it was soon carried into effect at other institutions, and happily this new movement early found its way to America. To President G. Stanley Hall and Dr. J. McKay[sic] Cattell, Wundt's first American students, belongs the credit of introducing the experimental methods of treating psychology into the American college; the first laboratory being that of Johns Hopkins University at Baltimore, in which laboratory so many of the teachers of experimental and comparative psychology in the various colleges of the United States received their training. From this one comparatively small laboratory at Johns Hopkins the number has rapidly increased to fifteen now in actual use while no less than ten other institutions have taken steps to secure laboratory facilities within a year.

In Europe the progress of the new movement in psychology has been much slower than in our own country, but of Wundt's students Münsterberg established a laboratory at Freiburg in Baden and Martius in Bonn, while G. E. Müller at Göttingen has a laboratory that can hardly be excelled. The last named is in all probability the outgrowth of that interesting series of lectures on *Medicinische Psychologie* read by Hermann Lotze while he was professor in Göttingen, whose successor Müller is. At Berlin, Heidelberg, Munich, Geneva, Bern, Copenhagen, Groningen, and Jena are smaller collections of apparatus which serve chiefly for the purposes of illustration and the carrying on of "practice courses" rather than for original research. The

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limited facilities at those latter places are due rather to the poor financial support on the part of the State, most of the laboratories having been established by the professors out of their own meager salaries and limited means. The facilities at Paris are very good, but in all of England there is as yet practically nothing in this line. At Cambridge a meager £100 has just been appropriated, while at Oxford only very recently has the matter been even discussed. On the other hand the valuation of the present laboratory equipment in this country is more than \$30,000, much greater than that of all the European laboratories put together.

In the following description an effort has been made to place before the public the actual facilities in experimental psychology at those institutions of our country so fortunate as to possess them, with a belief that many of the questions now being propounded will find answer in such a description; and also with the hope that it will be demonstrated to all that psychology no longer lives upon the crumbs that fall from the tables of neurology and physiology but investigates from its own point of view and no less broad mindedly than the other sciences. [p. 1140]

There is no longer need of argument for the value of experimental methods as applied to psychology and yet some would fain restrict the psychologist to a color mixer and a few models of the brain as his quota of apparatus, forgetting that nineteenth-century students demand nineteenth-century methods, and that a fourteenth-century psychology will no longer suffice in the American college. There was a time when the chemist needed little else than a spoon and a bottle for his work, but happily this is no longer the case.

In none of the natural sciences has there been the rapid growth that has marked the development of experimental psychology in the United States, for it must be remembered that with but one exception, all of the fifteen laboratories now in existence in this country have been founded since the autumn of 1888 -- within four years -- and furthermore, this number is to be nearly doubled within a year.

It is the further hope that the many doubts and misgivings with reference to the "new" psychology which so frequently find expression in the question: Of what use is a laboratory to the psychologist? will be met in the following description of the various laboratories and that the question itself will be afforded a sufficiently clear answer.

The exhibition in this branch of natural science at the World's Fair, as indicative of actual work done in our colleges, will surprise even some of the closest students of the curriculum and its modification in the American college and will further show as a real matter of fact that the facilities in experimental psychology in the colleges of the United States are nowhere surpassed in the may of advantages offered for original research in one of the most interesting, because one of the most fruitful lines of investigation open to the scientific student.

BROWN UNIVERSITY.

The courses offered in psychology are the following: (1) Introductory course in psychology extending through two terms, required of all juniors. (2) Introductory laboratory course with demonstration and experimental work by the students, one term, elective for juniors. (3) Advanced course, extending through the year, elective for seniors and graduates, consisting of original research in the laboratory and seminary for papers and discussions.

At the date of this writings (December, 1892) the laboratory has been in operation only three months, and hence is not yet fully equipped with apparatus. Some pieces have been ordered, but have not yet arrived, *e.g.*, chronoscope, time-sense apparatus, etc. Others are in course of construction. The list will be made thoroughly complete for demonstration, and every thing else will be procured as needed for special research. The principal instruments already procured are as follows: The usual apparatus for sensations of contact, pressure, temperature, smell, taste and position, rotation. For the muscle sense, weights, and a new apparatus for measuring extent and rapidity of motion. For hearing, tuning-forks, resonators, siren, sonometer and organ pipes. For vision, various pieces of apparatus for demonstrating the mechanism of the eye,

stereoscope, Holmgren's worsteds for investigating color blindness; Helmholtz and Bradley's colored papers, color-wheels and a complete set of apparatus for Hering's experiments in simultaneous contrast, [*]kymograph, tambours, and electric recording signals, recording metronome, sphygmograph, dynamograph, dynamometer, pneumograph, apparatus for detecting and recording unconscious movements of the hand and Jastrow's automatograph. Further apparatus is rapidly being procured and much can be constructed by the university carpenter and mechanic who have fully equipped workshops.

The library has four rooms, two large ones (one of them 40 by 20 feet) one of which can be thoroughly darkened, and two small ones, each of which is removed from noise, can be darkened, and is electrically connected with the main rooms.

The library of the University contains 75,000 volumes. In psychological literature it is yet far from complete but the defect is being remedied as rapidly as possible. Every thing needed for special research will be provided.

THE CATHOLIC UNIVERSITY OF AMERICA, WASHINGTON, D. C.

The laboratory for the department of experimental psychology had its beginning during the winter of 1891-'92, three suitable rooms in the divinity building having been set apart for the purpose. Lectures are given three times a week and experimental work is carried on daily. At present the equipment includes the following pieces of apparatus: 3 specimen brains, 2 large models of the brain (Auzoux), 10 small models of the brain (Leipzig), models of eye and ear, model showing eye movements (Wundt), microscopes and histological preparations of nervous tissue, 1 tone measurer (Appium), 1 set (13) tuning forks (Appium), 1 set (20) tuning forks (Kœnig), 1 set (22) cylinders (Kœnig), 1 set (14) resonators (Kœnig), 3 color tops, 1 [p. 1141] pendulum apparatus (Wundt), 1 control hammer, 1 Hipp chronoscope (new pattern), 1 recording drum, 2 metronomes, 2 sound hammers, 2 signal bells, 1 electro motor, 1 set staves; Edison batteries, rheochord, Morse keys, commutators, etc.

The arrangement of the laboratory in its present temporary location is far from perfection, However, improved facilities for work will be afforded in the new hall of philosophy, where greater amount of space, divided into convenient and well-appointed rooms, is assigned to the department of experimental psychology.

UNIVERSITY OF CHICAGO.

There is at present but one institution offering work in psychology, and during the present year three different courses are given as follows: (1) An introductory course consisting (a) of a physiological part, devoted to the anatomy and physiology of the nervous system, and the sense organs, and based partly on Bernstein's Five Senses; (b) a psychological part, in which is used James's Briefer Course. This is a "double minor," coming five hours a week, for twelve weeks. Next quarter there will be given two parallel courses occupying four hours a week each, and continuing through the remainder of the year, viz.: (2) An advanced course in psychology, reading course based on James's Principles, for those who have had the introductory course; (3) A laboratory course in experimental psychology, based on Dr. Sanford's Notes.

Most of the first appropriation of \$1,000 has already been expended for psychological instruments, models and the like. So far the apparatus is as follows: Series of tuning-forks, (Kœnig), differential sonometers, set of resonators (Kœnig), Helmholtz phakoscope, Kuehne's artificial eye, Ewald's pseudoscope, Golton's set of test-weights, Talrich's models of the brain, Auzoux's models of the brain, eye, and ear. Other pieces, e.g. Hipp chronoscope and Cattell's fall-chronometer, have been ordered, but have not yet arrived.

There has been made a further appropriation of \$800 for the purchase of psychological instruments in connection with the exhibit at the World's Fair. This will bring to the University a large number of pieces of value for demonstrational purposes.

Within a year the psychological laboratory will be in comfortable quarters in the new biological building which is soon to be erected.

CLARK UNIVERSITY.

The work in psychology at Clark University embraces the allied topics of anatomy of the nervous system, anthropology, pedagogy, and experimental psychology.

The laboratory in experimental psychology at this institution is in many respects the pioneer laboratory of this country both historically and pragmatically. Indeed it comprises nearly all the original apparatus used in the first laboratory in this country, that of Johns Hopkins University.

The three rooms occupied were planned with especial care in the construction of the university building. The largest room occupied by the general laboratory can be readily transformed into a very acceptable dark-room. In this room all the general class-work (except lectures) takes place. It is also the general apparatus room, well furnished with wall cases, and supplied with abundant table space, cabinets of drawers and a workbench. The larger part of the best apparatus have been made by the university mechanic.

A very complete equipment is available to the students in the following lines of experimental investigation: (1) Sensations of contact, (2) temperature sensations (hot and cold spots), (3) sensations of pressure, (4) static sensations, e.g., recognition of the postures of the body as a whole, (5) muscle sense, (6) joint and tendon senses, (7) study of bilateral asymmetry of function, (8) sensations of taste and smell, (9) hearing, (10) vision, (11) reaction time experiments.

Over 300 sets of experiments are carried out during the year under the supervision of the laboratory demonstrator.

The chief *apparatus* is: Hipp chronoscope, two Ludwig kymographs with Cambridge interrupter and other accessories; students drum as recording apparatus; a well-designed wall pendulum on knife edges set in motion electrically and a very accurate time measurer; Wundt's "Zeltsinn" apparatus; control hammer; æthsiometers[sic] of different patterns; a complete series of weights for experiment on pressure sense; tilting board; rotating table; Mosso's bed; olfactometer; harmonium; sonometer; Helmholtz phakoscope; ophthalmotrop; plenophalmotrope; tambours; Duprez signals; Hering's color mixers; battery, and motors. Mention can not be made of the numbers minor, and, to outsiders, seemingly insignificant pieces of apparatus with which the majority of the experiments are made. Twenty-five hundred dollars is a conservative valuation of the equipment at Clark.

The following are the courses offered:

(1) *Practical course*. -- This consists of about 300 experiments covering the chief [p. 1142] problems of touch, taste, smell, hearing, vision, psycho-physic law, reaction times, association, memory, rhythm, etc. This course follows the normal course now being marked out by Dr. Sanford in the *American Journal of Psychology*, and is intended to give practical familiarity with psycho-physic apparatus, methods, and phenomena, and will occupy three afternoons a week.

(2) *Lectures on Physiological psychology*. -- These are given thrice a week throughout the year. This course supplements and is concurrent with course 1. It treats of the history, methods, and results of modern experimental psychology and embraces digests of current literature.

(3) A course of two sessions per week through the year, partly by lecture and partly by seminary upon instinct, dreams, hypnotism, and other topics, with demonstrations. The psychological parts of anthropology (myths, rites, and customs) are, in a measure, included in this course.

(4) Weekly conferences devoted to lecturettes, journal club work, quizzes, and seminary study of selected themes in the field of psychology and philosophy.

(5) *Investigation*. -- Each advanced student is expected to select some promising topic of research, either experimental or literary, and to have something to show for his work before the end of the year.

Good literary digests in course 4, or valuable studies in course 5, may be published in the American Journal of Psychology, edited by the department.

The founder of this university endowed twenty fellowships, some yielding \$600, some \$400 annually, and ten scholarships yielding \$200 annually. Of the fellows, the past year, 8 were in the department of psychology, likewise 3 scholars.

The American Journal of Psychology is published at Clark University, edited by President G. Stanley Hall. Each volume contains four numbers of about one hundred and fifty pages each. Besides original articles, about half the space is devoted to careful digests of the important literature of the field. This journal stands in the same relation to the psychological investigations of our own land as do Wundt's *Philosophische Studien* and Ebbinghaus' *Zeitschrift für Psychologie und Physiologie[sic] der Sinnesorgane* to those of Germany.

COLUMBIA COLLEGE.

The laboratory of experimental psychology at this institution occupies four rooms on the top floor of the building containing the offices of administration. One of these rooms (about 40 by 20 feet) is used as a lecture room and laboratory for instruction. The other three room (each about 20 by 20 feet) are used chiefly for special research. One room is a dark room, for work on vision. The rooms are well lighted and are supplied with water, gas, and electric power. The college will remove in two years and in the new buildings great care will be given to the accommodation and fittings of the laboratory of experimental psychology.

The collection of apparatus is probably not surpassed by any in this country or in Europe. Two thousand five hundred dollars have been appropriated for the collection by the trustees, in addition to the apparatus which cost \$1,200 now in use. The apparatus has been secured with a view to a complete course of experiments, such as is carried out by the students attending the introductory course, and with a view to special researches. There are this year (1892-'93) six students doing special advanced work.

Three courses in experimental psychology are offered by Prof. Cattell: (1) Introductory course; (2) an advanced course whose subject is altered each year and (3) research work, for which the laboratory is open at all times. An introductory course in psychology is given by Prof. Hyslop and an advanced course by Prof. Butler. Prof. Osborn gives a course on "The Brain," and many other courses of interest to students of all experimental psychology are offered by the several faculties of the college and institutions of the city.

University fellowships are open to the students of this department and the library facilities are excellent.

CORNELL UNIVERSITY.

The psychological laboratory of Cornell University is one year old and completely arranged for work. It occupies the third story of the south section of White Hall and contains six rooms, each room being connected with all the others by an elaborate system of telegraphic wires, which facilitates the carrying on of simultaneous work in different parts of the laboratory. The floors are solid, an important feature in the adjustment of fine apparatus, and the elevation secures perfect quiet for experimentation. The first room is devoted to experimental work in acoustics. The laboratory is especially rich in acoustical apparatus, which includes a piano-forte, an

Appium's tone measurer (triple set), a long series of tuning forks from the [p. 1143] Hanau workshop, and an extensive set of the instruments made by Kœnig, of Paris. This room is connected by a metal tube for the transmission of auditory stimuli, with the acoustical reacting room.

The second room is arranged as the reacting room in chronometrical experiments. The apparatus is fairly complete. It comprises two Hipp chronoscopes of the new construction, a kymograph of the Ludwig pattern, to which the time-sense disk has been fitted; the large control-hammer, recently devised by Wundt; electro-magnetic hammers, and the Hipp fall apparatus, for sound stimulation; Cattell's keys, for lip and word reaction; a reading telescope (Cambridge Instrument Company); together with the usual series of simple reaction keys, commutators, bells, resistance boards, etc. A pendulum for light reactions, and a chronograph will soon be added to the collection.

In addition to these instruments room No. 2 contains a series of brain models, including the large Auzoux specimen; two Marey tambours, the Cambridge Instrument Company's box of weights; apparatus for the investigation of the sense of smell; metronomes.

Room No. 3 is arranged as the professor's private room. Here is stored a set of psychophysical and physiological diagrams, and the seminary library will be placed here for the convenience of students who are working continuously in the laboratory.

Room No. 4 is fitted up as a workshop. It contains, besides bench and tool cupboard, the storage battery from which the electrical supply for the laboratory is derived. The fifth room is a dark chamber, and will serve both for optical researches and as the reacting room in acoustical work. An internal chamber, which is movable and still darker, can be employed for perimetric and other experiments.

Room No. 6 is the largest of the suite. At present it has a double function. It is furnished to accommodate small classes; while it also contains the chronoscope table, and so stands in the relation of experimenting room to No. 2. Here are arranged, further, the optical apparatus -- Krille's large color-mixer and after-image apparatus; models to demonstrate the movements of the eyes (Helmholtz, etc.); three color-mixing tops of the new Krille pattern; two demonstration stereoscopes; a spectrophotometer, made by the Cambridge Instrument Company; the same company's box of wool color tests; two episkotisters; a diaphragm apparatus, as used by Kirschmann, etc. To these must be added Wulldt's fall chronometer for demonstrating the extent of apperception.

The collection of instruments is continually being added to, and the resource of the laboratory increased by the further acquisition of books and diagrams. It will, in all probability, be necessary before long to devote room No. 6 to experimental work exclusively. This term twenty-one students are hearing the professor's course (advanced psychology, with experimental demonstrations), and fifteen are taking work in the laboratory, introductory or advanced.

The laboratory has a special endowment, and psychology a special library fund.

The following courses are now offered: (1) Advanced psychology with experimental illustrations; (2) introduction to laboratory work (3) reading of German Psychology, with work of all kinds in the laboratory.

There are three fellowships and six scholarships in the Sage school; and these are open to candidates offering psychology.

DENISON UNIVERSITY.

The instruction in experimental psychology at Denison University is in charge of the department

of biology. The course is based on a thorough preparation in anatomy and physiology, including embryology, histology, and comparative morphology. A term in neurology is given to scientific students in the fall of the junior year, and a term of physiological psychology is elective for all students in the; winter term of the senior year. In the graduate course, a year of advanced work and research is provided for, distributed between psychophysics, comparative psychology, and neurology. A building in course of erection will afford room for one or more laboratories for this work and will be equipped with chronoscope, pendulum, myograph, and the most essential apparatus. A special course of shopwork in which students will construct apparatus of their own devising will be a feature of the equipment. The present year a single term has been devoted to neurology and physiological psychology.

HARVARD UNIVERSITY.

The department of psychology at Harvard has spared neither money nor endeavor to equip its laboratory in the best manner possible, and as a result we find at America's oldest educational institution what is probably the most valuable collection of psychological apparatus in the world. [p. 1144]

In the first place it must be mentioned that there are at Harvard three teachers giving their entire time and effort to instruction in psychology with thirty students taking the practice course and a dozen more advanced men occupying themselves with important research.

The laboratory occupies the upper floor of Dane Hall, the former home of the law school, and consists of two very large rooms (36 by 25 feet), well lighted, and also an excellent dark room.

The apparatus can not be listed in detail, but is arranged in the following four groups:

(1.) Demonstration apparatus (*a*) such apparatus as best serves to represent the connection between mind and body, and their reciprocal influence upon each other. (*b*) Models and prepared tissue of the brain, nerves, and organs of sense, including the most expensive models of the eye and ear, as well as one showing the course of the nerve tracts to the brain. Also a number of wax models for use in the comparative study of the brain. This group also includes a vast number of anatomical charts and histological preparations together with an excellent microscope and accessories. All these are of course only for the purpose of demonstration and form no part of the apparatus for real experimental work.

(2.) Department for the study of the psychology of the senses. There is included in this group a complete set of tuning-forks, an organ, harmonium, reeds and pipes, and resonators for psychological study of the sensations of sound, various kinds of color-mixers, excellent prisms, instruments for the study of the phenomena of after images, as well as of color blindness, and a perimeter, constituting some of the apparatus devoted to psychological optics. Mention must also be made of the complicated apparatus used for the study of the sensations of pressure and contact as well as the various forms of sensation of motion.

(3) Instruments used for psychometric investigations. The laboratory at Harvard is unusually rich in apparatus of this class. Indeed it is as complete in this line as any laboratory can be made at this stage of the science.

(4) The last group includes all apparatus which serves in the investigation of the higher mental processes, *e.g.*, illusions of space and time, studies of memory, attention, association of idea [*sic*], and forming of judgments. This group also comprises the most recently devised apparatus for the study of the æsthetic feelings.

Belonging to the above four departments, the most expensive pieces of apparatus are the following: model of the brain (Aeby's and also Auzoux's), models of the end organs of sense, Kœnig's acoustic apparatus, color disks from Hering and Wundt, Baltze's kymograph, registering tuning forks; Ewald's, Hipp's and Münsterberg's chronoscopes and Münsterberg's

apparatus for the study of sensations of movement.

At the time of this writing these are the chief pieces of research in progress:

(1) Influence of attention upon intensity; (2) localization of several simultaneous sound impressions; (3) investigations upon the æsthetics of color and form; (4) discrimination time for space intervals, following Münsterberg's favorite method of Kettenreaktion; (5) association time with speech; (6) reciprocal influence of sense impressions; (7) influence of the mental process upon bodily fatigue; (8) fusion of touch sensations; (9) reciprocal action of the various volitional impulses.

The courses offered are as follows: (1) Introduction to psychology. Three hours a week one-half year. (2) Beginner's course. Three hours a week entire year. (3) Weekly demonstrations of the above to groups of 10 persons each. (4) Laboratory research. Three to four hours each day. (5) Psychological seminary.

The laboratory also contains a well-equipped psychological library of 400 volumes. Prof. Münsterberg, who was for so long located at Freiburg in Baden, and who has so recently connected himself with Harvard, brought with him much of his own apparatus with which he made his name and reputation in Germany. This apparatus is a valuable addition to Harvard's facilities.

UNIVERSITY OF ILLINOIS.

The laboratory at this university is just beginning to assume definiteness of form and arrangement. Indeed, it is the newest of all the laboratories in the United States at the time of this report, the first apparatus being set up January 10, 1893. For present needs the quarters in the new natural history buildings are sufficiently ample, embracing one large laboratory room with water, gas, and electricity, well glazed, and having a solid floor; a dark room, with double sink and gas, entrance to this room being indirect through three doors; and a store room, while there is a lecture room and a private research room in the main building. These quarters, though merely temporary, are quite above the average.

A considerable amount of apparatus is ordered and on the way, but the best and most satisfactory is that constructed in the engineering shops of the university at very low cost, but with great skill. A complete set of charts is being prepared, while the best models and specimens of prepared tissue are in the laboratory. [p. 1145]

In the present class of the general course there are thirty seniors. One graduate student has been taking advanced work in this department. The courses are to be organized with a view to offering the best advantages in experimental psychology. The chief and most promising piece of original research now in progress is "A Study of the Dermal Sensations of Pressure, both simultaneous and successive." The results include some very important facts with reference to the educability and memory of the skin.

An entrée of the most generous sort into the State hospitals for the insane, deaf, and dumb, and the blind is not one of the least advantages enjoyed by the students in psychology of this university.

A university bulletin, the publication of which is just begun, affords a desirable avenue for the publication of important results of experimental work. All the leading magazines pertaining to work in this field are accessible to the students.

INDIANA UNIVERSITY.

The laboratory for experimental psychology in Indiana University was opened upon a very modest foundation in the winter of 1887-'88. Gradual additions were made, the value of

apparatus at the end of the college year 1890-'91 amounting to about \$500. The equipment did not warrant the opening of complete courses, but almost all chapters in experimental psychology were partially illustrated by demonstrations, while researches were carried out in reaction time, estimation of distance by the skin, successive association, and illusions of apperception.

During the college year 1890-'91 work in experimental psychology ceased during the absence of the professor on leave. In that year, however, provision was made for generous additions to the laboratory. At the present time the laboratory has in its possession:

(1) Most of the standard and subordinate appliances for the study of the psychology of the senses. (2) For time determinations a Hipp chronoscope, Marey drum, Ewald chronoscope connection with a standard clock, and the necessary supplementary apparatus, such as tuning-forks, Kronecker interrupter, Duprez signals, and the like. (3) Appliances such as stethoscope, sphygmograph, plethysmograph, myograph for use upon animal or human muscles, together with tambours, *recepteurs[sic]*, and tambours à transmission, for recording results graphically. (4) A set of apparatus for anthropometrical tests. (5) A good outfit of tools for the construction of apparatus.

Besides the courses in logic, ethics, and history of philosophy given by the department of philosophy, a course of one term has been given in general elementary psychology and a course of one year in experimental psychology. Provision will be made for advanced undergraduate and graduate work.

Special attention has been given by the professor in charge to the literature of child study and to that of experimental psychology with reference to its possible application to the study of school children. Special courses will be opened for the benefit of teachers, and the research work of the department will, in the immediate future, turn largely in this direction.

UNIVERSITY OF IOWA.

At this university the following courses in psychology are offered: (1) Elementary psychology. Lectures on the nervous system, special senses, and localization of cerebral function, followed by a course in empirical psychology on the basis of James's "Principles of Psychology" one term of five hours a week for seniors. (2) Advanced psychology. Lectures on the time relations of mental phenomena, with experiments in time reactions with the Hipp chronoscope. Lectures on attention, habit, instinct, expression of the emotions. Lectures on abnormal psychology including unconscious psychosis, dreams, hypnotism, human automatism, and multiple personality. One term, three hours a week, for seniors. (3) Memory class. Lectures on the history of memory theories, modern theories of retention, images, visualization, and amnesia. The second half of the term is given to lectures on memory training, and mnemonics, with exercises. One term, two hours a week. :

The equipment of apparatus is as follows: A complete set of charts, illustrating the cerebro-spinal system, the special senses, cerebral localization, and illusions of perception; Anzoux's dissectible model of the brain (with hardened specimens of the human brain and apparatus for dissecting sheeps'[sic] brains); Hipp chronoscope, with apparatus for measuring reaction and association, tune; etc.; apparatus for testing psychophysical law in pressure sense, vision, and muscular sense; set of Berlin worsteds for testing color-blindness; also "pseudo-isochromatischen Tafeln" for the same purpose; rotating desks for mixing colors, wooden compasses for testing space-discriminative sensibility of the skin, apparatus for exhibiting contrast, after-images, and illusions. [p. 1146]

There is as yet no separate room for experimental psychology, nor has any original research been attempted in this department -- that is, in experimental psychology. The apparatus is only used for illustrative purposes.

LELAND STANFORD JUNIOR UNIVERSITY.

The abundant resources of this university have made it possible to found as good a laboratory in experimental psychology as money wisely expended can secure. While nothing can be given as yet in the way of detailed account of the facilities in experimental psychology at this institution, yet from the steps already taken it is easy to see that the laboratory now being equipped will be such as to entitle it to a place in the very front rank.

UNIVERSITY OF NEBRASKA.

All students in psychology are required to do laboratory work. The introductory course occupies three hours a week; one hour in laboratory during the first half year and two hours in laboratory during the second half year. After this year the laboratory requirements will be doubled. The class in the introductory course this year numbers seventy, about one-third of whom are free elective students (not required to take any other work in philosophy). Two-thirds have chosen the subject instead of logic or history of philosophy. One half year's work in one of these three subjects is required of certain students. At present there are two students doing special work in psychology. Additional apparatus already ordered and the further assistance promised will doubtless add a number of others to the list of special students for next year. It may be interesting to know that ten of the seventy students are teachers in the city schools -- three hours a week being so selected as to make it convenient for them to attend the class.

At present there is but one room devoted entirely to laboratory purposes. It is 30 by 50 feet, has good light, excellent floor, and three piers from the ground. The small lecture room assigned to the department is often used as a laboratory when two rooms are needed at the same time.

The department possesses more than \$1,000 worth of apparatus, including the better-known standard pieces and a number of useful home-made pieces. In another year there will be abundant equipment with which to perform Stanford's[sic] experiments or their equivalent. In this institution experimental psychology is not taught as a sequence to descriptive or nitrospective[sic] psychology, but as an introduction to any study of mind. Some little advanced work along on or two lines is offered, and facilities for such work will be increased after sufficient apparatus for the introductory course is provided.

For a new department the library facilities in psychology are good, including nearly all the recent works which have been contributed to the subject by those specially interested in the experimental aspect of the question. The departments of philosophy and pedagogy now receive twenty-eight periodicals. In other institutions of learning some of these would be charged to various departments of biology and medicine.

UNIVERSITY OF PENNSYLVANIA.

The laboratory at this institution was opened in 1888, and occupies three rooms in the biological building, of which two are in actual use. The third will be fitted up in the course of the current year and others will be added as needed. The rooms are well lighted and heated, fitted with electrical apparatus, and supplied with means of cutting off light and sound from experimenters. The laboratory is furnished with all the smaller pieces of apparatus used in the study of the simpler sensations, such as color wheels, spectroscope, stereoscope and slides, siren, Appium tone-measurer, a very complete series of tuning forks and resonators, perimeter, chronographs, and chronoscopes. The apparatus for the study of simple and compound reactions was constructed and arranged with especial care by Dr. Cattell, so that the experimentee is within reach of the experimenter's voice, although cut off from the more distracting sense impressions.

The following instruments seem worthy of especial mention:

(1) A wheel 1 meter in diameter is so balanced on conical axles as to always be in a state of equilibrium. The periphery, 10 centimeters in breadth, revolves past an opening the size of which can be regulated. The rate of revolution can be determined by means of a chronoscope with which it is connected. This instrument can be used for mixing and contrasting colors, for

determining the time required to read words and sentences, and in general for any experiments in which it is desired to expose a visual object for a short but determinate time. If used as a chronograph, it may be made to register accurately the one hundred thousandth part of a second. [p. 1147]

(2)[**] *For measuring accuracy of discrimination of time and extent of motions.* -- A carriage to be moved by the hand upon a graduated brass scale is connected with the chronoscope. The actual time and extent of the carriage's motion can thus be compared with the judgment of the experimentee.

(3) *For measures accuracy of discrimination of extent and force of motions.* -- Resembles the preceding, but is not connected with the chronoscope, and has an attachment by which weights may be lifted as the carriage is moved.

(4) *For the measurement of sensitiveness to pressure.* -- A piston with an area of 1 square cm. is connected with a spring in the handle of the instrument. An index upon the handle registers pressure up to 15 kilograms.

(5) *For the measurement of sensitiveness to slight changes in temperature.* -- A metallic, water-tight chamber is inclosed[sic] in a black wooden case backed with asbestos. A point of the metal 1 mm. in diameter and turned to the form of a hemisphere, protrudes through the wood at the tip of the cone. Ice or water can be introduced into the chamber.

(6) A dynamometer for registering force of pull up to 25 kilograms.

(7) *For measuring sensitiveness to the relative intensity of lights.* -- A lamp, provided with a metal hood and sliding to and fro upon a graduated scale, throws a beam of light through a hole in a vertical plank upon a white background. A seconds pendulum, controlled by an electromagnet and bearing a blackened screen swings before the hole. By this means the duration and intensity of each illumination, the time interval between any two illuminations, as well as their relative intensity are brought under the control of the experimenter. Detailed descriptions and cuts of Nos. 2, 3, 6, and 7 will be found in a monograph on the "Perception of Small Differences," recently published by the department.

(8) *For the study of the more simple æsthetic judgments.* -- Designed by Drs. Münsterberg and Witmer. A uniform black surface one meter square is so supported upon an upright that it can be adjusted at any angle to the line of sight. In slots on its surface run metal carriers, bearing white points or strips of linen. These are connected with a graduated scale at the rear of the instrument, and are so controlled that the experimenter can present at will to the experimentee points at varying distances from each other, lines divided in varying ratios and many simple plane figures. It may be used for the study of judgments as to relative size and position, as well as for the æsthetics[sic] of simple plane figures.

The department has also in course of construction a color mixer, on which the sectors can be changed while the apparatus is in motion, and a piece of apparatus of simple design, for controlling the chronoscope less expensive but as accurate as Wundt's control hammer, and giving a far wider range of standard times.

The library of the university is especially well supplied with the literature of experimental psychology and may be regarded as fairly complete in this direction up to date. A sufficient fund is provided for the acquisition of new publications as they appear and the filling up of lacunæ. Books and pamphlets needed by a student for special lines of research are provided by the Department. The following periodicals are now taken and the list is being continually extended: Zeitschrift für Volkerpsychologie u. vergleichende Sprachwissenschaft, Zeitschrift für Psychologie u. Physiologie der Sinnesorgane, Zeitschrift für wissenschaftliche Philosophie, Philosophische Monatshefte, Mind, American Journal of Psychology, Wundt's Philosophische Studien, Philosophical Review, Revue Philosophique, Revue Scientifique, Annales des Sciences Psychiques, Revue d'Hypnotism, Pflueger's Archiv für Physiologie, and many others

dealing with philosophy, ethics, ethnology, neurology, psychiatry, and other subjects having a less direct bearing upon psychology proper. Complete sets are on hand of nearly all the above-mentioned magazines.

A course in experimental psychology is offered as an elective to undergraduates of the junior and senior classes and has been taken by 25 men this year. Ladd's smaller textbook is used in connection with lectures and laboratory work.

In the department of philosophy 13 graduates are taking courses in experimental psychology. Instruction is by lectures with collateral reading and experimental investigation of special problems. The following lines of work are being pursued by graduate students: (1) On reaction times as modified by age, education, and physical conditions; (2) Statistical inquiry into the æsthetics of visual form; (3) Certain phenomena of attention; (4) Mental and physiological rhythms.

After this year the courses in experimental psychology will be made elective for students of the fourth year of the course in medicine.

Students of experimental psychology also enjoy the exceptional facilities for the study of physiology, neurology, and psychiatry afforded by the department of medicine.

The results of the work carried on at the laboratory from 1888 to 1891 are embodied in the monograph recently issued by Profs. Fullerton and Cattell as No. 2 of; the philosophical series of the University of Pennsylvania and entitled "On the Perception of Small Differences." Other numbers of the series will appear from time to time. [p. 1148]

WELLESLEY COLLEGE.

The work in experimental psychology at Wellesley College was begun in the fall of 1891. It is, therefore, little more than a year old, and so far no special students have worked in the laboratory and the only original research undertaken is a statistical inquiry into cases of colored hearing and of forms for numbers, for months, and the like.

The work has, therefore, been of a general character, and its most important result, pedagogically, the aid which it offers toward demonstrating the value of experimental methods in such a general course in psychology.

The laboratory consists of one large room rather unfavorably situated with reference to quiet and to temperature. There is one small room adjoining, of which use is sometimes made, and the dark room of the department of physics is also placed at disposal.

The apparatus includes a reaction-time instrument (with attachment for measuring reading time), a "joint-sensation " instrument, a copy of Hering's roof-glass instrument (made in the Wellesley carpenter-shop), for experiment in simultaneous contrast, a Wheatstone stereoscope, a Rothe color wheel, with disks (Maxwell, Talbot, and Fechner); apparatus for the Helmholtz and the Hering colored-shadow experiment, and for simple optical and entoptic experiments; a pressure balance, a graduated series of weights, and a home-made "Galton's bar," a set of well-made metal staves with clamps and attachments (from Petzoldt, Leipzig), dissecting instruments, and various small pieces of apparatus.

The psychological laboratory is fortunate in being able to borrow from the biological and physical laboratories much of the necessary equipment such as models of brain spinal cord, eye, and ear; monochords, tuning-forks, and electric batteries. It is happy, also, in the coöperation of carpenters and machinists, under skilled direction.

The library to which all the students base access, is fairly good in the line of experimental psychology and is constantly improving. It contains, among many other useful books, Wundt,

James, Stumpf, Spencer, Bain, Sully, Ladd, the monographs of Ribot, Binet, Münsterberg, and Schneider; and among the periodical publications the American Journal of Psychology, the Philosophical Review, Mind, the Revue Philosophique, the Zeitschrift der Physiologie und Psychologie der Sinnesorganen, Wnndt's Philosophische Studien, and the Proceedings of the Society for Psychical Research.

The following is a description of the method of the course in experimental psychology. This description refers explicitly to the work of the first year but there has been no important modification of the course, whose aim throughout, is to supplement, and in no way to supersede introspection; to lead students to observe in detail, and to verify the facts of their ordinary experience; to familiarize them with the results of modern investigation, with the usual experimental methods, and to introduce them to the important works of psychological literature.

The first month is devoted to a study of cerebral physiology. The classwork includes recitations, informal lectures, and some written work on the part of the students. The study of the brain by textbooks, plates, and especially by models, precedes the dissection by each student of a sheep's brain. Even those students who most dreaded this dissecting are practically unanimous with regard to its value in clearing up the difficult points in cerebral anatomy. In the class-room during the week in which the dissection is carried on, the principal theories of cerebral localization are discussed.

The next six weeks are spent in the experimental study of sensation. About seventy experiments are performed by the students on sensations of contact, pressure, temperature, hearing, and sight. These experiments almost without exception are selected from those suggested by Dr. E. C. Sanford in his laboratory course in psychology, but re-arranged with reference to the plan of the lectures and the class discussion. Papyrograph descriptions of the experiments are distributed to the students and commented upon in class before the experiments are undertaken. The instructor keeps daily laboratory hours in order to answer questions and offer assistance. Each student is responsible for a record of her own experiments. In class reports are made on the results of experiments, and recitations are conducted on the psychology of the different senses. The bearing of the experiments upon the different theories of perception is discussed. Special efforts are made to free the word "sensation" from the vague, dualistic meaning, which it often carries with it. Then follows a six weeks' study of space perception with experiments. These experiments, of which there are more than thirty, illustrate the methods of gaining or at least developing, the space-consciousness. The theories of monocular vision are carefully studied and are illustrated by diagrams and by "cyclopean eye" experiments. The study of the perception of depth includes and adaptation from Herings's experiment, in which the subject, looking through a tube, finds that he can correctly [p. 1149] distinguish within very small distances, whether a shot is dropped before or behind a black string stretched before a white background. The fact and the laws of convergence are studied with the aid of a Wheatstone stereoscope;

There follows a consideration of illusions of space; and of visual space, including the experiments suggested by Dr. James on so-called tympanum spatial sensations; and others with a telegraph snapper, on the location of sounds and the sense of direction. The study of the emotions and of the will is accompanied by no experimental work.

In place of a final examination, a psychological essay is required. The subjects assigned are very general, and are intended as subjects for study rather than as definite essay headings. The immediate topic of the paper is decided upon after the study and not before it. Such subjects as association, attention, memory, imagination, the psychology of language, the psychology of childhood, the psychology of blindness, aphasia, animal psychology, are chosen.

The study of the psychology of blindness is accompanied by visits to the Perkins Institute. Thus a student who writes on "The Imagination of the Blind," bases her conclusions upon a personal study of blind children. She questions the children, consults with their teachers and reads their compositions. Those who write on the psychology of childhood make personal observations on babies and little children. Hypnotism and dreams also receive a full share of attention.

In connection with the work of the course a collection of statistics concerning colored hearing was undertaken the past year with interesting results. No new explanations of the phenomena were offered or discussed.

UNIVERSITY OF WISCONSIN.

The chair of experimental and comparative psychology was created in June, 1888, to be occupied by Dr. Joseph Jastrow, and at the same time provision was made for the establishment of a laboratory.

COURSES OFFERED

General psychology. -- It is the object of the course to acquaint the student with the problems of mental life, especially such as have a living interest and are susceptible of every day illustration. Observation of the intellectual operations in the student's own mind is encouraged and an acquaintance with the best literature is furthered. Among the topics introduced are the relations of body and mind, the development of mind in animals; the senses as factors in mental life; the mind in disease, illustrated by the diseases of language of memory, and of personality; the experimental methods applied to psychic acts; the time relations of mental phenomena; mind in savages; practical applications, especially in the field of education.

Experimental psychology. -- Five hours a week during winter and spring terms. In this course is considered the relation problems of psychology to the methods of experiment and observations. Special attention is given to the study of the senses; of the time relations of mental phenomena; memory and association; mental statistics; the psychophysics law; mental tests and standards. In the laboratory course each student verifies for himself the main facts treated in the course, while the more difficult experiments are reserved for demonstrations. Sanford's Laboratory Course in Psychology is used.

Advanced experimental psychology (laboratory course). -- Six hours a week throughout the year. In this course special problems are treated and topics in the literature assigned. Original research and verification of important points form the main work. Each student takes up a special problem and prepares an account of the results of his work. Those, when of sufficient value, are published in the American Journal of Psychology. One hour of each week is devoted to a consideration of the literature bearing most closely upon the problems under investigation. Each student is also expected to act as subject in other researches than his own.

Comparative psychology (fall term). -- The course of mental development along the animal scale forms the chief topic, and in this the works of Romanes are followed. Some form of animal life is selected for special study, and observation is encouraged. The development of mental faculty in the human infant is constantly brought in for comparison with the animal development.

Abnormal psychology (winter term). -- The chief topics are, the criterion of the normal delusions and hallucinations, the chief forms of mental diseases; the diseases of language, of memory, of the will, of personality, dreams, hypnotism.

Anthropological psychology (spring term). -- The development of the human mind in the race, as illustrated by the history of human arts, customs, and beliefs. Tyler's Anthropology is used as a reference book, and the topics there treated may be taken as a fair index of the nature of the course. [p. 1150]

A philosophical club is formed, meeting fortnightly in the evening. Discussions occupy a greater part of the time. Reviews of current literature are also a prominent feature in the exercises of the club. The number of students in the general course averages about 90 and the number doing special work varies from 6 to 12, but will probably increase under the group system, just inaugurated. The psychological laboratory is a pleasant room, 26½ by 25½ feet, well lighted

from the north and east. A smaller room adjoining is used when needed, and closed cases furnish room for a greater part of the apparatus, while large and small tables, with drawers, give the working space required.

Among the pieces of standard apparatus the following might be named as typical and most important: Timing -- a Hipp chronoscope and metronomes, recording tambours rotating drum, and tuning forks. Vision -- Snellen's test type, Wheatstone and Brewster's stereoscope, Hering's apparatus for color mixture, book for exhibiting color contrast, Herring's apparatus for quantitative tests of color blindness, Joy Jeffrie's color chart, and Holmgren's colored worsteds.

Antropological. -- Féré's dynamometer; apparatus for testing the sensitiveness to pain; scale for determining height. Standing and sitting, and the span of the arms. Demonstration -- apparatus illustrating the mechanism of the eye muscles; Hering's stands for demonstrating color contrast; electrical induction coils; batteries and motors.

Among the special pieces of apparatus are the following:: Apparatus for control of the Hipp chronoscope; electric key used with the foregoing; the automatograph, apparatus for experimenting upon time, and also apparatus for determining error in judgment of vertical, horizontal, and other positions of lines.

The laboratory of the university is used for three purposes -- demonstrations, student work, and original research. As with other branches of science, students, when they care to do so, are started in research work very early in their course.

The following are the subtitles of the more important results, all of which have been published in the American Journal of Psychology: On the Psychophysics series[sic]: Visual Extension, Tactile Motor Extension, The Perception of Space by Disparate Senses, On the Pressure Sense, On Just Observable Differences (Vol. III, pp. 43-58); The Effect of Foreknowledge upon Repetition-tunes, A Novel Optical Illusion, Accessory Apparatus for Accurate Time Measurements, The Psychophysics Series and the Time Sense, 'The Psychophysics Series and the Motor Sense (Vol. IV, pp. 198-224); The Interference of Mental Processes; A Study of Zöllner's Figures and other Related Illusions, A Study of Involuntary Movements, Observations on the Absence of the Sense of Smell, Classification Time, Finding Time, Some Anthropometric Tests on Students (Vol. IV, pp. 381-429); On the Judgment of Angles and Positions of Lines, On the Perception of Simultaneous Sense, Impressions. The Psychophysics Series as Applied to Lifted Weights (Vol. V, pp. 191-204).

Besides a member of the standard works on psychology, the library of the university possesses files of several psychological journals and a number of smaller works on special topics. The growth of this portion of the library keeps pace with the growth of the library as a whole.

YALE UNIVERSITY.

The psychological laboratory occupies the second, third, and attic floors of a building with a front of 24 feet and a dept of 64 feet for the first floor and 40 feet for the other two. In floor space it is as large as Wundt's laboratory at Leipsic[sic]. It includes an office, a lecture room, a chronograph and galvanometer room, a finely equipped workshop with a screw-cutting lathe and tools of all kinds desired, a library and reading room, apparatus room, seminary room, which is also used for research, one other research room, a battery room, chemical room, and a store room.

The work done at the Yale laboratory naturally falls into three divisions -- research, lecture instruction, and practical training. The research work has been made the prime object of the equipment in the laboratory, both as to rooms and apparatus.

Six investigations are under way: (1) An extensive research upon attention and the influence and interference of various sensations and ideas upon one another. In preparing for the

measurement of the reaction time which has involved in the investigations, a new method of recording has been invented, which combines great ease and economy of time and labor and at the same time does away with the sources of error in reading the records. (2) An investigation of the rapidity of movements of the arm and hand carrying a pen in the various directions and under the various circumstances attending penmanship; a determination of the fatigue attendant on various methods of writing will follow. (3) The reaction time of tones as dependent upon pitch, intensity, and duration. (4) The time and fatigue of monocular accommodation; this also has important educational bearings upon the use of blackboards and notebooks. (5) Electrical stimulation and sensation. (6) A mathematical and experimental treatment of the method of observational errors. The last two will [p. 1151] probably extend over two years. Another investigation of the sensitiveness of school children to differences in pitch and of their range of voice at various ages is about to be begun. Possibly also a research upon the influence of unconscious elements upon the course of ideas will be undertaken. Instruction is given not only by lectures and seminars, but opportunities for careful training are provided in the laboratory. The seminars offer continual exercise in teaching various sections of psychology; while the workshop instruction, continual experimentation, and research provide the technical training.

The courses of instruction may be outlined as follows: (1) Experimental and physiological psychology; experiments and lectures for seniors and graduates. (2) Laboratory course in psychology This includes discussions and lectures by the students (graduates only) upon the methods of experimental psychology, their mathematical formation and their application; methods and standards of measurement; the mathematical and graphical expression of results, statistics, etc.; a thorough training by repeated exercises in carrying out these methods, (3) practical instruction in the manufacture and care of apparatus, including the elements of mechanical drawing, use of tools, lathe work, etc. (4.)[sic] A few lectures on laboratory economy. The main object of the course is to fully prepare men to take charge of instruction in psychology.

The large attendance of graduate students and the number of investigators at work have rather taxed the facilities that could be provided. There are 16 men and 1 woman in the graduate laboratory course -- an attendance exceeded in the graduate department only by that on the general philosophical courses.

All the principal psychological magazines and journals are found in the library.

Footnotes

[*] *Classics Editor's note: There is no closing quotation mark paired with this opening quotation mark.*

[**] *Classics Editor's note: In the original text, some of the numbers in this list were set in normal font, and some in italics. I have replicated the pattern here.*

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