was only fair that they should be controlled by Americans.

Among American astronomers, however, strong objections were made to the part it was proposed that Harvard should take in the plan. For this reason two leading astronomers declined to serve even on an informal advisory committee. It was explained that this objection did not arise from jealousy of Harvard, or from fear that the plan would not be well carried out there, but from a belief that one observatory should not be more prominent than another in such a scheme, and that the control of such a fund and of its expenditure should be wholly independent of any one institution. I believe that the selection of a trustee for the care of the proposed fund should be made by the donor, and had expected that the informal advisory committee would have recommended some method of appointing the final committee, which would have secured unprejudiced action. The function of the first of these committees would have been to propose a plan like that described above. This want has been supplied, in a great measure, by my friends, Mrs. Henry Draper, Major E. H. Hills, Professor Simon Newcomb and Professor H. H. Turner, to whom I am indebted for important suggestions in preparing this pamphlet.

There are certain advantages to be gained by throwing the responsibility upon a single individual or institution, as all mistakes or failures can then be located and remedied. Continued efforts will accordingly be made by the writer to accomplish the desired results. As other observatories have not expressed a wish to aid astronomers elsewhere, there seems to be no objection to making it a part of the policy at Harvard.

The present discussion has been published to supplement that issued in 1903, a copy of which will be sent to those who desire it. It is believed that present conditions are unusually favorable for securing great progress in astronomical science. It is hoped that a sum of at least $50,000 may be obtained for immediate expenditure, so that a beginning may be made at once, and astronomers may have an opportunity to show what results they might obtain with unrestricted means.

My one object is to secure a real advance in astronomy. Any plan that will attain this will have my hearty support, if desired. If this advance is made, it is a matter of little importance whether the part taken by the Harvard Observatory, or by myself, is large or small.

EDWARD C. PICKERING.

July 11, 1904.

THE CHANGING ATTITUDE OF AMERICAN UNIVERSITIES TOWARD PSYCHOLOGY.

IN this adolescent period of its growth, psychology may be pardoned for wondering if its elder brothers understand the manhood it is attaining. The distortion by the public prints, in their eagerness to be a little more than up-to-date, has thrown numerous fads of 'mental science' out of all perspective, and resulted undoubtedly in the injury of psychology. At the present time, however, the general reader is learning to discriminate 'yellowness' in what purports to be psychological news. When the Sunday special announced in January of this year that the soul of a rat had been observed in the laboratory of a Washington psychologist, few had difficulty in pigeon-holing the article with another which declared, about the same time, that a California physicist expected to turn negroes into white men by the use of radium. In the following pages the writer collects certain facts which bear upon the recent development of psychology in American institutions of higher learning, with the hope of giving more adequate means for judging the present status of this sci-

ence. The data are taken from the catalogues of 150 colleges and detailed information furnished by the directors of 34 prominent laboratories.

Ten years ago, Binet stated in the opening chapter of his 'Psychologie Expérimentale' that there were 14 laboratories in Europe and 16 in America. To-day there are at least 54 universities in the United States and Canada having psychological laboratories. The equipments of 25 of the largest average in value over $4,000, while in 1893 it was estimated* that the total psychological equipment in the United States was worth approximately $30,000. This material prosperity, small as it is, becomes noteworthy when it is considered that 1904 marks only the twenty-first anniversary of the establishment of the first American laboratory.† Experimental psychology in this country is just becoming of age.

A more important advance than this acquisition of apparatus is the change in the character of instruction in the institutions of higher learning. Some introduction to descriptive psychology, under the title of mental philosophy, was part of the established order even in the early American colleges. At first it fell often within the province of the president to teach psychology and philosophy. Among the institutions which to-day have 15 or more in their faculties, the presidents of only nine preserve their colonial function of occupying the chair of philosophy. Moreover, there are only five among the 150 institutions‡ studied in this paper, in which no instruction in psychology is given. These five are Catholic schools.

Psychology is now organized as an entirely separate department in four universities, and there are professors or assistant professors having the title in psychology in about 30 others. The administrative arrangements in these latter are such as to associate psychology in the same department with either philosophy or education. In the middle west, especially, we find a movement to connect psychology and pedagogy. This is true of Colorado University, Cornell College, Upper Iowa University, South Dakota University, Illinois University, Ohio State University and the New York University School of Pedagogy. In all the other colleges psychology preserves its old affiliation with philosophy. On account of its intimate relation, as a pure science, to the philosophical disciplines, the close connection of these two departments may be expected to long continue. Many of the professors in both subjects regard it to their mutual advantage to preserve this condition. If we ought not to expect the growing strength of psychology to be manifested in the establishment of independent departments, we may yet find it shown in the size of the instructional force. There are to-day 45 colleges employing more than one person to give courses in psychology. The largest faculty in psychology is found at Columbia, where eight men give their entire time to the subject and four others give part time. Seven universities employ five or more for instruction in psychology.

The department organization, as above outlined, shows less progress than the rapid differentiation of the subject matter taught. Subdivisions have increased in number and strength, until recently a specialist in the application of psychology to teaching was made 'professor of educational psychology.'

* 'Report of the United States Commissioner of Education,' II., 1139.

† Founded at Johns Hopkins by G. Stanley Hall.

‡ The colleges were selected on the basis of the size of their faculties, as shown by the Report of the U. S. Commissioner of Education for 1901. All institutions of college rank having 15 or more in their faculties were taken; 95 of them had faculties of 20 or more members.

Comparative psychology, which considers the mental life of lower animals, no longer retains its place on the skirmish line; separate instructors, rooms and equipment mark its permanent position in the university. Twenty-two colleges now offer curriculums with comparative psychology cited as an independent course. In planning for the new laboratory in Emerson Hall, Harvard, a comparative psychologist went to Europe expressly to study the German 'institutes,' so as to be ready to introduce the most perfect arrangements for studying the psychology of animals. Besides these subtopics there are a score or more of others treated in separate courses by officers of the psychological departments. Intimately related subjects, like anthropology and sociology, have become university departments. The instructors in psychology, in addition to the familiar courses in descriptive and experimental psychology, are teaching such phases of the science as physiological psychology and abnormal psychology; genetic psychology and child study; historical, analytical and systematic psychology; the psychology of the emotions and will, the psychology of logic, of esthetics, of ethics and of religion; the application of statistical methods to psychology; experimental phonetics and various other investigations in special fields. There are at least 62 colleges where three or more courses with psychological titles are announced in the catalogues; 38 give five or more courses. At Columbia the department of psychology alone offers 20 different courses. The present differentiation in psychology is more noticeable when compared with the condition ten years ago. Professor Delabarre, writing at that time for *L'Année,* outlined the courses in the 26 American institutions. Only 16 then offered as many as five courses.

Turning from the attitude of the faculties toward psychology to the opinion among the students, the data which have been furnished by the laboratory directors are suggestive.* The student view is certainly of vital importance; psychology must depend largely on it for the future. The records at hand approximate the registration in psychological courses among 34 universities, each of which has a laboratory equipment worth $1,000 or more.† In trying to estimate the importance of psychology in the work of the student body, the registration in this department may be compared with the total enrolment of the colleges in which psychology is offered. These are only the graduate school and the colleges of pure science, of literature and of arts. The class rolls in psychology for the group of universities studied include this year from 10 to 50 per cent. of the students to whom it is offered.‡ Clark University, where the enrolment in psychology reaches about three fourths of the students, ought to be considered apart. Its position in regard to graduate study in psychology is unique on account of the prominence of President G. Stanley Hall, which has attracted a group of students with psychological interests. By omitting Clark our average becomes quite representative of conditions in the larger institutions; we find that the attendance on psychological courses is approximately 20 per cent. of the total enrolment. It seems fair to suppose that a third of the students in these 34 institutions, even in the colleges of science, literature and arts, can not

* I wish to take this opportunity to thank some fifty professors who have shown much consideration in supplying information regarding attendance on courses, laboratory equipment, etc.

† For a list of the institutions considered, see the discussion of laboratories, later in this paper.

‡ It has not seemed advisable to try to exclude double registrations in psychology, as they are comparatively few, and as in some cases only the approximate enrolment has been furnished.

register for psychology. Freshmen are excluded in all but eight, while eight do not admit even sophomores. The average enrolment in psychology would, therefore, mean that about 30 per cent. of the students to whom it is offered are taking some course in this department. With the shifting registration during the last three years in college, when the subject is generally taught, it is hardly claiming too much to suppose that 60 per cent. of the graduates from the larger universities in America today have taken at least an introductory course in psychology. When it is remembered that psychology is required for graduation in only eight of these larger institutions, the popularity of the subject among students can hardly be questioned.

Any ranking of the universities as to attendance in psychology would have little meaning on account of the numerous local factors which affect the enrolments. In some institutions an introductory course is required of all juniors; again we find that the percentage is reduced by the student interest scattering among the many prominent professors in large universities. The percentage of students studying psychology in Harvard, Yale and Chicago, for example, is in each case slightly below the average, while the number of students to whom they offer psychology is larger than anywhere else except Columbia. At the last-named institution the percentage reaches 32, but the students are required to take an introductory course, which is left optional in the other three. Cornell occupies a medium position; its enrolment in psychology is just 20 per cent. By comparison with reports from the other laboratories, the distribution of students among the various courses given at Cornell seems to be quite typical. In detail it is as follows: Number of students in the colleges where psychology is offered, 1,200; attending the introductory courses in psychology (open to sophomores), 175; the experimental course (open to juniors), 30 students for one semester, 20 continuing for the year; the research courses, 6 graduates doing major work and 6 undergraduates taking up minor problems; the psychological seminar, 15 students, limited.

Some idea of the actual number studying psychology may be gained from the fact that the introductory classes at Columbia, including Teachers College and Barnard, show an enrolment of 435 students; at Harvard, 300; Princeton, 250; Nebraska, 225; Cornell, Minnesota, Toronto and Wellesley, 175. The interest manifested by graduate students in productive work is best illustrated by a quotation from the address of Professor Cattell, as chairman of the section of anthropology of the American Association for the Advancement of Science: "In the year 1897 there were given by American universities eighteen doctorates with psychology as the major subject —more than any science except chemistry, six times as many as in astronomy, and nine times as many as in anthropology."* A summary published in 1903 showed that in five years the number of doctorates in psychology had been 68. Only three other sciences were credited with more—chemistry, 137; zoology, 72; and physics, 69.† Each of these doctorates meant the completion of an original investigation in the field of the major subject.

In winning its way to favor among scientific men, psychology has depended largely on its experimental work. The improvement in quality can only be apprehended by comparing the recent volumes of the technical journals in psychology with those of ten years ago. The adoption of new statistical methods, the use of correlation in studying psychological problems, the

* Science, VIII., 533.

† Science, April 10, 1903.

revolution in educational psychology which is placing its research on a very different basis than enumeration of answers to questionaires; these and other changes have introduced quantitative work in a way that was regarded as almost impossible a decade ago. That the students are acceding to this demand for training in refined methods of measurement is partly attested by an average enrolment of 25 students in laboratory courses in 34 institutions where the best facilities for this work are offered. In 19 of these universities we find seminars devoted distinctly to psychological problems. Still more encouraging is the fact that more than a hundred graduate students are to-day carrying on research in residence at these laboratories, while 63 undergraduates are investigating minor problems. Few other sciences can show an equal record, and certainly no other country approaches the United States in the number occupied in zealous psychological research.

It is ten years since any comprehensive survey of American facilities for psychology has been published. At that time Professor Delabarre described each of the laboratories in the United States, 26 in all.* A separate account of each laboratory is to-day out of the question. We must content ourselves with tabular statements. A study of the larger laboratories shows that they fall conveniently into three classes on the basis of the value of their equipment. This grouping, it must be remembered, is for convenience and is not intended to indicate the relative importance of the laboratories. The first group embraces those which have apparatus and fixtures valued at $\$10,000 \pm \$2,000$. This includes: Clark, Columbia, Cornell, Harvard, Pennsylvania and Yale. A second group contains those the equipment of which ranges in value between $\$5,000 \pm \$2,000$. In it are Brown, Chicago, Indiana, Iowa, Michigan, Princeton, Toronto and Wisconsin. The third group embraces all the other laboratories here studied. The equipments are valued between \$1,000 and \$2,000. It includes Bryn Mawr, California, Cincinnati, Colorado, Illinois, Indiana, Kansas, Leland Stanford, Jr., Minnesota, Missouri, Mount Holyoke, New York University School of Pedagogy, Northwestern, Ohio State, Randolph-Macon Woman's College, Texas, Vassar, Wellesley and Wesleyan. Under this arrangement the average equipments of the universities in each group are approximately \$10,000, \$5,000 and \$1,500, respectively.

The income of the laboratories might better express their potential value. Annual appropriations for improvement range from \$100 in a few of the smallest to \$1,000 in five of the largest; the average is slightly over \$400. These sums are small considering the needs, but, nevertheless, represent a condition which means the doubling of the equipment about every ten years, even if the generosity of the university authorities is not further awakened. In spite of the constant increase in equipment, the directors of the best laboratories are seriously embarrassed in trying to meet the demands made upon them for instruction in experimental work. The opening of tempting fields of investigation has to be postponed until the needs of the present courses are met.

Another mark of the material development of this youthful science, and particularly of the large research interest in the subject, is found in the increasing space occupied by the department in the university buildings. In the following institutions ten or more rooms are now devoted exclusively to psychology: California, Chicago, Clark, Columbia, Cornell, Harvard,

* *L'Année*, I., 209–55.

Indiana, Iowa, Leland Stanford, Jr., Michigan, Pennsylvania and Toronto. Yale should be grouped with these on account of its plan to retain a very large room for undergraduate experimental work, instead of dividing it up as is done elsewhere. On an average, eight rooms are occupied by psychology in the group of universities considered. The further scientific progress of psychology is assured by a general plan to provide as many separate rooms as possible to be used for research work. Six out of the eight rooms are usually available for special investigations. On account of the necessary isolation of the experimenter in psychology, this provision is of vital importance to the science.

The demand made upon the laboratories for research equipment is reflected also in the establishment of complete workshops in connection with the department. The psychological workshop has reached its most prominent development at Yale and Columbia. At New Haven the equipment of the shop is valued at $2,000. A teacher of manual training spends half his time during the school year and all of his time during the summer working for the department. A student also frequently assists in the shop. At Columbia a skilled instrument builder and a boy assistant are employed the year around; the value of the shop equipment is approximately $1,000. Cornell is soon to add a new workshop to its splendid laboratory equipment. It has for some time employed a mechanician half the day. Several of the laboratory directors prefer to have large pieces of apparatus built outside the department, and, therefore, maintain only a small shop for repairs. Of the 34 universities, all but seven have made provision for at least a work-bench and tools in the department.

To judge the worth of a laboratory on the basis of floor space and dollars invested is certainly unwise; yet size and capital are not unimportant considerations, even when comparing institutions of learning. An interesting classification of a different nature is suggested by the 'Statistics on American Psychologists,' recently published.* The ranking indicates something of the past performance of the older laboratories. The article considers 200 psychologists and tabulates the institutions that have contributed to their academic training (undergraduate and graduate). The seven highest rank as follows: Columbia, 42; Harvard, 42; Cornell, 27; Yale, 23; Princeton, 20; Pennsylvania, 17; Johns Hopkins, 13; 66 other institutions have also taken part in stimulating some of these prominent psychologists. It is recognized, of course, that this ranking overestimates the time that the laboratory has been in service. In proportion to the number of students working in certain younger laboratories, it may be said that the contributions to the science which they are making is often fully equal to the splendid achievements of those longer established.

In one respect the American laboratories differ distinctly from the German. The latter are often impressed by the personal interest of their directors, which shows itself in some special line of investigation. The laboratory of Stumpf at Berlin, with its complete technical equipment for auditory work, is a striking example. It may be said, however, that certain tendencies do seem to characterize a few of the older laboratories in this country; although in no case do they interfere with a broad teaching of all phases of psychology. In this science, as in all others, the American university first of all teaches, and teaches well. Nevertheless, the trends of thought which prevail among graduate students at present suggest that those who are funda-

* J. McK. Cattell, *Amer. J. of Psychol.*, XIV., 324.

mentally interested in philosophy gravitate to Harvard; those seeking primarily the scientific attitude find Columbia congenial; Cornell is the best university to place the student in touch with the historical development of experimental work and of systematic psychology; Clark is most widely known for its pedagogical interest in the science; Princeton for the biological interpretations of Professor J. Mark Baldwin; Yale for training courses in psychological measurement; and Pennsylvania for the introduction of extended experimental work into its sophomore introductory course in psychology. Nearly all the larger laboratories have some feature in which they are better prepared for specialization than their contemporaries. Only an extended study of the products of each would reveal these fruits of successful development along particular lines.

Satisfactory as have been the gains in the past, there are signs which point to fully as large growth for psychology in the near future. That the reader may sense more vividly the increasing stature of the science, there are given below the condensed statements of laboratory directors as to definite improvements now contemplated or just completed:

Harvard.—New quarters for the psychological department are to be provided in Emerson Hall, the $200,000 building which is now being constructed for the exclusive use of philosophy and psychology. The laboratory will occupy the third story, 22 rooms. Sixteen rooms will be available for research. Library, seminar and lecture rooms will be located on the other floors.*

Johns Hopkins.—No detailed plans made as yet, but a fully equipped psychological department and laboratory will be established by Professor J. Mark Baldwin, who previously founded laboratories at Toronto and Princeton, and has recently been called to this university. Professor George M. Stratton, of California University, has also been secured by Johns Hopkins for the work in psychology.

Leland Stanford, Jr.—The department has moved this year into new quarters, which Professor F. Angell expects to have fully equipped with apparatus in about eighteen months. The new arrangement provides a lecture room for a hundred students, a library and seminar room, two office rooms (one of which may be used for research), a work room, two dark rooms, a silent and dark room, five large closets for storage, drum smoking, lockers, etc., and nine other rooms for investigation and instruction.

Michigan.—A one-story building, 125 x 35 feet, this year was assigned to the psychological department. It provides 15 rooms, including two dark rooms, all provided with water, gas, low and high potential electric currents.

Cornell.—The building of the new Goldwin Smith Hall will provide a demonstrational laboratory, equipped by a special appropriation, and also a large lecture room fitted up for psychology. Besides this addition, the present quarters in Morrill Hall will be increased by adding at least two rooms and possibly as many as eight. A new workshop with improved equipment has been provided this year. It is the plan at Cornell to buy three or four big pieces of apparatus annually, pieces like the Wundt tachistoscope, the Helmholtz vowel apparatus, etc. New apparatus for quantitative drill work and for class demonstration has been built recently.*

Pennsylvania.—In 1903 a lecture room with a seating capacity of 50 was equipped with laboratory tables and with lockers for

* Hugo Münsterberg, *Harvard Graduates' Magazine*, IX., 424–433.

* E. B. Titchener, *Amer. J. of Psychol.*, XIV., 175–191; XV., 57–61.

each student. Another large room was divided into seven small rooms, principally for use in research. These rooms are all wired for telephones and electric currents. The two improvements cost $2,000 and Professor Witmer expects to spend from $1,000 to $2,500 in the near future in further fitting these rooms for original investigation. He will then have a time room, rooms for chronoscope and chronograph, a subject reaction room, small and large dark rooms (the latter 50 feet long for visual experiments). Special provision is to be made for readily making psychological tests on normal and defective children. Within the next two years the department expects to secure two additional rooms.

Clark.—The organization of philosophical and psychological departments in the college has taken place this year; Professor C. E. Sanford gives the courses in philosophy and James P. Porter those in psychology. An appropriation of $1,500 was made for fitting up this new department in addition to the graduate laboratory in charge of Professor Sanford.

Nebraska.—The department is to have seven rooms, 2,400 feet of floor space, on the upper floor of the new physics building, now being constructed. At present it has four rooms.

Wesleyan.—A suite of four rooms became available for the department this spring; only one room was used previously.

Vassar.—A thousand dollars was appropriated in 1903 to establish a psychological laboratory under the direction of Dr. Margaret F. Washburn.

Bryn Mawr.—The department will move next year into a building now being constructed and will occupy five rooms, instead of four as at present. An assistant in the laboratory was added last year.

Yale.—Dr. C. M. McAllister was this year appointed instructor and W. M. Steele made assistant in the laboratory. Apparatus necessary for the experimental course is being duplicated so as to provide a complete equipment for each group of two students.

Texas.—Psychology in charge of Dr. Warner Fite is this year given apart from the school of pedagogy.

Wisconsin.—Professor Jastrow contemplates adding rooms equipped for comparative psychology and the employment, together with other departments, of a mechanician. A shadowless room for stereoscopic research has been constructed this year.

California.—An instructor in experimental psychology, Dr. P. S. Wrinch, was added this year to the instructional force.

Chicago.—Professor James R. Angell expects a new building for psychology eventually, although not immediately.

Minnesota.—New quarters are expected if a building is constructed for history, political science and philosophy.

The recent record of psychology makes it plain that a statement of Professor Titchener, of Cornell, made in 1898, has now become trite. Speaking of psychology in an article in *Mind,* he said: "The training that can now be obtained in the American laboratories is at least as good a fitting for work in an American university as can be gained in Germany."* America has excelled Europe in psychological equipment for ten years. That the progress has not stopped with gaining an advantage in value of equipment is a matter of congratulation. In promoting this younger science, the young nation has not hesitated to continue to enlarge the opportunities for psychology, trusting to the workers in the science to refine the quality of the output.

The foregoing paper has aimed to bring

* 'A Psychological Laboratory,' *Mind,* N. S., VII., 330.

together various views of psychology that may be gained from a university standpoint: The enlargement of the portion of university appropriation devoted to this science; the broadening interest and increasing specialization within the department of psychology itself; the advanced position attained in the university faculties; and the growing favor among students and among scientific investigators. In the history of this institutional development the psychologists themselves deserve much credit. They have continually justified the confidence placed in them by intensifying their instruction and by increasing the merit of their literary and research contributions, until to-day these rank with the best of any nation.

BURT G. MINER.
UNIVERSITY OF ILLINOIS.

SCIENTIFIC BOOKS.

Gems and Gem Minerals. By Dr. OLIVER CUMMINGS FARRINGTON, Curator of Geology, Field Columbian Museum, Chicago, Ill. Chicago, A. W. Mumford. 1903. Imperial 8vo. Pp. xii + 229, with plates in color and black and white.

This work is a popular and comprehensive book on the subject of precious stones, treating of their finding, cutting, history and chemical composition. It is intended to supply a long-felt want for an inexpensive popular treatise adapted alike to the mineralogist, the jeweler and the general reader; and the work is one full both of illustrations and information. The nature of the leading gems, their occurrence, their mining, their color, luster, hardness and specific gravity; their optical properties, their crystalline form, their cutting, and the various superstitions connected with them, are treated in successive chapters in the order named. The minor gems follow in their natural sequence, a chapter or part of a page being devoted to each of the principal species and varieties. The volume is printed on good paper, and in large clear type. The illustrations are of two kinds, in colors and in black and white, the latter giving maps of gem regions, methods of mining and the various forms of natural and cut stones, most of the maps being made by half-tone processes and many of them very exact. The special feature of the work, however, is found in the numerous plates produced by the three-color process, and in most cases direct from the objects themselves. The application of this method makes possible a vivid presentation of most of the varieties of precious and semiprecious stones, almost exactly true to nature, a result which of course could not be attained by any black-and-white process.

Some of the plates prepared for this book have already appeared in that excellent and instructive popular publication, 'Birds in Nature,' issued by the same publisher, whose reprints of birds and other natural objects have been adopted by many educational institutions for use in teaching, in so much that more than 100,000 plates have been ordered by a single school committee. Others of the plates are reproduced from the great work, 'Edelsteinkunde,' by Dr. Max Bauer, who was one of the first to utilize the three-color method with success.

Dr. Farrington has had peculiar advantages in preparing such a work, from his position in charge of a great reference collection. This is based on the Tiffany collection of gems gathered for the Columbian Exposition at Chicago in 1893, and subsequently purchased for the Field Columbian Museum, where it is now installed in Higinbotham Hall. It is the best book published up to the present time as regards text, illustration and exact facts for a low price and useful to every mineralogist or collector of gems.

The color work in the gem plates compares remarkably well with the three-color work of Ives, who has attained excellent results, more particularly, however, with porcelains, enamels, pottery, etc., and is somewhat in the line of the plate illustrating North American gems issued by the U. S. Department of Mining Statistics in its report for 1899.

The Heliotype Company, of Boston, Mass., also, have printed (unpublished) a most re-