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CREATIVE EDUCATION

IN

SCHOOL, COLLEGE, UNIVERSITY, AND MUSEUM

VOLUME IV OF *COLLECTED ADDRESSES AND ESSAYS*

The author, Roy Chapman Andrews, and Walter Granger in the heart of the Desert of Gobi, on the scene of the great discovery anticipated by prolonged observation, imagination, research, and induction, and crowning the author's fifty years of research

10/6

CREATIVE EDUCATION

IN

SCHOOL, COLLEGE, UNIVERSITY, AND MUSEUM

PERSONAL OBSERVATION AND EXPERIENCE OF
THE HALF-CENTURY 1877–1927

BY

HENRY FAIRFIELD OSBORN
A.B., SC.D., PRINCETON; LL.D., TRINITY, PRINCETON, COLUMBIA
HON. SC.D., CAMBRIDGE; HON. D.SC., YALE, OXFORD, NEW YORK
HON. PH.D., CHRISTIANIA (OSLÔ); FOR. MEMB. ROYAL SOCIETY
RESEARCH PROFESSOR OF ZOÖLOGY, COLUMBIA UNIVERSITY
SENIOR GEOLOGIST, U. S. GEOL. SURVEY
PRESIDENT, AMERICAN MUSEUM OF NATURAL HISTORY

ILLUSTRATED

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TO

A NUMBER OF MY FORMER STUDENTS

WHO HAVE DEVOTED THEIR LIVES TO CREATIVE WORK

ROY CHAPMAN ANDREWS. WILLIAM BEEBE. B. ARTHUR BENSLEY. DAVID BOVAIRD. BARNUM BROWN. ADAM T. BRUCE. HAROLD COOK. C. FORSTER COOPER. CHARLES EARLE. EVAN M. EVANS. WALTER GRANGER. WILLIAM KING GREGORY. N. R. HARRINGTON. LAWRENCE M. LAMBE. FRANCIS E. LLOYD. RICHARD S. LULL. WILLIAM DILLER MATTHEW. CHARLES F. W. McCLURE. JAMES HOWARD McGREGOR. CHARLES S. MEAD. ARTHUR M. MILLER. JOHANNA KROEBER MOSENTHAL. AISAKU NAKAGAWA. HENRY ORR. RAYMOND C. OSBURN. PAUL M. REA. OLIVER S. STRONG. FRANCIS B. SUMNER. BERTRAM H. WATERS

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Observation and Induction Begin in the Schools ("Biology and Other Sciences in the Schools"), in the 1893 *Report of the Schoolmasters' Association of New York and Vicinity;* Adams's The Harvard College of 1906 ("Ideal College Training"), in *The* (Springfield) *Republican*, June 17, 1906; The World's Debt to Biology, in *The Chautauquan*, August, 1896; The Seven Factors of Education, in *Educational Review*, June, 1906; Florence Nightingale, in *The American Journal of Nursing*, February, 1911; and Training of the Museum Educator, in the *Proceedings of the American Association of Museums*, 1917.

INTRODUCTION

INTRODUCTION

Retrospect—A Junior Professor, 1881-1891—Creative Principle in Education, 1892-1926—Creative Education of the Child, 1891-1926—Creative Intelligence—The Joy of Creative Work—The Goal of Creative Education.

FIFTY years as a teacher have afforded an original retrospect and prospect of the art of education, an art which has an unchanging element in the quality of the human mind and an ever-changing element in the vicissitudes of our environment which we call civilization. Throughout this long half-century period I have been consistent with my oft-repeated advice to my students, namely, to think a subject out for oneself and then to read what others have thought about it. I have myself given an immense amount of personal thought to the methods of intellectual education and I am free to confess that I have depended very little on reading even of the works of the great masters and innovators to whom I refer from time to time in this volume. My rule with myself and with my students has been, first, to try to master a subject or to thoroughly understand it; second, to try to add something of my own to this subject—that is, to produce or create something new. I have followed this productive principle successively in psychology, in neurology, in comparative anatomy, in palæontology and finally in biology or the philosophy of life. In each of these great subjects I have undertaken original research

and publication and have attempted to impress upon myself and upon the talented students who sought my advice the spirit of thoroughness and then of creation or production.

Accordingly, in dedicating this volume to the graduate students of Princeton and Columbia who began their original researches in various branches of biology under my direction, I am giving expression to the most joyful recompense of a teacher's life, namely, the original, creative, constructive work of his students.

Retrospect, 1880-1908

In the first decade, 1880-1890, of my career as Professor of Comparative Anatomy in Princeton and in the more mature period of 1891-1908 as founder and head of the Department of Zoölogy at Columbia, I had the perennial privilege of coming into personal touch with members of twenty-eight classes of undergraduate and graduate students of Princeton and Columbia and with graduate students of other universities. Although my courses were chiefly elective, *original observation and research were required* or *compulsory* from the junior year onward to the attainment of the bachelor degree and of the valued degree of doctor of philosophy.[1]

Many of my promising biological students at Princeton and Columbia entered medicine, and in the dedication of this volume I include a number of those who carried the spirit of research into their medical work. The dedication, however, is chiefly to those

[1] My estimate of the significance of the Ph.D. degree is set forth in Chapter IV, "Creative Research in the University."

who began their advanced studies and researches in neurology, comparative anatomy, palæontology and geology under my direction and who have continued in the full tide of the productive and creative spirit to the present time. Their brilliant achievements in exploration, research, technical and popular scientific writing, instruction and inspiration of new generations of students have far surpassed even my fondest hopes. My "biological sons" are producing in various parts of our country and abroad a young army of "biological grandsons," as I like to call them. As my lecture and laboratory courses covered the very broad field of comparative anatomy—the structure of the skeleton, the muscular, vascular and nerve mechanisms, the structure and functions of the brain, the anatomy of the teeth—and the application of these living branches of zoölogy to palæontology, my graduate students have covered an equally broad field in biology and geology and a world-wide field in exploration.

A Junior Professor, 1881-1891

I shall recall in Chapter I, "Fifty Years a Student with Students," some of my own experiences as a student and some of the memorable incidents of student reaction to my teaching.[1] Beginning in the autumn of 1881 as a very young and inexperienced assistant professor of comparative anatomy in the College of New Jersey (the larger title of Princeton University was not assumed until 1896), I opened my courses very much along the lines I had myself followed two

[1] Compare Autobiographic Foreword in Osborn: Impressions of Great Naturalists.

years before in the laboratories of Francis Maitland Balfour at Cambridge and of Thomas Henry Huxley in London. While the technique and outline of the courses followed the general method introduced by Huxley into biological teaching, my attitude toward the students was rather that of Balfour in his splendid course in comparative anatomy, namely, a personal and more or less intimate attitude which is possible in classes of fifteen to twenty-five but impossible with the very large classes of the present college and university period. With my college students, I depended from the outset neither upon discipline nor upon the marking system, but upon the *inherent interest of the subject.* Once captivated by the interest of the subject, a student needs to be held back rather than pushed forward! I felt instinctively that original observation and original thinking by the students were far more important than any instruction or body of learning I could give them and I began to practise creative methods of education long before I had formulated any theory or principle of education.

One of the most brain-stirring periods of my life was in my study in the American Museum of Natural History when Baca-Flor, the Peruvian portrait painter, narrated to me his search for the lost art of the ancients, as he termed the masters of painting of the fifteenth and sixteenth centuries. For fifteen years he had read all that was written and had listened to all the lectures offered in Paris, but no one told him the secret of the ancients. Finally he concluded that their art was lost and must be rediscovered. Similarly and on my own account, in 1903[1] I came to the conclusion that

[1] Osborn: The Mediæval and the True Modern Spirit in Education. See Chapter III of this volume.

something had been lost in the art of education. I looked into some of the pedagogic literature of the day; it left me entirely unsatisfied; I felt that some principle must be rediscovered. Then I began to delve into my own experience and to wonder how I got my own education. I tried to get down to the very bottom of things and settle upon solid bases, cutting out of vision all the temporal and contemporary supports. One essay which may have helped me was Ruskin's "Seven Lamps of Architecture," but it was a mere coincidence that I came to the conclusion that the solid bases of education lay not at all in what modern pedagogues, such as President McCosh of Princeton and President Eliot of Harvard, were debating, that their controversy was matter which had temporarily assumed the aspect of solidity and of real importance, and that the real basis of education was the balanced or reasonable or well-adjusted working of seven principles, or factors, or forces, or influences, as intimately related as seven harmonious and beautiful sisters, so that none could be complete without the others; that every well-educated man from the very beginning had unconsciously worked out these seven principles in his own self-education and that the measure of his success and influence was the measure in which he employed them all or worked towards all, some flowing into him and some flowing out of him.[1]

But this centrifugal versus centripetal idea was a mere working hypothesis, tested perhaps, or sought to be tested, in my own long search; how about other men? Looking then into the lives of others, of scien-

[1] This seemed far more fundamental than the *elective* vs. *required* system, than *modern* vs. *classic* languages, than *literary* vs. *scientific* subjects of training—questions which have been debated *ad nauseam* since McCosh and Eliot crossed their swords in the '80s.

tists, of artists, of men of letters, I found corroboration. The principle of the seven cardinal elements of education is my own; if it were not I should be false to my profession of origination. It is the product of fifty years of experiment and observation as a teacher, not of reading what other people have written about education. In working it out I had undoubtedly observed and profited by the merits and failures of the work of McCosh, Guyot, Brackett, Balfour, Huxley and others of my great teachers, but it was not until after I had worked it out that I began to scan Spencer, Rousseau, Froebel, Pestalozzi, Montessori, etc. If I had reversed this order and started by reading what others had to say about education, I fear it would have atrophied my creative powers, such as they are.

Creative Principle in Education, 1892-1926

On coming to Columbia in 1892, I began to be called upon to talk about the teaching of biology and other sciences in the schools. From first to last I have given a long series of papers and addresses, lectures, forewords, and brochures of greater or less length. These papers now reach the surprising number of forty-seven and cover a very great variety of topics which touch education almost from the cradle to the grave; they form the bulk of this volume and are fully enumerated at the close of the volume. Under each chapter are assembled the papers which relate especially to that chapter, namely, to the school, the college, the university and the museum, to professional training, to the factors of creative education, and to the boundaries

of the creative spirit. Some of the papers are reprinted exactly as originally delivered; others are modified or abbreviated to make them more forceful or to avoid repetition. Following this personal bibliography [1] at the close of the volume is a list of recent books and articles by American and English authors which prove that there is at the present time a more or less concerted and widespread movement toward the greater encouragement of creative talent in all its forms, beginning with the period of childhood.

Creative Education of the Child, 1891-1926

The intellectual development of the child, as well as of the school boy and girl, fascinated me in the American Museum, where I discovered that the most surprising intellectual predispositions and tastes may manifest themselves at a very youthful age. I give some examples of this discovery in the chapters on the school and the museum.

I recently listened to a discussion of this subject by J. Howard Whitehouse, warden of Bembridge School, Isle of Wight, and William Wyamar Vaughan, headmaster of Rugby, in which the positive and negative sides were taken, and the advantages and disadvantages, the gains and losses were briefly summarized. Warden Whitehouse, who has recently made a representative collection of actual creative school work in England as a gift to the Department of Education of New York University, took the side which I am sup-

[1] See full Osborn bibliography covering the period 1879-1926, under the heading "Theory of Education" (school, college, university, museum).

porting in the present volume, and to show his point of view I may quote from one of his recent works:

> All creative interests which come into the lives of boys are good and may prove of transcendent importance. It is not that we want a boy to cut woodblocks in order to get his living when a man as a wood-engraver, any more than we desire a boy who loves flowers and creates a beautiful garden to become a professional gardener. Such boys in following these and other creative activities are unconsciously forging keys unlocking for themselves the entrance to courts of beauty and of joy—the beauty of all true work, the joy of service and self-realisation expressed in all true work, and to these courts they come with standards of taste and judgement achieved through personal effort and experience, not docilely received from others.—J. Howard Whitehouse: Woodcuts. P. xi.

So far as I observed in the English school work exhibition at Oxford, the creative movement in certain schools in England has advanced much further than in America; the actual work of the students themselves, in wood-engraving, for example, attains a very much higher level than any of our schools show. On the other hand, in the Lincoln School of New York City the creative school work in literature has already produced a surprising variety of composition in prose and verse.

Creative Intelligence

The one great force of life is its renewing and creating power, which throughout all Nature marks the impassable line between the life-world and the matter-world. True education takes its keynote from the life-world; it must instill in young and old its renewing and creating power.

Education is such a vastly comprehensive term that it includes every power and function of man as a

whole and of every cell of which man's body is composed. You cannot detach the education of the cells of the frontal lobes which distinguish the high order of human brain from the education of the cells of the liver which supply the frontal lobes with chemical reactions necessary to pure rather than to atrabilious thought. We need all the physical and all the psychical powers, and not the least the moral; we need to develop the will, the determination, the energy no less than the imagination, the individuality.

It is part of my creed that spiritual, moral and physical forces are absolutely essential as the environment of the intellectual forces, but in this volume I am writing only of the intellectual aspects of creative work. The genius of creative talent relies on the brother geniuses of hard work, of self-control and of persistent determination. The art of the teacher, whether in school, college, university or museum, is to discover this creative talent in his students and to encourage it by giving it proper nurture and environment. The creative mind is born, not made; it is an intellectual urge which may manifest itself in one of many thousand lines of activity of the human mind. Whether in industry, science, art or literature, the impelling motive of creative talent is to add something new or true or beautiful to our civilization. The creative mind may be born quite alone or as one of a group of kindred and productive predispositions, as in a rare genius like Leonardo da Vinci.

The bearing of these reflections on the modern practice of education is obvious. Originative and creative power in the germ is the very oldest of the distinctively human faculties, and the cultivation and development of this power should be the chief end of education, to

which all other forces should contribute. Man differs more, perhaps, with respect to this originative faculty than any other animal; there is a pretty sharp division between the sulphidic or productive and original mind and the bromidic or parrot mind. But in educating youth we should always proceed upon the theory that there is some sulphide if we can only discover it; if it is not there we should seek to engender it. With some exceptions our general tendency in education is to encourage the bromidic habit of mind; at least, our systems of premiums and awards and honors and standing are largely designed for exceptional memory rather than for exceptional originality and creative power.

The Joy of Creative Work

Since my regretful retirement in 1908 from active teaching as head of the Department of Zoölogy of Columbia,[1] I have solaced myself as an educator by endeavoring to adapt education to the new problems of civilization and the prospects of the future. From the standpoint of the lofty creative aim of education, the present prospects in America are far from bright, because the imitative element in our civilization is so dominant. I touch upon the tyranny of imitation in my Barnwell Address of 1926, included in Chapter II. More or less servile imitation of the creative achievements of the past leads on to fame and fortune and to other rewards of modern life. Imitation in speech, in

[1] On the presentation of a complete plan for biological teaching in Columbia University, the author was elected DaCosta Professor of Biology (Zoölogy) in 1890. This plan appears in full in Chapter III. On retiring from the active chair to become President of the American Museum of Natural History in 1908, the author was given the title of Research Professor of Zoölogy in Columbia, in reference to his future dedication to research and writing.

manner, in dress, is becoming world-wide, especially through the press and its methods of photographic reproduction. In almost every country beauty and originality of design are giving way to uniform and tiresome mediocrity. Even more lethal or deadly is the mediocre and stereotyped environment of our thought.

Let us, therefore, stoop to simple and primitive methods in order to conquer; let us show our youth that creative work is far more attractive than sport, than any of the modern forms of amusement, than newspaper or magazine reading, than any form of social dissipation, and, above all, that it has far higher rewards than any form of imitative work, however lofty the motive. Let us conclude this prospect with the inimitable apostrophe of Bergson:[1]

> Philosophers who have speculated on the significance of life and the destiny of man have not sufficiently remarked that Nature has taken pains to give us notice every time this destiny is accomplished; she has set up a sign which apprises us every time our activity is in full expansion; this sign is joy. I say joy; I do not say pleasure. Pleasure, in point of fact, is no more than an instrument contrived by Nature to obtain from the individual the preservation and the propagation of life; it gives us no information concerning the direction in which life is flung forward. True joy, on the contrary, is always an emphatic signal of the triumph of life. Now, if we follow this new line of facts, we find that wherever joy is, creation has been, and the richer the creation the deeper the joy. The mother looking upon her child is joyous because she has the consciousness of having created it, physically and morally. A man who succeeds in his enterprise—for example, a captain of industry whose business is prospering—is he joyous solely on account of the money he is winning and the notoriety he has acquired? Doubtless these elements count for much in the satisfaction he feels; but they bring him pleasures rather than joy, and whatever true joy he tastes belongs essentially to the consciousness he has of having

[1] Henry Bergson: Huxley Lecture. Delivered at University of Birmingham, May 29, 1911; reprinted as "Life and Consciousness" in the *Hibbert Journal*, Vol. X, No. 1, October, 1911, pp. 24-44.

established an enterprise which marches on, of having created something that goes ahead. Consider exceptional joys like those of the great artist who has produced a masterpiece, of the scientific man who has made a discovery or invention. We sometimes say they have worked for glory and derive their greatest satisfaction from the applause of mankind. Profound mistake! We care for praise in the exact measure in which we feel not sure of having succeeded; it is because we want to be reassured as to our own value and as to the value of what we have done that we seek praise and prize glory. But he who is certain, absolutely certain, that he has brought a living work to the birth, cares no more for praise and feels himself beyond glory, because there is no greater joy than that of feeling oneself a creator. If, then, in every province, the triumph of life is expressed by creation, ought we not to think that the ultimate reason of human life is a creation which, in distinction from that of the artist or man of science, can be pursued at every moment and by all men alike; I mean the creation of self by self, the continual enrichment of personality by elements which it does not draw from outside, but causes to spring forth from itself?

The Goal of Creative Education

There is little doubt in my mind that potential abilities, for the most part, remain undiscovered, for it is often only a happy accident which brings an inspiring object or inspiring idea within the range of the intellectual taste or predisposition. Sometimes this concurrence of predisposition and inspiring object comes early in life, but quite often it happens late in life and after a long career in some pursuit to which one is not fitted by natural endowment. I have in mind two marked cases of this kind of late entrance into a highly successful and productive career; for personal reasons only one may be cited: James Terry, a man of business, while visiting the country house of a friend, was descending a stairway in the dark and groping his way by passing his hand along the wall. Suddenly his hand

slipped into an alcove or recess, at the bottom of which he touched a large stone axe or 'celt.' Grasping the celt and hastening to the library, he inquired of his friend where it had been found and if others might be found in the same locality. On the following day he visited the locality, secured other celts and stone implements, and thereupon became infatuated with the subject of American archæology. He abandoned business and devoted the remainder of his life to archæological exploration and collection, thus accumulating the extensive James Terry Collection of the American Museum of Natural History, one of the finest of its kind.

Closely similar experience was that of a merchant of Ipswich, England, J. Reid Moir, who entered upon a career in prehistoric archæology through the casual handling of a single flint implement, as described in Chapter II of this volume.

The unhappy people of the world include two classes: those who have no creative talents, and those who possess talents and never discover them. Our goal of creative education, therefore, is to discover the potential abilities in science, art and literature which undoubtedly exist in the minds and spirits of the youth drawn from the many races which in the past two thousand years have created the science, art and literature of Europe. Such abilities are often like beautiful, tender and sensitive plants which soon perish in an unkindly, unsympathetic environment but which, if fostered and encouraged, will blossom and bear fruit in a material and mechanical civilization that is inwardly yearning for the True, the Beautiful and the Good.

I

FIFTY YEARS A STUDENT WITH STUDENTS

In this retrospect of fifty years, the reflection which gives me the greatest pleasure is that I have always been on the side of the student, rather than on the traditional faculty or professorial side. With each incoming class I usually asked at the first meeting: "Do you really feel interested in this subject? If not, I would advise you to change your course. If you do feel interested, I throw the whole responsibility of attendance and of work upon you. I shall never mark an absence or take a roll; if you are not in the lecture room or laboratory I shall know it is for some good reason of your own." Under these conditions I never knew a student to change his electives. At a subsequent meeting I would encourage independent thought thus: "I am giving evidence for this or that statement to the best of my knowledge and belief. Weigh this evidence for yourself and if you are not convinced try to find your own interpretation." Thus through the encouragement of original research the talented students soon found themselves, and more than once my interpretation was proved to be incorrect.

FIFTY YEARS A STUDENT WITH STUDENTS

Absence of Pose—Teacher and Creator—Self-Discovery—The Beginning of Two Careers in Geology and Palæontology—Prehistoric Causes of Self-Discovery—Value of the Intellectual Struggle for Existence—Mind-in-the-Making—Three Main Objects of the Intellectual Life.

ONE of the first principles in the teacher's code is never to pose, never to assume an attitude of intellectual superiority, of "knowing it all," when in your heart of hearts you are forever conscious of the close boundaries of your knowledge and of the unknown infinity beyond. I have always remained a student with my students.

The day of the professor who was reverenced merely because he looked like a professor or had certain professorial idiosyncrasies is past; the day has arrived of the professor who is reverenced because he is eagerly and enthusiastically, often at great personal sacrifice, endeavoring through his own research and discovery to advance the knowledge of his own subject. Such a professor may bear all the dignity of his great subject and all the impressiveness which even his limited knowledge gives him in the eyes of his students, yet he perennially feels like a student and need not court popularity by assuming to act like a student. The simplicity of modern professorial bearing is illustrated by the response of the late Henry Sidgwick, profes-

sor of moral philosophy in the University of Cambridge, of whom it is said that his stammering speech always served him well in bringing out the most forceful word in his jokes. On one occasion a visiting German professor of the old school, surprised at the general lack of scholarly aspect among the Cambridge dons, remarked, "You do not seem to have any real savants here." Sidgwick asked, "What do you mean by 'real savants'?" "Why, I mean men who look and dress like savants," replied the German visitor. "Oh, yes, we have them," said Sidgwick, "but we do not know them by that name; we call them p-p-prigs."

Teacher and Creator

Unfortunately for both the teacher and student, the genius of creative research rarely goes on all fours with the genius of teaching. Some of the greatest creators are notoriously poor teachers and some of the greatest teachers have shown their creative ability only in the art of teaching itself. Is not this true of Pestalozzi (1746-1827), of Froebel (1782-1852), of the more recent Montessori? Jean Jacques Rousseau (1712-1778) is one of these discoverers of the art of teaching who never filled either a tutorial or professorial chair, yet his "Emile" is a classic of the unworkable theory of self-realization unchecked either by accumulated past experience or by hourly competition with other youth. Socrates, Aristotle, Huxley, Foster, and our own Agassiz and Welch stand out as at once creators and teachers. It is only when one is privileged to be at the elbow of a great student-teacher watching the workings of his mind, the difficulties which

confront him, the unflinching resolve to advance, the continued self-denial, that one realizes he is entering the 'kingdom of research,' which is only less difficult to enter than the Kingdom of Heaven. To this kingdom of research "many are called but few are chosen"; of the many students with real creative ability, few have the other essential spiritual and moral qualities or the persistent ambition of Lycidas "to shun delights and live laborious days."

It was my good fortune as a student to be continuously inspired by the very rare combination of creative and educative ability in great teachers in each subject I pursued. In geology, Prof. Arnold Guyot, of Princeton, a distinguished exponent of the ancient glaciation of Switzerland and the relatively new theory of a great Glacial Age, ardently encouraged my first original researches in Palæontology. President James McCosh, leader of the Scottish school of philosophy, author of numerous original philosophical works, and the most forceful and influential teacher of my day in Princeton, encouraged, guided and actually shared my youthful researches in Psychology. Francis Maitland Balfour, of Cambridge, the most brilliant example of combined creative and educative ability and the highest exemplar of the life of "a student with students," at once enrolled me in research in Embryology. I did not feel the creative force of Thomas Henry Huxley, of the London science schools, because, owing to his preoccupation with many outside duties and responsibilities, he never intimately shared his personal life as a creator; but from Huxley I imbibed the spirit of encyclopædic learning and the inspiration of an exalted sense of scientific public duty. William H. Welch, another forceful teacher, gave me a strong im-

pression of the breadth and thoroughness of Teutonic research in biology and the fascination of the cumulative progress of anatomy.

Self-Discovery

The discovery of intellectual predispositions and abilities comes at different ages and under very different circumstances. I once asked a very small boy in the American Museum what he enjoyed most; he replied in a low sepulchral tone, long drawn out, "Fossil fishes." The boy appeared so young that I could hardly believe he really knew his own mind, but upon inquiry of his mother I found it really true and that at intervals of a fortnight he would beg her to take him to the Museum to see the comparatively rare and uninteresting exhibit of fossil fishes. It was surprising to find that while the majority of boys visiting the Museum are attracted by the many phases of Indian life and the girls are likely to favor the beautiful habitat groups of birds, many boys and girls show immediate preference for the fossil skeletons and restorations of extinct animals and repeatedly return to the halls exhibiting the dinosaurs, mastodons and mammoths, as well as the more inconspicuous fossil fishes. The fundamental reason for these unusual tastes is, I believe, that these skeletons make a far stronger appeal to the imagination than the completely preserved animals of recent times. We recall how the master naturalist, Edward Drinker Cope, as a very small boy was first attracted to the fossil ichthyosaurs, of which he made his own sketches and observations, especially of the bony plates around the eyes. These

were the first steps of his career in palæontology.[1]

The Beginning of Two Careers in Geology and Palæontology

Most naturalists of the order of Joel Asaph Allen, C. Hart Merriam, Theodore Roosevelt and William Beebe cannot recall the beginning of their passion for the observation and study of bird and mammal life, because it extends so far back into the earliest years. In my own case, while my brother Frederick was a born naturalist, the constant companion of the youth Theodore Roosevelt, I did not even dream of possessing biological tastes until my senior year in Princeton, when a hen's egg and two simple implements were placed before me and I was told, without previous instructions as to method, to see how much I could see. I had never before had the least interest in the anatomy of an egg and had regarded the outer envelope and the shell as something to be removed at the breakfast table as neatly as possible. Now, however, there opened to me a new wonderland of architecture, of mechanism, of perfect adaptation of means to ends, which completely fascinated me and was the gateway to many years of research into the laws governing the development of the egg and the formation of the embryo. About a year previous I had fairly stumbled upon the fascination of geology and palæontology and without any preconceived intellectual or educational purpose had planned my first geological expedition which, like the egg, proved to be the precursor of these fifty long years of geological and palæontological research. I was at the time in my junior courses at Princeton and

[1] See a forthcoming work by the present author, to be entitled "Cope, Master Naturalist" (Life and Letters of Edward Drinker Cope).

had been only moderately aroused by the lectures of the great Arnold Guyot, professor of Geology. The leading student of my class, "Wick" Scott,[1] was barely known to me personally but I selected him as a likely companion on the geological excursion and at once despatched to him the following letter:

Garrisons, N. Y.
July 15th 1876

My dear Wick

I am deep in Dana's Unabridged [Manual of Geology], having just finished Tyndall's Glaciers of the Alps—Something has just struck me, it is this, that you and I might take a trip together some time in August. My plans are of course somewhat indefinite but substantially these—We have old horses and old wagons in abundance and a full camping outfit—if you could join me here we could drive in a few days to any locality which gives opportunity for the study of geology, viz either the Catskills—Lake Mohonk—or some other place which we may select. We could average with one horse and a light wagon 35 miles a day and I know by experience that this is a delightful way to travel—and in a week or ten days we could accomplish a great deal. The expense would be slight, as we would probably prefer to camp out most of the time—at least I would and my mother will give me carteblanche to all such things as coffee, sugar, ham, crackers, &c. &c.

As I said before I have a camping outfit—viz a tent & cooking utensils.

Now Wick, I hope you will consider this matter fully and send me an answer as soon as possible. As to the time I have no engagements from the middle of August say the 12th until the 5th or 6th of September—and if the last week in August is convenient to you I would prefer to go then as it is cooler.

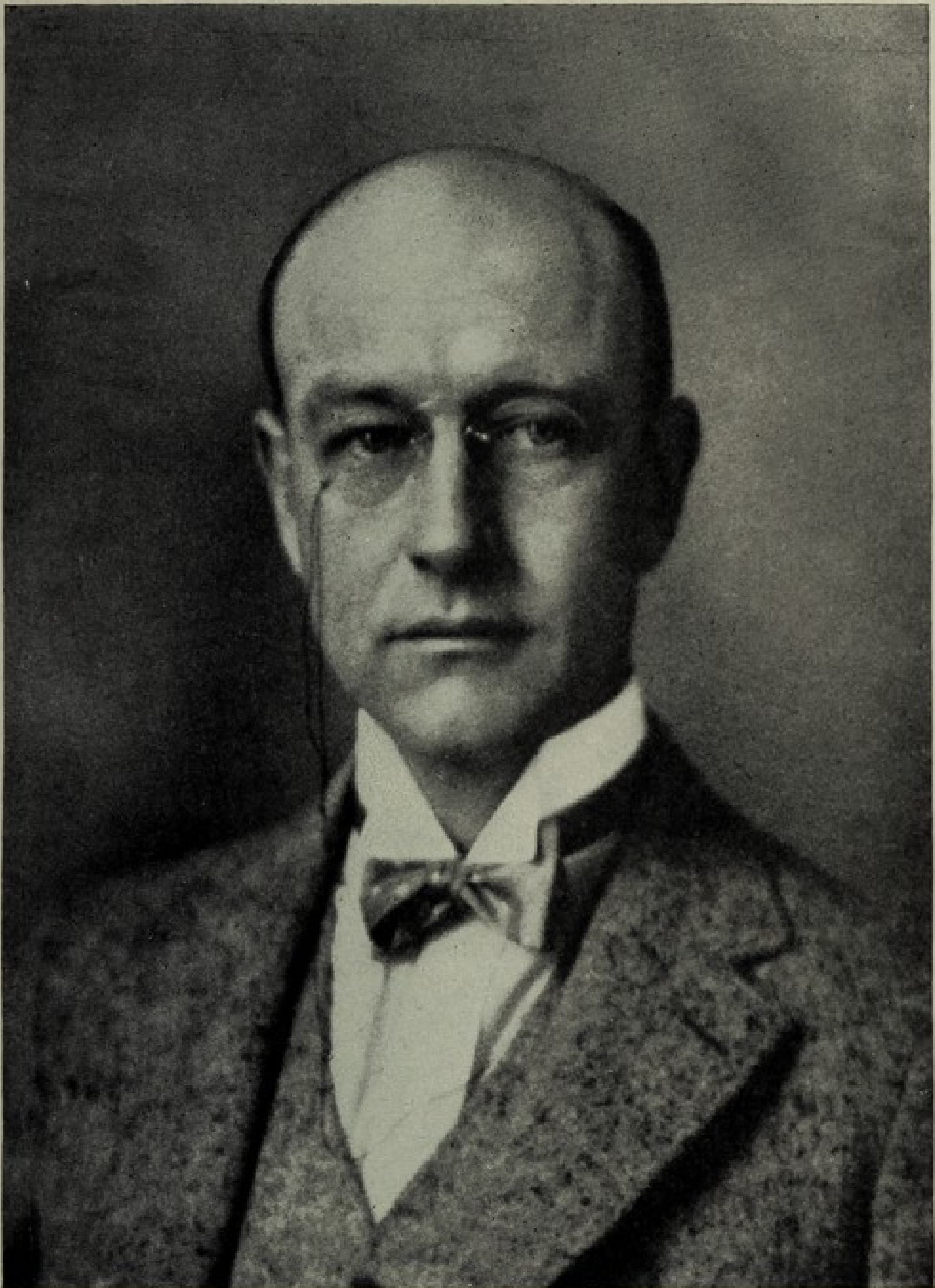
Of course I will accede to any improvement which you may suggest and if you are willing I would propose Andy McCosh[2] as a third party.

Hoping to hear an affirmative soon I remain

Truly yours, Henry F. Osborn

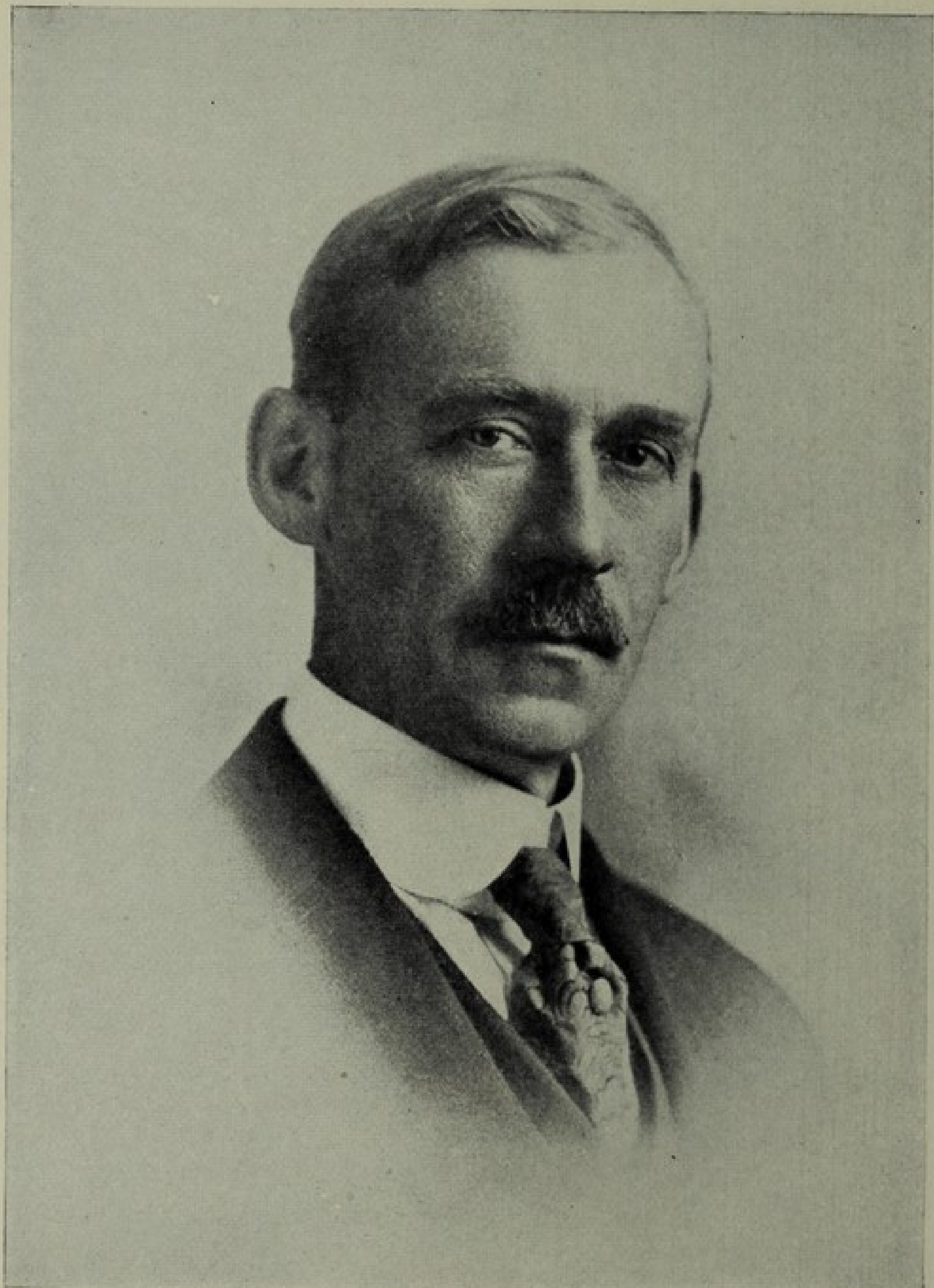
[1] William Berryman Scott, now National Academician, Blair Professor of Geology in Princeton University, President of the American Philosophical Society, Wollaston Medalist, etc.

[2] Andrew McCosh, second son of President James McCosh; subsequently a very distinguished surgeon, head of the surgical staff of the Presbyterian Hospital, New York City. Francis Speir, Jr., became a fourth member of the party.



ROY CHAPMAN ANDREWS

Mammalogist, explorer, author, Chief of the Central Asiatic Expeditions, American Museum of Natural History



WALTER GRANGER

Curator of Fossil Mammals, American Museum of Natural History; Assistant Chief of the Central Asiatic Expeditions

Of this incident Professor Scott writes in his "Materials for an Autobiography" as follows:

Near the end of Junior year occurred an incident which, though it seemed trivial enough at the time, nevertheless proved to be the pivot on which turned not only all my subsequent career, but that of Harry Osborn as well. He had fully intended to go into the business of railroads and finance. I had as fully determined to study medicine, and it had already been arranged that I was to attend the University of Pennsylvania. Both Osborn and I had been immensely interested in Guyot's course in Geology, which filled the second half of our Junior year, even tho' we had no laboratory or field work, only lectures and a text-book. Dr. Guyot was an eminent Swiss, a voluntary exile from Neufchâtel, who came to this country with Agassiz after the revolution of 1848. He never fully mastered English, and when he prepared his remarkably successful series of geographies, he had to have the assistance of a trained woman to put them into shape linguistically. We speedily learned to follow the quaint English of his lectures and the subject matter fascinated us. . . . We had reached the examination period in June, and on one very hot afternoon had gone down to the canal for a swim. After bathing and dressing, we lay on the canal bank . . . and began to talk. I said: "Fellows! I have just been reading in an old *Harper* an account of a Yale expedition to the Far West in search of fossils; why can't we get up something like that?" I hardly meant my question seriously, but Frank and Harry took to the suggestion at once and exclaimed: "We can, let's do it." . . . Somewhat later in the summer, I received a letter from Harry Osborn, suggesting that Frank Speir and I should join him in a camping trip through the Catskill Mts. and surrounding country and teach ourselves some field geology, as a preparation for the western expedition which we were hoping to get up the following year.

Here again, all unwittingly, a momentous decision was made. I had no idea of what that decision was to lead to and how many lives it was to affect, in ever widening circles, like a stone dropped into a pond. . . . Almost as soon as college opened in September, we set to work to carry out our plans for the proposed western expedition, and the first step was to create as wide a basis of interest as possible by talking the matter up among the Seniors and Juniors. Our propaganda, as it would be called nowadays, was very successful, and that encouraged us to form a "Natural Science Association" which held weekly meetings in a room in the west wing of Nassau Hall, assigned

to us by the authorities, who also furnished us with the necessary chairs and tables. At each meeting a paper was read by a member of the Association. I was elected president, and this was the sole honor conferred on me by my fellow students. The attendance and interest were maintained throughout the year, as we proposed that membership in the party should be determined by competitive examination.

It was these steps of self-discovery of inborn predispositions to pursue geology and palæontology, rather than medicine and business, which led Scott and myself into our ever friendly fifty years of exploration, research and teaching.

Prehistoric Causes of Self-Discovery

What is the explanation of the mysterious process of self-discovery? Why are these impulses and predispositions of the soul far more powerful than the guidance of teachers along the trodden paths of learning? We certainly can give no satisfactory answer, but the answer of the future may be hidden in the great antiquity of human experience, of human observation, of human intelligence, of which we have recently discovered most convincing proofs.

In gathering materials on the prehistory of man for my volume "Men of the Old Stone Age," I reached two very remarkable conclusions. The first is that men of intelligence as great as, or greater than, our own lived in western Europe between forty and fifty thousand years ago, with alert and observing minds, with brains capable of all higher realms of thought, with inventive powers of the brain and hand stimulated

by daily necessity, with astonishing creative powers in design and in sculpture. Far more ancient than these large-brained men of the closing glacial period were men of smaller brain power, though endowed with brain centers of thought, of action, of creation. Thus the brain power of man is not a recent acquisition; it is not the result of centuries of education, it is a native, inborn, original potentiality awaiting the advantages of higher education. It seems to be a not unreasonable conclusion from these facts about the origin of the brain and of the mind of man that our educators should take into account the original processes of thought, action and creation 'way back in the very beginning of the Stone Age. I return to this thought later in the paragraphs on mind-in-the-making.

The second discovery in my studies in the Stone Age is that, in my opinion, the education of the cave boy was in many ways superior to our own and that before the days of kindergartens, schools, colleges, universities and museums, the Stone Age boy of the river drifts and of the caves enjoyed the best of schooling and had advantages that most modern boys have been deprived of.[1] His father carefully instructed him in flint making, in fashioning wooden arrow and spear shafts and handles, in fishing and in the chase; part of his daily struggle for existence was this primeval form of compulsory education, and his survival depended on his aptness in working, in learning, and in imitation. After the Stone Age this kind of education survived in the apprentice system and extended into the world of ideas through such great apprentice teachers as

[1] See Osborn: The Cave Man Knew. *Collier's, The National Weekly,* May 23, 1925.

Socrates. Right before the cave boys' vision was the other master—the compelling force of Nature, gentle, inspiring, but relentless: the tree must be felled and fashioned into a canoe, the wild animal must be overcome.

But we have taken out of education the struggle to get it; we have taken away from our boys and girls the stern element of the struggle with the forces of Nature; we have, as a final step in the emasculation, substituted the woman for the man teacher. Admirable as are many of our women teachers, they have neither the natural mastery nor the natural leadership in the education of boys; even in the education of girls, especially in the upper grades, the virile quality is lacking in them.

Value of the Intellectual Struggle for Existence

Sooner or later life becomes a hard struggle; let us therefore initiate our youth into the struggle for education as our ancestors did in the Stone Age. I have always inculcated in my students the old Roman motto, "If you cannot find a way, make one." My own education involved a very hard struggle; not a single step in it was easy, but every step meant self-sacrifice, self-denial, strong resolution, inflexible purpose, the choice of the line of greatest resistance rather than of least resistance. Take the struggle for existence out of education and you paralyze the student. In our American eagerness for education we make it far too easy for the average American parent as well as for the average boy and girl. Nine parents out of ten get education for their children with little or no effort on their part because there is no direct tax for educa-

tion. Instead of saving pennies for the education of their children and for buying good books, as our forefathers did, and setting the example of home thrift and self-denial for this purpose, they receive all these gifts without cost, because everything is paid for by the relatively small number of taxpayers or by the benevolent few who endow great free institutions.

Only that which we get by effort and hard work is really appreciated and really becomes part of ourselves. Every parent should be made to feel that education is the great privilege which the State offers and should be made to carry his or her direct share of the cost. Some parents begrudge the advances in teachers' salaries, while their boys and girls are spending on chewing gum, the movies, and cosmetics more than enough to raise the teachers' remuneration to the level of that of bricklayers, masons, painters, and plumbers! The chief reason why it is impossible to recruit the teaching class from the best graduates of our normal schools is that the parents have received their own education and that of their children without apparent effort or self-denial on their own part, such as our forefathers practised. When the colony of Massachusetts passed the first compulsory education act in this country it coupled with the act compulsory pay on the part of every colonist. In my judgment the teaching force should be the best paid class in the whole community; it should attract the finest young men and women; it should rank with the ministry, medicine, and the law as the noblest of the professions.

Only the natural-born teacher, well cared for by the State so as not to feel the pinch of poverty, has the talent to put the struggle for existence back into education, to make boys and girls feel that education

is no pastime or luxury but something absolutely essential to their future existence.

Mind-in-the-Making

Continuous struggle for existence antedated by far even the very rudiments of mind, unless we accept the very pan-psychic conception of mind recently advocated by one of the most distinguished students of Huxley, C. Lloyd Morgan, in his recent volume, "Life, Mind and Spirit." In reviewing this work, G. C. Field writes:[1]

> Professor Lloyd Morgan will not allow that mind emerges at any point in the evolution of life. He maintains the doctrine of the "unrestricted concomitance of life and mind," and will only allow the emergence of new types of action of mind and new relations between the mental and physiological sides of the vital process. Mind, by which he implies more particularly the enjoyment, apparently the conscious enjoyment, of the activity of the organism, is there at the lowest stages of life. . . . Within the living organism we have the emergence of cognitive and reflective reference—we must not say mind—and, finally, the emergence of the spiritual or religious attitude, which consists in the acknowledgment of the working of Divine Purpose in the universe.

Mind-in-the-making, according to C. Lloyd Morgan's most recent expression of his own views,[2] from its appearance in the lowest organisms contains the principle of *conscious* endeavor and guidance.

> We start with organisms in being. We adduce evidence in favour of evolution, by which we mean a doctrine of descent. We adduce evidence from which we infer that, accompanying

[1] G. C. Field: Review of C. Lloyd Morgan's "Life, Mind and Spirit." *Nature*, October 23, 1926.
[2] C. Lloyd Morgan: Evolution and Mind.

certain organic events, the physiological nature of which we seek to characterise, there is in some organisms, but not in all, and even in man in some but not all of his behaviour, *conscious guidance which contributes to fuller life and to nicer and more delicate adaptation.* This "Mind" we accept where the evidence justifies its acceptance, just as we "accept" life on the evidence. We find it in being at a describable stage of individual development. It is then a factor in further development and on this wise, under heredity, a factor in organic evolution. . . .

The logically consistent extremists [of a newer school of biologists] say: not late in the course of development or of evolution does Mind appear, but at the very outset of life, which from first to last is but the organic expression of mind as *endeavour to accomplish its ends in development and evolution.* For them evolution assumes a radically different meaning. It is still restricted to the realm or order of life and mind as definitely contrasted with the utterly diverse order of matter and energy. Here only is endeavour in being, but here always. Even in the plant, even in the fertilised ovum, even in processes of cell-division, *that endeavour which is distinctive of mind,* and which is absent in the inorganic realm, *intervenes as directive of the course of events.* (Italics and capitals my own.)

For our educational purposes we need not enter into this more or less metaphysical speculation of Morgan; rather, we may take an entirely practical glance at the brain of the primitive man of Trinil, Java, and by comparing the functional areas of this primitive brain with corresponding areas in the modern Australian brain we are on safe ground in the assertion that even in the Stone Age man had certain faculties like our own. In the brain of the Trinil man of Java (*Pithecanthropus erectus*), belonging to the very dawn of the Age of Man, of a geologic age estimated at from 700,000 to 1,000,000 years, the brain centers of many of the higher human faculties have recently been discovered and plotted by the eminent neurologist, Dr. Frederick B. Tilney of Columbia University. Quickness of hearing is shown in the auditory centers; powers of keen vision are shown in the visual centers; beside

the great triangular area of general sensations—touch, taste, smell, etc.—there are the centers of voluntary control of the muscles and of skilled use of the hand and arm; below these is the area of speech. Even more important than the three centers of speech is the frontal area or higher psychic center of the higher faculties of mind, of personality, of judgment.

The exercise of all these varied faculties of primitive man is known not only from the original brain but in the actual flint and bone records of man's handiwork, the most ancient of which antedates even the Trinil man of Java. Together they afford the proofs that the primitive intellectual life of man included the following cycle of mental and manual processes: first, constantly to use and thereby to develop the faculties of observation and of imitation; second, to think, to reflect, to form judgments, and thereby to govern the action of the hands and limbs; third, to invent or to create, and thereby to equip the body with tools, weapons, clothing and shelter; fourth, to imitate, and thereby through the apprentice system of education to accumulate all the benefits of past observation and experience, reflection and invention.

Each phase of the intellectual advance of the Stone Age rested upon many, but not all, previous phases, just as at the present time our civilization rests upon the good elements of all previous civilizations.

The bearing of this glimpse of the intellectual life of the Stone Age on modern education is twofold: first, we have to deal with minds and hands of the very same kind as those in which the Stone Age lessons were inculcated; second, we must never allow modern civilization, with its stifling of observation and creative power, to enter into the processes of school, college and

university education. Fundamentally these processes should be the same as they were from the beginning of the prehistory of man.

Three Main Objects of the Intellectual Life

To *think*, to *act*, to *create*—these are our great impulses inherited from the far prehistoric past; these are the three main objectives in the intellectual education of our American youth.

Never in the history of man has it been more difficult to inculcate this trinity of power; in the prehistoric origin of mind all thought, action and creative force were stimulated by the struggle for existence, by the stern necessity of keeping alive; today this stern necessity has been largely removed and the struggle for existence has been eased. Our thinking is all done for us by the few thinkers of the daily press. The essential action of the hand under the guidance of the brain is done for us by thousands of labor-saving and brain-enfeebling devices. Except in practical inventions for the welfare of man, our general creative powers are almost at a standstill; we depend more and more on inventions and creations of the gifted few, which are spread all over the civilized world by the press and by applications of radiant energy.

The line of original thinking is the line of greatest resistance, while the line of memory is the line of least resistance. The teacher should not merely recommend original thought, he should demand it. The scholar should not evade original thought, he should deliberately cultivate it. This is why the teacher who is himself an original thinker, on however humble a

scale, has the advantage: he knows from his own painful experience how difficult it is to nurture the productive quality of mind which should be developed in his pupils and students.

II

THE CREATIVE SPIRIT IN THE SCHOOL

In one of his books William James advises his readers to read the last chapter first, after the manner of impatient novel readers who desire to know at once the *dénouement*. This chapter may also be read backwards, in Chinese fashion, because the opening pages represent my closing thoughts on education.

Fifty years ago the idea of creative education in the university was just beginning to get a foothold in this country, especially through the genius of Gilman. It has now made its way into some of our colleges and even into certain schools, although the majority of our college and school professors and tutors are still so embued with the spirit of *learning* that the idea of creative thinking never dawns upon them. I am convinced that the creative spirit must be inculcated from the very beginning, otherwise it may be lost on the long journey between infancy and young manhood or womanhood. This is not a new idea; it is more or less fully involved in Pestalozzi, in Froebel, in Montessori and in the recent Dalton laboratory plan. But in the essays of this and the preceding chapter it is traced to its prehistoric foundations in the origin of the human mind.

THE CREATIVE SPIRIT IN THE SCHOOL

Creative Education in the School—The School and the World—Initial Failure of Science Teaching—Observation and Induction Begin in the School—The Born Naturalist—Proposed Washington-La Fayette School for Boys in France: Ideals of Le Verrier—Education Begins at Home and with Parental Sacrifice.

Creative Education in the School [1]

To students and teachers of the Central High School, Philadelphia, November 22, 1926

TALENTS and predispositions are inborn or implanted in the human mind and soul. They may be discovered by education or by opportunity. They may be developed by environment and by practice. They may be purely individual in their effect or they may be of inestimable value to the welfare of the whole human race. The art of the teacher is either to discover such inborn talents in his pupils or to give his pupils opportunities for self-discovery. Many examples might be cited of discovery of talents by the teacher, but the instances of self-discovery are far more frequent, because relatively few teachers are on the lookout for rare and unusual intellectual predispositions. There are few tutors like Henshaw, who

[1] The twentieth Barnwell Address, delivered November 22, 1926, at the Central High School, Philadelphia.

could perceive the promise latent in the young and apparently unpromising Charles Darwin.

Last summer, near the coast of East Anglia, on the scene of the courageous struggles of Queen Boadicea with the trained legions of Rome, I stood upon a geologic stratum technically known as the 'sub-Red Crag,' in which among the débris of the coral-bound coast have been found several kinds of flint implements that the most hostile and sceptical archæological critics of France and England have been forced finally to admit as of human workmanship. On this shore-line of the Dawn Stone Age, on this most ancient of all relics of human endeavor, I stood with its discoverer, J. Reid Moir of Ipswich.

I mention the name of the discoverer of this most ancient site not only to give him fullest credit for one of the greatest of all archæological discoveries, namely, of evidence of the existence of man long antecedent to what we call the Age of Man or the Old Stone Age, but also because Reid Moir illustrates in his own career a great educational principle, namely, the self-discovery of rare intellectual endowments and predispositions which when allowed to develop contribute to all that we entitle learning, science, and civilization. By sheer accident this merchant of the town of Ipswich discovered in the year 1909 that he possessed a native, inborn talent for archæological research. The cultivation of the talent became his chief end in life, and devotion to archæology filled every interval of his career as a merchant and qualified him step by step to become one of the most expert archæologists in the world, aided by his rare power of discrimination of humanly-fashioned flints, known as 'artifacts,' from natural flint objects which have the deceptive appearance of being

fashioned by man; this self-education began in the year 1909 and culminates in the year 1926 in what we must consider one of the outstanding discoveries of the twentieth century, namely, the existence on the earth of intelligent human beings seven hundred thousand to one million years ago.

The bearing of this story of self-discovery on the subject of creative education in the school must be obvious to you all, not only from this biography but from autobiographies of great men of science, of letters, of art, and of technical invention.

Among the great scientific discoveries of the twentieth century none is of such intimate concern to the student of man as the almost unbelievable antiquity of the human race. Back of the historic period, which is now assigned to a maximum of six thousand five hundred years, is an infinitely longer prehistoric period which we now know extends back from seven hundred thousand to over one million years. My purpose is to consider the bearing of this discovery on the education of youth.

The Veneer of Modern Civilization

What a mere veneer upon human character and mentality is the brief period of historic civilization as compared with the prolonged period of prehistoric struggle for intellectual and moral, as well as for physical, supremacy! We have recently found strong anatomical reason for believing that this brief civilized period of six thousand years has made no direct impress whatever upon human nature and human mentality, except during the short periods of the efflorescence of culture, of taste, of refinement, when there was a large premium

on the intellectual and spiritual side of man, while the physical side was kept in its natural subordinate position.

It follows that all studies at the present time of "mind-in-the-making" (to use Professor Robinson's apt phrase) are of light moment as compared with the studies of mind-in-the-making during prehistoric time, for it was during the long era of prehistoric time that the nature and mind of men were fashioned, with their imitational, observational and creative powers.

In the most primitive stages, probably during the entire Age of Mammals or of the Dawn Man, observational powers were universal, since the life of every individual depended from moment to moment on keen powers of observation, just as the life of most members of the animal kingdom depends at the present time on constant alertness. Imitational powers were also universal, and all that we now include under the terms custom, tradition, social observance, and culture were handed down from generation to generation through these imitative powers.

The creative powers of primitive man took the protean forms of invention, of technical discovery, of resourcefulness in adaptation to new conditions and experiences. There were creators and inventors who stood out in those days from their fellows as creative youth does today. Then there were reason, reflection, the linkage of cause and effect as in the succession of the seasons and in the habits of animals and of man. By the concurrence of this sixfold intellectual endowment of observation, of imitation, of imagination, of creation or invention, of preception of cause and effect, and of the struggle for existence was built up what we call *intelligence*.

We have double reason to believe that primitive intelligence is of very great antiquity; it extends among our Dawn Man ancestors far back beyond the Age of Man into the Age of Mammals. Our first reason for believing this is the diversified and elaborate character of the flint tools fashioned by the Dawn Man recently discovered in East Anglia; many of these diversified tools are extremely difficult to fashion from the stubborn and formless flint pebbles and boulders that were washed out of the great chalk cliffs fronting the East Anglia shore-line.

If you doubt the statement that it required a high order of mentality to fashion the large implement known as the *rostro-carinate* [1] or 'beak-keeled' scraper out of a rounded flint boulder, just try the experiment yourself! After hours, days, and even weeks of endeavor you will have gained respect and reverence for your Dawn Man ancestors. Reid Moir, a natural expert in fashioning tools from the flint boulders, has been practising on the rostro-carinate for years with only a moderate degree of success.

A second reason for our profound appreciation of the mentality of the Dawn Man is found in the discovery of the seat of higher intelligence, namely, the forebrain, in which are lodged the powers of putting two and two together, of initiation, of mental resourcefulness and action, of the creation of new ideas. Our Dawn Man ancestors had a very respectable forebrain, and this forebrain was constantly in use in putting together the ideas coming in from observation and, especially, from experience gained by the incessant and carefully directed use of the hands in the manufacture of flint weapons. The industry of these Dawn Men in

[1] From the Latin *rostrum*, beak, and *carina*, keel.

fashioning a vast number of tools in flint, bone and wood, and in constantly improving the design of these tools clinches their claim to a grade of intelligence not far inferior to our own, of exactly the same order if not the same degree.

Primitive and Modern Intelligence

It is interesting now to compare this primitive intelligence with our own, especially as regards the brain and nervous system and, more particularly, the daily use of this inborn and hereditary mechanism.

MENTAL POWERS OF THE STONE AGE YOUTH	MENTAL POWERS OF THE MODERN YOUTH
OBSERVATION through sight, hearing, taste, touch, pressure- and thermal-sense; incessant use	OBSERVATION very much dimmed and blunted through prolonged disuse and civilization; infrequent use
IMITATION, gradually growing as the art of life elaborates; incessant growth in social tribes	IMITATION, gradually increasing until it becomes an obsession, dominating life
CREATION, INVENTION, INITIATIVE, ADAPTATION, RESOURCEFULNESS in daily demand	CREATION, INVENTION, INITIATIVE, ADAPTATION, RESOURCEFULNESS, confined to the relatively few gifted individuals; left out of daily life
REFLECTION, REASON, RECOGNITION OF CAUSE AND EFFECT dependent upon individual talent; applied first to struggle for existence	REFLECTION, REASON, RECOGNITION OF CAUSE AND EFFECT confined to gifted few; less essential to struggle for existence
STRUGGLE FOR EXISTENCE intense, continuous	STRUGGLE FOR EXISTENCE rarely intense, intermittent
IMAGINATION constantly stimulated by direct contact with all phenomena of nature	IMAGINATION largely dulled; conduct largely dependent on imagination of others

Contrasting the mental powers of early man and his daily use of these powers in all the occupations of life

with the mental powers of modern man as exercised daily, we remark that a revolutionary change has been brought about by civilization, resulting in the almost total disuse of these priceless primitive powers which undoubtedly are still ours. What the primitive youth constantly did for himself the modern youth allows others to do for him, thus squandering the best part of his heritage from ancestors of the Dawn Stone Age.

The first and most serious indictment which may be brought against the present age is that whereas primitive man and the primitive boy and girl were dependent on their own efforts and the constant use of their mental powers, we are today increasingly dependent on the gifted few whose labors are multiplied a thousand- or a millionfold by various mechanical devices, so that our inherited primitive powers are being dwarfed through disuse.

Our brains are somewhat larger than those of the man of the Dawn Stone Age, but only a very small portion of the modern brain is being put to use. Consequently, promising and full of potentiality as our brains may be in infancy, full of equipment for observation, for reflection, and perhaps for creation, these potentialities are seldom availed of. Thus these powers suffer daily diminution, until as life goes on they entirely disappear. The daily life of hundreds of thousands, even of millions, of people consists of elaborate forms of eating, drinking, clothing, of care of the young, of household production, of imitation and observance of what others are doing, of reading the daily papers, of going to the movies—a program requiring so little mental action that the development of the mind is brought to an absolute standstill.

Accordingly, we Americans live complacently in the

midst of borrowed art, of borrowed music, of a largely borrowed literature and history, and we manifest real creative power only in our wonderful mechanical inventions for the physical welfare of man and for the communication of ideas. In architecture we do indeed exhibit original creative ability, which has been stimulated by our growing taste and wealth since the Columbian Celebration in Chicago in 1892. In a century of literature only the works of Edgar Allan Poe and Walt Whitman rank as world classics, with high mention of Ralph Waldo Emerson; in contemporaneous literature we have not yet won a Nobel Prize. In painting we have achieved world rank only in the foreign-bred art of John Singer Sargent; modern painting of the whole world seems alike decadent. In sculpture we are gaining ground. In creative music we rank below France, Belgium, Germany, Austria, Italy and Spain. In certain branches of science, however, we hold a very high world position, and in mechanical invention we are *facile princeps*.

On a New Threshold

I am confident, however, that America is on the threshold of a period of true creative greatness and that the nationwide and schoolwide endeavors to arouse our youth to creative action will in time raise us from our present lowly creative rank. Creative education in the university was begun by Gilman at Johns Hopkins; creative education in the college is now beginning in Princeton and elsewhere; creative education is the watchword of certain schools like the Lincoln and of certain school leaders like McAndrew[1] of Chicago.

[1] Formerly of Washington Irving High School, New York City, now head of the Chicago school system.

The beginning must be made in the home and school period of life, because during this period the creative powers inherited from primitive man are at their best and must be appealed to before the commercial or imitative spirit of self-conscious boyhood and girlhood takes precedence. Independent confirmation of this statement is the recent finding of Dr. Truman L. Kelley, professor of education and psychology at Stanford University, as a result of a statistical study of the influence of training upon inborn mental differences in school children. His observations have recently been abstracted as follows:

> Young children are more truly individuals than older persons, largely because the schools tend to level out idiosyncrasies rather than to develop differences. Over 200 children that are gifted mentally were compared with 1,700 normal children by Dr. Kelley. The gifted eight-year-old children were more individual mentally than normal eight-year-olds. But he found that between eight and eleven years the gifted children have their individual traits ironed out by the public school influence, so that at 11 years they have fewer mental idiosyncrasies than normal 11-year-olds. These gifted 11-year-olds are more like normal children of 14 years in respect to their peculiarities, just as they are like the 14-year-olds in other mental traits. Dr. Kelley advocates "a policy which preserves and utilizes individual peculiarity except where it is established that social stability demands otherwise."

Imitation

Imitation is the arch enemy of the creative spirit. We have become slaves to convention. Close imitation in manner, dress and speech has become the very rule of life and the key in the struggle for existence. I never realized the full retarding force of imitation until I traveled far north of Peking into the rich agri-

cultural region bordering southern Mongolia, where I witnessed the Chinese harvesting their autumn crop of grain and of tubers. All the women were hobbling along on closely-bound feet in shoes with sharply pointed toes, in imitation of the beautiful Chinese princess of an early dynasty who set the fashion of small feet in court life. This fashion spread to every rank of life through the mothers' conviction that only the daughter with tiny feet has any chance of matrimony. Similarly, the painting of the lips and face by fashionable women of the court of Edward, Prince of Wales, at the close of Victoria's reign, has now spread to the farthest hamlets of our western states. Imitation less painful than the bound feet and less objectionable than the use of cosmetics now molds all feminine worlds into one; the women of every country follow suit, and the original art of dress and of personal ornament has declined. Unless this fatal imitative movement is checked by a nationalistic spirit, the dress of the entire Christian and Moslem world will soon be uniform and the creation of the uniform dress will be in the hands of London tailors and of Parisian dressmakers.

That absolute originality and beauty in dress are still possible is demonstrated in the art of a north Italian designer, who is not only inventing exquisite methods of textile design but has created a new robe of a single piece of silk, with all the grace and beauty of a Greek vase.

Through our press, imitation, the arch enemy of creative ability, stifles individual endeavor, renders original observation and alertness wholly unnecessary in the struggle for existence, controls and stereotypes opinion, makes original thought and reflection super-

fluous. It seems a harsh thing to say of the American press, but if I had the power of a Mussolini I would shut it off from our school youth entirely; I would exclude absolutely the irreverent "funny page"; I would substitute for it a simple, unsensational literature, of the kind that the youthful Benjamin Franklin found on arrival in the great City of Philadelphia. Of course Benjamin Franklin was a youth of rare genius, but his observant, reflective and creative mind found in the Philadelphia of his day the most encouraging and stimulating atmosphere, a center of pure and applied science, of conduct subdued by Quaker influence. In the Philadelphia of the eighteenth century Franklin's alert, receptive mind had full play.

The Influence of Franklin

Contrast the arrival today of a New England boy in the City of Philadelphia with that of the youthful Bostonian, Benjamin Franklin, on reaching Independence Square in 1723 and working his way as a newsboy by selling the one-sheet newspaper of the period. Franklin found everything stimulating to his creative ambition and he left his mark on the printing profession, on the City of Philadelphia, on the United States, on the civilized world! A recent writer [1] sums it all up as follows:

> It is doubtful if there ever lived a man who was useful to his city in so many varied ways as was Benjamin Franklin to Philadelphia, and the Independence Square neighborhood has reminders of Poor Richard at almost every step. The very streets are policed and paved and cleaned and lighted by municipal departments instituted by Franklin; the graceful, quaint

[1] Carroll Frey: The Independence Square Neighborhood.

lamps of Independence Square were designed by him. The State House is rich in memories of him, for he was its first Clerk of the Assembly; he was once President of the Supreme Executive Council of Pennsylvania, and he was a member of the Continental Congress and of the Constitutional Convention which met therein, and he was a signer of the Declaration. In Congress Hall, he was a member of Congress.

If, standing on the pavement of Independence Hall, you will look at the roofs of the buildings on the opposite side of Chestnut Street, you will see a water tank marked: "The Franklin Printing Company, Founded 1728 by Benjamin Franklin." The printing house is located perhaps fifty yards from where you stand,—at 518 Ludlow Street. The business was originally "on High Street, near the Market." Thus, although even in his lifetime it passed out of his hands, Franklin's printing business still continues.[1]

If a second Benjamin Franklin, of talents no less and no whit inferior to those of his famous namesake, were to come today to the City of Philadelphia, what would be his chance of surviving in the struggle for existence in that bustling metropolis? The answer is partly to be found in the life of Edward Bok, eminently practical, eminently philanthropic, eminently successful, but in a very limited sense creative as compared with Franklin. Consequently, the problem of creative education today is entirely different from what it was in Benjamin Franklin's day, namely, at the close of the eighteenth century. It is entirely different from what it was in Charles Darwin's day in the middle of the nineteenth century. The problem today is perhaps more fascinating, for the very reason that it is more difficult, because the spirit of creation has to contend with the financially successful spirit of imitation.

The environment of Franklin's day is the simple intellectual and moral atmosphere with which we should

[1] In 1729, nine months after its institution, Franklin took over the *Pennsylvania Gazette*, which in 1821 became the *Saturday Evening Post*, now by far the most influential journal published in the United States.

try to surround our American youth today, so as to draw from their unspoiled minds the full potentialities of their primitive intellectual heritage.

I am well aware that the comparison I am making between the primitive mind and the modern mind, between the youth of the Stone Age and the modern youth, will be considered by some educators as far-fetched and not of important or vital bearing upon the problem of creative education in the school. I am, however, confident that more mature reflection will convince all educators, whether of the home, of the school, of the college, of the university, that the comparison is a real and essential one. It is in youth that the wonderful primitive powers of the mind are most potential. It is in the youthful stages of mental as well as of physical development that these primitive powers of the past are recapitulated. It is true that the human infant is relatively helpless at birth, both mentally and physically, as compared with the infant of many other members of the animal kingdom, some of which manifest all their mental powers immediately at birth. But the youthful human mind is all the better for its very prolonged infancy, because it slowly ripens into an intelligence infinitely beyond anything we observe in the animal kingdom. During this slowly maturing period all the creative powers, Nature's greatest gift, should be given the most sympathetic and gentle nurture.

The School And The World

To the students of the Manlius School, June 15, 1910

A recurrent dream of mine is that having attained all the various academic and honorary grades of a scientific career I have through some deception never passed my senior college examinations for the Bachelor of Arts degree at Princeton, that these examinations are always hanging over my head, and that some time a day of reckoning will come when I shall be obliged to come before a stern faculty and confess my deficiency and admit that I am wholly unable to pass my senior finals and thus qualify for any higher degrees. This dream may grow out of the fact that, although fonder of and more dependent than ever on the classics, I am conscious of being decidedly rusty in the classics and of being obliged often to refer to a Latin or Greek dictionary for the true significance of various etymological terms.

The Character Back of the Career

One of these terms is *virtus.* The dictionary tells us that its various meanings are *manliness, manhood, strength, vigor, bravery, courage, aptness, capacity, worth, excellence, value, virtue, power, valor, fortitude.* May we not properly add to this royal list of human qualities the words *obedience, sense of honor,* the beautiful Greek derivative *enthusiasm,* and the French *esprit de corps* to amplify the significance of the good old Latin word *virtus?*

With all these noble definitions have we then described the all-round boy or the all-round man? Decidedly we have not, because the intellectual element, the intelligence of the trained mind, must be added to these moral and physical qualities.

As to the value of mind in the school world, I am reminded of a story of the youthful Disraeli, making his first speech on the hustings. After the British manner, he was rudely interrupted by a voice which called out, "This is a man of straw, what does he stand upon?" Quick as a flash Disraeli, conscious that he was not a man of property, called back, "I stand upon my head, sir." As to the union of intellectual and moral faculties, we may also recall two famous episodes in the life of Richard Brinsley Sheridan, the great English playwright. He may be considered to have reached the height of his career when on a single evening in London his comedy, "The Rivals," was being played at one theater, "The School for Scandal" at another, while he was at the same time making a speech in the House of Commons on the trial of Warren Hastings. The height of Sheridan's ambition was that his son should succeed him in Parliament, and his public services were so greatly appreciated that a seat was actually offered to his son. He is said to have called the boy before him and told him that his seat was secure. The son replied, "Father, I understand that Parliament is a venal body, so I think I shall inscribe upon my brow the words 'For Sale,' " to which Sheridan immediately responded, "No, my son, it would be better to inscribe there 'To let unfurnished.' "

To return to the word *virtus*, I like it in its original Latin significance better than I do the Anglo-Saxon word "goodness," because goodness always seems to me

more passive, while "virtus" seems active, efficient, effective; a monk or a nun may be a good man or a good woman but inured between four walls they may not be very influential or efficient. In other words, to be good and to do good is the double significance of *virtus* or virtue.

Much that the Manlius School stands for is summed up in the Latin word *virtus*, akin to the Sanskrit *vira*, from which is derived the Latin *vir*, a man, "one who deserves the name of a man." A number of stalwart young men like yourselves, built up through many years of home and school training, remind me of a ship, well rigged, staunchly built, with a compass and a rudder, about to start on a long voyage. This fairly brings me to my subject, namely, the voyage which you are about to take from the School into the World and how you are going to carry the influence of the former into the latter.

The Choice of a Career

First, there is the choice of your career. There is an infinite diversity of human nature, which constitutes its greatest charm; every man is like a bit of old quilt work, made up of patches taken out of various ancestors. In this marvelous combination Nature predestines every man to do some thing better than anything else, and one of the first steps is for the youth to discover what the thing is. It is often dictated by early tastes; for example, I have in mind a young man who from his earliest boyhood had a passion for living reptiles of all kinds; he was the despair of his family; he filled his bedroom with them, snakes would emerge and find their way to all parts of the house,

to the terror of the servants. None the less, as he grew up this taste marked out his career. He found his way into the American Museum of Natural History, and I finally selected him for a very important post as Curator of Reptiles in the newly founded Zoological Park. Here he has established his reputation. He has written one of the best books on living reptiles in the English language; he has shown remarkable skill in his position as curator; he is known all over the world for his observations and researches.

Again, the choice of a profession may come through sheer accident. I have in mind another young man who by the toss of a coin chose to take my course in biology at the time I was a professor in Princeton University. The subject was like the discovery of a new country and it took complete possession of him. He immediately petitioned the faculty to change all his electives, and took everything offered in the line of biology. From being a wholly careless, irresponsible student, he became one of the most serious workers in the class, and at the end of the year gained the highest honors in the course and earned a fellowship. He is now my successor at Princeton, a full professor of comparative anatomy. On the other hand, I know of a man who out of deference to his mother's wishes disregarded a strong predisposition to study medicine and undertook the study of law. He went into it half-heartedly; he probably would have made a great reputation as a physician, but he made only an indifferent lawyer.

The moral of these three episodes is that a young man should choose his own profession and not have it chosen for him; he should attempt to find that within him which permits him to take a certain course

and follow a certain career, whether it be one of the learned professions, the service of the State in the army or navy, or public life. So far as public life is concerned, it should begin in the circle around him, in the family, in school, in college, in the community in which he lives, after the manner of George Washington or of Lincoln, and thus fit him for the ever-widening relations with other men which grow with increasing years.

Having chosen his profession, the young man will discover that he has three important relations in life, which are humorously illustrated in Oliver Wendell Holmes' "Autocrat of the Breakfast Table." You will recall that at the table there always sat a young man called John. The autocrat analyzed John as really existing in three persons: John as he appeared to himself, John as he appeared to his friends, John as he appeared to his Maker. So the autocrat argued that there were really three Johns, and you will remember that the mischievous John made practical application of this argument; when at luncheon a plate was passed containing only three peaches, John helped himself to all three, saying that it was obvious that if there were three Johns, each John was entitled to a peach!

Observance of "Rule V"

First, as you appear to yourself. Do not think of yourself more highly than you ought to think. The modern form of the scriptural injunction, known in the author's family as "Rule V," reads:

Do not take yourself too seriously.

I do not know of any other rules in this series, none having been discovered, but "Rule V" certainly is extremely valuable. The significance of the rule is that modesty is one of the chief elements of true greatness. Think of the modesty of Charles Darwin: in a chance meeting by the roadside, William E. Gladstone engaged him in conversation; when Gladstone had passed on, Darwin said to a friend, "How remarkable it is that such a great man as Gladstone should consider it worth while to give so much time to a conversation with myself." Darwin little realized that of the two men he was far the greater. Similarly, we have the wonderful modesty of the great French biologist, Louis Pasteur, the greatest benefactor of the human race, who lived during the nineteenth century.

The second relation in the category of Oliver Wendell Holmes is John as he appears to his friends. You are a Manlius boy and always will be one. You will always have before you the thought of what the other Manlius fellows think; of what your principal, Colonel Verbeck, would think of a certain course of action, and this will check and control your future conduct, because you will always desire to appear well to your friends, both those who are present and those who are absent. In your wide relations with fellow-men the more positive your course, the more opponents you will make; you will always find in leadership that it is better to try to draw men after you rather than to drive them before you. You have as an interesting example the contrast between the oriental and western shepherds; in the Orient the shepherd always leads the sheep, in the more severe western countries the shepherd drives the sheep. You must also be considerate of the temperament of other men, and in dealing with

them you should try to put yourself in their shoes and consider how your action will appear to them.

There is a very interesting story in the life of Gladstone which comes to me through James Bryce. It appears that Gladstone was, contrary to general impression, singularly considerate of the opinions of his colleagues in the Cabinet; he always consulted them and listened to their views, and his policies were largely guided and governed by their counsels. There was, however, one great exception in his career, and that was his famous Irish Bill, advocating the establishment of an independent parliament in Ireland. This was his own creation, he kept it strictly to himself; he, so to speak, sprang it upon both his own Cabinet and Parliament. Perhaps because of this, this Bill was Gladstone's undoing; it disrupted the Liberal Party, failed of passage, and created a new party or made a split in the Liberal ranks. When I was in England in 1879 the feeling against Gladstone ran very high, the whole of England was divided for or against him. I well remember at Cambridge a conundrum illustrating the intense hostility and distrust which he inspired in certain persons. The question was, "What is the difference between an accident and a calamity?" The answer was, "If Gladstone should be boating and the boat should upset and he should fall in the water, that would be an *accident.* If anybody pushed out from shore and saved his life, that would be a *calamity.*"

The third relation in life, a most important one, namely, your relation to your Maker, that of an ideal standard of truth, uprightness, and righteousness, I may leave for treatment by the Bishop of Western New York, whose words are to follow mine.

Seek Other Producers

Then when you have chosen your profession and have established your relations in life, what will be the character of your work? You are brimful of potentiality and desire to turn the work of the school into something actual in the larger world. I know of no better motto to give you than always to range yourself beside those who are doing something, who are producing something, who are building up and enriching the world by their actions rather than impoverishing it; in other words, you may find the solution of almost every difficult question as to your conduct if you ask yourself, Which course will place me on the constructive side, which will make better the community in which I live? It is because of this creative and constructive element that professions like mining, manufacturing, farming, practical and theoretical science and teaching take my fancy more than many of the so-called business and office careers; I like science for this reason, because it is constantly taking unknown truths out of Nature and placing them within the reach of mankind, for man's enjoyment and benefit.

To do constructive work is within the power of every man, no matter what his profession may be, and it is also within your power. It is true, as Sherrard Billings says, that "nothing appeals to boys so much as the idea that they can do original work, that they can in their own way accomplish things that others can't." So you may be sure that if you work hard and think hard you will put into the world something it did not possess before.

Kingsley's Tribute to the Discoverers of Truth

In casting about for a suitable conclusion for my address this afternoon I have come across some words written by the great Englishman, Charles Kingsley, which I would like to read to you:

> Remember the wise; for they have laboured, and you are entering into their labours. Every lesson which you learnt in school, all knowledge which raises you above the savage and the profligate—who is but a savage dressed in civilised garments—has been made possible to you by the wise. Every doctrine of theology, every maxim of morals, every rule of grammar, every process of mathematics, every law of physical science, every fact of history or of geography, which is taught, is a voice from beyond the tomb. Either the knowledge itself, or other knowledge, which led to it, is an heirloom to you from men whose bodies are now mouldering in the dust, but whose spirits live for ever and whose works follow them, going on, generation after generation, upon the path which they trod while they were upon earth, the path of usefulness, as lights to the steps of youth and ignorance.
>
> They are the salt of the earth, which keeps the world of man from decaying back into barbarism. They are the children of light. They are the aristocracy of God, into which not many noble, not many rich, not many mighty, are called. Most of them were poor; many all but unknown in their own time; many died and saw no fruit of their labours; some were persecuted, some were slain, as heretics, innovators and corruptors of youth. Of some the very names are forgotten. But though their names be dead, their works live, and grow and spread over ever fresh generations of youth, showing them fresh steps towards that temple of wisdom which is the knowledge of things as they are; the knowledge of those eternal laws by which God governs the heavens and the earth, things temporal and eternal, physical and spiritual, seen and unseen, from the rise and fall of mighty nations to the growth and death of moss on yonder moors.

It has been a great pleasure to take this long journey and address you boys of Manlius today, because I am such a thorough believer that the future of this country

depends upon the training of the young men and young women in our schools, colleges, and universities; the young men and women of today will be the bulwarks of the great republic of tomorrow. Not our mighty battleships, nor the great fortifications along our coast, nor our well-ordered army constitute safeguards so strong as those found in the moral, intellectual, and spiritual qualities which are implanted in our young men and young women in institutions like this. The man behind the gun is far more important than the gun itself, and in these institutions are nurtured the men and women behind the guns of the American Republic.

Initial Failure Of Science Teaching [1]

To the teachers of the State of New York, July, 1896

It is a somewhat singular fact that Science is in a decidedly aggressive position in the world at large and in society, while in the educational world it is still more or less of a petitioner. It has been knocking at the doors of schools and of colleges and has been largely successful in finding its way into colleges; it is now finding its way into the schools.

The best ideas which prevail on science teaching and especially upon the teaching of botany and zoölogy have been brought together, emphasizing the fact that in botany and zoölogy it is possible to establish a certain form of educational discipline which is not possible in the older studies. In other words, briefly, we cultivate powers of reasoning and of induction. The world

[1] Osborn: The Aim and Method of Science Study in Schools below the College. Biological Work in the High Schools.

moves by the exercise of these two powers. If our schools are deficient in cultivating these powers, then they are not doing their duty to their pupils. In botany and in zoölogy we can bring some simple object before even the young students; they can ask and answer such questions as how and why. This is plainly impossible in history, for example, because the great movements, the various social, political, religious and military facts in history are so great that they are beyond the grasp of the child's mind. A child can take a bird or a butterfly and see certain adaptations and, if successfully led on by the Socratic method, can form an induction of exactly the same kind, though not, I should say, of the same degree as that which led Charles Darwin to the establishment of the theory of natural selection.

I think that one who lacks experience with younger students should speak with very great caution, and my experience has been chiefly with more advanced students. But it is the very fact that many advanced students have come to me without the slightest training in the God-given and most important faculty of reasoning that makes me feel so strongly that there is something lacking in our earlier educational system.

An ideal zoölogical and botanical course should combine with the method of questioning the older method of verification, that is, the search by the student for certain points for which he has been told to look. This union of questioning and verification should be strengthened by a reasonable amount of book work, which will bring to the young student the philosophy of the subject, the larger interests, its bearings and its touch with the larger questions of life. We are in danger of going from the extreme of memorizing to the

extreme of practical work; each has its limitations, and in advocating one alone there is danger that the reaction will carry us too far.

In adjusting these new studies to the school curriculum we have to face several very important and awkward facts. The chief of these is that boys and girls trained exclusively in science, as they are in certain parts of Germany and in certain schools in this country, by a peculiar paradox do not accomplish as much in the sciences at the ages of sixteen and twenty as do boys and girls trained by the older methods. I think that every teacher who has come face to face with two streams of students—one stream coming up through the scientific curriculum, the other through the academic curriculum—will agree with Helmholtz, Guyot and other teachers, that men coming from the academic curriculum do better work in science than men coming from the purely scientific curriculum.

The initial failure of science teaching in the schools and the reaction which followed were not because of any inherent lack in the subject but because of the incapacity of the teacher to bring out the educational contact of science in competition with great disciplines like the classics and mathematics, which had gained through centuries of experience. Biologists themselves are largely responsible for the lack of appreciation of the peculiar educational advantages of their branch of study. In the hands of men of great talent the older natural history was full of the right principles of observation, but this was followed by works of a purely descriptive character in the hands of men of less ability. I refer to technical notes of genera and species. This descriptive or systematic work robbed natural history

of its peculiar educational value and placed it upon the same par with the older branches.

James Bryce and Francis Galton, two close students of human nature and of history, express in their writings disappointment that the wonderfully widespread education of which we boast so much has not produced greater results. If the larger proportion of our population is being educated in the lower, middle and upper grades of the schools, why is not the intellectual product in equal proportion? Why do we not produce more first-rate men and women? Undoubtedly there is something wrong; our educational methods are deficient in not bringing out the higher faculties of the young minds entrusted to us, and the question of science instruction is one of the weak points to which we must give more careful and united consideration. I trust it may be possible to bring together for deliberation on this subject those who are interested in high school work, so that the science work may be handled in the best possible manner and in correct proportion to other studies.

Observation And Induction Begin In The School[1]

To the Schoolmasters' Association of New York and Vicinity, April 8, 1893

Our present methods of school education omit all training in observation and induction from Nature. The same mode of thought which led Darwin to his discovery of the theory of the origin of species is open to even the youngest students in our schools, differing only in degree, not in kind. Putting facts together to

[1] Osborn: Biology and Other Sciences in the Schools.

form an induction is an apparently natural gift with many boys and girls, and is probably latent in many in whom it does not appear. It is this gift which leads directly to the highest and most permanent features of modern human progress; yet the cultivation of it is practically omitted in earlier education, I may say up to the junior year of college life, as if it were something not worth cultivating; and this state of affairs is chiefly characteristic of the schools which prepare students for colleges.

We may hold our schools and colleges equally responsible for not recognizing these new branches of higher learning and holding to lines of early training which were current before these new branches acquired such importance.

Nature versus Tradition

Aristotle, we remember, divided learning into the knowledge of the organic and the inorganic universe. It is safe to predict, judging from the present strides of biology (which I use simply as an illustration of science teaching), that this old division of Aristotle will prove to be an equal one, and that the organic sciences or biology in the largest sense will weigh in the scales with the inorganic. With the discovery of the microscope the subject has been widening with great rapidity, until now biology is no longer equivalent to any single branch of inorganic science, such as chemistry or physics, but to these branches collectively. Bacteriology, for example, the youngest of the biological branches, already has as many votaries in this country as physics. These conditions are simply pointed out to show that the science of living phenomena, as largely

based upon chemical and physical principles, has advanced so rapidly that an entirely *new situation* has been created, which all educators must take into consideration.

If I were speaking to teachers of the public schools I would emphasize the importance of the practical side of biology, of giving the people through the schools some knowledge of the fundamental principles of this science on its applied side. Consider the advantages which would follow from a fuller appreciation of the practical importance of this science among our legislators, who are naturally chiefly educated in the public schools. Speaking in this case principally to the teachers of the private schools I would point out and lay principal emphasis upon my first thought of the importance of biology for mental training. These studies are still upon an optional or elective basis throughout almost the entire school and college career. They have to contend with the force of tradition and of precedent, which is as strong among educators as among other men. This tradition is that mathematics, Greek, Latin and English are all important and sufficient in fundamental training, and when it comes to the sciences that physics and chemistry are the branches which should receive first attention, and that these can be adequately taught from text-books.

Principles versus Details

The newer biology, largely inspired by the work of Darwin, is chiefly devoted to the discovery of the underlying principles of internal and external structure. Instead, for example, of simply noting an animal or

plant as marked by such and such external characters, we seek to ascertain the relation of these characters, the history and causes of their development as regards internal structure. A similar advance has been made in the new methods of laboratory teaching, inspired principally by the English masters of science, such as Huxley, Balfour, Howes and others. Thus, with the models of teaching methods set by these men, we have in this country, both under the direction of the school of Agassiz, including the older naturalists, such as Brooks, Hyatt, Morse, Packard and Whitman, and under the direction of a younger school of teachers principally trained in Germany, a thoroughly new spirit in biological education. This is the spirit of original observation and induction. The older systematic and descriptive training in fact has been somewhat neglected, but there can be no question that the new method of direct observation of Nature and the constant consideration of causes and relations of various facts observed gives to modern biological teaching its chief educational value.

It is clear that a difference should exist between biological teaching in the schools and in the colleges, that schools should not attempt to do the work of colleges any more than the colleges should be obliged to do the work which ought to be done in the schools, as is too often now the case. It seems to me to be the sphere of college instruction first to teach biology in relation to liberal culture, placing it in the curriculum along with other studies covering subjects about which every well educated man should be fairly intelligent. Then the college training certainly must take into account preparation for the medical profession, which attracts nearly ten per cent. of college students. This requires

a more extensive course of two or three years. Finally, it should select men who have a natural gift or aptitude for biological studies, to encourage them to enter upon a career of research and teaching in biology. Such a course as this occupies at least five years.

The sphere of the school is somewhat parallel, for the object of biological teaching should again be twofold: first, the scholars should learn certain classes of useful facts in physiology, especially in human physiology, in botany and in zoölogy. Here the teaching may be done with a text-book, and with simple experiments devised by the teacher himself. But this kind of instruction is clearly, so far as mental training is concerned, of no more distinctive value than the teaching of geography, for example. The primary object of biological or other science teaching in the school should be to develop the innate faculty of observation and reasoning upon the facts observed. Let the scholar see for himself certain facts, learn to put these facts together and form a simple conclusion from them. For example, put the following question: Compare the fore and hind limbs of a frog. How are they like each other, and how are they unlike? Then, why are they unlike? This very simple question is a type of all the larger problems in biology. If the scholar is not able to answer, after a careful examination of the specimen, the answer will immediately come to him when the frog is placed in the water and the different functions of the fore and hind limbs are thus brought out. No other branch of education seems to afford an equal opportunity for developing the power of induction. A schoolboy cannot reason upon the wars of Napoleon or of Washington, or put together the facts of physical geography; from the very nature of these studies their underlying laws

are so complex that they must be pointed out to him. But in biology it is quite different—inductions are extremely simple.

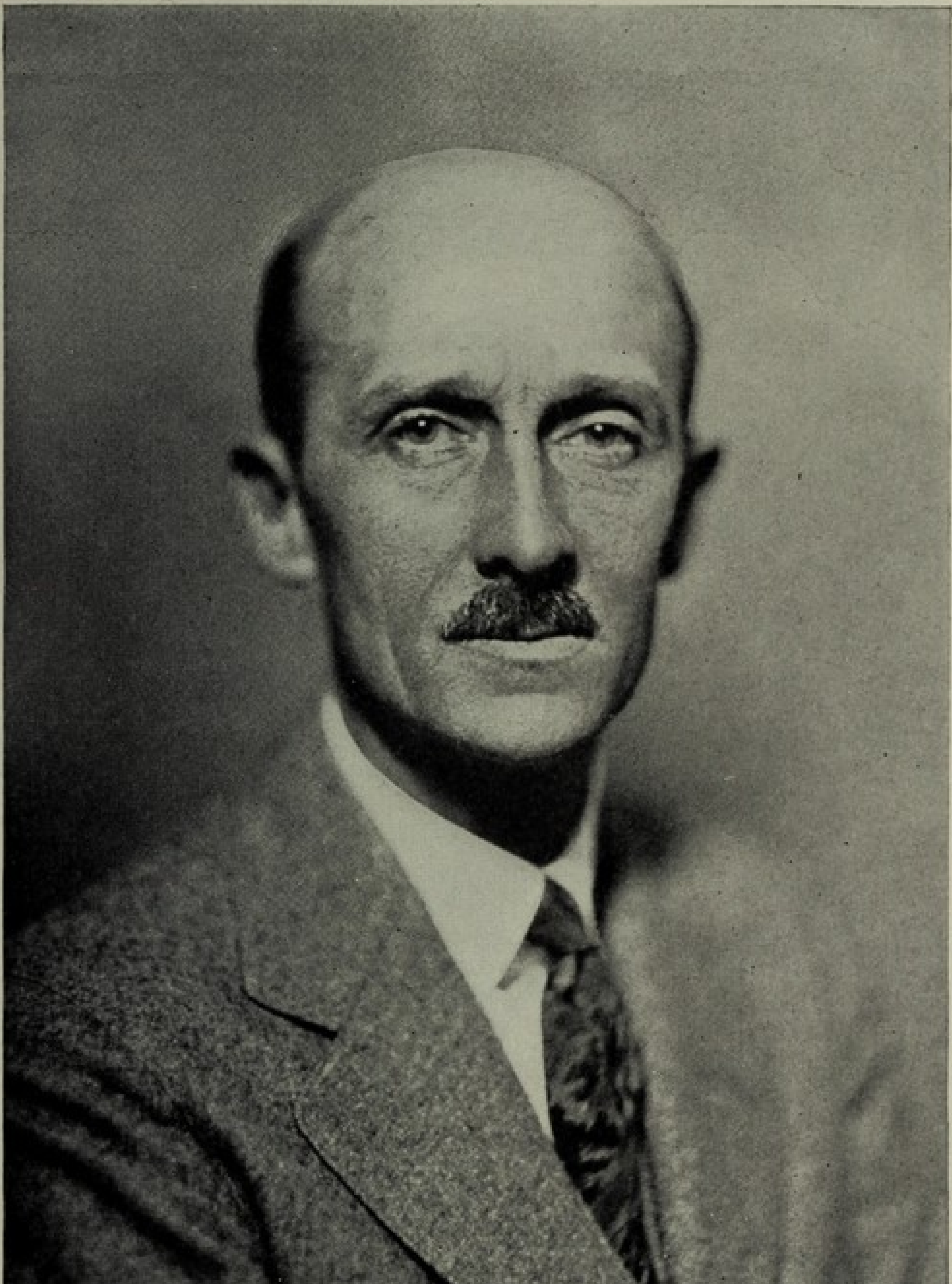
Lost Powers of Observation

The first step is to develop the faculty of observation. Almost every young person is a natural observer and collector; we are often struck by the acuteness with which even children, although wholly untrained, will observe and reason upon natural phenomena. When this innate faculty is ignored, the mind actually goes backward, since there is no standstill in mental development. In later years these faculties have to be called with the greatest difficulty from their degenerate slumber, and a taste for the observation of natural things has to be recreated even at the expenditure of a great amount of energy on the part of the teacher. My experience with large numbers of students just beginning biology in colleges is that they have lost their sense of form, that they have almost lost their powers of observation, and that they have absolutely no power of reasoning. And my conviction is that these are all losses of native faculties which have been present in much larger proportion, so to speak, in younger years. Occasionally one meets a student who has had fine but neglected opportunities, both in school and in the freshman and sophomore years in college, to whom biology comes as a perfect revelation of the existence of faculties and powers of which the possessor was wholly unaware.[1]

If science teaching is introduced into the schools beyond the limits of simply useful information it should

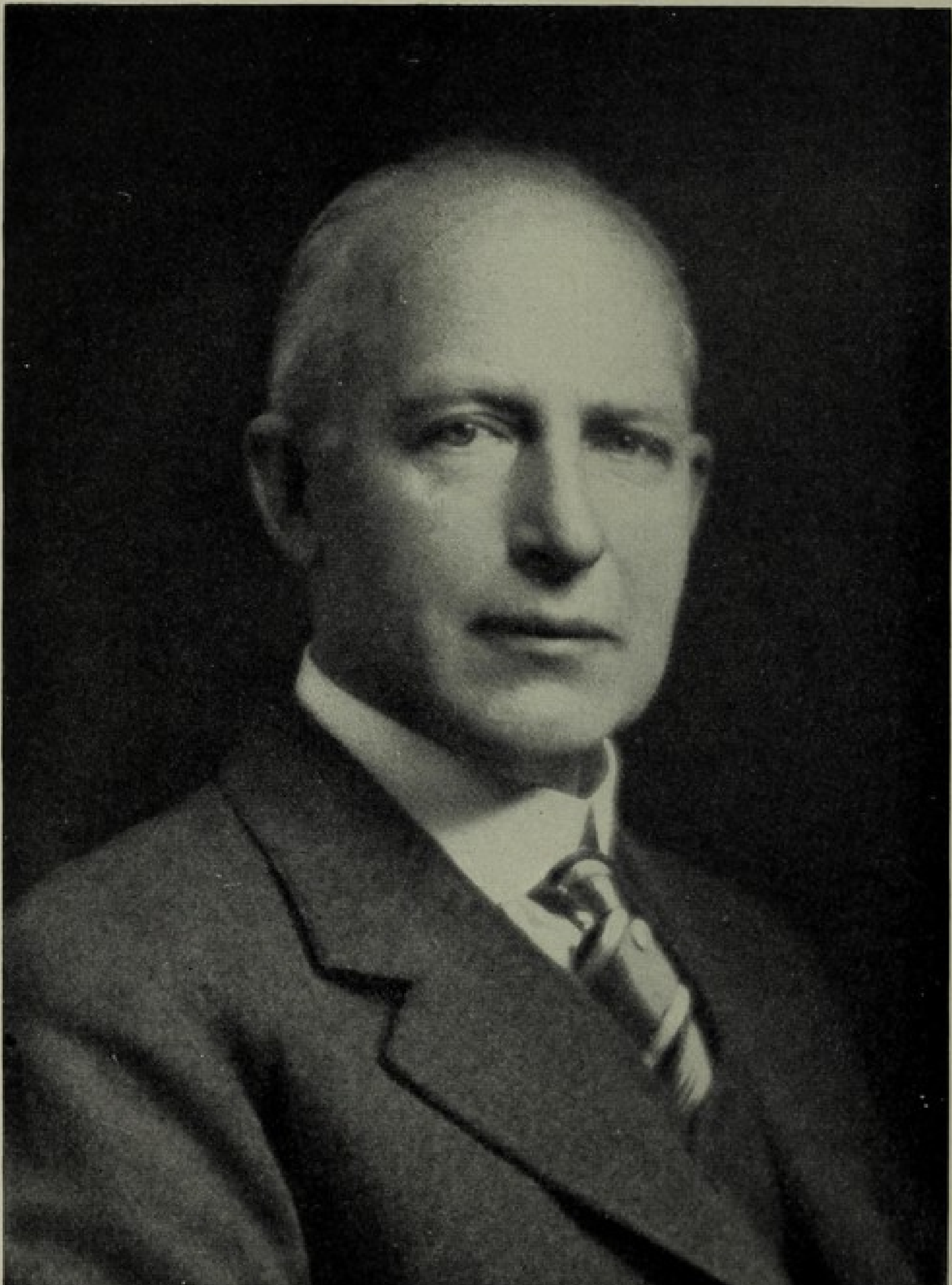
[1] Compare this passage (1893) with the opening article (1926) in this chapter.

be wholly objective, otherwise it will present no advantages which will justify the time taken from the other fundamental studies. How can we introduce objective teaching into a school? I have endeavored to expand an illustration used above of what may be done with comparatively little expense and a mode of instruction which an ingenious teacher may apply in many different lines. Supply a small aquarium and institute a series of comparisons between the frog and some hardy type of aquarium fish. These easily obtained animals can be taken first to illustrate the different modes of respiration. The students will be asked to observe how the frog takes the air in and out and to watch the effects of some simple experiment, such as placing a cork between the jaws, which entirely prevents respiration. This may lead to a comparison of the atmospheric respiration with the aquatic respiration of the gold fish, also made by the student under the stimulus of a few simple questions. Finally, the contrast between animal respiration and plant respiration can be brought out by placing some simple forms of water plants in the aquarium and observing the giving off of oxygen bubbles under the action of sunlight. Further subjects for comparison and observation are the different modes of the use of the limbs in the case of the fish and the frog, and the different structure of the fins and feet. The frog may further be taken advantage of while still in a living condition by the use of one microscope to show the circulation of the blood. A further series of questions directed upon the coloring of the frog and fish will lead the student unconsciously to bring together a large number of facts and enable him to form some conjecture, at least, as to the causes of the difference in color between the upper and lower



WILLIAM BEEBE

Ornithologist, explorer, author, director of the Department of Tropical Research, New York Zoological Society



BENJAMIN ARTHUR BENSLEY

Professor of Zoology, University of Toronto

surfaces. The teaching equipment should be enlarged by a few charts, a simple library, and a collection of alcoholic types, which should in all cases be made by the students themselves. In all this instruction the emphasis should be laid less upon the bare enumeration of the facts than upon the relations of the facts.

First Train and Inspire the Teacher

Another practical question is how teachers should be prepared for this work. This question is a very important one, for the impression seems to be very general that, whereas a teacher of mathematics or one of the ancient languages should have been prepared almost from infancy for his profession, any one can teach the natural sciences by simply reading a few books. A professor in the Massachusetts Institute of Technology gave me an amusing illustration of this peculiar delusion: a woman teacher came to him explaining that she was directed to take up zoölogical teaching through the coming year and asked him to recommend a book which would give her a knowledge of the subject. He told her it was impossible to take such a shortcut method of preparation, but she insisted, and from one of her pupils he learned that during the following year she was attempting to explain the circulation of the gases in the blood. She had spoken of carbon as being seen in almost pure form in charcoal and was explaining how the venous blood was surcharged with carbon, when one of her pupils asked if charcoal circulated in the blood; she was unable to answer this question. The fact is, a teacher cannot be trained either by reading books or by listening to

lectures. As it is an objective science the teacher must be trained by objective study. In other words, a teacher must prepare himself by the same methods which he intends to apply to his students. To meet this want in the practical training of teachers we have latterly made very great advances in this country in the establishment of a number of seaside laboratories or summer schools of biology, located at Cold Spring Harbor, Long Island, at Wood's Hole, Massachusetts, at Sea Isle, New Jersey, and at a number of points in the interior of the country. The growth of these laboratories has been remarkable, beginning with the famous station of Professor Louis Agassiz, on Penikese; continued by the station of the Boston Society of Natural History in Annisquam, by the Harvard, Johns Hopkins and University of Pennsylvania stations, which are for more advanced teachers, and by the Wood's Hole and Cold Spring stations, which are for teachers and students of all grades from the most elementary to the most advanced. The sessions of these summer schools begin a few weeks after the school and college terms end and continue usually for six weeks, thus not interfering with the vacation. They have attracted teachers from the schools and colleges of all parts of the country, especially from the New England and western states. The Cold Spring station on Long Island is within easy distance of New York, and has been taken advantage of by a large number of Brooklyn teachers. In the establishment of these schools we have the most hopeful outlook for the eventual introduction of biological teaching of the right kind in our earlier education, and, although progress in the introduction of science teaching is very slow, it is none the less sure; and we may look forward to a time when the questions, What is

nature? What is life? expressing the curiosity which exists in the mind of every boy and girl, as well as the taste for collecting natural objects and asking questions about them, will be cultivated instead of neglected.

The Born Naturalist

Prepared for the students of the University of Southern California, 1922

The Naturalist, like the Poet, is born, not made. One of the first of the many lines of inquiry before the aspirant to a scientific career is the self-examination: "Am I really a born naturalist? Am I so endowed by Nature that I can follow in the footsteps of the men, great and small, who have made Science what it is?" At best the path is long and very arduous. If we read the biographies of Faraday, of Maxwell, of Agassiz, of Huxley, of Pasteur—in brief, of any of the great physicists, chemists, geologists, or biologists whose names adorn the literature of Science—the early pathway is ever seen to be a hard one; yet, as Huxley observed of his voyage on the *Rattlesnake*, it is a good thing to be on the bare bones of existence.

There must be within the aspirant, therefore, not only the will to conquer, but also the belief, through a kind of spiritual and intellectual impulse, as well as of self-confidence, that he can conquer in the end. Even with this will-power and self-confidence a long period of apprenticeship and self-experiment is necessary before the novitiate can positively ascertain whether he has the natural gifts that will enable him to achieve even a reasonably successful career in Science. As a

teacher of forty years' experience, I have watched some of my students for many months, and in some cases for two or three years, before I could satisfy myself that they possessed the rare combination of powers which makes a man of science.

First of these essential qualifications is a keen sense of truth; the second is a keen power of observation; the third is the rare power of creative imagination; the fourth is indomitable will, energy, and determination—the spirit that delights in difficulties, that loves obstacles, that is not dismayed by any scientific ascent, however lofty, or by any scientific descent, however deep.

Once satisfied that he has his fair share of these four absolutely necessary endowments, the student may enter his career with real confidence, and if he maintains his health and keeps alert his moral and his spiritual senses, his chances of ultimate success are more than reasonable—they are bright. There is very little room at the bottom of a scientific career, because every profession is crowded with men and women who have made a wrong choice, who should have been content with some other walk in life. Halfway up, however, there is plenty of room in every scientific profession, room for extremely useful lives as teachers, if not as investigators. As one approaches the top he becomes more and more isolated and may finally stand alone, like the great Spanish neurologist, Ramon Y. Cajal, who has lately retired loaded with honors. The career of Cajal is typical. As a student he did not discover in all medical literature one Spanish name of note, and he made a vow to place his own there, if possible. Entering a most difficult field of research, he pursued it with ardent determination, his imagination suggest-

ing hundreds of new applications of the scientific method discovered but only partially employed by the Italian, Golgi. Now every medical work in every language in the world gives page after page to the work of Cajal.

To attain this end the student, if he is destined for research, must be born with an intense interest in one certain aspect of science; his tastes must not be too diffuse; he must especially love either the rocks, the fossils, the plants, the insects, mathematical problems, psychology, chemistry, astronomy—the one special form of scientific inquiry that attracts him most is that in which he will best succeed. This discrimination may not come at first; it may come after many trials, as in the case of Pasteur, who started as a crystallographer, continued as the discoverer of a new universe of ultra-microscopic life, and ended his life as founder of the great science of bacteriology.

Finally, the student must be endowed with the stimulus of ambition. Many young men are gifted in all the other essential qualities but are totally devoid of ambition. In many cases the professor in charge of their work has to supply the ambition, to spur, to stimulate, even to threaten the student in order to compel him to continue a certain piece of research and push it through to the point of publication.

May I therefore close this informal disquisition on the born naturalist with the lines from Milton's "Lycidas":

> Ambition is the spur that the clear spirit doth raise . . .
> To shun delights and live laborious days.

Proposed Washington-La Fayette School For Boys In France

The directors of the French Heroes Fund acquired La Fayette's birthplace as a memorial similar to Mount Vernon and the present author was requested to develop a plan for a school which would combine the best elements of American and French school education. The American plan, published privately November 12, 1917, is as follows:

Plan for the Proposed Washington-La Fayette School

The school will be dedicated to the memory and spirit of George Washington and of the Marquis de La Fayette. The foundation of the school will memorialize the union of France and America and the heroes of these two countries who have given their lives to the final struggle for liberty, justice and humanity.

The chief object of the school will be to deepen, broaden and perpetuate the bonds of sympathy and understanding which now unite France and America, through education in the proposed school of a number of the finest youth of France, beginning with the sons of some of the French heroes who have lost their lives and fortunes in the present war. With them it is hoped that there will be a few of the youth of America.

The school is to select from France and America the best principles of the education of youth now characteristic of each country, and to combine them, in order to develop in the largest measure the spirit of patriotism and service, in all branches of intellectual and scientific endeavor—to combine intellectual and political education with the spirit of morality, of high conduct, of health and physical courage and skill.

The school will be modeled partly after the best French, British and American precedents; especially in the planning of the school buildings and playgrounds will it follow the best recent models in America as to construction, sanitation, etc.

It is considered very important that a high standard should be established at once by very careful selection of the boys who constitute the original classes, starting with a limited number of

youths whose eligibility is attested to both by what they inherit from their parents and by what they have themselves shown in their own lives at home and in school.

The intellectual instruction will be along modern lines in the history of France and of America, in the languages and literature of the two countries, in the elements of science, mathematics, physics, chemistry and biology. Moral instruction will be on a religious and spiritual but not on a denominational or sectarian basis. Physical and health instruction will be drawn from the best principles and practices of the French and American schools.

Appointment to the school as a "Scholar of the Washington-La Fayette School" shall be considered an honor. A reward of high moral, intellectual and physical attainment, on completing the course of instruction, shall be the "Washington-La Fayette Diploma," certified to by the signatures of the masters of the school.

Washington-La Fayette scholars will also prepare for examination in a manner to be determined by the French Committee and the Minister of Public Instruction. It is most important that boys of the Washington-La Fayette School should prepare for a career—governmental or practical. It has also been suggested in France that boys showing aptitude along certain lines may, through the courtesy of the French government, be sent to schools where they could specialize in preparation for the work in this country, under the auspices of the Washington-La Fayette School.

In America this diploma will open the way to appointment for a two years' training in practical and scientific education in some of the largest institutions of the United States.

The plan prepared by the American committee was considered in Paris by a committee representing the French government and the Department of Education and the special representative of the American directors of the French Heroes Fund, Mrs. Ralph Sanger.[1] There were present at the meeting of February 11, 1918, the following persons: M. Painlevé, president of the Committee; M. Séris, director of the National Office of the Pupils of the Nation, sent by the Minister of Public Instruction; M. Coville, director of higher

[1] Daughter of Henry Fairfield Osborn; now Mrs. Robert Gordon McKay.

education; Mlle. Valentine Thomson and Mmes. Charles Le Verrier and Ralph Sanger.

Among the questions discussed were the location of the primary school at Chavagniac (near Lyons in Auvergne), and the location of the higher school near Paris, for the reason that Chavagniac was too distant. This discussion was interesting, as showing the French point of view of the importance of the centralization of education near Paris.

At the close of the meeting M. Charles Le Verrier was invited to prepare a project of the school which would meet the ideas of the majority of the committee as above expressed and which would also serve as an educational program designed to combine French and American ideas in advanced school education. At a meeting of the committee on March 27, M. Le Verrier submitted the following project:

Ideals and Objects of the School

Once we have determined the object for which the Washington-La Fayette School is coming into being and the happiest means of achieving that object, it will be possible to outline, in the main, the arrangement of the schedule. The model school should take into consideration the ideal type of man to be formed not only from the standpoint of the nation and from the standpoint of the individual, but from the standpoint of the immediate adaptation of that man to a social environment, in which for a comparatively short space of time and under circumstances somewhat predetermined, he would be called upon to live and to render service.

On the ideal man in an abstract sense we may agree. He should adequately combine moral, intellectual and physical qualities. On the ideal man in a national sense we might find agreement more difficult. One observes different nations developing men in different ways. As an illustration, we find that Americans are great believers in specialization, we find the English giving a great importance to sport and the development of man along physical and moral lines and we find that the French have subordinated everything to the intellectual development of man.

Again, where we see the youth of a nation dominated in education by a selfish nationalism, we resent it, feeling that the school influence at least should remain a disinterested one. In the Washington-La Fayette School we shall try to guard against the mistakes which tend to compromise the ideal.

Realizing that the best way of serving a nation in the society of nations is to make of its citizens the most perfect examples of men, we shall strive to develop our boys into well-rounded men who, on leaving the school, will be prepared to find themselves at once, not only in their own but in other countries as well.

But the ideal is ever a distant goal toward which man tends during the whole course of his life. A school can but lay the foundations of character, knowledge and physique and prepare a boy for his début into life, fitting him for immediate usefulness in a world where one continues to learn daily lessons in the hard school of experience.

Before the war, the practical and vital bond between France and America was reduced to its simplest expression. Few French lived in America, few Americans

in France. A thousand superficial reasons have been given for this. The true reason was the absence of commercial relations and industrial obligations between the two countries. As an aftermath of war conditions, we shall realize great changes, economical, intellectual and sentimental.

It is to prepare the field for this coming intellectual, sentimental and economic union between America and France that the Washington-La Fayette school should educate its pupils. The pupils, whether American or French, should be taught to know and to love the two nations, should be familiar with their histories, their institutions and the part they each have played in the world's politics, so that having theoretically and practically mastered a career, a boy would be prepared to live in either country.

The Languages and Courses of Study

The Washington-La Fayette School will receive a boy on his graduation from the primary school and will carry him to the threshold of a practical career. The principal subjects we shall cover will be the following:

1. Civic instruction with an elementary idea of political economy and common law, comprising a study of American and French institutions.
2. Knowledge of English and French and the important literature of the two languages.
3. German and Spanish or Portuguese.
4. American and French history and a general knowledge of history.
5. Study of geography relating particularly to France

and America and their colonies, and a general knowledge of geography.

6. Arithmetic, calculus, algebra and geometry.
7. Physics, chemistry and the natural sciences.
8. Stenography, accounting and bookkeeping.
9. Drawing, modeling, geometrical designs.
10. Manual and technical labor.

The foregoing program will be given as a three-year course to pupils provided with their certificate from the elementary primary school and having followed one year's course at the elementary primary superior school. Having successfully passed the course of the Washington-La Fayette School each boy will be given a diploma. It should be mentioned that one year of supplementary study to this course will suffice for a boy to present himself for his baccalaureate examination. The pupils will be equally prepared for a fourth year divided into three sections, commercial, industrial and agricultural.

We take the boys at thirteen and by the time they are sixteen or seventeen they should be prepared to launch forth into the world. The question then arises: Would these boys be better prepared for life with a knowledge of Latin and Greek or of modern languages? As we have not the time to accomplish all, would it not be better to provide them with a weapon such as familiarity with the modern languages would give them, which would at once widen their sphere of activities?

We must recognize in the study of German an obligation, for pedagogic as well as practical reasons. From the standpoint of pedagogy, a profound study of German fills, in large measure, a gap left by the non-

study of the classics. In fact, the immense advantage derived from a study of Greek and Latin, during the school year, is that it accustoms the mind to a sort of disarticulation of language. In Latin, we have the construction of a language totally different from ours, and the study of it tends to liberate the mind from words, making a man the master of his thoughts rather than the slave of his vocabulary. Benefit of the same nature would be derived from the study of German. In construction, it is precise, complex and radically different from the construction of the French language. After the war the knowledge of German will be vital to business men and men of industry. Not only will the conditions in the Balkans and Russia demand a knowledge of German, but the struggle for the conquest and possession of the world markets is destined to begin at once, and will be achieved successfully by the combatant having direct information as to the ideas and methods of the principal competitor. For these reasons, and in order that we may successfully hurl ourselves into the combat, it is important to master German; this will be our greatest weapon against our redoubtable adversary.

Spanish or Portuguese will open to our young men the markets of South America, and it is important to note that men who are familiar with the conditions of these countries are of the opinion that a knowledge of Portuguese will carry one as far, if not farther, than Spanish.

In our courses of political economy and common law, we shall include an idea of the theory and practice of finance. Most young people graduate from schools with no understanding of the laws which govern financial conditions and this ignorance often makes them the

tools of those employers who exploit them or of the more unscrupulous ones who use them as dupes. We shall assume our right to protect them from these two dangers.

A knowledge of literature is the most broadening of all studies, as it teaches us the history of humanity. Through it our pupils will acquire their first experience in the psychology of hearts and minds.

An intelligent understanding of current events presupposes a familiarity with past events. The changes that constantly occur become significant as we consider the evolution of our world. History plays, therefore, an important rôle in all liberal education, and as, in the Washington-La Fayette School, we are working with the very definite idea of preparing our pupils to help America and France to realize their mission of the future in their relations with other countries, we shall insist on a study of the histories of the two countries.

Man is not merely heart and mind. To this the relation of the physical man to the soil from which he springs bears partial testimony. Our pupils in their universal study of geography will acquire an understanding of the repartitioning of the races and their characteristics, but they should be given a special course in the geography of America and France, as they should be prepared to associate with and understand the people of either country.

We shall in our program give a larger place to mathematics, physics and natural sciences than to the science of letters. We shall add to the hours in class daily work in the laboratories and workshop, because a practical knowledge of the sciences permits even the average man to render incontestable services, whereas in a literary career, unless a man rise above the aver-

age, he would find it difficult to free himself from necessity. An assiduous practice in scientific work accustoms the mind to rigorous logic and accurate observation. We do not wish to load our pupils with too many facts, as it is perhaps less important, in science, to know than to know how to acquire, and it is certainly more important to be able to utilize one's knowledge than to be able to recite theories. It will thus be in practical demonstrations that we shall expect the best results, and we shall in this manner dispose of many study hours.

Division of the Day's Work

The program as outlined is more crowded than that of the primary superior schools. We hope, however, without overtaxing the boys, in the three years' course to cover the ground, besides devoting a great part of each afternoon to play and physical exercise. An hour would be the limit of time devoted to any one class and the last class of the morning would take three quarters of an hour. We should allow the first quarter of each hour for a class to get well under way and three quarters for hard work. We shall exact of each pupil far more than his mere presence, we shall exact real activity. This we can obtain by our plan of small classes, in which the instruction may be almost individual in character, and also by arousing through questions the constant interest of the boys, so that the contact between the mind of the master and that of the pupil is not interrupted. Between each class we shall arrange fifteen minutes of study. During this time the pupils will write a short résumé of the lesson, from which the professor will be able to tell how much of the lesson has

been assimilated and what part should be repeated. Between this brief study period and the following class, the boys will be allowed a few moments of recreation, in which to stretch their legs, relax their muscles and fill their lungs with fresh air. We shall make a much larger use of books than is customary in the universities. Too many professors are apt to ignore the fact that printing has been invented; they load their scholars with dictations which bore them and waste the time which might be better employed in the fresh air. The subjects for the following day will be announced the day before and the scholars will not enter class without having made a preliminary reading of what they are to study with their professor. Thus the class will not drag in tiring explanations. It will especially be a spoken commentary on the questions proposed by the professor and on questions asked by the scholars. Often there would be no reason why such a class should not be held out of doors.

As far as the real courses are concerned we will ask the professors not to waste time in introducing each year a public announcement. We will get them to have the list multigraphed and we will distribute the copies to the students.

We shall seek to reduce the hours in class. A genuine acquisition of learning is the result of an effort of mind and not merely a facility of expression. We shall constantly draw the attention of the teachers to the importance of exacting from the pupils work carefully prepared with the idea of constantly striving for perfection. We shall hope to eliminate the long sittings in class with corresponding waste of time and to substitute for it written work prepared by the pupils and corrected by the master.

Initiative and Individuality

In order to encourage the initiative of our pupils and to render them apt in the use of their mentality to realize the practical, rather than to achieve a profound learning, we shall advise that a concrete method be applied to the whole order of teaching the school. By the concrete method we understand that in every instance of pedagogic procedure a gathering of the material should be made in such a way that the facts would anticipate the idea, and thus the faculties of perception, imagination and memory would be touched before the faculties of intellectual elaboration, judgment and reasoning begin. We know well that in the application of what we ourselves have learned, we apply only what we have acquired by experience; that is to say, we take one point of departure in the realities, namely, the practical, and then only take into cognizance the theoretical. From this principle, we deduce that when the teaching of a modern language is in question, we would apply the objective method, as in America—what we should call the direct method. To quote from the *Journal des Débats:*

> As a general rule a language should be taught in the language itself; the ear and the mechanism of speech is thus more quickly formed than by recourse to translation. Again, the grammar, instead of presenting itself as an indigestible mass of rules and exceptions, to be acquired as a separate thing, is euphoniously absorbed.

There would, however, be an omission were we to practise this method exclusively, and as in the translation of one language to another we recognize a most

effective mental discipline, we shall add this work to our program.

Methods in Literature, Science and Economics

In the study of literature, the educative value lies in an intimacy with the great authors and also in the personal effort of the pupil to seek to express his sensations, his sentiments and his ideas. We shall eliminate then the erudite judgments which the professors find in manuals and critical essays and seek to pass on to their classes. We shall establish an immediate contact between the mind of the scholar and the author, and the rôle of the masters will be to make a choice of the best authors and to see that what is read and studied has been properly assimilated. For this purpose the professor renders an indispensable service, for without his help the reader risks becoming copious, inordinate and lazy, whereas in collaboration with a more mature mind he is taught to recognize that order must be respected in the presentation of thought.

In learning to write in English and French our pupils will acquire a facility in the art of expression and we shall suggest as themes subjects both interesting and instructive. The school life itself will be fraught with interest; the sports, the development of the school organizations among the boys, the monitor system perhaps, the impression made on the boys by the distinguished guests who will be invited to address them, the visits to factories—all these will provide topics which, being of their very life, will stimulate their minds.

In the publishing of a school paper and in the acting of comedies we shall realize as a benefit what the boys will consider only a pleasure. In so far as possible,

we shall try to develop all work along pleasurable lines. Thus debates on questions of interest to them would prove of great value.

In history we shall consider it necessary for the boys to memorize only the important events with their dates; the number of these we shall reduce to the minimum.

In the study of geography we shall use pictures, synoptic pictures, cinematographs, and the processes which do not overtax the memory but rather arouse that part of the mind which has to do with reason and judgment.

The theories and practice of the sciences will be one and inseparable; that is, the hours spent in the laboratory in dissection, in manipulation, in botanical walks and in factories will demonstrate book knowledge.

As to mathematics and mechanics, though abstract in character, we can yet demonstrate their reality in the manual work of a shop, which can be transformed into a veritable laboratory of mathematics.

Literature and the sciences are contagious of interest to the young when translated by an enthusiast. An immense influence is exerted on a young man by a great mind or even by one who speaks lovingly of his subject. We shall hold it a great honor to receive in the Washington-La Fayette School illustrious men who will, as in American schools, share for a moment the interest of their own lives with our boys.

Most of us have aptitudes, vocations, which sometimes we do not discover until too late to be of use; we are often revealed to ourselves athwart another personality. The wasted talent of a man is a loss to his country, and in recognizing this we shall help our boys to discover potentialities that will give them the greatest advantage.

Theoretic and Practical Instruction in America

In America will culminate what in France will have been begun. For the pupils of the school who prove worthy, we shall have a fund which will make it possible for them to live in America to study at first-hand her great institutions. Through the interest in the school of influential Americans, offers have been made whereby our boys will be accepted in different industries as privileged employees; privileged in this sense, that as rapidly as a boy can assimilate or master the working of a department in the particular institution to which he is assigned, he will be transferred to another, and by this rotation he will come away in the course of a year or two with a real knowledge of how a large American institution, be it a bank, railroad, museum, newspaper, mine, telegraph system or factory, is conducted.

We shall try to steer the boys toward the career for which they would seem to us to be the most suited. Those of scientific or literary bent will have to be helped in a different way from those giving evidence of a more practical mind.

In the development of the mind our first effort should be to acquire the art of concentration and control. In school one should learn how to use one's intelligence, how to retain one's knowledge, how to project one's imagination, and how to judge and reason in a sound manner. The exigencies of the physical machine are identical; one should learn to know one's body and its best use. In the physical development of our boys we shall strive for the same objective as in our intellectual program, and the parallelism is significant.

Physical Education

It is remarkable that up to the present we have in France been singularly lax in recognizing any need of developing man physically and have been perhaps too insistent on developing man intellectually.

Spencer says that the strong nations are those composed of the best animals. We are apt to forget the importance of being strong animals and to overlook the physiological foundation on which the intellectual and moral man must build. Elementary hygiene often remains an unused field and man suffers because of what he fails to assimilate along these lines in his youth. The most simple laws of hygiene are ignored because they have not been put forward theoretically and taught in a practical way. Why are they not imposed? Why when learning about one's body should one not at the same time learn how it functions and what one should do to develop it and keep it in condition?

The mind is an organ and in intellectual effort we stimulate and train it. Too evidently we do not care in the same way for our body; to this the rounded shoulders, sunken chest, bent spinal column and atrophied muscles too often testify. It suffices for us to compare the poor, shortsighted, thin, yellow student, foregoing any recreation in order to pass his examinations, with the happy youth of an American university, to realize what a fountain of joy and energy we have sacrificed in denying to our boys the more rounded education realized in an American university.

It is possible for every one to attain a certain physical standard, but to try to surpass it without scientific supervision would often subject one to severe conse-

quences. There are certain rules one may follow which permit one to judge what the approximate measurements, breathing capacity, weight and muscular development of each individual should be and our effort in this direction should lie in helping each boy to realize his capacity.

In this instance, as in the preceding ones, we should not merely offer the facilities, but should impose as an obligation the standard of physical perfection to be achieved. Morally a man has no more right to live as a weakling than he would have to live in idleness or indulge in viciousness. We despise the blockhead, we analyze and criticize his writing and we render life a misery to him if he falls down in mathematics. Shall we continue to accept the awkward youth as a matter of course, or shall we not consider that it is as great a reproach for a man to fall short of the physical standard as of the intellectual? This program incorporates practical ideas regarding health and the conservation and upbuilding of a man's physique.

It is an advantage for an adult to know the art of self-defense, so we shall among other things teach wrestling. In learning this one acquires rhythm and poise. It takes years to perfect oneself in this art and to develop the patience which at the proper moment calculates the best point of application of effort. Boxing, too, discovers resources of great value. It carries the advantage of inculcating the body with a sense of equilibrium and renders bravery easier in proving to the pupil how often a quick action will avert a danger which appears serious. Jiu jitsu merits more practice. Many lack strength and for them it would be well to know how to offset brutality by skill. All fencing is valuable, in that it combines physical ardor

with mental astuteness. Our pupils will learn to handle a cane, the sword and the saber. They should be accustomed to the play of the bayonet, as there is nothing more disconcerting, nor anything which requires to be opposed by greater *sang-froid* or promptitude—qualities always desirable. Shooting has been unjustly neglected. It teaches one caution and power, and to find a bull's eye with a revolver or rifle may prove useful. Attack and defense in peace time happily play little part, but it is often necessary to know how to get out of an awkward situation. Of course one should know how to swim, climb, jump, ride a horse and bicycle, and to drive a motor; he thus accommodates the opportunities of modern and civilized life to a better physical development.

Having now covered the principal features of the physical program, which will hold a regular place in each day's activities, we will add that certain exercises should be superintended by a man whose familiarity with anatomy, physiology and medicine would give him the authority and influence to direct the boys' efforts into the proper channels. Ardor and joy are necessary conditions to the proper development of the body. We must recognize this fact, and in the working out of our physical plan we shall find in games the happiest expression of these. A greater part of the afternoon will be devoted to games, which accustom the young to the discipline of concerted action.

Moral Education

The moral education of man is of the greatest importance, and we shall here find that physical culture can be of great assistance. One of the first moral ad-

vantages derived from regular athletics lies in inspiring a child with appreciation of the value of well-being. A man suffers intellectually if his body remains inactive. He becomes prone to forgetfulness and negligence and these infirmities often do not emphasize the need of physical activity until it is too late. In contrast to this, you find an organism nourished according to a plan, developing its breathing and other functions, craving light, fresh air and pure water, and, in order the better to enjoy these, wearing light clothing. Cleanliness, in the minds of our pupils, should be considered not only desirable but necessary. The moral man suffers when the physical man is neglected. The care that one gives one's body bespeaks the account in which one holds oneself. The daily cult of self gives one poise, and this is reflected in the opinion of others. Harmony, sobriety in the use of words, promptitude in action are all qualities which express a well-regulated conscience.

Athletes refer constantly to being in training. All terms of this sort suggest the idea of methodical progression. All life in which physical activity plays a part must exact precautions and measures destined to obtain and to conserve for the longest possible time the supreme realization of individual capacity called form. To obtain form it is useless to hasten. Often in an effort to reach a goal quickly one is defeating one's own end. It requires self-control, calm and good judgment to make a good athlete, in addition to all the physical characters. Vice is held in contempt by the man who has realized in the physical life a preparation for the moral. A man who is physically normal is apt to be morally normal. Whoever understands progress is armed against vanity, which is a form of stupidity. Vanity is the consequence of a failure to recognize one's

own limitations and is the empty pride of one who contemplates himself in a more favorable light than he does others, even though in his accomplishment he fails to measure up to what he set out to do. The sporting spirit gives a man a sense of exactness. He determines in advance what the precise result of each effort will be and turns as naturally to his masters and superiors to receive his lesson as the man of vain disposition avoids advice, which he considers humiliating.

Frequent and reasonable exercise teaches us modesty, uprightness and frankness. Equally it teaches courage. Ignorance and awkwardness make cowards of us all. We are doubly ignorant and awkward when we do not sound our own resources, which we may underestimate, or which we may exaggerate, or by not making use of all of our talents in the struggle of life. Courage is in great part habit and mechanism. A quiet and pondered judgment with which to face danger, and a rapid decision mustered at the right moment to cope with a situation can be largely acquired as the result of sport. Self-inspection and the final triumph of patient effort represent yet another lesson of life which can be transposed from sport to that of conduct in general. Success is a total made up of many component parts.

The sense of continuity which comes to one gradually leads to a coördination of desire and prepares the will for the most trying and difficult tasks. Are there any of the traditional or eternal virtues which cannot be intensified by the assiduous practice of well chosen physical activities? The taste for physical culture, if we are able to achieve it, will become for our nation an instrument of moral unity.

Anxious to mold our boys into splendid characters,

we shall attach the greatest importance to rules of conduct, heart and will. The events which have led up to the idea of founding in the Washington-La Fayette School a Franco-American *entente* illustrate in the most manifest way the words of the old pedagogue, "Science without conscience is the ruin of a soul."

Religious Teaching Outside of the School

A systematic moral doctrine composed of precepts applicable to all circumstances of life is given by religion. We shall see that each child is brought up in the religion of his parents—in lieu of parents, we shall consult his tutor or nearest relatives. Religious teaching, the school being non-sectarian, will be given outside.

Respect for the rights of the child makes neutrality a duty of tolerance. We must, then, institute in the curriculum a moral teaching quite independent of religious instruction. This is the more important, as religious beliefs are not sheltered by conscientious scruples, while moral principles should be protected from the doubt which dissolves or suspends their application.

We shall vigorously insist in the school on a morale founded on the incontestable dignity of thought and will, which places man above the animals and makes it possible for him to triumph over nature and to recognize his obligations to himself and to his fellow-men.

In following the progress of reason we will give the child to understand that life has an object superior to pleasure, a spiritual aim which one cannot attain without devoting one's best to the service of humanity.

Like all other teachings of the school the moral training will have a practical bearing on the life of the boys rather than a theoretical one. We shall emphasize the importance of this in charging the director to find a means of personally influencing the boys not only to realize what life can be when righteously lived, but also to demand of themselves a life conforming to the precepts established by common accord.

Meditation, reading, the example of great men, the organization of intellectual society, will play a large part in this teaching, and we shall eliminate the discipline which creates insubordination and defiance, preferring to appeal to the honor of the pupils. Any youth so abnormal as to fail to respond to this plan we shall drop from the school.

In the above project of M. Charles Le Verrier and in the discussions which followed by such leaders of French thought as MM. Painlevé, Poincaré, Buisson and Lapie and by Mmes. Sanger and Le Verrier and Mlle. Thomson, we have endeavored to embody [1] all the highest ideals and practice of modern school education in France. As this unique educational idea was advancing favorably toward a concordant result, a new situation was created in Paris by the continued and violent attacks of the German army, and consideration of plans for education and reconstruction had to give way to plans for defense and the care of the wounded and the refugees who crowded into Paris. The funds for the proposed Washington-La Fayette School were necessarily diverted to other purposes, and the subject of the creation of the proposed institution was not renewed.

[1] Plan published in full in *School and Society*, Oct. 12, 1918-Feb. 8, 1919.

Education Begins At Home And With Parental Sacrifice [1]

Education demands incessant self-control, self-denial, self-sacrifice; from infancy onward there is no royal road to any form of achievement. In the United States we are paralyzing education by making it too free and too easy and eliminating from it the stimulus of the struggle for existence. New England and other colonies, rich and poor, originally banded together to insure equal opportunity to all in education. This early democratic method is now substituted by the taxation of the few instead of universal taxation for education.

In New York City and State the present system of taxation is extremely undemocratic and should undergo a revolutionary revision. The present system whereby 570,000 people pay all the direct taxes for 6,700,000 [2] belongs not to a democratic but to a plutocratic system of government. Our city at present cannot find the money it needs for educational purposes, because only one person in ten is paying directly for education. Indirect taxation through rentals is causing a great deal of discontent. People who do not hold landed property and who do not pay taxes naturally cannot understand why rentals are going up; they think they are being robbed.

I know of specific instances where the present system is working great injustice. For example, a young

[1] Osborn: Free Education Overdone. *New York Times,* May 28, 1919.

[2] In 1919 there were 578,043 taxpayers in the City of New York, out of a total estimated population of 6,740,000.

and eminent man of science, a member of the Royal Society of Great Britain, through years of close economy and saving, has finally gotten together enough money to buy a small piece of land and build a house on it, a home for his wife and children. This involved the assistance of a building and loan company and of the local banks, but after years of effort these loans have been paid off. Owing to the increased cost of living, his small professional income is entirely inadequate and he is now obliged to deprive himself and his family of some of the real necessities of life, including advanced education. At this critical moment the state and city enter and impose on his house, home and income a heavy tax, which amounts to more than one-tenth of his total income. This tax is partly used to give free education to the children of an alien colony in his community who are hoarding to send over to Italy and the Balkan States money which they should devote to the education of their own children. These aliens are not obliged either to become citizens or to pay taxes, yet the schools and all other free advantages of the American system are wide open to them—free hospitals, free dispensaries, free day-nurseries, free baths, free public lectures, free music—all of which they accept without giving corresponding return to the community in which they live or feeling any responsibility in its government. They live not in homes of their own, but in crowded tenements, exercising the utmost economy both in rentals and in all their modes of life. The money thus saved is not spent for the improvement of this country or for the improvement of their community, except in very rare cases. In some parts of Italy and Sicily whole villages and towns have been rebuilt and rehabilitated with the savings of aliens

in this country or, very occasionally, of naturalized citizens who have retained a natural affection for their native places.

Although I have devoted the last quarter of a century to education in the City of New York, I have gradually come to believe that free education is greatly overdone. What we are doing is accepted without gratitude, not because the recipients are naturally ungrateful, but because they know nothing about it. How should they know? They take what they are offered in free schools, colleges, museums, parks and aquarium as a matter of course, without inquiry as to the source from which it comes. Many of the newspapers which they read are constantly fostering resentment and antagonism toward the very people who are doing the most for them and who are making the greatest sacrifices in time and effort for their benefit.

Another aspect of the subject comes from a fundamental principle of human nature, namely, the lack of appreciation of and the failure to fully benefit by that which costs us no effort. The free educational system of the City of New York, to the great majority of people who benefit by it, apparently costs nothing. It would be of vastly greater value to the head of a household if he had to make a little effort, to practise a little economy and to exercise a little self-denial for the purpose of educating his children; even the money spent in small luxuries and the 'movies' would more than cover the per capita cost for education, because this per capita cost is not very large.

It seems to me in the true spirit of democracy that every one who is of age should be compelled to participate in all the responsibilities of citizenship; that he should vote for the government, work for the govern-

ment, pay for the government and, if necessary, fight for the government; certainly every one should feel the necessity for some self-sacrifice for the public welfare. I believe that we would have far more intelligent interest in public education if we had a direct per capita educational tax. It is the one tax which no one would oppose, because the one thing about which all Americans agree is the necessity for education. Of course it will be necessary to create a new public opinion on this subject in order to bring the country back to the original purposes of taxation for public education which were first enunciated, I believe, in the State of Massachusetts in the seventeenth century, at the time when every man had his own home and piece of land, and when the imposition of a tax was designedly universal and democratic, instead of, as at present, limited to the few and thus essentially aristocratic or even plutocratic.

Double or Treble the Pay of Teachers [1]

In surveying the general condition of education in this country, it becomes clear that united effort on the part of all our citizens is necessary to offset the educational crisis brought about by the high cost of living. From the universities at the top to the primary schools at the bottom, the prestige and influence of the teaching profession are rapidly declining, because the teaching class is not being drawn from the most intelligent members of the community. Just at the moment when the United States needs the greatest intelligence and inspiration in its teachers to meet new social and eco-

[1] From the Fifty-first Annual Report of the American Museum of Natural History, May 1, 1920.

nomic problems, which can be solved only through intelligence and moral endeavor, we find the ranks of the teaching profession being deserted all over the country and the vacancies filled by men and women ill-fitted by nature and training for the most vital function of our government. Education as "the most important subject which we as a people can be engaged in" was the opening thought of Abraham Lincoln's first public speech.

In round numbers, it costs twice as much to build schools and other educational buildings; it costs twice as much to equip and to maintain them; it costs twice as much to pay the teachers properly as it did ten years ago. This situation must be met sooner or later by doubling both the expenditures and the revenues devoted to education. An educational tax would supply city governments with the funds that are absolutely necessary for educational purposes; it would enable us to give remuneration adequate enough to make the teaching profession an incentive to men as well as to women. Recalling the epigram of Doctor Eliot that he who trains the mind is more important than he who minds the train, we observe at present a very serious thing, namely, the turning over of the training of boys especially to the woman teacher. The education of our youth is devolving almost entirely upon our women, because the men are obliged to seek more lucrative positions. This is the real reason why our education is being feminized, although, in my judgment, it needs both the masculine and the feminine elements, just as in the home both the masculine and feminine influence and authority are equally necessary.

Today in seventeen states there is an educational poll tax. We should have such a tax in New York

State. It would interest all people in education. It would make them more keen about the administration of the schools, more insistent that the schools should be kept free from all influences except those making for the greatest welfare of the young. We are now prepared to throw our entire support in favor of such a tax or of some other method which will give the municipal authorities of the City of New York sufficient funds to erect, equip and maintain its various educational buildings, as well as to pay adequately its great corps of teachers. It is noteworthy that New York State stands, not first, as it should, but thirtieth, in per capita appropriations for purposes of education.

We believe that the mayor and the board of estimate of the City of New York are deeply interested in the education of our children and will support a well considered movement to secure adequate funds for education, provided it can be shown that this movement is in the interest of the 900,000 children of our public schools. The present governor of the State of New York and the members of the Senate and Assembly must prepare to meet the crisis which has suddenly overwhelmed the educational system of the state. At the moment a democratic measure of taxation, one that has a precedent in many other states, seems advisable. President John H. Finley, at the head of the entire educational system of the state, has recently declared himself in favor of united support for home rule for the schools, for financial independence on the part of boards of education, and for *separate tax rolls and assessments for educational purposes.*

We believe that the people of this state, of all political parties and of all religious creeds, when the matter is thoroughly explained to them, will also share cheer-

fully in the new burdens necessary to develop and to protect our youth. Americans, one and all, are keen about the education of their children; all are ready to make some sacrifices, and the greater number are ready to make substantial sacrifices. It is true that all adults now pay an invisible and indirect tax through rentals. A visible and direct tax for education would be paid with less murmuring if its purpose were well known and understood.

III

THE MEDIÆVAL AND THE TRUE MODERN SPIRIT IN THE COLLEGE

While British and Continental colleges and universities are substantially the same as they were fifty years ago, American colleges have undergone a complete revolution. In wandering through the streets of Cambridge, Oxford, Heidelberg or Berlin or around the Sorbonne in Paris, one looks vainly for innovations; the Oxford or Cambridge don knows his way into every nook and corner of the same old libraries, bookshops, dining halls, rivers, fields and playgrounds. Here and there a new laboratory has inserted itself, but not a new custom.

But with all our American material and physical revolution, deeper insight reveals that we have not kept pace in our spiritual and intellectual life. The intellectuals of the Old World have a mental alertness far greater than our own; they eagerly receive and cultivate new intellectual ideas, especially in the field of science, while retaining all that is best of the old. Only in a few favored branches like astronomy, geology, palæontology and, of late, biology, is the American pace really quicker.

In the present chapter we may give a picture of the American college of the nineteenth century, its virtues and defects, the long transition to the new, and seek some of the underlying reasons why we Americans have not yet reached our collegiate goal.

THE MEDIÆVAL AND THE TRUE MODERN SPIRIT IN THE COLLEGE

The Old American College—Plain Living and High Thinking Fifty Years Ago—An American College in the Doldrums, 1903—Charles Francis Adams on the Harvard College of 1906—Foundation of Biology at Columbia University, 1891—The World's Debt to Biology, 1896—Huxley's Influence in Productive Thought.

IN the fifty-four years between 1873, when I entered Princeton, and the present year, 1927, the American college has expanded with the American republic. For the few thousand students of 1873 there are said to be 750,000 students today. Entrance classes alone today number as many students as the entire college roll of 1873. This is almost if not quite true of Harvard, Yale and Princeton, our three senior institutions. Only recently have the disastrous results of mass education come to the fore and compelled the colleges to study ways and means of reviving the individual instruction of the nineteenth century. It is no exaggeration to say that in the old American colleges the students felt the direct influence, whether depressing or stimulating, of every one of their tutors and professors.

The violent debates of the 1873-1900 period were, unfortunately, concerned rather with the machinery of education than with education itself; little thought was given to individual inspiration and leadership.

The debates centered chiefly around the following questions: The Required versus the Free Elective curriculum; Compulsory versus Voluntary religious attendance; Science versus the Classics and Humanities; Modern versus Classical languages; the Three-year college course versus the Four-year college course. These once burning questions have now cooled and have ceased to be regarded as worthy subjects of inter-presidential debate.

While the distinguished proponents of these various antagonistic doctrines were fully alive to the importance of securing on their faculties the influence of noted men of science, of letters, and of art, they did not consider how the torch of inspiration might be passed on to our youth, how the student might be induced to look upon education as the most important object of his life. Consequently, the college student became more and more devoted to athletics, and what are now known as extra-curricular activities took first rank in the student mind.

We cannot pretend to review all the details of this pedagogic warfare of the 1873-1900 period, but in this chapter we may cast a succession of glimpses at college education in America of 1877, 1891, 1903, 1906, 1910, the years which happened to be prominent in my own experience as student and teacher. I have also taken the liberty of quoting part of the brilliant address of Charles Francis Adams in which he attacked the free elective system.

The general outcome of fifty-four years of observation, experience and collective wisdom of many colleges and of many minds has been to substitute voluntary for compulsory religious service, to remove the high protective tariff which formerly walled in the

classics, to give the sciences the freest possible rein, to insist on the cultural value of classic and modern literature as essential in the training of the mind, to substitute the group elective system and logical arrangement of studies for the free elective system and, finally, to cap the climax, to insist that the *chief end of college education is original thinking and production on the part of the student himself!*

To my mind, we should go still further, for the future has in store *the compelling force of creative education*, not only in the college but in the pillars of the college—the school and the home. This is the opening and concluding of the present chapter.

Plain Living And High Thinking Fifty Years Ago, 1873-1877 [1]

When James McCosh, a hundred per cent. Scotchman, was called from a pastorate at Brechin to the Queen's College at Belfast, the whole north of Ireland rose in indignation. "Why is an Anglo-Saxon called to rule over the sons of northern Ireland? Why are our own great scholars passed by in filling this important post?" So violent and withal so amusing was the opposition that Thackeray immortalized it in verse; otherwise, like similar outbursts of patriotism, it would soon have been forgotten:

As I think of the insult that's done to this nation
Red tears of rivinge from me faytures I wash,
And uphold in this pome, to the world's daytistation
The sleeves that appointed Professor MacCosh.

. . . .

[1] Osborn: Plain Living and High Thinking at Princeton Fifty Years Ago. *Princeton Alumni Weekly,* March 18, 1925.

On the logic of Saxons there's little reliance,
And, rather from Saxon than gather its rules,
I'd stamp under feet the base book of his science,
And spit on his chair as he taught in the schools!

O false Sir John Kane! is it thus that you praych me?
I think all your Queen's universities bosh:
And if you've no neetive professor to taych me,
I scawurn to be learned by the Saxon MacCosh.

The very handsome and forceful young Scotchman soon quieted the storm of disapproval and established himself as preacher, teacher, and theistic philosopher in this northern stronghold of Irish Presbyterianism.

Princeton, Historic But Somnolent in 1868

Meanwhile Princeton, founded and nurtured in the same great branch of the Christian Church, was looking out for a great divine, a man of wide learning and reputation also, and in 1868 discovered him in the Queen's College at Belfast. Following the Civil War there had been a slack period in Princeton history; the institution was worthy and historic, but decidedly somnolent. The Rev. John Maclean, D.D., better known as "Johnnie," presided over the Faculty, which included several distinguished but aged laymen and a number of divines who had been called to the teaching profession. Among the latter several were rarely endowed as teachers; we recall especially Professor Duffield's clarity in mathematics and Professor Atwater's judicial treatment of logic. The great Joseph Henry, who discovered electric transmission of speech, had been called from Princeton to the head of the Smithsonian Institution. Princeton's once glorious

position as a leader in the nation's affairs and center of statesmanship and of law had waned and it had become simply good old Princeton College, hardly known beyond the boundaries of the State of New Jersey. The college was hardly holding its own; it was only gently moving onward, if not backwards. In the verse of one of the early sons of Princeton, there was a solid 'south wall' in the Faculty itself:

> Silently snooze the snoozers three,
> Dreaming of things as they used to be
> In the ancient æons in B.C.
> When "Johnnie" was prex and the college N.G.

When the eye of James McCosh first surveyed the Princeton campus he must have been struck with its barren simplicity, poverty of design and construction, and general ugliness as contrasted with the superbly built, beautifully designed, and imposing colleges and universities of Great Britain, Scotland, and Ireland. Let not the fifty-year graduates of Eli and of John Harvard feel too elated, for in New Haven and in Cambridge also it was the day of small buildings and great thinkers, of plain living and high thinking. In both these sister institutions of New England great mathematicians, physicists, and chemists were working in buildings so plain and simple, with funds so meager, that the human mind, not distraught by administration, could concentrate on its original function, namely, thought. At Princeton only Nassau Hall redeemed the landscape, but American architectural taste was so backward that its beauties were not realized as they are today. East and West were oblong boxes perforated with windows, with innovating mansard roofs, which also distinguished Reunion. The old chapel had

just a touch of Gothic relief. The wooden halls of Whig and Clio were Ionic, as today. The health department, known as South Campus, was of cryptic design, like the Catacombs of Rome.

The Professors of Philosophy and of Ethics

There were many collisions between the solid 'south wall' of the old faculty and the vigorous and progressive Scotchman. Through the wives and families of the professors there would leak out rumors of the somewhat violent differences in educational theory, for example, between the Rev. James McCosh and the Rev. Lyman Atwater, that kindly and stately leader of the old school of learning. McCosh's temperament had in it a mixture of the Celtic and of the fighting Scot; Atwater's dignity was that of the English which he brought with him from his Connecticut home. These differences of temperament led to the respectively appropriate college nicknames 'Jimmie' and 'Dad' and to the spirited verse, sung to the tune of "Steady on the Long-tailed Blue," which followed a particularly animated and prolonged breach of opinion between the two learned divines:

> Dad and Jimmie had a fight,
> They fit all day, they fit all night.
> And in the morning Dad was seen
> A-punching Jimmie on the Bowling Green.

Then, as now, student and faculty nicknames were chosen to mark the most conspicuous or obvious characteristic; they had no relation whatever to popularity or esteem, nor did they by any means indicate any real

irreverence. The portly figure of Lyman H. Atwater, slowly crossing the campus in his broad swallowtail or black overcoat, with heavy gray muffler and ancient silk hat slightly tilted backwards, gave an air of antiquity and professorial dignity to which the surname "Dad" could be appropriate. He was known and loved not only as the fairest and kindest man in the Faculty but also as the squarest. Again, there was only one hat on the campus older than that of Doctor Atwater and that was the venerable beaver which surmounted the massive brow and benevolent face of ex-President "Johnnie" Maclean, whose aging figure carried on the tradition of olden college days for many years after James McCosh took the reins of government.

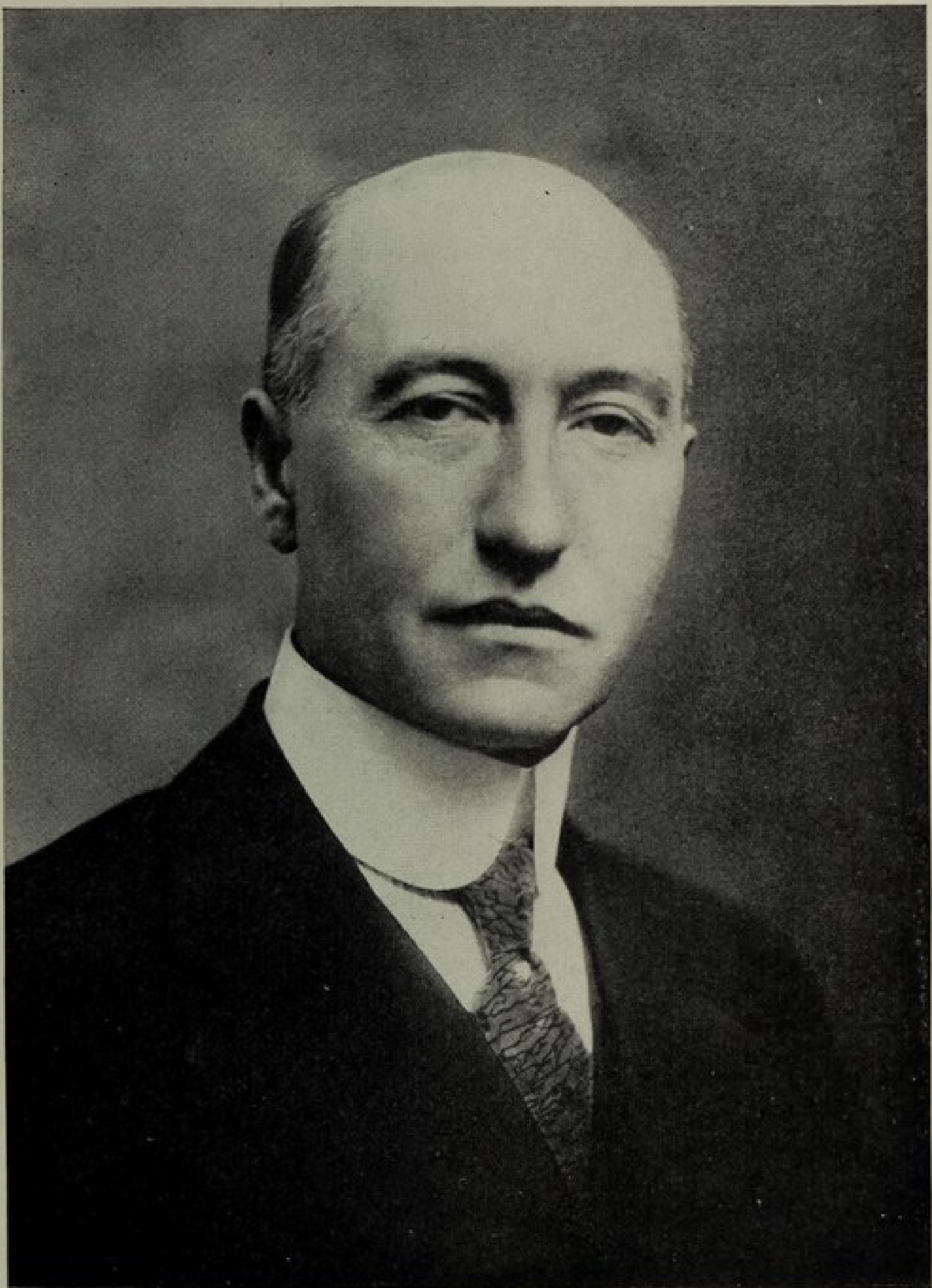
Johnnie's long prayers in the old chapel were famous and were pretty well known by heart. On one occasion he seemed to feel that the whole nation needed Divine protection; he started his lengthy prayer with the President of the United States, including the Senate and House of Representatives; he continued with the Governor and Legislature of the State of New Jersey; he did not forget the new President of the College, and he called down the Divine blessing on the entire Faculty, not omitting the tutors! Then it seemed that the students needed special intervention; he invoked a blessing for the Seniors, the Juniors, the Sophomores—but as the Reverend Doctor reached the Freshmen, a roar of laughter proceeded from the seemingly reverently bowed heads of the entire student body. At this unexpected "amen" Doctor McCosh became very impatient. After the disturbance was duly quelled and the Doxology sung with unusual fervor, he was heard to remark: "Surely Doctor Maclean is

in his dotage; *he ought to have more sense than to pray for the Freshmen!*"

"*Drill, Ye Tarriers, Drill*"

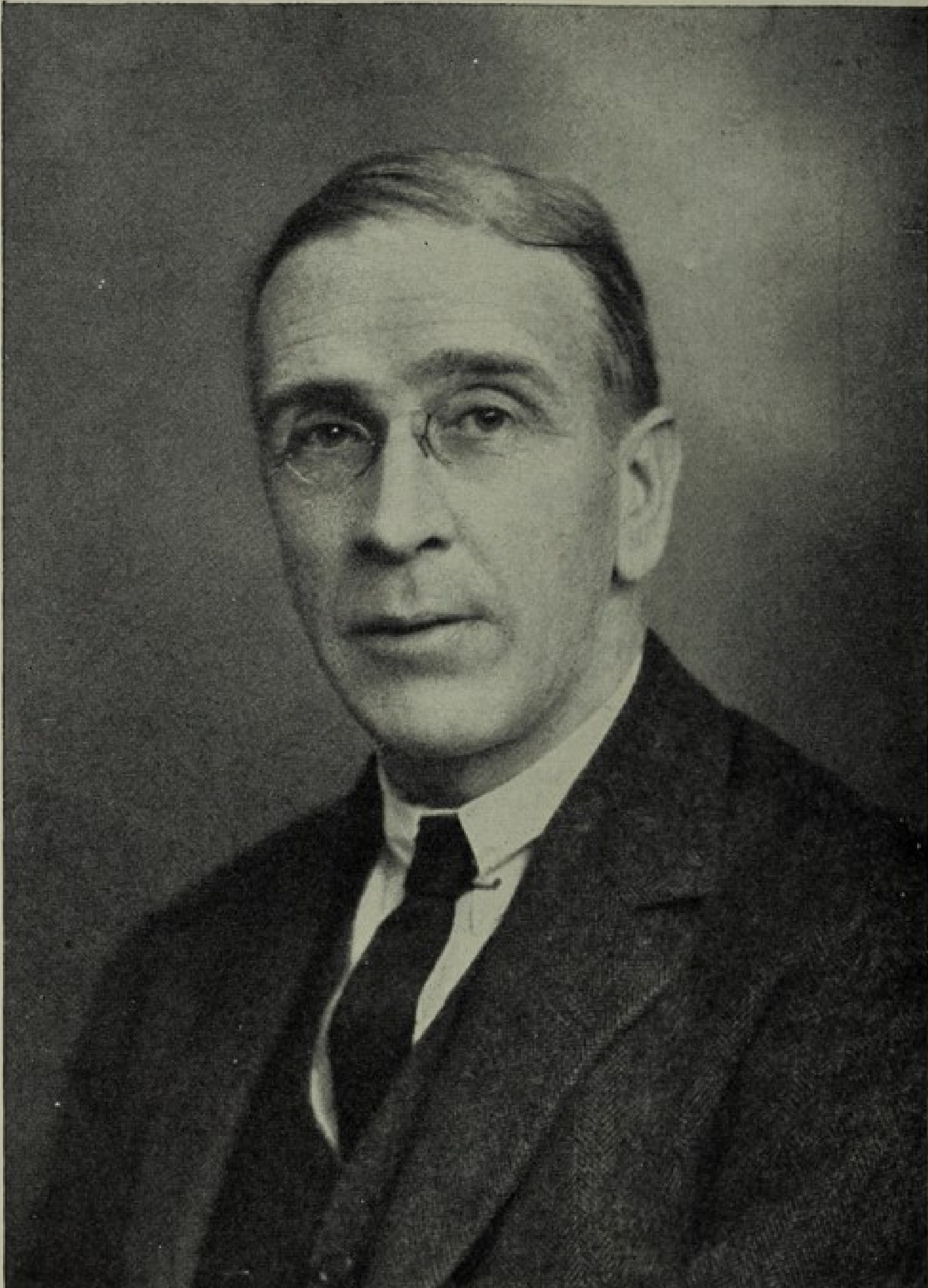
The curriculum of freshman and sophomore years at Princeton was deliberately chosen to smother any love of learning or any enthusiasm for the classics which may have been inspired by the clever teachers of the old preparatory schools from which Princeton was now rapidly recruiting its new membership. The method of instruction in Greek and Latin was on the old basis of "Drill, ye tarriers, drill"; six days a week in Latin, six days a week in Greek, until we were all convinced that the Greeks and Romans were the most tiresome people in all human history and we longed to break the bonds of languages so thoroughly dead, as they were then taught. Mathematics was somewhat better, but beyond the extraordinary clarity and simplicity of the teaching of Duffield was little vision of the glories of the mathematical mind; in fact, the two most unpopular teachers were those in Latin and mathematics. The instruction in chemistry and anatomy by Doctor Schanck was elementary, rudimentary, full of strange odors, the strongest appeal to our sense of humor being a *papier mâché* model of the muscular system of man.

Through this quiet vale of educational somnolence we burst into the new thought and vision of our junior year, under the inspiring lectures of James McCosh in psychology and of Cyrus F. Brackett in physics. The latter course was terribly difficult to non-mathematical minds, but Brackett himself was full of



BARNUM BROWN

Palæontologist, explorer, author, Curator of Fossil Reptiles, American Museum of Natural History



CLIVE FORSTER COOPER

Chief of the Museum of Comparative Zoology, University of Cambridge

inspiration. Many of the literary men, in fact, found more inspiration in his lectures than in many of the lectures in literature. For the first time we began to realize that we had minds and more or less of intellect.

Men who had been toiling along far in the rear in the drill hours of freshman and sophomore years, when memory was the supreme qualification for high percentage grades, now began to move forward toward the front and feel their intellectual awakening. Blasé students of the wealthy and leisured class who had never done a moment's study or thinking now began to sit up and think. On the other hand, a junior like the young philosopher Ormond, who had laboriously tried in freshman and sophomore years to overcome very bad school preparation, now sprang to the very head of his class, for psychology is a special endowment and the philosopher is born, not made. The lectures were delivered with the utmost clearness and were illuminated year by year with beautiful illustrations; the whole history of the science of the soul was told, from its beginnings among the Greeks, and by the end of the year James McCosh was securely enthroned as the master-mind of the College. This spell continued into his wonderful course on the history of philosophy in the senior year and culminated, in the Class of 1877 at least, in a genuine thirst for further learning.

McCosh was quick to perceive this response to his teaching, and in order to hold these men he planned the foundations of the structure that has expanded into the great Graduate School of the present day. Noteworthy is the fact that through the influence of McCosh the first great graduate class was entirely composed of Princetonians; we are told that neither Princeton nor Harvard nor Yale is today holding

their own graduates in their graduate schools but that they are obliged to recruit from other colleges and universities at home and abroad. This was not the case in McCosh's day.

James McCosh, Inspiring Teacher

That plain living led to high thinking at Princeton fifty years ago was therefore chiefly due to the inspiration of a number of great teachers on the faculty, but, above all, to the greatest teacher, James McCosh. No one can forget his kindly words of encouragement as he aided the early faltering steps of learning and of research. Original thinking among the advanced students was fostered by putting upon them as much responsibility as they could bear. The library meetings in Doctor McCosh's own study, in which all kinds of philosophical questions were discussed and papers read by students and younger men for discussion by all, were most provocative of original thought. Doctor McCosh's own attitude of eager receptivity to new knowledge, his enthusiasm for the rising science of physiological psychology, his open-armed welcome to the then more or less tentative theory of evolution, his vigorous advocacy of the elective system in advanced years, his own ardent spirit of inquiry and independence in educational polemics conspired to impress on all the men who came under him between 1868 and 1888, when he put aside the presidency, the intellectual stamp of James McCosh. When sixty or more men gathered on his eightieth birthday they found no more fitting inscription for the golden pitcher which they

presented him than the quotation from Aristophanes' "Clouds":

εὐτυχία γένοιτο τἀνθρώπῳ, ὅτι προήκων
ἐς βαθυ τῆς ἡλικίας
νεωτὲροις τὴν φὺσιν αὐ-
τοῦ πρὰγμασιν χρωτίζεται
καὶ σοφίαν ἐπασκεῖ

Prosperity attend him, since while passing on
Into the vale of man's decline
He yet with newer learning's tint
His mind imbues
And wisdom cultivates.

An American College In The Doldrums

To the Trustees and Faculty of Princeton College, April, 1903

A vessel in the doldrums suffers from lack of motive power afforded by a freshening breeze and wavers in its course of direction. This was the condition of uncertainty which prevailed in our American colleges during the first decade of the twentieth century. It was perhaps especially noticeable in Princeton, which, following the régime of McCosh, had fallen under the direction of a brilliant scholar and personally delightful *mediævalist*, President Francis Landley Patton. Princeton lost the wonderful momentum which it had attained under President McCosh and which it was destined to regain under the inspiring leadership of Woodrow Wilson.

The Princeton of 1927 has an altogether ideal collegiate system of education which has entirely replaced the inertia of 1903 deplored at that time in the following confidentially printed article.

The Author on the Princeton College of 1903 [1]

Written at a distance and some time after severing my direct connection with Princeton University, these observations may gain in perspective while they may lose in exact reflection of present conditions. Wholly impersonal, they represent the result of years of experience, also of questioning students in different colleges, especially those of Princeton, Columbia, Yale and Harvard. They purposely omit all reference to questions of moral and physical education. In course of comment on education as it is at Princeton an original attempt is made to *develop a fundamental theory of education which it is hoped may be of some service.*

As regards the public and educational life of the country, we must take more account of changed conditions; of the fact that we are no longer preparing largely for the ministry, although strong influence should be exerted in this direction, and that while law and medicine still make large demands on our graduates, new objects of education are rapidly springing up. There is the public service in city, state and nation, the call for college-trained men in the government scientific bureaus, in the colonies; the large demand for teachers incidental to the rapid extension of educational institutions throughout the country, and for men trained in literary lines. Is Princeton doing her full share in entering men into these lists? This could only be fairly answered by careful statistical

[1] Osborn: The Mediæval and True Modern Spirit in Education. A privately printed brochure reflecting the collegiate conditions of 1903, which have been entirely superseded at Princeton under the great administrations of Presidents Woodrow Wilson and John Grier Hibben.

inquiry, but we must not forget that Princeton once held a leading position in the national government and that this is no longer the case. It appears that Princeton is not in as close touch as the third college of the country should be with modern life in any of its manifold phases. As a college every historical and natural advantage is hers, and it is the college that we have in mind in this paper.

The Princeton curriculum requires thorough reconstruction rather than alteration or repair; it must be considered *de novo* and adapted to modern conditions. The rigidity of our system is similar to that which drove Darwin to idle away his days at Cambridge, and frightened Rowland, the greatest physicist America has produced, away from college altogether. Are such minds as those of Darwin and Rowland worth arresting and interesting if good fortune sends them among us? Our present system ignores the profound constitutional or hereditary intellectual predispositions or differences which exist among young men, and one of the first objects of a curriculum *should be to fasten the interest of the student at some point for some subject, and use this as a lever to lead him to take a more serious view of other subjects.* Every man is born to do one thing better than any other; the earlier he discovers it the better it may be for his intellectual salvation.

Princeton must progress with the rest of the educational world. In the past fifteen years we have stood absolutely still so far as any radical reconstruction is concerned, and we now occupy a unique and isolated position among the larger universities of the world. The old and conservative colleges of Oxford and Cambridge have abandoned certain principles

THE SCHEME OF MEDIEVAL EDUCATION AT OXFORD.

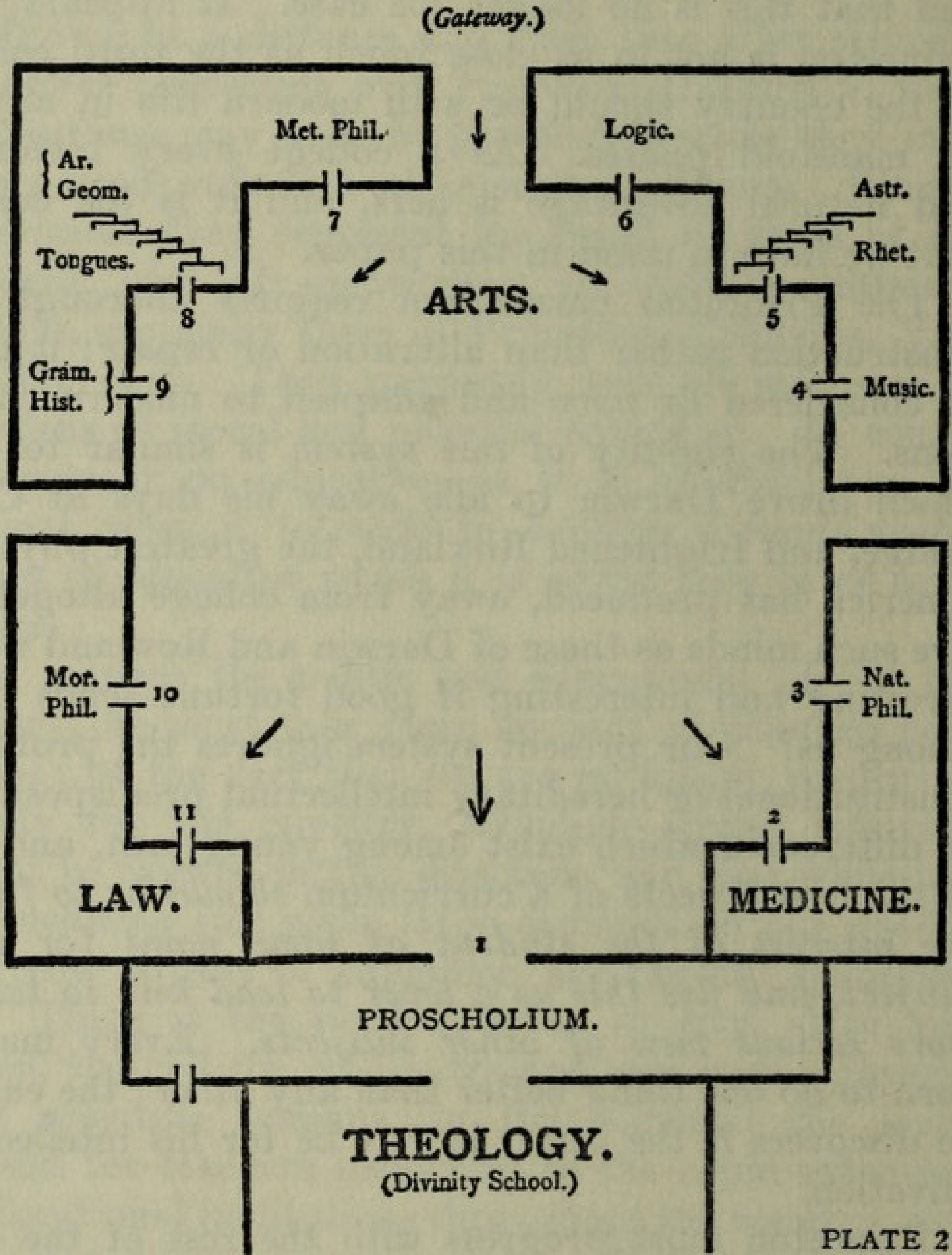


PLATE 2

THE QUADRANGLE OF THE SCHOOLS, NOW PART OF THE BODLEIAN.

(Built in 1612-19.)

The four corner staircases led to the first floor. Thus Medicine was over Natural Philosophy, Astronomy was over Logic, and Rhetoric over Music.

COURSE OF STUDY

ARTS.

(Degrees B.A., M.A.)

Trivium.	*Quadrivium.*	*Philosophies.*	*Tongues.*
Grammar (*degree*).	Music (B.Mus., D.Mus.).	Moral.	Greek.
Logic (=Dialectic).	Arithmetic.	Metaphysical.	Hebrew.
Rhetoric (*degree*).	Geometry.	Natural.	——
	Astronomy.		*History.*

THE 'SEVEN LIBERAL ARTS.

LAW	THEOLOGY.	MEDICINE.
(*B. Can. Law*, B.C.L. *D. Can. Law*, D.C.L.)	(B.D., D.D. = S.T.P.)	(B.M., D.M.)

(*Obsolete degrees are in italics.*)

THE 'SEVEN LIBERAL ARTS.'

Gram loquitur, *Dia* vera docet, *Rhet* verba colorat:
Mus canit, *Ar* numerat, *Geo* ponderat, *As* colit astra.

'Tis Grammar teaches how to speak,
And Logic sifts the false from true,
By Rhetoric we learn to deck
Each word with its own proper hue.

Arithmetic of number treats,
And Music rules the Church's praise;
Geometry the round earth metes,
Astronomy the starry ways.

[From "Oxford Outside the Guide Book" by Falconer Madan, Hon. Fellow of Brasenose College, formerly Bodley's Librarian, Oxford. Basil Blackwell, Oxford, 1925.]

for which we are still standing. One would expect to see in the current magazines and reviews the friends of the Princeton system, if there be such, taking the offensive and holding their ground; but one looks in vain for articles of this character.

Few of us appreciate how conservative and reactionary our position is. Here is a part of a letter [1] regarding a young student entering a 'natural science' course at Oxford, which is in bright modern contrast to the mediæval conditions the same student would face were he to desire to enter Princeton:

> The other Balliol scholarships are equally the first things in their respective categories, and it is interesting from the point of view of heredity that 4 of them are now held by sons of Oxford resident teachers: 2 in classics, 1 in modern history, and now 1 in natural science. Ted will go back to Rugby till August, and come up here next October when he will be just over 19. That is I think just the right age to begin University life. He will in the meantime chiefly study modern languages, especially German, as he *finished his Greek and Latin two years ago* [that is, at 17] and passed the 'certificate examination' which is accepted instead of all classics up here.

Altered Position of the Classics in Education

We should totally abandon the claim that the classics have superior 'mind training' value or that they alone best conduce to a 'pure English style' and substitute the claims of the true modern spirit that as *perfected studies* the classics develop systematic thinking; that by familiarizing us with the greatest people of any age they give us a sense of perspective and proportion for our lives and times; that they tend to broaden culture, and that they may be harmoniously

[1] E. B. Poulton of Oxford University to the author.

and advantageously combined with classical history, art, archæology and philosophy.

"No doubt both Greek and Latin are very great ornaments, and of very great use but we buy them too dear." These words of Montaigne exactly fit the situation. College education in the classics now extends from the eighteenth to the twentieth year. Years ago it extended from the seventeenth to the nineteenth year. It is extremely important to keep in mind the advanced age of college entrance, which has been brought about partly by the increased requirements, partly by the generally freer social conditions in our colleges which lead parents to hesitate to send their sons at the earlier age. Thus has arisen a greater disproportion between mediæval education and modern education than existed previously. In other words, there has been a positive retrogression in this regard, an actual increase in amount of time in proportion to the whole life period which is given to these subjects.

Summing up the whole linguistic training as compared with training in other subjects, or any other group of subjects, up to the time of graduation, say at the twenty-first year, we find that it compares in about the same ratio as a cathedral to a village chapel. No cultivated man can fail to appreciate classical education; on the contrary, modern science, and more especially the biological sciences, all benefit by classical preparation. The question is not, therefore, the value of the classics, but whether the classics are so valuable as to warrant their absorbing four-fifths of the whole educational period and nearly one-third of one's lifetime. Exactly the same criticism applies to the over-exercise of mathematics.

'Required' classics beyond the freshman year is

an anachronism. Let the student learn what the ancient authors, taught in the culture spirit, represent; if they still do not appeal to him, nothing is gained by continuing the high protective tariff for classical studies another year. It is this high protection of the classics in our American colleges which has been so fatal to the life of these studies. From the sophomore year on let the classical and mathematical teachers enter the intellectual struggle for existence and compete for students with the humanists and the scientists.

Princeton, thanks to her new library, to the seminar system, and to the accession of teachers of talent and enthusiasm, is now beginning to enjoy a classical revival in the best sense. There is a rare opportunity in the future development of the Art School to make a new departure in classical education. We would rejoice to see a beautiful building exclusively devoted to classical teaching, connected with the galleries of the Art School and the monuments of Greek and Roman antiquity. In other words, archæological should go hand in hand with linguistic teaching. There is now a totally unscientific divorce between the Greco-Roman archæology, as taught in the junior and senior years, and the purely linguistic work of the freshman and sophomore years. This is another illustration of the lack of sequence and correlation in our present courses.

Theory of Reconstruction of the College Course

For the early years of the course we would advocate in general, first, that a true proportion be established between the Classics, English, Modern Languages,

Mathematics, Physics and Chemistry, Logic, History, Government (citizenship and service of the state), as if the educational problem were to be considered *de novo*, and we had an opportunity to build up a curriculum not upon tradition and custom, but upon the merits of various subjects and upon their relative value in cultivating the six great forces of education as above described.

The two fundamental sciences should be taught, not in a technical spirit, nor even as groundwork for serious research, but in *a felicitous welding of hard thinking, of information, of philosophy, of culture, and glimpses into the marvels of the cosmos.* Such a lecturer as Professor Brackett of the Department of Physics gave us a cultural standard of science in 1875; a well known man of letters still speaks of this course as the most stimulating of all his four years.

The second step, partly a financial one, is to equalize the *per capita* cost of education; that is, to spend as much on freshman education as on senior education. There is no inherent reason why it should cost several times as much to educate a junior or a senior as it does to educate a freshman or a sophomore; the under classmen are paying as large or even larger total fees than the upper classmen. They are not receiving their share of the benefits of these fees, but these benefits are crowded into the two upper years where there is such a profusion of courses that no man can take advantage of them all. In other words, there should be such a redistribution of the educational riches of the University that *the freshman and sophomore years shall be as full of inspiration as the junior and senior years.*

As soon as a student enters Princeton he should feel a strong and refreshing contrast to school life in the

wider intellectual horizon; in the continuation of classical work on the culture rather than the 'cram' basis; in the immediate stimulus of English; in the glimpse into political and national life; and, if he elects, into the world of science also, through a course in physics.

The third step is the establishment of sequence in the various lines of work, such a sequence that the freshman and sophomore work will naturally lead into and prepare men for the junior and senior work. The Chinese wall which now divides these four years into 'mediæval' and 'modern' is wholly unnatural and should be replaced by a sequence of studies.

The fourth objective is the recognition that the natural sciences and the humanities contribute alike to modern liberal culture and that the sciences supply far the best media of original observation, of reasoning from cause to effect, of induction and generalization; that laboratory instruction or direct observation in the sciences is the method most effective, although for larger classes it involves expenditure which will make it almost prohibitive at present; that a deliberate and thorough course, with sufficient time for collateral reading, reflection and discussion, has more educational value than a large number of hurried courses; that personal contact, discussion and deliberation between students and teachers is quite as potent and in some cases even more potent than lecture room contact.

In my opinion, the best method of bringing about a sequence of studies in the first two years is the institution of the group elective system, which has been successfully tried at Johns Hopkins, Bryn Mawr, and Chicago, and is under consideration elsewhere. This system evades the extreme disadvantages of the free range of election, and combines the advantages of the elec-

tive and the required systems; that is, after the student has made a general choice, the faculty decides what is the proper correlation and sequence of studies, what should precede and what should follow, while still allowing for absolute freedom of choice in the later years.

Science pursued as a technical profession belongs by itself, and the ultimate destiny of every School of Science is to divide into two parts, one part leading to the technical professions, the other more closely correlated with the work of liberal education. The divorce between academic and general (that is, non-professional) scientific studies is totally unnatural; it is another survival of mediævalism, namely, the notion that the training of the mind through the works and thoughts and language of man is superior to training through the works of nature. All nature studies pursued for their own sake belong in the same category with classical, philosophical and literary studies. All scientific studies pursued with reference to technical professions, or, in other words, all applied sciences, belong in another class. The tendency of recent progress has been clearly to recognize this distinction, and Princeton should rank with the leaders in this inevitable educational reform.

Fallacy of the Three-Year Course Argument

It is to the interest of all education that the American college should preserve its integrity intermediate between the school and the university. The three-year question promises soon to be an economic one of the first importance because it will soon affect seriously the

flow of student life and patronage. It may be met only by moderating the age of entrance. The fallacy of the argument for a three-year course consists in the fact that when we look back at the whole trend of American education in the last quarter-century it is obvious that the present cause of this movement is the increased age of entrance to college which, in turn, is the result partly of the natural evolution of the human race in the prolongation of childhood and boyhood, partly of the increased entrance requirements. The arithmetic of the matter is this: from one to two years have been added to school life, and to equalize matters it is now proposed to subtract one year from college life; one whole year of loss in the culture period of education is the net result. The most sanguine schoolmaster does not claim that the school period, terminating with the dreaded two years' cram for the entrance examination, is a culture period. Similarly, university or graduate work, while embracing and developing a larger culture, is distinctly *special*, even when proceeding along lines of three great subjects. For example, the graduate may pursue physics, chemistry and biology as his two minors and a major. These will require his undivided attention and energy for at least three years, and whatever culture he gains is that which always comes from the more profound, original, and productive investigation of any subject.

The college course must, therefore, stand distinctively for culture, not in the restricted mediæval sense of book learning but in the broad sense of the cultivation of knowledge, of individual judgment and opinion, reasoning, observation of men and things, expression, and the firm establishment of those high ethical and æsthetic standards which lend to all future specializa-

tion the absolutely essential elements of truth, beauty and service.

The college course of four years affords barely sufficient time to prepare for university work in any of the humanistic or natural sciences. On the contrary, these sciences demand at least two years of special preparation before the student can advantageously enter work for the degree of Ph.D. The wise exception as regards the four-year course is naturally that students preparing for the professions—ministry, law, medicine—may devote their fourth year to the fundamental studies and work of those professions. As long as Princeton lacks either a law or medical school, it will be extremely difficult to make this fourth-year preparatory work valid in another university, such as Columbia, for example; but I believe that the desirability of securing Princeton graduates in the professional schools of Columbia, Harvard and other universities, will make it possible to bring about some reciprocal arrangement whereby Princeton senior work will receive the same credit as Columbia or Harvard senior work.[1]

[1] Under President Wilson's administration, which began in the year 1902 and continued until the year 1910, many of the reforms suggested in this paper were instituted, especially the spirit of national responsibility and public service, the spirit of the intellectual life taking precedence of all other life with renewed and direct contact of teacher and student through the institution of the preceptorial system. These changes involved a revolution in the mediæval system but lacked sympathy with the cultural and intellectual value of scientific studies. President Wilson to the last remained jealous of the rising tide of science, and it was left to his successor, President John Grier Hibben, to create a true balance between science, literature and philosophy and, of even more moment, to compel the students to do their own original thinking.

Charles Francis Adams On The Harvard College Of 1906 [1]

"The ideal college organization is not difficult to outline; but, besides a decided lack of faith in ideals, I recognize fully the practical obstacles in the way of attaining their fulfilment. In the case of Harvard, none the less, I would, were it in my power, discontinue absolutely, and wholly break up, the traditional academic system. Harvard College, save in name and continuity, should cease to exist. In place of it I would have a number of colleges, all independent, at the head of each of which should be a master—if you like, a president. Those colleges should be so limited in size that individuality would be not only possible but a necessary part of the system. The master should know every student. Instructors and students should constitute a large household under several roofs and with common grounds—independence and individuality under suitable restrictions should be the underlying motive. The university with its elaborate machinery of instruction would then come into play to supplement college instruction. The university professors would teach; and the students of each college, under the supervision and by the advice of the master of the college, would select their courses. The system of general university electives would be combined with prescribed home courses in each individual college. The master would give tone and character to his college, and to each individual student in it. The final degree, bearing the name and seal of Harvard, would be conferred

[1] Address before the Columbia College Chapter of the Phi Beta Kappa Society in New York City, June 12, 1906.

as the result of examinations in common, all the colleges competing.

"Such is my ideal of a system to replace the present and traditional system, and make good its glaring deficiencies. The obstacles in the way of its realization, however, loom large. Harvard is a growth—a growth of close upon three centuries. Its halls, its grounds, its location, its endowments, its organization, and, more and most of all, its traditions, are obstacles well nigh unsurmountable. The additional cost also of such a system as that outlined, though it would vary according to colleges, would, at lowest, be comparatively large. Each college would, it is true, establish its own tuition fee, as secondary schools now do, and thereby a great present defect would be removed; for Harvard now has one fee for all, rich or poor, a most inequitable equality. Under an independent college system, at once elastic and individual, but culminating in a common and uniform result, anything and everything might be anticipated—the endowed and free college, the college with scholarships, the college of moderate cost, or, finally, the college of millionaires. All, however, would be subject to the supervision of the board of overseers, acting as the grand inquest of the university, and all would be judged by the common test, the conferring of the college degree.

The Elective System A Fad

"I have referred to the course of studies to be pursued in the ideal college—the prescribed courses and the electives. All would be under the immediate advice and impulse of the master, necessarily of more mature

judgment, acting on personal knowledge of the individual student—his aptitudes, his deficiencies and his environment; and this naturally brings me to the remaining, and much the more important part of my theme. I refer to the elective system, so-called, in its present stage of development and application, so far at least as Harvard is concerned. And here I may as well blurt out a confession of faith. Briefly, speaking from personal experience of which I know, and from observation both long and patient, I have come to regard the elective system in its present form of development as an educational fad, and a very mischievous one. As such I do not believe in it; nor have I any faith in its outcome until, as an educational process, it has been reconsidered and placed on a new basis, radically different from that now in use. I am quite well aware that such a conclusion as that just expressed is at present hardly conceivable among educators, at least those in my immediate environment. It is in their eyes much as if doubt were expressed of the Copernican system, or the multiplication table were challenged; all the same, I doubt, and I challenge. I am here also to set forth the reason for the faith, or lack of faith, that is in me.

"Let me, in the first place, clearly define my position; for, though misrepresentation is of course, I do not want to be misunderstood unless intentionally. I have said that I am a disbeliever in the elective system, so-called, as at present developed and applied; and I may add I am no more a believer in it as developed and applied fifty years ago. In the fundamental idea of an elective system, that of individuality and the cultivation of aptitudes, I have firm faith; but that idea finds poor expression through the system now in use,

an expression in my judgment crude, ill-considered, thoroughly unscientific and extremely mischievous. . . .

"My understanding of the argument in favor of the elective system, both in its earlier form of fifty years back and its more fully developed phase at present, is that, recognizing individuality, it gives scope and play to aptitude. The field of human knowledge has also been of recent years vastly extended, and its products so diversified and again differentiated, that a smaller portion only can be covered even by the most ambitious intellect, and, hence, selection is necessary. So, fifty years ago, and in yet greater degree now, the youth of eighteen was let loose in this vast and diversified pasture ground and told to make his selection, consulting his aptitudes. The system thus presupposes that the average youth of eighteen, fresh from school, has defined aptitudes, and not only understands himself but can be depended on to select judiciously. I may have thought so once; but I was very young. I am older now, and I make bold, as the result both of experience and somewhat bitter experience, and of observation and somewhat extended observation, to challenge both premise and conclusion.

The Boy No Judge of His Needs

"In the first place, I wholly deny that the average youth of eighteen has any well-defined or clearly developed aptitudes; or, having them, that he is at that age well qualified, or, indeed, in any sufficient degree qualified, to judge of them, or of the training most calculated to their more perfect development. I distinctly and most definitely know, and now sadly recognize the

fact, that it was not so in my case; it was not so in the case of any of my brothers or of my sons; it has not been so in the case of any single person who has chanced to come within my range of close observation. That I, and that every one of those I have thus referred to, had a certain degree of individuality and could do some things far more readily than I, or they, could do other things, goes without saying; but that the average youth of eighteen has distinctly defined aptitudes, or any clear apprehension of how his faculties as a whole should be brought into play and trained to the proper development of those aptitudes, I know positively to have been the reverse of correct in my own case, and I have, moreover, never known a case in which it was correct. That the elective idea was an improvement, and a great advance on the educational Procrustes-bed system which preceded it, I do not for a moment deny. On the contrary, I fully and unreservedly concede it. But, in itself, as yet developed and as a final result, I find myself compelled to repeat, I regard it as crude, ill-considered, thoroughly unscientific and extremely mischievous. It recognizes only liberty; and liberty, though much, is not all. Like most other things liberty is liable to abuse as well as misapplication; and anything, sunlight even, taken in excess is poison. . . .

"The old Procrustean system of college education was based on the assumption that certain things went to make up what was, and for that matter still is, conventionally known as a man of liberal education. All men, moreover, were assumed to be alike. What experience had shown was good for most was good for all and for each. The educated man, so-called, must know certain things, or at least have a smattering knowledge thereof. They were always the same things. The only

conception of a mental training was confined to a thorough grounding in what were known as the 'humanities.' This system was traditional; and accepted as final in university circles until a time lost within the memory of men now living It was first broken into at Harvard during the presidency of Josiah Quincy, and his remark when a chair of physics was then suggested has become a Harvard classic. 'Throw physic to the dogs,' the old president exclaimed. Whether through accent and intonation in this case the word 'dogs' was intended to designate the student body, or whether in a general way Mr. Quincy merely relieved himself of an apt Shakespearean quotation, does not appear. Nevertheless, the system was, and by tradition had always been, one of strictly prescribed studies, uniform in character and application. Once released and in motion, the pendulum swung far back. In fact it swung to the other extreme. The cry was liberty, aptitude, individualism.

"Originally, and distinctly so in my time, the conception of a university, or liberal, education was that the baccalaureate had at least a rudimentary insight into a great many branches of useful knowledge—for example, the classic tongues, history, physics, metaphysics, philosophy, mathematics, including arithmetic, algebra and geometry, logic, astronomy, political economy, the use of the spheres, etc. These studies were not much regarded from the mental gymnastic, or training, point of view; but, like silver dollars in the pocket, they were good things to have in the head and memory. A little knowledge of chemistry or algebra might come in handily some day; almost as much so as an apt classical quotation. More recently this mid-

century practice has given way to the specialist theory now in vogue.

"I find myself as much unsatisfied with the new as I was with the old. Neither squares at all with my experience or my observation. What have I to propose as a substitute for that which exists and which I thus unsparingly condemn? Something, I unquestionably have; like Touchstone's Audrey, perhaps, 'a poor virgin, sir, an ill-favored thing, sir, but mine own; a poor humor of mine, sir, to take that that no man else will.' But before propounding a system it is necessary to agree on first principles. To begin with, it is essential to define a college education—that is, an education which prepares for life's specialty or calling. It is, I contend, purely a training of the mental powers—the supplying and developing of the intellectual muscles and sinews—the proportioning of the faculties. So far, I imagine, there will be a general concurrence; no paradox has yet been enunciated. But both my observation of others and my self-experience next tell me that all the faculties, as seen in every human mind I have had occasion to study, group themselves under three distinct heads: first, and highest, the imaginative, second, the reasoning, and third, the observing. There is no attribute of the mind, so far as I know, which will not find its proper place in one or another of these groups, and be subject to its laws. The imaginative includes, of course, the literary and the artistic; the reasoning, logic, mathematics and cause and effect; the observing, all outward manifestations of matter and inward of mind, the subjective as well as the objective. Every man's aptitudes lie in one or other, or possibly all three, of these directions. If in all three he is apt to

be afflicted with what is commonly known as a fatal facility. If exclusive in one, he has a manifest call—he is then known as a poet, astronomer, naturalist, Shakespeare, of imagination all compact; Newton, who, as Lord Erskine tells us, 'carried the line and rule to the uttermost barriers of creation, and explained the principle by which all created matter exists and is held together'; Darwin, who, through observation, rewrote Genesis.

The Educated Man

"The educated man—what we colloquially call the all-round educated man—is next to be defined.[1] *An educated man is*, I take it, *one in whom the imaginative faculties, the reasoning faculties and the observing faculties have all been properly and adequately developed, developed to such a degree that each becomes a usable tool for accomplishing the work in hand to do.* The imaginative man should be trained to reason and observe, to a degree. The reasoning man, devoid of imagination and unable to observe, becomes, whether in religion, in politics, or in philosophy, notoriously a pitfall. On the other hand, the observing man finds himself at fault unless he can imagine and reason. No man, moreover, is fit to be called educated unless in him each group of faculties has been supplied and trained. Newton, for instance, observed an apple drop; he fell back on his imagination, his mathematics did the rest." [Italics my own.]

[1] Compare my definition of a liberal education in this volume with that of Huxley and Charles Eliot.—H. F. O.

Foundation Of Biology At Columbia University, 1891 [1]

The will of Mr. Charles M. Da Costa, a graduate of Columbia College in 1855, contains the following paragraph:

> I give and bequeath to the Trustees of Columbia College, in the City of New York, the sum of one hundred thousand dollars. I express the hope that such sum may be used for the endowment of some new professorship, which, in the good judgment of the Board of Trustees, may be needed in any of the schools or departments of the College. But this expression of mine is in no way to limit the absolute right of said corporation to use said sum for any of its corporate purposes.

This munificent legacy of $100,000 was the indirect means of the founding of the Department of Biology at Columbia University. A Committee of the Board of Trustees, after a special study of the educational needs of the year 1891, presented a unanimous report, the spirit of which centered in the following passage expressed by President Seth Low:

> In the mind of the President, which has been confirmed by testimony from almost every faculty, the literary, as well as the scientific, there is no direction in which Columbia, as a university, is so deficient as in the great department of study known as Biology. It is in this field that the most interesting and important results of scientific research are being achieved at the present day. Columbia, in effect, has not entered it at all. At the same time there is being carried on at the College and in the Medical School more or less work which can be articulated to great advantage with the Department of Biology. . . .

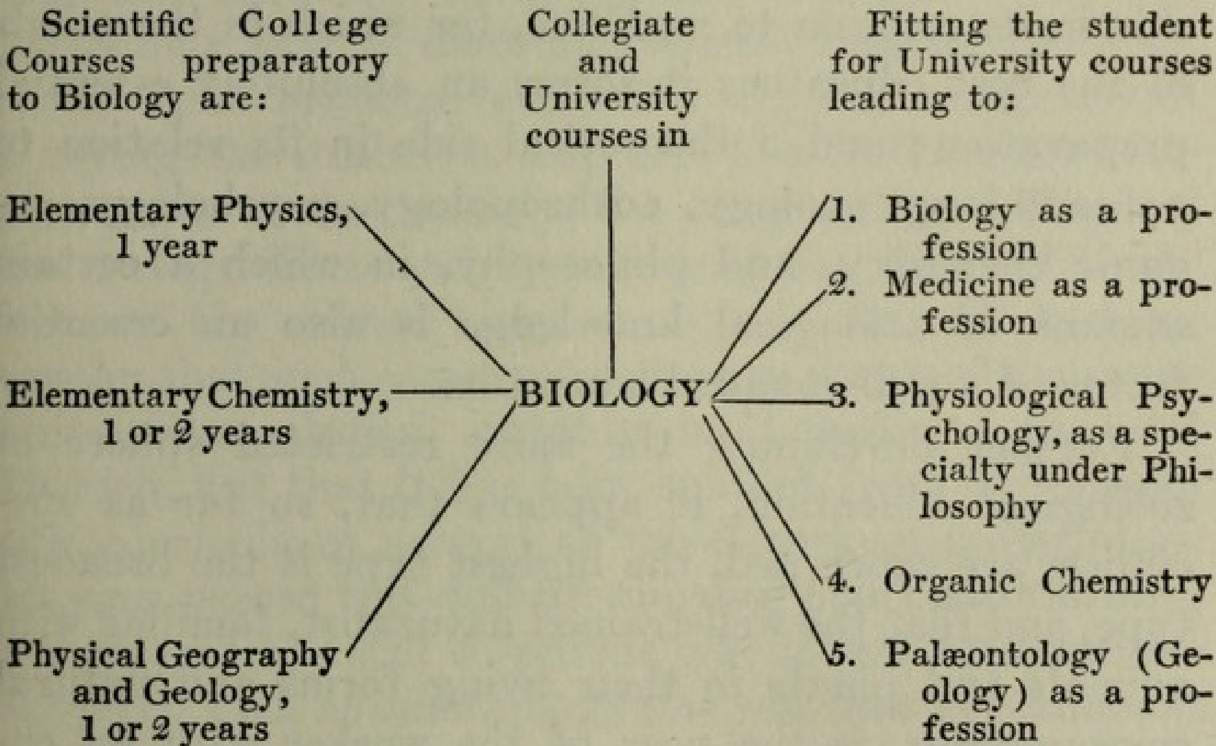
This decisive first step having been approved, the Trustees decided to prepare for teaching biology, and

[1] Osborn: Zoölogy at Columbia.

especially zoölogy, upon a liberal scale, provision having already been made for the important kindred branches of botany, physiology, and palæontology.

The working out of a theory of biological education required more care and thought than any of the other matters connected with the development of the Department. The scheme presented below is slightly modified from that originally presented by the author [1] to the Trustees, as expressing the general relations and environment of biology in the college and in the university course. The problem was to institute these relations and at the same time plan a progressive course in zoölogy proper.

Relations of Biology



[1] "The Relations of Biology to Other Studies." A scheme for biology teaching and the complete organization of the Department of Biology, presented to the Trustees of Columbia University by Henry Fairfield Osborn, completely ratified by them, and followed by his call to the University as head professor of Biology.

The progressive spirit of the Trustees was shown in the creation of a staff of instructors large enough to care amply for graduate and undergraduate instruction, and at the same time to carry on original investigation. This was upon the educational theory, insisted upon by myself and fully supported by President Low, that the teacher who has no time for research rapidly becomes an ineffective and uninspiring teacher, and that over-teaching defeats its own ends.

Biology is to be regarded as a special subject of rare interest pursued for its own sake; also as a fundamental part of education, literary as well as scientific and philosophical—in science quite as important as physics and chemistry, and in philosophy of far greater importance, because of its close relation to human origin, history, and society. Further, it has a practical side in its relation to medicine, for which in the minds of the best educators it forms an absolutely essential preparation; and a theoretical side in its relation to palæontology, geology, anthropology, psychology, organic chemistry, and philosophy, in which a certain amount of zoölogical knowledge is also an essential factor of a well-rounded education.

Further developing the more restricted sphere of zoölogical education, it appears that, so far as specialists are concerned, the highest type is the broadest type, and that the well-trained naturalist, familiar with animals and plants in their living forms and natural surroundings, is the peer of the worker with an exclusively laboratory education. Thus provision had to be made for training in the field as well as in the laboratory—for instilling practical knowledge, as well as

theoretical and book knowledge, into students with many different aims.

With these general motives or guiding principles kept constantly in view year after year, various changes have been made in the courses, in order to make them consecutive and constituent parts of a regular, progressive zoölogical development, and also in order to make them effective in relation to other branches of education. Thus, the first course in elementary biology, offered in the Junior year, has become largely a culture course. It is conducted by the head professors of the Department, who give their best attention to it, in order to inspire the students with interest in the subject, to give them vistas of its wide bearings, by explanations of the fundamental principles of biology and of the history and meaning of evolution, variation, and heredity. The course which follows this in the Senior year is more specialized, bearing more directly upon medicine and other applied sciences, and carrying the student a step forward to the most comprehensive course, namely, the comparative zoölogy of the first graduate year, which includes the final treatment of the animal kingdom as a whole. It is noteworthy that such a course is given in many of the great universities abroad, notably in Leipsic, Jena, and Munich, but that it has been omitted from the university curricula of several of the American universities. Having passed this difficult turning point successfully, the student has still to pursue one or two fundamental subjects, such as embryology; he can then specialize at his pleasure, either upon the vertebrate or invertebrate side, among living or extinct types, in neurology, cytology, embryology, or any division of morphology or palæontology.

Research, as the most important part of zoölogical education, deserves a special paragraph. Even in the Junior year the students are encouraged to look towards investigation as a possible goal. In the Senior year, the senior thesis is taken advantage of for a really serious piece of original work; and already several admirable contributions have been made in this way, especially during the comparative leisure of the summer months. From this point on, training in the methods of investigation occupies one-half the student's time. This has led practically to the adoption of a very high standard for the degree of Doctor of Philosophy; for it is apparent that what is needed in this country—and abroad as well, for that matter—is not more zoölogists, but more very highly trained men. It may surprise the readers of this article to know that during the past six years, only one student has been awarded the degree of Doctor of Philosophy in Zoölogy at Columbia, although a large number of students who have attended the courses from the outset are still working for the coveted degree, and no student has left Columbia because he finds the standard too high. It is believed that this standard will finally give our zoölogical doctorate a value of its own, which will fully compensate the men for the prolonged time and energy which they are devoting to it.

It is clear that only a beginning has been made towards the development of zoölogy at Columbia, or of work which will compare favorably with that which can be done with the keen and zealous spirit that pervades our American university students at the present day. The greatest encouragement we Americans receive is from our old masters and present colleagues in Germany, who are even more enthusiastic than we are

over the outlook of biology in this country. While we have every reason to feel that Columbia has started in the right direction and has made considerable progress, it must be made clear as a final word, that the work is still far from complete, and that probably another five years are necessary before the plans which are now in mind can be fully carried out.

The World's Debt to Biology

To the Students of Chautauqua, 1896

In this material age and in our still too material America biology may share with astronomy the reproach of being the least of the sciences in its contributions to wealth. Geology, mineralogy, chemistry, mechanics including electricity, and physics—these branches in their innumerable applications to industrial development are the great wealth producers. The science of life has an economic or a wealth-producing side of daily increasing importance, but in our opinion this is not the side where the greatest debt lies. It lies first at the door of our knowledge of the history of living things, including our knowledge of our own relation to the universe, then in our knowledge of our friends and enemies in the world of life below and around us, which tends to the preservation and perfection of our physical life, then in the principles which underlie the social welfare of the race, and finally in the principles of heredity which when more widely understood are destined to uplift the moral as well as the physical development of our race—in short the intellectual, moral, and physical benefits arising out of man's knowledge of life and of himself.

Man the Master and Servant of Nature

When Aristotle divided the sciences into the organic and inorganic he unconsciously forecast the equal relations which begin to exist between these divisions and men: first, in the material benefits which are flowing to us as we are gradually turning the laws of nature to our service; second, in the intellectual and moral benefits which will come from our better understanding of and obedience to these laws. Every year we see more clearly that man is both the master and the servant of nature—a strange paradox. We have already made many great strides toward these goals. Upon the one side we are fast distinguishing certain common properties of ether and of matter which tie chemistry, physics, and electricity together. The wonderful visions of the English physicist Faraday of the unity of those different forms of energy which we call heat, light, and electricity have been confirmed in England by Maxwell and in Germany by Hertz.

But how about the unity of matter and of life?

It is well to put foremost what we do not know but never to admit for a moment that we cannot know. We do not know how these properties of matter and of ether are related to life. We are still far from understanding what life itself is, or how it began, or even how living and lifeless forms of matter are connected and separated. We only face the fact that there is some great mystery in life itself which cannot be analyzed in any chemical or physical laboratory. Yet what seemed unknowable to the greatest philosophers a century ago is now the common knowledge of the schoolboy, so that we may well follow the lead of the

late Professor von Helmholtz when he declares: "Science, whose rôle is to fathom the secrets of nature, must always advance upon the principle that these secrets are fathomable." And every step forward, while increasing our knowledge, increases rather than diminishes our reverence; for, as Tennyson tells us, the secrets are tied up not only in man but in the very humblest animals and plants.

Man's High Instinct of Curiosity

First in order of what we owe to the biology of the present century is the history of living things. Like a compass this directs in a true course our survey and study of nature and hastens our interpretation of its laws. The truth of the past and present evolution or gradual development of the universe, which has been observed for twenty-five centuries,[1] can now be understood and taught in the schoolroom. Is it not striking that the slow unfolding of this truth has extended from the largest and most remote heavenly bodies to the nearest living bodies and has thus followed the actual order of Genesis? In the awakening of science led by Galileo in the sixteenth century man's high instinct of curiosity as to the origin of things was not first directed upon himself but upon objects most remote; during the eighteenth century he found in astronomy proofs of the evolution of the heavenly bodies; during the early part of the nineteenth century he recognized in geology the evolution of the surface of the globe; in zoölogy and botany, the evolution of the lower ani-

[1] The earliest record we have of the dim perception of the evolution of life is in the philosophy of Empedocles, a Sicilian who lived 600 B.C.

mals and plants; only as a final step in the century comes his general recognition of the evolution of his own frame.

Now, as to the influence of this truth upon human thought, look to the writings of the first half century, such as the "Bridgewater Treatises," and see how the tide of reasoning was all flowing in the wrong direction; then consider how in 1859 "The Origin of Species," the greatest biological work ever written, slowly stemmed this tide and, as it was followed up by evidence brought forward in Darwin's succeeding works, turned the whole current of thought into the broad channel of true conceptions of nature. And when we pass on to consider what this means in all our biological studies, and in fact in our thought upon all subjects, our debt to the evolution idea seems immeasurable.

Evolution a Perfecting Principle

This idea ceased to be unwelcome to those who believed that everything in nature was cast by the creator in a perfect but fixed and unchangeable mold, as soon as it appeared that animals and plants are the more perfect for the very reason that they are not fixed but can change with their surroundings. People who love to look beyond nature to its Author find in this gradual and changeable perfection still stronger evidence that the universe is intelligently ordered. The foundations of our belief have not been undermined, for, whatever be the causes of evolution, the order and result are more full of purpose and fitness of means to ends than the old order of fixed creation. Darwin's especial view of these causes, that in the struggle for existence only the

fittest survive, was but one solid advance in the search for the reasons why plants and animals and man himself are constantly improving. Probably a century or more of study confronts us before we shall learn all that constitutes this perfecting principle which we call evolution; but remembering the advice of Von Helmholtz this very incompleteness of our knowledge is an added stimulus to serious study and reflection. None the less, evolution is now part of history and has extended like a tonic into every sphere of human thought; this new biological interpretation extends into every new page of philosophy, of history and of literature; it enriches our very language; if rightly understood it makes our prophecy of the future more hopeful. Competition, struggle, survival and selection are now current coin of our intellectual realm.

As for the history of life in general, how much in the dark we should be without palæontology. When "The Origin of Species" was written the vulnerable point was the lack of evidence that animals were directly descended from each other. The sceptical demanded proofs. But Darwin's work revitalized palæontology and it began to be treated as a live science, upon the principle, cleverly stated by Huxley, that the only difference between a fossil and a recent animal is that one has been dead a little longer than the other. Out of the solid rocks we are expanding the terse but grand verses of the first chapter of Genesis. In St. Johns, New Brunswick, has recently been found a fauna which appears to be older than the oldest hitherto known. Continuous steps in the scale of life are now traced through vast periods of time. When the vertebrated or back-boned animals appear, our progress has been if anything still more wonderful—certainly

more brilliant—because of the greater variety of vertebrate forms and closer approach to the human type. The migrations of these ancient animals enable us to map out the ancient seas and continents, to close up Behring Strait into an isthmus, and to widen the track of the Panama Canal into an ancient sea connecting the Atlantic and the Pacific. In the arid Rocky Mountain region our scientific imagination pictures a superb chain of beautiful and fertile lakes. We not only people their shores with extinct monsters but we there trace our familiar friends of the house and the stable—the dog, cat, and horse—to their ancestral stock. We know not only the geography and zoölogy of these old lakes but abundant fossil plants give us the key to the changes of temperature, climate, and moisture. The history of life is crowned by the history of man.

Man's Highest Study Is Man

Man's highest study is man, and the science of man does not begin with written history, nor with archæology as the history of human arts, nor with ethnology as the history of the human races; it begins with three purely biological sciences, anatomy, embryology, and palæontology. These are the three great fountains of evidence as to man's origin. We commonly think of anatomy as applied to the physician and surgeon, but the non-medical side of anatomy is contributing to our history. The variations which occur in our bones, muscles and teeth are full of proof of our past and present evolution [1] and of signs of what the future man will be in body and mind. Embryology [2] and

[1] See Osborn: The Contemporary Evolution of Man. The Cartwright Lectures, No. 1. *New York Medical Record,* 1891.

[2] C. S. Minot: Human Embryology.

infant development,[1] both mental and physical, also open to us remote vistas of past forms, habits, and instincts so unlike our present selves that man appears like a palimpsest—a new writing upon the almost obliterated traces of an old. Palæontology, the third fountain of evidence, has thus far failed to connect us with the lower mammalia, but three skulls found in widely separated parts of the earth, in Neanderthal, in Spy, and in Java, point to the wide distribution of an inferior type if not an older species of the human race. Thus at any moment may be heralded the discovery of the link which will definitely connect us with our past and in fulfilment of the beautiful thought of Aristotle, so oft repeated in the verse of modern poets, show that man is the flower of the ages, the highest step in creation.

The Ever-Widening Service of Biology

But now we pass on to see how evolution is influencing the practical development of that side of biology which is most useful to man.

Under zoölogy every class of animals upon water and land has its corps of enthusiastic students until there are "ologies" without end, each with its peculiar charm, with its own historic development and aims, and each serving its noble purpose. Of all these branches, three perhaps stand out as rendering the greatest services to mankind at the present time; these are the sciences of insect life, of fish life, and of bacterial or monad life. But before dwelling upon the practical side let us widen our point of view and deepen our

[1] J. Mark Baldwin: Mental Development.

philosophical insight by a joint reference to botany and zoölogy in their services to both human thought and our physical well-being. Why have these sciences become so useful to man in the last half century?

We find again that it is the stimulus of the evolution idea which has led the modern botanist to vie with the zoölogist in the study of animals and plants not only in themselves but in their relations to each other. It is our rapidly increasing knowledge of these relations in the struggle for existence, in the competitive and destructive powers of species, in parasitism, in the rapid growth of species when unchecked, in the influences of increased and diminished food supply, in distribution in climate, in air and ocean currents—in short, in all the so-called factors of evolution—it is this mass of knowledge flowing in the first instance out of pure biological research which we are turning to practical and economic purposes. When an orchard, a vineyard, or a great wheat district is attacked and the prosperity of a whole section of the country is threatened we turn to some specialist who is trained in his own branch of biology. He knows that a living enemy will be far more fatal to an insect pest than any chemical or mechanical means of destruction and he sets about to discover and disseminate some infectious disease, as has been done so successfully in certain cases; or he looks the world over for another insect which, while harmless in itself, is known to feed upon the pest, as in the case of that brought to southern California from Australia by Dr. C. D. Riley; or again, in the relations of insects to plants he knows that certain varieties of plants enjoy immunity or resist attack, as the European grapevine grafted upon the American vine-stock stoutly resists the fatal *Phylloxera.*

Turning from entomology to ichthyology we find man again suspending the enormous destruction of life which is part of the regular order of nature and protecting the eggs of fishes from their hosts of enemies. The artificial fertilization, hatching, and rearing of fishes opens up a ledger of future wealth greater that the national debt. The United States Government leads the world in encouraging this applied science by liberal appropriations, just as it is leading in applied entomology. Experiments now in progress in lobster hatching and oyster hatching will undoubtedly prove successful in the end, although the difficulties encountered in imitating nature among these animals seem to be almost insurmountable. Great as has been our recent progress, we recognize that we are still only upon the threshold of the enjoyment of the practical benefits which invariably flow from a deeper knowledge of nature. There is no occasion for a gloomy or pessimistic view of the future food supply. As the population of the earth increases and the old routine sources of food supply known to our grandfathers may perhaps diminish, the biologist, ever fertile in new expedients, will more than offset this diminution by further conquests upon land and sea.

The physical well-being of man leads us now into a widely different field, where biology is perhaps rendering its most humane and noble services. We refer to the great movement toward the preservation of human life and health by the study of the life of the minutest germ-organisms; we cannot as yet positively decide whether they are animals or plants. The present resistance among the Arabs to the advance of European sanitary legislation may seem to us childish and even barbarous, but we look back only half a cen-

tury to find as great barbarism in civilized England. Witness the prolonged efforts of Dean Buckland, a palæontologist, and Richard Owen, a comparative anatomist, to secure even the crudest sanitary legislation in Parliament, and to remove the heavy tax upon windows that was depriving the poor of ventilation. The whole modern sanitary movement was cradled by biologists, but we have space here to glance at only one aspect of it. First, then, let us remove what is perhaps a widespread misapprehension that all germs are malevolent; on the other hand, we have learned, step by step, of their constructive and beneficent properties. The bacteriologist will tell you that every stage of our existence is dependent upon the working of bacteria; so far from being our greatest enemies, they are among our greatest friends. Every form of food depends in some stage of its preparation upon the activity of bacteria, so that we may say that without these wrongly dreaded organisms we should cease to exist. The discovery of immunity, anticipated in vaccine and developed successively in the hydrophobia cure of Pasteur, the 'tuberculin' of Koch, and the 'antitoxine' of Behring—which consists in sending a messenger through the system so that either a mild form of the disease or the diffusion of a counter-poison renders the individual safe from attack—this is a principle which will undoubtedly extend until one after another of these deleterious bacteria will be met and conquered for all time.

Obedience to the Laws of Heredity

In conclusion let us turn to the widely different subject of heredity. Here we are in a field where the world

is still unconscious of its debt; for we have not yet availed ourselves of the data which are thus far confined to the writings of a few specialists. But the great laws of inheritance, like all the other gifts of biology, will gradually be disseminated more widely and become the common property of the people. At present heredity is in the pure-research stage; it stands relatively where bacteriology did twenty years ago. Obedience to the natural laws of heredity could not be enforced now. It would be as unwelcome to Europeans and Americans today as the enforcement of the principles of bacteriology is in the Orient. But once spread among the people the intelligence that the violation of certain laws of nature tends to spread misery, insanity, and disease, then these laws will receive popular support.

Pure research in heredity, while preceding its application to the benefit of humanity and outwardly making no stir, is nevertheless most active, and the progress which has been made in the past few years is simply marvelous. We find that the physical basis of inheritance lies in two substances called chromatin and archoplasm. In the process of conception, or fertilization, the union of the chromatin from the paternal and the maternal sides, whether in animals or plants, represents the union of all the ancestral hereditary characters which enter into the offspring. Any violent disturbance at the time of this union or during the early stages of development may profoundly modify this offspring, but the natural growth to maturity may now be compared to a well-constructed watch which will keep perfect time unless its environment is so much disturbed as to interfere with the

mechanism. Finally, as the offspring advances toward maturity the hereditary characters are distributed by the chromatin to all the cells of the body and brain, and now begins a contest between the hereditary predisposition and the forces of nurture and of education. In the meantime a portion of the hereditary chromatin early passes to the reproductive cells and is shut off from all the influences of nurture and experience except those connected with health. We owe mainly to Professor Weismann of Freiburg the emphasis upon this idea of the continuity of the hereditary substance from generation to generation and of each individual as the bearer of the hereditary or race plasma. As these principles become better known there will grow up a new idea of the responsibility of each individual in the preservation of the unimpaired vitality of this marvelous hereditary mechanism. It must be guarded against the poison of alcoholism and infectious diseases and also preserved in its integrity by a full realization of the relation which a sound, healthy body bears to the vitality of all the cells and especially to the hereditary cells as the most important for the future of the race.

The first of all our duties as thoughtful men and women interested in science is to fearlessly welcome the great truths revealed in the study of nature, believing that whatever is true will stand as immutable as the moral law. It is the distinction between these discoveries and the hasty philosophical inductions drawn from them which we must observe with the greatest caution. The systems of materialism, agnosticism and monism may follow and supersede each other in two decades, but the system of nature is unchangeable.

Huxley's Influence In Productive Thought [1]

To the Students of Columbia University, September 28, 1910

The stars come nightly to the sky;
  The tidal wave unto the sea;
Nor time, nor space, nor deep, nor high,
  Can keep my own away from me.
—*Burroughs.*

The most sanguine day of the college year is the opening one: the student has not yet faced the impossible task, annually presented, of embracing the modern world of knowledge; his errors and failures of earlier years are forgotten; he faces the coming months full of new hope.

Huxley and Creative Education

How would my old master, Huxley, address you if he were to find you in this felicitous frame of mind, sharpening your wits and your pencils for the contest which will begin tomorrow morning in every hall and laboratory of this great University? May I speak for him as I heard him during the winter of 1879-80 from his lecture desk and as he in conversation kindly gave me of his stores of wisdom and experience? May I add to his truly brilliant essays entitled "Science and Education," delivered between 1874 and 1887? May I contribute also from my own thirty-seven years of life as a student and teacher, beginning in 1873 and

[1] H. F. Osborn: Huxley and Education.

reaching a turning point in 1910 when Columbia enrolled me among its research professors?

It was Huxley's life, his example, the tone of his writings, rather than his actual precepts, which most influenced me, for in 1879 he was so intensely absorbed in public work and administration, as well as in research and teaching, that little opportunity remained for laboratory conferences with his students. How I happened to go to him was as follows.

Unlucky—as they appeared to me at the time, but lucky as I look back upon them—were my own early flounderings and blunderings in seeking the true method of education. Huxley has observed of his "Voyage of the *Rattlesnake*" that it is a good thing to get down to the bare bones of existence. The same is true of self-education. As compared with the hosts of today, few men in 1877 knew how to guide the graduate youth; the Johns Hopkins was still nascent; the creative force of Louis Agassiz had spent itself in producing the first school of naturalists, including the genius, William James. One learned one's errors through pitfalls.

With two companions I was guided by a sort of blind instinct to feel that the most important thing in life was to make a discovery of some kind. The advice of one of our most forceful and genial professors was negative and discouraging: "Young men," he said, "go on with your studies for ten or twelve years until you have covered the whole subject; you will then be ready for research of your own." There appeared to be something wrong about this, although we did not know exactly what. We disregarded the advice, left the laboratory of this professor, and at the

end of the year did succeed in writing a paper which subsequently attracted the attention of Huxley and was the indirect means of an introduction to Darwin. It was a lame product, but it was ours, and in looking back upon one's maiden effort, one feels with Touchstone in his comment upon Audrey that it is "a poor virgin, sir, an ill-favored thing, sir, but mine own."

Huxley on the Joy of Thinking

I shall present in this brief address only one idea, namely, the lesson of Huxley's life and the result of my own experience, that *productive thinking is the chief means as well as the chief end of education, and that the natural evolution of education will be to develop this kind of thinking earlier and earlier in the life of the student.*

One of the most marvelous of the manifold laws of evolution is what is called *acceleration.* By this law the beginning of an important organ like the eye of the chick, for example, is thrust forward into a very early stage of embryonic development. This is, first, because the eye is a very complex organ and needs a long time for development, and second, because the fully formed eye of most animals is needed immediately at birth. I predict that the analogy in the evolution of education will be very close. Productive thinking is the eye; it is needed by the student the moment he graduates, or is hatched, so to speak; it is now developed only in the graduate schools. It is such an integral and essential part of education that the spirit of

it is destined to be 'accelerated,' or thrust forward into the opening and preparatory years.

If the lines of my life were to be cast afresh, if by some metempsychosis I should be molded into what is known as a 'great educator,' a man of conventions and platforms, and I should suddenly become more or less responsible for three thousand minds and souls, productive thinking, or the 'centrifugal method' of teaching, would not be postponed to graduation or thereafter, but would begin with the freshman, yes, among these humble men of low estate!

As regards the raw material into which 'productive thinking' is to be instilled, I am an optimist. I do not belong to the 'despair school' of educators, and have no sympathy with the army of editorial writers and prigs who are depreciating the American student. The chief trouble lies not with our youth, nor with our schools, but with our adults. How can springs rise higher than their sources? On the whole, you students are very much above the average American. You are not driven to these doors; certainly in these days of youthful freedom and choice you came of your own free will. The very fact of your coming raises you above the general level, and while you are here you will be living in a world of ideas—the only kind of a world at all worth living in. You are temporarily cut off, more or less, from the world of dollars and cents, shillings and pence. Here Huxley helps you in extolling the sense of sheer joy in thinking truer and straighter than others, a kind of superiority which does not mean conceit—the possession of something which is denied the man in the street. You redound with original impulses and creative energy, which must find expression somehow or somewhere; if not under the pre-

vailing incurrent, or 'centripetal system' of academic instruction, it must let itself out in extra-academic activities, in your sports, your societies, your committees, your organizations, your dramatics—all good things and having the highest educational value in so far as they represent your output, your outflow, your centrifugal force.

Mediocrity Triumphant in America

You are, in fact, in a contest with your intellectual environment outside of these walls. Morally, according to Ferrero, politically, according to Bryce, and economically, according to Carnegie, you are in the midst of a 'triumphant democracy.' But in the world of ideas such as sways Italy, Germany, England, and in the highest degree France, you are in the midst of a 'triumphant mediocrity.' Paris is a city where *ideas* are at a premium and money values count for very little in public estimation. The whole public waits breathless upon the production of a "Chantecler." That Walhalla of French ambition, *la Gloire,* may be reached by men of ideas, but not by men of the marts. Is it conceivable that the police of New York should assemble to fight a mob gathered to break up the opera of a certain composer? Is it conceivable that you students should crowd into the theater to prevent a speaker being heard, as those of the Sorbonne did some years ago in the case of Brunetière? If you should, no one in this city would understand you, and the authorities would be called on promptly to interfere.

A fair measure of the culture of your environment

is the depth to which your morning paper prostitutes itself for the dollar, its shades of yellowness, its frivolity or its unscrupulousness, or both. I sometimes think it would be better not to read the newspapers at all, even when they are conscientious, because of their lack of a sense of proportion, in the news columns at least, of the really important things in American life. Our most serious evening mentor of student manners and morals gives six columns to a football game and six lines to a great intercollegiate debate. Such is the difference between precept and practice. American laurels are for the giant captain of industry; when his life is threatened or taken away acres of beautiful forest are cut down to procure the paper pulp necessary to set forth his achievements, while the pulp of perhaps a single tree will suffice for the brief, inconspicuous paragraphs which record the illness and death of our greatest astronomer or mathematician.

Your British cousin is in a far more favorable atmosphere, beginning with his morning paper and ending with the conversation of his seniors over the evening cigar. As a Cambridge man, having spent two years in London and the university, I would describe the life as not so much serious as *worth while*. There are humor and the pleasures of life in abundance, but what is done, is done thoroughly well. Contrast the comments of the British and American press on such a light subject as international polo; the former alone are well worth reading, written by experts and adding something to our knowledge of the game. In the more novel subject of aviation we look in vain in our press for any solid information about construction. Or take the practical subject of politics; the British student finds every great speech delivered in any part of the

Empire published in full in his morning paper; as an elector he gets his evidence at first hand instead of through the medium of the editor.

The Lock-step in the College

I believe the greatest fault of the American student lies in the over-development of one of his greatest virtues, namely, his collectivism. His strong esprit de corps patterns and molds him too far. The rewards are for the 'lock-step' type of man who conforms to the prevailing ideals of his college. He must parade, he must cheer, to order. Individualism is at a discount; it debars a man from the social rewards of college life. In my last address to Columbia students on the life of Darwin,[1] I asked what would be thought of that peculiar, ungainly beetle collector if he were to enter one of our colleges today? He would be lampooned and laughed out of the exercise of his preferences and predispositions. The mother of a very talented young honor man recently confessed to me that she never spoke of her son's rank because she found it was considered 'queer.' This is not what young America generates, but what it borrows or reflects from the environment of its elders.

Thus the young American is not lifted up by the example of his seniors, he has to lift it up. If he is a student and has serious ambitions he represents the young promise of his nation, and the college brotherhood in general is a light shining in the darkness. Thus stumbling, groping, often misled by his natural leaders, he does somehow or other, through sheer force,

[1] H. F. Osborn: Life and Works of Darwin.

acquire an education, and is just as surely coming to the front in the leadership of the American nation as the Oxford or Cambridge man is leading the British nation. Our student body is as fine as can be, it represents the best blood and the best impulses of the country; but there may be something wrong, some loss, some delay, some misdirection of educational energy.

Bad as the British university system may be—and it has been vastly improved by the influence of Huxley—it is more effective than ours because more centrifugal. English lads are taught to compose, even to speak, in Latin and Greek. The Greek play is an anomaly here, it is an annual affair at Cambridge. There are not one but many active and successful debating clubs in Cambridge.

The Essentials of Greatness

The faults with our educational design are to be discovered through study of the lives of great men and through one's own hard and stony experience. The best text-books for the nurture of the mind are these very lives, and they are not found in the lists of the pedagogues. Consult your Froebel, if you will, but follow the actual steps to Parnassus of the man whose political, literary, scientific, or professional career you expect to follow. If you would be a missionary, take the lives of Patterson and Livingstone; if an engineer, "The Lives of Engineers"; if a physician, study that of Pasteur, which I consider by far the noblest scientific life of the nineteenth century; if you would be a man of science, study the recently published lives and letters of Darwin, Spencer, Kelvin and our prototype Huxley. Here you may discover the secret of great-

ness, which is: first, to be born great, unfortunately a difficult and often impossible task; second, to possess the *instinct of self-education.* You will find that every one of the masters, while more or less influenced by his tutors and governors, was led far more by a sort of instinctive feeling that he must do certain things and learn certain things. They may fight the battle royal with parents, teachers, and professors, they may be as rebellious as ducklings amidst broods of chickens and give as much concern to the mother fowls, but without exception from a very early age they do their own thinking and revolt against having it done for them, and they seek their own mode of learning. The boy Kelvin is taken to Germany by his father to study the mathematics of Kelland; he slips down into the cellar to the French of Fourier, and at the age of fifteen publishes his first paper, to demonstrate that Fourier is right and Kelland is wrong. Pasteur's first research in crystallography is so brilliant that his professor urges him to devote himself to this branch of science, but Pasteur insists upon continuing for five years longer his general studies in chemistry and physics.

This is the true empirical, or laboratory, method of getting at the trouble, if trouble there be in the American *modus operandi;* but a generation of our great educators have gone into the question as if no experiments had ever been made. In the last thirty years we have seen rise up a series of 'healers,' trying to locate the supposed weakness in the American student; one finds it in the classic tongues and substitutes the modern; one in the required system and substitutes the elective; one in the lack of contact between teacher and student and brings in preceptors, under whom the pa-

tient shows a slight improvement. But the kind of diagnosis which comes from examining such a life as that of Huxley shows that the real trouble lies in the prolongation to mature years of what may be styled the 'centripetal system,' namely, that afferent, or inflowing mediæval and oriental kind of instruction in which the student is rarely, if ever, forced to do his own thinking.

You will perceive by this that I am altogether on your side, an insurgent in education, altogether against most of my profession, altogether in sympathy with the overfed student, and altogether against the prevailing system of overfeeding, which stuffs, crams, pours in, and spoon-feeds, and then, as a sort of deathbed repentance, institutes creative work after graduation.

The Somnolent or Alert Goose

Are you the somnolent goose *Anser* of Strasbourg, artificially stuffed with knowledge, or the alert *Anser* which saved the Capitol of Rome? Ask yourself, "Am I a parrot, that I should always repeat? Have I a parrot mind?" How do you yourself stand on this question? Is your idea of a good student that of a good 'receptacle'? Do you regard your instructors as useful grain hoppers whose duty it is to gather kernels of wisdom from all sources and direct them into your receptive minds? Are you content to be a sort of psychic *Sacculina*, a vegetative animal, your mind a vast sack with two systems, one for the incurrent, the other for the outcurrent of predigested ideas? If so, all your mental organs of combat and locomotion will atrophy. Do you put your whole faith in reading, or in book knowledge? If so, you should know that not a five-foot

shelf of books, not even the ardent reading of a fifty-foot shelf aided by prodigious memory will give you that enviable thing called culture, because the measure of this precious quality is not what you take in but what you give out, and this from the subtle chemistry of your brain must have passed through a mental metabolism of your own, so that you have lent something to it. To be a man of culture you need not be a man of creative power, because such men are few—they are born, not made; but you must be a man of some degree of centrifugal force, of individuality, of critical opinion, who must make over what is read into conversation and into life. One little idea of your own, well expressed, has a greater cultural value than one hundred ideas you absorb; one page that you produce, finely written, new to science or to letters and really worth reading, outweighs for your own purposes the five-foot shelf. On graduation, *presto!* all changes. Then of necessity must your life be independent and centrifugal, and just in so far as it has these powers will it be successful; in so far as it is merely imitative will it be a failure.

There is no revolution in the contrary, or outflowing, design. Like all else in the world of thought it is, in the germ at least, as old as the Greeks, and its illustrious pioneer was Socrates (469-399 B. C.), who led the approach to truth, not by laying down the law himself but by means of answers required of his students. The efferent outflowing principle, moreover, is in the program of the British mathematician Perry and many other reformers today. About thirty years ago, after some brilliant individual examples like Louis Agassiz, the centrifugal system was imported to America from Germany, on a very large scale, but only for graduate students.

Against the centripetal theory of acquiring culture Huxley revolted with all his might. His daily training in the centrifugal school was in the genesis of opinion; and he incessantly practised the precept that forming one's own opinion is infinitely better than borrowing one. Huxley was not by any means the greatest man of his time, but he made—what is possible to us all—the greatest use of his opportunities and endowments, he fairly burnt his life out in his battles for all that he believed in. Our sophisticated age discourages originality of view because of the plenitude of a ready-made supply of editorials, of reviews, of reviews of reviews, of critiques, comments, translations and cribs. Study political speeches, not editorials about them; read original debates, speeches, and reports. If you purpose to be a naturalist get as soon as you can at the objects themselves; if you would be an artist, go to your models; if a writer, on the same principle take your authors at first hand, and, after you have wrestled with the texts and reached the full length of your own fathom line, then take the fathom line of the critic and reviewer. Do not trust to mental peptones. Carry the independent, inquisitive, sceptical and even rebellious spirit of the graduate school well down into undergraduate life, and even into school life. If you are a student, force yourself to think independently; if a teacher, get out of the lecture chair and compel your students to express their own minds in an original lecture now and then.

In listening to a lecture weigh the evidence as presented; cultivate a polite scepticism, not affected but genuine; keep in your mind a running fire of interrogation, and you will finally develop a mind of your own. Do not climb the mountain of learning in the hope that

when you reach the summit you will be able to think for yourself; think for yourself while you are climbing.

In studying the lives of your great men you will find that certain of them were veritable storehouses of facts, you will discover that the average man or woman is a gregarious and imitative creature. Memory itself is an imitative function. Enormously useful as it is, it is an insidious danger; it is like a gold or silver electro-plating process which lends a coating of brilliancy and polish to a shallow and imitative mind. Certain great men have enjoyed marvelous memories and many equally great men have had imperfect memories. Darwin depended largely on his inveterate and voluminous note-taking. Shift the premium from the memory to the mind. Put mind in the front rank. Thus you may pray for the daily bread of real mental growth, for the future paradise of education is a state of mind and not a state of memory.

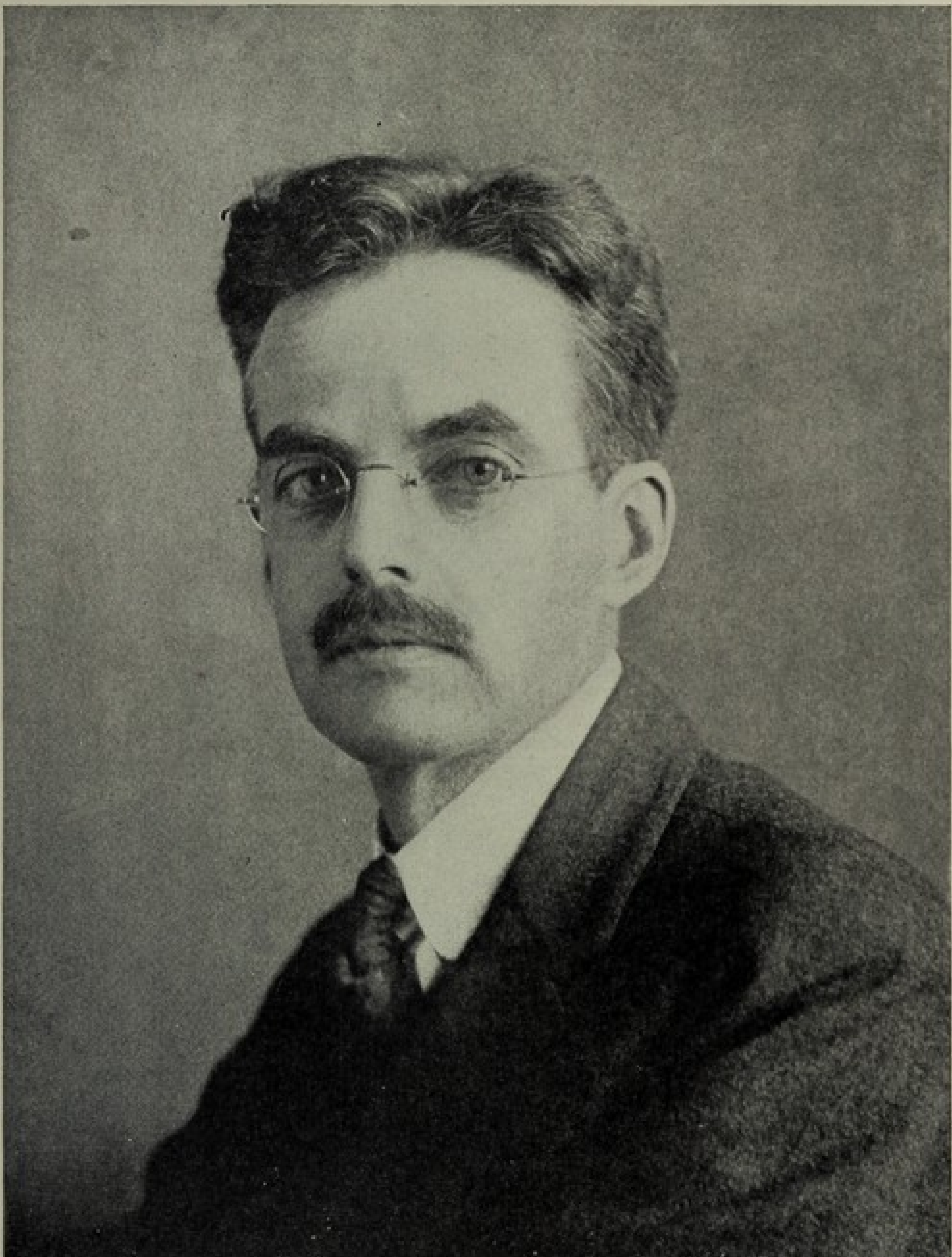
The accumulated knowledge of what has been thought and said serves as the gravity law which will keep you from flying off at a tangent. The danger of centrifugal force is the tangent; the instant you become tangential you lose your power. Find the balance between the centrifugal and the centripetal life. No warning signals are needed, there is not the least danger that constructive thinking will drive you away from learning; it will much more surely drive you to it, with a deeply intensified reverence for your intellectual forbears; in fact, the highest result of centrifugal education is that keen and fresh appetite for knowledge which springs only from trying to add your own mite to it.

How your Maxwell, Hertz, Röntgen, and Curie, with their world-invigorating discoveries among the laws of

radiant matter, begin to soar in your estimation when you yourself wrest one single new fact from the reluctant world of atoms! How your modern poets, Maeterlinck and Rostand, take on the air of inspiration when you would add a line of prose verse to what they are delving for in this mysterious human faculty of ours. Regard Voltaire at the age of ten in Louis-le-Grand, the Eton of France, already producing bad verses, but with a passionate voracity for poetry and the drama. Regard the youthful Huxley returning from his voyage of the *Rattlesnake* and laying out for himself a ten years' course in search of pure information.

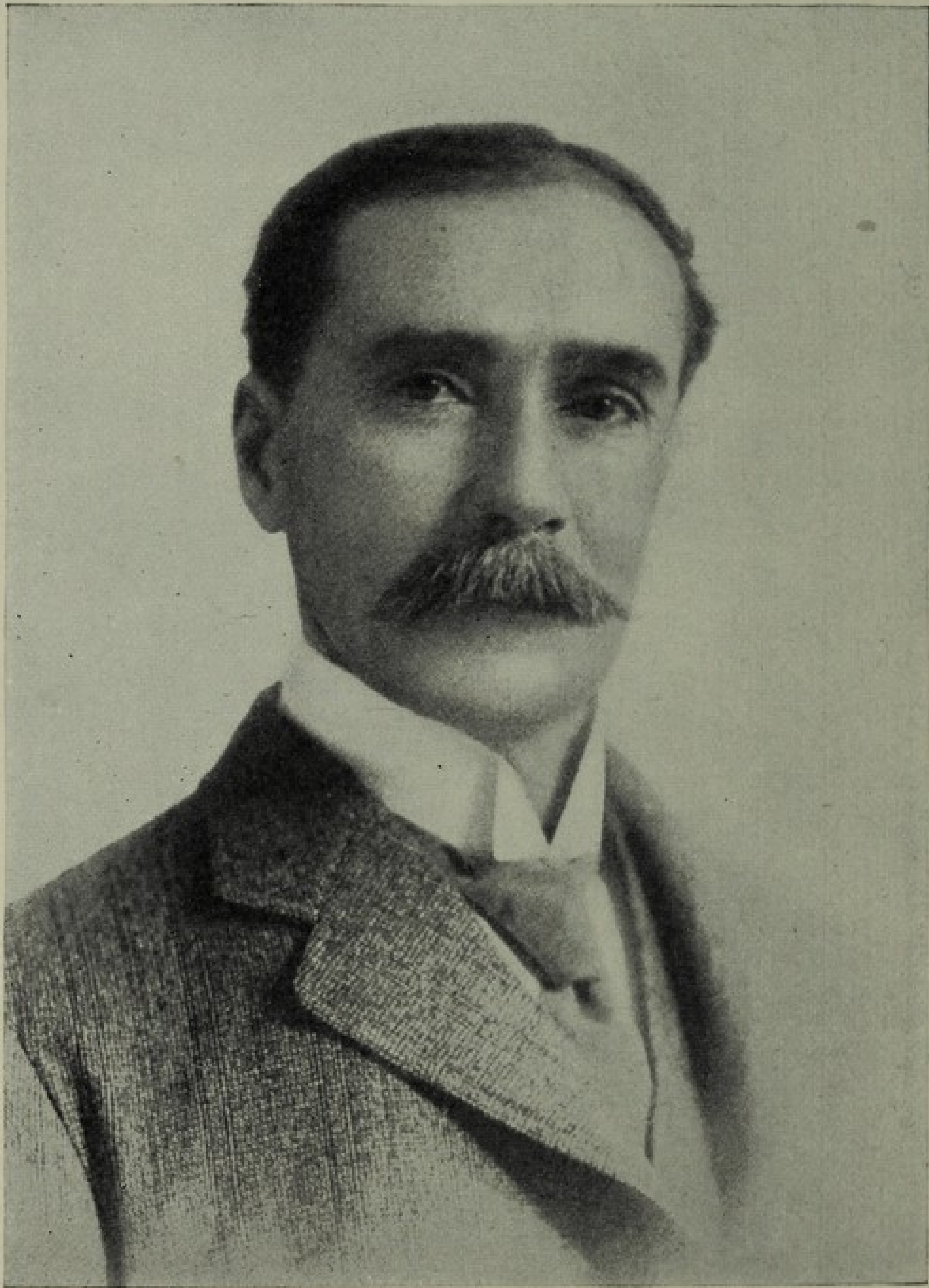
This route of your own to opinions, ideas, and the discovery of new facts or principles brings you back again to Huxley as the man who always had something of his own to say and who labored to say it in such a way as to force peple to listen to him. His wondrous style did not come easily to him; he himself told me it cost him years of effort, and I consider his advice about style far wiser than that of Herbert Spencer. Why forego pleasures, turn your back on the world, the flesh, and the devil, and devote your life to erudition, observation and the pen if you remain unimpressive, if you cannot get an audience, if no one cares to read what you write? This moral is one of the first that Huxley has impressed upon you, namely, *write to be read;* if necessary, "stoop to conquer," employ all your arts and wiles to get an audience in science, in literature, in the arts, in politics. Get an audience you must, otherwise you will be a cipher and not a force.

Pursuant of the constructive design, the measure of the teacher's success is the degree in which ideas come not from him but from his pupils. A brilliant address



WILLIAM KING GREGORY, N. A. S.

Curator of Ichthyology and of Comparative Anatomy, American Museum of Natural History; Professor of Vertebrate Palæontology, Columbia University



LAWRENCE M. LAMBE
(DECEASED)

Chief Vertebrate Palæontologist, Geological Survey of Canada

may produce a temporary emotion of admiration, a dry lecture may produce a permanent productive impulse in the hearers. One may compare some who are popularly known as gifted teachers to expert swimmers who sit on the bank and talk inspiringly on analyses of strokes; the centrifugal teacher takes the pupils into the water with him, he may even pretend to drown and call for a rescue. In football parlance, the coach must get into the scrimmage with the team. This was the lesson taught me by the great embryologist Francis Balfour of Cambridge, who was singularly noted for doing joint papers with his men.

An experiment I have tried with marked success, in order to cultivate centrifugal power and expression at the same time, is to get out of the lecture chair and make my students in turn lecture to me. This is virtually the famous method of teaching law rediscovered by the educational genius of Langdell; the students do all the lecturing and discoursing, the professor sits quietly in his chair and makes his comments. The stimulus upon ambition and competition is fairly magical; there is in the classroom the real intellectual struggle for existence which one meets in the world of affairs. I would apply this very Socratic principle in every branch of instruction, early and late, and thus obey the 'acceleration' law in education, which I have spoken of above as bringing into earlier and earlier stages those powers which are to be actually of service in after-life.

There is, then, no mystery about education if we plan it along the actual lines of self-development followed by these great leaders and shape its deep undercurrent principles after our own needs and experience. Look early at the desired goal and work toward it from the

very beginning. The proof that the secret does not lie in subject or language but in preparation for the living productive principle is found in the fact that there have been *relatively* educated men in every stage of history. The wall painters in the Magdalenian caves were the producers and hence the educated men of their day. Many years ago I set out to solve the so-called mystery of education; I found it to be soluble. It culminates in one great final object, which was learned by the leaders of Palæolithic man 200,000 years ago and is equally available today for the men of dirigible balloons and aeroplanes. It is, to follow the law of evolution, to follow in mind-culture the principle of addition and accretion characteristic of all living things; namely, to develop the highest degree of productive power, centrifugal force, original, creative, individual efficiency. Through this the world advances; the Neolithic man with his invention of polished implements succeeds the Palæolithic, and the man of books and printing replaces the savage.

The standards of a liberal mind are and always have been the same, namely, the sense of Truth and Beauty, both of which are again in conformity with Nature.

> Beauty is truth, truth beauty—that is all
> Ye know on earth, and all ye need to know.
>
> *Keats', Ode on a Grecian Urn.*

The sources of our facts are and always have been the same, namely, the learning of what men before you have observed and recorded, and the advance only through the observation of new truth, that is, new to man, though old to nature. The handling of this knowledge has always been the same, namely, through

human reason. The giving forth of this knowledge and thus the furthering of ideas and customs has and always will be the same, namely, through expression, vocal, written, or manual, that is, in symbols and in design. One cannot too often quote the rugged insistence of Carlyle: "Produce! Produce! Were it but the pitifullest infinitesimal fraction of a product, produce it, in God's name! 'Tis the utmost thou hast in thee: out with it, then."

A Liberal Education Defined

It follows that the all-round liberally educated man,[1] from Palæolithic times to the time when the earth shall become a cold cinder, will always be the same; namely, *the man who follows his standards of truth and beauty, who employs his learning and observation, his reason, his expression, for purposes of production or original creation, that is, to add something of his own to the stock of the world's ideas.*

Now note that whereas there are the above six powers—truth and beauty, learning and observation, reason and expression—which subserve the seventh—production or constructive thinking—and whereas the giving out of ideas is the object to be attained, the only power which figures prominently in our modern system of college and school education is the learning of facts and the memory thereof. It is no exaggeration to say that this makes up ninety-five per cent. of modern education. Who are the meteors of school and college days? For the most part those

[1] Compare Huxley, Charles Eliot and Charles F. Adams, as cited in other parts of this volume.

with precocious or well trained memories. Why do so many of these meteors flash out of existence at graduation? The answer is simple if you accept my conception of education. Whereas it takes six powers to make a liberally educated man or woman, and seven to make a productive man or woman, only one power has been cultivated assiduously in the 'centripetal' education; whereas there are two great gateways of knowledge, learning and observation, only one has been continuously passed through; whereas there are two universal standards of truth and beauty, only truth has constantly been held up to you, and that in precept rather than in practice. For nothing is surer than this, that the sense of truth must come as a daily personal experience in the life of the student through testing values for himself, as it does in the life of the scientist, the artist, the physician, the engineer, the merchant. Note that whereas you are powerless unless you can by the metabolism of logic make the sum of acquired and observed knowledge your own, that kind of workaday efficient logic has never been forced upon you and you are daily, perhaps hourly, guilty of the *non sequitur*, the *post ergo propter hoc*, the 'undistributed middle,' and all those innocent sins against truth which come through the illogical mind.

"*That man,*" says Huxley, "*has had a liberal education . . . whose intellect is a clear, cold, logic engine, with all its parts of equal strength, and in smooth working order; ready, like a steam-engine, to be turned to any kind of work, and spin the gossamers as well as forge the anchors of the mind.*" [Italics my own.]

Note that whereas you are a useless member of society unless you can give forth something of what you know and feel in writing, speaking, or design, your ex-

pressive powers may have been atrophied through insufficient use. In brief, you may have shunned individual opinion, observation, logic, expression, because they are each and every one on the lines of greatest resistance. And your teachers not only allowed you but actually encouraged and rewarded you for following the lines of least resistance in the accurate reproduction, in examination papers and marking systems, of their own ideas and those found in books.

May you, therefore, write down these seven words and read them over every morning: Truth, Beauty, Learning, Observation, Reason, Expression, Production.

In the wondrous old quilt work of inherited or ancestral predispositions which make your being, you may be gifted with all these seven powers in equal and well balanced degree; if you are so blessed you have a great career before you. If, as is more likely, you have in full measure only a part of each, or some in large measure, some in small, continue the daily examination of your chart as giving you the canons of a liberal education and of a productive mind.

Remember as regards the somewhat overworked word 'service' that every addition in every conceivable department of human activity which is constructive to society is service; that the spirit of science is to transfer something of value from the unknown into the realm of the known, and is, therefore, identical with the spirit of literature; that the moral test of every advance is whether or not it is constructive, for whatever is constructive is moral.

I would not for a moment take advantage of the present opportunity to discourage the study of human

nature and of the humanities, but for what is called the best opening for a constructive literary career let it be Nature. The ground for my choice of Nature rather than Man is that human nature is an exhaustible fountain of research; Homer understood it well; Solomon fathomed it; Shakespeare divined it, both normal and abnormal; the modernists have been squeezing out the last drops of abnormality, until it would appear that only the dregs of human life are left for analysis.

On the other hand, Nature, studied since Aristotle's time, is still full to the brim; no perceptible diminution of its interest is evident from any point at which it is approached, from nebulæ to protoplasm; it is always wholesome, refreshing, and invigorating. Of the creative literary artists of our time, Maeterlinck, jaded with human abnormality, comes back to the bee, the flowers and the 'bluebird' with a delicious renewal of youth and of optimism; Rostand turns not to the "fowls of the air" but to the fowls of the barnyard and creates his immortal "Chantecler"; Anatole France finds in his "L'Isle des Penguins" the source of a brilliant satire on modern life.

IV

CREATIVE RESEARCH IN THE UNIVERSITY

The author first became responsible for the theory and practice of Creative Education in the university in the year 1891, when, to his surprise, he was elected Dean of the Faculty of Pure Science in Columbia University, a newly organized faculty devoted especially to pure science as distinguished from the applied science of the famous School of Mines of Columbia. Almost immediately ensued a contest for the highest standard for the degree of Doctor of Philosophy, in opposition to the practice which had grown up of awarding this degree on a basis apparently lower than that set by leading German universities. The argument as of 1893 is presented in "A Three-Year Course for the Degree."

The quiet and undisturbed environment necessary for productive thinking is stressed in "The Corner-Stones of Learning," in which a plea is made for a broad, as well as deep and reposeful, foundation for creative thought.

Finally, in "The Seven Factors of Creative Education" the author's entire concept of the ideals of creative education is set forth.

CREATIVE RESEARCH IN THE UNIVERSITY

A Three-Year Course for the Degree—The Corner-Stones of Learning—The Seven Factors of Creative Education.

IN American social and political life there is the widespread impression that progress is represented by the mass multiplied by the rate, and the equally wide illusion as to the cardinal distinction between the consumption and the production of ideas. Nowhere, perhaps, is the confusion more prevalent than in New York City, which, in its present state of civilization, is a great consumer and a comparatively limited producer of art, music, literature or science. This confusion to a certain extent permeates our scientific life and the government of even our best institutions, as shown by the annual exploitation of student numbers and by the timid attitude toward the standard of the higher degrees, as if mass and rate, rather than quality, were our aim. We still have something to learn from the Old World, and much from the past in our own country.

A Three-Year Course For The Degree

To the Council of Columbia University, 1893

The degree of Doctor of Philosophy is at the top of the whole system of education in Columbia, and upon the standard of scholarship which we make

it represent, our future effectiveness and reputation very largely depend. This degree is awarded not as a compliment nor to mark the man of culture, but as a professional degree in any of the branches of pure, as distinguished from applied, knowledge. It indicates that in the opinion of the University Council the recipient has attained the highest standard of knowledge which we can give him as a *student*, that he has acquired the ability to add to knowledge by his own independent studies; also the ability to use this knowledge in original thought and investigation. In other words, a Doctor of Philosophy must have a full equipment of facts, a ready familiarity with the literature of his subjects and a thorough training in the methods of original thinking.

This University has now before it the option between two paths—either to follow in the wake of other institutions or to become a leader in the movement for the elevation of the American standard of scholarship. We trust that Columbia will make the latter choice; no institution is in a safer or readier position to do so. One great need of this degree-scattering country, which we can now emphasize by our example, is a higher appreciation of the meaning and value of the Ph.D. degree. Let us elevate it as we are elevating the degrees of Doctor of Medicine and Bachelor of Laws, and boldly take the ground that the ability to investigate and to teach is certainly not more readily acquired than the ability to practise medicine or to practise law. At the same time we must consider the practical questions of the limited means of the small number of students who voluntarily enter upon the plain living and high thinking which is well known to be the career of a Doctor of Philosophy. Our standard must not set

up an ideal and unpractical barrier which will turn students away from our doors, but must be that which experience has shown elsewhere to be both practical and ideal. If we are ready for more university students, we should project a course which will attract them and not deter them.

There are four points to be considered:

1. Is Columbia now prepared to give the higher training?
2. What period after graduation is required to give thorough philosophical training?
3. What standard has proved to be the most attractive and effective in the administration of this degree?
4. Shall Columbia lead or follow in the adoption of this standard?

Higher Courses in Columbia

We do not believe that Columbia is ready to give the best training in all branches; there are some very obvious gaps in our curriculum. The fact remains that in a very large number of branches we are strongly equipped and ready to enter, both as to personnel and facilities, into friendly competition with the other universities. There is no surer way to ascertain our deficiencies, as well as the best manner of meeting them, than by undertaking the higher courses of study. The especial timeliness of this question as to the standard of the Doctor's degree arises from the fact that within the last two or three years the Trustees have largely strengthened the old departments of study and have founded new ones. This raises the question, as it were,

de novo. Hitherto the work for the degree has assumed an important phase only in a few departments; now it affects a very much larger number. A new situation has been created during President Low's administration, and we may fairly take the position that the question of standard should be considered not with reference to the past, but in reference to our present and future growth as an educational center in this country. If, however, it is insisted that the experience of Columbia has shown that the former standard has been thoroughly satisfactory, then the only course will be to examine and compare our record during the past ten years with that of other institutions. This is unnecessary, if it is clearly understood that the change is proposed because the institution has changed on its university side, not because the former standard was not the best for the college in its day. An institution can certainly raise its standard when it increases its facilities, without in any way reflecting upon its past career or administration.

The Necessity for the Three-Year Course

We start with the statement that the course should not be a month longer than is necessary to make the degree represent a high standard of training. We have first our own experience, as testified by two members of this body, that two years after graduation do not allow sufficient time for the major and minor studies and the thesis; that the research and thesis alone occupy a full year with the best men; that while two years has been the rule, three years has very frequently been the practice. This situation is unfortunate. It

means that not until seven years after entering college may the student procure his Ph.D. degree. Johns Hopkins has met the situation for its own students by arranging its whole course of study with reference to the Ph.D.; it has practically lowered the liberal standard for the B.A. degree by giving it in three years and allowing the student to begin to prepare in his special studies at once in certain groups. But Johns Hopkins does not extend this advantage to graduates of other institutions, and perhaps the most striking result of its whole system is that its best men have issued not from its own specialized B.A. students, but from the broader B.A. students of other colleges. This is, of course, partly due to the fact that it has enjoyed the selection of the brightest graduates of other institutions and has received credit for training well founded elsewhere. A second feature drawn from Johns Hopkins' experience is important in this connection: while its three-year Ph.D. course is a minimum, a very large proportion of its students has remained much longer—indicating that the three-year period is none too long, in its experience, even for men of ability.

Let us look at the question candidly and frankly in our practical experience as educators. How few B.A. students are ripe for university methods of instruction; how slowly the new discipline takes its hold; how often we are influenced in giving the degree by our personal interest. The truth is, the three-year time standard is essential. Unless we remodel our B.A. courses, we require three years to produce a certain result. Students readily give this time in Law or Medicine, and when it is demanded in Philosophy their appreciation of the degree will rise accordingly.

The only suggestion, therefore, we have to make in

this connection is that the Council consider the advisability of recommending a remodelling of the junior and senior arts course into groups, in connection with preparation for the Ph.D. degree. In this way the training equivalent to the first year of university study may be secured for Columbia students while studying for the B.A. Such students may be able to qualify for the Ph.D. degree two years after graduation. They will have given the due proportion of time to their major and minor subjects 2, 1, 1, for an equivalent of three years. This will lower somewhat the liberal standard for the B.A. In our judgment the wiser course is either to give the B.A. after three years' study, or to leave the B.A. as it is and to require three years additional for the Ph.D.

It should be clearly stated that in taking this step Columbia will rank with Johns Hopkins as an educational leader. The present Columbia standard is, so far as appears *in writing*, not an exceptional one, except in the 'double degree' system; it is equivalent to that of Harvard, Princeton, Yale, Cornell and most of the larger institutions. *In practice*, however, we have been living below our written standard, because, unlike these other institutions, *we have not required the entire time* of the candidate, but have allowed him to pursue courses for other degrees simultaneously, as for example, in the case of one student who took both a medical and law degree last year while supposedly qualifying himself for the Columbia Ph.D.

The Highest Standard the Best Policy

The three-year standard will increase the number as well as the quality of our university students. The

point has been raised that an elevation of standard will empty our lecture halls, and this argument if sound would be a strong one, but it is not sound. The universal result of elevation of standard in this country has been an increase of attendance, the highest institution draws the largest numbers—and all this turns upon the simple fact that a degree is invariably valued in direct proportion to the amount of work which it costs. It may be said that this applies to the M.D., A.B. and LL.B., but not to the Ph.D.; this is wholly refuted by the practical success of this standard at Johns Hopkins.

With the encouragement of twenty fellowships and twenty-five scholarships, Johns Hopkins, with no tradition and at first placed in an unsympathetic community, at once sprang into a successful university career. At the outset the standard was courageously set at three years, and it has been maintained from three to five years according to the ability of the student. The number of graduate students has risen slowly but steadily until it now amounts to 203, only one-fifth of this number being encouraged by university funds.

The graduate degrees conferred have also risen steadily from four to an average of thirty in each year. The success of these graduates has been remarkable. Out of 211 obtaining the Ph.D between 1878 and 1891, inclusive, the following differentiation has occurred:

College Professors	142
College Instructors, Assistants, Experts upon Surveys, &c.	47
Librarians	2

The most striking feature of these figures is that practically all of these graduates have continued their philosophical profession, either in teaching or investigation. Statistics are given of every Ph.D., and among them we find only one who has apparently no record; there are three lawyers, two physicians, one missionary, and one editor. The high standard system has been a complete success; first, in attracting, then in educating, finally in producing in each graduate the true expression of the degree—the love of learning. While other colleges have been holding a lower standard and doing the same work in a less successful way, Johns Hopkins has become the mother of faculties. The degree has proved not only to have its intrinsic, internal, intellectual value, but to have a commercial and market value; these graduates are in demand because it is believed they are well trained.

Is it necessary to go further to show that the highest standard is not only good education, but good policy?

The Position of Columbia

The final question is, whether this step should be taken at present or at some later day, whether we should slowly and cautiously raise our standard or act at once. In my judgment this is the most appropriate time. The progress towards a true university establishment will be hastened rather than retarded by taking this step. As the higher standard has been taken by another institution, we are occupying a place in the second rank so long as we stand where we are. It is said that quality, not time or quantity, is what should be aimed at. This is undoubtedly true. An

ideal system would contain no mention of time, but in a new country like ours the time standard has come to be the invariable expression of quality; it is true of the Ph.D. as well as of every other degree. The announcement in our circulars of the coming year that we had adopted a limit equal to the highest would not be regarded as a technical or arbitrary rule, but the announcement that we had determined that the Ph.D. degree should hold the highest place of honor when written upon a Columbia diploma would be welcomed by every lover of higher education and would hasten the day when other institutions would have the courage to take the same stand.

The Corner-Stones Of Learning [1]

To the Alumni and Students of Columbia University, May 2, 1896

Passing as we are today from one to another of these foundations of Literature, Philosophy and History, Chemical and Physical Science, who would not be stirred with the enthusiasm of learning? What naturalist, near or far, will not rejoice in the laying of the corner-stone of this Hall, which we now dedicate to the studies beloved by Aristotle and Goethe, by Linnæus, Buffon and Lamarck, by Lyell, Darwin and Huxley, by Agassiz, Torrey and Dana?

The influence of these masters is bounded neither by time nor language. The close touch with nature which

[1] Address on the laying of the corner-stone of Schermerhorn Hall, Columbia University.

they have inspired makes the whole world kin. The incessant production and interchange of new truths tie together the naturalists of every country. Our political and social systems may reverse those of Russia, but such differences do not separate American and Russian naturalists. The history of the earth, the origin of its plants and animals, the secret hidden in the simple cell of the amœba or in the countless cells of the human brain, are the same in distant Siberia as upon this continent. A new law discovered in these laboratories will not be estimated at our own valuation, for it will be neither new nor true here unless it is so everywhere. We may well say *Mare sejuncta, veritate conjuncta* when we dedicate this building, and we may feel assured, in the generous emulation of scientific progress, that the benefits of Schermerhorn Hall will extend far beyond our shores if we set the example of broad research and build our instruction upon a scale worthy of this noble building.

A hundred thoughts of the past and future crowd upon us, but few can be expressed when a university is rising, like Minerva, in a single day. We would speak of the past, of the naturalists whose names are associated especially with this city, of Audubon, of Torrey or of Newberry. But these rising walls point to the future and prompt us to consider what will insure the true greatness of this and of its sister buildings. How shall we plan our research and instruction to produce the best results? What have we accomplished; what have we yet to do and how shall it be done? What are the especial needs of American scientific education today?

In the last quarter-century we have found much inspiration in Germany, but we can observe with satis-

faction that England and France are now adopting certain features of our graduate schools. In continuing to study the best foreign models we are not sacrificing our independence; we are entering into the world spirit, which is the true spirit, of science; we are endeavoring to put a right estimate upon our own position. We must build the best; we must join the learned circle of the universities of history—of Paris, of Bologna or of Cambridge; not in mere rivalry, but in the spirit of veneration for these institutions, in the love of science for its own sake. We look forward to the day when foreign students will come to America as we now go abroad. It is a great achievement that in taking so much from others we have maintained our individuality. Our essential advance is this: we have established the principle that in the college the student is learning, he is gathering in knowledge; in the university he is more than a learner. In school and college he is a consumer; in the university he must be both consumer and producer, and the criterion of our universities, of American scientists at large, is the extent and quality of their productiveness.

The Intellectual versus the Material

During this advance we have been under four great educational leaders, McCosh, Eliot, Gilman and Low, who have been keenly observant of this principle of production. Our debt to them and to the faculties associated with them can hardly be estimated. The elevation of these five buildings is but a mile-stone in the course of the most rapid university development ever seen in any country. Justly confident as we are in this prog-

ress, it would be over-confidence to suppose that we have as yet reached the general level of either Germany, France or England. In three or four branches of science, perhaps, where our circumstances are especially favorable, we have struck the highest note, but certainly not in all. Moreover, if we candidly apply the criterion of productiveness not as to quantity, but as to quality, are we assured that our intellectual output is keeping pace with the material equipment of our universities? Are we now training natural philosophers of the calibre of Franklin, of Henry or of Dana? The problem of the past twenty years was to establish universities. We have established them. The problem of the next twenty years is to train thinkers of the highest type.

When we consider that the number of students has increased tenfold, and that our educational facilities have multiplied a hundredfold, do we find a corresponding ratio in the increase of original thought? If not—and it is at least an open question—which is at fault, the American student or his educational environment? Our students are of the most virile Anglo-Saxon, Teutonic and Latin stock, and the stability of mental type is so assured that if there is a defect it must be in our methods of education. The very rapidity and eagerness so characteristic of our country and of our university growth are at once a sign of strength and a source of danger. The momentum of thought is not the momentum of a comet.

Breadth and Height, Energy and Repose

If this building, rising so rapidly that a year hence we expect to see here the full tide of work and thought,

is to accomplish its purpose and become a center of production in geology and biology, then we must plan to establish that type of educational environment which, within or without the walls of universities, in the experience of centuries, has nurtured thinkers of the highest rank. Figuratively speaking, in such an environment there are four factors, which we may term breadth, height, energy and repose.

Breadth, partly inborn and partly the result of training, is that sympathy with many sides of nature which arises through widely extended observation, where many facts of many kinds are correlated. Every master like Helmholtz has become master of more than one science. It comes as a rare birthright, through the irresistible bias towards breadth characterizing a genius like Darwin, who unaided and unconsciously sought it in his self-education. But because it is rare we must supply the lack by insisting upon it in our scheme of instruction. In chemistry and physics, perhaps, it can be cultivated in the laboratory. The out-of-door sciences demand prolonged work in the field or upon the sea, as well as in the laboratory. Think what the world owes to the long voyages of Humboldt, of Darwin and of Dana.

The second factor, height, we recognize at once in specialization. The height we are seeking is specialization pursued with a continually widening horizon, as distinct from specialization with a continually narrowing horizon, and this also is gained only by prolonged and deep study of more than one subject.

Energy is the chief American characteristic in science, as in other pursuits. It places us among the leaders in Arctic, in geological and palæontological exploration, and in astronomical expeditions. These are

among its more fortunate results, but, on the other hand, this very characteristic impels our students to superficiality, leading them to pursue six courses where they should pursue only three. It impels our professors to overload themselves with duties of administration and of practical affairs, as well as of teaching and research. In a manner it explains the unselfish willingness to work early and late and sacrifice everything to the duties of instruction, the over-teaching which burdens so many able men in our best institutions and finally cripples them. Our energy is of such disproportionate development that it is becoming a bar to research. In this country the children of science—the telegraph, steam and electrical transportation, the press—have become the greatest enemies of pure science, for they have produced a social and material environment utterly without repose, in which the most coveted thing is a wholly undisturbed hour. If this be true—and every close observer of our scientific life must admit it—our greatest need is that repose which affords time for reflection, time for thought, when, after long inductive observation, there comes the sudden illumination of a discovery.

Without repose even genius will not liquefy the gases, will not discover argon or helium, will not send rays of light through solid objects, will not find the unknown factor in evolution, will not disclose the relations of the chromatin and archoplasm in the cell. An eminent English biologist recently spoke of Darwin's invalidism, contracted during the *Beagle* voyage, as a blessing in disguise. During forty years it caused him suffering, but it also insured him the prolonged days, weeks and years of undisturbed thought which revolutionized the thought of the world. We need not go

beyond the walls of this university for an illustration. You remember that Röntgen announced his discovery of the X-rays with the law that, unlike light rays, they were *not* reflected. Physicists everywhere began experiments, with feverish energy. You know too how reporters and magazine editors besieged every physicist whose door was not doubly barred. One of our own colleagues, however, succeeded in resisting invasion for some weeks. At the end of a period of self-imprisonment came the simple announcement from Professor Rood, "I have discovered that the X-rays *are* reflected." In this discovery lies the chief addition to our knowledge of the physical properties of the Röntgen rays.

Repose is the feature of the student's ideal environment which our scientific forefathers enjoyed. It is an absolute requisite from boyhood upwards if we are to rear men of a high order of originality in the production of new ideas.

In the rapid rise of our educational institutions we have added breadth, yet there is room for far more. We have added specialization and energy; we have, if anything, diminished the opportunities for quiet, undisturbed work. Upon those who are governing it must be impressed: give your best teachers time, and ample means to live; fewer teachers, fewer students and fewer subjects, if need be, where the resources are limited; let no original thinker feel the *res angusta domi* and destroy his finest powers in the struggle for subsistence. Upon our teachers it must be impressed: do not multiply subjects; give your students, young and old, time to think; make provision for deliberate thought throughout the whole scale of education, beginning in the home and school.

Let us therefore establish in this building the cornerstones of learning: breadth, standing for thoroughness of preparation and wideness of horizon; height, for specialization; energy, for determination in the prosecution of research; and repose, for undisturbed observation and induction. The symmetrical and balanced cultivation of all these factors will make Schermerhorn Hall a birthplace of discoveries, a new force in American science, a permanent monument to its generous founder and a worthy addition to Columbia University.

THE SEVEN FACTORS OF CREATIVE EDUCATION [1]

"Produce! Produce! Were it but the pitifullest infinitesimal fraction of a product, produce it, in God's name! 'Tis the utmost thou hast in thee: out with it, then."—*Carlyle, Sartor Resartus.*

Or that the past will always win
A glory from its being far.
From art, from nature, from the schools
Let random influences glance.

—*Tennyson.*

The word *factor* is used in the sense of collective or coefficient action, as "one of several circumstances, elements, or influences which tend to the production of a given result." For example, Lewes in his "Problems of Life and Mind" calls Attention one of the necessary factors in Perception; or, in the realm of physics, it is said that "light is the most powerful factor amongst all the agents which influence life upon the earth." In

[1] This contribution of 1906 contains much of the thought embodied in the author's "The Mediæval and True Modern S-irit in Education" of 1903, partly reprinted in Chapter III. The spirit of this contribution is also epitomized in the author's "Huxley and Education," which also appears with some modifications in Chapter III as an address to college students.

physics and mathematics the word *coefficient* has a similar significance. If the arguments in the present address are sustained, then the inculcation among our youth of these factors or coefficients becomes part of the CANONS of education.

The Conditions of College and University Education in 1906

Many years ago I was profoundly impressed in reading for the first time Ruskin's "Seven Lamps of Architecture," setting forth the universal illuminants of architecture, the architecture of all time and of every people. Am I too venturesome to enter an arena so warmly contested as that of modern teaching, and endeavor to determine whether there are also universal illuminants which lighten the way to the perfect training of the mind? Are there universal canons which extend over the whole period of human prehistory and history? Is there in education, as in architecture, an absolute code, derived from the intellectual experience of generations of thinkers, a code for every subject, for all time, and for every people?

Is the general revolt from authority in morals and literature, which is the most conspicuous tendency of our times, to leave Education also without the sanction of experience?

In the year 1903 I was drawn to these questions; first, by consciousness of my own somewhat cloudy thought in the matter, consoled only by signs of similar cloudiness in others; second, by my rising indignation against the apparent infection of education in this country with certain material and experimental tendencies, as if from the contamination of a triumphantly

successful commercial age. Mass education was heralded by pride of quantity rather than of quality, by boast of numbers rather than of individual achievement.

My inquisitive route as to the illuminants of education is one of observation, rather than of theory; it follows the lives of men, rather than the ways of the books. Consider Huxley, although not the most creative thinker, as the best pattern of the educated Englishman of the last century; carefully observing the gradual attainment of his perfect discipline, we find it arose less through his teachers than through his own discernment of the collective and cumulative value of several educational factors and his deliberate purpose to experience them all, so far as lay in his power. Consider Pasteur, guided by a similar self-educating instinct, actually resisting the advice of some of his professors. Similarly, we observe the superb education of Darwin and of Spencer as chiefly a self-schooling, growing out of the consciousness of certain intellectual wants, such mental appetite and the determination to satisfy it being one of the symptoms of greatness. From such biographies as those of Darwin, Huxley, Pasteur and Spencer, from the actual methods of the great teachers, it appears that there are universal illuminants, that there is an absolute code by which to develop the infinitesimal, as well as the almost infinite, powers of the human mind.

Separately, these illuminants of education are as near and familiar parts of our intellectual inheritance as collectively they are far from lighting the long and often obscure paths of the average teacher. Few perceive with the clear vision of posthumous critics and biographers that the over-cultivation of one or more

of the factors distinguishes the ill-balanced from the well-balanced mind, the inefficient from the efficient student. From the broad standpoint of symmetry, many very learned men, as well as many great observers, are alike imperfectly educated, and for this their guides and masters, in part at least, may be held responsible. One work I have studied, by a man of high authority, omits all reference to what I regard as the supreme factor of education.

Whatever the grade of instruction, whatever the subject, whether in science or literature, whatever the choice of profession, we may always find our path lighted by these same signals, and ask whether a symmetrical development of the factors is being brought about. Every great subject has within it the possibility of developing these factors, but a combination of subjects, selected with reference to their special influences, may bring about this development to the greatest advantage, for there are studies to stimulate the imagination, others to develop the memory and power of learning, others to facilitate observation, others reason, and so on. The universal illuminants remain both as the guide and the single basis of criticism of the teacher, of the course, of the curriculum, of the institution, of the student himself, and of his most elementary thoughts and most advanced original contributions.

In an imposing academic procession one cannot fail to be impressed by the lack of proportion between the form and the substance—the colorful display of hoods and gowns in contrast with the actual productive scholarship represented. The corrective to this disproportion would be to make the teaching profession more of an object and to establish between the school, the col-

lege, and the university an unbroken continuity. We shall be learned when, not only in university, but in school and college, we reach a perfectly clear understanding of and unite our energies in the chief object of education, namely, the *inculcation of those factors which, according to the several abilities and predispositions of men, culminate in the several forms of productive activity.*

The Art of the Teacher

What are these factors which are essential to the creative and productive mind, and what educational theory is most apt to develop them?

So far as intellectual progress is concerned—and I am not now discussing religious, moral, or physical progress—the first and most fundamental of these forces are in the nature of canons, or standards; they lie in the distinction of truth from error, in the appreciation of beauty and fitness, and in the application of these standards to thought. Together with our standards come our sources of knowledge, and there arises, as the first, that of learning from the stores of tradition, from books, and the experience of man in our own and previous generations; there follows close, as the distinctively nineteenth-century source of knowledge, that of direct observation of men and of nature. Then, for the testing of our knowledge, there is applied the triumphant crucible of human reason. Next, our standards, our knowledge, and our reason seek expression in spoken and written language. Finally, as the supreme human, most closely approaching the superhuman, power, the six preceding forces lead to the pro-

duction of new ideas and to all the forms of original activity. This is the epitome at once of the 'universal,' both in intellect and in education.

Truth, beauty, learning, observation, reason, expression, and production, in their most comprehensive forms, are the seven forces of progress, and the *factors of education* are the processes of storage of these forces by coöperation of teacher and student, the former with his constantly diminishing, the latter with his constantly increasing, responsibility. The batteries become ready to discharge, the potential intellectual energies ready to be liberated; and the cunning business or art of the teacher consists in patience and alertness in ways, means, and methods, in repairing or supplying deficiencies, and discovering powers which are never actually to be idle. As Eduard Suess, the distinguished Austrian geologist, recently observed in his farewell lecture: "When I became a teacher, I did not cease to be a student; and now that I cease to be a teacher, I shall not cease to be a student, as long as my eyes see, my ears hear, and my hands can grasp. With this wish, I do not step out, but take up my former position."

In such a theory, we are first to substitute the newer centrifugal ideal of production for the older centripetal ideal of liberal culture. Liberal culture, that indefinable quality imparted by learning multiplied by the sense of beauty, is to be the stepping-stone; it is to be the obligato or running accompaniment, rather than the solo; it is to be the stage, rather than the summation. Second, we are to ascertain in what sense, in what measure, and by what means the college may range itself with the polytechnicum and the university as a school for training producers. Such training is a

very serious undertaking; if there is any field of human activity in which it is light or easy, I do not know of it, but rather contend from the precept and example of my chief masters, McCosh, Huxley, and Balfour, and from the much more exacting master, experience, that the road from nothing to culture, and from culture to the point where man produces anything of the least value, is an extremely long and hard one.

Looking for a moment to our social obligations, it would appear possible to cultivate the first five of these factors in a monastic existence, totally without benefit to one's fellowmen; to acquire 'liberal culture' without effect or result except for its possessor; to attain an individual mastery of truth and beauty, of learning, of observation, and of reasoning, as purely receptive or centripetal powers. In contrast, the last two factors of expression and production are the centrifugal applications of knowledge, by their very terms altruistic and marking the purpose of education—the service to our fellows in commerce, in art, in politics, in literature, in scientific discovery, in every form of human activity.

To learn to produce, to be of service, we must, with Huxley, discern to the full the special rôle of each factor and, at the same time, secure a balance. The balanced enforcement of the heptalogue is as essential to the perfectly educated man as the balanced working of the great system of organs is to the ideal bodily development.

The attainment of symmetry will always baffle us, because of the generally inborn or constitutional asymmetry of mind; because of the limitations and predispositions of pupils and students—one having the gift for truth, another for beauty, another for learning, another for observation, another for reason, another

for expression, another for creative production, and the many having no special gifts whatsoever. Only rarely are the largest number of these gifts in the largest measure combined in what we call the youth of genius, and only that educator will rightly serve his calling who holds in his charitable heart this law of the mental variability of the race, who suspects the existence of talents out of the direct line of his own sympathies, who hopefully foresees that the dunce in mathematics may become the brilliant biologist, that the defective memory may be housed in the same brain with the keen reasoning power, that the deficient linguist may metamorphose into the brilliant observer, that the listless youth of eighteen may exhibit the spirit of the daring explorer at thirty, that the Rowland who leaves the small New England college in disgust may become the leading American physicist, that the Darwin who loiters through Cambridge may revolutionize the thought of the world. Even my own experience with students yields instances of an inborn predilection for a certain subject working a marvelous metempsychosis. A careless student, in the search for an elective involving the irreducible minimum of effort, perhaps by the toss of a coin elects a subject which, because of an atavistic, though previously unsuspected, impulse, fascinates and transforms him for life. Herein lies often the failure of the more rigid and restricted curriculum, and the success of the miscellaneous fire of many electives or aimless discontinuity of studies, that among the repeated shots one may hit the bull's-eye of intellectual predisposition and thus discover the man.

If we are to direct education throughout into the original, the creative, rather than into the receptive, the absorbent, the critical temper of mediævalism, I do

not know how we can more clearly introduce its relation to our school and college life and to the further elevation of our university life than by a series of contrasts, which will lead the way back to the main question as to *what are the factors of education, which culminate in production.*

Modern Mediævalism and True Modernism

The mediæval university looked backwards; it professed to be a storehouse of old knowledge, and except in the way of dialectic cobweb-spinning, its professors had nothing to do with novelties. Of the historical and physical (natural) sciences, of criticism and laboratory practice it knew nothing. Oral teaching was of supreme importance on account of the cost and rarity of manuscripts. The modern university looks forward, and is a factory of new knowledge; its professors have to be at the top of the wave of progress. Research and criticism must be in the breath of their nostrils; laboratory work the main business of the scientific student; books his main helpers. . . . The cardinal fact in the university question appears to me to be this: That the student to whose wants the mediæval university was adjusted looked to the past and sought book learning, while the modern looks to the future and sees the knowledge of things.—*Huxley.*

What is mediævalism? Is it not surviving in the methods proposed and continued in some of the most modern professional systems? I am inclined to answer the second question in the affirmative.

We should not, for a moment, fall into the almost universal error of confusing mediævalism in education with classicism, an error which has been widely disseminated by such brilliant and effective essays as Adams' "A College Fetish."

Greece and Rome illustrate the distinction. The relatively non-productive Romans were partially mediæ-

val. Rome, economically, and, in a large measure, intellectually and artistically a parasitic or centripetal state, was supported by phenomenal military genius and genuine centrifugal or constructive powers in law and government. Not so with highly centrifugal Greece. Greek supremacy was no accident; it was due to great educational conceptions applied to a people purified by race culture and selection.

If there is such classical authority for the anti-classical movement, it does not follow that the elimination of the substance has eliminated the spirit of mediævalism from among the anti-classicists. The true classicist may be one who follows most closely the highest classical models, and these were certainly the models of the Greeks, both in their methods and in their achievements. The Greeks will be modern for all time, and are still to be studied for the truest modern ideals, for ideals which resulted in the most remarkable achievements in the way of centrifugal life that the world has known, considering always the period and the infantile state of knowledge. While anticipating us in the sciences, in the extraordinary development of mathematics, in the discovery of the evolution theory, they gave ethics, philosophy, literature, and science their foundation stones. The destruction of the Greek intellectual movement by political, moral, and social decay, and by the loss of numerical and military supremacy, set the intellectual progress of the world back two thousand years.

The over-valuation of classical literature and science inevitably brought the reaction of the great "observing century" which has just passed, a reaction partly ending in a false modernism, however, which may have exceeded the limits prescribed by the truest modern spirit.

While we may abandon the claims for the classics of "superior mind-training value," or of "best conducing to a pure English style," we may adhere to them as our most highly perfected disciplinary studies, as developing systematic thinking, as familiarizing us with the marvelous classic spirit, as giving us a sense of perspective and proportion for our own lives and times, as fundamentally associated with the technical language of biology and other sciences, with all discoveries or centrifugal work in classical history, art, archæology, and philosophy. The question is not as to the value of the classics, but as to the part they shall play in the educational period. Old Montaigne's epigram even today most truly expresses the real essence of the classical question: "No doubt both Greek and Latin are very great ornaments and of very great use, but we buy them too dear."

There is also the reaction to the "modern subject." In the artillery fire against Latin and Greek, in the smoke and confusion about elective and required courses, the impression is abroad that the modern subject constitutes the essence of modernism as opposed to mediævalism. This is a dangerous half-truth, for, considering the diversity of subjects upon which the minds of great men have been bred down the ages, is it not apparent that the essence of the matter must lie less in the subject than in the intellectual objective of the teacher and of the student? Do we not often observe the modern languages taught in a most intensely mediæval fashion, and the ancient languages, under a different type of teacher, presented in a most modern spirit? May not the classics be taught in such a way as to rapidly develop all the forces of education, although such forces may be still more rapidly and

readily developed through the sciences? It is not a matter of fancy, but of fact, that, despite clear perception of its special objective value, the very teaching of science itself is still largely after the mediæval, dogmatic fashion, and that even the "verification of anatomical fact" method of Huxley has its dangers.

Asymmetry and superficiality are the two words which sum up my criticism of our present American education from bottom to top. Swinging like a pendulum, it has lost some of the merits of mediævalism, without attaining the full advantages of modernism.

Rising Materialism and Experimentalism

In contemporary American life there are two currents which are setting away from, rather than toward, a clearer perception of the 'universal' in education—these are our materialism and our experimentalism. Much of the material spirit undeniably pervades our college halls and mars the otherwise splendid progress of educational idealism in this country; computors are heralding great gifts and statistical increases in which numbers are swelled by summer schools, by dental, veterinary, and miscellaneous departments, as if to maintain prestige on a distinctively quantitative, rather than on a qualitative, basis.

Experimentalism is partly an intruder from our material atmosphere, partly an offspring of the general revolt from authority.

It is a truism of trade that our manufacturers owe a large measure of their supremacy to their readiness to abandon old machinery and substitute new. It is as much an American instinct to welcome change as it is

an English instinct to shrink from it. Was not the manufacturers' spirit more or less pervasive in the Boston meeting of the National Educational Association of 1903,[1] when the prolonged debate was summarized, with some irony and much truth, in the statement that from electives and courses we are to pass to experiments with curriculums as a whole, and with the period of studies on a grand scale; in other words, that the colleges shall compete in the cultivation of brains after different fashions, just as rival furnaces are competing and experimenting in the production of steel; that we are to witness the survival of the fittest institution, which shall turn out the largest quantity of the best product in the shortest possible time, and thus most thoroughly exemplify the spirit of American trade.

Confused by the tremendous inrush of new knowledge, we have already been experimenting for some years past. Perhaps our impulse for facile modification and adaptation is nowhere more conspicuous than in the rapid movements of these decades, prompted by the fallacy of regarding change as identical with progress, and ignoring the fundamental evolutionary law that change is as often retrogressive as progressive. It is quite possible, not to say probable, that many of the sweeping alterations which have taken place, and are now contemplated, are distinct retrogressions, and will remove us farther and farther from solid intellectual advance; that they conform to the commercial spirit, rather than transform it; that some of our ablest educators have been unwittingly contributing to a backward movement by failing to grasp clearly in their own

[1] "The length of the college course and its relation to the professional schools." Papers read before the Department of Higher Education of the National Educational Association, at Boston, Mass., July 7, 1903. *Educational Review*, New York, September, 1903.

minds, or to set clearly before the nation, the slow and difficult steps which are necessary to teach men how to think and how to produce.

Pathology of the American College [1]

Consider the case of the college in this year 1906; it is generally, but not altogether, fairly alleged that it is a patient, that it is a sick organism, even that it has reached a condition which may be regarded as useless. Remedies are being administered, not from any very clear system of educational therapeutics, but on the rule that when one tonic fails another shall be given trial. A cupping process or drawing of blood is suggested; one presidential doctor prescribes four years of life, another allows three years, another two; another proposes to cut short life altogether, predicting the extinction of the college and the direct passage from the high school to the university.

The extinction of the American college is the *reductio ad absurdum.* Such an end to experimentalism would be a national calamity, because schools can never equal colleges, either in resources or in fitting for citizenship; because the longer period of the education of the larger number would fall into the hands of women teachers, who are constantly multiplying in the public schools; because the democratic social spirit, so vital to the college, is fatal to the university, the future triumph

[1] The following paragraphs refer to the proposals, chiefly by President Eliot, for a three-year college course, for advancing the college entrance age so that students with free election might begin work of the university grade in the freshman year for the beginning of medical and law courses practically in the junior year. All these debated questions of 1906 were finally settled by the unification of college entrance requirements and the preparation for medical and law school work by the group elective system in the college.

of which depends chiefly upon the enforcement of the idea that here belongs exclusively the young intellectual aristocracy of the country.

Even abbreviation may be another instance of failure to distinguish between progressive and retrogressive evolution. If a year be cut from the college to adjust the year which has been added to the school by belated entrance or advancing standards of admission, the net result is to substitute a year or two of school life for a year of college life. Is this a progressive change? Is not a college year rich in historical associations, teaching capacity, libraries, laboratories, museums, and all the other products of generous endowment of more value than a school year? Similarly, if learning or the acquisition of general knowledge remains in fashion even by apology as a specific function of the college, does not the prodigious intellectual advance of the nineteenth century tend to lengthen, rather than shorten, the college course of the twentieth century? If the college period is to be changed, would not a consistent movement be the opposite of an abbreviation? Would it not be, for the more effective school, the earlier admission to college? I do not pretend to settle this very difficult question, but only to put it in the light of an evolution problem.[1]

[1] My personal opinion may, however, be stated that economy and careful adjustment of time should begin in the school years where the vista of life seems so long that the value of time is not appreciated; that early waste of time should not be compensated for by the abbreviation of the real preliminary culture period of college life. If we are to experiment, therefore, *let us try the experiment of thoroughness of education.* If one student is so clever as to acquire in two or three years what another does in four, let him profit by making his work broader and more intense. We shall at least be on the side of the method which has led to the best creative work in all time. If the American college disappears in the struggle for existence between the high school, the technical scientific school, and the university, it will not be because it deserves to disappear, but because the men at the helm of college education have no clear conception of what they are aiming to accomplish and are trying fortuitous experiments in quantitative matters of subjects, hours, days, and months, instead of reforming the quality and standard of the work accomplished.

The friends of the collegiate patient advance the traditional plea that the college is to be preserved as the home of "liberal culture"—a laudable reason for prolonged life, which, however, contains an element of indefiniteness. Here we approach a more rational diagnosis of the disorder, which, in itself, suggests a remedy. Liberal culture, for what end or purpose, one may ask? Is not this lack of purpose, this dysteleology, to borrow a Haeckelism, the internal disorder which has bred the pathological condition of the college during the very years when the university and the technical school have flourished like green bay trees?

Refreshing definiteness of purpose in training for material production is the invigorating principle of the technical schools which show no signs of internal disorder or degeneration, and as to the utility of which there is no question. No one proposes to cut their periods from four years to three, or to two, or to eliminate these schools altogether; they have their weaknesses, but no one charges them with dysteleology.

Modernism Fails to Foster Creative Production

Accepting the general truth of Huxley's brilliant, if somewhat extreme, contrast between the mediæval and the modern spirit, as quoted above, we see that professed modernism in education still contains a large admixture of mediævalism in its failure to develop the creative forces of the mind. Such development was the essence of the Greek spirit in education, yet the modern spirit emphasizes, even more than the Greek, man's relation to his fellow-man, not merely in the political, but in every aspect. In fact, the essence of the modernistic

spirit is public service rather than creative production. In Greece, on the other hand, creative production was foremost.

In education, Socrates, Plato and Aristotle were eminently men of their period, or moderns, as we learn from their frequently reiterated views. It will be recalled that the Socratic solution of the educational problem was that the new state of society was to be based on knowledge, that the germs of knowledge were inherent in every human being, by virtue of his own experience, and that these germs could be developed by the dialectic process. The whole bent of Socrates as a teacher was the cultivation of originality. His rule that, to educate a youth, the less we think for him and the more he thinks for himself, the better, is the root of the true modern spirit, because it is the first step toward production. Louis Agassiz professedly adopted the Socratic method in teaching zoölogy, and Huxley's method was largely Socratic. Plato observed: "We next come to arithmetic, geometry, and astronomy . . . all citizens shall learn the rudiments of these sciences, not because of the necessities of practical life [a word for our most practical schools], but because these are endowments belonging to the divine nature. *By a good method, the teaching of these sciences may be made attractive and interesting, so that no force may be required to compel youth to learn.*" Inspiration, sequence in the development of body, mind, and soul were Plato's modes of training the young citizen, while his curriculum was surprisingly similar to that of our older colleges.

Unfortunately, there is preserved only a fragment of Aristotle's writings on the art of teaching, our knowledge of his opinions on the development of the mind

being largely inferential from his works and from his intellectual ideals. If these great Greeks had recommended the youth of their country to devote ten of the formative years of their lives, first, to the Mycenæan language and culture, and, second, to the Egyptian and Mesopotamian languages and cultures, then the few who still maintain that our modern youth should largely devote the formative period of their minds to ancient languages might rightfully claim to be classicists.

Contrast with the centrifugal Greek spirit the centripetalism of the old educators in their renaissance of classical learning, impelled partly by the extraordinary intrinsic or inherent force in such fragments of this learning as remained; consider their sedentary life, absorbed in poring over and discussing what Aristotle and Pliny had to say about the world, rather than in travel and exploration of their own; contrast their scrutiny of the books of the ancients, rather than the book of Nature herself; their compilations in natural history with their dearth of observation of the objects about them, of the birds, the fishes, flowers, and even of human society.

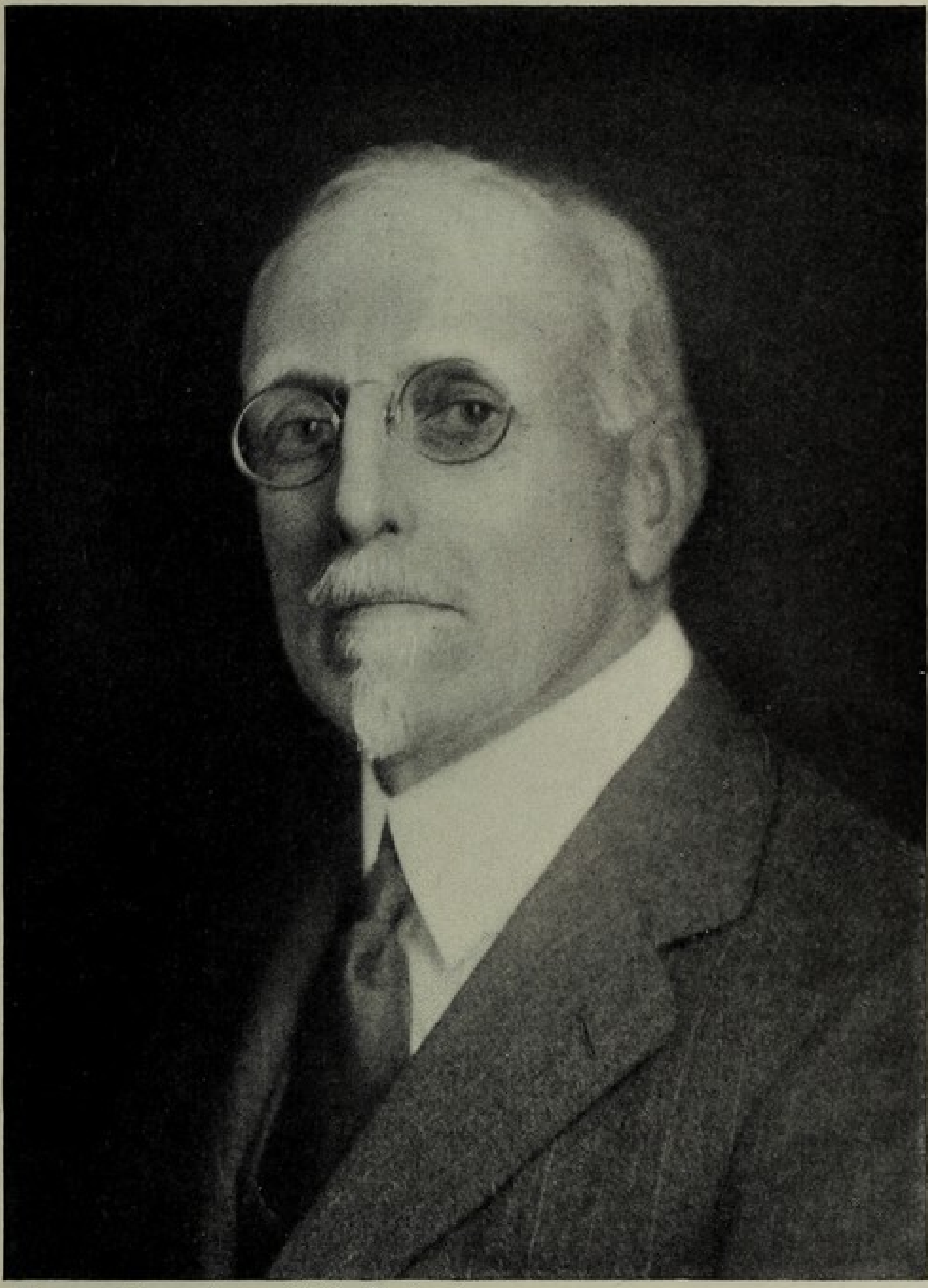
Even the centripetal system of education cannot crush out the passion for creative work which is born in some men and women, but since the mission of education is itself production, it must produce the producers, it must discover them and train them to the highest, as well as to the intermediate or the lower, planes of creative work. Once inoculated with this virus, education enjoys a new vitality, an immunity to ennui; the centrifugal power, inborn or instilled, turns into those channels which taste and opportunity unfold: into science, literature, theology, law, medicine,

commerce, manufacture, politics. Vanity is checked and humility engendered by learning what has been achieved, and the supreme difficulty attending achievement.

What I am contending for is that the one absolute essential in all education is to hold out the centrifugal life of originality, of efficiency, of construction, of production, of creation, as the chief end of education, rather than to make any of the subsidiary factors, such as intellectual morality, or learning, or reasoning, or the cultivation of taste, or the power of expression, ends in themselves.

Let master and student be impatient of the systems which postpone creative production until after-years of learning and acquisition through brilliancy of memory give a false sense of power. Rather from the outset learn and think to do. Be not impatient of the slowness of the process of acquiring either the power of production or of the many complex factors which enter into it.

The initial step in the schooling for creative production is what is familiarly known as the original exercise, which may begin in the kindergarten and terminate in the most advanced laboratory. The whole creative process is the same in kind, while it differs infinitely in degree. In classics, it is the turning of English into Latin and Greek; in mathematics, it is the original problem; in English, it is the theme; in science, the induction from the observed experiment, however simple; in brief, it is the outflow from the mind, rather than the inflow to the mind; the acquisition of centrifugal, rather than centripetal, power. Thus are taken the rudimentary, the intermediate, as well as all the successive steps from the simplest to the very



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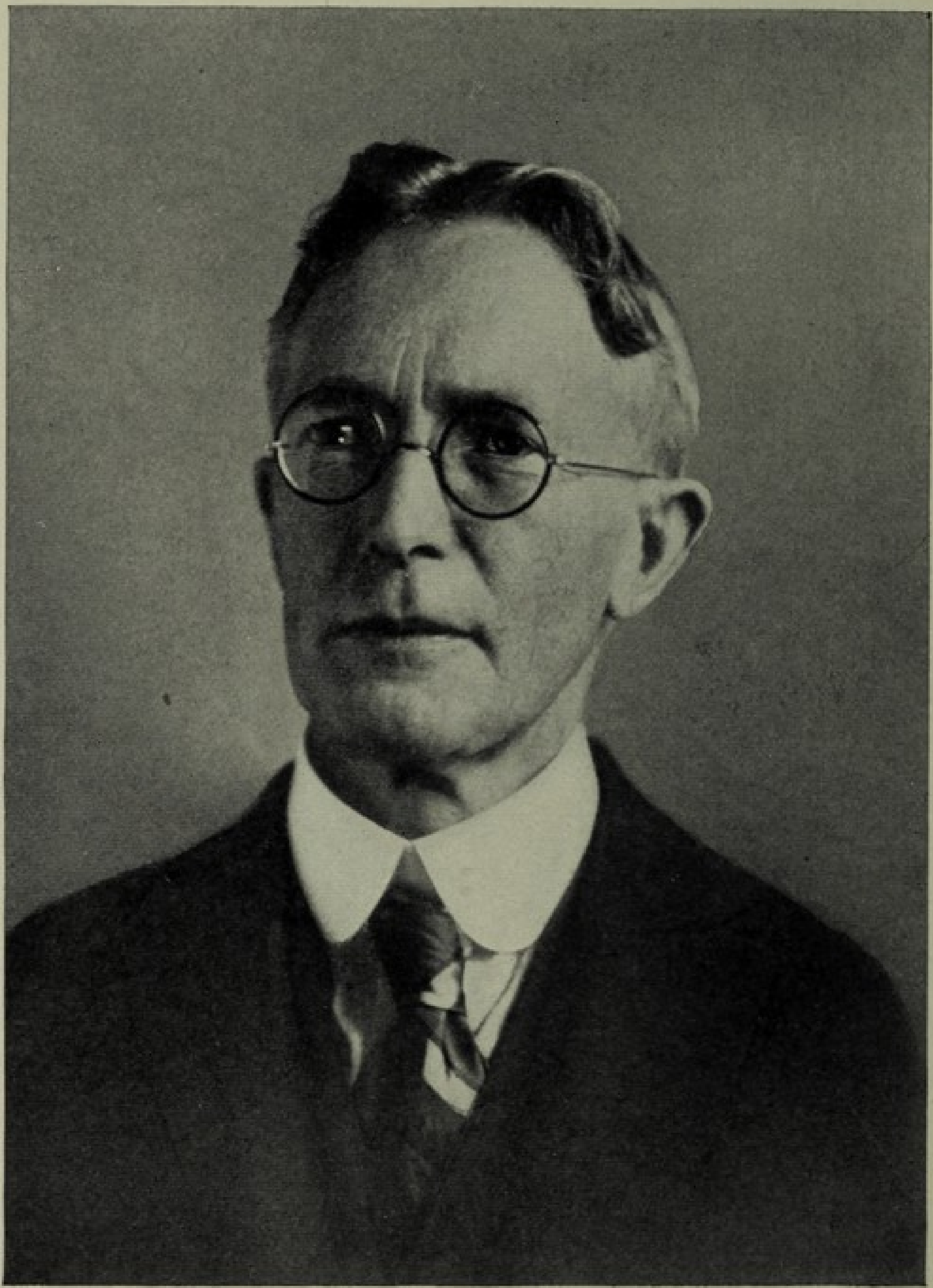
RICHARD SWANN LULL

Curator of Vertebrate Palæontology and Director of the Peabody Museum, Yale University



WILLIAM DILLER MATTHEW, F. R. S.

Curator of Vertebrate Palæontology, American Museum of Natural History, 1894–1927; Professor of Vertebrate Palæontology, University of California

highest grades of creative production. I fancy the instinct that this is the real purpose and end of education has been the more or less unconscious inspiration of every great teacher of all time. It is the most difficult part of education. It is the point where students rebel most. It is the point where the largest number of teachers fail. It is the method which is most difficult to prescribe. A merely fine memory that brings the highest collegiate honors and standing, when combined with the inability to produce, results in the barren after-life and wonder as to the worth of the first diploma. It is far easier to compel a student to read six books of Homer than to train him to turn one page of English properly into Greek; it is far easier to learn by rote Tennyson's "In Memoriam" than to produce one line worthy of a place in that great poem; it is far easier to memorize Darwin's entire "Origin of Species" than to devise a single new biological experiment of real value.

CREATIVE PRODUCTION	Its Canons and Ideals	TRUTH—the conscience and the intellect BEAUTY—the imagination and the spirit	
	Its Sources of Knowledge	LEARNING—the inherited source OBSERVATION—the original source	
	Its Discriminations, Comparisons and Judgments	REASON—upon the facts gathered through observation and learning, guided by standards of Truth and Beauty	
	Its Services to Mankind	EXPRESSION PRODUCTION	in literature, science and art. Conveyance to others of what we have discovered

By focusing our attention upon each in turn, in the light of the wisdom of our own and preceding centuries, we may best discover the special parts played by each of the seven factors of education, individually ineffective. collectively an irresistible power.

Factors of Truth and Beauty

For myself I found that I was fitted for nothing so well as for the study of Truth; as having a mind nimble and versatile enough to catch the resemblance of things (which is the chief point), and at the same time steady enough to fix and distinguish their subtler differences; as being gifted by nature with desire to seek, patience to doubt, fondness to meditate, slowness to assert, readiness to reconsider, carefulness to dispose and set in order; and as being a man that neither affects what is new nor admires what is old, and that hates every kind of imposture. So I thought my nature had a kind of familiarity and relationship with Truth.—*Francis Bacon.*

In the sacred procession of humanity the good man comes first and after him the Servant of TRUTH, and then the Priest of BEAUTY, the artist or the poet.—*Renan.*

I am inclined to call Beauty Truth, because the former springs from the latter; but even if I were to admit that beauty and truth are not synonymous terms I should give preference to beauty because truth in her keeping is more glorious than truth pure and simple. I dare say that outside of beauty there is nothing real in the world. Lacking the appreciation of beauty, we lack the knowledge of the truth of the past, of the present and of the future. It is beauty that teaches us to live. Renan thought so, too, when he exclaimed: "Beauty is as good as virtue!" Art shows us that beauty is our greatest teacher, the refiner of morals, the inspirer of religion. What would we possess without artists and poets, without ancient Greece and Rome?—*Anatole France.*

The divine order of truth and beauty, as conceived by Plato, is at the foundation of all things and forms the soul of education, for a truthless education is fruit-

less, and an education without the sense of beauty and harmony fails, both of its imaginative elements and of its full effect on other men. The inspiration of these standards and basal guiding qualities is through religion, the study of the beauty and harmony of nature, of classical and modern literature, of art, led by the personal influence of men of culture and productive capacity.

Intellectual virtue, the truth canon, the first ingredient of education, must be derived from some source or other. No element is more essential to the educated man; it is the *alpha* and *omega* of his learning. Virtue and knowledge do not necessarily run on all fours; many conspicuous instances could be cited of their absolute divorce, and with Huxley in his Romanes lecture, I am not hopeful of deriving moral qualities from the study of pure science. Some of the greatest scientists have not been consistently truthful, for proclaiming truth and practising and conforming to the truth are a combination rarely maintained throughout an entire scientific career. All scientific men are prone to fall in love with their theories, just as theologians fall in love with their dogmas, and the passage from fact to untenable hypothesis is no less frequent than the passage from religious truth to pure dogma in theology. Even Darwin was biased by his love of his theory of natural selection, although an apostrophe to accuracy and a veritable passion for truth are found in the following passages, springing from his own hard experience:

Good heavens, how difficult accuracy is! . . . Accuracy is the soul of natural history. . . . Absolute accuracy is the hardest merit to attain, and the highest merit. . . . For myself I would, however, take higher ground, for I believe there exists, and I feel within me, an instinct for truth, or knowledge, or discovery, of

something the same nature as the instinct of virtue, and our having such an instinct is reason enough for scientific researches without any practical result ever ensuing from them.

It is aside from our present path to consider whether the æsthetic factor was more, or less, appreciated by mediævalists than by moderns. The art spirit has certainly suffered a decline since the Renaissance; the spirit of the Florentines was the nearest to a revival of the Greek spirit that the world has seen. The sense of the beautiful, combined with the appreciation of natural law, as manifested in Leonardo da Vinci, enters into scientific, no less than into artistic education, and the cultivation of the imagination is the constructive basis as much of the physical sciences as of literature.

In the relative spheres of the essential union or separateness of ethical and æsthetic cultivation, we are again on debatable ground, as will be readily seen from comparison of the Latin environment, abounding from childhood in æsthetic cultivation, while, perhaps, less insistent upon the element of truth, with the German, English, and American—in short, with Teutonic—environment relatively deficient in the sense of beauty, while perhaps more insistent upon the element of truth.

The Factor of Learning

With this close hold upon practical life and this constant interest in the politics of the world, especially of England and the United States, no one could be less like that cloistered student who is commonly taken as the typical man of learning. But Lord Acton was a miracle of learning. Of the sciences of nature and their practical application in the arts he had indeed no more knowledge than any cultivated man of the world is expected to possess. But of all the so-called 'human subjects' his mastery was unequaled. Learning was the business of his life. He was gifted with a singularly tenacious memory . . .

the passion for acquiring knowledge which his German education had fostered ended by becoming a snare for him, because it checked his productive powers. It absorbed so much of his time that little was left for literary composition. It made him think that he could not write on a subject till he had read everything, or nearly everything, that others had written about it.[1]

The middle centuries were distinctively the period of learning; the great and enduring contribution of mediævalism to the world and to modern education was its insatiable thirst for information, for knowledge of the achievements of man as set forth in books and book lore; for literature, and for the traditional science of the Greeks and Romans. As Harris aptly expressed it, "through learning, we stand on the shoulders of all previous generations," and, figuratively speaking, the survival of mediævalism is only to be deplored in the one great feature of its faith, that a secure position on other men's shoulders is of paramount importance and constitutes an end, rather than a beginning and an accompaniment, of education.

The learned attitude is naturally the historian's attitude toward education. We have cited above the late Lord Acton as a modern mediævalist of the highest type, of vast learning, of limited production, as a storage battery which rarely discharged, as a life illuminating our present contention. By way of contrast to Acton may be instanced, among historians, our own Fiske, Browning, Tennyson, Victor Hugo, and, above all, Balzac, as pouring the forces of learning into expression, into the conversations, debates, and discussions of their men and women, or into the pages of history. In his brief, but great, preface to "Père Goriot," in which Balzac lays bare the whole philosophy

[1] Special correspondence of the *Evening Post*, London, June 23, 1902; the *Evening Post*, Friday, July 18, 1903.

of *la comédie humaine*, he shows thorough conversance with the whole biological movement of his times, beginning with Buffon of the middle of the eighteenth century and ending with the famous discussions of the early nineteenth between Cuvier and St. Hilaire—all a matter of pure and well-digested learning. It may be said that his works fairly bristle with learning and knowledge and that acquisition was one of the great elements of his genius. Similarly, Tennyson's "In Memoriam" shows a remarkable comprehension of modern biology in its many more open and more subtle allusions to evolution and heredity.

Our shelves are loaded with the books of unlearned men. I have in mind two remarkably original works of recent times; they have justly brought their authors great renown, yet they both fail at the critical point, where the authors extend from their specialties and attempt to reach out for broader conclusions in neighboring fields of knowledge—conclusions which are rendered totally invalid, almost ridiculous, through deficiency in biological and anthropological learning.

Learning necessarily occupies a vast amount of time, and it is a false modernism which depreciates its place in education. "*Learning* is the quality which has made the Chinese to be one of the greatest people in the world. They have preserved their integrity as a race from the dim ages of the past. They have resisted the incursion and admixture of foreign influences while in other parts of the earth nations have been born, become great, and sunk back into oblivion. They have from the time of Confucius handed down the principles of human wisdom in a pure and simple form to the present day. They have clearly discov-

ered truth, virtue, human justice and good government, but the quality they exhibit in supreme perfection is the power of standing still without losing strength or virility."

How near-sighted are certain reactions against learning; how absurd the fads of certain ultra-modern schools; how out of time the premature exclusive specialization; how inadequate the extreme laboratory system; even in the university, how futile to attempt to educate exclusively through research.

As Emerson observes, whatever force may have compelled us to education, we are always gravitating back to learning, to the accumulated knowledge of our subject, and this is one of the most striking phases in the self-education of men. We recall that Aristotle opens every disquisition with a review of all that was known and said by his predecessors; this is the well-known method of introducing the doctorate thesis in Germany. We recall that Darwin, although eventually more learned in books than any other scientific man of his generation, neglected book knowledge while at Cambridge and, after becoming attracted to science by observation and discovering how largely it is necessary to draw from the recorded observations of others, was fairly forced back to book knowledge.

Fine proofs these that the teacher should even "stoop to conquer"; that he should fascinate the student with the spirit of some principal subject; that, interest once enlisted, the value and necessity of book knowledge become apparent; that the student should learn in order to produce and produce in order to learn; that one idea proceeding out of the mind is worth ten ideas proceeding into the mind.

The Factor of Reason

That man, I think, has had a liberal education, who has been so trained in youth that his body is the ready servant of his will, and does with ease and pleasure all the work that, as a mechanism, it is capable of; whose intellect is a clear, cold, logic engine, with all its parts of equal strength, and in smooth working order; ready, like a steam engine, to be turned to any kind of work, and spin the gossamers as well as forge the anchors of the mind; whose mind is stored with a knowledge of the great and fundamental truths of Nature and of the laws of her operations; one who, no stunted ascetic, is full of life and fire, but whose passions are trained to come to heel by a vigorous will, the servant of a tender conscience; who has learned to love all beauty, whether of nature or of art, to hate all vileness, and to respect others as himself.—*Huxley.*

Reason is the great asset of man. Granted the impulses of beauty, of truth, of knowledge, and of observation, there is still to be trained the efficient "logic engine" of thought so wonderfully pictured by Huxley. George Meredith also speaks in inimitable style of the relation of observation to reason and discrimination:

Observers of a gathering complication and a character in action commonly resemble gleaners who are intent only on picking up the ears of grain and huddling their store. Disinterestedly or interestedly they wax over-eager for the little trifles, and make too much of them. Observers should begin upon the precept, that not all we see is worth hoarding, and that the things we see are to be weighed in the scale with what we know of the situation, before we commit ourselves to a measurement. And they may be accurate observers without being good judges. They do not think so, and their bent is to glean hurriedly and form conclusions as hasty, when their business should be to sift at each step, and question.

Nature is not over-liberal with this asset; she often richly endows with all other forces while most parsi-

monious with this. Two of my older scientific colleagues, most learned, most gifted observers, profound students, able writers, and prolific producers, were yet almost devoid of the power of sound logic. On one occasion, after examining their joint advocacy of a certain theory, which I myself strongly entertained at the time, I could not help remarking, "Heaven preserve us from our friends!" Scientific common sense, or the absence of it, is congenital; it comes from our forebears or from that strange benefactress—the saltation in heredity.

If not inborn, this break in the ranks must be perceived and, so far as possible, repaired by the teacher—certainly one of the most difficult, if not most hopeless, of tasks. The induction into correct thinking is not only in formal logic, in philosophy, in the history of the sciences—more especially where taught by personal contact and discussion between master and student—but in the continuous exercise or practice of reasoning by the student himself, guided by kindly, but expert, criticism by the master in every branch of original thinking. Here is where mathematics and the natural sciences make their most effective contributions to education, in affording the data for reasoning from problem to solution, or from cause to effect, in its simpler forms. There is no abbreviated formula for reading nature or men at sight: the invention of the guesses that make an hypothesis, the trials of the hypotheses that make a theory, and the discarding of the theories that fall for a truth—in brief, the unerring scent on the track of new truth—can only be acquired by the method of trial and error, guided by skillful and ingenious advice.

The Factor of Observation

I have always felt that I owe to the voyage of the *Beagle* the first real training or education of my mind; I was led to attend closely to several branches of natural history, and thus my powers of observation were improved, though they were always fairly developed.—*Darwin.*

You know much of what has been done, but have you the power to discover, to add to the world's knowledge? Your knowledge has been derived from books and lectures; you have now to learn that a week in the laboratory, during which you seem to crawl, during which for examination purposes you do less than in reading ten lines of a textbook, is really of more value to your scientific education than a month's hard reading. This is almost unbelievable to you who are such adepts in passing examinations, yet it is quite true. Lectures and lessons have spoon-fed you until now; lectures and lessons will in future teach you to feed yourselves.—*John Perry.*

But how willingly I would as a poet exchange some of this slumbering, ponderous, helpless knowledge of books, for some experience of life and man.—*Elizabeth Barrett Browning.*

Although it be a more new and difficult way, to find out the nature of things, by the things themselves; than by reading of Books, to take our knowledge upon truth from the opinions of Philosophers: yet must it needs be confessed, that the former is much more open, and less fraudulent, especially in the Secrets relating to *Natural Philosophy.*—*William Harvey.*

Schopenhauer's premise that "all truth and wisdom lie ultimately in observation," we find reflected in the lives of men of science and of letters—a very thirst for transition from book learning to original and direct observation of men, of facts and things, of nature, as inexhaustible sources of new knowledge. The reciprocal relations, or the actions and reactions, between learning and observation are wonderfully illustrated in the life of Pasteur—the noblest scientific life re-

corded. Again, when young Ramon y Cajal, while a medical student, found in works of reference no citations from his own countrymen, he resolved that, if it lay in his power, at least one Spanish name should appear in the history of medicine of the future and remove the reproach of Spain. He threw himself with ardor, not into deeper and more extensive learning, but into the observation of the nervous system by means of a method which had just been discovered by the Italian histologist Golgi, and with such success that in the course of a few years every anatomical treatise quoted the brilliant discoveries of Cajal from the ancient University of Cordova.

This truism, that *the world holds its own by learning, that it moves forward by observation*, is the distinctive gift of the scientific spirit to education. It has not yet become a truism of educational practice. Quick and keen in children, undoubtedly inherited from our very remote ancestral life, where powers of observation were factors in survival, this faculty was unrecognized in the mediæval system of education, and is also unknown to the college, which ignores the element of observation in its requirements both for admission and for honors at graduation. It is, therefore, largely ignored in the school which prepares for the college—a condition of things which, however, is widely perceived and rapidly being remedied in the public secondary schools of this country. Here I may quote from a noteworthy recent address by the headmaster of one of the most successful colleges of England:

> A school preparation should be of a kind which will foster the desire and develop the power to overcome difficulties; it should give self-reliance and sufficient knowledge of scientific principles to enable the pupil in after-life to understand changing condi-

tions and see their trend. Above all, school work should encourage the spirit of inquiry, which finds delight in making new observations and experiments with whatever resources are available. The principle upon which Humboldt constructed Prussian education a century ago was: whatever we wish to see characteristic of our nation we must first implant in our schools. Assuredly, if we would prepare our scholars for life, the supreme intellectual preparation is found in methods which evoke the faculty, the originality, the mental resourcefulness of our pupils. It is for us to see that the subjects and methods of teaching in our schools are such as to promote the development of these qualities, for national progress depends upon them.

School and college should, from the outset, foster this most fertile of natural faculties. Postponement of observation to the graduate school, where it naturally enjoys its maximum cultivation, is a hazardous experiment, because of the law of degeneration of unused mental powers. *What* we observe is less vital than that we *do* observe, and the introduction of science in the school should be less for knowledge and learning than for facility in vision and elementary reasoning. Observable material is what is called for; not always the same material, neither is it necessarily in the scientific sphere—it may be in the poetical, literary, or classical. In the social world, the young observer is most admirably advised by Montaigne:

This great world, which some do yet multiply as several species under one genus, is the mirror wherein we are to behold ourselves; to be able to know ourselves as we ought to do in true bias. In short, I would have this to be the book my young gentleman should study with the most attention . . . so the several fragments he borrows from others, he will transform and shuffle together to compile work that shall be absolutely his own; that is to say, his judgment, his instruction, labor and study, tend to nothing else but to form that. He is not obliged to discover whence he got the materials that have assisted him, but only to produce what he has himself done with them.

The Factor of Expression

And art thou then that Virgil . . .
That style, which for its beauty into fame extends.
—*Dante.*

. . . Believe me, you must run your pen
Not once or twice, but o'er and o'er again,
Through what you've written, if you would entice
The man who reads you once, to read you twice.
—*Horace.*

That is the best style which conveys the thought of the speaker to the mind of the listener with the least friction on the part of the listener.—*Spencer.*

For my part, I venture to doubt the wisdom of attempting to mold one's style by any other process than that of striving after the clear and forcible expression of definite conceptions, in which the Glassian precept, "First catch your definite conceptions," is probably the most difficult to obey. But still, I mark among distinguished contemporary speakers and writers of English, saturated with antiquity, not a few of whom, it seems to me, the study of Hobbes might have taught dignity, of Swift concision and clearness, of Goldsmith and Defoe simplicity.—*Huxley.*

All men stand in need of expression. In love, in art, in politics, in labor, in games, we study to utter our secret. The man is only half himself, the other half is his expression.—*Emerson.*

Perhaps if we should meet Shakespeare, we should not be conscious of any steep inferiority; no, but of a great equality,—only that he possessed a strong skill of using, of classifying his facts, which we lacked.—*Emerson.*

Why, with Lycidas, "shun delights and live laborious days"; why acquire the canons of truth and taste, the familiarity with achievement, if you cannot bring forth discoveries and ideas which may have cost you an infinite amount of labor, if you have not the power

of expression in language, drawing, painting, sculpture, architecture, or other forms of design?

The gist of Huxley's famous thought, quoted above, is that *ideas, practice, and the native literature are the three chief factors in the cultivation of style.* In language, look to the best lay writers of England, to Huxley himself, as well as to the uniformly fine style developed in France, and avoid Germany as you would avoid a labyrinth or a quick-sand.

The mediæval spirit, instilled in prejudice to the mother tongue, was manifested in the writing of the Bible and all works of science in Latin; it survives in over-reliance upon Latin and Greek in the cultivation of the art of expression. In this day, when two great exponents of English style—Huxley, with little early classical training, and Tyndall, chiefly of scientific education—stand shoulder to shoulder with two other masters of prose—Maurice and Goldwin Smith, both of classical education; when Darwin and Galton are models of simplicity and clearness, we cannot believe that there can survive a classical monopoly for the acquisition of style. Latin is said to be enjoying a great revival in the secondary schools of America, but the classics, as generally taught with us, fail to have the productive and constructive value in expression which is enforced in England, where style is cultivated and developed by a constant interchange of classical and English expression. At Eton, for example, the training culminates in the ability to put a *Times* editorial into Greek or Latin. With us, the chief régime of classical preparation consists in translation, parsing, translation; and in truly mediæval spirit some of the most progressive colleges have been piling up 'reading' requirements, in raising the standard of ad-

mission. As the entrance examination approaches, translation increases in quantity and intensity, and for two years there is a long and arduous cram, until the average student becomes fairly surfeited with the very masterpieces of literature and as thoroughly cured of any taste for the classics as the Israelites were of any partiality for manna. The transfer of a large proportion, if not of the entire, classical training from the culture period of college life to the more purely disciplinary period of school life, is also one of the most conspicuous illustrations of what has been spoken of above as retrogression in the guise of progress.

Happily, however, expression is the one direction in which a substantial advance has been made in American college education in the last two decades. Under wise leadership, in this art we far outclass the Germans, although we still lag behind the French. If we are gaining expression, all the more need to follow more ardently the "Glassian precept" to gather our ideas and harvest our observations, so that we may bring them forth into the final stage of original production.

Concerning the art of expression, we may cite from some of the recent masters:

Writers of high aim in all branches of literature, even when they are not—as Mr. Swinburne, for instance, is—lavish in expression, are generally over-deliberate in expression. Mr. Henry James, delineating a fictitious writer clearly intended to be the ideal of an artist, makes him regret that he has sometimes allowed himself to take the second-best word instead of searching for the best. Theoretically, of course, one ought always to try for the best word. But practically, the habit of excessive care in word-selection frequently results in loss of spontaneity; and, still worse, the habit of always taking the best word too easily becomes the habit of always taking the most

ornate word, the word most removed from ordinary speech.—*Francis Thompson.*[1]

I have tried my best to make it clear and striking, but very much fear that I have failed; so many discussions are and must be very perplexing. *I have done my best.* If you had all my materials, I am sure you would have made a splendid book.—*Darwin.*[2]

I need not remind you that mere expression is to an artist the supreme and only mode of life. It is by utterance that we live. . . . On the other side of the prison wall there are some poor, black, smoot-besmirched trees that are just breaking out into buds of an almost shrill green. I know quite well what they are going through. They are finding expression. . . . To the artist expression is the only mode under which he can conceive life at all. To him what is dumb is dead.—*Wilde.*[3]

The Factor of Production

In the intellect constructive, which we popularly designate by the word Genius, we observe the same balance as in the intellect receptive. The constructive intellect produces thoughts, sentences, poems, plans, designs, systems. It is the generation of the mind, the marriage of thought with nature. To genius must always go two gifts, the thought and the publication. The first is revelation, always a miracle, which no frequency of occurrence or incessant study can ever familiarise, but which must always leave the inquirer stupid with wonder. It is the advent of truth into the world; a form of thought now for the first time bursting into the universe; a child of the old eternal soul; a piece of genuine and immeasurable greatness.—*Emerson.*

I do not propose for a moment to invite you to blink the fact that our huge Anglo-Saxon array of producers and readers—and especially our vast cis-Atlantic multitude—presents production uncontrolled, production untouched by criticism, unguided, unlighted, uninstructed, unashamed on a scale that is really a new thing in the world. It is all the most complete reversal of any proportion, between the elements, that was ever seen before. —*Henry James.*

[1] Francis Thompson : Shelley.
[2] Letter from Charles Darwin to Lyell, written June 21, 1859, cited in "The Coming of Evolution" by John W. Judd, p. 131. Cambridge University Press, 1910.
[3] Oscar Wilde : De Profundis. Letter to his friend Robert Ross.

"Produce! Produce! Were it but the pitifullest infinitesimal fraction of a product, produce it, in God's name! 'Tis the utmost thou hast in thee: out with it, then." This stirring appeal and command of Carlyle for production should be carved in stone over the portals of every school, college, and university, and embodied in the precepts of every teacher, because production, as our foremost intellectual service to God and to man, and as the end of the whole educational system, should be prepared for by injecting the true creative spirit into every course in school and college.

Creative production in the form of original research is the proclaimed ideal of the American universities. This ideal was first embodied among us in the early years of Johns Hopkins University, when, with an assemblage of gifted teachers, and with the flower of American students, the average results throughout all the departments were commensurate with the best attained anywhere, and at once spread throughout the world the new and momentous fact that America could establish and maintain a university. Such an ideal is, however, not maintained, chiefly because the American university at present rests upon the insecure foundation sands of superficial college work, seemingly meriting the charge of the Oxford don who said of the early American Rhodes scholars:

> It would seem that the school and college training of the average American who comes to Oxford has been too superficial and mechanical.
>
> They are good at book work, but better at getting up things than at getting inside of them. They are not very teachable, are little accustomed to criticise their textbooks, and in particular have been quite unused to working with original authorities. They are rather markedly deficient in style and in the power of exact expression; they run to verbosity and are wanting in grip.

They seem to have been taught some of their subjects—economics, for example—too early.

It is the experience of some colleges that the Rhodes scholars who have done best are those who have taken classics. The reading for this examination gives them precisely that training in method and that intellectual discipline which they need most. It might well seem a little doubtful if it is worth a man's while to come all the way from America to study some branch of natural science. There are probably many subjects in which Oxford offers no particular advantage.

The term 'creative production' is used advisedly for all activities of the artisan, of the designer, of the engraver, of the architect, as well as of the artist, because there are as many who can produce in some form as there are few who can create.

The vast majority of men are born consumers; there are few who are either instinct with the desire to produce or who have had the vast hiatus between consumption and production impressed upon them. Many clever people fail to grasp the distinction; in the metropolis of America, for instance, we consume vast quantities of foreign intellectual product—the music, the art, the literature—and the metropolitan, in his heart, thinks that we are a musical, an artistic, or a literary people, whereas we may lay small claim to any one of these attributes until, in these commodities of the mind, our exports equal or exceed in quality our imports.

There is in general, outside of the great field of mechanical endeavor, a singular blindness to the supreme importance of productive and creative work, to the fact, as Henry James observes, that the quality of production in philosophy, politics, political administration, in law, medicine, literature, in pure or applied science, in whatever you will, is the one absolute criterion of a nation's intellectual standing. As a recent

writer has said, invention abounds, discovery is rare; the inventor enjoys a national reputation and a niche in the Hall of Fame; the discoverer often enjoys an undisturbed obscurity, and looks for his recognition, not in his own country, but in other countries. Production, even of the highest order, may not enjoy contemporary approval or reward. The classic value of certain great works may wait for generations or even for centuries for recognition, the producer in his lifetime having suffered unpopularity rising almost to expatriation. Thus between 1883 and 1886 the great British novelist, George Meredith, wrote:

> The effect of public disfavour has been to make me indifferent to my works after they have gone through their course of castigation, and I have copies of only a few. *Vittoria* happens to be of the number, but my children are now getting old enough to claim what can be preserved of them: otherwise I would send it. I will, when I am next in town, see whether a copy remains with the publisher. . . . I am no longer sure of my work at the best—the forty years of jeering in my ear corrects that original exultation of the producer. . . . I have no claim to popularity in England.

There is a similar blindness, even where there is less excuse for it, in schools, colleges, and universities, as to the prolonged, broad, and profound training which must precede and accompany production in any branch of human endeavor. Again, we may quote from Suess's farewell address:

> In the course of the years I have seen and experienced much. In the beginning a man has honestly to endeavor with zeal, and with certain restrictions upon himself, to learn the detail; and sometimes the hair whitens before he is in a position to obtain a general view and to risk a first synthetic attempt. This first step to synthesis is, however, the deciding step in the life of the inquirer. Soon he notes that his judgment obtains more consideration among his colaborers; he becomes more careful and

conservative with the same; and finally the hour arrives in which his soul is filled with the highest satisfaction, because he has been able to add to human knowledge some new view or a new fact—a feeling over against which everything naturally vanishes that the outer world is able to offer in acknowledgment.

Production is conceived, with Carlyle, as a man's output, as the utmost he has in him, his resourcefulness, his centrifugal rather than centripetal life, in its highest form his creative power. If training for production vitalizes the technical schools, if it is the ideal of our universities, is it not evident that such training, in the broader sense, is the restorative principle of the American college; that the collegiate antidote is not to be found in further experimentation, in lengthening or shortening periods, in eliminating Greek or mathematics, or any other difficult subjects, in a rigid required system, or in a universal elective system, nor even in inducing men to think and study by means of a preceptorial system, admirable as it may prove to be; but that the elusive remedy is rather to be sought in the application of a basal or universal working theory of education?

V

THE MUSEUM A NEW FORCE IN EDUCATION

Museology, a word recently introduced to designate the science of museum development, is really superfluous, because the museum is merely the reincarnation of all the visual or direct education from Nature known to naturalists the world over since the time of Aristotle. If all our youth could wander along the shores of the Ægean Sea as the young Aristotle did in preparing himself to write his "Historia Animalium" or could travel in distant parts of the globe as did Humboldt and Darwin in preparing the "Voyage aux régions équinoxiales du Nouveau Continent" and "Voyage of a Naturalist," museums would not be at all necessary. The modern museum is especially designed for those who can neither travel nor explore in the quest of an education, and Nature is brought within their reach in order to give them an opportunity, otherwise denied, of direct vision. Consequently, museology is a branch of naturalistic education created especially to meet modern conditions of life, in which by far the greater number are "cribbed, cabined and confined" within the walls of cities.

THE MUSEUM A NEW FORCE IN EDUCATION

Do the Most Important Thing First—Training of the Museum Educator—The American Museum of Natural History: Its Ideals; A New Force; Free Nature Education; The Dream of Francis Bacon; Influence on Citizenship; Vision of the Wide World; The Dawn of Education; in Public Health —The Natural History Museum of the Future—Debt of the State of New York to its State Museum.

THE museum as a new force in creative education through its extension work with the schools has inaugurated a movement of enormous possibilities. At present this force is exerted and manifested especially in our large cities, where the museum treasures are being extended by every means possible to the students of the schools.

Do The Most Important Thing First

To curators and teachers in museums, 1920

The New Year of the natural history museum opens in the autumn, when the explorers return from the field and when those less fortunate than explorers return from vacation. It is a time for the interchange of experiences, for the renewal of the ideals of museum life, and for plans and resolutions for the next long

period of museum work. Conditions may have changed in many departments because of the necessity of decreasing or of increasing the working force. High operating costs have made a pressure which brings to every curator and to every teacher the question as to whether it is possible through greater energy and more intelligent and intensive effort to speed up the work so that the institution will not suffer from the increased strain. In every branch of activity it is desirable to consider every moment of time as affording the golden opportunity for getting something done, whether it be a bit of preparation, a line of manuscript, the finishing of a school exhibition case.

"Getting things done" is a prosaic motto, but never an ill-timed one. The number of half-finished pieces of work is always countless, work begun with high hopes and great promises. Many years ago, when I began my work in the American Museum of Natural History, I sought the advice of one of the most effective men in our public life as to how to get things done when there were so many interruptions on every side. He gave me a motto which has been priceless to me. It came from Samuel J. Tilden, one of the great governors of the State of New York, who was in the habit of writing it on a small piece of paper and reading it over every morning while he shaved. It was this:

Do the most important thing first.

This I have found to be one of the secrets of a creative and productive year. Consider all the matters before you and select the one which is most important to do first. You will not thus follow the line

of least resistance, but often the line of greatest resistance and the line which presents the most obstacles. It is far easier to attend to daily correspondence and to clean up details of office routine than to do a bit of hard research work. No doubt it is easier for every curator, as for every teacher, to arrange for a coming meeting or to dispatch all the many details of daily administration, but suppose that in response to this daily question the still small voice of conscience dictates: the most important thing in my department is to complete a piece of scientific research, or, the most important thing in my department is to finish a long-delayed piece of literary work, or, the most important thing is to take the disorder out of certain educational exhibitions. I believe that Samuel J. Tilden's motto repeated every morning by every member of the faculty, high and low, would have wonderful results throughout an entire institution.

The city administrations of New York, St. Louis, Chicago, Buffalo, San Francisco and even of smaller cities like Charleston, South Carolina, are showing confidence and even enthusiasm for the great educational work which the museums are doing in the public schools. We have won the esteem of the municipal bodies, not through political means, but through a clear and straightforward exposition of what we are actually doing; not through promises, but through performance. We believe that this offers the brightest augury for the long-delayed extension of our great mission in education, for which we have been waiting for years.

Therefore, let every one of our small army of museum workers all over the country consider every morning what is the most important thing and proceed to do

it with all his might. Let us work together with good-will. Let us work as rapidly as is consistent with effective results. Let us produce each day as much as it is possible to produce.

Training Of The Museum Educator

To the American Association of Museums, May 21, 1917

Every year museum education becomes broader instead of narrower, becomes more important, more interesting, more a part of the common everyday life of the people, more vital to the nation and more essential to national education. The museum teaching profession is, therefore, by no means an easy one, and it should enlist the best ability. With the ever-widening scope of the museum educator, the training of the museum teacher requires a period no less long and arduous than that of the school teacher.

As the beginning of my museum training, I look back to the year 1877, when I did the hardest kind of manual work in the Museum of Geology at Princeton under Dr. Franklin C. Hill and Professor Arnold Guyot. At that time, when I spoke of the slowness and difficulties of museum work, Doctor Guyot gave me a motto which I have never forgotten:

Art is long and difficult;
Criticism is short and easy.

The sooner we learn that it is extremely difficult to meet and to overcome the successive problems which

arise in museums, the better for our success in our profession. We enlist in a form of education which is, in fact, most difficult, since its ideals are to present visually the laws of nature and of art in such a way as both to educate and to create a strong impression on the mind of the visitor. In other words, museum folk are educators of a special type who seldom have an opportunity of speaking to their students; the expression of their thoughts and of their ideals is through the exhibits which they arrange. The successful museum teacher is the one who is able to teach without speaking, as nature teaches or as art teaches. He may speak only through labels on his specimens. It is but rarely that he has the opportunity in the lecture hall of explaining his exhibits.

Since 1877 I have had the privilege of watching the whole period of museum evolution, both in Europe and in this country. In 1878, under Sir William Flower of the Royal College of Surgeons, I watched that gifted man as a pioneer in many modern museum methods. He began by showing that bones might be made extremely interesting; that was before he was called to the directorship of the British Museum. Then, as director of the British Museum of Natural History, he began to introduce those remarkable methods of presenting principles of evolution and of zoölogy in the exhibits grouped around the great central hall of the British Museum. We owe to him, I believe, the training of Mrs. Mogridge, who came to this country from the British Museum and introduced in the American Museum the first of the elaborate bird habitat groups which have now developed to such a remarkable extent in our habitat gallery. I watched the history of the Muséum d'Histoire Naturelle in Paris, the

mother of modern museums, and have seen there the relatively arrested condition of the grand institution built up by Cuvier, Saint-Hilaire, and Lamarck, as well as others of the great group of men who made the institution a center not only of museum exhibition, but of research, exploration, and publication, in fact, a model of all future museum development.

In successive years my steps, as palæontologist, were taken over all the chief museums of Europe, including those of Spain, Russia, Germany, France, Austria, Bohemia and England, all in various stages of operation and representing various types of administration. In traveling abroad one soon learns how not to conduct a museum, especially the fatal effect of what may be called the spirit of inhospitality, such as that which confronts one in many foreign museums where the visitor or even the scientific investigator is made to feel that he is somewhat of an intruder. In general, inhospitality of various kinds ranges throughout the museums of the Continent, and it is chiefly in the British Museum of London that one is made to feel entirely at home.

Then, the marvelous development of the museums in this country has passed under review, the coöperation and interaction between these museums that has brought about finally the development of this Association of Museums, which is destined to exert a great influence in the advance of the science of museum education.

The world of beauty is the last which appears to be taking hold of our American museums of natural history. We are realizing that nature is more than truth; it is beauty as well, and to express the whole of na-

ture the element of beauty must go hand in hand with the element of truth. To express beauty we need to have the artist and the sculptor to help us. One of the most interesting features of museum evolution in recent years in this country is the bringing together of groups of men and women who are primarily artists, to interpret the beauty of nature for us—sculptors like Carl E. Akeley, painters like Charles R. Knight, Will S. Taylor, Howard McCormick, Hobart Nichols, and many others. It is absolutely impossible to give the visitor the full impression of palæontology or of zoölogy unless the artist is at hand. Perhaps the most mysterious thing about nature is the omnipresence of beauty, and a museum which does not clothe its natural history with the aspect of beauty fails to give the visitor one of the most important impressions which is everywhere received by the traveler and the explorer. We attempt to bring to the visitor this or that corner of the world—the sea, the forest, the mountain—which forms the setting of the animal and of the plant.

Museums in the crisis of the great war today are confronted with entirely new problems. What has the natural history museum to do when the minds, hearts, and thoughts of the people turn not to peace but to war? When questions of health and of national defense are uppermost, has the museum any part to play? We believe that it has. Inasmuch as a knowledge of the laws of nature is more essential in times of stress and strain than at any other time, our foremost duty is to stand with all the other scientific men and to endeavor to diffuse as widely as possible a knowledge of all those laws and principles of nature which may be of service to our fellow-men, young and old.

The American Museum Of Natural History

Louis Agassiz placed on the walls of his Penikese laboratory for the guidance of his students a series of epigrammatic phrases, the most inspiring of which was the brief four-word injunction: "Study Nature, not Books." Consistently practising his own motto, he compelled his students to first make for themselves all the observations on a specimen which they could, then to seek the teacher or textbook for confirmation or supplementary advice. Thus direct observation of anatomy and of nature became a characteristic of all the learned zoölogists who emerged from the laboratory of Louis Agassiz, and it is noteworthy that these pupils also followed the precept and example of their master in making collections and in founding museums. Among the young men thus inspired was Albert Smith Bickmore, who created the design of the now world-famous American Museum of Natural History.

The Ideals of the Founders

We commemorate this afternoon [1] the founding of the American museum in 1869. The founders of 1869,[2] whose names have recently been inscribed on yonder wall, voiced the public spirit of their day. New York was a relatively small and relatively poor city. It was before the era of the great captains of industry, of the single-handed patrons of art,

[1] Forty-first anniversary, at which was unveiled a statue of Morris Ketchum Jesup.

[2] Among the great founders were the eminent lawyer, Joseph H. Choate, and the eminent financiers, J. P. Morgan and Morris K. Jesup.

science and education; nor were there any models on which to draw the lines or to take the scale—there was no British Museum of Natural History, there was no National Museum of the United States. We marvel the more at the audacity of the trustees who conceived a museum so great and who in 1874 approved a general plan larger than that of any building in the world even to the present day, larger than the Escorial of Spain or the National Capitol of Washington.

We are honored by the presence of delegates from the president of the United States, from the governor of this state, from several of the great American universities and national institutions of scientific research. The leading officers of the city government and of the board of education are present. The mayor, the president of the park department and the comptroller are members of our board. It is significant that these heads of the second greatest municipality of the world are uniting with us to play the part of hosts in this celebration, because the city and trustees have enjoyed from the first a free and cordial union. From their entire community of purpose there is no reason why they should ever disagree. Through the original application of the museum for land, this institution is legally under the department of parks, but although the relation is amicable and effective, the museums are less a part of public recreation than of the great civic system of education.

A few words may be said as to the kind of educational spirit which has been developed under past administrations and will be increasingly developed in the coming years in other branches of science. They are words as to our future. We believe that we are

only on the threshold of the applications of science, or of knowledge of the laws of nature as they bear on human morals, welfare and happiness. If there is one new direction which this museum shall take it is in the applications of science to human life. Here people shall have a vision not only of the beauty, the romance, the wonder of nature, but of man's place in nature, of laws as inexorable as the moral commands of God handed down by great religious teachers. Over the portals of our new hall of public health we may well place the inscription, "Learn the Natural Commandments of God and Obey Them." If Nature is stern and holds in one hand the penalty for violation of her laws, she is also gentle and beneficent and holds in the other hand the remedy, which it is the duty of science to discover and make known.

What is the part the museum exhibition halls should play in this teaching? An ideal museum is a mute school, a speechless university, a voiceless pulpit; its sermons are written in stones, its books in the life of the running brooks; every specimen, every exhibition, every well-arranged hall speaks for itself. In this sense, in its appeal to the eye, in its journeys for those who cannot travel, the museum is not the rival, but the helpful ally of all the spoken methods of instruction within its own walls and throughout the great city.

Now a few words as to our past. We owe the rise of public spirit in this city and country to the war for the union; that terrible experience brought men and women of all classes together in a closer sympathy, into a new and great union. Thus Lincoln was our prophet at Gettysburg when he said, "This nation under God shall have a new birth of freedom." As will be fully told by the historian of the day, the inspiration to

build a free museum for the people of this city came to us through Albert S. Bickmore. Under his scientific guidance and that of Daniel Giraud Elliot the right direction was taken.

It crowns this occasion that four of the originators of the museum are with us, two of its scientific advisers, two of its founders. The two founders are, *mirabile dictu*, as young as or younger than they were forty years ago. If youth is measured by energy, by productiveness, by patriotism, these founders are two of the very youngest men in the City of New York, as each day brings forth afresh surprising and ever-welcome proofs. Who among the so-called younger generation can equal Mr. Morgan, who has quietly, and almost unknown to the public, sustained the successive administrations of Wolfe, Stuart and Jesup with his loyalty, his time, his advice and his noble gifts, and who stands behind the present administration with undiminished force and generosity?

Are not our very bones founded in the law? In the early years Mr. Choate rendered incomparable and lasting service not only to the two museums, but to the city, in laying down our charter relative to that union of public and private responsibility and beneficence which has been the model on which all the other institutions of the kind in this city have been founded, which has proved by experience to be a perfect union, for it has given the City of New York something far superior either to the publicly administered institutions of foreign cities or the privately owned and privately administered institutions of other great American cities. The essence of this charter and constitution is that from the beginning the city officials as the elective representatives of the people under-

take to give the land, the building, the maintenance; the trustees volunteer to give their best ability and their valuable time to administration, their means and that of others to filling the building with collections. The agreement has been kept on both sides in the best spirit. To the honor of the City of New York be it said that her rulers have never withheld funds from education, neither have her citizens been lacking in generosity. Owing to this peculiarly American and altogether ideal union of public and private endeavor we discover that at the end of forty-one years the amount which the people of the City of New York have contributed to this museum is balanced by an equal amount given by officers, trustees and other friends.

A New Force in Creative Education

To the Science Teachers of New York, July 7, 1916

One of the pioneers in the movement to coördinate the school and the museum in creative education was the American Museum of Natural History, under the leadership of the late Albert S. Bickmore, who in 1880 inaugurated a series of lectures for the teachers of New York City, which during the next decade was so extended as to embrace the teaching force throughout the state. It was not until 1904, however, that the first lectures to the school children themselves, designed to illustrate and supplement their work in the schools, were given at the Museum, and still later, in 1914, that the Museum arranged to give series of lectures at the schools, especially in the crowded districts of the city, where the transportation of children to and from the Museum was difficult.

In the meantime, in 1902, when nature study was first introduced into the city schools, a system of sending out to the public schools small nature study collections reached no less than 1,200,000 pupils. In 1906 the plan was adopted for providing instructors for public school classes visiting the Museum, in order that the teachers and pupils might utilize their time to the best advantage. In 1915 the Museum began the system of lending to the public schools its lantern slides, derived from explorations in all parts of the world.

Another advance in the Museum's educational work was the provision in 1909 for instruction to the blind. This work has since been extended, through special endowment, until now courses of evening lectures are given for the adult blind, at which they have opportunities for actual contact with the specimens, and classes for blind children from the public schools are held regularly at the Museum. The system of placing in the public libraries special exhibits on various subjects of travel and exploration was inaugurated in 1907, with the result that there is a very great demand for books on these topics. This system was extended in 1915 to the regular circulation of the Museum exhibits among the branch libraries of the city. A similar movement was begun in 1887 by the Milwaukee Public Museum.

Step by step measures of extension similar to those taken by the American Museum have been adopted by other institutions, and the movement has gradually extended over the entire United States—for example, in the Commercial Museums of Philadelphia; the Field Museum of Natural History, Chicago; the Charleston Museum, South Carolina; the Museum of Fine Arts

of Boston; our own Metropolitan Museum of Art, and the Art Museum of Worcester, Massachusetts, and of Toledo, Ohio.

The American Museum is now visited daily by hundreds and sometimes by thousands of children, and the arrangement of all the collections, in the more abstruse as well as in the simpler fields of natural history, is designed to be self-explanatory and educational. The great principles of natural science, the elucidation of which represents one hundred and fifty years of exploration and research and which were first set forth by the great French naturalist, Buffon, through his popular expositions of scientific truths in Paris in the year 1739, are made clear not only in the text of the labels accompanying the specimens but in the arrangement of the objects themselves. This arrangement calls for the highest and rarest gifts of the museum exhibitor, for the truth as well as the beauty and harmony of the laws of nature must be evidenced. In fact, the reason the museum has become the great new force that it is in public education is because the old conception of a museum as a storehouse of curiosities has been entirely abandoned and replaced by the newer and truer conception of illustrating the underlying principles of the laws of nature.

A new definition of the purpose of a museum is: *to bring a vision of the world to those who otherwise can never see it.* Children are wonderful observers; as a rule they see things even more quickly than their elders, whose powers of observation have been largely dulled through disuse. The invaluable childish powers of wonder, surprise, and reverence are all cultivated. This inspirational movement is, perhaps, the most

precious outcome of the extension of the museum to the school, to those who can never travel and to whom a journey even from a distant point in the city to a museum, where are brought together all the wonders and marvels of nature in its various forms, is of itself a great event.

The practical aspects of this new museum movement are no less important. In art, all the beauty which has been created by the mind of man is brought together in orderly form as an inspiration to æsthetic development and individual achievement. In nature, the book work of the classroom and the experimentation of the laboratory are supplemented and filled out by the intensive study of exhibits of the best that has been found through the centuries. As an illustration, the studies in botany in several of the high schools of New York are followed by direct observations in the Hall of Forestry, originally arranged under the direction of Professor Charles S. Sargent, author of "Silva Americana." The school studies in biology and zoölogy are rendered real by visits to the wonderful Darwin Hall, with its vistas of life on the land and in the sea, originally planned by two of the most talented zoölogists of this country.

Free Nature Education in the Schools [1]

The school, the college, the university and the library have gone in advance; the museum follows and has won its own place and influence because it supplies a demand which none of its sister institutions fills. The

[1] Osborn: Nature in the Schools. Preface to "Free Nature Education by The American Museum of Natural History in Coöperation with the Department of Education of the City of New York, 1920," by George H. Sherwood, curator of the Department of Public Education.

rise of the museum as a new force in town, city, state and nation is *the latest phase of educational evolution.* Every community, small or large, needs its museum as it needs its schools and its churches. The very fact of this independent development is a proof that the museum is not one of the luxuries of life, but an essential and vital force in the enlightenment of our people.

The old idea was that of a sanctuary or refuge, a safe deposit vault for curios, rare or beautiful objects which might otherwise be lost or destroyed; the child or the ignorant visitor was tolerated rather than attracted; the curator was a keeper, not a teacher. The New Museum Idea comes with the new spirit of exhibition, which is to withdraw the dull and meaningless, and to hold a mirror up to nature in all its aspects, from the astronomic meteorites to the most animate bacteria. This New Museum Idea is a complete fulfilment of Francis Bacon's plan of education as outlined in his "New Atlantis" three hundred years ago.

The growing museum influence, which during the past quarter of a century has been especially remarkable throughout the cities of the United States, is largely due to the recognition that *the museum is not a conservative but a progressive educational force, that it has a teaching quality or value peculiar to itself, that the museum succeeds if it teaches, fails partially if it merely amuses or interests people and fails entirely if it simply mystifies.*

The new idea within the natural history museum is the educational idea, and this is animated by what may be called its ethical sense, its sense of public duty, its realization that the general intelligence and welfare of the people are the prime reasons for its existence, that exploration, research, exhibition and publication

should all contribute to these ends, that to serve a community the museum should reach out to all parts of nature and must master what nature has to show and to teach. *The museum will flourish if the high educational service of the city and state is inscribed over its portal and instilled in the mind of every member of the staff, from the highest to the lowest.*

Museum education gives a great deal more than the three R's. If well ordered it gives what nature gives, in spiritual, intellectual and moral inspiration, as well as a knowledge of the physical basis of well-being on which all these higher spiritual, intellectual and moral processes depend. It affords inspiration as well as information in every branch of nature. It affords instruction in local history, in geography and geology, in travel, in climatic laws, in the simple economics of food, in all that concerns personal health of mind and body, in the natural history of flowers, forests, streams, of insects, fishes, birds and mammals, in all that living nature has to tell our youth.

The chief subjects now extended to the schools by the American Museum of Natural History are:

Nature Study—
Lessons from the Life of Land and Sea, Insects, Fishes and Amphibians, Reptiles, Birds, Mammals.

Geography of the World—
Physical features—Travel, Adventure, Exploration.

Geology and Mineralogy—
Structure of the Earth, of Rocks and Minerals.

Zoölogy—
Life and Development of Animals.

Botany and Forestry—
Life of Plants and Economic Uses of Woods.

Health and Hygiene, Personal and Public—
Carriers and Control of Disease Germs, Water Supply and Sanitation.

History of Primitive Races of Mankind—
Life of Natives of America and other Countries.

Native Art and Design—
Textiles and Industries.

Industry, Primitive and Modern.

History of America and Related Countries—
Local History of New York City and State.

The museum extends every facility to the training of teachers in the normal colleges and in the three New York training schools for teachers. It draws upon its incomparable series of explorations, collections, and photographs from all parts of the world. It brings the latest discoveries of science to the eye and mind of the child. It aims not only to instruct but to *educate* and to inspire. Through forty years of experience and experiment since our school work began, we have shown that the museum is a real force in education, especially of the city-bred child and youth.

In this development the American Museum has carried out the purposes of its founders half a century ago, as expressed in the charter of 1869, of "establishing and maintaining in said city a Museum and Library of Natural History; of encouraging and developing the study of Natural Science; of advancing the general knowledge of kindred subjects, and to that end of furnishing *popular instruction.*" In the agreement between the City of New York and the American Museum of Natural History, 1878, occurs the following clause:

All professors and teachers of the public schools of the City of New York, or other institutions of learning in said city, in which instruction is given free of charge, shall be admitted to all the advantages afforded by the said party of the second part, through its museum, library, apparatus, and collections, or otherwise, for study, research and investigation, free of any charge therefor, and to the same extent and on the same terms and conditions as any other persons are admitted to such advantages, as aforesaid.

In a letter from the Comptroller of Central Park, 1869, "the Commissioners appreciating the views you so kindly express, entirely concur in the desirability of the establishment of a museum in the park, *that shall become an aid in the Great Educational System of the city, concentrate and develop Scientific efforts in all Departments of Natural History* [italics my own], and at the same time be an instructive and acceptable resort for the people of the city, and for the throng of strangers that visit it."

The Dream of Francis Bacon [1]

Next, a spacious, wonderful garden, wherein whatsoever plant the sun of divers climates, out of the earth of divers moulds, either wild or by the culture of man, brought forth, may be, with that care that appertaineth to the good prospering thereof, set and cherished; this garden to be built about with rooms to stable in all rare beasts and to cage in all rare birds, with two lakes adjoining, the one of fresh water, the other of salt, for like variety of fishes. And so you may have in small compass a model of universal nature made private. The third, a goodly huge cabinet, wherein whatsoever the hand of man by exquisite art or engine hath made rare in stuff, form, or motion; whatsoever singularity, chance, and the shuffle of things hath produced; whatsoever nature hath wrought in things that want life and may be kept, shall be sorted and included.—*Francis Bacon.*

[1] This and the three following articles are extracted from the 53rd, 54th, 55th and 56th Annual Reports of the American Museum.

The American Museum of Natural History, in coöperation with its sister institutions, the Botanical Garden, the Zoölogical Park and the Aquarium, is beginning to fulfil the dream of the natural philosopher, Francis Bacon, namely, to bring together the plants, the animals, the "rare beasts," "rare birds," "variety of fishes"—"whatsoever nature hath wrought in things that want life and may be kept"—so that we "may have in small compass a model of universal nature made private." The founder of inductive science, if he could visit the City of New York today, would find all these wonders of nature, living, lifeless, and extinct, gathered from every clime and every continent, from the Arctic and Antarctic seas, from the Americas, Europe, Asia and Africa, from Polynesia, and now at last from Australia.

It was inevitable that the American Museum should become a World Museum, as New York has become a World City and as the United States has become a World Power, in the best sense of the diffusion of light and learning, the basis of true civilization, which rests in every country, as with us, in a knowledge of and obedience to the laws of nature. As the beneficent work of the Rockefeller Foundation spreads the laws of health in all parts of the world, as the Smithsonian Institution and the Carnegie Institution extend American scientific research, so the American Museum is fulfilling its ideal when it sends its able and devoted explorers world-wide to gather and compare, both for our own benefit and for the benefit of every country which we may visit. The governments and scientific institutions of all these countries are coöperating with us; specimens and scientific literature are being freely exchanged, and the methods of museum and nature edu-

cation which we are developing from originally European prototypes are also going out to every country. As a result, we are receiving the most cordial coöperation, political, institutional and personal. Yet it appears that we are only on the threshold of what may be accomplished when the American Museum Building is complete, when every continent and every natural division of the earth's surface are represented.

Influence on Citizenship

Speak to the earth and it shall teach Thee.—*Book of Job.*

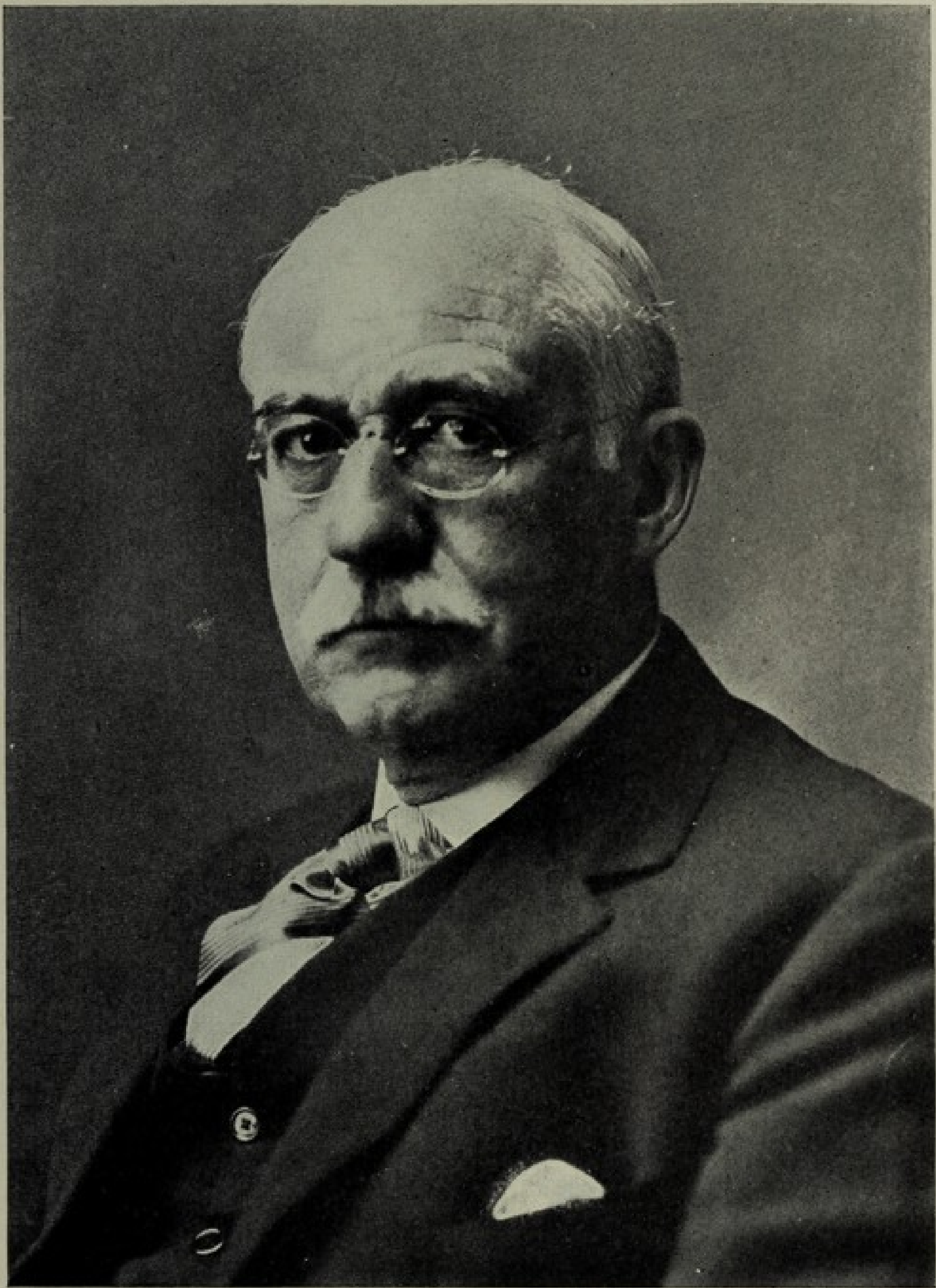
Wherefore, if it is your wont to admire my wisdom—and I would that it were worthy of your good opinion and of my own surname of *Sapiens*—it really consists in the fact that I follow Nature, the best of guides, as I would a god, and am loyal to her commands. It is not likely, if she has written the rest of the play well, that she has been careless about the last act, like some idle poet. But, after all, some "last" was inevitable, just as to the berries of a tree and the fruits of the earth there comes in the fulness of time a period of decay and fall. A wise man will not make a grievance of this. To rebel against Nature—is not that to fight like the giants with the gods?—*Cicero.*

Study Nature not Books.—*Agassiz.*

To bring the wonders and beauties and truths of nature from every land and every sea, to exert their broadening and uplifting influence upon the young citizens of America—this is our chief public mission. "To read Nature more, not to read books less" was the meaning of the motto placed by Louis Agassiz, the greatest nature teacher we have known in America, on the walls of his seaside laboratory on Penikese Island. About two thousand years before this, Cicero wrote, "My wisdom . . . really consists in the fact that I

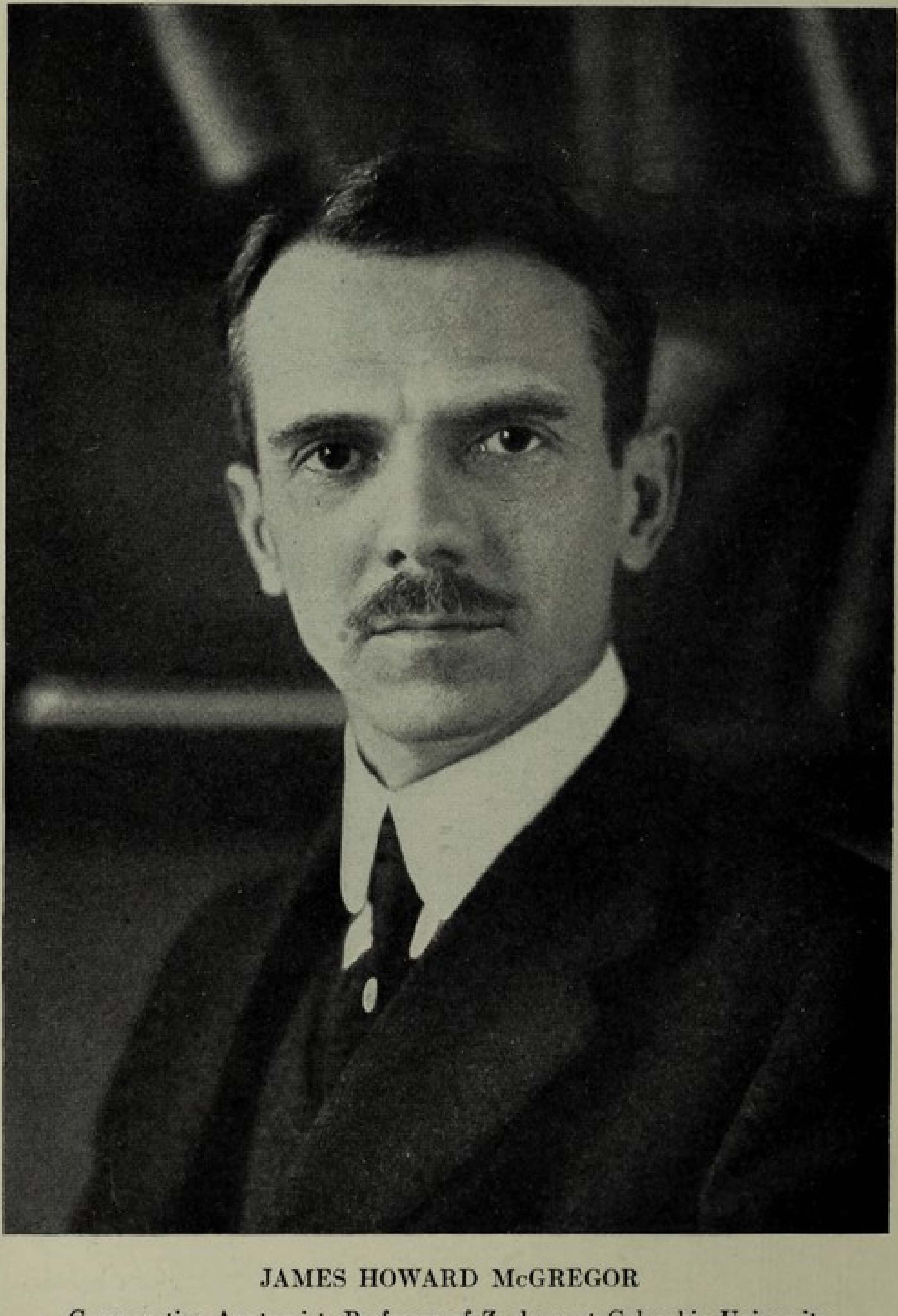
follow Nature, the best of guides, . . . and am loyal to her commands." Another four centuries earlier in human history, we find similar counsel in the language of Job, "Speak to the earth and it shall teach thee." In the counsel of these three very wise men—Agassiz, Cicero and the unknown author of the Book of Job—we see why the American Museum has an important and very direct influence on American citizenship. The best training for citizenship, in the highly artificial environment which surrounds the mind and spirit of the boy and girl in our times, is to show Nature in all her beauty and attractiveness, in all her moral lessons and inspirations, as well as in her stern moods of command. Whereas teachers and books may differ in their counsels, Nature is the visible expression of the divine order of things, and her facts are immutable.

The best of books, written by the best scientific teachers, soon become out of date, but a fact of nature, simply and clearly displayed to the child mind, will be the same for thousands of years—in truth for as long as the Museum endures. This is the reason that in the Library of the American Museum, the largest of its kind in America, there are more than a hundred thousand books and pamphlets, while in the exhibition halls and in the study collections of the Museum there are now over 5,000,000 specimens, each of which is a permanent fact. In a library the young reader may find books which will either make or unmake him as a citizen. The French and the Russian anarchies were bred in books and in oratory in defiance of every law of nature. In the exhibition halls of the American Museum we are scrupulously careful not to present theories or hypotheses, but to present facts, with only a sufficient amount of opinion to make them



CHARLES FREEMAN WILLIAMS McCLURE

Professor of Comparative Anatomy, Princeton University; President of Association of American Anatomists



JAMES HOWARD McGREGOR

Comparative Anatomist, Professor of Zoology at Columbia University

intelligible to the visitor. In the Hall of the Age of Man, for example, are brought together reproductions, as nearly as can be—facsimiles of the actual facts which have been discovered bearing on the prehistory of man in various parts of the world. These facts are put together conscientiously by experts who have been trained to clearly distinguish betwen fact and opinion, between truth and hypothesis or theory. The exhibits in this hall have been criticized only by those who speak without knowledge. They all tend to demonstrate the slow upward ascent and struggle of man from the lower to the higher stages, physically, morally, intellectually, and spiritually. Reverently and carefully examined, they point man upward towards a higher and better future and away from the purely animal stage of life. This is as striking an illustration of the wisdom of Agassiz, Cicero and the author of the Book of Job as can be cited, yet it has been widely misrepresented in this country—often by well-meaning persons, whom we would again refer to the words of the Almighty in Job 38:2: "Who is this that darkeneth counsel by words without knowledge?"

Close daily observation of the thousands of boys and girls who pass every year through the exhibition halls of the American Museum of Natural History would convince any critic that they become more reverent, more truthful, more interested in the simple and natural laws of their being, and better citizens of the future through each visit. This conviction as to the all-round educational influence of the exhibition halls of the American Museum, on adults and on teachers as well as on pupils, led the Legislature of the State of New York in 1909 to reaffirm by a slight modification of our Charter that the American Mu-

seum of Natural History is an educational institution. It also led the Board of Estimate and Apportionment, at a time when the City has no funds to waste, to make appropriations unprecedented in magnitude for the expansion of the Museum building and for the erection of the new School Service Building, which is designed to serve as an interpreter between the museum and the schools. The City is not advised to take part in any purely scientific work or in explorations, expeditions and publications—these do not come within the scope of its functions; the liberal and rapidly increasing endowment fund of the Museum and the increasing gifts of Members take care of this. The City is vitally concerned in the training of its young citizens, and by repeated and unanimous vote and through unprecedented appropriations it has declared that the American Museum is doing an important and enduring work in such training and that this work shall be encouraged and extended.

On the relationship of education to citizenship we may close with citations from the addresses of some of the great presidents of the United States:

> The time is come when a system of universal education ought to be adopted in the United States. In a country governed by the sense of the community, the people must be enlightened.
>
> The assembly to which I address myself, is too enlightened not to be fully sensible how much a flourishing state of the arts and sciences contributes to national prosperity and reputation.—*George Washington.*

> I look to the diffusion of light and education as the resources most to be relied on for ameliorating the conditions, promoting the virtue and advancing the happiness of man.—*Thomas Jefferson.*

> Upon the subject of Education, not presuming to dictate any plans or system respecting it, I can only say that I view it as

the most important subject which we, as a people, can be engaged in.—*Abraham Lincoln.*

Education should not confine itself to books. It must train executive power, and try to create that right public opinion which is the most potent factor in the proper solution of all political and social questions.—*Theodore Roosevelt.*

Vision of the Wide World

KING HENRY. O heaven! that one might read the book of fate,
And see the revolution of the times
Make mountains level, and the continent,
Weary of solid firmness, melt itself
Into the sea! and, other times, to see
The beachy girdle of the ocean,
Too wide for Neptune's hips; how chances mock,
And changes fill the cup of alteration
With divers liquors!

—*Shakespeare, Henry IV.*

To bring the world of nature within the walls of a great city to those who cannot otherwise see the world, who cannot explore or travel, who cannot go very far beyond their immediate environment—this seems to be the primary object of a great municipal museum. We cannot be local. We cannot be provincial. We cannot confine ourselves to the boundaries even of a great country like our own. We must extend to other lands and seas and to all parts of the globe. We must give a vision, not only of the earth but of the depths of the seas below and of the firmament above. In a city like New York, with people from all parts of the globe, we must give the people the inspiration, the broad vision, the largeness of mind, and the breadth of sympathy which come to their more fortunate brethren who are able to travel and explore.

By our methods we show not only the animals and plants, but where and how they live.

This compass of the world of nature is not a matter of recent decision, but extends back to the very foundation period of the Museum and to the original plan of the building. In fact, the American Museum began in 1869, in Albert S. Bickmore's time, with collections from the Old World—from the East Indies, from southern Asia, from Africa—because in the period of our foundation the whole science of natural history had been built up by the great French and British savants on collections from the Eastern Hemisphere. It was only through the labors of great American naturalists and explorers like John J. Audubon, Spencer F. Baird and F. V. Hayden that the riches of North America began to be fully appreciated and the American Museum waked up to the fact that it must thoroughly explore North America itself, in coöperation with the United States National Museum and other great museums of this country.

Then it was realized that South America had been sadly neglected and overlooked; our late Curator Allen repeatedly urged the exploring of this continent and there finally resulted a series of highly successful expeditions, which are still going on. Then in the beginning of the year 1908 a great new movement started for fresh exploration, along entirely new and much more thorough lines, in the Eastern Hemisphere, beginning in Africa and continuing with our present surveys and discoveries in Asia. Nor was Europe forgotten: Italy, Spain, France, Great Britain, Scandinavia and Germany were visited, for both original and exchange material, illustrative especially of its palæontologic history and the prehistory of man.

In the meanwhile, expeditions were sent to both the north and south polar regions, and contact was made with great Arctic and Antarctic explorers.

The world-wide commercial and political outlook of New York requires a natural history museum with a world-wide outlook. This is exactly what we are making it. We are getting into scientific touch with every country in the world, and when our great building plan is carried out we shall be able to take a journey through every continent and over every sea, all in the halls of the museum; not a journey in books of travel, but a journey in the lives and vision of our young explorers. The primary object of our museum is to bring to those who cannot travel or explore, who cannot go very far beyond their immediate environment, the whole world of nature. Especially for the city populations, which now outnumber the country folk, the first vision of the wonders and beauties of nature gives a thrill which had never been experienced before and this thrill inspires them to go further, to observe, to read and to study. It is a nursery for good citizenship.

Thus, during the past fifty-five years, the American Museum has gradually become a *World Museum* in its collections, and it is expressing this great fact in its building units.

The Dawn of Education

Education is a problem which arose 500,000 years ago and which will endure as long as man endures. The first educator was one of our eolithic ancestors, sitting over the fire teaching his boys how to fashion flints, while his mate was teaching the girls how to

prepare skins for clothing. Among the most up-to-date types of education are those of our sister institutions, Columbia University, with 1,778 teachers and 32,769 students, and the Greater New York School System, with 29,503 teachers and 1,093,270 pupils; contrasting these with our own Museum, with its five teachers and 3,602,100 specimens and upwards of 6,000,000 pupils and students receiving occasional instruction, it is interesting to point out the strength and weakness of these four great types of education: The Stone Age, the School, the University, the Museum.

While dictating this report, we read in the *New York Times*, January 11, 1925, Section 8:

Butler Offers Cure for Our "Ignorance." In his annual report on Columbia University, President Nicholas Murray Butler hurls a volley of bombshells at the intellectual complacency of the United States. Not for many years has a public man, holding a position in the educational world so responsible as his, indulged in a candor so ruthlessly uncompromising. Here is a country which has spent uncounted billions on universities, colleges and schools. Nowhere on this planet, so one would have thought, can you find an enthusiasm for teaching and a zeal for learning so eager as here. Yet, according to Dr. Butler, the results are so unsatisfactory that Abelard, a founder of universities, were he to come back, "might well wonder whether, despite his amazing intellectual conquests, made so long ago, he had not lived and taught in vain," while at our "spoken English," the Venerable Bede, were he to return, would be assuredly affrighted.

Similar laments on university, college and school education come, not only from all parts of our country, but from Great Britain. If these laments are even in part justifiable, we conclude that our progress in education is by no means commensurate with our progress in expenditure. While expenditure has increased a

thousandfold, the average intellectual output has remained the same or has retrogressed since the time of Abelard and may even have retrogressed since the time of the cave man. The cave boy certainly had advantages which our boys have ceased to enjoy; he was surrounded on all sides by vibrant nature, full of inspiring and wonderful phenomena which filled him with reverence and awe if not with superstition. His father and mother, at least in the Cro-Magnon period, carefully instructed him, not only in flint making, but in the rudiments of art, while his sisters were taught how to sew and cook. Education was part of his daily struggle for existence—the boy's survival depended on his aptness in working, in learning and in imitation. Even in the far more remote eolithic times, the stern master which we now designate the "Struggle for Existence" was ever by the side of the boy and girl; compulsory education took this primeval form. Under these two teachers, the compelling "Struggle for Existence" and "Inspiring Nature," the eolithic boy and the cave boy attended school regularly. The only check to their progress was the lack of the arts of writing and printing, whereby what they learned and acquired intellectually could be passed on to future generations.

In our large cities, in the press, and in the minds of teachers who depend upon the press, civilization has reared a Frankenstein which shuts out the direct vision and inspiration of nature and banishes the struggle for existence. Thus the two masters of the eolithic boy and the cave boy have quietly vanished. Meanwhile the mind of the boy in the lower and higher races of mankind has not changed, but is the same as the mind of the eolithic boy and of the cave boy.

The great function of the American Museum is to bring back to life these two masters; to restore the vision and inspiration of nature, as well as the compelling force of the struggle for existence in education. This is our antitoxin for most of the educational poisons of our day. On restoration of the privileges enjoyed by the cave boy and on coming for the first time into direct vision of the wonders and beauties of nature, not only boys and girls, but men and women, young and old, feel a thrill which they may never have experienced before. This thrill inspires them to go further, to examine the objects more closely, to see all they can themselves and perhaps to go home and read what others have observed. Thus, they discover in themselves latent faculties of which they had not the least knowledge before, latent predispositions and tastes which gradually come to the surface of consciousness, new ambitions to enter the struggle for existence in science, in literature or in art. This is not guesswork on our part. It is a record of actual experiences, not only of boys and girls but of adults. Artists and designers tell us that all the wonders of classic art and design have not aroused them as have our well-arranged exhibits of the works of prehistoric man and of the primitive races.

In these few words we have set forth the whole theory and practice of American Museum education, namely, to restore to the human mind the direct vision and inspiration of nature as it exists in all parts of the world and as it is becoming known through all the sciences, thus to discover and encourage predispositions and tastes, thus to arouse ambitions to overcome all resistance, and to return to books and learning as the handmaids and not the masters of education.

The Museum in Public Health [1]

The brilliant epigram of Archimedes, "Give me a lever long enough and I will move the earth," illustrates a great principle in mechanics, but the levers which will raise humanity are not, like that of Archimedes, impossible of adjustment. Without undue confidence, we may say, give us Science and the sympathy to spread its beneficent applications among the people, and we will lift the world. Only the other evening, I learned from President van Hise of the University of Wisconsin, of the highly successful methods which he has devised to spread the special researches of the laboratory throughout the great State of Wisconsin. I shall never forget his closing remark: "If we can only spread this knowledge, in ten years we shall stamp all infection out of the State."

It is such exact and precise knowledge, won only after the hardest kind of battle against the unknown, which, inspired by compassion and by the brotherhood of man, brings the grand discoveries of Pasteur, Koch and other workers within the reach of the humblest and even of the most ignorant. It is hard to realize that at the time of the Franco-Prussian war in 1870, Pasteur was still a subject of attack by the greater part

[1] Osborn: The Museum in Public Health. First address, "Introductory Remarks by the President of the American Museum . . . at opening of the International Tuberculosis Exhibition, November 30, 1908." Second address, "Introductory Remarks by the President of the American Museum . . . at the Opening of a . . . Joint Exhibition . . . Illustrating the Work of the Metropolitan Sewerage Commission, and . . . Inauguration of the Work of the Department of Public Health of the American Museum of Natural History." (May 15, 1911.) Third address, "Introductory Remarks by the President of the American Museum . . . at the Public Meeting on April 16, 1913, in the Interest of the Campaign for Civic Cleanliness Instituted by the New York City Department of Health and at the Opening of the Hall of Public Health of the American Museum."

of the French world of medicine; that as late as 1879, when I happened to be studying in London, Lister, who had applied Pasteur's discovery to antisepsis in surgery, was still a subject of ridicule or at least of cynicism in the lecture room.

Even at that comparatively recent day the mosquito, the fly, the tick, and the rat were considered as among the mere annoyances of life which must be endured patiently if they could not be driven away. Now it is known that these animals may become indirectly the most dangerous enemies of mankind, that they may carry death more certain and widespread than bullets, cannons or battleships, that they largely determine the welfare of man, that they condition great economic enterprises—for example, that where France failed to build a great canal between the oceans, it is possible for America to succeed, largely because of the discovery that the mosquito is the bearer of the germs of yellow fever and malaria.

Historians have found in the moral and intellectual degeneration of its people the causes of the decline of Greece. It has remained for the student of the deadening influences of malaria to point out that the causes of this moral and intellectual decline may have lurked in the malarial infection which was brought back to Greece from the Orient and from Africa, through the campaigns of Alexander the Great.

One of the duties of the museum is to explain to the people that the health, welfare, morality and happiness of man depend upon the elimination of these hostile hosts of the microscopic world. It is our duty to spread the knowledge of nature, and only through such knowledge can victory be won. Therefore, the International Tuberculosis Exhibition finds an appro-

priate position in the American Museum, which cooperates the more willingly because it enlisted with the association in the past. The first tuberculosis exhibit made in this country was held here; it was conceived and carried out by Dr. Livingston Farrand, then a curator skilled in exhibition methods, now the Executive Secretary of the National Association for the Study and Prevention of Tuberculosis. The Director of our Museum, Dr. Hermon C. Bumpus, has lent his entire experience and energy to the arrangement and installation of this great exhibition, and the trustees and officers will do all in their power to help make it a success. After it closes, this kind of education, in which we thoroughly believe, will not cease, because we are planning to devote ample space in the Museum to an exhibition of the life habits and history of all those small forms of animal and plant life that are now known to be man's greatest enemies.

. . . .

The last occasion on which I had the privilege of addressing the Museum on the subject of public health was November 30, 1908, at the opening of the International Tuberculosis Exhibition. That exhibition filled us with amazement; it attracted 700,000 visitors. On a single Sunday, December 27th, set aside as Hebrews' Day, a new "exodus," from the East Side of this City, including a far greater host than that which Moses led out of Egypt, began in the early morning and continued until this vast building was packed with humanity to the estimated number of 60,000 souls. I doubt if ever before in human history so many persons were gathered under a single roof in one day and with a common object—that of learning the causes,

means of prevention, and means of cure of the Great White Plague.

This is the first time, I believe, in the development of any natural history museum that so broad a view has been taken regarding the duties and responsibilities of such museums for the enlightenment of the people of a great municipality in that which, after all, most closely concerns them.

The burden of proof rests with those critics who believe that we are too far afield, that such a subject belongs to a distinct museum, or only to hospitals and medical schools. Such criticisms lose their force when the developments of the last twenty years are considered. No one would deny that a natural history museum is a highly appropriate place in which to display the anatomy and life history of such animals as the mosquito, the fly and the rat; then why stop the study of the life history of these animals at the point where they come into relation with human welfare and happiness? Does the mosquito become of less human interest when it is known that the sting carries with it a malarial parasite? In my opinion it becomes of infinitely greater human interest. Or, to take a widely different illustration, does the migration and propagation of the shad as a food fish of enormous value become of less interest because, as shown in the splendid work of the Metropolitan Sewerage Commission, the City of New York is now imposing a hostile barrier to the passage of these fish up the Hudson? Everyone would grant that the matter of breeding is a matter of natural history, and we have given an enormous amount of attention in this country to the breeding of every kind of domestic animal—cattle, pigs, and chickens. Does the subject of breeding suddenly lose its

interest when it comes to man? Is the breeding of man less important than that of chickens? Are we not worth many sparrows? Or take the matter of the natural history and biological view of migration. Enormous progress has been made in the subject of heredity; we now know how a very large number of characters are developed and transmitted; again, does this heredity lose its interest when man is involved?

There are certain sentimental persons who still have to be brought to see the force of these questions. These sentimentalists fully sustain our laws regarding the lower animals; there is no port in this country through which you can bring in a diseased animal or a noxious animal or weed, yet as soon as a patriotic citizen like William Williams stands at the port of New York and refuses to admit noxious human beings he is hounded like an enemy of the public by a large section of the daily press.

According to our customary speech Nature is feminine; we speak of "her" laws and "her" decrees. I submit that in two respects Nature is masculine: first, she is very reluctant to tell her secrets, and this is not generally believed to be a feminine attribute, and second, she is very stern in the execution of her laws, certainly a masculine quality. In the words of Sir Andrew Clark, the great British surgeon, Nature forgives but never forgets; and this is the keynote of the whole distinction which separates sentiment from sentimentality.

Now it is the duty of the museum to substitute sentiment for sentimentality, and the only way in which this can be done is through spreading knowledge; knowledge of nature is the close ally of sentiment, it is the arch enemy of sentimentality. We must take

our part in preaching the gospel of the twentieth century, and part of this gospel is to spread knowledge of nature, thereby to prevent disease and thereby to establish public health. The litany of the Middle Ages, chanted for hundreds of years, was written, "From plague, pestilence, and famine, Good Lord deliver us." The litany of the twentieth century is written in these words, to my mind far more reverent: "From ignorance and defiance of Thy natural laws, Good Lord deliver us." We are not entering into this field half-heartedly, but vigorously and aggressively and with all the means at our disposal. Our duty is not to rival the laboratories of institutions of research, but to set forth in the simplest possible visible form, so that, in the language of our new Director, Doctor Lucas, where the children may understand, the adults surely can understand the results of the work which is now going on all over the world, often in an heroic spirit of self-sacrifice, in ascertaining the relations of the lower organisms to man and in determining how far the conduct of man should be governed by what he may learn from these lower organisms.

. . . .

This evening we enter into the campaign to clean up the homes of six million people.

Has it ever occurred to you that among his other inventions, man is the inventor of dirt—in the whole of God's universe before man defiled it there was not a speck of dirt, everything was spotlessly clean. Go into the wilds anywhere, into the great deserts or into the great swamps—it is always the same.

In the economy of nature, wherever there is a temporary deposit of what might be classed as dirt, like a

decaying carcass or a pile of excrement, there is an army of scavengers—either bacteria or beasts of prey—and a complete clean-up follows in an incredibly short space of time.

The part the museum can play is to furnish visual teaching, first, of the perfect way in which nature conducts the campaign of cleanliness and health, and, second, of the clumsy way in which man does it. The contrast is really between the work of God and the work of man, and it is certain that in the advance of civilization the closer we get to nature's laws and example, the more civilized we shall be. In nature therefore we find the prophets and harbingers of Commissioner Lederle, of Commissioner Edwards, of Mrs. Hewitt, of Curator Winslow, and others who are marshalling this great movement.

In the Hall of Public Health which opens to the public for the first time this evening under the energetic and intelligent direction of Curator Winslow,[1] you will find the first attempt made in a pure natural history museum to regard man as after all one of the most important animals.

It is singular how long man takes to treat his fellow-man as well as he treats his animals. It is true we have societies for the prevention of cruelty to children, child beating, neglect, etc., but there are more subtle forms of cruelty to children and to grown people as well, which we are just beginning to understand and to guard against. It is cruel to bring into the world a child predestined to disease and suffering—hence eugenics. It is cruel to bring into our country the kind

[1] When Dr. C.-E. A. Winslow was called from the Massachusetts Institute of Technology to a professorship in City College under President Finley, he received a simultaneous call to the newly inaugurated Department of Public Health in the American Museum of Natural History.

of people who will produce children like this—cruel, I mean, to those already here—hence the Survey of immigration. It is cruel to bring up children in an unclean environment—hence this great campaign for a clean city.

As New York goes, so goes the nation in politics and in civics. This great city, which is always decrying itself, and is too large to care for its outside critics, is also the center of the most intense local patriotism and public spirit; and tonight we are to see some of its best manifestations among both those who speak and those who support the movement by their presence here.

The Natural History Museum Of The Future

To the School Teachers of New York, November 11, 1911

The future ideal for the museum is to provide at no cost a little journey on this planet and among the heavens beyond it. Our ideal of museum order is, to pass by a natural and easily seen sequence from country to country as you would in travel, or from age to age in the past history of the earth, or from lower to higher stages of life in the history of animals and plants. This is what we are working toward, although it is by no means attained. We propose to add astronomy and geography of the land and of the sea to the older and traditional subjects of the museum.

Very few people, even among those who have the means to travel, really see nature in the sense of understanding it, and to the millions within the cities nature is practically unknown. So we are interpre-

ters; we are trying to tell in a very simple way the laws which the greatest minds have wrestled with from the earliest times, and we are also trying to add to these laws, for it is part of the genius of the institution to create new knowledge as well as to spread it. This gradual elucidation of the deep and difficult is to my mind one of the most marvelous features in the growth of science. Some great law is first in the will of the Creator; then, like the light of a star so distant that it takes ages to reach the earth, it reaches the mind of some great naturalist, and finally comes down, down to the vision of the very youngest. And the best way to learn one of these laws is to see it in operation; this is far better than to read about it, for what is seen becomes part of oneself. Already the child can see here what Aristotle dreamt of but never saw, and what Darwin and Huxley put into prophecy but did not live to see.

Therefore, in the development of our halls there is a constant effort to shut out the human artificial element, to bring the visitor directly under the spell of nature, as under a great and infinitely gifted teacher, by making every case, every exhibit, tell some clear and simple story which appeals at once to the imagination, to the reasoning instinct, and to the heart.

There are three especial ends we are now endeavoring to advance: first, to bring within your grasp the scope of the museum as a whole; second, the particular meaning and lesson of each of its parts; third, how this meaning may best be impressed on the young mind. I believe strongly that the average child is a better nature observer than the average adult, and if you let children alone they will see a great deal. Thus there are one or two suggestions which I would make from

more than thirty years of experience as a teacher: first, look at the object and get all you can out of it yourself, then read about it; second, try to make the child work out the reason of things before you work it out for him. In brief, nearly all the works and processes of man are complex, and one great lesson we have to learn from nature is its simplicity. In the museum are given simple lessons in animal and plant architecture, in beauty, in government, in coöperation, in endurance. Among the social insects, the ants, bees and wasps lead wonderful lives, not alone in their industry; we may consider all their ways and be wise. The moral lessons, much needed for our day and generation, to be learned in the habitat groups of birds are endless —the maternal and paternal love, the happy family life of the young, the joy of living, the beauty of their homes. In the halls of anthropology many of the so-called savages can teach us far more than the so-called civilized peoples—their industry, their patience, their sense of beauty which adds the æsthetic touch to all their implements, often their integrity, their courage, their fidelity.

Nature study in the school and in the open already has hosts of friends; it is no longer on trial, it is an established system. Nature study in the museum is a newer part of the same educational movement. The great museum can, however, do what neither school, college, nor even the university can: it can bring a vision of the whole world of nature, a vision which cannot be given in books, in classrooms or in laboratories. This is a branch of public education which is especially urgent in a great city, crowded with the works of man and where, except for the nightly vision of the heavens obscured by smoke and dust and the altered

wild life of our parks, the works of Nature are totally destroyed.

In so far as we draw on public funds, public education is our chief and final purpose; toward this all our plans tend; for this the city erects the great building and gives the larger part of the maintenance; for this the trustees and other friends give their time and means; for this members of the scientific staff are exploring, collecting and arranging objects of natural history, constantly inventing new methods to attract and to impress visitors, young and old.

In Pittsburgh recently I was delighted to meet a party of San Francisco public school boys who had worked their way east through all the great cities and to learn that while in New York they had spent the greater part of their time in the Natural History Museum, in the Zoölogical Park and at the Aquarium. This little incident in itself proves that we have already advanced far along educational lines; but we are still not satisfied, and Director Lucas and the scientific staff are concentrating their time and attention for three or four months on the practical and very difficult problem of elucidation of all the exhibition halls. You have little idea in walking through these halls what labor they have involved, what sacrifices men have made and are making for them today in all parts of the world, how much the workers in this Museum are imbued with what may be called the spirit of the institution—the desire to extend the call and vision of nature.

We realize that teachers cannot all be specialists, that we must make many of our special collections more readily understood by you, if you in turn are to bring your pupils here and explain objects and principles to them. We want the teachers to feel that the

museum is part of their educational plant, we want their coöperation, their suggestions, and their frequent presence.

Debt Of The State Of New York To Its State Museum [1]

To the Legislature and Citizens of New York State, October 15, 1912

It has been the good fortune of the people of this Commonwealth to have elected to preside over its interests those men who were positively instrumental in promoting science and learning, and who were especially active in promoting agriculture, and the branches allied thereto. Your own recommendations and influence, touching these great interests, are highly appreciated by the people, as is evident from their united movements in establishing institutions which are designed to bear directly upon those objects, and which are specially designed to place them upon a scientific basis.—*Emmons.*[2]

The citizens of New York and their representatives in the Legislature are those especially addressed on this historic occasion rather than the distinguished company of scientific men gathered here for this celebration. While the present is a critical period in the moral and economic welfare of our people, we predict that the twentieth century, which is still in its youth, is destined to reach its maturity with a far more general distribution of human happiness than we witness at the close of the nineteenth century. The unequal distribution of the good things of life is the underlying cause of all present social agitation, and by the good things of life we do not mean riches, but family, health,

[1] Address at dedication of State Educational Building at Albany.
[2] Ebenezer Emmons to His Excellency Hamilton Fish, Governor, Albany, December 25, 1851.

food, sunshine, pure air, labor, the beauty of nature, the creative works of man. A redistribution will come about, not through politics which seems to produce little except rivalry and bad feeling, nor through socialism which is essentially unnatural, but through the application to human welfare of all of nature's resources, known and still to be discovered. These resources administer to our spiritual, intellectual and moral as well as to our bodily welfare. The great pathway to state progress is knowledge, obedience and unselfish utilization of the happiness which nature puts into our hands.

Our theme today is the part which the museum has exerted and is destined to exert toward this millennium of the twentieth century.

New York State a Leader

What renders this celebration a great one is that the ideal just sketched is largely exemplified in the New York State Museum, in the historic fact that the noble men of science and the wise rulers of our State have long been leaders in one of the great principles of museum development, namely, that the foundation of a state museum is mastery of the natural history of the state itself. In this regard since 1836 New York has been holding the torch for all the other states of the Union. There has already evolved here that intimate union between a natural history survey, pure scientific research, a museum and the public welfare which the most enlightened communities in the civilized world have either attained or are striving to attain.

There remains to be developed by the Education Department through the museum the great work of spreading the beneficent products of this union throughout the public educational institutions of the State, a work with which the honored name of Albert S. Bickmore will always be associated as pioneer and founder.[1] This celebration is auspicious because it prepares the way anew for the educational function of connecting the museum with the schools. This commodious building renders it possible for the first time in the history of the institution to expand along all the other lines of the new museum spirit, and directly and by extension touch the entire educational system of the State.

Thus we celebrate not the birth but the opportunity for renewed growth of an institution of which all the citizens of the State may well be proud. Like the nautilus, the museum moves into a new and beautiful chamber with its fine heritage, its ideals and its purposes unchanged; the shell is not the vital part, but it is highly favorable to the prolonged and expanding existence of the organism within.

In looking for the causes of the origin of this institution we find they are threefold: first, the natural grandeur and interest of the territory of the State itself as a source of scientific inquiry and inspiration; second, the assemblage of an unusual number of scientific observers of the first order, whom New York found among her own sons or attracted to her borders; third, a wise and liberal exercise of the powers of govern-

[1] The law providing for courses of free lectures to the teachers and pupils of the common schools of the State was passed in April or May, 1884. The first lecture under this grant from the State was given by Professor Albert S. Bickmore of the American Museum on October 18, 1884. The last lecture under State grant was given on March 12, 1904. The work has since been carried on directly by the Department of Education.

ment on the part of the rulers of the State. It follows that our chief concern today should also be threefold: namely; the preservation of this natural beauty as a continual source of inspiration and happiness to posterity; the birth and training of men and women capable and worthy of observing the laws of nature and spreading knowledge of them; the maintenance of standards of government equal to those of Secretary Dix, who first outlined the survey, and of Governors Marcy, Seward, Bouck and Fish, who promoted it.

As illustrative of the close union between science and good government two ancient episodes in the State's history may be recalled. One is that Samuel Latham Mitchell, the pioneer of natural science in this State, delivered an evening address before the State Legislature, was elected to a seat in the Legislature of 1790, and in 1807 took the first steam-propelled voyage up the Hudson with Fulton. Another is that in 1818, on invitation of Governor Clinton, Amos Eaton, the pioneer geologist of the State, delivered a course of lectures before the Legislature. He inspired Governor Clinton to actual field work in geology and the State Museum now possesses a collection of minerals and fossils made by him in the leisure hours of his gubernatorial service. He interested many of the leading men of the State in geology and its application to agriculture by means of surveys, thus planting the idea which eventuated in the great work, "Natural History of New York."

Is New York State today seeking among her votaries of science some of her representatives at Albany to counsel her in matters of state welfare? We may not answer the question but may put another: Is the vast free educational system of the State, on

which eighty millions of dollars are being expended annually, with a total attendance of one and one-half million pupils, turning out its due proportion of men of science for the future service of the State? Whatever the answers to these questions, it is certainly well, even on a jubilee occasion such as this, for the members of a great democratic commonwealth like ours, full of confidence and pride in its institutions, dazzled perhaps by stupendous expenditures and vast numbers of students, to pause and consider which direction our social evolution is taking through education and democracy—progressive or retrogressive.

Discovery of Men of Science

As regards the birth and education of men of science, the honor roll of geology in this State, the product of old educational methods, is a long one. We are impressed with what the state, the nation and, more than these, the world owes to the generations born between 1764 and 1860 within our own State borders. Among the pioneers of science in this country were the following: Samuel Latham Mitchell (1764-1831), born in Hempstead, L. I., whose political services have been alluded to above and who published in 1796 "A Report of the Geology and Mineralogy of the Hudson," the first work of its kind in the United States; Stephen van Rensselaer (1765-1839), born in New York City, founder of the Polytechnic of Troy, patron of the first serious geological work in the State; David Hosack (1769-1835), born in New York City, closely associated with De Witt Clinton in the leadership of civic life, promoter of botany and mineralogy, master of

John Torrey; Amos Eaton (1776-1842), born at Chatham, turned toward science by Mitchell and Hosack, whose survey of Albany and Rensselaer counties marked an era in the progress of geology in this country, the master of James Hall; Henry Rowe Schoolcraft (1793-1864), born in Albany County, pioneer explorer of the geology and the mineral wealth beyond the Alleghenies and discoverer of the source of the Mississippi; John Torrey (1796-1873), born in New York City, pupil of Hosack, founder of American botany, master of Asa Gray; Joseph Henry (1799-1878), born in Albany, discoverer of the magneto-electric telegraph, which has put the whole world into communication; William Williams Mather (1804-59), born in Brooklyn, one of the four geologists of the Survey, pioneer geologist of Ohio and Kentucky; James Dwight Dana (1813-95), born in Utica, geologist of the Wilkes Exploring Expedition, the foremost geologist of his time in America; Alexander Winchell (1824-91), born in the Northeast, geologist of Michigan; Othniel Charles Marsh (1831-99), born in Lockport, famous vertebrate palæontologist, one of the leaders in the exploration of the western states; Robert Parr Whitfield (1828-1910), born in New Hartford, invertebrate palæontologist of distinction; Edward Orton (1829-99), born in Delaware County, state geologist of Ohio; John Wesley Powell (1824-1902), born in Mount Morris, explorer of the Grand Cañon, famous ethnologist, director of the United States Geological Survey; Israel Cook Russell (1852-1906), born at Garrettsville, geologist, explorer and eminent writer.

We trust space may be found within the new museum to memorialize in bust or tablet the services of

these great men as well as of those who, like Hall, came from other states. In this matter the State may well follow France, which leads the world in appreciation of its men of science and erects more statues to its savants and littérateurs than to its military leaders.

Among the living natives of the State who have rendered or are rendering distinguished service are Raphael Pumpelly (1837), geologist and explorer; John James Stevenson (1841), geologist of the Wheeler and Pennsylvania surveys; Grove Karl Gilbert (1843), geologist of two state and two national surveys; Charles Doolittle Walcott (1853), leading invertebrate palæontologist and administrator of the United States Geological Survey and of the Smithsonian Institution; last but not least, John Mason Clarke (1857), pupil of James Hall, invertebrate palæontologist, distinguished in geology and palæontology. From this number the nation has chosen two of the directors of the United States Geological Survey, Powell and Walcott, and two of the secretaries of the Smithsonian Institution, Henry and Walcott.

The Natural History Survey

Our early political governors and men of science found their inspiration in the State itself, in its splendid area equal to that of all New England, in its scenery—including the Palisades, the Hudson, the Catskills, the Adirondacks, the Mohawk, Niagara, the lake and great western plains district—and in its diversity, second only to that of California. Beautiful as the surface is with its flora and fauna, its interest, significance and utility have been vastly

enhanced for man by the thorough understanding of its natural history and its prehistory, from the birth of the Adirondacks and Highlands to the final sculpturing of the State by the glaciers, with all the grand procession of life from the time of the interior Palæozoic seas to the plants and animals of our day. For all this deeper knowledge we are indebted to the Natural History Survey of the State, begun in 1836 and practically continuing to the present time.

The survey,[1] as established seventy-six years ago, was by far the most important scientific event in the history of our State and one of the most important in the history of the nation.[2] It attracted five of the most able geologists and naturalists of the country to its service: Lardner Vanuxem (1792-1848) from Pennsylvania, Ebenezer Emmons (1799-1843) from Massachusetts, from New York Mather, the geologist, and Torrey, the botanist, and James Hall (1811-98) from Massachusetts. The survey set a new and high standard not only for the State but for the country; it exemplified the ideal development, side by side, of pure and applied science.

> The survey of New York was indebted for its projection and execution to a movement in science—a movement which pervaded the entire thinking community. It was one of those natural results which mark the progress of truth; and itself was an evidence of the progressive intelligence of the human mind.—*Emmons.*

> The enlightened spirit in which this survey was directed, and the munificence with which it has been sustained, have afforded every means required for its completion. The State of New

[1] It was the essay of John A. Dix as Secretary of State (1835) on the Natural Resources of the State that was the efficient final act before legislation was effected, a report prepared at the request of the Legislature with reference to the organization of the Natural History Survey.

[2] See Merrill: Contributions to the History of American Geology, p. 344.

York, which has hitherto established her claim to the dignity of the Empire State, has now added another wreath to her laurels, in becoming the first in the patronage of science, and in the benefits thereby bestowed on her citizens, as she is first in resources, in commerce and public improvement.—*Hall.*[1]

The State of New York is the first that fully carried out the principle of division of labor in the execution of a survey on the natural history of the State, under the name of a geological survey. By this arrangement each head of a department of the survey has been enabled to devote his whole time and attention to his own specific duties, without having the entire range of natural science to distract his attention. . . . The survey of New York, unlike that of some of the other states, has been uninfluenced by party and political considerations, and the chief magistrates, during its execution, have been actuated by high and ennobling motives.—*Mather.*[2]

This led to an organization which has left a more lasting impression upon American geology than any that has followed or had preceded it. As fate ordained, the locality was one of the most favorable that could have been selected for working out the fundamental principles of stratigraphic geology; moreover, those appointed to do the work proved equal to the occasion. The New York survey gave to American geology a nomenclature largely its own; it demonstrated above everything else the value of fossils for purposes of correlation, and incidentally it brought into prominence one man, James Hall, who was destined to become America's greatest palæontologist.—*Merrill.*[3]

What was discovered by the original survey, between 1836 and 1842, fills thirty great volumes, stately and beautiful in form, epoch-making in content. The data in these works and the new series of thirteen "Memoirs of the State Museum," published between 1889 and 1910, are the units out of which, with our present knowledge, the wonderful geologic history of

[1] James Hall: Natural History of New York, Part IV, New York, Boston, Albany, 1843, p. ix.
[2] William M. Mather: Natural History of New York, Part IV, New York, Boston, Albany, 1843, p. x.
[3] George P. Merrill: Contributions to the History of American Geology. *Rep't U. S. National Mus. for 1904,* p. 344.

the State with all its natural mineral wealth and other resources, its botany and zoölogy, can be written.

The scientific growth of New York State is the past, the present, and a forecast of the future of our State Museum. The offspring has become the parent; the museum now conducts the geological and other surveys of the State. From its slow birth under the Natural History Survey between 1836 and 1843, under vicissitudes of name, of scope, of direction, and of dwelling-place, the State Museum is now the titular head of the survey and of the entire science division under the New York State Education Department.

Relation to School Education

Yet in no relation is the function of the State Museum more full of promise than in its relation to school education, a relation which has been established since 1884 but which should be greatly extended in the future. The peculiar teaching quality of a museum is that it teaches in the way nature teaches, by speaking to the mind direct and not through the medium of another mind. This principle of natural instruction is being carried out in the development of the exhibits of the museum, and through photography these exhibitions may well be extended to the schools of the State. The museum should be the center from which the visual and practical instruction of the children of the State in science should emanate. The pulse of the new museum should be felt in every country school in the State and in the schools of every one of its cities which has not developed its own museum center. The museum should supply the

schools with collections of scientific materials; it should distribute traveling demonstrative collections in natural history. In brief, the museum should supply the State Education Department for distribution among the schools with all materials for the visual instruction in the scientific features of the State. Our school children should receive their first inspiration in science not from abroad but from the things about them. Our Education Department could not do a wiser thing than to popularize the technical geology of the State in a schoolbook and put such a volume into the hands of every pupil; it would exert a vast influence. There is every reason why the State Museum should do for the resources of the State what the Commercial Museum of Philadelphia is doing for the people of Pennsylvania.

It is now the great opportunity of our State not only to maintain liberally a museum the purpose of which is to present in fulness the character of its natural resources, but to furnish the State Department of Education with the means of spreading the work of the museum in popularized form throughout the schools of the State. The appropriations have doubled in recent years, but they are insufficient to develop a museum worthy of the dignity of the State of New York either along the lines of exhibition or those of public education.

The truest measure of civilization and of intelligence in the government of a state is the support of its institutions of science, for the science of our time in its truest sense is not the opinions or prejudices, the strength or weakness of its votaries; it is the sum of our knowledge of nature with its infinite applications to state welfare, to state progress and to the distribution of human happiness.

VI

SCIENCE AND SENTIMENT IN PROFESSIONAL EDUCATION

The attention of the author was attracted to the profession of trained nursing through the activity of members of his family on both the Osborn and Sturges sides, which began during the Civil War in aid extended to the Sanitary Commission and continued in assistance to the Bellevue, New York, Ruptured and Crippled, and the Presbyterian hospitals of New York; particularly was he influenced by the active interest of his mother, Virginia Sturges Osborn, in the foundation of the Bellevue Training School for Nurses. Joseph H. Choate, in his address at the anniversary of the founding of the first training school for nurses, paid tribute to "the woman of sainted memory, Mrs. William H. Osborn, who led the activities in the creation of that great school, . . . who gave so much of her heart, her soul, her life, and her treasure to the building up of that school."

The several addresses in this chapter were inspired by the observation of the application of the most advanced scientific discoveries in the art of healing. The true relations between science and sentiment and the true distinctions between sentiment and sentimentality are exemplified today as never before in the humanitarian eugenics movement. This great branch of biological science, understood and practised by the Greeks, neglected under misapplied doctrines of Christianity, is now recognized as even more fundamental for the future welfare and happiness of the human race than all the combined arts of euthenics. As far as possible, the ills that flesh is heir to should be conquered before birth rather than modified or rendered more endurable after birth.

SCIENCE AND SENTIMENT IN PROFESSIONAL EDUCATION

Florence Nightingale—Science and Sentiment—The Euthena and Eutheny—Eugenics and Euthenics—The Dysgenic Tragedy of the World War.

THAT part of the great world of life which we call humanity is never stationary; it is always moving forward and upward, impelled by two forces. The first of these forces is the combined conscientious and laborious effort of great masses of individuals. Such movement is steady, but always slow; sometimes so slow that we hardly perceive it. Again, this movement from time to time receives a sudden impulse in a new direction from the genius of one individual: a divine spark seems to flash from Heaven and illumine a soul. It may be in literature—we have a Shakespeare; in music—a Beethoven or a Wagner; in politics—a Lincoln; in science—a Darwin. The attitude of the world at first is always the same—sceptical, incredulous, hard to convince; but heaven-born inspiration invariably wins in the end, and a new, sudden, and great impulse is imparted from which humanity never recedes.

Florence Nightingale [1]

Such a divine messenger was Florence Nightingale. She instinctively prepared herself for her mission in

[1] Introductory address at the meeting at Carnegie Hall, May 18, 1910, commemorative of the fiftieth anniversary of the founding of the first training school for nurses at St. Thomas' Hospital, London, England.

childhood. As a young woman she was projected by a wise government into the cruel, unnecessary, and sickening war of the Crimea, from which she emerged after demonstrating two great principles: first, that the physician or surgeon cannot work unaided, but needs an ally; second, that the ally best fitted by temperament and nature is the trained woman nurse.

From that the movement became world-wide, spreading over Great Britain, America, Germany and, somewhat more slowly, France. As a climax, tonight we know of 126 training schools for nurses in this state alone, and upwards of 26,000 trained nurses in the United States.

Our meeting this evening is partly retrospective, partly a noble tribute to a great woman, partly a history of the development of nursing; but it would fail of its object if it were not also partly prospective, that is, in the nature of a renewal and reiteration of the ideals and standards of what has become a great profession, namely, trained nursing. Florence Nightingale, if she could be here tonight, would not wish it to be otherwise, she would dwell lightly on the past, especially on her own part in it, she would speak seriously and earnestly of the future. She would perceive that with the enormous expansion of the system, the training school, the training of the nurse, the education of the nurse have now become national questions, which should be considered by the entire community; that the special qualifications of character and fitness for entrance into this profession should be most carefully defined, that with the great and increasing competition, the profession should not become commercialized and lose sight of its original ideals; perhaps that

under acts of legislation there should be adopted somewhat uniform standards of admission and education, such as the universities and colleges are gradually adopting, so that the diploma of the nurse would have more nearly the same meaning and dignity throughout the country.

In this connection allow me to read a letter from Nicholas Murray Butler, President of Columbia University, who had hoped to be present:

Had it been possible for me to be present I should like to have taken occasion to express my own belief that the education and professional training of the nurse have become matters of high importance to the community, not only in the curing of disease and in the care of the suffering, but also for the prevention of illness. Through better protection and safeguarding the public health the trained nurse is destined to occupy an increasingly important place.

It is a profound satisfaction to me to know that our University, which has done so much for medicine and which plans to do so much more, is foremost among those institutions which make provision for the higher training of nurses. The name of Florence Nightingale must always be a name to conjure with. If to scientific training and insight we can add something of the ideals of service and of sacrifice which took her to the Crimea more than half a century ago, we shall have made no small contribution to human welfare and human happiness.

In Walt Whitman's letters to his mother, from the hospital camps of our Civil War, we find the most poetic and truthful expression of the *sentiment* peculiar to army nursing and of the scenes peculiar to the army hospital in the time of war. It is not the mere wasting away of life which in itself always arouses our compassion, it is that of life which has been given—sometimes freely and gladly given—to country, to the defense of home, to some great and patriotic cause.

It is a double emotion. It was this wondrous mingling of devotion and suffering observed among the British soldiers and sailors which first brought out the finest qualities of heart, will, and mind in Florence Nightingale.

Thus may not this great meeting, inspired by those who are to speak after me, be the occasion for a renewal of the ideals which Florence Nightingale held aloft? *The ideal nurse is the woman whose inborn sympathy and tenderness are guided and controlled by knowledge, by science, by obedience to the physician in charge.* That I am sure would be Florence Nightingale's especial message to this great meeting tonight.

Science And Sentiment [1]

I am proposing tonight a new word, 'avunculism,' as a counterpart of 'nepotism.' It is not the name of a new disease or of a new specific remedy; neither is it so difficult to understand or remember as it sounds. If a man has a partiality for his nephew, or *nepos,* and may be charged with 'nepotism' in extending such an honor and opportunity as the delivery of this address,[2] may not the nephew be charged with 'avunculism' if he entertains a very particular affection for his uncle, or *avunculus?* And even as the uncle explains away his nepotism, may not the nephew also plead in extenuation that his admiration is based not

[1] An address before the graduating class of the Presbyterian Hospital Training School for Nurses, New York City, May 15, 1907.

[2] Frederick Sturges invited his nephew, Henry Fairfield Osborn, to deliver this address. In his invitation he used the following expression: "Three years' work should result in a perfect transformation by the renewal of their minds."

on kinship but on merit? May he not further explain that this 'avunculus' is the living and very active exponent of a family which, since the time when the leading citizens of New York lived on Battery Park or as far uptown as Greenwich Street, has been continuously exemplifying the main theme of this evening's address, namely:

Among men sanity tempered by charity, among women charity tempered by sanity.

Feminine Women and Masculine Men

I may explain that this address has not been hastily thought out; the actual writing of it was in fact done under pressure, in a very brief time, but it represents the experience of thirty years; for although my *avunculus* may (and I hope always will) regard me as a youth, my scientific career began just thirty years ago next June, when I first went out to the Rocky Mountains on a scientific expedition.

I take it that from long observation my uncle understood the beginner in the nursing service far better than I; he understood that the average neophyte enters with an abundant supply of heart and that the long and severe training must be chiefly devoted to the development of the mind, to the inculcation of knowledge or, in other words, of science. Women are not men, and no amount of education or training, not even the dictates of fashion, can make them so; and this is simply because nature has been at work some hundreds of thousands of years making them different, and, to reverse a familiar sentence, "whom God hath put asunder, let no man join together."

The exceptional woman may be masculine exactly as the exceptional man may be feminine. I do not know any particular advantages which can be claimed for feminine men, but there are women like Madame Curie, the discoverer of radium, so gifted with creative genius that the pursuit of knowledge is not only their manifest destiny but their manifest duty. All honor to them, and may more such women be discovered and every opportunity extended to them for intellectual development, without any restrictions whatsoever.

But for the general march forward of the army of civilization and for the general development of society we need feminine women and masculine men. The world is far happier and better for these natural differences, which are so well known that we need not discuss them further but come directly to the one difference which does bear very pointedly on our text, namely, that the tendency of the average man is reliance on knowledge rather than on love, on science rather than on sentiment, while the tendency of the average woman is reliance on love rather than on knowledge, on sentiment rather than on science.

As the ideal well rounded man in any profession, not alone that of medicine, should have his knowledge tempered by a deep and sincere love of humanity, so the ideal woman should have her natural sympathies, her compassion, her tenderness, and above all her spirit of self-sacrifice tempered and directed by knowledge. This is what is meant when it was written by the devoted friend and counsellor of this hospital that "three years' work should result in a perfect transformation by the renewal of their minds."

Knowledge and Love of Humanity

In using the word knowledge I refer to knowledge of the laws of nature, including everything relating to the physical and living universe and to humanity. The Bible was long considered a book of knowledge and a revelation of the laws of nature—in other words, a work of science. St. Augustine clearly saw that this was an error, and if his profoundly learned and sensible advice had been followed the world would have been spared the long and most unfortunate period of misunderstanding which has terminated, among all Protestant thinkers at least, in the belief that the Bible is a book of science only in so far as it is a correct history of the Hebrews, that it is essentially a book relating to conduct, to the love of man and to the fear of God.

In using the word love I am not speaking of the tender sentiment, although this is the season when the young man's fancy is alleged by the poet to turn lightly in that direction; I am speaking of the love of humanity as defined for all time in the beautiful chapter on charity, I. Corinthians, xiii., 4, 5, 6, 7. In other words, humanitarianism, the passion for the physical, moral and spiritual welfare and progress of humanity, is the supreme teaching of the Bible.

Knowledge and love, or science and sentiment, should be twins, they should go hand in hand in every department of human activity. Unfortunately they do not. The confidence of some persons in the influence on morals and conduct of the pursuit of knowledge for its own sake is unfounded. Whatever confidence I

myself may have entertained in such influence has been entirely shattered by my own experience and observation. I have observed that the greatest successes in science have come through due regard for sentiment and morality, that the greatest failures have come through absence of these qualities. The notion that the pursuit of science or knowledge in itself has an uplifting effect upon human nature is an absolute fallacy; it should do so, but it does not. Similarly, the pursuit of the art of music or of literature should transform human nature, but it does not, for a reason which is very simply explained by the laws of heredity. The composition of every human being is like a piece of quilt work: in one part of the hereditary quilt may be an especial talent for the acquisition of knowledge or the pursuit of art; in another part of the hereditary quilt there may be some grave flaw in character. The talent does not remove the flaw, but the flaw may defeat the consummation of the talent.

The Ideal Scientist

Popular misconception on this point may be well illustrated by an address to which I once listened before an association of professional men. The speaker made a somewhat impassioned harangue on the superior qualities of the man of science as compared with the man of business. He drew a flattering picture of the scientist as animated solely by the highest motives, in contrast with the merchant animated merely by sordid love of gain. It happened that I sat next Mayor Seth Low, whose father was a merchant, and he became

restive. You can imagine my emotions as I listened to this wholly uninformed contrast, while having in mind my own father, a merchant, and my grandfather, a merchant. The orator supposed that his address would be particularly pleasing to me, but when my turn came to speak I took him completely by surprise by differing from him in toto, by asserting that men of science are no better and no worse than other men, that the quest of truth is often a beautiful cloak thrown over the shoulders of the real motive, which is personal ambition, or the quest of fame; that the real cleavage is not between the scientist and the merchant; that the sheep and goats are not separated by any such classifications, but that the sheep include those scientists and merchants who are animated by humanitarianism, while the goats include those scientists and merchants who are animated by purely selfish motives of egoism. I pointed out that the conflict in ideas, the theft of priority, the pirating of literary property, the appropriation of the discoveries of others, the rivalries, the jealousies of scientific men would range a very considerable number among the goats, in the last reckoning. To this I now wish to add that the chief obstacles to scientific progress today, not only in medicine but in all branches, are obstacles in the lack of proper sentiment toward other men, in the proper animating spirit, and that the ideal pursuit of knowledge is when its main object is not ambition, not fame, *but the pure search for the truths of nature in order that they may be revealed to man for his intellectual, moral, and physical welfare.*

Fortunately we have many examples of such ideal devotees of science. Some religious-minded persons

of little faith in the progress of the world deplore the fact that the days of miracles and of saints are over. It is difficult to understand such blindness to the actual condition of things. Remember that, if you are really devout and believe that the work of nature is the work of God, then the study of nature must be a branch of theology. Remember that the miracles of ancient days affected but a few people; the miracles which are performed today affect hundreds of thousands. Remember that these miracles are never actually the work of man; they are always the work of Nature herself. The old form of prayer in the Middle Ages was, "From plague, pestilence and famine, good Lord, deliver us." The enlightened Christian of to-day adds to this: "From ignorance and disobedience of Thy laws, good Lord, deliver us." If Nature appears to extend in one hand a curse in the form of a plague or pestilence, she holds out in the other hand a blessing in the form of a preventive or remedial agent. To man it is permitted to discover this remedial agent. Man does not create; he only finds something which already exists and applies it. Would not the early church in the pure period of St. Augustine have canonized a Louis Pasteur for his life of devoted service to his fellow-men and for the myriad miracles which are being daily performed, through his insight into the laws of nature?

Saints of the Profession

In this combination of the head and the heart, of science and sentiment, of knowledge and love, we recognize some of the true saints of our day and generation. We are perhaps too near them to appreciate

them, but as time goes on it will happen, just as it happened of old, that they will be canonized. Out of the host of instances I may refer only to three:

Some five years ago Dr. Hermann Franz Müller was investigating the bubonic plague. Some cases presented themselves and in order to study them more closely he was isolated with them in a small house in the hospital grounds. The patients died, and with some anxiety his colleagues watched for the signal previously agreed upon that he had become infected while waiting for the period of inoculation. When the signal appeared food and drink were placed for him in the usual place, as was the custom with his former patients. One day the food was not taken in. He sacrificed himself to science, for it was found that during his illness he had made a very exact analysis of his symptoms as they had developed to within a few moments of his death.

Before the Spanish War the island of Cuba was periodically suffering from the ravages of yellow fever, and after the war the now famous commission under Major Walter Reed conducted experiments to discover the method of its spread. The experiments were conducted at Camp Lazear, four miles from Havana. Dr. James Carroll and Dr. Jesse W. Lazear were the first volunteers. It was suspected that the mosquito *Stegomyia fasciata* was the vehicle of the disease, the germ of which was unknown. In order to test the matter these men allowed themselves to be bitten by mosquitoes which according to Dr. Reed's hypothesis had become the bearers of infection through biting yellow fever patients. They both took the disease and Dr. Lazear died. Of the results obtained by these ex-

periments, in a memorial service to Major Reed some years after, General Leonard Wood said:

> I know of no other man on this side of the world who has done so much for humanity as Dr. Reed. His discovery results in the saving of more lives annually than were lost in the Cuban war, and saves the commercial interests of the world a greater financial loss each year than the cost of the Cuban war. He came to Cuba at a time when one-third of the officers of my staff died of yellow fever and we were discouraged at the failure of our efforts to control the disease. In the months when the disease was ordinarily the worst the disease was checked and driven from Havana. That was the first time in nearly two hundred years that the city had been rid of it.

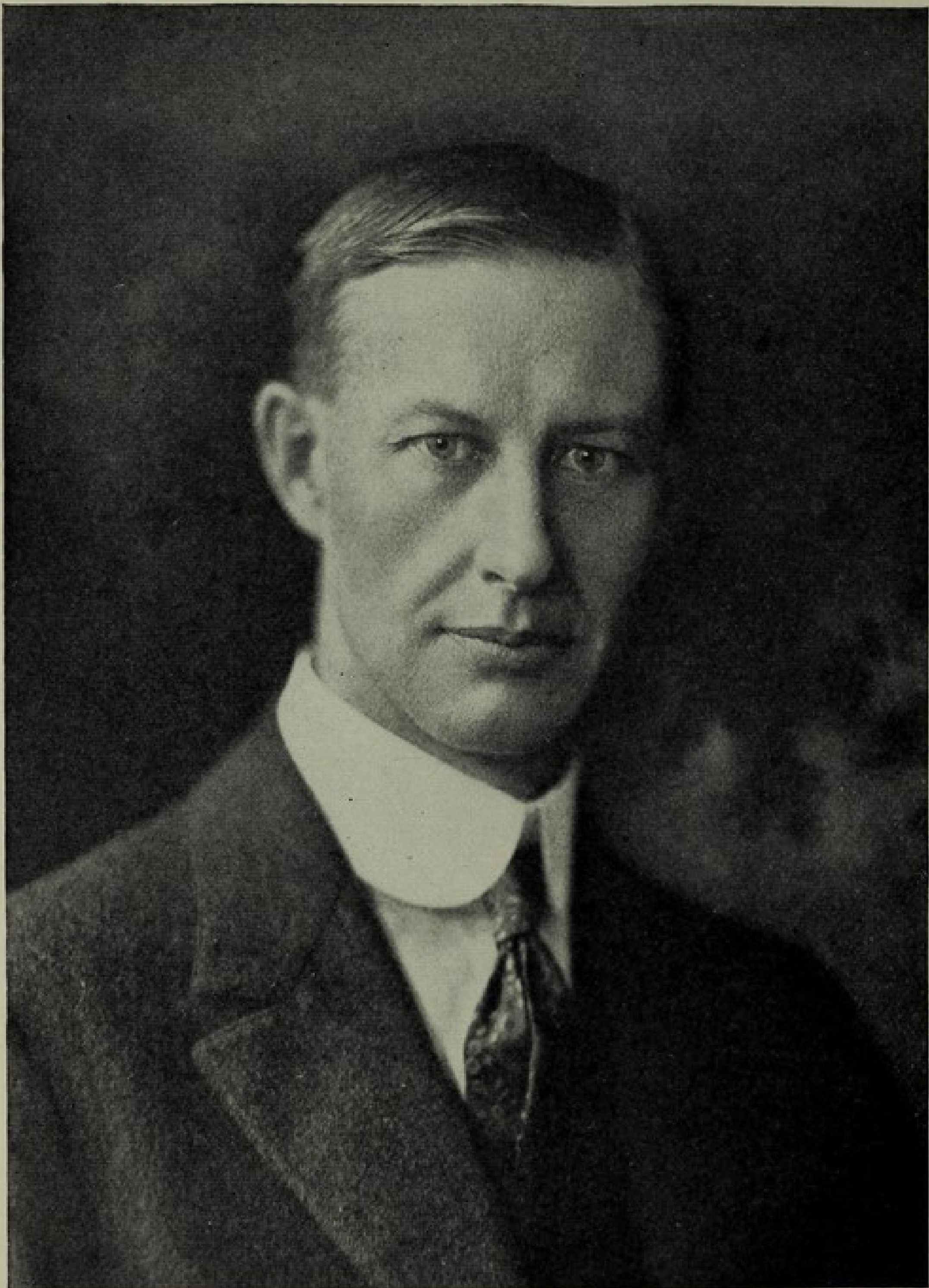
Of still higher import are the well considered words of Dean William H. Welch of the Johns Hopkins Medical School:

> Dr. Reed's researches in yellow fever are by far the most important contributions to science which have ever come from an army surgeon. In my judgment, they are the most valuable contributions to medicine and public hygiene which have ever been made in this country with the exception of the discovery of anæsthesia. They have led and will lead to the saving of untold thousands of lives. I am in a position to know that the credit for the original ideas embodied in this work belongs wholly to Major Reed. Such work if done in Europe would receive substantial recognition from the government.

But the highest example of the combination of science and sentiment we find in the life of Louis Pasteur. He ranks next to Darwin as the most original biologist of the nineteenth century, and he was certainly Darwin's superior in the combination of science and sentiment. The miracles which have been and are being performed through his discoveries of the germ theory of disease are incalculable and are beyond the possibility of any statement. Up to 1880 his line of

RAYMOND CARROLL OSBURN

Professor of Zoology and head of the Department of Zoology and Etymology, Ohio State University



PAUL MARSHALL REA

Director of Charleston (S. C.) Museum, 1903–1920; Director of Cleveland Museum of Natural History

thought was largely preventive and taught us how to avoid the curse in the left hand of Nature.

In 1880 he began his great constructive work in the discovery of the method of securing immunity through the use of living parasites attenuated in virulence, a revival of the idea of Jenner, on the basis of modern knowledge. He thereby seized the right hand of the beneficent agencies of nature which may be used to check and destroy disease. Only one illustration may be taken from his wonderful life. In 1885 Joseph Meister, a little Alsatian boy nine years of age, was badly bitten by a rabid dog. He was brought to Pasteur's laboratory and, after consultation with Vulpian, Pasteur gave him his first inoculation. As the inoculations grew in strength and approached the final inoculation of strength sufficient to communicate hydrophobia to any of the lower animals which had been experimented upon, Pasteur passed through a series of hopes, fears, and ardent yearnings to snatch little Meister from death. After administering the final inoculation he spent a terrible night of insomnia, when all vision is distracted. The next morning the boy was better, the danger period passed, and the miracle of the cure of hydrophobia was established for all time.

If I have laid bare my convictions as to the weakness and strength of men of science, as to the absolute necessity of a combination of sentiment with science, everything I have said applies in equal degree to you women. *In your development of knowledge and in your acquisition of science let there be no diminution in sentiment, otherwise you will fail of your chief object, and you will not have learned the chief lessons which the Hospital is designed to impart.*

THE EUTHENA AND EUTHENY

To the Graduating Class of the New York Hospital, 1914

In an earlier address to a graduating class of your sisters in another hospital, the relations of science and sentiment, of knowledge and love, were uppermost in my thoughts, because these relations touch the sources or foundation principles of your profession.

Speaking tonight as a scientist and educator, may I now impress on your minds two chief principles which I have no doubt you have more or less clearly evolved in your minds, but which it may be well to emphasize particularly, at this memorable time of your graduation? First, the practice of nursing should be entered in the spirit of a profession, not of an occupation—a profession discovered and ennobled by women and for which women are peculiarly endowed by nature. Second, the art or science of nursing stands between the science of medicine and surgery and the far more wonderful healing and restorative powers of nature. There is every reason why, through observation as well as learning, the women who enter this profession should also be contributors to it as a branch of science.

I accepted the invitation of President Rives to address you tonight with the more pleasure because of the association of my revered father and mother with the early history of your great profession. One incident will touch your hearts, I know, as it has warmed my own. From 1873 to 1876 my father was a trustee of the New York Hospital and he became greatly impressed with the necessity of providing for the period of convalescence on leaving the hospital, especially of

those patients whose homes and means did not permit proper care during this often critical period. At that time my mother had recently undergone the great sorrow of losing her only daughter and her second son, both unusually gifted and lovable. She sought relief from sorrow not in idle lamentation but in active and generous devotion to the welfare of the sick in the great City of New York. It happened that the large and formerly famous hostelry known as "Cozzens," situated on a high cliff overlooking the Hudson River near West Point, was offered for sale, and immediately my mother secured it as a convalescent home for invalids leaving the New York Hospital. Unfortunately, this wonderful project, the example of which would have undoubtedly led to the establishment of many similar convalescent homes throughout the country, was prevented from development by a flaw in the sale, so that my mother turned her mind and heart to the creation, in coöperation with a number of other noble women, of the Bellevue Training School for Nurses, in 1876.

It was these incidents in the life of my parents which gave me such a peculiar interest in the education of nurses. Also, possibly because of this interest, there fell to me the pleasure of presiding at the great meeting of May 18, 1910, in honor of Florence Nightingale, at which a thousand schools of trained nurses, fifty thousand graduates and twenty-five thousand pupils, gathered to testify to their admiration of and debt to a woman whose name will be immortal as the founder of your noble profession in Great Britain and America. On this occasion the question of dignifying and protecting your profession came up. My opinion then, and now more strongly, was that the profession should

be safeguarded by law and by state regulation and that it should be as illegal for an untrained, or practically untrained, woman to practice nursing as it is for a spurious lawyer, physician, dentist or pharmacist to practise the professions into which they intrude. Since the Nightingale meeting, as far as I have been able to consider the subject of nursing at all, my whole undercurrent of thought has been in the direction of giving the profession greater opportunity and a larger play for originality and invention.

Perhaps the first or instinctive tendency of most professional men and of some women, for various practical reasons, would be to oppose such a movement, but when we develop the notion of nursing as an art which we owe both in England and America entirely to women, as an art in which women are peculiarly gifted, we reach the further idea that in the development of this art they should themselves take a leading and independent part.

The Trained Nurse Deserves New Ranking

To further this notion, I am strongly in favor of introducing a new designation for the trained nurse, and one which is by far the oldest in the human language. It is derived from the Greek *εὐθηνία* or *εὐθένεια*, from which comes also our modern word 'euthenics.' As Athena is known as the Goddess of Wisdom, the presiding female deity of the sickroom and hospital may become known as 'Euthena,' and the art of nursing as 'Eutheny.' The new designation of a profession, such as this, always has a strange sound at first, but the ear would soon become accustomed to it, and to me

it has a feminine tone, just as the words 'physician' or 'surgeon' sound masculine. A 'Euthenal Association' would be an association of trained nurses, similar in significance to Medical Association. Imagine a skilled euthena, an awkward euthena, and the term soon becomes familiar.

As far back as the time of Homer the euthena was a specialized member of society, and the practice of the profession is mentioned in these terms also by Æschylus, Sophocles, Plato and Pindar. Probably Æsculapius, the father of medicine, mentions the euthena, but I do not know of the reference. The profession of the nurse was also known as Tithenia, and Plato speaks of nursing as Tithenesis, but this use is its literal significance.[1] I propose this evening, therefore, to christen each of you a Euthena and all of you Euthenæ, and I propose for the art of nursing the term Eutheny.[1]

This art, which naturally will continue to be practised both by the physician and the euthena, is as essential as that of medicine or surgery, because the ideal euthena, under the constant direction of the physician, stands half way between the healing art and great experience of the physician and the sovereign healing powers of nature. The duty of the euthena is, under the direction of the physician, through constant attendance or readiness to attend, to keep the patient in such an environment of nutrition, of cleanliness, of fresh air and, perhaps, of exercise or motion, and in such a state of mental and spiritual freedom, that nature may be free to perform its miracles of

[1] The same idea of "well-being," i.e., "flourishing through plenty of nourishment," inheres in the word *euthenia* (*εὐθηνία or εὐθένεια* —both forms are found) as in *τιθήνη*.—E. D. Perry in letter to the author, April 30, 1914.

healing. In brief, the euthena is constantly to give nature every possible chance either to fight the enemy of disease or to re-create the wounded or affected part. In the shambling barrack hospitals of the Crimea Florence Nightingale found that the physicians and surgeons had done their work well, but that every possible obstacle and impediment had been put in the way of the benevolent forces of nature.

We sometimes forget that nature is the source of all our knowledge, that the mind of man and woman really creates nothing, and we must ever recall the spirit of Cato's remark to Scipio:

> Wherefore, if it is your wont to admire my wisdom—and I would that it were worthy of your good opinion and of my own surname of *Sapiens*—it really consists in the fact that I follow Nature, the best of guides, as I would a god, and am loyal to her commands. It is not likely, if she has written the rest of the play well, that she has been careless about the last act, like some idle poet. But after all some "last" was inevitable, just as to the berries of a tree and the fruits of the earth there comes in the fulness of time a period of decay and fall. A wise man will not make a grievance of this. To rebel against nature —is not that to fight like the giants with the gods?

We should, however, also remember the favorite saying of Sir Andrew Clark, the great British practitioner of the close of the last century, that "Nature forgives but never forgets." It is certainly true that there are those desperate cases where a physician and euthena are alike baffled, owing to the fact that Nature, while perhaps forgiving, cannot forget a taint of heredity, of alcoholism, or of some other violation of her laws, and the miracle of healing is either delayed or even arrested altogether.

Thus a euthena, however she may advance her profession, will always be between two masters, the Physi-

cian and Nature, and will require to be obedient to the one and loyal to and observant of the other. And I doubt if the constant need of observation, with the possibilities of discovery in this profession, has ever been sufficiently impressed upon the euthena. Let her constantly and persistently learn from nature, as well as from books and from the precepts and rules laid down by the physician. The ideal euthena, therefore, should have not only a prolonged training, by which I mean both knowledge and experience, but a prolonged period of observation to provide her with practice. She must continue to cultivate all her powers of observation, which should by no means be limited to the mechanical registration of the thermometer and other instruments but should include all the phases of the body and of the mind of the patient. There is no reason why a euthena should not be a discoverer as well as a practitioner, because you may be sure that while eutheny, or the art of nursing, has developed with wonderful rapidity, yet there are further discoveries to be made, and the women, with their exceptional opportunities, may discover them as well as the men.

When we think of all the qualities which combine to make the ideal euthena, and when to loyalty and obedience we add knowledge, observation, experience, good judgment, we have a very galaxy of virtues. But this is not all, for there must ever be the all important sentiments of sympathy and of mercy, tempered and controlled by judgment. A mere man may well despair of finding all these qualities combined in one individual, and seldom recognizes them in himself. Happily for the future of our race, the combination of these rare virtues is far more frequently found in women than in men. It is true that sometimes men

can be very tender—I shall never forget the sympathy of the late Dr. Andrew McCosh in straightening out for me the adhesive ligaments of a broken shoulder—but it will always be, in the future as it has been in the past, that when "anguish wrings the brow, the ministering angel" is the woman.

Gains and Losses in Feminism

The spirit of development of woman's sphere seems to me to have a broader bearing, because it suggests that one of the most important of our duties in the present state of social evolution is to find more occupations and professions for women. In this sense I am a very strong advocate of 'women's rights,' although I have the greatest contempt for women's fads, and at the present time many women do not distinguish between 'rights' and 'fads.' It is perhaps the most striking feature of the social evolution of our times that while our men are at present unchanging, our women, or certain classes of women, are in a ferment of evolution—they are trying to be something different from what they were, either in family life, in social life or in political life. Many women who rebel against ours as a 'man-made world' are nevertheless trying to be as masculine as possible—in fact, to 'out-man' man. The underlying motive of all these movements, namely, the desire for occupation and responsibility, is something which we all must admire, even if it has as its surface manifestation what we must regard for the time as a 'social disease,' in that certain bodies of women of our time are suffering from a sort of 'social hysteria.' The best remedy for this

social hysteria is not to be found in rest or enforced quiet, but in *activity*, and a world-wide cure will come through the opening of new channels for the activity of women and the further development of lines of work which have been already discovered. Florence Nightingale thus was a benefactor of the whole human race, not so much because she taught us a new means of saving life, but because she discovered a new line of activity for women. As she herself observed:

> I would say to all young ladies who are called to any particular vocation, qualify yourselves for it as a man does for his work. Don't think you can undertake it otherwise. Submit yourselves to the rules of business, as men do, by which alone you can make God's business succeed. Three-fourths of the whole mischief in women's lives arise from their excepting themselves from the rules of training considered needful for men.

I maintain that every girl, whatever her station in life or whatever her means, should be compelled, not merely *allowed*, to do something with her talents. Just as our young men who do not take up work of some kind are despised by the community, so our young women should also feel that something is expected of them.

In eutheny, as well as in other fields, let women discover new lines of feminine activity for which they are fitted by nature and by temperament to enter and which will not interfere with their all-important duty of motherhood or in the reproduction and conservation of the race.

I believe that such lines of work and new conceptions of social duty will constitute an entirely natural evolution, whereas the endeavor to make out of a woman a poor imitation of a man is an unnatural evolution and

is destined to fail absolutely. For the world's work give us masculine men and feminine women, and banish all the blends!

In conclusion, I hope you will enter your profession with the thought that, thanks to the splendid training which you have received in this historic institution, you will have an opportunity of contributing to our knowledge of the preservation of life and the prevention of suffering. In taking your place in one of the finest lines of service, endeavor by your life, your example and perhaps your observation and discovery, to make the world better for having lived in it and to leave behind something by which you will be remembered.

Eugenics And Euthenics [1]

It is very important that all parents, all teachers, and all physicians should understand the interlocking relations of heredity and environment. So much reliance is placed on education in America that it is necessary to stress the great importance of being born with a sound and healthy constitution and with good moral, spiritual and intellectual predispositions.

Heredity is, in fact, altogether a matter of predisposition and potentiality; it is the key which fits the lock of environment, including all the steps in nurture and in education. Consequently, eugenics, which has to do with being born well, and euthenics, which has to do with being nurtured and educated well, have

[1] See Foreword to Henry Dwight Chapin: Heredity and Child Culture.

been inseparable from the beginning of time. These two fields of humanitarian endeavor overlap exactly as heredity interlocks with environment, nature with nurture. During the last seventy-five years we have made marvelous progress in euthenics, and I believe we are on the threshold of similar progress in eugenics.

Leon J. Cole, in his "Relations of Eugenics to Euthenics," says:

> According to one of the foremost exponents of euthenic ideas in this country, euthenics means "The betterment of living conditions, through conscious endeavor, for the purpose of securing efficient human beings," or "Euthenics deals with race improvement through environment," while "Eugenics deals with race improvement through heredity."[1] Galton himself defines eugenics somewhat more broadly as "the science which deals with all influences that improve and develop the inborn qualities of a race,"[2] though he must have had chiefly hereditary influences in mind. . . .

The value of a clear understanding of these principles to the parent, teacher and physician begins with birth and extends through the entire life-education, when the responsibility of the world's welfare passes on to another generation. If there is an hereditary predisposition—a passion for drink, for instance—and we know of it, we can, through nurture and environment, take away the opportunity for its development; if there is an hereditary predisposition to certain physical defects, such as tuberculosis, we can, by change of environment and proper nurture, prevent its development. Charles B. Davenport, leader of the eugenics movement in America, also stresses the importance of euthenics:

[1] Richards, Ellen H.: Euthenics, the Science of Controllable Environment, Boston, 1910.
[2] *Nature,* Vol. 70, 1904, p. 82.

Just as soon as the individual fully realizes that he himself is to blame for his suffering or his poverty in human energy, he will apply his intelligence to the bettering of his condition. Why are men and women so apathetic over the prevalence of disease? Why do they not devote their energies to stamping it out? For no other reason than their disbelief in the teachings of science, coupled with a lingering superstition that, after all, it is fate, not will-power, which rules the destinies of mankind.[1]

But the voice of Pasteur protesting alone in the Academy of France for the euthenic welfare of mankind is no more potent than the voice of Galton crying in the wilderness of ill-assorted, fruitless and unhappy marriages for eugenic reform. In close interrelation to the euthenic view of the importance of environmental conditions is the eugenic view of the importance of clean blood. Taking an extreme case, a child born an imbecile cannot be changed, neither by the best of nutrition, the most scrupulous cleanliness, the purest air and sunshine, nor the best of physical and mental training. Imbecility cannot be cured; in most of its forms it is a result of wrong parental mating, a consequent of patent or latent defects in the parental germ plasms. The imbecile is imbecile for the same reason that a blue-eyed person is blue-eyed.

The nation that takes the best care of the birth of its children, that encourages the kinds of birth which will bring into the world the greatest amount of happiness and the least amount of suffering, and the nation that brings to the care of children after birth all the advantages of education in its broadest sense, is destined to survive and to lead the world in the progress of the future.

[1] C. B. Davenport: Euthenics and Eugenics.

THE DYSGENIC TRAGEDY OF THE WORLD WAR [1]

I doubt if there has ever been a moment in the world's history when an international conference on race character and betterment has been more important than the present. Europe, in patriotic self-sacrifice on both sides in the World War, has lost much of the heritage of centuries of civilization which never can be regained. In certain parts of Europe the worst elements of society have gained the ascendancy and threaten the destruction of the best. At this moment we welcome the sound and highly trained judgment of Major Leonard Darwin, leader of the eugenics movement in Great Britain; of Dr. Lucien March, the leading statistical authority of France, also leader in the eugenics movement and senior representative of the eugenics movement there; of Dr. Lucien Cuénot, foremost student of the science of heredity in France; of Dr. G. V. de Lapouge of France, the leading authority on racial anthropology and earnest exponent of practical eugenic measures by the government; of Dr. Jon Alfred Mjøen of Norway, leader in the vigorous movement of race hygiene in Scandinavia. Contributions are welcomed from other representatives of Great Britain, of France, of Italy, of the new Republic of Czecho-Slovakia, of our sister Republic of Cuba, and of South and Central America. The leading students in the United States of heredity, of statistics, of anthropology, and of eugenics are here to welcome their confrères from abroad.

[1] Presidential Address of Welcome to the Second International Congress of Eugenics, New York City, September 22, 1921.

Racial Losses and Gains

To each of the countries of the world racial betterment presents a different aspect. To the five countries most closely engaged in the recent fratricidal conflict, the financial and economic losses of which we hear so much are as nothing compared with the spiritual, intellectual, and moral losses which each has sustained. In the Scandinavian countries, which kept out of the conflict, and to a large extent in the United States, the case is different. In Scandinavia, which I have recently visited, it is largely through the active efforts of leaders like Mjøen and Lundborg that there is a new appreciation of the spiritual, intellectual, moral, and physical value of the Nordic race, and that a warning is being given that it must not be too severely depleted by emigration. Nearly half of that race is now in the United States.

In the United States we are slowly waking to the consciousness that education and environment do not fundamentally alter racial values. We are engaged in a serious struggle to maintain our historic republican institutions through barring the entrance of those who are unfit to share the duties and responsibilities of our well-founded government. *The true spirit of American democracy that all men are born with equal rights and duties has been confused with the political sophistry that all men are born with equal character and ability to govern themselves and others, and with the educational sophistry that education and environment will offset the handicap of heredity.* South America is examining into the relative value of the pure Spanish and Portuguese and of various degrees of racial mix-

ture of Indian and Negroid blood in relation to the preservation of its republican institutions.

Racial Virtues and Talents

The constructive spirit of this Congress is to discover the virtues and the values of each of these minor divisions of the human species, as well as the need of the major divisions, known as the Caucasian, the Mongolian, and the Negroid. The reason that these races are so stable and maintain their original character so stoutly is that the most stable form of matter which has thus far been discovered is the germ plasm on which heredity depends. This outstanding fact of heredity will be brought out in the First Section of the Congress. As a palæontologist and geologist, as well as something of a biologist, I find no form of matter so stable in nature as that on which heredity depends—consequently the selection, preservation, and multiplication of the best heredity is a patriotic duty of first importance. In the selection of the best we should know no prejudice. If we extenuate nothing, we write down nothing in malice. In the matter of racial virtues, my opinion is that from biological principles there is little promise in the "melting-pot" theory. Put three races together, you are as likely to unite the vices of all three as the virtues. This opinion, however, awaits the experimental proof or disproof which will be presented by researches such as those of Doctor Sullivan in the Hawaiian Islands. For the world's work, give me a pure-blooded Negro, a pure-blooded Mongol, a pure-blooded Slav, a pure-blooded Nordic, and ascertain through observation and experiment what each

race is best fitted to accomplish in the world's economy. If the Negro fails in government, he may become a fine agriculturist or a fine mechanic. The Chinese and the Japanese have demonstrated in the history of their respective countries a range of ability in art, literature, and industry quite equal to our own in certain arts, and greatly superior to our own in other arts, like ceramics. Let each race consider its own problems and demonstrate its own fitness. The 500,000 years of human evolution, under widely different environmental conditions, have impressed certain distinctive virtues as well as faults on each race. In my recent tour through Belgium and all parts of France, I was deeply impressed with the very slight convergence produced by 12,000 years of similar environment and a thousand years of similar education upon the three divergent races of which France is composed—the Mediterranean, the Alpine, and the Nordic.

The State and the Family

Our Fourth Section is devoted to eugenics and to the State. The right of the State to safeguard the character and integrity of the race or races on which its future depends is, to my mind, as incontestable as the right of the State to safeguard the health and morals of its people. As science has enlightened government in the prevention and spread of disease, it must also enlighten government in the prevention of the spread and multiplication of worthless members of society, the spread of feeble-mindedness, of idiocy, and of all moral and intellectual as well as physical diseases.

I would not anticipate the findings of any of the four sections into which the work of the Congress is divided, but I would express my opinion that the monogamous family, *i.e.*, one husband, one wife, is to be maintained and safeguarded by the State as well as by religion as a natural and hence as a patriotic institution. In Doctor Lowie's very able recent work, "Primitive Society," it is shown that in general the family is safeguarded; that the natural instinct, so widely prevalent among all social lower orders of animals, to preserve the family at all costs dominates the elementary morals of primitive races. It is not an exaggeration to say that many tendencies in recent social development, as distinguished from racial evolution, are against this natural mandate regarding the family. The wisdom of British biologists, expressed by Tennyson in his memorable lines:

> So careful of the type . . .
> So careless of the single life,

has been transmuted into the fatal reverse,

> So careful of the single life . . .
> So careless of the type.

Eugenics versus Individualism

The closing decades of the nineteenth century and the opening decades of the twentieth have witnessed what may be called a rampant individualism—not only in art and literature, but in all our social institutions—an individualism which threatens the very existence of the family. This is the motto of individualism: let us

obey our own impulses, let us create our own standards, let each individual enjoy his own rights and privileges —for tomorrow the race dies. In New England a century has witnessed the passage of a many-child family to a one-child family. The purest New England stock is not holding its own. The next stage is the no-child marriage and the extinction of the stock which laid the foundations of the republican institutions of this country.

It is questions of this kind which are being set forth before this Congress, so that they may be disseminated among our people. Let us endeavor to discard all prejudices and to courageously face the facts. Recent works by Bury and Inge on human progress are regarded in some quarters as pessimistic. I do not regard them as pessimistic, because to my mind the pessimist is one who will not face the facts, and these writers, especially Inge, look at the worst as well as at the best. I regard an optimist as one who faces the facts but is never discouraged by them. The optimist in science is one who delves afresh into nature to restore disordered and shattered society. This was the constructive spirit of Francis Galton, founder of the science of eugenics. I trust it will be the keynote of this Congress. To know the worst as well as the best in heredity; to preserve and to select the best—these are the most essential forces in the future evolution of human society.

VII

CREATIVE EDUCATION IN AFTER-LIFE

In the present chapter I draw not from professional educators but from the lives of men who have been more or less wholly devoted to creative thought. We find that almost unanimously their testimony is in accord with the chief canons set down in the present volume. The scientist differs from the man of letters only in the more enforced adherence to truth and in the elements of serious purpose in all his writings. To attain the highest point he must ever keep before him the ideals set forth in Green's "Prolegomena to Ethics":

> The good will is the will to believe what is true, to make what is beautiful, to endure pain and fear, to resist the allurements of pleasures, in the interest of some form of human society.

CREATIVE EDUCATION IN AFTER-LIFE

Life Experiences of Longfellow, Clemens, James, Ruskin, Thoreau, Chamberlain and Eucken, Pearson, Galton, Ramsay, Mendel, Carlyle, Montessori, Stevenson, Eliot—Mark Twain Challenges Our Creative Power—Thoreau Sets Forth the Nobility of Labor—Chamberlain Champions Observation and Creative Freedom—Pearson Helps to Train the Engineer—Galton Creates a School of Followers—Mendel Discovers the Law of Heredity—Carlyle, Montessori and Stevenson Agree on Creative Principles.

IT is a well known biological principle that our physical stature and growth advance continuously up to a certain period, then are arrested for a time and then retrogress into a period of senescence. This law sometimes applies also to the intellectual and spiritual side of man but there are many exceptions, some even brilliant. As expressed by Longfellow in his famous poem on the golden anniversary of his graduation from Bowdoin College:

> Nothing is too late
> Till the tired heart shall cease to palpitate.
> Cato learned Greek at eighty; Sophocles
> Wrote his grand Œdipus, and Simonides
> Bore off the prize of verse from his compeers,
> When each had numbered more than fourscore years,
> And Theophrastus, at fourscore and ten,
> Had but begun his "Characters of Men."
> Chaucer, at Woodstock with the nightingales,
> At sixty wrote the Canterbury Tales;
> Goethe at Weimar, toiling to the last,
> Completed Faust when eighty years were past.

These are indeed exceptions; but they show
How far the gulf-stream of our youth may flow
Into the arctic regions of our lives,
Where little else than life itself survives.

After the attainment of the school diploma, the bachelor's degree, the doctorate of philosophy or the honorary degree from one or more universities, our education should continue and our creative powers grow stronger and stronger instead of diminishing. This type of education may not be comprised within the new movement for the "education of the adult," nor can we claim that any concerted attention has heretofore been given to creative education in after-life. From my own experience, education in after-life is the most enjoyable part of the entire process, for we are now completely our own masters, we are free to set aside all traditions except those which we have ourselves formed, and the chief daily problem is to discover in this insistent age the *time* in which to do our thinking. But before establishing our own canons, let us consider the experiences of some of the men who have devoted their lives to creative effort.

Mark Twain Challenges our Creative Power

Glancing first at Samuel Clemens, better known as Mark Twain, we find him challenging the creative powers of man in an anonymous volume privately printed and distributed only among his intimate friends, with the title "What is Man?" As noticed [1] in the *New York Times* of May 1, 1910, the book takes the form of a dialogue between an old man and a young man, in which the old man asserts that man is merely a ma-

[1] "Mark Twain's Secret Book Gives Startling Views." *New York Times*, Mag. Sect. p. 2, May 1, 1910.

chine and nothing more. He opens his argument by a comparison of the relative merits of two steam engines, one made of steel, the other of stone, declaring that each is the result of the "law of its make," that no possible process can refine them into something else.

YOUNG MAN—You have arrived at man, now?

OLD MAN—Yes. Man the machine—man the impersonal machine. Whatsoever a man is is due to his make and to the influences brought to bear upon it by his heredities, his habitat, his association. He is moved, directed, commanded by exterior influences solely. He originates nothing—not even a thought.

YOUNG MAN—Oh, come! Where did I get my opinion that this which you are talking is all foolishness?

OLD MAN—It is a quite natural opinion—indeed, an inevitable opinion—but you did not create the materials out of which it is formed. They are odds and ends of thoughts, impressions, feelings, gathered unconsciously from a thousand books, a thousand conversations, and from streams of thought and feeling which have flowed down into your heart and brain out of the hearts and brains of centuries of ancestors. Personally, you did not create even the smallest microscopic fragment of materials of which your opinion is made, and personally you cannot claim even the slender merit of putting the borrowed materials together. That was done automatically by your mental machinery in strict accordance with the law of that machinery's construction. And you not only did not make that machinery yourself, but you have not even any command over it.

In the argument which follows, the Young Man finally says:

It is an exasperating subject. The first man had original thoughts, anyway; there was nobody to draw from.

OLD MAN—It is a mistake. Adam's thoughts came to him from the outside. You have a fear of death. You did not invent that—you got it from the outside, from thought and teaching. Adam had no fear of death, none in the world.

YOUNG MAN—Yes he had.

OLD MAN—When he was created?

YOUNG MAN—No, when he was threatened with it.

OLD MAN—Then it came from the outside. Adam is quite big enough; let us not try to make a god of him. None but

gods have ever had a thought which did not come from the outside. Adam probably had a good head, but it was no sort of use to him until it was filled up from the outside. He had not a shadow of a notion between good or evil. Neither he nor Eve was able to originate the idea that it was immodest to go naked. The knowledge came in with the apple from the outside.

Young Man—Well, never mind Adam: but certainly Shakespeare's creations—

Old Man—No, you mean Shakespeare's imitations. Shakespeare created nothing. He correctly observed, and he marvellously painted. He exactly portrayed people whom God had created; but he created none himself. Let us spare him the slander of charging him with trying. Shakespeare could not create. He was a machine, and machines do not create.

Young Man—Where was his excellence, then?

Old Man—In this. He was not a sewing-machine, like you and me. He was a Gobelin loom. The threads and colors came into him from the outside; and so framed the patterns in his mind and started up its complex and admirable machinery; and it automatically turned out that pictured and gorgeous fabric which still compels the astonishment of the world. If Shakespeare had been born and bred on a barren rock in the ocean, Shakespeare would have produced nothing.

Young Man—And so we are mere machines. And machines may not boast, nor feel proud of their performance, nor claim personal merit for it, nor applause and praise. It is an infamous doctrine.

Old Man—It isn't a doctrine, it is merely a fact.

Young Man—I suppose, then, there is no more merit in being brave than in being a coward?

Old Man—Personal merit? No. A brave man does not create his bravery. He is entitled to no personal credit for possessing it. It is born to him.

Young Man—And so—

Old Man—Having found the truth, perceiving that beyond question man has but one moving impulse—the contenting of his own spirit—and is merely a machine and entitled to no personal merit for anything he does, it is not humanly possible for me to seek further. The rest of my days will be spent in patching and painting and puttying and calking my priceless possession and in looking the other way when an imploring argument or a damaging fact approaches.

Perhaps at the time Clemens had been reading Oliver Wendell Holmes' "Mechanism in Thought and

Morals" or some materialistic article of the period. At present the mechanistic point of view is far less fashionable than it was and the creative point of view is correspondingly more popular. A modern exponent of the original and creative powers of the human mind is the brilliant Santayana, as seen in his analysis of the powers of William James.[1]

William James enjoyed in his youth what are called advantages; he lived among cultivated people, travelled, had teachers of various nationalities. His father was one of those somewhat obscure sages whom early America produced; mystics of independent mind, hermits in the desert of business, and heretics in the churches. They were intense individualists, full of veneration for the free souls of their children, and convinced that every one should paddle his own canoe, especially on the high seas. William James accordingly enjoyed a stimulating if slightly irregular education: he never acquired that reposeful mastery of particular authors and those safe ways of feeling and judging which are fostered in great schools and universities. . . . While he shone in expression and would have wished his style to be noble if it could also be strong, he preferred in the end to be spontaneous, and to leave it at that; he tolerated slang in himself rather than primness. The rough, homely, picturesque phrase, whatever was graphic and racy, recommended itself to him; and his conversation outdid his writing in this respect. He believed in improvisation, even in thought; his lectures were not minutely prepared. Know your subject thoroughly, he used to say, and trust to luck for the rest.

John Ruskin

As I owe to Ruskin's "The Seven Lamps of Architecture" the direction of thought which led me to choose the same mystic number of seven for the factors or coefficients of creative education, it is interesting to cite a passage from Ruskin [2] bearing on his conception

[1] George Santayana: Character and Opinion in the United States, pp. 64, 66.

[2] John Ruskin: The Stones of Venice, Vol. III, pp. 219-221.

of the real significance of education[1] and on the vagaries of intellectual predispositions:

The great leading error of modern times is in mistaking erudition for education. I call it the leading error, for I believe that, with little difficulty, nearly every other might be shown to have root in it; and, most assuredly, the worst that are fallen into on the subject of art.

Education then, briefly, is the leading human souls to what is best, and making what is best out of them; and these two objects are always attainable together, and by the same means; the training which makes men happiest in themselves also makes them most serviceable to others. True education, then, has respect, first to the ends which are proposable to the man, or attainable by him; and, secondly, to the material of which the man is made. So far as it is able, it chooses the end according to the material: but it cannot always choose the end, for the position of many persons in life is fixed by necessity; still less can it choose the material; and, therefore, all it can do is to fit the one to the other as wisely as may be.

But the first point to be understood is that the material is as various as the ends; that not only one man is unlike another, but *every* man is essentially different from *every* other, so that *no training, no forming, nor informing, will ever make two persons alike in thought or in power. Among all men, whether of the upper or lower orders, the differences are eternal and irreconcilable, between one individual and another, born under absolutely the same circumstances.* One man is made of agate, another of oak; one of slate, another of clay. The education of the first is polishing; of the second, seasoning; of the third, rending; of the fourth, moulding. It is of no use to season the agate; it is vain to try to polish the slate; but both are fitted, by the qualities they possess, for services in which they may be honored.

Now the cry for the education of the lower classes, which is heard every day more widely and loudly, is a wise and a sacred cry, provided it be extended into one for the education of *all* classes, with definite respect to the work each man has to do and the substance of which he is made.

Therefore, in the education either of lower or upper classes, it matters not the least how much or how little they know, provided they know just what will fit them to do their work and to be happy in it. What the sum or the nature of their knowledge ought to be at a given time or in a given case is a totally dif-

[1] Compare with the conceptions of Huxley, Eliot, Adams, Osborn.

ferent question: the main thing to be understood is, that *a man is not educated, in any sense whatsoever, because he can read Latin, or write English, or can behave well in a drawing room; but that he is only educated if he is happy, busy, beneficent, and effective in the world;* that millions of peasants are therefore at this moment better educated than most of those who call themselves gentlemen; and that the means taken to "educate" the lower classes in any other sense may very often be productive of a precisely opposite result. [Italics my own.]

Henry Thoreau

Another poet who speaks from the standpoint of youth, as well as of education, in after-life, is Thoreau, whose emphasis, with Rousseau, is on education through the actual doing of things for oneself, with the hand and with the mind. He says:[1]

. . . I think that it would be *better than this,* for the students, or those who desire to be benefited by it, even to lay the foundation themselves. The student who secures his coveted leisure and retirement by systematically shirking any labor necessary to man obtains but an ignoble and unprofitable leisure, defrauding himself of the experience which alone can make leisure fruitful. "But," says one, "you do not mean that the students should go to work with their hands instead of their heads?" I do not mean that exactly, but I mean something which he might think a good deal like that; *I mean that they should not play life, or study it merely, while the community supports them at this expensive game, but earnestly live it from beginning to end. How could youths better learn to live than by at once trying the experiment of living?* Methinks this would exercise their minds as much as mathematics. If I wished a boy to know something about the arts and sciences, for instance, I would not pursue the common course, which is merely to send him into the neighbourhood of some professor, where anything is professed and practised but the art of life;—to survey the world through a telescope or a microscope, and never with his natural eye; to study chemistry, and not learn how his bread is made, or mechanics, and not learn how it is earned; to discover new satellites to Neptune, and not detect

[1] Henry Thoreau: Walden; or, Life in the Woods. Riverside Edition, pp. 81-84.

the motes in his eyes, or to what vagabond he is a satellite himself; or to be devoured by the monsters that swarm all around him, while contemplating the monsters in a drop of vinegar. Which would have advanced the most at the end of a month—the boy who had made his own jack-knife from the ore which he had dug and smelted, reading as much as would be necessary for this,—or the boy who had attended the lectures on metallurgy at the Institute in the meanwhile, and had received a Rogers' penknife from his father? Which would be most likely to cut his fingers? . . . To my astonishment I was informed on leaving college that I had studied navigation!—why, if I had taken one turn down the harbour I should have known more about it. Even the *poor* student studies and is taught only *political* economy, while that economy of living which is synonymous with philosophy is not even sincerely professed in our colleges. The consequence is, that while he is reading Adam Smith, Ricardo, and Say, he runs his father in debt irretrievably. [Italics my own.]

Chamberlain and Eucken

Under the influence of German culture are two of the foremost writers of the nineteenth century, H. S. Chamberlain and Rudolf Eucken. Chamberlain is in accord with Rousseau's "Emile" in the discovery of individual power and in the absorption from nature of what appears in man as creative originality: [1]

It will only be when we shall have so completely revolutionised our methods of education that the training of each individual from the first shall resemble a Discovery, instead of merely consisting in the transmission of ready-made wisdom, that we shall really have thrown off the alien yoke in this fundamental sphere of knowledge and shall be able to move on towards the full development of our best powers.

The men whom we call geniuses, a Leonardo, a Shakespeare, a Bach, a Kant, a Goethe, are finely organised observers; not, of course, in the sense of brooding and burrowing, but in that of seeing, storing up and elaborating what they have seen.

[1] H. S. Chamberlain: Foundations of the Nineteenth Century, 2 vols., pp. 25, 273, 280.

This power of seeing, that is, the capacity of the individual man to adopt such an attitude towards nature that, within certain limits prescribed by his individuality, he may absorb her ever creative originality and thus become qualified to be creative and original himself—this power of seeing can be trained and developed. Certainly only in the case of a few extraordinary men will it display freely creative activity, but it will render thousands capable of original achievements.

. . . The only thing that deserves to be called culture is the daughter of such "creative freedom," or in a word "art," and with art philosophy—genuine, creative philosophy and science—is so closely related that both must be recognised as two sides of the same being; every great poet has been a philosopher, every philosopher of genius a poet.

Eucken denies to his own people their share of creative power in the following marked fashion: [1]

. . . There is no people more exposed to this danger than are we Germans, with our thorough but heavy and plodding nature; for us it is particularly difficult completely to overcome technique by creation, to attain to that experiencing of oneself in the things without which our work cannot obtain any purely human greatness and genuine simplicity. Thus, today in particular, there exists in our life, a serious discrepancy between the production of intellectual and artistic work and the origination of creations which appeal to and elevate the whole man. If the desire for a more personal culture means that simple fundamental lines of development are to be selected from the surrounding confusion, thence to operate upon the whole of human being, then the movement is worthy of joyful encouragement.

It would appear that erudition has long been stifling the creative power of Germany. France and England, less learned, are far more creative. China, also, which once blossomed marvelously in all forms of creative originality—in art, literature, architecture, manufacture and agriculture even—is now completely static, stifled apparently by her own erudition. McAlister

[1] Rudolf Eucken: Main Currents of Modern Thought, p. 422.

Coleman, secretary of the Chinese Information Service, writes in this connection:[1]

In a recent issue of the *Chinese Students' Monthly* Professor Frank J. Goodnow quotes from the "Great Learning" of Confucius as follows: "The ancients, when they wished to exemplify illustrious virtue throughout the empire first ordered well their states. Desiring to order well their states, they first regulated their families. Wishing to regulate their families, they first educated themselves. Wishing to educate themselves, they first made pure their purposes. Wishing to make pure their purposes, they first sought to think sincerely. Wishing to think sincerely, they first extended their knowledge as widely as possible. This they did by investigation of things.

"By investigation of things their knowledge became extensive; their knowledge being extensive, their thoughts became sincere; their thoughts being sincere, their purposes were made pure; their purposes being made pure, they educated themselves; being educated, their families were regulated; their families being regulated, their states were rightly governed; their states being rightly governed, their empire was thereby tranquil and prosperous."

Prolix as the statement is, it nevertheless breathes the spirit of disinterested research that is the proudest boast of twentieth century science, and it was written some 400 years before Christ.

Pearson Helps to Train the Engineer

The guidance of creative thought seems to be far simpler in science than in literature or art, because nature is the norm or standard in both truth and beauty. Perhaps the poet or man of letters is more dependent on imagination and on shifting codes or standards, while the naturalist is immediately disfranchised if he swerves for a moment from adherence to his code. Certainly, we derive from scientists some of the finest aphorisms; thus the geologist, Grove Karl Gilbert, says:

[1] McAlister Coleman: Why Not Modernize China from Inside?

Education seems to consist in storing the mind and training the mind. If you store the mind only, it may never become trained. If you train the mind, it will store itself.

J. Arthur Thomson, the biologist, recites [1] an impressive experience of Karl Pearson in developing the power of observation and of mathematical precision in statement:

. . . In one of his lectures Prof. Karl Pearson makes the following impressive statement of his own experience: "I have been engaged for sixteen years in helping to train engineers, and those of my old pupils who are now coming to the front in life are not those who stuck to facts and formulae, and sought only for what they thought would be 'useful to them in their profession.' On the contrary, the lads who paid attention to method, who thought more of proofs than of formulae, who accepted even the specialized branches of their training as a means of developing habits of observation rather than of collecting 'useful facts,' these lads have developed into men who are succeeding in life. And the reason of this seems to me, when considering their individual cases, to be that they could adapt themselves to an environment more or less different from that of the existing profession; they could go beyond its processes, its formulae, and its facts, and develop new ones. Their knowledge of method and their powers of observation enabled them to supply new needs, to answer to the call when there was a demand, not for old knowledge, but for trained brains. . . . The only sort of technical education the nation ought to trouble about is teaching people to see and think. . . . What we want are trained brains, scouts in all fields, and not a knowledge of facts and processes crammed into a wider range of untrained minds." It comes to this: that, on the whole, the deeper and more difficult studies, which stretch our brains most, are of much more value, even technically, than what are called "useful facts."

Galton Creates a School of Followers

In the life of Francis Galton, a cousin of Charles Darwin and master of Karl Pearson, we find a mar-

[1] J. Arthur Thomson: Introduction to Science, pp. 237, 238.

velous example of creative originality in the discovery of new fields of research and the application of mathematical standards to the science of heredity, which have been so patiently elaborated by Pearson.

Francis Galton was far from originating the idea that exact quantitative methods are applicable far beyond the range of the physical sciences. Wherein lies then his significance for the science of today, and, perhaps, more still for the science of the future? Not solely in the fact that he sketched in broad lines the manner in which quantitative methods could be applied to many branches of descriptive science, but that without being a professor or teacher of students, he succeeded in creating a school of enthusiastic disciples who, inspired by him, have carried his work and his suggestions into practice in craniometry, anthropology, sociology, genetics, and medicine.

The elements in Galton's character and life which made this achievement possible for him are manifold. Heredity, tradition, education, economic independence, all played their parts, and not least among these stands hereditary temperament. No younger man who knew Francis Galton at all intimately failed to be influenced by his marvellous keenness, his wide but wise generosity of suggestion and practical help, and above all, his equable and lovable personality. His manifest pleasure and gratitude for the simplest little thing done for him; his complete respect for the time and duties of others, whether they were his friends or the servants of his own houshold, produced a reverence which worked its effect, not only on his immediate environment, but upon the men who carried his inspirations and suggestions into practical science.[1]

Of the making of the man of science and the harmony between precocious genius and opportunities for productive work there is no finer passage than that of Wilhelm Ostwald regarding Sir William Ramsay: [2]

. . . The portions of the inheritance constituting a new being probably only on rare occasions fit together or harmonise with each other. The adolescent man then applies the greatest

[1] "Francis Galton." Obituary notice in *Nature,* Vol. 85, No. 2153, p. 441.

[2] Wilhelm Ostwald: Scientific Worthies, xxxvii. *Nature,* Vol. 88, No. 2202, 1912, pp. 339-342.

portion of his energy in the task of organising these accidental inheritances for the purpose of common work and harmonious coöperation, and this task uses up the greater part of the available energy, and withdraws it from productive work. It is only in rare cases that the inheritances are so constituted that they fit each other from the beginning, so that the young man has not to expend any energy on the mutual harmonising of his elements, but can immediately set about this creative work. Such a case seems to be that of Sir William Ramsay. On one occasion he described himself as a precocious, dreamy youth, of somewhat unconventional education. The precociousness is a practically universal phenomenon of incipient genius, and the dreamy quality indicates that original production of thought which lies at the basis of all creative activity.

Mendel Discovers the Law of Heredity

No more illustrious example of the triumph of genius and intellectual predisposition over environment and opportunity can be instanced than the life of the priest-scientist, Gregor Mendel, of whom his great disciple, William Bateson, wrote as follows:[1]

Gregor Johann Mendel was born on July 22, 1822, at Heinzendorf bei Odrau, in the "Kuhland" district of Austrian Silesia. His father was a small peasant proprietor, being the first of the family to raise himself to that degree, and he held his land by a kind of socage, performing "Robot" (agricultural labour) for the lord.

It is recorded of his father that he took special interest in fruit-culture, initiating his son at an early age into the methods of grafting. Mendel's maternal uncle, Anton Schwirtlich, was evidently a man of intellectual tastes, which is shown by the fact that he started private classes for the children of Heinzendorf who could not walk so far as the neighbouring village, for in Heinzendorf itself there was at that time no regular school. Mendel was thus able to say with some pride that he came from an educational family. . . . He appears to have taken great pleasure in teaching and to have been extraordinarily successful in interesting his pupils in their work. He continued this occu-

[1] William Bateson: Mendel's Principles of Heredity, pp. 309-314.

pation till 1868, when he was elected Abbot, or more strictly, Prälat of the Königskloster. The experiments which have made his name famous throughout the world were carried on in the large garden of the cloister. From the time of his novitiate he began experimental work, introducing various plants into the garden and watching their behaviour under treatment.

The types of the great discoverers are most various. To the naturalist the fact is full of meaning. The wild, uncertain, rapid flash of genius, the scattered, half-focussed daylight of generalization, the steady, slow-perfected ray of penetrative analysis, are all lights in which truth may be seen. Mendel's faculty was of the latter order. From the fragmentary evidence before us we can in all probability form a fairly true notion of the man, with his clear head, strong interest in practical affairs, obstinate determination, and power of pursuing an abstract idea. The total neglect of his work is known to have been a serious disappointment to him, as well it might. He is reported to have had confidence that sooner or later it would be noticed, and to have been in the habit of saying, "Meine Zeit wird schon kommen!"

Carlyle, Montessori and Stevenson

All the authors cited above, as well as many of those cited in the course of the present volume, are in entire accord as to creative experience. The process of self-controlled and guided mental development which results in constantly accumulating power of expression and of production—in other words, the creative faculty—develops through use, like all other faculties. If this process is commenced in childhood, "the child will produce outside of himself that which he conceives within himself. This is a proof of his tendency to do something, to produce (his creative impulse), and a token by which he shows this impulse." [1] Therefore, repeating Teufelsdröckh's insistent command: "Produce!

[1] Froebel: Education by Development. International Education Series, Vol. XLIV, p. 61.

Produce! Were it but the pitifullest infinitesimal fraction of a product, produce it, in God's name! 'Tis the utmost thou hast in thee: out with it, then."

The word *produce*, derived from the Latin *producere*, signifies to cause, to create, to originate. To be productive is to be efficient, causative. Similarly, the German word *produkt* in its creative sense has as correlatives *das Werk*, *die Schöpfung*, *Frucht*, hence the adjectives *fruchtbar*, *hervorbringend*, *schaffend*, *schöpferisch*. In defining the word *production*, Baldwin [1] involves, in the field of art and artistic impulse, the idea of creation, and to my mind, under the influence of my prolonged and profound study of the making of the mind in animals and in man, *creation* appears infinitely preferable, for it better expresses what is actually going on in the great drama of human evolution, namely, the incessant addition of new qualities, new characteristics, new powers.

The contrast between the creative and productive and the purely receptive mind is again shown in Baldwin's conception of the word *constructiveness*.[2] As applied to the mind, he says: "Mental constructiveness exists if, and so far as, the ideas and conceptions which enter into a train of thought become systematically modified or newly combined in the process of thinking."

Doubtless we shall progress far beyond the discoveries of Rousseau, of Pestalozzi and of Froebel—in fact, certain admirers of Montessori claim that she has advanced beyond Froebel. One writer [3] contrasts the Montessori and Froebel systems thus:

[1] James Baldwin: Dictionary of Philosophy and Psychology, Vol. II, p. 357.

[2] James Baldwin: Dictionary of Philosophy and Psychology, Vol. 1, p. 221.

[3] Agnes Naumburg: That First Year at School. *New York Evening Post*, June 21, 1913.

The Montessori system re-emphasizes Froebel's defence of the child's right to be active, to explore environment, develop his inner resources through creative effort. Education is to guide activity, not repress it, and the teacher's duty is to nourish and encourage rather than prescribe or restrict. There is in both systems the same insistence upon care of the person, upon acquisition of the ability to wait upon oneself and others, the use of physical exercises, the plea for gardening and outdoor activities. But with these broad generalities, the likeness ends. The differences, Professor Holmes points out, are of arrangement, emphasis, and degree. That means that each system aims to reach a similar ideal through different methods. The different phases of the work are valued differently.

In presenting "A New Definition of the Cultivated Man," Eliot [1] in 1903, named four elements of culture: Character, Language, Knowledge, and Imagination. Although the process of education appears to be more of the aggressive and creative order than that expressed by Eliot in this address, it is interesting and timely to quote his splendid passage on imagination:

The imagination is the greatest of human powers, no matter in what field it works, and the training of the imagination is, therefore, far the most important part of education. I use the term "constructive imagination," because that implies the creation or building of a new thing. The sculptor, for example, imagines or conceives the perfect form of a child ten years of age; he has never seen such a thing, for a child perfect in form is never produced; he has seen in different children the elements of perfection, here one and there another. In his imagination he combines these elements of the perfect form, which he has only seen separated, and from this picture in his mind he carves the stone, and in the execution invariably loses his ideal—that is, falls short of it, or fails to express it. Constructive imagination is the great power of the poet as well as of the artist; and the nineteenth century has convinced us that it is also the great power of the man of science, the investigator, and the natural philosopher.

[1] Charles Eliot: A New Definition of the Cultivated Man. *New York Evening Post,* July 7, 1903.

It is far from my purpose throughout this volume to minimize any one of the great coefficients of education, each of which is essential to creative work of the highest order. The drilling of the mind is just as important as the independent work of the mind; as education exclusively by drilling and over-cultivation of reverence for the past is fatal to creative activity, so the over-emphasis upon self-development and individualism is fatal to the highest order of creative work, which depends upon thorough grounding in all that has been achieved in the past through observation and experience. Of all tasks, the most difficult is the originative or creative; as expressed by Virchow at the Berlin conference on higher education, in 1890, "it is only by means of independent work that the pupil learns to hold his own against external difficulties and to find in his own strength, in his own nature, in his own being, the means of resisting such difficulties and prevailing over them."[1] Virchow protested against the German educational system, in which over-emphasis was laid upon drilling the mind, to the neglect of independent work and character development.

Finally, we Americans are especially concerned in the development of an ideal society of our own, a society in which every moral, mechanical, and artistic predisposition *to do something original* is taken advantage of and trained. We should avoid imitation and everyday adoption of other people's ideas as we find them in the magazines and the daily press and in "every other up-to-date device for frustrating the natural movement of the mind when reading, and preventing that irresponsible rumination of the material in one's

[1] Ernest C. Moore: Discussion and Correspondence on German Education. *School and Society,* Vol. 1, No. 25, p. 889.

own way which is the *soul of culture*." [1] Let us each endeavor to discover for ourselves our own particular gift in which we are predestined to do something original and creative, and thus make the world somewhat better for having lived in it. In the words of Robert Louis Stevenson: [2]

> If you recognize in yourself some such decisive taste, there is no room for hesitation: follow your bent. And observe (lest I should too much discourage you) that the disposition does not usually burn so brightly at the first, or rather not so constantly. Habit and practice sharpen gifts; the necessity of toil grows less disgusting, grows even welcome, in the course of years; a small taste (if it be only genuine) waxes with indulgence into an exclusive passion. Enough, just now, if you can look back over a fair interval, and see that your chosen art has a little more than held its own among the thronging interests of youth. Time will do the rest, if devotion help it; and soon your every thought will be engrossed in that beloved occupation.
>
> . . . We come to those vocations which are at once decisive and precise; to the men who are born with the love of pigments, the passion of drawing, the gift of music, or the impulse to create with words, just as other and perhaps the same men are born with the love of hunting, or the sea, or horses, or the turning-lathe. These are predestined; if a man love the labour of any trade, apart from any question of success or fame, the gods have called him. He may have the general vocation too: he may have a taste for all the arts, and I think he often has; but the mark of his calling is this laborious partiality for one, this inextinguishable zest in its technical successes, and (perhaps above all) a certain candour of mind, to take his very trifling enterprise with a gravity that would befit the cares of empire, and to think the smallest improvement worth accomplishing at any expense of time and industry. . . .
>
> . . . The direct returns—the wages of the trade—are small, but the indirect—the wages of the life—are incalculably great. No other business offers a man his daily bread upon such joyful terms. The soldier and the explorer have moments of a worthier excitement, but they are purchased by cruel hardships and periods of tedium that beggar language. In the life of the artist there need be no hour without its pleasure.

[1] William James: Introduction to Thorndike's "Psychology," p. vi.
[2] Robert Louis Stevenson: Letters to a Young Gentleman.

In closing this chapter and the present volume, we note that all the creators of modern thought, of modern philosophy, literature and art, of modern science, are of one accord whenever they pause in their chief labors and direct their attention for a while on the all-important subject of creative education. It is delightful to the present author, after having independently formulated and applied the theory of creative education set forth in these chapters, to find in these authorities complete confirmation of what he has himself found to be the main principles guiding creative endeavor, from which it appears that we must abandon our old ideal of liberal education as something passive and receptive and substitute something essentially active. The men of letters cited in this volume appear, like myself, to have small faith in the storage system of education, in the idea that the mind, after years of storing, is charged for a splendid explosion, like a storage battery or bomb. Such a result is unthinkable. Great discharges must be prepared for by a long series of minor discharges; the creative effort of the child, of the youth, of the college and university student is the necessary prelude to the creative effort of all after-life.

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