THE SHEFFIELD SCIENTIFIC SCHOOL OF YALE UNIVERSITY: A SIMI-CINTENNIAL HISTORICAL DISCOURSE, OCTOBER 28, 1897

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649258291

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Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

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I SHOULD BE THE LAST TO FORGET OR DISPARAGE THE SERVICES OF UNKNOWN BENEFACTORS. THESE HAVE IN A LARGE DEGREE MADE LIFE FOR US WHAT IT IS. THESE HAVE THEIR OWN COMMEMORATION WHEN WE RECALL THE PROGRESS OF THE AGES.

BUT THERE ARE OTHERS WHO STAND OUT AS LEADERS, AS REPRESENTATIVES. GIFTS, LABOURS, THOUGHTS OF DISTINGUISHABLE ANCESTORS GO TO SWELL OUR SPIRITUAL PATRIMONY. IT MAY HAVE BEEN BY SOME CONSPICUOUS WORK WHICH WAS NOBLY SPREAD OVER A LIFETIME; IT MAY HAVE BEEN BY SOME SWEET TRAIT WHICH WAS JUST SEEN IN A CRISIS OF TRIAL; BUT "HERE AND THERE" THEY HAVE HELPED US, AND IF WE ARE TO ENJOY THE FULNESS OF THEIR SERVICE, WE MUST SOLEMNLY RECALL IT.

IN DOING THIS WE ARROGATE TO OURSELVES NO AUTHORITY OF FINAL JUDGMENT BY GRATEFUL CELEBRATION.

—*Bishop Westcott.*

Press of The Friedenwald Company, Baltimore, Md.

HISTORICAL ADDRESS

This is the hour for congratulation and recollections. It is our privilege to look backward over the path of half a century and to trace the steps, often slow but never devious, by which the penniless, nameless and homeless offspring of an ancient and vigorous stock has attained commanding influence, rich in possessions, beloved by thousands of followers, honored wherever known, and still with the fresh enthusiasm of youth, aiming at lofty ideals, attractive as the face of nature, varied and comprehensive as the laws by which this world is governed.

It would be easy, and it might be profitable, to engage in an exclusive commemoration of those who have made this institution, and to bring forward reminiscences of incidents and events—some of them truly romantic—which illustrate the progress of its remarkable life; yet the dignity of this assembly, the presence of so many persons from a distance, and the relation of the Sheffield School to higher education in the United States forbid such limitations. You must therefore permit me to give a subordinate place to those sentiments which are uppermost in our hearts—congratulations mingled with affection and gratitude, and with vivid memories of those who have departed—while I

try to do justice to their wise and assiduous labors by showing their relation to the times and to the progress of science in the latter half of the nineteenth century.

If the Antiquary should now appear, you would be sure to remember that his task had already been well performed; and if I should assume the garb and chisel of Old Mortality, you might remind me that the moss has not yet gathered upon the inscriptions in yonder cemetery. While Argus and Briareus, the one for the University and the other for the School of Science, are on the alert, it requires some assurance to traverse the annals which they have collected; and yet this discourse must be historical. So in face of difficulties, enhanced by the distance which has separated the speaker from these once familiar scenes, from muniments and archives, I enter upon the duty of the hour, conscious of the honor received from your courtesy and grateful for an opportunity to stand once more among former colleagues, pupils and friends.

To a returning wanderer, it is a delight to see this favored university renewing its youth, at the approach of its second centennial anniversary—more comprehensive, more useful, more liberal and more worthy than ever before of loyal affection and support.

Eighteen hundred and forty-seven is the year of our nativity. But there was a pre-natal existence worth remembering. Truly, Yale College has always stood for Science, and therefore it is no wonder that those who initiated the department of Philosophy and the Arts, just after President Woolsey assumed the chair, had faint notions of the importance of their proceedings. They were quite unconscious of developing new forces.

Mr. Bryce, in his sketch of the Holy Roman Empire, remarks that the year A. D. 476, which schoolboys are taught as one of the most important dates in everybody's chronology—the downfall of the Roman Empire —was no such date to those then living as it has since become, nor was any impression made on men's minds commensurate with the real significance of the event. So it is in our academic chronology. As conclusive evidence, recur to this modest announcement originally made in the Catalogue of 1847:

"It has long been felt at Yale College to be important to furnish resident graduates and others with the opportunity of devoting themselves to special branches of study, either not provided for at present, or not pursued as far as individual students may desire." Accordingly the department of Philosophy and Arts is established. By this simple decree the system of graduate studies now in vogue throughout the land was formally inaugurated. Moreover an inconspicuous postscript states that "Professors Silliman and Norton have opened a laboratory on the College grounds for the purpose of practical instruction in the applications of science to the arts and agriculture."

Thus was born the Sheffield School, with the inheritance of an opportunity, a desire, a hope and a belief, supported by an empty purse and slight expectations.

> "That primal age which did as gold excel
> Seasoned its acorns with keen appetite
> And thirst to nectar turned each springing well."

To illustrate the evolution of this idea, then first produced among us, to show what ingredients it included,

what unexpected nurture it received, what storm and stress it survived; especially to show that this idea was planted in fertile soil by the spirit of our age, the *Zeitgeist*, believing and delighting in the study of nature and her laws, we must consider the state of mankind in the middle of the nineteenth century, and the conditions of liberal education then prevalent in the United States and England. No milestone marks the transition from the old to the new, yet the older men in this assembly are conscious that this is a very different state of society from that of 1847. The education, the creeds, the industries, the commerce, and of course the science and the arts of civilized countries are changed. This is a freer, busier, wealthier, more complex, and indeed a wiser and happier world than that of our fathers—before the gold of California and Australia and the diamonds of South Africa had been discovered, or the magic spark, flashing over land and sea, had transformed the usages of domestic life and the processes of international intercourse; or the life-giving agencies, the heaven-sent blessings of anæsthesia and antisepsis, had removed from the bed of pain, apprehension and distress.

It was the middle of this century when the doctrine of evolution, which has pervaded every branch of natural history, and extended its influence to medicine, anthropology, sociology and history, was publicly set forth, a period, as a recent historian has shown, in which a doctrine that may be traced to Empedocles, Heraclitus and Aristotle, found "its perfect expression" in the writings of Charles Darwin. On the evening of July 1, 1858, a day almost as memorable as that when the

island of Guanahani was revealed to Columbus, the epoch-making papers of Darwin and Wallace were read to the Linnaean Society of London; but it should not be forgotten that, sixteen years before, Darwin had written out a sketch of the Origin of Species, and with wonderful self-control had kept it in his portfolio while he gave eight patient years to the study of barnacles. We have the authority of Sir Archibald Geikie for saying that the two geological chapters in the Origin of Species produced the greatest revolution in geological thought which has occurred in our time. It was in 1860, when Herbert Spencer announced the programme of his philosophical system; but nine years earlier he had printed a volume entitled "Social Statics, or the conditions essential to human happiness specified and the first of them developed." Lyell had been for a long while the leading authority of England in the science of palæontology, but the startling book in which he demonstrated the antiquity of man did not appear until five years after the publication of the Origin of Species. This is not the place to discuss the far-reaching and all-pervading influences which proceeded from these writings, nor to dwell on the controversies they evoked, such as those with which we are familiar between Agassiz and Gray, but I bring these instances forward as indications of the extraordinary intellectual vitality of the middle of the nineteenth century and of the changes in human thought of which this school has been the watchful observer.

I have the authority of an eminent naturalist for saying that "The most significant aspect of this movement is the general recognition, by all thoughtful men, of

the proof which was afforded, by the progress of discovery, of the truth that the unity of all nature is orderly, and discoverable by scientific methods."

In the domain of physics, changes have occurred almost as remarkable. The doctrine of the conservation and correlation of forces, beginning with a determination of the mechanical equivalent of heat, was suggested and developed between the years 1842 and 1862 by Mayer, Grove and Joule. Faraday was then at the zenith of his powers, Helmholtz and Kelvin at the outset of their illustrious careers. But it was as far back as 1830 when Joseph Henry, then a schoolmaster in a country town, reached those discoveries in electromagnetism which made the telegraph a proximate certainty and brought into the intercourse of mankind a revolution almost as great as the primitive invention attributed to Cadmus. Spectrum analysis, that powerful agency which reveals the constituents of incandescent bodies, even the chemical and physical nature of the remotest stars, was then unknown.

Likewise glance at mathematics and astronomy fifty years ago. Laplace had been dead for over twenty years; Gauss was living in an advanced age; Sir Wm. Rowan Hamilton had announced but had not published the new calculus—Quaternions—which was to give him high rank with the greatest mathematicians; Cayley, Sylvester, and Hermite were at the portal of those investigations which have made their names illustrious in the science "which never takes a backward step." The abstract reasonings of such men are beyond the apprehension and appreciation of minds non-mathematical; but this is not true of astronomy, for every human be-