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CONTRASTS[1]

By Professor FREDERICK G. KEYES

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

ANY alumnus of Brown would be very sensible of the honor of being asked to take part in as important an event as we celebrate to-day. When I received the invitation to speak, my first impulse was to rejoice for the opportunity to express my gratitude for the abundant benefits Brown extended to me some thirty years ago. My second thoughts turned to dwell on the significance and meaning of the splendid Metcalf Research Laboratory, designed exclusively for graduate study and research.

That this addition had long been a practical necessity was clear these many years to those who have followed at first hand the rise of the department to a position of outstanding importance. Because of my nearness to the university and my membership on the department's visiting committee, it was easy to comprehend the time and patience expended under what henceforth will probably be referred to as "the old conditions." Professor Kraus and his colleagues will no longer spend valuable time in effecting the compromises required heretofore to provide adequate opportunities for a rising level of graduate students. It is a great joy to know that the efforts of the staff to promote the progress of graduate study and research will take place in a setting worthy of Brown University and of the man whose wisdom and generosity have made the dream of the research laboratory a reality.

Sometimes it is a salutary procedure to pause occasionally, as on the present occasion, to survey the steps which have led up to the present position. The exercise puts events in their proper relationship, promotes a decent humility, induces a just pride, emphasizes the eternal verities, makes for simplicity and enables one to lay the course for the future on a more assured basis.

Brown University was the seventh American college

[1] An address delivered at Brown University, Providence, R. I., on the occasion of the dedication of the Metcalf Research Laboratory of Chemistry on December 28, 1938.

of the nine founded before the Revolution, and all were established exclusively in response to the need for an educated ministry. The college started with a president, James Manning, and one student; without buildings, library or endowment, in the midst of Baptists hostile to ministerial education. The charter of the college was a document of extraordinary liberality, notwithstanding an age of bitter sectarianism in which it was written. It provided that the corporation be composed of four denominations, prescribing the exact number of each to prevent non-Baptists from ousting Baptists and *vice versa*. It stated also that all teachers except the president were to be exempt from religious tests of any kind. Finally, and most remarkable, was the exclusion of all teaching of "sectarian differences of opinion," and "youth of all religious denominations" were on an equal footing in every respect. As a commentary on the present state of tolerance in certain parts of the world, the corporation voted on September 6, 1770, "that the children of Jews may be admitted into this Institution and entirely enjoy the freedom of their religion without any constraint or imposition whatever." In 1774, by the terms of a ruling, Seventh Day Baptists were not required to attend church and Quakers were exempted from a law prohibiting students from wearing hats indoors. Tolerance relative to science was written into the charter, which stated that "the public teaching shall in general respect the sciences."[2] This liberal and catholic spirit is remarkable, for the temper of the time was quite the contrary. Thus, at Yale a student could only be admitted who was "grounded in polemical divinity according to the Assemblies' Catechism, Dr. Amos Medulla, and cases of conscience," and similar restrictions existed at each of the six colleges whose founding preceded that of Brown.

Chemistry had been taught in medical schools abroad in the 1790's, but instruction in the science at Brown does not appear until the medical school was established in 1811 under President Asa Messer (1802–1826), in the course of whose administration enlarged courses were given in mathematics as well as instruction in mechanics, astronomy, animal and vegetable physiology, pneumatics, hydrostatics and geology. Moreover, the "almost worthless" philosophical apparatus was replaced through the generosity of Nicholas Brown and Thomas P. Ives, "adapted for all purposes of illustration." The first laboratory, also due to the generosity of Nicholas Brown, was set up in Rhode Island Hall in 1841, which contained a museum and lecture rooms. This patron's gifts and bequests amounted in all to $160,000 and set an example to friends of Brown and other colleges. A sum of possibly eight to ten times this amount would represent equal purchasing power at the present period.

Following the Civil War the physical equipment was much improved and the friends of the university gave the library building, Slater Hall, Sayles Hall, Rogers Chemical Laboratory, Wilson Hall for Physics, the Ladd Observatory. At the close of Benjamin Andrews's administration there were nearly a thousand students, of which 101 were graduate students and the staff had grown to 90. Under W. H. P. Faunce's administration the university funds were considerably increased; in 1914 to a total of more than three times that in the previous 150 years, while the physical plant was further enlarged.

The foregoing hasty sketch brings us to the moment of a great change in the role which the universities of the United States were to play in the future; a role, we hope, that will last a long time, provided humanity is tough enough to resist the collective madness surging through the world these twenty years.

The interval between the Civil War and 1914 was of course one of steady development of science, industry and transportation in the United States. The country depended almost entirely upon Europe for goods of exceptional quality, for scientific apparatus, for dyes, pharmaceuticals and numerous other products. Graduate study and systematic research in the universities had made a beginning in the 1880's under the guidance of a few German trained chemists, physicists and mathematicians. By the turn of the century, however, Germany had become the foremost scientific nation in the world and was beginning to straddle it like a Colossus. Nothing apparently could resist the progressively dominating influence of Germany in every department of art, science, industry and world commerce. An insistently proclaimed excellence in every field set the ultimate standard as German, and the hall-mark of the American scholar was a German university degree. The models of scientific research and graduate study were faithfully copied in the American universities, while an increasing stream of freshly Ph.D.'d students from Göttingen, Berlin, Heidelberg and elsewhere in Germany was not infrequently distinguished by a curiously accented German speech which often disdained American pronunciations of the commonest chemical substances. The American student content with graduate study in an American university was believed to be distinctly second rate and was usually offered second-rate opportunities, if any.

Our large-scale manufacturers employed none or few scientific men, and employers frequently selected German and Austrian engineers for responsible positions. Many manufacturers took over, in their entirety, developments perfected abroad for American exploitation, and in general cut themselves off from the great

[2] Science probably included geography, arithmetic, algebra, Euclid, trigonometry, surveying, navigation and astronomy.

body of organized and coordinated knowledge brought together by thousands of university and industrial investigators. When German or other foreign competition reduced profits, it was always possible to raise the tariff.

To-day, a scant twenty-five years later, we look back on an interesting phenomenon: a miracle, as far as pure and applied science is concerned, in every respect as striking as the Greek revival some 2,400 years ago. From a relatively second- or third-rate contributor to scientific advance prior to 1914, the United States is now leading the world in nearly all scientific fields, and the quality of the product as well as the volume is growing steadily. It is a justifiable cause for satisfaction to the university, its graduates and friends, that Brown has contributed generously to this progress in all fields, and particularly in the field of chemistry. It is often the pleasant custom on occasions like the present to permit oneself the indulgence of a good measure of generous comment. In the presence of this audience I shall merely note as every one does the fine quality of the physical plant and the esprit de corps of the scholarly staff of this early American university. The satisfaction arising from the opportunities Brown generously offered have grown richer with the years, and we may now rejoice that these opportunities are preserved and further enlarged for the benefit of the students of the present and the future.

It would be interesting, did time permit, to digress and survey the exploitation of science by industry which runs parallel with the extraordinary revival of science just cited. Relative to the first decade of the century, progress has been striking, but due consideration of the many aspects of the subject convinces one that continued advance in science and industry can not be maintained unless scientific methods and an enduring probity are practiced in the conduct of government, in the drafting and application of laws, and in the conduct of public business generally. Indeed the possibility is by no means negligible that the effects generated in the past six years through the amazing spread of irrationality and emotionalism in government may have been given sufficient momentum to bring about the collapse of as splendid a foundation as ever existed for the most alluring prospect in civilization the world has ever known.

It is quite evident that this remarkable period in the United States, which the future history of science will duly record, is based on a substantial preparatory period. We know that this was the case with the Greek revival, although the induction period apparently extended over several centuries, whereas it is difficult to assign more than a hundred years at most in our own case. That it should be short seems reasonable in view of the character of the people, amongst whom were a normally disproportionate number of intelligent, independent and courageous men and women who were able to function in an atmosphere of freedom without restrictive interferences of political origin. Generous consideration must also be given to the influence of nineteenth century European contributions to scientific development, often brought directly by students returning from study in the foreign universities.

Only a cursory reading of the Federalist papers is enough to show the character, probity and insight of the men available for leadership in the states during the eighteenth century. That they would recognize the fundamental necessity of providing educational facilities for the developing nation goes without saying, and the impulse grew finally to a veritable passion. Perhaps the stimulating climate of the North Atlantic seaboard played its part as well as the intellectual and moral qualities of the early settlers, but the fact remains that the progress of the American colleges was uninterrupted and scientific work of the first order was accomplished in the early period by Franklin, Joseph Henry, Priestley, Hare and others.

As already stated, after the Civil War large numbers of our younger men attended the German universities. Thus, J. W. Gibbs, A. G. Webster, Rowland and many others came under Helmholtz's influence, while the number of chemists awarded the doctor's degree grew year by year down to 1914. I believe it is substantially true that in science the influence of these German-trained young men provided a technically deep and sound foundation which, functioning under American conditions, produced American chemistry as well as American physics and mathematics. Beginning with the turn of the century, their influence had begun to have a pronounced accelerating effect on research.

The presence of a relatively large number of enthusiastic and talented young scientific men in our universities is certainly one of the necessary factors for good progress, but this alone would have been insufficient to account for the American miracle. The factor of tremendous importance, perhaps even decisive, was indubitably the existence of our free institutions, financially independent and unhampered by centralized bureaucratic control. Their liberating influence over successive generations produced a type well suited to widening intellectual frontiers. Self-reliance and resourcefulness probably come to be inherent characteristics in a people who have the stamina needed to settle a continent in a relatively short time.

The financial independence of our universities permits great freedom in the development and exploitation of a variety of educational objectives which has had an extraordinary stimulating effect on our university students, in spite of the fact that good judgment

has not always been exercised. It has also made possible abundant laboratory facilities, which accounts for the manipulative skill characteristic of the American student. The rising prosperity of all classes of the rapidly growing population in the midst of unparalleled natural resources is another factor not to be neglected. Under such conditions the probability that all grades and varieties of talent in the population will be given an opportunity to develop is very great. This is the fruition of the principle of equality of opportunity, without which no society can discover a large fraction of the varied abilities latent in its people.

The phenomenon of the founding and the endowment of large numbers of colleges and universities generously and consistently supported for three hundred years by private enterprise and generosity is certainly without parallel in recorded history. The growth of this almost universal generous public spirit is moreover a distinctly American phenomenon[3] and it is responsible for the establishment of every sort of institution in the public interest. It should be remarked that in isolated instances free institutions have been established in Europe by groups of public-spirited citizens. These at the present time have become defunct or seriously damaged financially. Where, however, in the established circle of history can an institution resembling the Rockefeller Foundation be found, to name only one conspicuous example of a product of private generosity characteristic of, shall I say, "economic royalists" and "entrenched greed"? Where also does there exist in the record of the past a single instance of privately endowed organizations establishing research institutes, repairing war's destruction, feeding the starving and clothing the naked the world over? It would take more than my allotted time this afternoon to even outline the manifold beneficences and varied civilizing influences that have flowed in an ever-increasing volume from the remarkable public spirit characteristic of the citizens of the United States. Fundamentally we owe our free institutions to the existence of this spirit, and through the opportunities afforded, the talented men and women of the United States have been given unparalleled facilities to exploit their abilities in an atmosphere of freedom according to the scale of their inherent abilities. It is unquestionably our free institutions that have provided the essential basis for the greatest scientific and industrial awakening on record.

Brown University is one of the institutions that has helped to bring about this great miracle. The question arises inevitably: Will the conditions and circumstances which have supported the movement persist and allow continued progress? What, for example, is the prospect that we will often again assemble to rejoice under like circumstances in the gift of a building provided by private generosity? Unfortunately we are not without indications that influences and trends have been developing more or less parallel with the scientific and industrial rise which may eventually crush or even destroy the unique qualities of enterprise, courage, independence, resource, tolerance and public spirit inherently responsible for the American phenomenon. These influences for the most part have the appearance of being of direct political origin, although fundamentally, in a country organized as the United States is, subversive political influence is traceable either to lack of popular understanding and interest or to stupid human inability to defer apparent temporary advantage for future permanent gain. Certainly if the present destructive financial and other governmental tendencies continue, the descent from the heights to which we are ascending will be spectacularly rapid. It can not be overemphasized that processes of destruction once in motion come to a halt on levels where the distribution of poverty can contrast sharply with the widest diffusion of prosperity and well-being ever known to mankind. The incentives to public generosity are certainly in danger of drying up, due largely to unwise fiscal policies, intemperate legislation and increasingly huge taxes. Little imagination is required to foresee that if the trend is not halted, all private endowments will be irreparably damaged and the evolution of democratic institutions retarded. The loss of financial freedom on the part of our universities and manifold public institutions involves not only a staggering material loss to the people of the United States but the destruction of social values and the obliteration of a civilizing spirit which is sorely needed in a world where the terrors of ancient human savagery press upon us from every side.

I realize there are those who think otherwise, at least in part. The great state universities will be cited as examples of politically supported institutions. But does any one doubt that they would stand at their present level, in serious activities, were it not for the example, performance and competition of the independent universities that still serve as models and which function for half the college and university students in the country. Should any one doubt the dire calamity that would attend the passing of our free institutions, let him investigate the opportunities, equipment and facilities of European universities at the mercy of political functionaries. The experience of residence abroad will show the interested observer the utter poverty of physical equipment except in a very few centers, and also disclose the restrictions and central-

[3] Private charities and the establishing of independent institutions proceeded in England during the nineteenth century, but the magnitude of the development was far less than in the United States, as would be expected, on the basis of the greater natural resources in the latter country.

ized bureaucratic control that retard progress while suppressing enterprise and initiative. University men and women abroad too often carry on their scientific labors in poverty, with poor facilities and no assistance, while burdened with teaching and routine prescribed by the political bureaucracy in power at the moment. The few of genius and talent upon whose efforts much of the prosperity and well-being of the masses depend function (in Europe) with difficulty, without adequate rewards or incentives, while spiritual evolution and advance in physical welfare are slowed to a fraction of that possible under our favorable conditions.

As Arthur D. Little says in his fine essay "The Fifth Estate"—"Our civilization is certainly imperiled, but there will be no downfall if mankind can be taught to follow the light already before it." "In the past the world suffered grievously from lack of knowledge; today it suffers from its rejection or misapplication." "With the recognition of the spirituality of science and the divinity of research and discovery should come larger interests and a new breadth of vision to the average man, and to us all an acknowledgment of the steadfast, purposeful striving shown in the development of the created world, together with a reverent appreciation of man's privilege to aid and further this development."

Professor Kemmerer, of Princeton University, has shown in a recent article that the endowments of our universities are already in danger and indicated clearly the undermining of democratic institutions brought about by unsound government financing.[4] He cites what should be an obvious fact, curiously unappreciated by the holders of 113,000,000 insurance policies, that it is the creditors who must pay ultimately for the consequences of unwise fiscal policy. These creditors are of course the people who hold bonds, our universities and educational institutions (1 and ½ billion), insurance companies (100 billion dollars), hospitals, museums, libraries, foundations, religious organizations; in fact, every institution holding bonds and mortgages. As Professor Kemmerer states: "These creditors are our most conservative investing classes—classes whose welfare is a matter of such great social importance that we protect many of them by special laws which restrict the investment of trust funds to a limited and supposedly safe field of investments." That the situation is now grave is beyond question.

There is also the further problem. Where are our independent institutions to turn in the future for the additional financial support needed to promote research and improve educational procedures? The adoption of the income tax formulated on the so-called principle of "the capacity to pay" has, to say the least, made it very difficult for generous public-spirited citizens to give money to the universities or other public institutions and it has already gone far to promote the tendency to "let the government do it." That is sad enough, but the "highly progressive income, inheritance and gift taxes on the part of both the national government and the states, taxes whose combined rates in the higher brackets are already the highest of any advanced country in the world" (to quote Professor Kemmerer) makes it likely that the impulse to generous giving will soon die for want of the means of reasonable exercise.

It is in order to ask what can be done to halt the danger. In a free country we have the glorious right to discuss a situation, and a danger promptly recognized is often partly forestalled. In a true democracy it is moreover the business of every one to exert himself in the public interest according to the measure of individual ability. First: Every citizen should be made aware that the qualities of public spirit and public generosity so wide-spread in the United States are unique in the history of the world, and without parallel anywhere except to a far lesser degree in England. Second, the examples by suitable classification of our privately endowed educational institutions, hospitals, scientific and medical foundations, charitable and religious organizations, museums and student-aid organizations should be clearly described and the present amounts of the endowments given. It is important also to give for comparison the number of similar institutions in the rest of the world with the amounts of their endowments, before the war and at present. I understand Professor P. G. Wright has prepared a report under the Duke University Endowment which gives data for certain independent institutions in Germany, Austria and France. Third, the viciously-false unsupportable statements incessantly promulgated in the United States that only a few wealthy individuals pay the taxes expended by government should be vigorously refuted by appeal to the facts. These facts are available, and there are many ways in which their significance and importance can be made clear to every one. An important item related to this which seems to have escaped the attention of a very large number is that a continuation of the present fiscal and other government policies is endangering the hundred billion dollars worth of insurance back of 113,000,000 widely held policies. Fourth, the attention of people should be focussed on the relation of our free institutions to the public welfare and to the astounding progress in civilizing influences they have promoted. This can perhaps be most strikingly exhibited by comparisons with conditions in other countries since 1900, and especially the contrasting wide-spread prosperity in the United States amongst those possessing industry and goodwill should be made crystal clear by numerical elaboration. Fifth, much of the criticism about the incompetence and demagogery of politicians, while too often

[4] E. W. Kemmerer, *Atlantic Monthly*, 160: 729, 1937.

justified, should be abandoned for a policy of positive assistance to those in public office who are capable and sincere. It is commonplace that under our system politicians must have "causes," and other things being equal, it is ridiculous to suppose they wilfully prefer false ones. It seems clear that it is the people with insight and intelligence who should provide the causes and support the politicians who demonstrate their sincerity by doing effective work for them in the form of providing and disseminating accurate data and information relevant in the promotion of all causes which will insure the preservation and growth of a free, just and liberal society.

We belong to a group which has been selected by the so-called higher educational system of our country. Favored by natural endowment we have been enabled to utilize magnificent advantages provided by our free institutions. Advantages, facilities and an environment of freedom which can exist on the present level only as long as the good will, the generosity, the tolerance and the unique public spirit which created them are preserved.

Many of you will join with me in confessing, however, that while passively grateful for our advantages, we have scarcely done anything actively to insure that the advantages we enjoy will be passed on undiminished and enhanced, to our successors. I am convinced that the greater part of the men in public office do not realize the nature or value of that which is so commonplace in our country. It is our duty to take action without delay, perhaps through our scientific societies in a concerted effort to preserve our heritage of financially free institutions, and save from perishing the priceless spirit of public generosity which brought them to their present flowering.

The message I bring has a somber cast; perhaps too serious a tone at the hour of rejoicing. But we have come upon evil times and see the finest fruit of our labors being misused increasingly to blight the spirit of mankind and to blacken his soul. Alas, no one wishes more than I do that the poisons distilled into the world by addled brains since I trod this campus thirty years ago could be spontaneously neutralized. We, however, more than any one else, have the imagination to envisage the evils and the power to neutralize the poisons by uniting and exerting ourselves promptly and courageously. In doing so, we will give tangible evidence of gratitude for gifts received, and which is more important, save from perishing the divine civilizing spirit that gave Brown University the Metcalf Research Laboratory.

FREDERICK G. KEYES

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

OBITUARY

SAMUEL PRENTISS BALDWIN

SAMUEL PRENTISS BALDWIN, widely known for his pioneer work in the trapping-and-banding of wild birds and for his Research Bird Laboratory, was born at Cleveland, Ohio, on October 26, 1868, and died of coronary thrombosis in that city on December 31, 1938. He was the son of Charles Candee and Sophia (Prentiss) Baldwin.

His father, a judge of the circuit court of appeals, was one of the founders and principal supporters of the Western Reserve Historical Society and was deeply interested in archeology and geology. The son inherited his father's tastes, and was a trustee of the Historical Society from 1907 until the end of his life.

After graduation from Dartmouth College in 1892, Prentiss studied in the Law School of Western Reserve University and was the first to receive its degree of LL.B. in his class of 1894. For six years he was a member of law firms in Cleveland, but withdrew in 1900, and for a considerable time thereafter was engaged more or less continuously in business.

At intervals in this early period the law had to give way to geology, when Mr. Baldwin took part in geological expeditions to the Muir Glacier and to New Mexico; but after 1900 he returned to his first love, natural history, and devoted himself more or less completely to ornithology.

In 1914 Prentiss Baldwin became interested in the newly devised method of banding wild birds—encircling one of their legs with a numbered, aluminum ring—so that, if later recovered and reported, incontrovertible data upon their wanderings and longevity could be secured. In the course of these practises, which were systematically conducted at his Gates Mills farm in Ohio, in summer, and at Thomasville, Ga., in winter, Dr. Baldwin devised traps for securing large numbers of living birds, and originated the method of trapping-and-banding adult birds, which by 1920 had become so successful that it was approved by the Biological Survey. This governmental agency, which took over the work of the American Bird-Banding Society in 1920, soon became the "clearing house" for the registration of the recovered aluminum bands, that began to flow in from all parts of the country. As a result of this movement four Bird-Banding Associations, The Inland, Eastern, Northeastern and Western, were established, thus covering a large part of the continent of North America, and affording all necessary assistance to their