When Millikan Came to Caltech

An extract from the forthcoming "Autobiography of Robert A. Millikan" *

After serving as vice-chairman of the National Research Council in Washington during World War I, Robert A. Millikan returned to his post as Professor of Physics at the University of Chicago in the last days of 1919 with some very definite ideas as to the needs of the United States in the field of the physical sciences. The most definite of these was the necessity for establishing research institutes in physics and chemistry in at least half a dozen universities well distributed over the country. Though he naturally expected the University of Chicago to be the location of one of these institutes, he failed to get immediate support there for the idea of an augmented staff and facilities for the physics and chemistry departments.

EARLY in 1921 the health of Dr. Scherer, President of C. I. T., broke down, and my Pasadena friends, George Hale, Arthur Noyes, Henry Robinson, Dr. Norman Bridge, and C. I. T. Trustees Arthur Fleming, Harry Chandler, George Patton, and Henry O'Melveny, who in the winters of '20 and '21 had been content to have me spend the fourth quarter of my Chicago year in Pasadena, laid siege to me to persuade me to change my allegiance and accept full-time appointment at Caltech, as Dr. Noyes had recently done. I told them that my first loyalty was to the University of Chicago, that I had been entirely content there, and that I proposed to remain there if the conditions for carrying out my program in physics were made satisfactory.

To show me that if I came to Pasadena these conditions would be made satisfactory, Mr. Arthur Fleming, president of the board of trustees, came to me with the proposal that if I would come full-time to Pasadena he would transfer his fortune in trust to the institute. He estimated its value at $4,200,000. He would guarantee me an annual income *for the development of the strongest possible department of physics* of not less than $90,000 per annum, which he anticipated would rise in a year or two to $130,000.

Then Dr. Noyes came on with his Caltech sales talk, as follows: The institute was indeed a very weak institution, with practically no endowment, with but three permanent buildings on the campus: (1) Throop Hall, a good large engineering and administration building costing in 1910 some $170,000; (2) the first wing of the Gates Chemical Laboratory built in 1916 under Dr. Noyes' direction at a cost of $70,000; and (3) Culbertson Assembly Hall, holding 500 persons, built in 1921; but the president of its board, Mr. Fleming, was tremendously interested in the institute's development and each year he made up its deficit from his personal fortune. The institute was ideally located in the most rapidly growing area in the United States, an area that had terrific need for science and its applications but with no possibility of satisfying that need save as the California Institute of Technology could qualify for such a role.

This area had already pioneered in developing the world's first 220,000-volt electrical transmission line. It had here the Mt. Wilson Observatory, already more famous scientifically than anything else in the West. This, with the Huntington Library less than a mile away, and the California Institute of Technology—if the latter could but become outstanding primarily in physics and chemistry, the basis of all engineering and of all biology—would constitute, with suitable cooperative arrangements between the three institutions, a research center in Pasadena of no mean proportions.

But the biggest asset that C. I. T. had, in addition to a remarkable Board of Trustees, was Dr. Noyes himself. His influence in the development of M. I. T. had been exceeded by that of no other individual. He had been at one time the acting president of that institution. While retaining his post in chemistry at M. I. T. for some seven years prior to 1921 he had been spending his winters in Pasadena, and since 1916 directing research in the Gates Chemical Laboratory; but in 1919 he resigned from M. I. T. so as to be able to devote his entire energy to C. I. T. Dr. Noyes felt, and often said as much to me, that the last thirty years of advances in physics were of much more basic significance than were those in his own field, chemistry; that physics itself actually underlay chemistry as well as the whole

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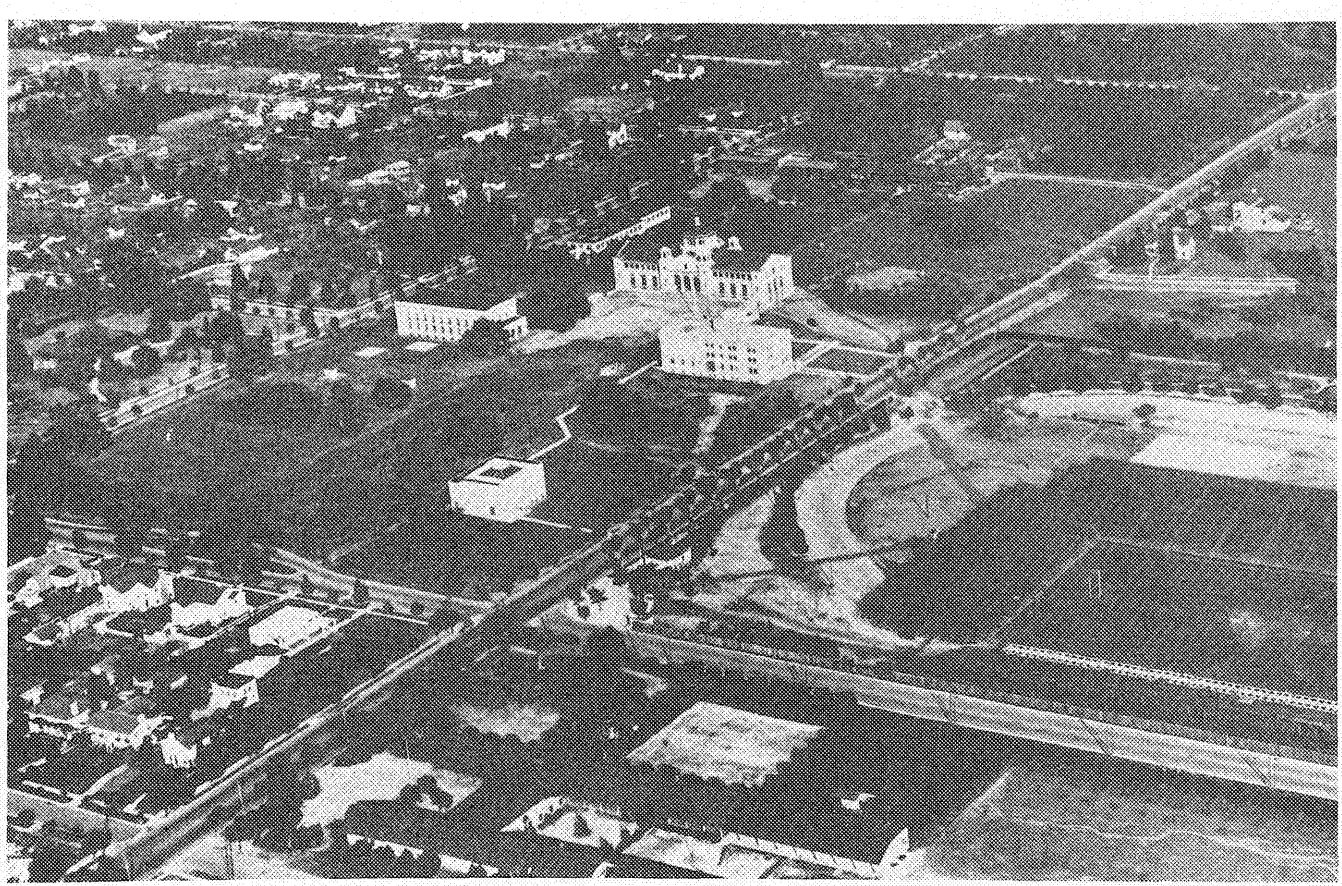


In 1921 the Institute consisted of four buildings — Throop, Gates, East Bridge and Culbertson.

of biology and of engineering, and he was therefore willing completely to subordinate his own field, chemistry, at C. I. T. to developing strength in physics; that he was wholeheartedly behind Mr. Fleming's proposal to commit a large fraction of the latter's resources to the strengthening of physics, for if physics succeeded the turn of the other departments for expansion would come later, while without strong physics their turn would never come. Such complete self-effacing objectivity is very rare and a very great asset to any individual, and even more so to the institution which he is trying to serve.

But Dr. Hale was my most ardent wooer. He did not quite tell me that he would shoot himself if I did not yield to his suit, but I did actually have some misgivings about his health if I turned him down.

Before making any decision I had another conference with Professor Michelson and another with the administrative authorities at Chicago. Mr. Michelson and I were of one mind, namely, that in a great university like Chicago it is in general next to impossible to get the administration to break step and push one department out in front of the others, no matter how much the general interests might demand such discrimination. Mr. Michelson left me with, "If I were a few years younger I would join you in an ultimatum that it is a substantial increase now in the physics budget, or else! In any case, I will back you to the limit in such a move, since you are not even suggesting an increase in your own salary." The administration did not like ultimatums, perhaps correctly, and so my California venture began in September 1921.

Moreover, the best thing that ever happened to physics in Chicago followed upon my departure. I was fifty-three when I left and my departure not only made it possible but necessary for Chicago to bring in quite a group of younger and abler men who have put Chicago physics very much on the map. I knew this had to happen, and it did happen. My leaving the university, which had given me my chance, was my greatest service to Chicago.

Further, my move made possible the development of a new and active center of scientific and engineering progress which perhaps would not have been created had I remained in Chicago.

Also, I had been extremely sympathetic with President Harper's effort about 1900 to create an engineering department at the University of Chicago. I had no sympathy with the ivory-tower attitude which I found all too prevalent there. The intense interest in fundamental advances is so powerful an urge in everyone that I had no fear whatever of its being smothered in utilitarianism. The continual analysis of *the ultimate* value of our activities to the progress of the race is a wholesome, not an unwholesome, attitude. It is the best possible stimulant to wise choices, the best deterrent to useless research, of which there will always be aplenty. I was happy to become associated with an institution which was likely to be active in following discoveries through to their applications. In a word, I believed heartily in the intimate association of science and its applications because of their mutual stimulus. *At Pasadena science and engineering were merged in sane proportions.* That situation attracted me greatly.

Finally, the only member of the University of Chicago faculty who resented my leaving told me a few years ago that physics in the country had certainly gained greatly from my move.

My first job at C. I. T. was the development of a program in physics. One of the influential conspirators

who had set out as early as 1919 to try to detach me from Chicago and attach me to Pasadena was Dr. Norman Bridge, a beloved retired physician who had early come to Pasadena with tuberculosis, made fortunate investments in oil, and was seeking to invest his fortune where it would most effectively serve the public interests. I think it was less than a month after the close of World War I that he telephoned me from New York while I was back in Chicago and invited me to take the Century to New York that Friday afternoon and spend the week-end with himself and Mrs. Bridge at the Plaza Hotel. I packed my traveling bag at once, and the next evening as the three of us chatted together he told me that he was ready to provide the institute with such a laboratory of physics as I might plan if I would take its directorship.

I did not agree at that time to leave Chicago, but I did agree to do such directing as I could by being in Pasadena for the winter quarter of each year, just as Dr. Noyes had been doing with respect to the Gates Chemical Laboratory since the inception of that laboratory in 1916. With that much encouragement Dr. Bridge instructed me to have the New York architect Bertram Goodhue draw the plans for the first unit of such a "Norman Bridge Laboratory of Physics."

Dr. and Mrs. Bridge ultimately put more than a million dollars into the three units of that laboratory and its maintenance. The first unit was completed and ready for occupancy by the fall of 1921, so that when in the late summer of 1921 I had decided to make the transfer from Chicago to the institute I had a fine new laboratory, as well as an adequate budget, with which to attract to the institute graduate students and also the newly established National Research Fellows. They came at once in encouraging numbers.

Recruiting a Staff

In September of the year 1921 I went to Europe in response to an invitation to participate in the so-called Solvay Congress, consisting of twenty-five physicists especially invited by Mr. Solvay to assemble at his expense in Brussels to review the present state of physics. I used this visit to Europe to persuade Dr. H. A. Lorentz to spend the winters of 1921-22 and 1922-23 at the Norman Bridge Laboratory. I also brought back with me from Leiden, as a new member of our physics staff, Dr. P. S. Epstein, an altogether outstanding theoretical physicist; and I further went to Cambridge and arranged to have Charles Darwin join us for the following year. Paul Ehrenfest of Leiden, Arnold Sommerfeld of Munich, and Albert Einstein later came on similar temporary appointments, each for at least two successive winters. In Washington, too, I gathered in Richard Tolman as a permanent staff member straddling physics and chemistry. These men, with Harry Bateman, who was already on the staff, gave as good theoretical leadership as could be found anywhere.

On the experimental side, the National Research Fellows in general brought their own experimental problems with them, and I myself had a bag full of problems that I distributed among the graduate students, just as I had been doing at Chicago. Further, I continued to conduct the graduate seminar in physics. This started the first year (1921-22) with a very inspiring group of twenty-five men, and it grew in the following years to an average attendance of about forty. Further, I had induced the twenty-two-year-old I. S. Bowen, who in 1919 and '20 had been working with me on my personal researches at Chicago, to come with me so as to continue our collaboration at Caltech, both on hot-spark spectroscopy and on cosmic-ray work, in which latter field we made our first balloon flight to an altitude nearly double any thus far attained in Europe. This flight was made in April, 1922, from Kelley Field near San Antonio, Texas, from which point Dr. Victor Neher and I, in the thirties, made some of our best and most illuminating flights.

Small—and Selective

In those early years I did not allow administrative duties to interfere with my primary job of trying to build an outstanding department of physics—the main objective of my going to Caltech. So far as internal administration was concerned, the setup of the institution did not require much of it from me. It was small and highly selective, and we proposed to keep it so. We left the very important problem of mass education to other institutions. The executive council and the trustees were a unit in limiting the number of freshmen admitted each year to 160. Without counting on losses, that would give a total undergraduate body of 640. We did not expect many undergraduate "fatalities" because we had set up a system for the careful screening of applicants, all of whom were required to pass entrance examinations in (1) mathematics, (2) physics, (3) chemistry, and (4) English and history. These examinations were adapted to the level of those finishing the twelfth high school grade.

We admitted no undergraduates whatever by credentials alone, for we wished to avoid the cruelty of admitting men and then dropping them because of unfitness for *succeeding* in the field of our type of training. The failure would then be our fault, not the applicant's. No man was injured, or developed an inferiority complex, if he had to go elsewhere because of failure to pass our entrance tests. It merely meant that his aptitudes did not lie in the direction of our program of studies. He knew, too, that three or four times as many failed as got in, and this try at the examination was his own private business.

Again, we were pioneering in developing an intensive three-year postgraduate program in engineering, with a definite sequence of studies leading to three graduate degrees—the master's degree, M.S.; the professional degree, E.E., C.E., M.E., etc.; and the doctor's or Ph.D. degree, but we wanted all of our staff to have the broadening effect of some undergraduate teaching, although not so much as to swamp them in their efforts to build for themselves outstanding reputations in their professional fields.

The Balance of Power

I shall next give the administrative setup with a presentation of my views about the weakness of power in the field of university administration, beginning with the unsupported assertion that in general the American college or university president has or may assume more power than is good, either for him or his institution. I attribute most of the academic rows about which I have known during the past sixty years to that situation. The following incident shows that I arrived at something like these views as a very young man.

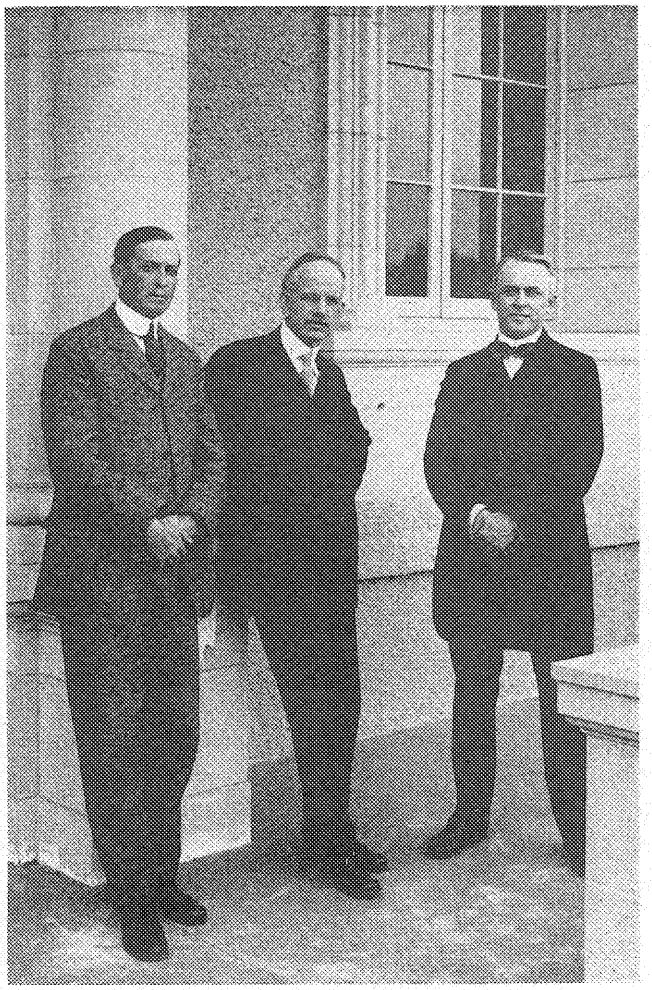
When the University of Chicago was being organized Dr. Harper appointed some dozen or more head professors, paid them the princely salaries (for those days) of $7,000 each, made them essentially czars in their departments, and gave them much power, also, in the

University at large. Some of us younger men led a debate in the faculty as to the wisdom of having head professors at all and got legislation enacted to the effect that no new head professors were to be appointed.

Our argument was that the great University of Chicago of the future, as we envisaged it, would want a number of men of distinction, perhaps many in some single department, and it would be harder to get and hold such men if they had to be subordinated to a one-man departmental head. We therefore urged and secured the abolition of the departmental head after the existing departmental heads were gone. We urged, too, that the highest rank and the highest salaries obtainable in the University of Chicago be associated with its most distinguished and outstanding scholars and teachers, rather than with its deans or other administrative officers, administration being in general subordinated to distinguished intellectual accomplishment.

All full professors in each department were to be charged with electing a man to be responsible for the administrative details of the department. He might be, and perhaps in general would be expected to be, one of the younger men, not one of those of greatest distinction, largest accomplishment, or highest salary. This plan of departmental organization, first started, if I mistake not, at the University of Chicago in the nineties, is now, I think, the most approved type of departmental organization in a large number of our foremost universities, the administrative officer being called "chairman" (in general a rotating officer) rather than departmental head.

However, in my sixty-three years of intimate contact with academic institutions it is not only in departmental organization that I have often felt that there was room for this kind of improvement. Probably the most frequent difficulties which American universities and colleges encounter have their origin in the distribution of power between the president, the faculty, and the board of trustees.



Arthur Noyes, George Hale and Robert Millikan in 1921

Organization of the Institute

What, then, is the origin of the American system in which the president is given so much power and stands to such an extent for the university? I suspect that the system has been transplanted from American business in which, especially because of the newness of the country, aggressiveness and activity being the indispensable qualities for success, there has developed, quite logically, too, a semi-military form of organization with lines of authority and responsibility clearly marked. Let me call it the Pentagon philosophy of organization, and let me recognize the fact that wherever *action* is more important than *wisdom*, as in military operations and to a lesser extent in American business, it represents at any rate a natural, if not a necessary, mode of organization. Also, since the trustees of most of our higher educational institutions are nearly all business men, a president and a hierarchy of deans was the natural basis about which the whole institution became organized and managed.

At the time when I went to the institute with a well formulated scientific program, which it was my purpose to carry out, the Pentagon philosophy obviously represented an impossible mode of organization for me to fit into. The trustees asked me to take the presidency, but I thought that the title itself would act as a deterrent to my scientific program, which I was determined not to abandon.

The written contract that I signed with the trustees when I came to the institute provided that I was not expected to spend my time raising funds; that my first and most pressing job was to build the best department of physics of which I was capable with the aid of a yearly fund of not less than $90,000 if I needed it. The expansion of other departments was to come later.

We then set up a scheme of organization of the institute that was based on the postulate that the field of higher education differed radically from the field of military operations or the field of business in that in it *wisdom* was vastly more important than *action*, and that *wisdom only comes from the joint, independent judgments* of a group of able and informed men. We therefore set up, to take the place of a president, an executive council consisting of four of the most interested and active trustees (an educating device for them) and four members of the faculty, all of large experience in educational matters.

The eight men constituting this council were entirely equal in authority and responsibility. There was no one above any of them save the full board of trustees. These eight met more frequently than the board, discussed beforehand all questions needing the attention of the board (of membership twenty to twenty-five) voted by telephone on obvious, noncontroversial matters, and came to know the institute from A to Z. The four faculty members of the Council sat with the board but had no vote in it. The board elected me chairman of the executive council, but the board got its picture of the institution and its staff equally through the four faculty members of the council rather than as usual through one man, the president, who thus lost power

PERSONNEL OF THE NORMAN BRIDGE LABORATORY—1921

Benioff DeRemer DuMond Goode Lewis Brode Greenlees Pearson
Klein S. Smith Miss Bedell Burt Bowen Friauf Claney Otis Merkel Henny
Whitney Watson Millikan Lorentz Epstein Bateman Gilmore

while the board gained greatly in its knowledge of the institution and the dependability of its own conclusions.

The following eight men served on the executive council without change for more than ten years: from the staff—Arthur A. Noyes, William Bennett Munro, Thomas Hunt Morgan, and myself; from the trustees —Allan C. Balch, Henry M. Robinson, Harvey S. Mudd, and James R. Page. This group thus had all the powers exercised by a president and in addition it had the interim powers of the trustees. Having four active trustees upon it, any clash in judgment between it and the trustees was almost impossible and actually never occurred. Also, embracing four very influential and experienced members of the faculty, it had ideal relations with the staff, which had access to the seat of authority not merely through one man but through four or even eight men. This setup made abuse of power by any individual virtually impossible.

The aforementioned four faculty members of the council, as their names indicate, were all equally competent to represent the institute at home or abroad, for they were all men of broad interests as well as worldwide influence in their respective fields. They all shared the responsibilities of the executive office. After the death of Dr. Noyes and the retirement of Dr. Morgan, Max Mason and Richard C. Tolman, equally well known men, took their seats on the executive council. In general, any subject upon which there was not found pretty general agreement in the executive council at the start, and before prolonged debate, was dropped on the theory that there is practically never need of hasty action in the field of education. If eight competent and experienced men are not in agreement, the subject had better be dropped until conversions have occurred.

In addition to the foregoing device for improving the relations between the staff and the administration, there were set up a rotating faculty chairman and some fifteen standing faculty committees among which a large part of the routine administrative work of the institution was divided. Thus, the administrative work of the institute was spread throughout the whole staff, thereby giving the faculty, to its great advantage, increased opportunity to develop understanding of the institute and some administrative skill, as well as teaching and research ability. This dispersal of administrative responsibilities, instead of their customary concentration in a presidential office, enabled the four faculty members on the executive council to maintain without serious abatement their scholarly activities, as records of the foregoing quartet will show.

Whether such a plan of organization would work in a larger institution some may doubt. Also, there may be other equally good ways of avoiding the bad results, known to everyone, of the undue concentration of power in the presidential office that sometimes has occurred in American universities. The plan was set up to meet an exceptional set of circumstances, and it seems to have worked in the twenty-five years in which I was a part of it. Its essence is in the council of eight selected by the board, half from its own membership and half from the faculty, this council of eight having complete control, subject to the approval of the trustees, of all budgets and all appointments, promotions and salaries. Whether the presiding officer has the title of president or not is unimportant, the charting of some such mean course in university administration between the rule of the czar and that of the academic proletariat is the vital point in the interests of both the ruler and the ruled.