

Noyes, Millikan, and Hale—a painting by Seymour Thomas

A. A. NOYES

A tribute to his close friend and colleague

by Earnest C. Watson

As I look back upon a long and full life spent largely at Caltech, Arthur Amos Noyes stands out as the person whom I most respected, admired, and loved—not only as a scientist but as a man. And if I were to name the single individual to whom in my opinion Caltech owes the most, it would be he.

It is therefore, I believe, very fitting that Caltech's handsome yet functional new laboratory of chemical physics should be named in his honor. I can imagine no more fitting memorial, nor one that would have pleased Noyes more if he were alive.

The familiar painting by Seymour Thomas that

hangs in the Athenaeum dining room portrays the three men, George Ellery Hale, Robert Andrews Millikan, and Arthur Amos Noyes, who were the founding fathers of the Institute. At the unveiling of that portrait I asked Mr. Thomas why he had not done justice to Arthur Noyes' really beautiful soft brown eyes, and Mr. Thomas replied, "I didn't dare. If I had, he would have dominated the picture."

Similarly I feel that if I, or anyone else, were to paint truly the early years of Caltech, Arthur Noyes would dominate that picture. This he would not have wanted, for he was a shy, modest, and retiring

This article has been adapted from a talk given at the dedication of Caltech's new A. A. Noyes Laboratory of Chemical Physics in May 1968 by Earnest Watson, Caltech professor of physics, emeritus.

man, entirely uninterested in his own personal aggrandizement. I shall therefore not attempt to paint the whole picture but will be satisfied if I can succeed in giving you some insight into the lovable personality and sterling character of this trail-blazing educational pioneer.

Arthur Amos Noyes came from pioneer New England stock, with a heritage of common sense, integrity, ingenuity, tenacity of purpose, fairness, courage, and love of nature—as well as the traditional New England reserve. From his father he learned Latin, chess, swimming, rowing, and sailing—accomplishments in which he took a certain amount of pride. It was probably his mother who was responsible for his appreciation of beauty and the arts, especially his passionate fondness for poetry, which he could recite from memory by the hour. I remember a day we spent hiking together on the glaciers of Mount Rainier. Noyes started off in the morning with a stirring recitation of “Sunrise on Mount Blanc” and continued all day in the same vein, almost without interruption.

“If I were to name the single individual to whom in my opinion Caltech owes the most, it would be Noyes”

Noyes entered MIT in 1882, and, excepting about three years of advanced study in Germany, remained there as student, faculty member, director of the Research Laboratory of Physical Chemistry, and acting president for more than 35 years. During much of this time he struggled—without success—to turn MIT into the sort of institution it has now become. It is not surprising therefore that when George Ellery Hale, one of his first students at MIT and later his closest lifelong friend, offered him the opportunity to do in California what he had tried so hard to do in New England, he came to Pasadena. He came to help build here something new in the educational world, “a college, graduate school, and research institute of science, engineering, and the humanities.”

Although the unique center of education and research that Caltech is today was conceived by Hale,

its development was due largely to the vision and careful, painstaking work of A. A. Noyes. Noyes not only originated most of the educational policies that made Caltech what it is, but he formulated them so carefully that they have served almost without change to the present day. These include the commitment to research and creative scholarship at all levels—undergraduate as well as graduate, postdoctoral, and faculty—that characterizes Caltech, and the conviction that research and teaching are so closely related that creativity can, nay must, be carried over into the classroom and become part and parcel of all the Institute’s teaching.

These policies also include the decision not to try to become a university but to concentrate upon the most fundamental fields of science; not to try to cover all areas of knowledge but to become outstanding in a few, and then not to expand into other fields until the right people can be found and adequate financing can be secured. They include moreover the emphasis upon basic rather than applied science and the attempt to train the creative rather than the operating type of engineer—to provide, in a word, education rather than training. They include the limitation on the number of undergraduate students and their careful selection; the requirement of courses in the humanities as a means of providing the students with a broader experience with people and ideas; the development of the student houses as a part of the overall educational process; the fostering of self-government for the students; and the attempt to provide a stimulating, creative atmosphere with close contacts between students and faculty both in and out of the classroom. They include the breaking down of departmental boundaries and the cultivation of interdisciplinary fields. All these and much more were largely due to Noyes.

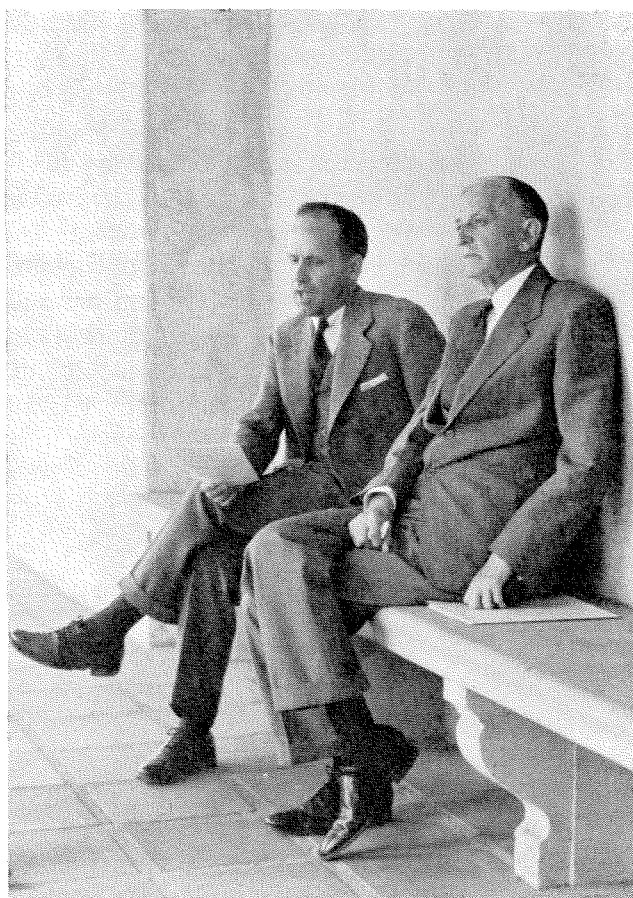
It is hard to remember what engineering schools, even the very best such as MIT, were like 50 years ago, or to realize how great a change has taken place since Noyes provided at Caltech a model of an entirely new type of scientific and engineering school; for this model has been followed by almost all the best engineering schools in this country, and even by many abroad.

What has been the nature of this change? In the early decades of this century the better engineering schools were providing excellent technical training in civil, mechanical, electrical, and chemical engineering. They were turning out young men well

trained to handle the purely technical problems assigned to them. But a few thoughtful scientists and engineers were beginning to realize that while these young graduates had indeed been taught their trades well, they did not have the breadth of view necessary to enable them to take over the larger administrative positions, nor did they have either the imagination or the training in fundamental science and research needed to enable them either to conceive new projects or to grapple successfully with the new types of problems that were already arising in our industrial society. As a result, some of these thoughtful men were advising their sons, when they were ready for college, to go to a liberal arts school for broad fundamental education before proceeding to graduate work in science or engineering—and to research. This is of course a possible solution to the problem, but Dr. Noyes believed that it was not the best solution. He felt that, since science and engineering are closer to boyhood interests than are the arts and humanities, at least a few of the ablest students should be put as early as possible into a research and creative atmosphere. The California Institute as he envisioned it was therefore to be a research institution of the highest quality, where able students would come into contact with creative minds and where the emphasis would be primarily upon the basic sciences of mathematics, physics, and chemistry. But the arts and humanities were not to be neglected or treated as mere requirements to be gotten out of the way before plunging into research. Instead, strong courses in these fields were to be provided, and all students from the beginning of their study were to be required to dig rather deeply into them.

This meant, of course, pushing the highly developed applied courses either entirely out of the curriculum or at least off into graduate years. I am sure you can realize what a struggle it was to bring this about. The engineering faculty felt very strongly that courses in the applications were necessary in the training of anyone worthy of the name of civil, mechanical, electrical, or chemical engineer. And in this they were strongly backed by their professional societies. They insisted that Caltech graduates educated in accordance with the Noyes plan would be unable to compete with graduates of other engineering colleges where more practical training was offered.

These arguments, compelling though they seemed at the time, were soon shown by experience



Physicist Earnest Watson and chemist Arthur Noyes confer outside the Gates Laboratory—1925.

to be unsound. Caltech graduates, although sometimes in the early days at a slight disadvantage immediately upon graduation, have, thanks to their better grounding in basic science, gone further in the long run than their competitors and have been more able to branch out into new directions.

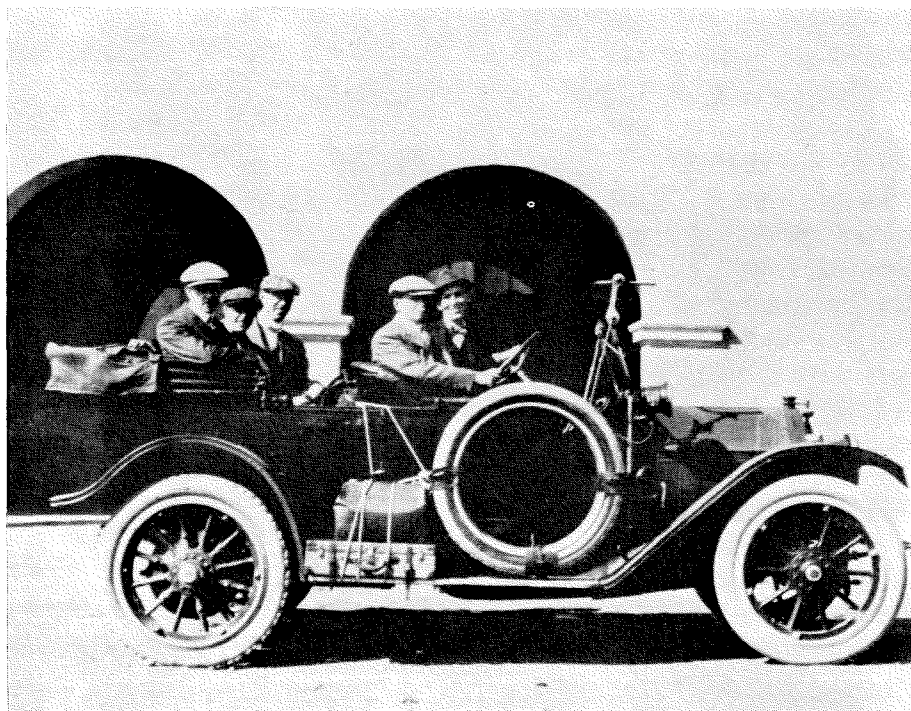
Noyes pushed his reforms through in the firm confidence that this would be the case, and he formulated the necessary policy statements with a compelling clarity. The literate and unambiguous phrasing of statements of all kinds was a passion with him. No slipshod statement ever got by his scrutiny. Indeed, I have actually seen him take out his pencil and revise a letter he had just received in the mail to make it fit, as he felt, for intelligent reading.

Noyes also saw the dangers of too strict departmentalization and realized the importance and interest of interdisciplinary fields. Having personally seen what could be done by the use of physical methods in attacking chemical problems, and having been largely responsible for the development in

this country of the then new discipline of physical chemistry, he naturally enough also saw the possibilities of such fields as biochemistry, biophysics, and geophysics.

Actually, when he came to Caltech from MIT, he brought with him a physicist as a member of his own chemistry department; and very soon thereafter he pushed through the appointment of Richard Tolman as professor of theoretical chemistry and mathematical physics. It was Noyes more than anyone else who, after strong research in biology had been started at Caltech under Thomas Hunt

country and had been the most highly regarded faculty member at our leading engineering school. When he came to Caltech, he was promised ample funds to build up an outstanding research center in chemistry. Then the opportunity to bring Robert Millikan to the Institute arose. But funds were not yet available for a broad development in both physics and chemistry. Noyes, being the kind of man he was, did not hesitate to step aside and allow the trustees to throw all their resources into physics and make Millikan the nominal leader. He placed himself wholeheartedly behind this move, telling



"Old Mossie" sets out on another expedition with Stuart Bates. James Ellis, James Bell, Noyes, and Howard Lucas. Noyes' old touring car was generally thought to hold the world's record for the standing broad jump because Noyes so often tried to start off in high gear.

Morgan, persuaded the Rockefeller Foundation that it should support work in the interdisciplinary fields between biology and chemistry and between biology and physics. All this was by then relatively easy and natural at Caltech because of the strength of the already existing departments of physics and chemistry and because a divisional rather than a departmental administrative system had been set up. It was also facilitated because of Noyes' high principles, idealism, and unselfish devotion to science and to the Institute as a whole.

Let me give you one example of the extraordinary unselfishness of this remarkable man. Noyes was the first topflight scientist to be brought to Caltech. He was the outstanding physical chemist in the

Millikan that physics actually underlay chemistry as well as biology and engineering and that he was therefore willing to subordinate his own field temporarily and to help in any way he could in building up physics.

This was much more than the act of self-effacing objectivity that Millikan thought it, for chemistry and its development was a passion with Noyes; and, as a bachelor who had no family, his feeling toward chemistry was almost that of a father toward a very promising only child. It therefore was an act fraught with deep emotion, the act of a rare soul and a very great man.

Noyes' ability to set aside his own personal interests and to work for the good of a cause was also

demonstrated by his performance in Washington during World War I, when he assisted in the reorganization of the National Academy of Sciences and the organization of the National Research Council. While again Hale was the prime mover in these matters, it was Noyes' careful backstopping and infinite capacity for taking pains that made much of the difference between success and failure.

Noyes' interest in able students was phenomenal and became legendary. An astonishing number of the most creative scientists of this century in this country owe a debt to Noyes—for training, encouragement, stimulation, help of many kinds, often including financial. His reputation in this regard among his peers was such that James Conant, shortly before he became president of Harvard, accepted Noyes' invitation to work at the Institute for a few months partly because he was so intrigued by what he had heard about Noyes that he wanted to find out at first hand if it were true.

Noyes' favorite method of becoming acquainted with a student—or even with a new colleague such as myself—was to invite him to go on a camping trip in the desert or to spend a weekend at his beach house on the cliffs of Corona del Mar. These trips or visits were invariably stimulating experiences. Noyes would think aloud, so to speak, about whatever problem or idea was uppermost in his mind. Then he would draw upon his guest for advice or criticism. And from the interplay of ideas there frequently developed some new line of scientific investigation or new development at Caltech.

When Noyes first came to Pasadena, Hale gave him an old touring car—a Cadillac of early vintage that Hale was discarding—and this was used for the trips to the desert and the beach. The students came to call the car "Old Mossie," which was short for Demosthenes, in honor of its pronounced stut-ter. Old Mossie was generally thought to hold the world's record for the standing broad jump because Noyes would so often absent-mindedly try to start off in high gear. This may in turn have contributed to the frequent breakdowns which, Noyes said, gave him an opportunity to learn quite a lot about the ingenuity, initiative, and mechanical ability of his guests.

At the Institute Dr. Noyes spent a great deal of time working personally with the abler students, trying to steer them into careers in research. Every one of the Institute undergraduates who has since won a Nobel Prize was a person to whom Noyes at

one time or another gave special attention. He worked regularly, for example, with the students who were selected each year to compete for European travel prizes, freeing them from routine work, encouraging them to undertake special projects, helping the winners with their travel plans, even providing additional funds from his own modest resources. In the selection of the winners he tried to get away from reliance on mere grades by taking into account the students' outside interests and accomplishments, even going so far as asking the students to rate one another upon a number of carefully selected personal qualities.

Noyes' interest in undergraduate students did not prevent his giving considerable attention to graduate and postdoctoral students. He advised many with personal as well as professional problems and often gave them financial assistance at crucial times. Once, jokingly, he suggested that he and I should collaborate on the writing of a book dealing with the personal problems of graduate students. As he put it, Mrs. Eddy had written *Science and Health* and become famous; Dr. Millikan had written *Science and Religion* and become famous. Why then shouldn't we write a book on *Science and Love* and become famous too? In a way I am sorry we never did.

Let me read from a resolution of respect to Dr. Noyes adopted by the Institute's board of trustees after his death. These lines seem to me to sum up quite beautifully what I've been trying to say about the ideals and character of Dr. Noyes:

From 1919 until his death in 1936, Dr. Noyes was the most constructive influence in the development of the educational policies of the California Institute and in shaping its ideals and its program. The effect of his work had a very wide sweep. There has been no more significant figure in the development of chemistry in the United States than Arthur A. Noyes. The imprint which he made on both of the two institutions at which he spent his life, the Massachusetts Institute of Technology and the California Institute of Technology, have been far reaching and lasting. These two institutions as they exist today are in a very real sense the living memorial to the life, character, and ideals of Dr. Noyes. His extraordinary soundness of judgment, unselfish devotion to science, sweetness of character, thoroughness of analysis, and objectivity of approach made him an unmatched leader in every undertaking to which he devoted his energies. The Trustees of the California Institute herewith record their profound appreciation of his work here and of the world service which he rendered in setting an example to his generation of a life guided by reason, kindness, intelligence, and the unfaltering devotion to his own ideals. □