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ACCOMPLISHMENTS AND FUTURE OF THE PHYSICAL SCIENCES[1]

By Dr. W. R. WHITNEY
GENERAL ELECTRIC COMPANY

INTRODUCTION

THE promising study of mankind is man. I want to direct your thoughts with that in mind, under the title, "Accomplishments and Future of Physical Science."

This means a hurried view of a lot of territory with an eastern horizon at sunrise. Any single picture would be inadequate. If I could make a "movie" of many frames taken through an open mind, you would still not distinguish science, but only a moving blur. Really to see things, we need about a twenty-fifth of a second per frame. Science moves much faster than that. So any picture of accomplishments is neutral gray, much as newspapers appear feeding rapidly from a printing-press.

I shall select unrelated and peculiar pictures which do not seem to blend. By my poor lighting I lose detail, and by speed I spoil clearness. Perhaps also most important things are left out—spiritual things—but science is still a little confused there.

See first the animal itself, forced to experiment in order to keep alive. He tries, tests and names everything, but apparently creates nothing at all. He may *never* create, but he may continually put discoveries together in new ways. The log which saved him from drowning has become the steamship of to-day. His magic for keeping the wolf from the door—those pic-

[1] Address given on the occasion of the celebration of the fiftieth anniversary of the founding of the Sigma Xi, Cornell University, June 20, 1936.

tures he scratched on the cave wall—continues to work under improved conditions, and so we see the graphic arts, writing, printing and painting, still disclosing through new experiments additional ways of keeping that animal aloof.

My next picture is really a growing cerebral cortex. It seems to be the high-up part of the nervous system, which, in all animals, has grown more complex as the animal tried more and more experiments. It is some kind of record of impressions or sensations. This enlargement of his spinal column, overshadowing several other swellings on his main cord, is always reminding him, even when he is not struggling to keep alive, to try new combinations and to make changes just to learn how his environment may be better used. He seems to be creating his brain. So he now aims to improve things which are already good.

He next reduces labor, increases conveniences and adds to his physical comfort. Mental comfort is still for the future. By his successes it seems as though he aimed directly at the ends attained, and yet, when he finally imitates the birds, he flies in an entirely new manner. When he calls long distances or peers abroad or looks intently close up, he uses quite unnatural extensions of his original organs. These result from accidental observations which subsequently give him entirely new tools. Thus everything, including space, seems to grow smaller. And in our second picture he begins to research widely, just because he has seen the value of it.

In this picture we see our industrial research of the modern times. Much of it, too, was done to keep the wolf from the door, but there resulted such things as the controllable wind-pressure of steam, in place of oars and sails, and of harnessed lightning for every one's use. Things we call engines, for all heavy work, and machine tools of every kind (to displace or to extend hands) are parts of this picture, and the word "gadget" has come to stay.

The pure scientist is my next picture. He sees all truth as ultimately serviceable, and feels the boundlessness of it. He learns that unforeseen facts become valuable assets for improving himself and that his limitations lie in the growth-rate of his brain cortex. It is not alone gadgets that may be improved, but the designer himself. Therefore he is searching as never before for every particle of new truth, removing it from the infinite mass of the still unknown for its effects upon him. No encyclopedia can now include even the names of the modern products which form the life-studies of science specialists. No single mind can encompass the new work or even understand the new words at the rate they actually become necessary.

Twenty thousand members of Sigma Xi survey the boundaries between known and unknown over a broader area and by narrower angles than could be indicated by any compass-card, and they find in the tiniest atom an entire new universe.

And so we approach another picture, the future. We must try to predict from the past. How will man continue to experiment after his needs are supplied? Probably as heretofore, by finding new needs. Clearly he must improve the combination, from tools on the one hand to tool-holder on the other. There's no use fitting fine new adjustments to old style lathe-beds, for example. So he must go ahead, just ahead of his tools.

Judging from the past, we must picture continued new experiments, yielding unexpected results, these in turn developing new human possibilities and providing needs for what we call "necessities," after the fact. This applies in countless ways, but a few examples will suffice. I omit community interests, sociological and economic research, mysticism and metaphysics, in order to touch a few changes in human chemical, physical, electrical, muscular, neurological, psychological and hereditary individual compositions. The mere words confuse one—they suggest so much. But man will proceed, in the fields which they represent, to try new combinations and to learn how he likes them after the event. He will graft into his cortex new thought, just as he has grafted new bone into his frame. The researches on nerve morphology will extend into mental improvements. He has learned scientific progress and will continually extend it. As long as he effectively reveres demonstrable truth the whole world will go along with him. It is in this immense territory of pure, unprejudiced research in countless divisions of physical science that you men will live and have your being. You will often sense the minuteness of your particular contribution, but dimensions are distinctly our artificial invention. Nature defies them. There are no little or big discoveries to be made, but only true ones. This suggests the wide gulf between pure science and existing metaphysical philosophy.

You may philosophize as you wish. Most people do exactly that! But true scientific work is not done that way. It takes the direct path of demonstrable truth. That is why your scientific publications refer to other people's related researches and seem cluttered with descriptions of possible repetitions. Wishful thinking and speculation serve as catalyzers, but scientific work must not retain such admixtures. My last picture therefore will concern itself with man, from his crudest sensory mechanics to his most wonderfully complex cerebral acquisitions.

INDUSTRIAL RESEARCH

If industrial research were done by more and better people, we should have less unemployment and perhaps none. This is perfectly obvious. There is, and always will be, an increasing circumference of untested assets about us and an infinitely fertile area for progress just adjacent to the known. At any instant the maturing of some new crop of facts, materializing in gadgets, may put new industries into action. The trouble with us is that there are too few and too poor industrial researchers. We have had inadequate mental backgrounds, too little appreciation of science, and too much urgency. In other words, in a world where we expect continual improvement, there is no quick and easy way to remove the hurdles. So I suspect striving to overcome hurdles may be a necessary part of the game.

But there will always be fresh opportunities for the new generation, so I wish now to make suggestions for the younger members of the society, and particularly for those who may contribute to the various industries.

Here the question quickly and forcibly presents itself: Is it enough in a research laboratory to tackle known difficulties, to improve output and to analyze competitors' methods and products? The answer is, No! And this leads to asking how far afield should a research laboratory go. The aims of the research group should include protection of the industry against the sure obsolescence due to new discoveries by some one. Discoveries made entirely outside an industry may disconcert and injure it. They may stop the earning power of conservatively invested capital. The harness men and carriage builders of the early days were more or less embarrassed by the oncoming automobile makers, because there was little in the harness or wagon business to anticipate the gasoline engine. Research on the old ground is not enough. One must assume that advances will be continually made in all industry and try to be party to it. The president of the Telephone Company, recently testifying before a committee of Congress, referred to many unexpected products of research, made by that company, which, almost unavoidably, put the company into new commercial developments like radio, talking motion pictures, etc. The discoveries were made in the course of far-sighted research, and, once their worth was seen, the new processes just had to be carried out and the new products produced. Otherwise some most important matter relating to the main interests of the company might have been overlooked. If, for example, radio in other hands had proved capable of rapid and easy house-to-house talking, with the discarding of wire circuits, great numbers of innocent investors in the Telephone Company who depend upon its stability might have been ruined.

Again, if our own company had not early undertaken expensive research work on radio and power tubes, we should certainly have lost our place in the industry which the high frequency radio alternator of Alexanderson had given us. The alternators were soon entirely superseded by power-tubes at greatly reduced cost, and it was fortunate that we took active part in that development.

Similar duties meet the automobile makers. This is illustrated by the studies they make of paints, stream lines, anti-knock gasolines, of Diesel engines and of every conceivable source of portable power just beyond the horizon.

Such considerations account, too, for our own development of photoelectric tubes, and, with them, of all sorts of devices depending on this electromechanical eye. Its study had become an essential part of the research work on vacua. We had to learn more about all vacuum tubes. So new electron tubes of widely diverse characteristics and capabilities came into existence, and soon all sorts of applications were found for them, from exploring the heavens for nebulae hundreds of millions of light-years away to producing artificial fever in the human body, and, in between, innumerable gadgets for automatic inspection, control, counting, sorting and regulating most diverse materials, products and processes. Thus the electric drive and control systems already marketed by the company have been made more useful, new systems made possible, and perhaps harmful competition in that field forestalled.

The great chemical concerns interested in gums, varnishes, paints and synthetic organic products, can not afford to be idle in the now fertile fields of new synthetic polymers, because many of these are proving superior to natural products. This is true whether it it for molded compounds, surface coatings, electrical insulators, fabrics or even rubber.

There are large investments in silk products in America. If the industry languishes, the doctor should suggest research, and research is now being carried on with many new artificial fibers where the wood of the tree is used instead of the leaves—a perennial supply instead of seasonal. There is no great probability that the complicated machinery of the tiny silkworm was designed to produce from mulberry leaves a product so well fitted for every changing *human* service that better products might not be found. One naturally looks for such discoveries to those experimenters who already know the applications and the limitations of existing products, so that each industry should be inquisitive.

The petroleum industry presents a similar condition. Not long ago its researches were being made by the Indian medicine man, who collected oil in blankets floated on Pennsylvania creeks. All he knew about his research was that it made "good medicine."

To-day complex organizations with skilled research men and expensive apparatus detect hidden oil domes and apply novel processes of well-drilling and product-purification. Their highly developed tests of quality now include so much novelty that only specialists understand it. Such organizations are in the best possible position to value any new modification or substitute and to carry on syntheses which disclose unexpected products for future use.

Modern photographic research also well illustrates my point. We continually see cheaper and better products. Lenses and cameras are being rapidly improved. New optical properties and speedier emulsions are being discovered for landscapes and portraits, movies and colored movies. The texture is being made of finer grain so that more exact microscopic and telescopic reproduction is made possible and so the whole photographic industry flourishes.

All this is the conservative end of research. No one is better equipped to approach the novelty than those with so much local experience. The real researcher, the optimist, asks, Why not extend the photography out of sight?, while the conservative says, Why attempt to photograph what you can't see? No one can answer such "whys," but one is productive and the other is not. The closely contiguous fields of invisible light, the ultra-violet, the infra-red, the x-rays and the cosmic rays are in the offing, so you are not surprised to find a large photographic company busily investigating the invisible. There is probably no limit to such expansion, and I am hoping for some sort of x-ray photographs of muscles, of moving viscera and of nerves and arteries, just because these are the things next to our bones.

I ought to tell you how feebly I illustrate right research. I am tongue-tied. Research is the result of child-like inquisitiveness, and we are likely to check that inquisitiveness, as we do a child's because we are lazy. It is easier to plan experimental work close to the old home acre, so we do. In electricity, for example, I can think only in terms of wires, magnetic fields and wave-lengths, so I lazily encourage inquisitiveness only about adjacent areas. So much has been accomplished with 25 and 60 cycles and a few selected high frequencies in radio, and even with zero frequency itself, that wave-lengths between zero and infinity are subjects for research—simply adjoining fields. But this, too, discloses laziness, ignorance and conservatism, because I have thought only of the obvious. I may have actually forgotten that I never knew what electricity is, and am ignorant of what it might do if freed from the shackles which limited knowledge has forged. We almost need to provide more "accidents," for it is frequently the unexpected effect which drives a researcher into a new and productive field.

So I suggest to young listeners to do pioneer, inquisitive research work in the field opened to them and let others do most of the repeat and repair work. It is almost a question whether you ought not be warned against too great efforts expended on long-wanted or prescribed needs. Engineers in any field can easily misdirect a young research man's efforts against impenetrable walls. A long-felt want, like perpetual motion, the philosopher's stone, the fountain of youth, workless weeks, frictionless motion, water substitutes for motor fuel, fireproof organic matter, black metals and other undiscovered chemical elements are not the most promising targets for research. If a want has been felt long and persistently, it is possible that sufficient heads have already been broken over it. It is distinctly more fun, and perhaps more profitable, to utilize things in your own field that you didn't suspect would be needed, even products you didn't suppose could exist.

For youngsters in research I suggest more education and greater specialization. Discoveries and interesting work easily start at the outer edges of the known. Explorers leaving the home-town take modern carriers to reach "the open," with the tall trees. They later have to walk some, too. They may view the waterfalls or fertile fields as accidental discoveries, but such things are fixed by inviolable laws, which may be learned. Just as our former open spaces are now partitioned into states, cities, towns and farms, so science became chemistry, physics, biology, etc., and these in turn multiply and subdivide, putting the most promising values among the younger offshoots.

I wish there were some way to lift the innocent boondoggling leaf-duster from the highway into research in medicine, for example, but he would be in the way and get run over. Even to be interested in medicine now calls for knowledge of advanced chemistry, physics and what not, and the same applies to most other active fields.

Pure Research

It is impossible to anticipate science, its consequences and industrial developments. It continually discloses new possibilities, most of which can not be foreseen at all. The wisest man of Queen Elizabeth's active reign, Francis Bacon, tried to describe all the possible novelties which orderly research might disclose. He incorporated his prediction in a short story, "The New Atlantis." He wrote that story to convince people of the value of experiment. It popularized science. He had already tried, by the more pretentious publications, "Advancement of Learning" and "Novum Organum," to educate people. He plainly felt that he had shot over their heads. So the accidentally discovered island, in his popular story, made use of such unheard-of advantages as horseless carriages, sailless ships, submarines, human wings, etc. He apparently exhausted himself by his suggestions of desirable but undiscovered things. But no one can exceed his number even now. It is so difficult to think in terms remote from experience. There were over twenty widely different predictions and all but one have been realized. That one seems simple. It is a filter to take potable water from the ocean. That this has eluded research so long does not make it insoluble, but it indicates limits to describing the impossible.

Scientific research is fishing with a tiny scoop-net in oceans of unfathomable depth and infinite area. We make the nets ourselves. Our catches often make a disordered pile, but we may orient them and fit them together as we do jigsaw puzzles. Then some one may give our puzzle one more dimension, like depth, and then we have a new necessity.

It may not have helped aeronautics much for Bacon to make his islanders fly somewhat like birds, but he certainly gave research a first and lasting boost. He may not have written Shakespeare, but suspicion attached to him because he was so wise.

After centuries of research it has been recently said by Hans Zinsser, "There is no just reason to believe that we, transitional creatures in the upward progress of evolution, have reached the highest possibilities."

I doubt if it is recognized that the average research worker is a healthy, justified kind of unselfish communist. He aims at everything and works for everybody. He pays personally for the spread of his propaganda and broadcasts freely all his home-grown produce. He pays for the publications by supporting the scientific societies which publish for him (if his written work passes their critical examinaton). Moreover, he is charged extra for reprints of his own scientific papers, and he has established the commendable custom of exchanging freely his reprints with brother scientists. Prodigal teachers and unselfish pure researchers do their individualistic work and pay twice for telling the world. The expense to a good worker may exceed several hundred dollars a year. The better he does it, the more it costs him. I do not know of any other such self-sustained and useful group. In science publications, note the growth merely in chemistry. In 1907, *Chemical Abstracts* published reviews of about 8,000 new papers, about 15,000 in 1920, about 25,000 in 1927, 32,000 in 1930 and 42,000 in 1935. In biological science, for example the reviews have jumped from 7,000 in 1931 to 10,000 in 1935, and it is clear that this is going to be a most active field.

Sigma Xi is not particularly interested in technical research, nor is that especially exciting. What is exciting is the discovery of new facts among the mind-expanding wonders of creation. What do we care about applications of cosmic rays, for example? The wonderful thing is that they exist, have such remarkable properties and speak an unknown language which we may be able to learn through great effort. The so-called pure science encourages its devotees by endowing them with something of a creator's interest and a forever unsatiated, even unsatisfied longing. It is a desire to observe, to know, to understand, to construct, to measure, to conquer by self-effort. As I have seen scientists at work, I have often marvelled at the remarkable forces which keep them concentrated in their individual fields. It is as though they instinctively felt that throughout the unending future their contribution to knowledge would grow forever, through developments which could not be preconceived by any one. I suppose every one of our mundane commercial developments first passed through the inquisitive experimental hands of some highly individualistic inquirer without fixing in his cerebral cortex any so-called practical application. As with kitchen gadgets, it isn't so important who discovered the thing nor what it does, but the bearing it has on our real improvement. When all is said and done, there seems one thing worth advancing, and that is the man and his mentality.

It is easy to imagine such a new series of improvements as would practically free us of physical effort. A mere local extension of available stock may arrange things so that machines do all the real work. The coal burned at the mine and the electric current used in the most advantageous places might let every one bask in southern sunshine in winter and fly back north in the spring. But we may be built for something better and much more enjoyable. The processes of greatest interest lie within our cerebral fields, and as this is central station for our nervous system, and as I am interested in certain aspects of nerve actions, I wish to illustrate pure research by a few selections from that particular area. This serves both to illustrate broad research and is a movie, as it should be.

We ourselves are our nerves, except for a lot of common mechanics, and our happiness is bound up with their behavior, whether we talk about simple reflexes or complex brain networks. Research has gradually traced out more and more of these electrical conductors and their interconnections. Their number exceeds all power to count. They serve us our pain. They measure us our pleasure. They predetermine our most refined thinking, and they are made by us for us. They interpret both mind and matter, and they stand for "free will."

I shall narrow down my wide-spread remarks to a few cases. I want to trace lightly the relations between common cold-feet and mental gangrene, between chemical hormones and knowledge and judgment. Connecting them thus is anticipating future research, but that is my aim.

Our nervous system is divided into three parts, though it is built as a unit. The autonomic system operates a pair of lines and central stations (ganglia) down the trunk parallel to the spine. They are connected to the main or voluntary system within the vertebral column, so in turn to various parts of the brain, and finally to the top—the captain's bridge, the cortical layer. Another nerve group, also outside the spinal column, courses down from the midbrain to the various viscera, and cooperates and competes with the rest of the automatic system in trying to keep a fixed or healthy state within the dried skin bags in which our colonial cell immigrants have to cooperate, as Cannon sees it.

This para sympathetic and the ganglianated sympathetic are the antique wiring systems of the early animal. By their continued efforts, now usually quite outside our consciousness, they preserve our temperature, our combustions, our compositions, etc. Dr. Cannon calls this "homeostasis." It is as though we once knew how to control and mold ourselves, but, after developing thinking nerves we delegated the less important visceral control to automatic mechanisms. Of course this new cerebral or voluntary system is the most interesting. If we depended solely upon the autonomic system, wonderful as it is, we should be at a comfortable standstill. We should all be stable and uniform, but we'd never get anywhere or have anything new. Judging from the nervous system as a whole, we are designed for change and growth; in other words, for something better. If we are not getting better we are doing wrong; that is, we are becoming mentally or physically ill.

Let us consider first the defects of our machine.

There are a number of maladies which are persistent and nearly incurable. They are among the oldest troubles the race has known. Rheumatism, arthritis, asthma, angina pectoris, osteomalacia, poliomyelitis, Raynaud's and Buerger's diseases, epilepsy and high blood pressure are some of them. A part, if not all, have the peculiar property of being due to spasmic, irregular behavior of the homeostat and of leading to irreversible structural changes. It has been discovered that this peculiarity is often traceable to nerves. "Wires are down," "shorted" or carrying too much load. The insulation may be "all shot," as electricians say. To check this thought, surgeons are cutting selected nerves, and much is being learned thereby. Sometimes, after the removal of part of a nerve (or wire) or even several ganglia (or small switchboards), the rest of the automatic circuit proceeds to do the whole job better. It readjusts things and the patient gets well. I suppose this is because we are provided, as is a battleship, for example, with many repair parts and auxiliary, even hidden, circuits for just such accidents. New wiring connections are automatically made when the demand is insistent.

Raynaud's disease, which is one of these spasmic nerve disturbances, starts with cold feet and often leads to gangrenous toes and then to surgical operation. The blood circulation is reduced, not by calcification of arteries (sclerosis), nor by internal organic deposits (*thrombo angiitis obliterans*), but by irregular nerve control. Leading experts now raise the question, What gets on the nerve? It looks like worry. Further research is indicated, for if mental trouble reduces circulation to a foot, why not also to a brain? The surgeons successfully cut the wiring for Raynaud's disease, therefore they try it for other spasmic maladies. Surgical literature shows that such study is now well under way. But this is really taking place before we know how nerves perform their work and how they share it in their multiple electric circuits.

Surely we ought to do more research on the actions of our nerves.

Throughout this field, a few researchers are busy, as illustrations show. For example, the heart is speeded up by adrenalin, which enters the blood from a gland which is under sympathetic nerve control. But the heart is also retarded by the vagus nerve, which acts independently. The proper heart balance is thus automatically and unconsciously due to nerve action. Do the nerves act like mechanical clamps, electrical devices or chemical products? Here some wonderful researches are already being made. It has been shown that less than one part of adrenalin per billion of blood accelerates the heart. Similarly, also, blood passed through a heart retarded a second, isolated heart by mere solution-contact. This shows not only the physical chemical effects of the hormones which circulate within the blood, but also indicates that the local action of nerves, like the vagus, is probably also due to chemical products. Nerves produce chemicals for stimulation. As this stimulation can be brought about electrically, I became interested.

In this connection I must refer to G. H. Parker's work, which I hoped he would describe at this meeting. It illustrates the importance of distant pioneering. It makes one gleefully accept long, new names for useless things. This part of my "nervous" talk I call the embarrassed fish. No one knows much about it. Some humans get embarrassed and blush. So also do shrimp, frogs, salamanders, fishes, etc. This is nervous, protective coloring. A black bullhead, when transferred to a white dish of water, nervously lightens his skin. Under the microscope the mechanism of the process is seen in the contraction of a lot of black spots in the skin (melanophores). When these are expanded the color is black, but when advised by messages from the optic nerve they contract and the animal becomes light-colored. In the case of the embarrassed shrimp, its eye stalks have been removed and extracted with water. This solution, when injected into an unembarrassed shrimp, produces the anticipated change in its color. Finally, and very significantly, Parker has shown that in certain cases the chemical nerve-product is not soluble in water, but may be extracted by oil, so by injecting the oil-solution into other fish the color becomes changed near the treated spots.

This is one of the many cases where the immiscibility of oil and water is emphasized and utilized in nature. It is not new that fats are oils, and that contact between the two is common in animals and plants. Probably many processes of growth depend on the presence of the pair in contact. Surely nature has adapted itself to this mixture and adopted its dependable properties. So while we may never completely understand their functions, we like to consider them just the same. The oils may carry in solution compounds insoluble in water. The aqueous plasma carries salts insoluble in oil. When the two solutions come into contact, new compounds of the two components may be found. Such reactions may well be closely connected with nerve action, as they probably are with tissue growth, calcification, etc. This makes some of Langmuir's researches on molecular films doubly interesting to me. For example, an inert oil floats as a lense on water. If a little stearic acid be dissolved in the oil, and if the water contains a little calcium, there is formed at once a film of calcium stearate which is quickly forced out from the oil-water surfaces and grows to a compact molecular film on the water. This film neither the water nor the oil seems to care any further about. Perhaps this is a part of the picture of growth. At any rate, it lies at the extremity of current biological science.

Cannon looks "forward to new triumphs of physiologic investigation, and that fair prospect lies in the direction of the nervous system." This is scientific modesty. Knowing much less of the subject, I am not so careful. All our troubles and pleasures are in the final analysis neural. From the pain of a cold toe to the happiness of some constructive process, our nerves are the necessary generator and network. From dreams of avarice to indigestive nightmares, all the information comes to nerves through nerves. Moreover, all the storage of past records lies probably intact in nerve structures and might be available if we better knew the system.

The nerve groups which control our insides willy nilly, without consulting our cerebral system, seem to differ in themselves as though competition were necessary even for the smallest organ. Chemists understand balanced reactions and know that the equilibrium condition is not idleness but represents stability, just because two necessary reactions are doing all they can in opposite directions. This proves that good living itself is process rather than product. Researchers discover that one group of nerves cooperate with ductless glands and the heart to keep the blood supplied with various catalyzers, which react on all the organs both to buck them up and tone them down. And as though this were insufficient, the parasympathetic part of our automatic outfit gets in its work by quickly supplying particular organs, modifying and controlling chemical products which refine, correct or overrule, where needed, the general actions of the less exacting and more diffuse sympathetic system. Probably all processes that proved desirable, among those of the simpler nerve-system, were adopted into the cerebral system as it developed from the lower states of man. So some day we may begin to see how beer and pretzels change into music, arts and science—or Brahms, Cellinis and Pasteurs.

Just imagine how far such studies might extend! I have thus speculated at this point, because I am speaking of the future of physical science.

THE CONTRIBUTIONS OF ARTHUR A. NOYES TO SCIENCE

By Professor MILES S. SHERRILL
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

AN old letter came to light, by the merest chance, just one week to a day before Arthur Noyes died. It was dated November, 1901, bore his familiar signature, had been dispatched from Boston to a student in Leipzig and contained the following paragraph:

. . . I have made a proposition to the President [Pritchard, M. I. T.] in regard to the establishment of a Research Department. It is rather an audacious proposition to make for a person who hasn't much more property than the obligations involved in the proposition require, but I feel the highest ambition of my life would be realized if I were in charge of such a department, and it is a favorite sentiment of mine that:

''Those love truth best who to themselves are true,
And what they dare to dream of dare to do! . . .''[1]

[1] The italics are those of A. A. N.