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## BEYOND THE CLASSROOM AND THE LABORATORY: GENERAL ELECTRIC SCIENTISTS SPARKED AN ENVIRONMENTAL MOVEMENT

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### ABSTRACT

During the first decades of the 20<sup>th</sup> century, the General Electric Company, in Schenectady, New York, developed an engineer training program with a world class faculty, well-equipped laboratories, and hundreds of jobs for eager young college graduates. Scientists who had trained in disciplines of chemistry and physics in Europe were invited to work in the laboratories and were given the freedom to do “pure science,” which led to a golden age of invention. This paper traces the relationships between many of the top scientists and engineers and tells a little known story about their extracurricular activities as they took advantage of the recreating in New York’s Adirondack Park. Many of the young scientists and engineers took an interest in preserving the wilderness areas and, especially, in saving the islands of Lake George—from logging, development, and erosion caused by a commercial dam. These scientists became activists who volunteered to haul rocks, write letters, and venture into politics to help defend the Forever Wild clause of the New York Constitution. GE became a sort of incubator for leadership in the wilderness preservation movement.

## INTRODUCTION

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During the first decades of the 20<sup>th</sup> century, the General Electric Company in Schenectady, New York experienced a period of remarkable industrial growth, leading the world with inventions and technology. Top executives came to the realization that it would be useful and advantageous to allow researchers and scientists a sort of academic freedom to pursue a wide range of scientific interests and to become active in many fields beyond the laboratory. Many of these early scientists and engineers became leaders of progressive causes, including efforts to protect wilderness areas in New York's Adirondack Park. By examining the contributions of several outstanding individuals (e.g., Charles P. Steinmetz, Irving Langmuir, Robert H. Doherty, and John S. Apperson) we can better understand the results that were achieved and gain insight into the impact this scientific incubator had on the careers of hundreds of young recruits.

By 1900, GE was already attracting top students from all over the country who came eager to find jobs and receive advanced training in the exciting new field of electrical engineering. Many of them went on to excel as professors in academia and as professional engineers. And while in Schenectady, many found great pleasure and excitement in the off-hours by pursuing various forms of recreation in the mountains and lakes just a short distance away.

John S. Apperson, Jr., a young man from Virginia who didn't even have a college degree, arrived in the "Electric City" (Schenectady) in 1900 determined to find employment. He had an aptitude for math and science and an engineer's capacity to pay attention to details, however. He managed to get accepted into the test program and by 1918 had advanced to be second in charge of the Power and Mining Department. During his 47 years with the company, he developed a second career—or avocation—as the leader of a conservation movement, or more accurately, a preservation movement that essentially became a sort of wilderness lobby in New York State. Frank Graham, Jr., in his book *The Adirondack Park: A Political History* (1978), described this group of activists as "the Schenectady force." Here is a passage describing the leader of this group, John Apperson, and telling of his style and methodology:

*Apperson pursued his devotion methodically, like the engineer he was, disdaining sentimentalism and vague rhetoric for hard facts. Before he wrote a stinging letter to a state official or presented a statement at a public hearing, he spent days going over the site of the controversy, grasping details of law and topography that often put the "experts" to rout. Not even poor Verplanck Colvin, incredibly still wandering the streets of Albany in those days (he lived on until 1920), knew the "trouble spots" in the Adirondacks any better than Apperson did. "He told us never to talk about any problem area before we had gone and stood on the spot," a colleague of his once said.*

## ASSEMBLING A TEAM OF SCIENTISTS

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In 1900, GE top officials, led by Dr. Willis Whitney, opened a research laboratory and hired world-class teachers, researchers, and scientists. About the same time, GE started an engineering training program, known as the "test program," thus introducing their newest recruits to all the latest technological advances, and giving them a chance to apply their knowledge and training to the task of designing and developing new products. A few decades later, one of the top executives, Dr. E. W. Rice, looked back enthusiastically to the early days, saying that the engineering department had become "second to none in this country by World War I."

The intellectual atmosphere was stimulating and exciting. One instructor described his expectations about the new crop of students, saying, “Now we wait to see what great talent it brings in.” Many new employees came with wonderful credentials, with bachelor’s degrees from the best colleges. However, their instructors were also interested in aptitude and attitude. Dr. Charles P. Steinmetz stated his philosophy this way:

*If a young man goes at his work as a means to an end, like getting a raise in salary or making a million dollars, I am not much interested in him. I am interested, however, if he seems to do his work for the work’s sake, for the satisfaction he gets out of it.*

This stimulating intellectual environment attracted others who became important members of the research team, including Willis R. Whitney (known for magnetic arc lamps), William D. Coolidge (tungsten wire), and Irving Langmuir (gas-filled lamp, and later, surface chemistry.) As stated in a centennial history of the company, “the work of Whitney, Coolidge and Langmuir proved that the support of science, far from being charity, was the soundest of business decisions.”

## CHARLES PROTEUS STEINMETZ

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The most prominent star in General Electric’s galaxy was that of Charles P. Steinmetz, known as the electrical wizard. Shortly before earning his degree in Breslau, Germany, he was forced to flee the country and find a new home in America. In order to succeed in America he had to learn English and seek employment that would allow him to use his advanced education. Fortunately, his abilities were soon recognized. In 1901, the American Institute of Electrical Engineers bestowed on him its highest award, and in 1902, Harvard awarded him with a Master of Arts degree in Electrical Engineering. Harvard’s president, Dr. Charles W. Eliot stated, “I confer this degree upon you as the foremost electrical engineer in the United States, and therefore the world.” Then, a year later, Union College awarded him with a PhD and invited him to become a member of the faculty as professor of electrical engineering.

Despite his meteoric rise in prestige and influence in the industry, Steinmetz also found time to be active in the wider Schenectady community, making friends with the Socialist Mayor (George R. Lunn) and taking an interest in improving the public schools. According to Larry Hart in his book *Schenectady’s Golden Era: 1880 – 1930*,

*Steinmetz’s concern for educational opportunities for all children led him to seek election to the Schenectady Board of Education in 1910. Not only was he named to office but in a short time became Board President. He at once set out to campaign for more schools (“a seat for every pupil” was his slogan), better playgrounds, free textbooks and lunch programs.*

Another piece of evidence that Steinmetz took an interest in environmental issues can be found in a clipping from the *Schenectady Union Star* in 1936, when it ran an article about Steinmetz titled “Electrical Wizard, in 1921, Accidentally Found Rains Followed Flames; Lack of Trees Brings Droughts. Fires and Floods,”

*That theory concerned the relation between widespread forest fires and subsequent flood conditions. Green Cross embraces that theory as sound, and its members have developed it to show that careless destruction of forests in the South and Southeast is one of the chief causes of drought in the Middle West.*

According to Frederick Cowles, chairman of Green Cross,

*“Charles P. Steinmetz came to a meeting of the Green Cross in California. He told us, ‘I have spent eleven years to find out how plants make starch. I haven’t discovered that but I have found out some other things that will interest you.’”*

*Steinmetz turned to a map on the wall. Pins in it indicated forest fires that had burned 100,000 acres or more. Attached to each was a newspaper clipping telling the story of the fire. Then, he made us sit up by matching nearly every one of those news clippings with another which told a story of heavy rainfall over that burned area, within three years after the fire, accompanied by flood destruction.”*

*What is the connection? Just this: Vegetation and trees are constantly evaporating moisture into the air—transpiration, it is called—which rises and acts as a trigger to release moisture in the upper levels which falls as rain. When this happens regularly the rains are normal. But if the forest is burned away by fire there is no transpiration, the upper atmosphere becomes saturated with moisture, which finally comes down in one tremendous rainfall. It beats on the ground where there is no vegetation to absorb it. The bare soil is flooded and eroded.*

We know that Steinmetz’s interests also included concern for environmental preservation. Larry Hart (1974) listed a few of Steinmetz’ broad interests:

*He was on top of all new theories and often looked ahead at what the future might hold for man and his environment. Many of his predictions, made in dissertations either before an audience or in magazines, were amazingly prophetic. He foresaw the use of air conditioning and electric ranges in homes, electric refrigerators and a form of television—as early as 1917.*

*Steinmetz was vitally concerned about air pollution and the excess use of coal and gasoline. He said the electric car was the auto of the future because “it runs cleanly and quietly and burns only rechargeable fuel.”*

*In 1915, he wrote an article on the energy of the future, warning: “Oil and natural gas will long have vanished, indeed may be the first to go. Wind and tide and wave power may be used as far as possible. . . There is only one other source of energy left and that is the energy of sunlight, but this is the greatest of all energies.”*

## IRVING LANGMUIR AND JOHN APPERSON

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When Irving Langmuir joined General Electric, in 1910, he had left a teaching job at a university, “which left him little time or opportunity to explore his own interests.” He discovered that GE was “the only industrial laboratory in the nation engaged in basic research.” By 1913, after three years of apparently unproductive research, he commented to the director, Willis Whitney, “I’m having a lot of fun, but I really don’t know what good this is to the General Electric Company.” Whitney replied, “That’s not your worry. It’s mine” (Hall 2011).

Langmuir, who had studied in Europe and developed a love of mountain climbing and skiing, arrived in Schenectady eager to explore the region. It was not long before he heard of the enthusiastic exploits of John Apperson, an engineer in the Power and Mining Department.

Langmuir's biographer, Albert Rosenfeld, described their friendship this way:

*Of the early friends Langmuir made in Schenectady, no one had a more passionate attachment to Lake George and the great Adirondack wilderness than John S. Apperson. . . who possessed almost incredible powers of endurance, and who, had he lived in the West in an earlier day America would have had Paul Bunyanesque legends spring up around him by the dozen.*

The first mention of Apperson in Langmuir's diary appears on September 23, 1910 (Rosenfeld 1966),

*Saw Apperson about taking a trip up to 'his country.' Langmuir and a young friend took their trip up to Apperson country the very next day. Though Irving, a naturally rapid-striding hiker, was in excellent condition, he complained, in his diary, that Apperson went too far and had to keep coming back for them. A later entry reads, "7 men reached the top of Mt. Washington yesterday. All but Apperson were frostbitten."*

Irving Langmuir and John Apperson discovered a mutual joy and enthusiasm for exploring the wilder forms of recreation in the park and together organized excursions into the high peaks, making camping trips in the coldest weather, using skis, snow shoes, and homemade sleeping bags. They took a special interest in Lake George, camping on islands and paying attention to the damage being done by high water and erosion. Langmuir and his wife, Marian, gave their enthusiastic support for Apperson's schemes: organizing work parties and repairing the island shores (through a process known as rip-rapping).

Langmuir's diary includes numerous entries with reference to John Apperson and his political activities (Rosenfeld 1966):

**1916:** *Apperson came in evening. He wants to start agitation to get the Federal government to make the Adirondacks a national park.*

**1923:** *Mr. Coffin called me in to talk re: Lake George and Mr. Apperson. Mr. W. J. Knapp had previously seen Mr. Coffin and tried to get Mr. Coffin to stop Apperson. I spoke for some time and convinced Mr. Coffin that our cause (Lake George and conservation) was a good thing.*

**1928:** *(Langmuir is in New York City to receive the Perkin's Metal): Go see Nathan Strauss and Raymond Ingersoll to seek their support for Apperson's plan to get 300 acres of Knapp's land for Lake George Park.*

**1941:** *(Langmuir in Washington attending meetings of the American Association for the Advancement of Science—of which he was president that year—and the National Academy of Sciences): Appy calls in the evening re the purchase (by the state of NY) of Knapp's land at Lake George, I spend the evening calling Hugh N. Bennett. I try to get Eleanor Roosevelt and VP Wallace but can't. Next day: Telephoning again re Knapp Bill. I find that Eleanor R. is on the Pacific Coast. C.R. Wilson calls me and tells me that he has had a long talk with Lehman. I suggest responsibilities of the GOVERNOR and public resentment at the lumbering of the land if it occurs on Black Mountain.*

**1944:** *Meeting of the Executive Committee, Board of Directors of the Lake George Protective Association of which I am president. Now 100 members. We retain counsel to prevent legislature or to prepare injunction if bill passes to intervene on the side of the state in the suit against the Paper Co.*

Langmuir's diary gives us a pretty accurate idea of the important projects on Apperson's plate. Starting around 1908, when he came up with the idea of trying to protect the Dollar Islands by rip-rapping shores, he decided to invite all his friends to help. By his count, hundreds of friends volunteered to haul rocks and build walls, all while enjoying the experience of "roughing it" and enjoying the spectacular scenery without having to pay for hotels and other expensive accommodations.

In April 1922, Apperson was abruptly fired from his senior position in the Power and Mining Department. He rarely talked about this unpleasant chapter of his life, but Irving Langmuir later mentioned this event in his diary, giving the name of W.J. Knapp as the individual who complained about Apperson to top officials. Apperson was soon given a new management assignment in the Engineering General Department, where he continued to coordinate details for patent applications.

However, he must have learned to stay out of the spotlight, to avoid becoming a target for his enemies. Many historians think of Apperson as a rather obscure figure with interests confined just to Schenectady or Lake George. But, his voluminous correspondence, now available to researchers in the Kelly Adirondack Center at Union College, reveals just how broad and effective his influence actually happened to be.

## ROBERT H. DOHERTY—CARRYING ON THE GE APPROACH TO SCIENTIFIC TEACHING

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It is hard to be sure whether Apperson and Steinmetz had much contact with each other, but we do know that one of Apperson's good friends, Robert Doherty, became top assistant to Steinmetz in the laboratory. It seems likely that Doherty told Steinmetz about their activities at Lake George and about the dream Apperson pursued of creating a Lake George Park. Doherty went on, after Steinmetz' death in 1923, to teach classes at GE, further developing theories and techniques for teaching advanced courses in electrical engineering. In 1930, during the Great Depression, he accepted an offer to become a professor at Yale University and by 1932 became Dean of the Yale School of Engineering and Applied Science. Then in 1936, he became President of the Carnegie Institute of Technology in Pittsburgh, PA. Here is a description of his presidency, from the Carnegie Mellon website:

### **Robert E. Doherty, 1936-1950**

*Robert Doherty became president in March 1936 in the midst of the Great Depression. He brought with him superb preparation for leadership, a clear vision of what technical education ought to be, a firm commitment to promote graduate education and research, and strong administrative ability.*

*In the mid-1940s, Doherty implemented an approach to undergraduate education called the "Carnegie Plan." The Carnegie Plan provided a well-rounded "liberal/professional" education in which students were taught to apply fundamental knowledge to solve practical problems and to learn about and appreciate academic disciplines outside their primary area of study. The Carnegie Plan, which received much national attention, was the forerunner to today's focus on an interdisciplinary, problem-solving university curriculum.*

When Doherty retired in June 1950, he left behind a student body in which full-time undergraduate and graduate students outnumbered part-time night students, a revitalized faculty whose members focused their energies on both teaching and research, a dramatic new curriculum, a reorganized administrative structure, an endowment that nearly doubled during his tenure, and an institution that would very quickly become one of the nation's premier universities. Most of the seeds for today's university were sown during the Doherty administration.

## CONCLUSION

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This paper only gives a limited account of the significant accomplishments of these scientists and engineers, but perhaps it can further our understanding of the intellectual environment that encouraged so much genius and creativity. Apperson, Langmuir, Doherty, and scores of others benefitted greatly from the special kind of stimulation and encouragement they found in Schenectady, and they, in turn, gave their time and resources generously to try and protect wild places in New York's Adirondack Park.

More information about John Apperson can be found in numerous articles by the author, published in Adirondack and regionally-focused publications, and in the author's book, *John Apperson's Lake George*, which features Apperson's remarkable documentary photographs. Apperson's papers are also available for researchers to explore at the Kelly Adirondack Center at Union College in Schenectady, New York.

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