activities of the society have orbited around either having experiences in the broad field of medicine and that could be from shadowing to speakers or things related to the decision to go to medical school." Currently, the society has organized a blood drive and has worked closely with the Emergency Medical Services Club at Dartmouth. Recently NSS members also participated in the Cross Cultural trip to Nicaragua that the Tucker Foundation sponsored in December. Dr. Witters wants NSS to show its members that there are many different paths to medical school other than the traditional choice of majoring in the sciences and applying during his or her senior year. Most importantly, he wants students who do go on to medical school to be "well rounded leaders of American medicine."

For more information on the Nathan Smith Society or Pre-Health Activities at Dartmouth College, interested parties can go to *www.dartmouth.edu/~nss*.

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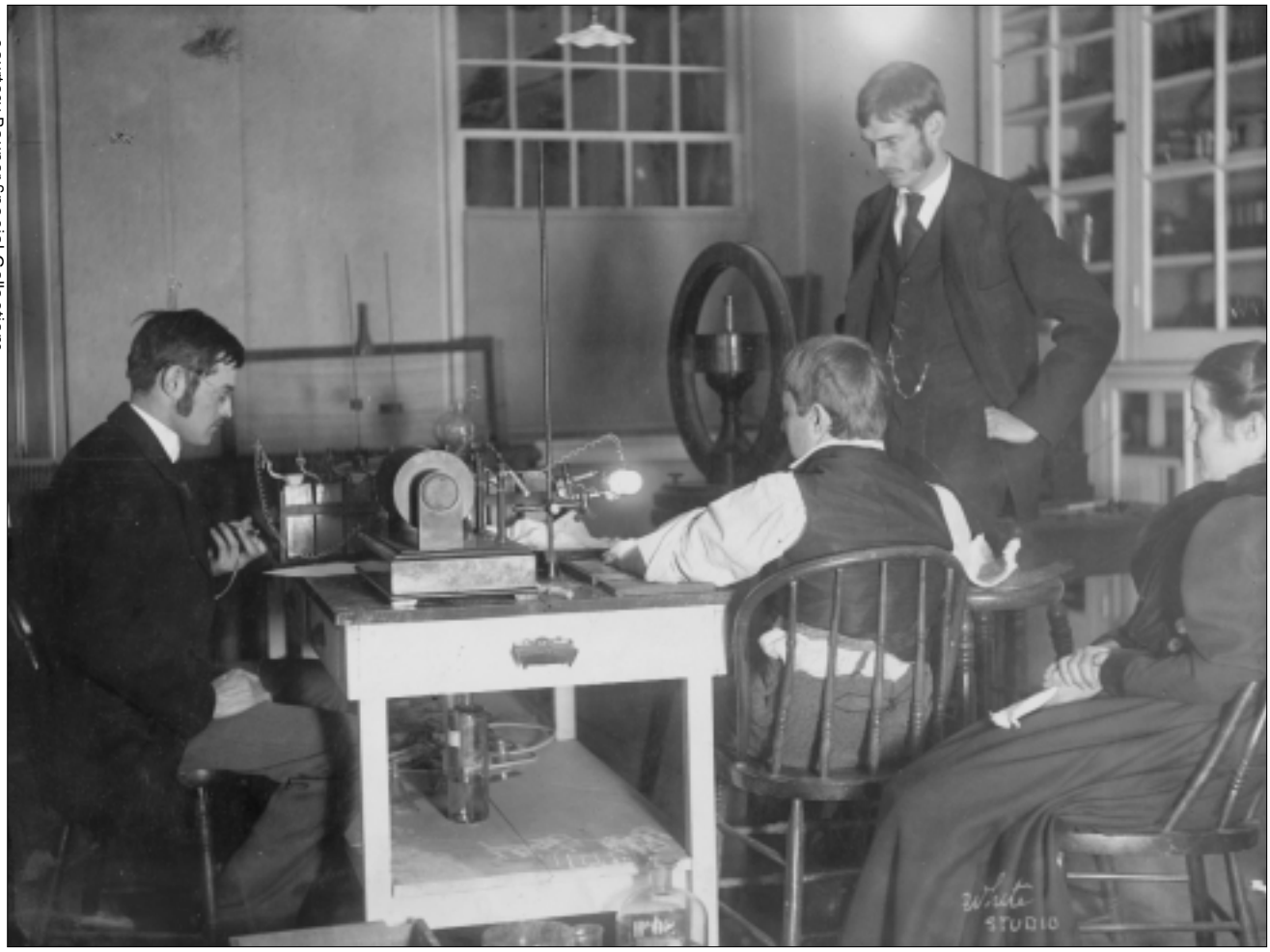
We regret to announce that Dr. Thomas Almy, one of the first advisors to the Nathan Smith Society and instrumental in its formation, passed away in May 2002. He joined Dartmouth Medical Schoolís faculty in 1968 from Cornell University College of Medicine. In addition to being heavily involved in both undergraduate premedical and medical education, he was also a prolific author with numerous articles in gastroenterology and internal medicine. Dr. Almy was a Professor Emeritus of Dartmouth Medical School and a member of the National Academies Institutes of Medicine. The DUJS Editorial Board would like to honor Dr. Almy's achievements and offer its heartfelt gratitude for his contributions to the Dartmouth community.

From Bavaria to Hanover:
the Early History of X-Rays

BY JAMES KLAAS '04

courtesy Rauner Special Collections

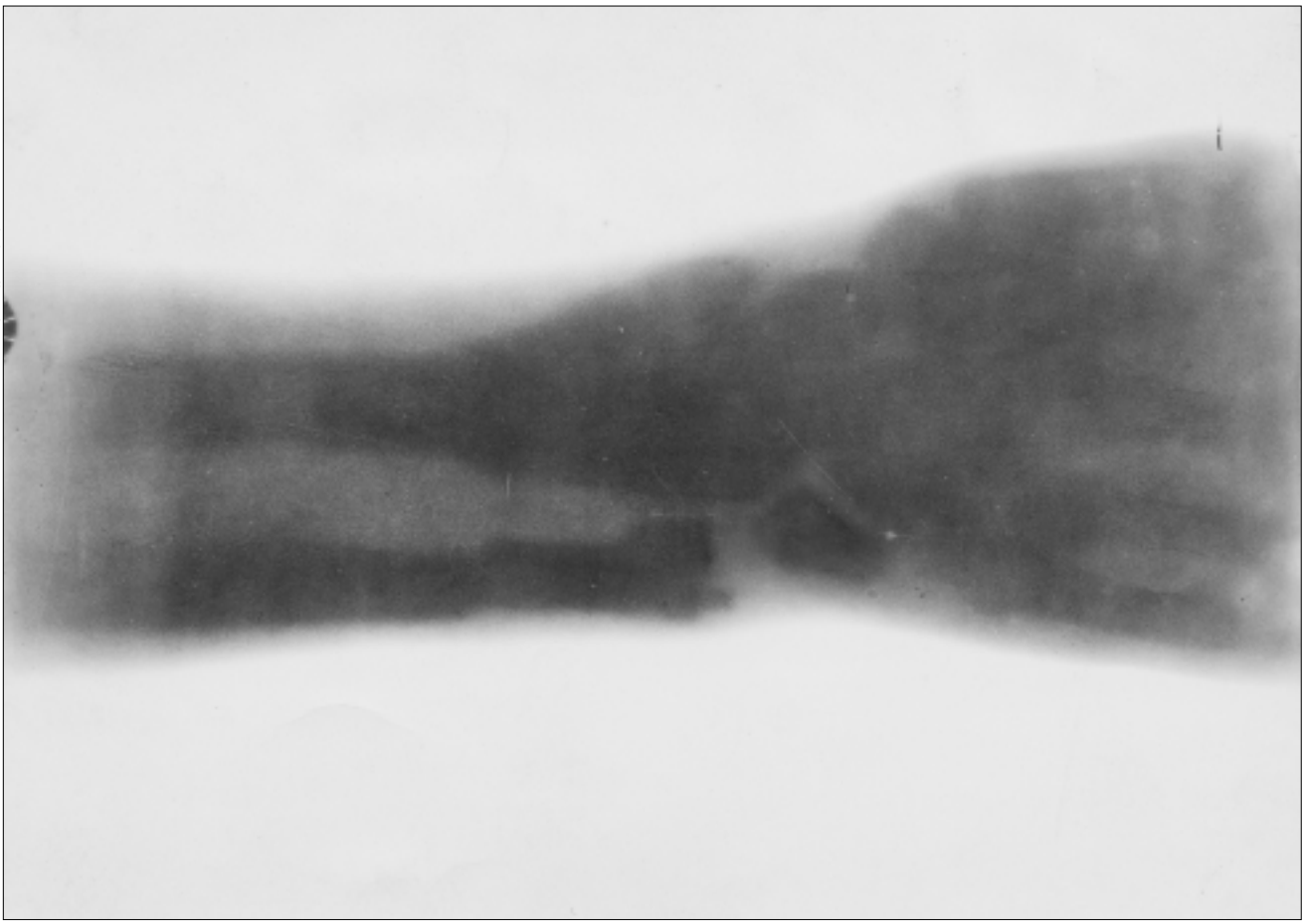


Drs. Edwin and Gilman Frost perform the first American medical X-ray in Reed Hall, Dartmouth College on February 3, 1896

For over a century, scientists experimented with vacuum tubes and the effects of passing high-tension currents or electrical discharges through these tubes. Without a doubt X-rays were generated during these experiments. In the early 1880s, Sir William Crookes conducted such experiments using a cathode ray (a stream of electrons emitted from an electrode) and modified vacuum tubes. He found that if he left his photographic plates out during these experiments, something emitted from the tube caused his photographs to become cloudy (Michette 1996). It was not until the experiments of Wilhelm Conrad Röntgen, however, that the source of the cloudiness was discovered.

Röntgen set up an experiment in which he set up a cathode ray, a Crookes tube and a screen of barium platinocyanide (a luminescent phosphor) in a darkroom. When the tube was aimed at the platinocyanide screen luminescence was observed. Röntgen concluded that the tube was giving off invisible radiation that was traveling through the air, striking the phosphor, and causing it to luminesce (Michette 1996). Röntgen appropriated the conventional scientific nomenclature of using the letter *x* to designate an unknown quantity and named this new form of radiation X-rays. On December 28, 1895,

courtesy Rauner Special Collections



The first American medical X-ray : 14-year-old Eddie Murphy's fractured ulna.

Röntgen submitted his findings to the University of Würzburg, Bavaria, in an article entitled, "On A New Kind of Ray." Word of this newly discovered ray traveled quickly throughout the scientific world and through the popular press and a flurry of experiments at a multitude of scientific institutions commenced.

A January 26, 1896 issue the newspaper the *Sun* ran an article about Röntgen's discovery headlined "The New Photography." This was the article that caught the interest of H.H.H. Langill, a Hanover photographer. He approached Frank Austin, class of 1885, an assistant in Dartmouth College's physics department, and offered him his photographic plates if Austin could find a suitable tube. At this time Dartmouth College possessed several tubes from Europe that were similar to the Crookes tube used in Röntgen's experiments. Austin began experimenting with the tubes, and he found only one that produced X-rays. The tube that produced these X-rays was known as a "Puluj tube." This type of tube is similar to a Crookes tube, except that it has a piece of mica (a silicate that is easily split into thin, flexible sheets) placed at a slant in the middle of the tube (Lunardini, 1995). Surprisingly, Austin's test showed that this tube was actually better than the tube used by Röntgen because it produced a greater quantity of X-rays. The Puluj tubes could produce an image of higher quality with less exposure time than a Crookes tube. In the 1930 edition of Dartmouth Alumni Magazine, Dr. Edwin Frost wrote that the Puluj tube "was one of the best tubes in America for the next few weeks. It was handled carefully and was not burned out, as were many of the tubes used in other laboratories" (Frost 1930).

After Austin's discovery of the tube, Dr. E. Frost, an assistant professor in the physics department at the time, took over the project and supervised the experiments. Austin and Frost, using the Puluj tube and a Holtz machine to gen-

erate the cathode rays, began taking pictures of various objects, and Langill developed the resulting photos. They found, through these experiments, that certain objects appeared opaque, while others were transparent (Frost 1896). The group placed a pair of scissors and a knife in a wood box, and a coin and a key between two sheets of wood, and photographed each of these with X-rays. Much to their enjoyment, the X-rays penetrated the wood, and they were able to produce images that showed the objects distinctly. Dr. E. Frost also took a picture of his and his wife's hand, and the resulting images "revealed the bones of the hand and arm with startling distinctness" (Frost, 1896).

Austin, immediately recognizing the medical implications of such a technology, suggested to Dr. E. Frost that they use X-rays in a medical diagnosis of a patient. Dr. E. Frost's brother, Dr. Gilman Frost, was a professor at the Dartmouth Medical School and he had just received a patient with a possible broken bone. The patient was 14-year-old Eddie McCarthy, a local schoolboy, who had been ice-skating on the Connecticut River when he fell headfirst onto the ice. He reached out to halt his fall, but he fell with such force that he severely injured his wrist (Richmond 1959). Dr. G. Frost told his patient about the experiments and what the technology could do for his case, and a brave Eddie McCarthy consented to have his arm X-rayed.

On February 3, 1896, Dr. G. Frost accompanied Eddie to Reed Hall, the location of the physics lab at this time. They sat the patient down and placed his arm under the tube. Dr. E. Frost turned on the Holtz machine, and after an exposure time of 20 minutes the first clinical X-ray in America was taken (Frost 1930). The X-ray revealed that Eddie had fractured the ulna in his left wrist.

Dr. E. Frost submitted an article, dated February 4, 1896, about his experiments with X-rays to the magazine *Science*. Dr. E. Frost ended the article by writing, "It was possible yesterday to test the method upon a broken arm . . . the plate on development showed the fracture in the ulna very distinctly. Comment upon the numerous applications of the new method in the sciences and arts would be superfluous" (Frost 1896).

Controversy arose a short time later over whether the X-ray taken by Dr. E Frost was indeed the first X-ray taken for medical purposes in America. Yet, after more than 100 years, no contrary evidence has surfaced, and it has thus been concluded that this was indeed the first experiment of its kind. Thus, in February of 1896, Dr. E Frost and his companions Frank Austin, H.H.H. Langill, Dr. G. Frost and young Eddie McCarthy put themselves in the annals of history by taking the first pathological X-ray in the United States.

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