

The First Demonstration of X-rays in Puerto Rico: June 1897

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Objective: Röntgen's discovery made international news in January 1896, but the appearance of x-rays in Puerto Rico has been dated to 1911. This investigation was undertaken to identify the time, place, participants, and equipment of the first public demonstration of x-rays in Puerto Rico, document other users before 1911, and frame the events and persons in their social, professional, and international contexts.

Methods: Information was retrieved from digitized Puerto Rico newspapers available online and secondary printed and digital sources.

Results: The first demonstration of x-rays in Puerto Rico was organized by physician José Esteban Saldaña in June 1897 and included Francisco Pelati (who documented the event), an electrician; José C. Barbosa, Francisco and Pedro Del Valle, and Juan and Ricardo Hernández, physicians; and José A. Canals, an engineer. Other users prior to 1911 are documented.

Conclusion: Internationally, the first reaction to the discovery of x-rays was a mixture of wonder, experimentation, fascination with a scientific novelty carrying other-worldly resonance, and recognition of potential dangers. Puerto Rico was not an exception. The news arrived in seven weeks, although the equipment (apparently from New York) arrived a year and a half later (June 1897). The readily apparent common denominator for this group of first users is political affiliation, but they were connected by a variety of experiences, despite differences in race, class, and religious ideas. As in other places, x-ray use increased slowly and was available in several cities in Puerto Rico by 1911.

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On November 8, 1895, Wilhelm Conrad Röntgen (1845–1923), a physics professor at the University of Würzburg (Germany), discovered what he called “x-rays” (“x” for unknown; a full explanation of their nature would emerge over the next three decades). His report was published in the last days of the year; a newspaper in Vienna mentioned his discovery on January 5, 1896. The information was published in London the next day, and in several cities of the United States on January 7, 1896 (1). The instruments required to produce the new radiation were well-known, inexpensive, and easy-to-use. The news provoked what has been called “the x-ray craze of 1896”: myriad scientists and technicians testing and expanding the method’s possibilities and a public interested in viewing its own internal anatomy and fascinated and repelled by images associated with death, corruption, and the afterlife (2). By September 1896, physician William J. Morton and electrical engineer Edwin W. Hammer in New York produced a technically detailed and profusely illustrated textbook that explained the theoretical and practical aspects of using x-rays. By 1900, x-rays were considered useful for clinical care, especially for detecting foreign bodies and fractures, although routine use in hospitals was not yet commonplace (3).

In contrast, the appearance of x-ray machines in Puerto Rico has been dated to 1911. Other dramatically useful discoveries (e.g., the smallpox vaccine, surgical anesthesia) reached the island

as soon as the method and the transports of the era allowed. Why would x-ray technology take 15 years to arrive? My skepticism was reinforced by a pamphlet published in 1898, which mentioned the utility of “Rotgen” rays in the care of the wounded in battle. This pamphlet suggests that there was local experience with the method before the Spanish–American War (4).

The first use of an important invention reveals the priorities, knowledge, and resources of the community in which it is used and identifies both the persons who sought innovation and their physical and intellectual connections to the world. The purpose of the investigation described herein was to identify the time, place, participants, and equipment of the first public demonstration of x-rays in Puerto Rico and frame the event and persons in their social, professional, and international contexts. I show the outline and inner workings of the event, the participants, and then document other users before 1911.

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Materials and Methods

The recent (partial) digitization of Puerto Rico serials with open access at the Library of Congress's "Chronicling America" newspaper collection, plus the *El Mundo* digital archive made possible a search for "rayos X," and for the persons and events described here (5). It is still a limited search (only digitally accessible material) among all possible newspapers and archives available, so my results are open to elaboration by future researchers. All translations from Spanish are mine.

Results

This is a historical account of a medical landmark in which most of the participants were already important actors in the affairs of their time. The decade before the events described here (1887 to 1897) saw the formation of the Partido Autonomista (Autonomist Party), which requested a locally centered administration for the Spanish province of Puerto Rico; the cruel persecution of the party's leaders; the proposal by Luis Muñoz Rivera in 1891 to sign a pact with a metropolitan party to reach that goal; the refusal by republican autonomists to ally with a monarchical party; and an agreement obtained by Muñoz in Madrid in 1896. The minority dissidents, led by Dr. José Celso Barbosa, established the Partido Autonomista Ortodoxo (Orthodox Autonomist Party). Spain granted autonomy in November, 1897. The profound political division was still present when war broke out between the United States and Spain in 1898, after which the island became a possession of the United States. Barbosa's group eventually formed the Republican Party of Puerto Rico, which was in opposition to Muñoz Rivera's Federal Party, later named "Unión de Puerto Rico."

On February 26, 1896, *La Correspondencia* (San Juan) published "Otra Carta de Nueva-York" (Another letter from New York), a regular column of mostly economic and political news of the time, that described "the new commotion in the realm of science." The author asked, "Is it a trivial thing to be photographed inside, even if one can try to avoid it inside a box or behind armor plate? How much good will come to light if this discovery is perfected! Roentgen's x-rays or Lenard's cathodes are a noble thing, [...] this mysterious light for which glass is opaque and wood and various metals, transparent" (6). There were undoubtedly reports of this discovery in foreign professional journals received in Puerto Rico, and the curiosity was evident in the newspapers. For example, *La Democracia* (Ponce) published in March, "Los rayos de Rontgen," which explained that these rays made possible "the photograph of an object through an opaque body" and allowed "the physician to directly observe internal organs through images that could be preserved in a photographic negative." The author, apparently a law clerk and a native of Barcelona, presented the experiences of university professors in his native city and even attempted to explain the phenomenon (7).

In June 1897, *La Correspondencia* published a report on what seems to be the first local use of x-ray equipment, "Los rayos X," by Francisco Pelati (8) (Figure 1). The newspaper announced that this equipment, imported by well-known San Juan physician Esteban Saldaña, was the first of its kind on the island, and *La Democracia* repeated the news (9). Pelati's indication that he was

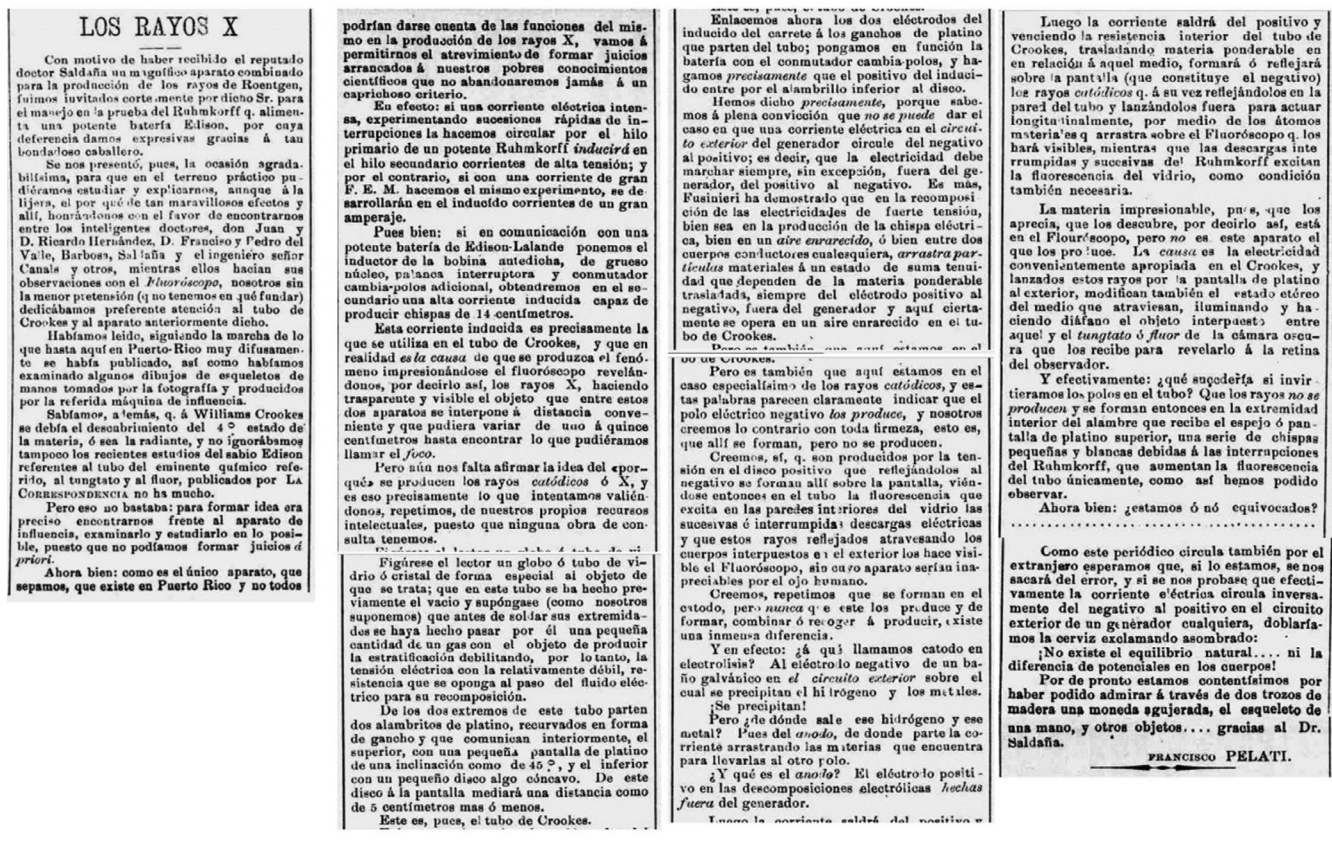
invited to operate the electric components suggests he was needed for the very first use of the machinery. The date and location of the meeting are not mentioned. Most likely it took place only days before, presumably at night (to enhance the visibility of the fluorescence), and in Saldaña's office or home, both on 89 (now 364) Fortaleza St., the "corner near the entrance of the theater," although he had other properties outside of San Juan (10). There was a select group of witnesses: five physicians, an engineer, and unnamed "others." The six (in total) physicians were a significant proportion of the 19 practicing in San Juan at that time (11), but the historian can easily detect a political nexus.

The Participants

José Esteban Saldaña Casenave (1860–1926), born in San Juan, studied medicine at the Université Libre de Bruxelles (Belgium), 1876–1883. It was a "liberal university," where professors taught "sound scientific doctrines" and occasionally contradicted Pope Pius IX's *Syllabus* (his condemnation of the "errors" of the times), which drove Saldaña to study the authors who defended the "errors" (12). This was also the era of foundational discoveries by Pasteur and Koch: "the germ theory," which reset medical ideas on causes, symptoms, and treatments. (All Saldaña's physician guests lived through that transition.) In Puerto Rico, Saldaña opened a private office, worked at the Sociedad de Auxilio Mutuo (Mutual Aid Society) from 1884 to at least 1910, and, for most of his life, also managed his family's rural properties. Greatly respected by his colleagues, he seems to have promoted new medical and social ideas through example rather than research or publication. As member of the Sociedad Económica de Amigos del País (Economic Society of Friends of the Country), from 1892 to 1897 Saldaña lectured on political economy in a course for the artisan (skilled worker) class, judged agricultural contests, petitioned for the establishment of a bacteriologic institute, and proposed ways to improve the living conditions of farm laborers (13). He played an important role as a friend and supporter of the painter Francisco Oller (14). During the military government (1899), he was appointed as a member of the San Juan city council and the Board of Education. He was the president of the Board of Medical Examiners (1903–1911), a member of the Insular Board of Health (1907–1911), and the president of the Puerto Rico Medical Association (1912). In the Catholic revival that followed the establishment of Protestant denominations on the island, he was a visible, prestigious lay participant. As the Consul for Belgium from 1902 until his death, he worked tirelessly to assist that country during the First World War (15).

José Celso Barbosa y Alcalá (1857–1921) was the best known among Saldaña's guests. Although a member of a working-class Afro-Puerto Rican family, he graduated (valedictorian) from the University of Michigan School of Medicine in 1880. Shortly thereafter he joined the Masons (1885), entered politics as a member of the Partido Liberal Reformista Party (Liberal Reformist Party), and then helped establish the Partido Autonomista (1887). In 1890 he joined the faculty at the Instituto de Enseñanza Superior (Ateneo) (Institute of Higher Education, Ateneo), teaching subjects related to natural history and medicine. He helped establish cooperatives for savings and business operations with collaborators Francisco and Pedro Del Valle. (One of the institutions still survives

Figure 1. Francisco Pelati, Los rayos X, La Correspondencia de Puerto Rico, 16 June 1897, page 2 (extracted from original newspaper page for legibility). Also available at: <https://chroniclingamerica.loc.gov/lccn/sn91099747/1897-06-16/ed-1/seq-2/>



as Banco Popular.) In February 1897, he led the group that opposed the fusion of the Partido Autonomista with a party in metropolitan Spain and formed the previously mentioned Orthodox Autonomist Party. During the bombing of San Juan in 1898, he crossed the bay under enemy fire to report to his neighborhood's Red Cross casualty center. After 1898, he founded the pro-statehood Republican Party, serving on the island government's Executive Council from 1900 to 1917 (five consecutive presidential appointments) and was then elected senator (16).

Francisco Del Valle Atilas (1852–1928) was an astonishingly versatile physician and a champion of modern hygiene in Puerto Rico. His training (studies in Cádiz, a doctorate from the University of Seville in 1872, an internship in Paris), a decade before his colleagues in the group, was based on the notion that environment, race, and individual predisposition were the principal causes of illness. Back home, he served in public and private institutions and was quickly appointed to the Subdelegación de Medicina (Subdelegation of Medicine: the government's medical licensing and health advisory board). He was the editor or co-editor of three medical–pharmaceutical journals, a writer of fiction, a founding member of the Ateneo, and a professor at its Institución de Enseñanza Superior. In 1898, he was elected president of the Puerto Rico Commission of the Spanish Red Cross. As did Barbosa, he joined the Liberal Reformist Party and figured prominently in the Autonomist Party and its “Ortodoxo” splinter

(with his brother Pedro). He was the mayor of San Juan for two periods in 1898 (during and after the war), and again from 1907 to 1910. He co-founded the Anti-tuberculosis League and was the president of both the Insular Board of Health (1912–1916) and the Puerto Rico Medical Association (1916). Del Valle's ability to adopt new contexts, such as germ theory and United States colonial rule, can be measured by the distance between his opinions in his medico-sociological essay on the condition of agricultural laborers (*El campesino puertorriqueño*, 1887) and his later medical publications. At the time of Saldaña's invitation, he was a member of the Provincial Board of Health (17).

Pedro Del Valle Atilas (1860–1937) was first a pharmacist and then studied medicine, similar to Barbosa, at the University of Michigan, graduating in 1891. Along with Barbosa, he was one of the founders of the Autonomist Party in 1887, Banco Popular in 1893, and the Partido Autonomista Ortodoxo in 1897. At the onset of war in 1898, he was the general inspector in charge of Red Cross preparations, but the Spanish military kept a close watch on him, since “he smelled of Yankee.” In June 1898, he was appointed member of the Subdelegación de Medicina. Before the war, he was an officer in “Sanidad Marítima” (ship quarantine), and the new regime appointed him port physician with the U. S. Public Health Service, a position he kept until 1930. Del Valle was, throughout his adult life, a distinguished Mason, involved in programs for the assistance of poor children (18).

Juan Zoilo (1849?–1898) and Ricardo María Hernández Salgado (1851–1908) were the sons of the much-admired physician, Francisco Jorge Hernández (1816–1885), and studied at Bellevue Hospital Medical College in New York, 1870–1873 (19). Juan was appointed one of San Juan’s municipal physicians in 1877 and professor of English at the Instituto Civil de Segunda Enseñanza, 1882 and 1883. There is little information on him except high praise for his clinical skills. As did Saldaña, Barbosa, and the Del Valles, the brothers volunteered their services to the Red Cross in 1898, but Juan and one of his sons drowned on July 17 (20). Ricardo was an alderman (“regidor”) of San Juan and a member of its board of health in 1879, and he taught obstetrics at the Instituto de Enseñanza Superior (Ateneo) (1892–1894). In 1897, he was the “médico higienista” (physician-sanitarian) in San Juan’s Welfare (“Beneficencia”) Department. He was appointed by the military government in 1899 to the Superior Board of Health, and under the civil government, he was the Board’s president, 1900–1902; the Director of Sanitation, 1902–1904; and president of the Insular Police Commission, 1905 (21).

José Antonio Canals Vilaró (1859–1926) was born in Cuba but raised in Puerto Rico. He studied civil engineering at Universiteit Ghent (Belgium, 37 miles from Brussels), graduating, as did Saldaña, in 1883. Back in Puerto Rico, he was responsible for the design of an irrigation system and aqueduct for the district and town of Guayama, and he married Saldaña’s sister, Ángeles. In 1897, he was the chief engineer for trains at the Puerto Rico Railroad Company. Before and after the war of 1898, he worked first for the railroad company and then for the city of San Juan, initially as a municipal architect and later as an engineer. From 1905 to 1919, he practiced independently as an engineer and a consultant. Two of his best-known projects were—and remain—the present administration building and the chapel of the Universidad del Sagrado Corazón in Santurce, both constructed in 1913. He served as member of the Superior Board of Health from 1904 to 1907 and was elected president of the Puerto Rico Society of Engineers in 1911 (22).

Francisco Pelati Raventós (ca. 1858–1913) is remembered principally as an early spiritualist and a feared, erudite polemicist. Around 1883, he converted “from the grossest materialism” to spiritualism and was later involved, at least in 1889 and 1909–1910, in not only public debates about his beliefs and freedom of worship but also scientific advances (23). In 1876 (around age 18), he became a clerk at the Treasury Department. In 1880, he was accepted at the School of Telegraphy, 4th of the 13 applicants who passed exams on reading, writing, grammar, taking dictation, and arithmetic. Presumably, he learned about electricity at the school. He was a telegraphist in Yauco in 1882 and in Cayey in 1887 (24). In 1889, he was the editor of a spiritualist weekly journal and later was a prolific columnist for *La Correspondencia*, as an early expert on electric power when electricity had only begun to reach homes in San Juan. At the 1893 Exposition to celebrate the four hundredth anniversary of Columbus’s arrival in Puerto Rico, he won a silver medal for his display of electric devices (batteries, a motor, bells, buzzers, a toy with moving figures, an “electro-medical machine,” and two telephones altered for better reception and transmission) (25). In early 1897, he published a series of articles in *La Correspondencia* on the advantages of electricity supply meters (the rates in San Juan were fixed, based on the number and intensity

of the lamps in the building), and in July through August 1900, on the dangers of high (alternate) currents. From 1902 to 1903, he supervised the installation of electric service in Arecibo (26). Pelati was a member of the Liberal Reformist Party in 1877, an autonomist (and persecuted by the Guardia Civil) in 1887, and a follower of the Liberal Party (which was opposed to the Orthodox Autonomist Party) in November 1897. Saldaña may have met him at political meetings, seen his inventions at the 1893 Exposition, or learned of him through his articles or advertisements (27). Francisco Del Valle Atilés, a vice-president of the Exposition, must also have been familiar with Pelati’s abilities.

Before the meeting at Saldaña’s, Pelati knew of Röntgen’s discovery through newspaper articles that had been “very diffusely published” locally, plus the “drawings of the skeletons of photographed hands” and Edison’s recent studies using tungstate and fluorine in a Crookes tube, which had recently been reported by *La Correspondencia*. He was also familiar with British physicist Sir William Crookes’s “discovery of the fourth state of matter, that is, radiant matter.” Crookes was a “giant of experimental physics” and, at the same time, a well-known spiritualist and investigator of “psychic force” (28).

The Equipment

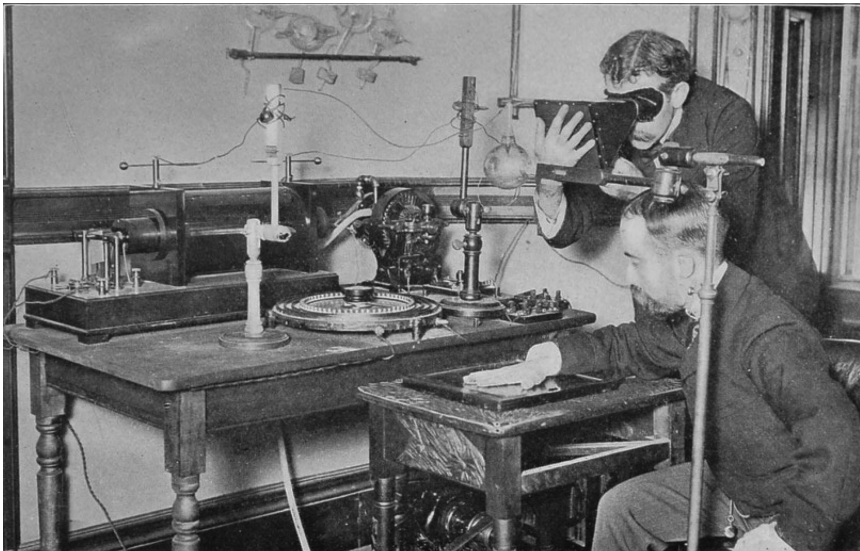
At the meeting, Pelati devoted his attention to the electrical equipment, while the named guests “made their observations with the *Fluoroscope*,” capitalized and in italics. This term, together with the use of an “Edison Lalande” battery, suggests that Saldaña was using an apparatus obtained from Edison’s company in New York. Edison’s complete outfit sold for from \$100 to \$300 (roughly \$4,000–\$12,000, today) (29). Pelati describes five components: battery, influence machine (electrostatic generator), induction coil, Crookes tube, and fluoroscope.

Pelati would have operated the influence machine to produce a rapid succession of interruptions of the electric power supplied by the battery to the coil, which would induce a strong current to the Crookes tube: a glass bulb with negative (cathode) and positive (anode) electrodes in a partial vacuum, that produced a stream of “rays” projected straight from the cathode, and electromagnetic waves (the x-rays) that passed through most objects and elicited fluorescence in appropriate materials, and therefore an image of the object traversed by the rays. Röntgen viewed (or fixed) images in fluorescent or photographic plates, but in 1896, Edison invented a handheld “fluoroscope” with a more sensitive plate attached to a “mask” that the examiner could hold to the face (30). This mask permitted movement of the studied object and improved the image (by reducing the influence of ambient light and allowing the viewer to move closer or farther to find, as Pelati said, the best “focus”).

Figure 2 (taken at Dr. William Morton’s lab in New York in 1896) shows the apparatus and the procedure for taking an x-ray picture. According to a modern description

a huge induction coil (on the table against the wall) provides high voltage to drive the rays in a partially evacuated gas tube; behind it, in the back corner, a motor-operated interrupter repeatedly breaks the direct current supply to create magnetic-field changes for induction. The large flat disk in front of the table is the power control, made of an adjustable resistor. A rack on the wall holds spare gas tubes.

Figure 2. Apparatus for the taking of an x-ray picture, from Morton WJ, Hammer EW. The X ray or Photography of the invisible and its value in surgery. London: Simpkin, Marshall, Hamilton, Kent, [1896?] Plate figure 54, explained in pages 88-89.



The man who is standing is viewing his right hand with a fluoroscope, while the one who is sitting has his right hand on a photographic plate. For both, the source of x-rays is the globe-shaped Crookes tube placed in line with the standing man's hand, fluoroscope, and eyes. The standing man is the operator "judging as to the probable effect of the X Ray on the photographic plate in the plate-holder by noticing the appearance of his own hand on the screen of his fluoroscope" (31).

More than half of Pelati's text is dedicated to his theory that x-rays are produced by the anode and reflected by the cathode to the walls of the glass tube and beyond. The identification of "cathodic rays" as electrons and the rejection of the concept of radiant matter occurred at about the time of Pelati's article, or shortly thereafter, but other contemporaries concurred, and present knowledge indicates that, indeed, the x-rays are emitted by the anode (32).

The Experience

In the final lines of text, Pelati expresses his joy at "having been able to admire, through two pieces of wood, a perforated coin, the skeleton of a hand, and other objects," leaving us with the desire to know more about the session. In other locations, experimenters evaluated the x-rays' ability to go through solids of varied densities and consistencies, including a perforated coin placed inside containers made of metal, wood, or leather. They used hands, but also small animals, to evaluate the differential penetration in flesh, internal organs, and bones. The fluoroscope would have allowed Saldaña's group to examine the differences between images of the same object at different angles to the projected rays. Nevertheless, according to early users, "fluoroscopic images as presented to the eye alone are often tantalizingly vague and indistinct, not, it would seem, from want of illumination of the screen by the X Ray, but because of the 'diffusion' of this X Ray by masses of muscle and other tissues which may happen to surround the bones or the

foreign objects sought for. [...] The mind walks in among the tissues themselves. It seems as if it were their ghost or astral forms we see depicted (33)."

I have not found a contemporary or near-contemporary x-ray image taken in Puerto Rico. Curators of extensive repositories should be aware that the identification of our oldest extant radiography would merit publication.

The Aftermath

The reader will have realized that there was no protection from radiation for any of the participants, while the intensity and length of exposure were much higher (15 minutes for a hand, longer for other bones) than are used at present (34). Three weeks later, Pelati wrote a second (and last) article on Röntgen's discovery, titled "Chemical action of x-rays." It was based on the reports of persons exposed to them "very frequently and for some time."

Pelati indicated that the x-rays "provoke in the tissues they cross true chemical decompositions, without a trace of microbe." Nevertheless, his text was not intended to warn, but to explain this action, according to his understanding of electrophysical theories. The utility and danger inherent to the new discovery, though little understood, were evident, at the time of its first use in Puerto Rico (35).

From 1897 through 1914, local newspapers published many articles (almost all from Europe and the United States) about not only the x-rays' utility in medicine but also their adverse side effects. There were also allegations of curative power (e.g., x-rays to restore sight to the blind) and unbelievable reports (a child in Massachusetts with x-ray vision). Mentions of x-ray equipment in local use appeared sparsely from 1898 to 1901 (1898, in a U. S. hospital ship off the coast of Mayaguez; 1899, Dr. Rafael Del Valle Rodríguez's new office in San Juan; 1900, the Military Hospital in San Juan; 1901, an "American doctor" in Ponce) (36).

Perhaps not surprisingly, there is a four-year gap in the mention of medical uses. The years immediately after the war were very difficult for the average Puerto Rican. Coffee (the main export product) lost its markets after the island's political separation from Spain. In 1899, a devastating hurricane destroyed crops and factories. Laborers emigrated to Hawaii, Mexico, Cuba, and other places looking for sustenance. Nevertheless, x-rays entered common parlance and even movies. In 1901, a satirist in the newspaper *La Democracia* (critical of the government) wrote about teachers who "lack a stomach for lack of use." One of them ("a Republican, by the way") talked disparagingly of x-rays: "In Puerto Rico, they are not necessary," he said. He bared his chest and, truly, I could count all his internal organs. He was transparent" (37).

Medical mentions resume in 1905, with the expected opening of Dr. Miguel Hernández Comas's new office in Aguadilla; in 1906, with plans for an x-ray suite in the new San Juan Municipal Hospital, with bids for installation at the end of 1908; in 1906-1907, with

plans for and the installation of x-ray facilities at the Tricoche (municipal) Hospital in Ponce (Drs. Ferrán and Coronas operate them in 1909 and more equipment arrives in 1910); in 1909, with the hospital of Drs. Vadi and Perea (Hospital Perea) in Mayaguez; in 1911, reporting on Dr. Roses Artau's (from Arecibo) attendance at the annual meeting of the Medical Association to present a patient with right eye neoplasia treated with x-rays by Dr. [Manuel?] Figueroa, and again in 1913, announcing a refurbished office that included x-ray equipment; in 1911, when Drs. Vidal and Pila Iglesias began to provide x-ray diagnoses in Ponce; in 1912, reporting on Auxilio Mutuo's new facility (its present location) and x-rays; in 1913, reporting on Dr. Isaac González Martínez's "X-ray laboratory" for radiography and treatments; and in 1914, when Dr. Manuel Fernández Náter brought his equipment to Ponce from Bayamón to treat a patient (38).

The island's change of status from Spanish province to United States territory, by eliminating a customs barrier, possibly made the acquisition of Edison's x-ray equipment less expensive. Nevertheless, it seems few, if any physicians immediately followed Saldaña's example, and it is not clear whether even Saldaña made much use of the equipment he acquired in 1897. Saldaña took a risk, given that the method was so new. He may have had problems with the system's functioning or maintenance, the onset and aftermath of war, mentioned above, or concerns about the side effects on operators. If his practice included few patients with broken bones or bullet trauma, he may have had little use for x-rays. It was not until 1906 that municipal hospitals in San Juan and Ponce announced plans for x-ray suites, and other hospitals and physicians followed suit. In 1897, radiologic equipment was installed at Pennsylvania Hospital (Philadelphia), but its use, even in patients with broken bones, did not reach even 50% until 1909. In 1897, the equipment was ordered for Spanish naval hospitals, but the first installation took place at Ferrol (Galicia) in 1909 (a delay from administrative inefficiency, lack of funds, or a precautionary wait after the initial enthusiasm?). The available dates for Cuba and the Dominican Republic are 1907 and 1911, respectively (39).

By 1905, x-rays (and also radium) were used to treat lupus, ringworm, and inoperable tumors. Saldaña's use of x-rays was mentioned again in September 1907, when Mr. Oscar Porrata, of Naguabo (on the island's east coast) was in San Juan undergoing an unspecified x-ray treatment for lupus, with notable improvement over three months (40). Then on August 7, 1910 (and almost daily for the rest of the month), Ruiz, Saldaña, and Company "offer themselves to the public as operators in radioscopy and radiography, with a good X-ray apparatus and the necessary accessories, for treatments in connection with doctor Saldaña's office, 89 Allen [Fortaleza] Street." Ruiz and Saldaña were not further identified, but the adjacent advertisement of Dr. Ramón Ruiz Arnau's return from the United States and new office at 46 Fortaleza Street suggests a collaboration between the two physicians (41).

Dentists' offices incorporated x-ray equipment later, if newspaper advertisements give fair evidence. The earliest finding in a digital newspaper search for "dentista" and "rayos X" showed an advertisement for "radiographs for dentists" on January 15, 1921, by S[alvador?] Sierra Amalbert, a doctor in "mecanotherapy," who may have been a partner with Dr. Pedro Del Valle Atilas in a corporation that supplied machinery, including x-ray equipment. In

February 1923, Dr. Ramón Fernández Carballo, a dentist, offered "radiographic examination when necessary." On October 6, 1924, Drs. Gerardo S. Martorell and H. W. Monroe, and Dr. James E. Johnson (on December 6), all dentists, advertised their "X-ray cabinets," at 45 and 66 Allen (Fortaleza) Street, respectively (42).

Saldaña's and many others' roles in the early use of x-rays in Puerto Rico were forgotten by the 1940s, when Manuel Quevedo Báez (1865–1955) wrote his chronicle of medicine in Puerto Rico. He had been prominent in medical and social circles since the end of the 19th century and was the first president of the Puerto Rico Medical Association (1902–1904). Relying not only on his memory, but also on that of Isaac González Martínez (1871–1954, renowned for his work in parasitology and later radiotherapy), he dated the first use of x-rays to 1911, by general practitioner Dr. José N. Carbonell Olarraza (43). One of Carbonell's patients, a German national called Hugo Stearn, brought an x-ray machine to San Juan and "put it at Carbonell's service." Carbonell used it at the Insular Penitentiary ("La Princesa"). (Why Stearn had the equipment is not explained by Quevedo Báez.) González Martínez, in turn, remembered that, by 1911, Dr. Carbonell was using a Kny-Scheerer "Perfection" machine bought by the penitentiary, and the first three physicians to use x-rays were José Carbonell, Miguel Roses Artau (in Arecibo), and himself, in that order, around 1911. It would be interesting to learn what other circumstances in Quevedo Báez's and González Martínez's lives made them remember Carbonell's machine but forget the use of x-rays prior to 1911 (44).

Discussion

Internationally, the first reaction to the discovery of x-rays was a mixture of wonder, experimentation, fascination with a scientific novelty carrying other-worldly resonance, and recognition of potential dangers. Puerto Rico was not an exception, but the investigation of local events has revealed the specific routes of the technology transfer. Information arrived no more than seven weeks after the discovery was made public (from New York and Barcelona, indicating the island's close ties to both places before 1898), and the equipment (apparently Edison's), arrived after a year and a half, for an interesting team of first users. As in other places, it took years (nine, in Puerto Rico) until x-ray use became relatively prevalent. Those developmental steps were later forgotten, showing the unreliability of "memory-based" chronicles. X-rays and subsequent technologies for visualizing body organs and cavities have evolved from detection to intervention for treatment, with a history that is global in scope. The events in Puerto Rico merit further investigation (45).

A cursory examination of Saldaña's guest list suggests an underlying political nexus. Pelati and at least five of the six physicians (little is known of the sixth, Juan Hernández) were autonomists. The Del Valles were important members of the Partido Autonomista Ortodoxo, and, along with Barbosa (its leader) and Ricardo Hernández, held important positions in the governmental structures that dealt with public health issues in the war of 1898 and thereafter. I found no mention of Saldaña as a first-line activist at that time, but he appears later among the long-time "Republicans" (46).

Political affiliation is only the most obvious of the prior social and professional collaborations between these men. They held a

similar reformist outlook and worked together, despite differences in race, religious outlook, and class. Barbosa was Black; the rest were white. Barbosa and Pedro Del Valle were Masons, Saldaña a devout and progressive Catholic, and Pelati a combative spiritualist. Barbosa came from the poor working class, Pelati belonged to the skilled-worker class (to which Saldaña addressed a course on political economy), and the rest were upper-class professionals trained in Europe or the United States. They were all male, but the unidentified “others” at the meeting may have included wives and other interested women.

Pelati, a working-class newspaper columnist even before 1898, partially fits the profile of an activist worker-writer in Puerto Rico at the beginning of the twentieth century. These individuals have been described (by Carmen Centeno Añeses and others) as mostly self-educated intellectuals who were still laborers; believers in progress and science and irreverent, anti-clerical, combative essayists in periodical literature (47). Pelati was one of a kind, though. He wrote on electricity and debated on spiritualism, but not (that I have seen) on social issues. His technical texts suggest that just as there is poetry, prose, and drama by working-class authors that is found not in books but in newspapers, there may also be a wealth of scientific literature by workers to be found in our unexamined periodicals.

Resumen

Objetivos: El descubrimiento de Röntgen fue noticia internacional en enero de 1896, pero el primer uso en Puerto Rico se ha fechado en 1911. Esta investigación se realizó para identificar el tiempo, lugar, participantes y equipo de la primera demostración pública de rayos X en Puerto Rico, documentar otros usuarios antes de 1911 y encuadrar los eventos y personas en sus contextos sociales, profesionales e internacionales. **Métodos:** La información se recuperó de periódicos de Puerto Rico digitalizados y en línea y de fuentes secundarias impresas y digitales. **Resultados:** La primera demostración de rayos X fue organizada en junio de 1897 por el médico José Esteban Saldaña e incluyó al electricista Francisco Pelati (quien documentó el evento), los médicos José C. Barbosa, Francisco y Pedro Del Valle, y Juan y Ricardo Hernández y el ingeniero José A. Canals. Otros usuarios, antes de 1911, aparecen aquí documentados. **Conclusión:** A nivel internacional, la primera reacción al descubrimiento de los rayos X fue una mezcla de asombro, experimentación, atracción como novedad científica con resonancias ultraterrenas y reconocimiento de peligros potenciales. Puerto Rico no fue una excepción. La noticia llegó en siete semanas, aunque el equipo (aparentemente de Nueva York) llegó año y medio más tarde (junio de 1897). El denominador común evidente para el grupo de primeros usuarios es la afiliación política, pero compartían una variedad de experiencias, a pesar de diferencias en raza, clase e ideas religiosas. Como en otros lugares, el uso de rayos X se generalizó lentamente; para 1911 estaba disponible en varias ciudades de la isla.

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Collazo, PhD, and for the insightful comments of the anonymous reviewers. Any errors or omissions are my responsibility.

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5. Library of Congress (Washington, DC) “Chronicling America” newspapers collection, Puerto Rico: https://chroniclingamerica.loc.gov/newspapers/puerto_rico/ covers the government's *Gaceta de Puerto Rico*, digitized 1836-1902; *Boletín Mercantil de Puerto Rico*, 1871-1915; *La Correspondencia de Puerto Rico*, 1890-1910; *La Democracia*, 1891-1907; *El Imparcial*, 1918-23; *El Mundo*, 1919-1925. East View Global Press Archive (Minneapolis, MN) includes *El Mundo Digital Archive*: <https://www.eastview.com/resources/gpa/el-mundo/> fully digitized 1919-1990. These collections provide no coverage for 1916 and 1917, all have gaps for different dates and the digital images are based on old microfilms that vary in legibility. Direct digitization from the originals is still necessary.
6. Otra carta de Nueva York. *Correspondencia.* 1896 Feb 26:2 (emphasis in the original). The author may be Carlos O'Neill, who signs another “Carta de Nueva York” (*Correspondencia.* 1897 Mar 16:2) and is elsewhere identified as secretary of the New York Spanish Chamber of Commerce (“Nuevo vapor entre Puerto Rico y Nueva York”. *Correspondencia* 1897 April 4:1). I have not found the additional report he promises.
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- law clerk in Ponce, see Salazar Anglada A, editor. *Puerto Rico y la Guerra Civil Española. La Voz de los Intelectuales*. Madrid: Punto de Vista Editores, 2022:498-500.
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 9. Noticias. *Correspondencia*. 1897 June 13:3 (col. 3); *Cartera de la Isla. Democracia*. 1897 June 15:3 (col. 3).
 10. Saldaña moved to that address in 1893 (El Dr. Saldaña. *Correspondencia*. 8 May 1893:2). In 1904 (*Anuncios del día. Democracia*. 10 June 1904:3) he is at Plaza Colón 8 (possibly an alternative address for the same place), and in 1910 (Saldaña, Ruiz y Co. *Correspondencia*. Aug 7:2) the office is at Fortaleza 89. See also Geo-Isla, *Plano general de San Juan (1921)*, Geo-Isla (San Juan, PR) [cited 2024 Jan 6]. Available from: <https://www.geoisla.com/2018/04/plano-general-de-san-juan-1921/> where Fortaleza 89 is marked “Antigua casa de Saldaña”. He had evidently moved out of there by the date of the map. Other properties at the time, for example, in Río Piedras (current Avenida Ponce de León corner calle Saldaña) and Carolina (Hacienda Aurora).
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38. Notas de Aguadilla Democracia. 1905 June 7:1. Informe. Correspondencia. 1906, Mar 28:2. Notas municipales. Boletín Mercantil. 1908 Dec 23:2. En el Ayuntamiento. Democracia. 1906 June 26:3. Impresiones y noticias. Democracia. 1906 Aug 18:3. Una visita al Hospital Tricoche en Ponce. Correspondencia. 1907 April 15:1; Más notas y noticias. Correspondencia, 1909 June 30:4. Municipalidades Unionistas. Correspondencia. 1910 Oct 7:3. El Sr Pandini bajo el bisturí. Correspondencia. 1909 May 22:1. La asamblea médica en Arecibo. Boletín Mercantil. 1911 June 21:2. Gacetillas. Boletín Mercantil. 1913 Sep 30:5. Ponce al día. Boletín mercantil. 1911 Oct 13:1. Sociedad Española de Auxilio Mutuo y Beneficencia. Boletín Mercantil. 1912 May 22:4 and almost daily through January 24, 1913; again in December 30-31, 1914:5. Laboratorio de Rayos X. Boletín Mercantil. 1913 Sep 3:4, almost daily through December 19. Desde Ponce. Boletín Mercantil. 1914 Nov 6:5.
39. Howell 343; Redondo-Calvo FJ, Pozuelo-Reina AA, Bejarano-Ramírez N, Dusuky A, Villazala-González R, Pinardo-Zabala A. La introducción de los rayos X en España. La ciencia médica y la sanidad naval rumbo al siglo XX. Sanidad Militar. 2016; 72: 296-300. Cuesta Rojas Y, Rivera Fernández OI, Lescaille Elías N. Desarrollo de las altas tecnologías en Cuba y la formación del Tecnólogo en Imagenología y Radiofísica Médica. Referencia Pedagógica (Cuba). 2021;10:391-405 [cited 2024 Jan 6]. Available from: www.rrp.cujae.edu.cu (Dr. Francisco Rodríguez Roldán, Hospital Reina Mercedes, actual "Comandante Manuel Fajardo"); Stern Díaz HS. Historia de la medicina española en la República Dominicana, siglos XIX y XX. Santo Domingo, República Dominicana: Clínica Oftalmológica de Santo Domingo, 2019:104, 112, 118-119 (Dr. Mariano Rovellat Canals's Sanatorio Español, Santiago de los Caballeros, but there seems to be controversy).
40. Pamboukian 67; Porrata in Varios informes. Democracia. 1907 Sep 17:5 ("se encuentra sometido a la aplicación de los rayos X"; "mejora notablemente"), Diversos asuntos. Democracia. 1907 December 7:2.
41. Ruiz, Saldaña y Co. El Doctor R. Ruiz Arnau. Both items in Correspondencia. 1910 Aug 7:2.
42. Gabinete Radiográfico Dr. S. Sierra Amalbert, M. T. Imparcial. 1921 Jan 15:6 [and for the rest of the year]; Comercial [Sociedad Sierra y Del Valle disuelta] El Mundo. 1921 Oct 10:4; Dr. Ramón Fernández Carballo Dentista. El Mundo. 1923 Feb 15:3; Dr. Gerardo S. Martorell Dr. H. W. Monroe Dentistas. El Mundo. 1924 Oct 6:3; Dr. James E. Johnson – Dentista. El Mundo. 1924 Dec 6:4.
43. Died in 1923, Quevedo Báez 2:404-405. He was also an activist in the Republican Party, see La Lucha del domingo. Correspondencia 1910 July 12:7.
44. Quevedo Báez 2:156-158. The Kny-Scheerer Company was in New York City. In 1897, Quevedo Báez lived in Utuado (in the central mountains of Puerto Rico) and González Martínez in Barcelona, so they may not have had access to Pelati's newspaper article. See González Contreras 451 (Quevedo in Utuado); Antonio Pacheco Padró. Isaac González Martínez. Su vida y su obra. San Juan, PR: Editora Montalvo (Ciudad Trujillo, República Dominicana), 1954:37. By 1948, the named participants in Saldaña's test were long dead, but Carbonell Olarraza had been a close collaborator of Quevedo Báez in the Medical Association.
45. Frankel RI, Centennial of Rontgen's discovery of x-rays. West J Med 1996; 164:497-501; Wang G. Medical imaging in increasing dimensions. Am Scientist. 2023;111:294-301. For indications of developments in Puerto Rico, see García-Rodríguez JM. Sociedad Española de Auxilio Mutuo: los años decisivos. San Juan: Sociedad Española de Auxilio Mutuo y Beneficencia, 1998:265-268 (The allegedly first malpractice claim in Puerto Rico was related to radiologic diagnosis, filed against Auxilio Mutuo hospital in 1924. The experts for the claimant were Roses Artau and González Martínez.) Gutiérrez Igaravidez, P. La División de Roentgenología del Departamento de Sanidad de Puerto Rico. Bol Asoc Med P Rico. 1926;20:2-8; Pagán Sáez H. Historia del Programa de Residencia en Radiología de la Escuela de Medicina de la UPR. Buhiti. 2010; 15(1):7-12; Colón Negrón E. 50 años de radiología diagnóstica. Buhiti. 2010;15:15-16; Cintrón E. Una visión breve a la evolución de la radiología pediátrica. Galenus. 2013 (May-June):50-51.
46. Propósitos de nueva política. Correspondencia 1906 Nov 10:1. En el Senado hoy. Imparcial. 1922 Feb 15:1.
47. Centeno Añeses C. Modernidad y resistencia: literatura obrera en Puerto Rico (1898-1910). San Juan, PR: Centro de Estudios Avanzados de Puerto Rico y el Caribe, Ed. Callejón, 2005:159-161, 218, 226-227.