The History of the Bellevue Hospital Chest Service (1903–2015)

William N. Rom and Joan Reibman

Department of Medicine and the Bellevue Hospital Chest Service, New York University School of Medicine, New York, New York

Abstract

For more than 100 years, the Bellevue Hospital Chest Service in New York City has contributed major advances in our understanding of pulmonary disease. Research from the cardiopulmonary laboratory of the Chest Service by Drs. Cournand and Richards resulted in the shared Nobel Prize in Physiology or Medicine in 1956 for the development of human cardiac catheterization. In more recent years, continuing its mission to serve the underserved and respond to health crises, the Bellevue Chest Service has served as a leader in the management of HIV infections, multiple drug–resistant tuberculosis epidemics, early detection of lung cancer, and management of urban asthma. Members of the Chest Service founded the World Trade Center Environmental Health Center shortly after collapse of the towers in 2001. The Chest Service became New York's infectious isolation unit caring for the first patient in New York infected with Ebola virus. Recent research has focused on disease management, with the first in-house Directly Observed Therapy Clinic for treatment of tuberculosis, clinical trials of aerosolized IFN-γ, and translational research on host defense against tuberculosis infection. Studies of the airway mucosa have revealed mechanisms by which ambient pollutants promote asthma. Studies on the World Trade Center firefighters and community populations have promoted understanding of systemic inflammation and small airways function. Today, the partnership between a public hospital and an academic institution promotes the synergy that leads to cost-effective and state-of-the art care for an underserved population as well as cutting-edge training and research.

Keywords: twentieth-century medical history; hospitals; tuberculosis; AIDS; environmental medicine

(Received in original form June 19, 2015; accepted in final form August 14, 2015)

Correspondence and requests for reprints should be addressed to William N. Rom, M.D., M.P.H., Division of Pulmonary, Critical Care, and Sleep Medicine, Department of Medicine, and the Bellevue Chest Service, NYU School of Medicine, 550 1st Avenue, New York, NY 10016. E-mail: william.rom@med.nyu.edu

Ann Am Thorac Soc Vol 12, No 10, pp 1438–1446, Oct 2015

DOI: 10.1513/AnnalsATS.201506-370PS
Internet address: www.atsjournals.org

Bellevue Hospital, in southern Manhattan in New York City (NYC), is the oldest public hospital in the United States. Bellevue serves as a final recourse for the poor, the immigrant, the mentally ill, and those inadvertently faced with trauma or disaster. This mission has obliged the Chest Service at Bellevue Hospital to become a resource for clinical care and education. Its academic associations promoted translational and clinical research in areas of pulmonary physiology, tuberculosis, AIDS, sleep, asthma, and environmental disasters. The Chest Service, started in response to tuberculosis, serves as the preeminent example of the synergy accomplished by the combination of medical care, education, and research.

Bellevue Hospital: Early Years

Bellevue Hospital began in 1736 as a public almshouse. By 1795 it housed 655 "homeless, sick and insane" patients, more than three-fourths immigrants. By 1811, in response to the yellow fever epidemic, a new expansion was accomplished with the purchase of the 150-acre Kips Bay farm. This complex of buildings for the "insane," paupers, and prisoners, spanned 23rd to 28th street, from the East River to Third Avenue. In 1825 a new "fever" hospital building was added—"Bellevue Hospital."

Bellevue was one of the first teaching hospitals in the United States, with faculty and medical students assigned by New York University in 1841. By 1860, Columbia University's College of Physicians and Surgeons affiliated with the hospital, with Cornell Medical College soon following suit. These academic affiliations laid the groundwork for the inception of the Bellevue Chest Service.

The Bellevue Chest Service under James Alexander Miller, M.D.

The Bellevue Chest Service, first designated the Tuberculosis Service, was founded by Dr. James Alexander Miller in December 1903 in response to the tuberculosis epidemic rampant at the time. Dr. Miller, a graduate of Columbia Physicians and Surgeons, was only 29. He wrote:

Figure 1. James Alexander Miller, M.D.

> In 1903, … I was transferred from the relatively aristocratic surrounding of Columbia's Vanderbilt Clinic to those of Bellevue Hospital…my interest in tuberculosis had been aroused by the fortunate personal and professional relationship for two years with Doctor Edward Livingston Trudeau in the Adirondacks, who taught me that my medical school and hospital internship experience had left me totally ignorant of the basic principles underlying a knowledge of tuberculosis. I found at Bellevue that in the very crowded Out-Patient Department hundreds of cases of pulmonary tuberculosis were included in the general medical clinic. They were almost exclusively advanced cases, in which the diagnosis was easy and the treatment consisted of prescription for cod-liver oil and a cough mixture. There was no attempt to give instruction in the sanitary disposal of the sputum, no follow-up in the homes, no study of their social or economic status and no effort to examine family contacts. Within Bellevue Hospital itself there was a male and a female ward for tuberculosis with a total capacity of 80 beds. On the wards, there were standing orders for a cough mixture, for one quarter grain of morphine in case of hemorrhage and a regular half ounce of whiskey three times a day for every patient, with a double portion on the day of their projected transfer to another hospital. (1) (Figure 1)

In Miller's first year, the service expanded rapidly, with the Chest Service treating 577 new patients for tuberculosis and 3,092 visits to the clinic (Figure 2). By 1907, a second clinic for children of the adult patients with tuberculosis was added. In 1908, an old ferryboat, "Southfield," was moored in the East River near the hospital grounds to expand capacity (Figure 3). By 1912, 2,800 patients were enrolled in the clinic: 400 treated on the Southfield and 3,600 patients on the tuberculosis wards in the 69 available beds; 405 patients died.

Treatment, which included fresh air provided from rooftops, was combined with social work programs, extending care from the hospital to the home in a holistic approach. In contrast to the exclusive sanatoriums of the time, all patients—men, women, and children of all immigrant status and race—were included (Figures 4 and 5).

Dr. Miller's reputation and status as President of the American College of Physicians and of the New York Academy of Medicine, as well as his association with Harry Hopkins, President Franklin D. Roosevelt's closest advisor, enabled public funds to build the new tuberculosis pavilion at Bellevue, now the current C and D buildings (1).

Growth of the Bellevue Chest Division under J. Burns Amberson, M.D.

J. Burns Amberson (1890–1979) graduated from Johns Hopkins University School of Medicine in 1917, only to become a tuberculosis patient at the Loomis Sanatorium in New York. He subsequently worked in the William H. Maybury sanatorium in Michigan, where he conducted one of the first randomized clinical trials (2).

> By a flip of the coin, one group of TB patients became identified as group I (sanocrysin-treated) and the other group as group II (control). The numbers of the separate group were known only to the nurse in charge of the ward and to two of us. The patients themselves were not aware of any distinction in the treatment administered. (2)

Dr. Amberson joined Columbia and New York University in 1927 and was recruited by Dr. Miller to Bellevue Hospital in 1930. At Bellevue Hospital, Dr. Amberson taught undergraduate and graduate medical students in a shabby hospital setting, chronically short of equipment, supplies, and support staff. He managed a 500-bed pulmonary service with patients overflowing into hallways. In 1938, he became head of the Chest Service, a position he held until 1955. Dr. Gerard Turino, a resident at Bellevue Hospital in 1948, remembers Dr. Amberson as the high point of an intern's life,

> Dr. Amberson, in a most unassuming, unexaggerated, and kindly manner would talk about the radiograph…. The Professor had a way of bringing forth, in the most logical way, an analysis of the case that carried with it the perspective of a whole lifetime spent with the disease, and of having cared for many different people living many different lives. (3)

Amberson helped introduce streptomycin to treat patients with tuberculosis in the 1940s and para-aminosalicylic acid (PAS) to form a combined therapy. A prolific writer (4), he was President of the American Trudeau Society (1939–1940, predecessor of the American Thoracic Society [ATS]) and the National Tuberculosis Association (1942–1943, predecessor of the American Lung

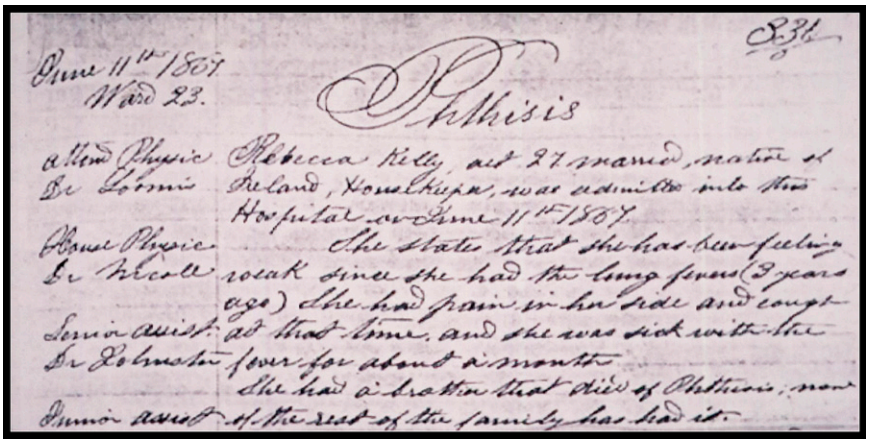

Figure 2. Phthisis patient history recorded in a Bellevue Chart.

Association [ALA]). He is honored with the annual Amberson Lecture at the meeting of the American Thoracic Society (Figure 6).

Bellevue Cardiopulmonary Laboratory

The Bellevue Cardiopulmonary Laboratory was founded by Dr. Dickinson W. Richards (1895–1973). A graduate of Columbia University College of Physicians and Surgeons in 1923, he completed his postdoctoral training under Nobel Laureate Sir Henry Dale, studying humoral agents responsible for circulatory control. He returned to the United States to become Director of the Columbia Division of Bellevue Hospital and founded the Cardiopulmonary Laboratory, the first laboratory to merge the study of the heart and the lung.

Dr. Cournand (1895–1988) received his M.D. from the Faculté de Médecine de Paris, after which he became an auxiliary battalion surgeon in World War I and was awarded the Croix de Guerre with three bronze stars. Recruited as Chief Resident of Bellevue's Tuberculosis (Chest) Service by Dr. Miller in 1930, he began working under D. W. Richards in pulmonary physiology while a resident. He soon became a full-fledged member of the laboratory, and together Richards and Cournand described fundamental concepts, first in lung physiology, then in the heart, and, finally, in the interaction between the heart and lung.

Richards and Cournand recognized the importance of a publication of Dr. Werner Forssmann in Germany, in which Forssmann described passing a ureteral catheter into his own arm vein and into the right side of his heart (Forssman subsequently became a member of the German Nationalist Socialist German Worker's Party, precursor to the Nazi Party). Cournand practiced the technique on dogs, a chimpanzee, and finally tested the procedure on four human volunteers, calculating accurate cardiac output with mixed venous oxygen (5). In 1942, Cournand and Richards measured right heart pressure and showed that it was increased in right heart failure (6). Their definitive paper, published in 1945, summarized findings of 260 human catheterizations showing consistent estimates of cardiac output and numerous refinements of technique (7). Importantly, they were able to show the safety of the procedure (8). In 1956, Drs. Richards, Cournand, and Forssmann were awarded the Nobel Prize in Physiology or Medicine "for their discoveries concerning heart catheterization and pathological changes in the circulatory system" (6–8). These advances enabled the understanding of pulmonary diseases and their close connection to the heart and circulation (9, 10) (Figure 7).

Ewald Weibel described Cournand:

> André Cournand was an artist among scientists; he combined imagination with discipline and rigor in his analytical approach, a sense of drama with critical thinking about the course to take both in his research projects and, in later years, in his concerns about shaping the future. (11, 12)

The excitement of the cardiopulmonary laboratory at Bellevue attracted other innovative scientists. Dr. Ewald Weibel joined the cardiopulmonary laboratory in 1959, recruited to do anything on the structure of the lung that was of interest for physiology. Working with Dr. Domingo Gomez, a Cuban refugee, they described the lung with conductive zones (10% of the lung volume) and the respiratory zone (90% of the lung volume), important for alveolar ventilation, perfusion, and transcapillary diffusion (13).

Figure 3. Southfield boat.

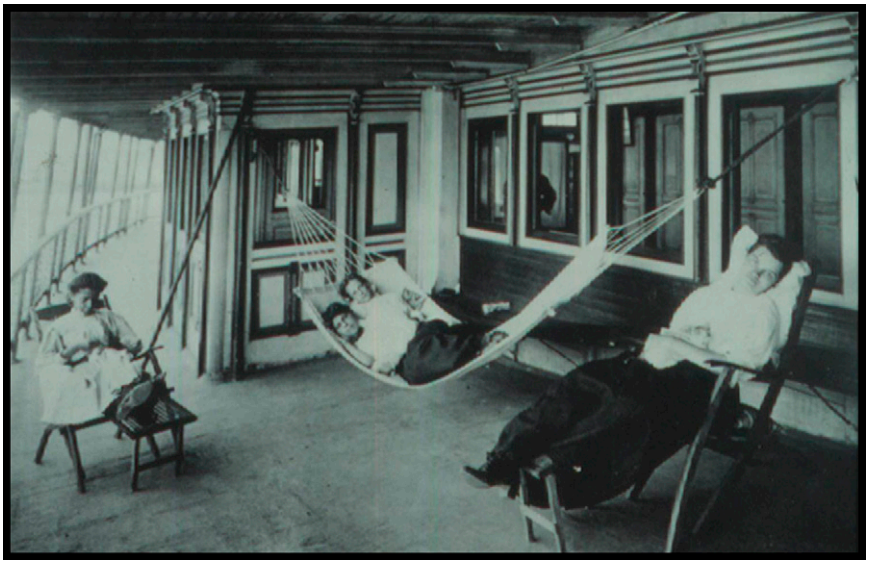

Figure 4. Patients with tuberculosis recovering on the Southfield boat.

Using human lungs, they calculated the number of alveoli ($296 \times 10^6 \pm 3.9\%$) and number of alveolar ducts and sacs combined ($13.8 \times 10^6 \pm 11\%$). They calculated the alveolar capillary surface in adults to be between 60 and 80 m^2 (14).

Bellevue Cardiopulmonary Chest Clinic and Laboratory Trainees

Numerous graduates of Bellevue's Chest and Cardiopulmonary Laboratory became leaders in cardiopulmonary programs throughout the United States and the world.

Richard Riley described the ventilation–perfusion relationship for gas exchange with Cournand (15) and is responsible for our present understanding of gas exchange, diffusion, and ventilation/perfusion relationships. He designed the ventilation system that is currently used in the isolation rooms based on principles of circulatory function. Dr. Rene Ferrer, the first woman to serve as chief resident at Columbia's division at Bellevue Hospital, used cardiac catheterization to define the mechanism of action of many cardiac medications, including digitalis. Together with, Dr. Rejane Harvey she described cor pulmonale and pulmonary circulatory physiology (16).

Other members of the Chest Service and Cardiopulmonary laboratory included: Richard and Mortimer Bader (Co-Directors of the Pulmonary Function Laboratory at Mt. Sinai Hospital), Thomas King and William Briscoe (Chief of Pulmonary Medicine) at Cornell, Peter Caldwell and Yale Enson (Chief and Acting Chief of Pulmonary Medicine at Columbia University), Eugene Braunwald (Chair of the Department of Medicine at Brigham and Women's Hospital), Alfred Fishman (Director of the Cardiovascular–Pulmonary Division at the University of Pennsylvania), Harry Fritts (Chair of the Department of Medicine at the State University of New York, Stony Brook), Dudley Rochester (Chief of Pulmonary Medicine at University of Virginia), and Attilio D. Renzetti (Chief of Pulmonary Medicine at the University of Utah). Gomez remained as a Professor of Experimental Medicine at New York University (NYU) School of Medicine and Weibel, a Foreign Member of the U.S. National Academy of Science, became Chair of the Institute of Anatomy at the University of Berne.

Growth of the Bellevue Chest Clinic under John H. McClement, M.D. (Third Director)

John H. McClement, M.D. served as Director of the Chest Service from 1955 to 1983 after being recruited from the University of Utah where he had developed a Veterans Affairs cooperative study on chronic obstructive pulmonary disease with Attillio D. Renzetti (17). During his tenure, the Bellevue Chest Service became an exclusive academic affiliate with NYU School of Medicine (1968). Despite the waning of the tuberculosis epidemic, NYC remained a center of the disease, with its indigent and often immigrant population (18).

As the Chest Clinic grew, serving 2,500 patients and 16,000 clinic visits per year, the focus on clinical management was maintained under the leadership of Julia Jones, Director of the Chest Clinic from 1939 to 1968. Jones became the first woman to serve as Vice President of the American Thoracic Society (ATS), a leadership path followed by Anne Davis, who became President of the ATS (1980–1981) and the ALA (1989–1990). The clinical program expanded to include the Manhattan VA, with Drs. Lynne Christensen and Milena Lewis.

It was a time of controversy over the relationship between the public hospital system and the academic affiliates. Then Dean of NYU School of Medicine, Lewis Thomas, said "the city has on its hands a national treasure…we do not believe there is a better place to teach medicine on earth." Affirming that vision, in the midst of a NYC fiscal crisis, a new hospital complex opened in 1975 under the leadership Mayor John V. Lindsay. The "new Bellevue" consisted of 25 floors with more than 800 beds, an attending physician staff of 1,200, and more than 500 house staff physicians (Figure 8).

The Pulmonary Function Laboratory

In 1970 Dr. H. William Harris was recruited to be the Director of the Graduate Training Program of the Chest Service, and he became Acting Director of the Chest Service (1983–1989). He served as President of the ATS (1962–1963).

Activity in the Cardiopulmonary Laboratory continued under the guidance of Dr. Roberta Goldring, a laboratory graduate. She became the Director of the Pulmonary Function Laboratory (now renamed the André Cournand Pulmonary Physiology Research Laboratory) in 2014. For nearly 5 decades, every pulmonary trainee has undergone rigorous training in pulmonary

Figure 5. Patients with tuberculosis recovering on the Bellevue rooftop.

physiology under her guidance. With these fellows, she described alveolar hypoventilation causing hypoxemia and hypercapnia with resulting cor pulmonale from cystic fibrosis or musculoskeletal deformities of the thorax (19) and permissive hypercapnia for ventilated patients. In 2001 she received the Distinguished Achievement Award from the ATS.

First as Dr. Goldring's trainees, and later as independent investigators, Drs. David Rapoport and Stuart Garay developed a treatment for obstructive sleep apnea syndrome with the application of continuous positive airway pressure (CPAP) through nocturnal nasal ventilation (20). The laboratory interest in alveolar hypoventilation syndromes in obesity led to research programs in sleep and development of a Sleep Disorders Center (David Rapoport, Director), research in ventilator control and CO_2 homeostasis (Kenneth Berger), and cardiopulmonary effects of obesity (Beno Oppenheimer).

Onset of the AIDS Epidemic

In 1981, a 45-year-old patient with severe wasting and multiple opportunistic infections baffled the intensive care unit (ICU) physicians at Bellevue Hospital. Within months, doctors soon began treating numerous patients with *Pneumocystis* pneumonia. The AIDS epidemic had hit, with NYC as the epicenter; the Bellevue Chest Service geared up to treat those who few others wanted.

The Bellevue Chest Ward teemed with patients with "gay-related immune deficiency (GRID)," subsequently AIDS (acquired immune deficiency syndrome), and as the virus was identified, HIV. Patients presented with *Pneumocystis* pneumonia, the first cases of disseminated *Mycobacterium avium*, Kaposi sarcoma, *Mycobacterium tuberculosis*, cytomegalovirus infection, and untreatable wasting.

Initially filled with gay men, the Chest Ward soon became overwhelmed with patients with hemophilia and intravenous drug users; fellows often performed four to six diagnostic bronchoscopy procedures in a day. Over the next 10 years, thousands of patients, mostly the young, were treated and often died on the Chest Service or in the ICU, until the development of antiretroviral treatments.

Responses to Epidemics and Environmental Disease Crises under William N. Rom, M.D., M.P.H. (Fourth Director)

William N. Rom was Director of the Bellevue Chest Service and NYU Division of Pulmonary and Critical Care Medicine from 1989 to 2015 (Figure 9). Trained in occupational medicine under Dr. Irving Selikoff at Mt. Sinai, he had developed the Rocky Mountain Center for Occupational and Environmental Health at the University of Utah and had worked at the NHLBI, National Institutes of Health, under Ronald G. Crystal, M.D., in the new field of cytokines, studying mechanisms of fibrosis in asbestosis, silicosis, and coal workers' pneumoconiosis (21–23). In his 25 years as Director, he continued the mission to respond to the underserved, his tenure filled with epidemics and disasters. Rom modernized the Bellevue Chest Service, enlarged the clinical service, and expanded the research brief to include epidemiologic, clinical, and translational studies.

Intending to continue his work in occupational medicine, Rom soon realized that the issue of the moment was the AIDS and tuberculosis epidemics overwhelming NYC. The public health clinics had been dismantled, crack use was rampant, and HIV was prevalent. There was an increase in tuberculosis, and by 1992, 3,811 cases of tuberculosis were reported, exceeding an incidence rate of $50/10^5$.

Tuberculosis

Rom organized the Chest Service to confront these problems at a clinical and research level. With the NYC Department of Health, Dr. Neil Schluger began one of the first hospital-based Directly Observed Therapy (DOT) programs for patients with *M. tuberculosis* (24, 25). Studies using bronchoalveolar lavage in patients infected with *M. tuberculosis* provided novel

Figure 6. J. Burns Amberson, M.D.

findings in mechanisms of infection, including the description of neutrophils and IL-8 in early disease (26).

Studies with Dr. Michael Weiden described cytokines in radiographically involved lung segments and characteristics associated with a poor response (neutrophils, cavities, positive acid-fast bacillus sputum smears, and Th2-like cytokine response) versus a favorable outcome (IFN-γ, IP-10, and tumor necrosis factor-α) (27–29). Mechanisms by which *M. tuberculosis* increased HIV replication were described (30), including the interaction of the transcription factor C/EBPβ with nuclear factor-κB and cytokine transcription binding sites within HIV-1 (31, 32). These studies led to novel clinical trials on treatment of *M. tuberculosis*, including those showing clinical and biologic improvement after aerosol-delivered IFN-γ in patients infected with drug-sensitive and -resistant *M. tuberculosis* (33).

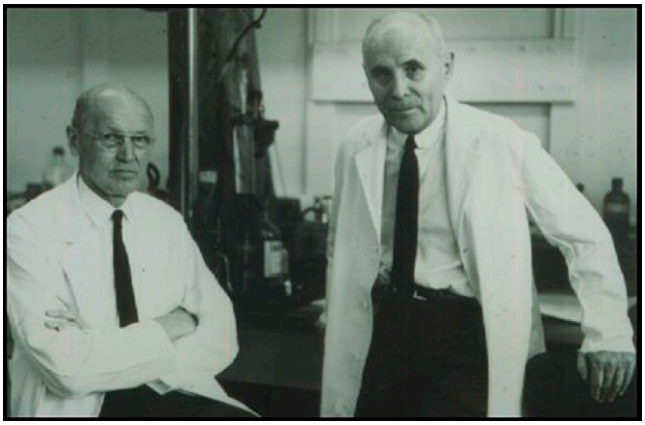

Figure 7. Dickinson Richards, M.D. (*left*) and André Cournand, M.D. (*right*).

Asthma

However, NYC was also besieged with an epidemic of asthma. By the early 1990s, New York City had the highest rate of morbidity and mortality from asthma in the United States. In 1991, funded by a New York State grant, Dr. Joan Reibman expanded the NYU/Bellevue Hospital Asthma Clinic to provide state-of-the-art care to an indigent population as well as to develop a clinical and translational research program.

Studies showed a relationship between smoking subjects with asthma and air pollution, the impact of asthma in the parent on children, and the effect of longstanding asthma on lung physiology. Numerous clinical trials as part of the ALA Asthma Clinical Research Centers were performed. Additional studies showed a protective role of the microbiome (*Helicobacter pylori*) and a gene–environment association (thymic stromal lymphopoietin variants, tobacco exposure, and asthma) (34). Translational studies revealed the interaction of ambient particulate matter with human bronchial epithelial cells, including the first studies showing bronchial epithelial cell–derived chemokines and cytokines involved in the recruitment and conditioning of adjacent dendritic cells to promote a type 2 response (35–37).

World Trade Tower–related Lung Disease

On September 11, 2001, the collapse of the World Trade Center (WTC) towers created a massive cloud of irritant, alkaline dust exposing 11,000 members of the Fire Department of New York and 300,000 residents and workers in southern Manhattan (38).

The Bellevue Chest Service responded in force to this new disaster. A study of one of the first ill responders, a 38-year-old firefighter admitted to Bellevue's ICU for hypoxic respiratory failure who underwent bronchoalveolar lavage, revealed a preponderance of eosinophils. Importantly, mineralogic analysis showed

Figure 8. Protesters against the closure of the Tuberculosis Clinics in the 1970s New York City financial crisis. Dr. John McClement is at the *lower left* with glasses.

asbestos fibers, fly ash, and degraded fibrous glass, confirming the ability of these large WTC-derived particles to reach small airways and alveoli (39).

With Dr. Prezant at the Fire Department of New York, Drs. Weiden and Nolan described chronic cough, airway hyperreactivity, and decline in lung function in firefighters exposed to the WTC dust (40, 41). They showed a relationship between lung function decline and specific inflammatory markers, metabolic syndrome, and cardiovascular biomarkers (42, 43). Meanwhile, Reibman, working with local community groups and the New York State Department of Health, provided the first documentation of adverse respiratory health effects in the local community.

These studies expanded into a pilot treatment program and, finally, a federally funded medical and mental health treatment program, enacted into law as the James L. Zadroga 9/11 Health and Compensation Act in 2011. This program, the WTC Environmental Health Center, is the only program providing treatment for the local community from the environmental disaster. Studies in the exposed community have been used to characterize the involvement of small airways, trajectories in lung function, and role of inflammation in lung injury after an environmental disaster.

In 2000, Rom established the NYU Lung Cancer Biomarker Center as part of the National Cancer Institute's Early Detection Research Network (44). This registry of more than 1,800 high-risk smokers has been used to describe the course of noncalcified nodules and the history of stage I adenocarcinomas. Biomarker studies on panels of serum proteins, autoantibodies, gene expression, and DNA adducts have been described (45–49).

Figure 9. William N. Rom, M.D., M.P.H.

Hurricane Sandy

On October 29, 2012, Hurricane Sandy inundated NYC with a 14-foot surge of sea water. Bellevue Hospital's basement flooded, knocking out the pumps that delivered diesel fuel to emergency generators on the 13th floor (50). Bellevue house staff formed a brigade to carry diesel fuel to the generators.

Although the Medical ICU was rapidly evacuated, the Chest Service Ward remained open for an additional 3 days, with minimal electricity, water, and services. Physicians and nurses wore headlamps as they cared for these patients; medical students ran up and down stairs transporting blood samples and bringing food. Few hospitals were capable of caring for the patients with multidrug-resistant tuberculosis or wanted the uninsured or the prisoners housed on the service; these were the last patients transported out of the hospital. With the closure of the ward, the Chest Service faculty met in adjacent bars to plot strategy. The Asthma, Chest, and WTC clinics were set up as virtual clinics with computer and telephone networks.

Environmental Medicine

The environmental focus of the program had a national reach. In 2003 to 2004 Dr. Rom worked as a legislative fellow with Senator Hillary Rodham Clinton and staffed the first Senate floor debate on climate change. He founded the Environmental

Figure 10. Daniel H. Sterman, M.D.

Health Policy Committee at the ATS and worked on climate change with the U.S. Environmental Protection Agency and the U.S. Global Change Research Program in Washington, D.C. Work during this era was summarized by texts edited by Rom: *Environmental and Occupational Medicine* (four editions), *Tuberculosis* (two editions), and *Environmental Policy: Air Pollution, Global Climate Change, and Wilderness*.

Rom received the Distinguished Achievement Award from the ATS, the Murray Kornfeld Honor Lecture from the American College of Chest Physicians, the Alumni Achievement Award from Harvard School of Public Health, and the Champion of Change Award from The White House. New York City provided funding to Rom and Reibman to build a laboratory at Bellevue now named the William N. Rom Environmental Lung Disease Laboratory to study environmental health effects, including those of WTC dust.

During Dr. Rom's leadership, the training in the Chest Service expanded under Dr. Doreen Addrizzo-Harris, with a more than 18 fellows enrolled in training program each year.

Launch of New Era under Daniel H. Sterman, M.D. (Fifth Director)

In 2015, Daniel Sterman, M.D., became the fifth Director of the Bellevue Chest Service and the Director of the NYU Division of Pulmonary, Critical Care, and Sleep Medicine (Figure 10). With a background in translational research in gene transfer from the University of Pennsylvania (51), Dr. Sterman is well situated to lead the Bellevue Chest Service in fresh directions. As he responds to new epidemics and disasters, and builds new lung programs for diseases of the upcoming eras, he is well served by the long history of patient care, education, and research that provides the groundwork for the translational, clinical, and physiologic research programs with the Bellevue Hospital Chest Service. ■

Author disclosures are available with the text of this article at www.atsjournals.org.

Acknowledgment: The authors thank Roberta Goldring, M.D., for thoughtful comments on this manuscript. They also thank the many doctors and staff contributing to the history of the Bellevue Chest Service: Drs Weiden, Nolan, Munger, Tsay, Kazeros, Caplan-Shaw, Kanengiser, Leibert, Rogers, Greenberg, Tchou-Wong, Bleck, Addrizzo-Harris, Friedman-Jimenez, Harrison, Evans, Gold, Uppal, Doerfler, Chong, Schluger, Lowy, Garay, Steiger, Chitkara, Condos, Hay, Rapoport, Sauthoff, Smith, Adams, Amoroso, Ayappa, Bashar, Berger, Berkowitz, Burschtin, Dweck, Felner, Kamelhar, Kaufman, Mooney, Marmor, Tang, Gordon, Nilsen, Oppenheimer, Parsia, Plottel, Schattner, Garafano, Schwartz, Sloane, Patrawalla, Lubinsky, Walsleben, Goldenberg, and staff Ting-an Yie, Siham Akleh, and Ellen Eylers, among many others.

References

1 Amberson JB. James Alexander Miller. In: Garraty JA, James ET, editors. Dictionary of American biography. New York: Scribner's; 1974. Suppl 4, pp. 577–579, 1946–1950.
2 Amberson JB, McMahon BT, Pinner M. A clinical trial of sanocrysin in pulmonary tuberculosis. *Am Rev Tuberc* 1931;24:401–435.
3 Enson Y, Chamberlin MD. Cournand and Richards. In: de Bary WT, editor. Living legacies at Columbia. New York: Columbia University; 2006. pp. 238–251.
4 Amberson JB. Tuberculosis, Vol. V. New York, NY: Oxford University Press; 1941. pp. 260–386.
5 Cournand A, Ranges HA. Catheterization of the right auricle in man. *Proc Soc Exp Biol Med* 1941;41:462.
6 Cournand A, Richards DW, Darling RC, Gillespie WH, Baldwin EF. Pressure of blood in the right auricle, in animals and in man: under normal conditions and in right heart failure. *Am J Physiol* 1942;136:115.
7 Cournand A, Riley RL, Breed ES, Baldwin ED, Richards DW, Lester MS, Jones M. Measurement of cardiac output in man using the technique of catheterization of the right auricle or ventricle. *J Clin Invest* 1945;24:106–116.
8 Richards DW. Right heart catheterization: its contributions to physiology and medicine. *Science* 1957;125:1181–1185.
9 Cournand AF. Dickinson Woodruff Richards, 1895–1973. A survey of his contributions to the physiology and pathophysiology of respiration in man. *Am J Med* 1974;57:311.
10 Biographical memoirs, Vol. 56. Washington, D.C.: National Academy Press, 1986. pp 459–485.
11 Weibel ER. André Frédéric Cournand 1895–1988: a biographical memoir. Washington, D.C.: National Academies Press, 1995.
12 Cournand A. The code of the scientist and its relationship to ethics. *Science* 1977;198:699–705.
13 Weibel ER, Gomez DM. Architecture of the human lung: use of quantitative methods establishes fundamental relations between size and number of lung structures. *Science* 1962;137:577–585.
14 Weibel ER. It takes more than cells to make a good lung. *Am J Respir Crit Care Med* 2013;187:342–346.
15 Riley RL, Cournand A. Ideal alveolar air and the analysis of ventilation-perfusion relationships in the lungs. *J Appl Physiol* 1949;1:825–847.

16 Ferrer MI, Conroy RJ, Harvey RM. Some effects of digoxin upon the heart and circulation in man. Digoxin in combined (left and right) ventricular failure. *Circulation* 1960;21:372–385.
17 Renzetti AD Jr, McClement JH, Litt BD. The Veterans Administration cooperative study of pulmonary function. 3. Mortality in relation to respiratory function in chronic obstructive pulmonary disease. *Am J Med* 1966;41:115–129.
18 McClement JH. Tuberculosis. In: Practice of medicine, Vol III. Hagerstown, MD: Harper and Row; 1977.
19 Goldring RM, Fishman AP, Turino GM, Cohen HI, Denning CR, Andersen DH. Pulmonary hypertension and cor pulmonale in cystic fibrosis of the pancreas. *J Pediatr* 1964;65:501–524.
20 Rapoport DM, Sorkin B, Garay SM, Goldring RM. Reversal of the "Pickwickian syndrome" by long-term use of nocturnal nasal-airway pressure. *N Engl J Med* 1982;307:931–933.
21 Rom WN, Bitterman PB, Rennard SI, Cantin A, Crystal RG. Characterization of the lower respiratory tract inflammation of nonsmoking individuals with interstitial lung disease associated with chronic inhalation of inorganic dusts. *Am Rev Respir Dis* 1987;136: 1429–1434.
22 Rom WN, Basset P, Fells GA, Nukiwa T, Trapnell BC, Crysal RG. Alveolar macrophages release an insulin-like growth factor I-type molecule. *J Clin Invest* 1988;82:1685–1693.
23 Rom WN, Vijayan VK, Cornelius MJ, Kumaraswami V, Prabhakar R, Ottesen EA, Crystal RG. Persistent lower respiratory tract inflammation associated with interstitial lung disease in patients with tropical pulmonary eosinophilia following conventional treatment with diethylcarbamazine. *Am Rev Respir Dis* 1990;142:1088–1092.
24 Schluger N, Ciotoli C, Cohen D, Johnson H, Rom WN. Comprehensive tuberculosis control for patients at high risk for noncompliance. *Am J Respir Crit Care Med* 1995;151:1486–1490.
25 Park MM, Davis AL, Schluger NW, Cohen H, Rom WN. Outcome of MDR-TB patients, 1983-1993. Prolonged survival with appropriate therapy. *Am J Respir Crit Care Med* 1996;153:317–324.
26 Zhang Y, Broser M, Cohen H, Bodkin M, Law K, Reibman J, Rom WN. Enhanced interleukin-8 release and gene expression in macrophages after exposure to *Mycobacterium tuberculosis* and its components. *J Clin Invest* 1995;95:586–592.
27 Law K, Weiden M, Harkin T, Tchou-Wong K, Chi C, Rom WN. Increased release of interleukin-1 β, interleukin-6, and tumor necrosis factor-α by bronchoalveolar cells lavaged from involved sites in pulmonary tuberculosis. *Am J Respir Crit Care Med* 1996;153:799–804.
28 Chang JC, Wysocki A, Tchou-Wong KM, Moskowitz N, Zhang Y, Rom WN. Effect of *Mycobacterium tuberculosis* and its components on macrophages and the release of matrix metalloproteinases. *Thorax* 1996;51:306–311.
29 Nolan A, Condos R, Huie ML, Dawson R, Dheda K, Bateman E, Rom WN, Weiden MD. Elevated IP-10 and IL-6 from bronchoalveolar lavage cells are biomarkers of non-cavitary tuberculosis. *Int J Tuberc Lung Dis* 2013;17:922–927.
30 Nakata K, Rom WN, Honda Y, Condos R, Kanegasaki S, Cao Y, Weiden M. *Mycobacterium tuberculosis* enhances human immunodeficiency virus-1 replication in the lung. *Am J Respir Crit Care Med* 1997;155:996–1003.
31 Honda Y, Rogers L, Nakata K, Zhao BY, Pine R, Nakai Y, Kurosu K, Rom WN, Weiden M. Type I interferon induces inhibitory 16-kD CCAAT/ enhancer binding protein (C/EBP)β, repressing the HIV-1 long terminal repeat in macrophages: pulmonary tuberculosis alters C/EBP expression, enhancing HIV-1 replication. *J Exp Med* 1998; 188:1255–1265.
32 Hoshino Y, Nakata K, Hoshino S, Honda Y, Tse DB, Shioda T, Rom WN, Weiden M. Maximal HIV-1 replication in alveolar macrophages during tuberculosis requires both lymphocyte contact and cytokines. *J Exp Med* 2002;195:495–505.
33 Dawson R, Condos R, Tse D, Huie ML, Ress S, Tseng CH, Brauns C, Weiden M, Hoshino Y, Bateman E, et al. Immunomodulation with recombinant interferon-γ1b in pulmonary tuberculosis. *Plos One* 2009;4:e6984.
34 Liu M, Rogers L, Cheng Q, Shao Y, Fernandez-Beros M, Hirschhorn J, Lyon H, Gajdos Z, Vedantam A, Gregersen P, *et al*. Genetic variants of TSLP and asthma in an admixed urban population. *Plos One* 2011;6:e25099.
35 Reibman J, Hsu Y, Chen LC, Bleck B, Gordon T. Airway epithelial cells release MIP-3α/CCL20 in response to cytokines and ambient particulate matter. *Am J Respir Cell Mol Biol* 2003;28:648–654.
36 Bleck B, Tse DB, Curotto de Lafaille MA, Zhang F, Reibman J. Diesel exhaust particle-exposed human bronchial epithelial cells induce dendritic cell maturation and polarization via thymic stromal lymphopoietin. *J Clin Immunol* 2008;28:147–156.
37 Bleck B, Kazeros A, Bakal K, Garcia-Medina L, Adams A, Liu M, Lee RA, Tse DB, Chiu A, Grunig G, et al. Co-expression of type 2 immune targets in sputum-derived epithelial and dendritic cells in asthma. *J Allergy Clin Immunol* [online ahead of print]. 23 Mar 2015; DOI: 10.1016/j.hjaci.2014.12.1950.
38 Rom WN, Reibman J, Rogers L, Weiden MD, Oppenheimer B, Berger K, Goldring R, Harrison D, Prezant D. Emerging exposures and respiratory health: World Trade Center dust. *Proc Am Thorac Soc* 2010;7:142–145.
39 Rom WN, Weiden M, Garcia R, Yie TA, Vathesatogkit P, Tse DB, McGuinness G, Roggli V, Prezant D. Acute eosinophilic pneumonia in a New York City firefighter exposed to World Trade Center dust. *Am J Respir Crit Care Med* 2002;166:797–800.
40 Prezant DJ, Weiden M, Banauch GI, McGuinness G, Rom WN, Aldrich TK, Kelly KJ. Cough and bronchial responsiveness in firefighters at the World Trade Center site. *N Engl J Med* 2002; 347:806–815.
41 Oppenheimer BW, Goldring RM, Herberg ME, Hofer IS, Reyfman PA, Liautaud S, Rom WN, Reibman J, Berger KI. Distal airway function in symptomatic subjects with normal spirometry following World Trade Center dust exposure. *Chest* 2007;132:1275–1282.
42 Nolan A, Naveed B, Comfort AL, Ferrier N, Hall CB, Kwon S, Kasturiarachchi KJ, Cohen HW, Zeig-Owens R, Glaser MS, *et al*. Inflammatory biomarkers predict airflow obstruction after exposure to World Trade Center dust. *Chest* 2012;142:412–418.
43 Naveed B, Weiden MD, Kwon S, Gracely EJ, Comfort AL, Ferrier N, Kasturiarachchi KJ, Cohen HW, Aldrich TK, Rom WN, *et al*. Metabolic syndrome biomarkers predict lung function impairment: a nested case-control study. *Am J Respir Crit Care Med* 2012;185: 392–399.
44 Greenberg AK, Lu F, Goldberg JD, Eylers E, Tsay JC, Yie TA, Naidich D, McGuinness G, Pass H, Tchou-Wong KM, *et al*. CT scan screening for lung cancer: risk factors for nodules and malignancy in a high-risk urban cohort. *Plos One* 2012;7:e39403.
45 Li XJ, Hayward C, Fong PY, Dominguez M, Hunsucker SW, Lee LW, McLean M, Law S, Butler H, Schirm M, *et al*. A blood-based proteomic classifier for the molecular characterization of pulmonary nodules. *Sci Transl Med* 2013;5:207ra142.
46 Ostroff RM, Bigbee WL, Franklin W, Gold L, Mehan M, Miller YE, Pass HI, Rom WN, Siegfried JM, Stewart A, *et al*. Unlocking biomarker discovery: large scale application of aptamer proteomic technology for early detection of lung cancer. *Plos One* 2010;5:e15003.
47 Showe MK, Vachani A, Kossenkov AV, Yousef M, Nichols C, Nikonova EV, Chang C, Kucharczuk J, Tran B, Wakeam E, *et al*. Gene expression profiles in peripheral blood mononuclear cells can distinguish patients with non-small cell lung cancer from patients with nonmalignant lung disease. *Cancer Res* 2009;69:9202–9210.
48 Feng Z, Hu W, Chen JX, Pao A, Li H, Rom W, Hung M-C, Tang MS. Preferential DNA damage and poor repair determine ras gene mutational hotspot in human cancer. *J Natl Cancer Inst* 2002;94:1527–1536.
49 Rom WN, Hay JG, Lee TC, Jiang Y, Tchou-Wong KM. Molecular and genetic aspects of lung cancer. *Am J Respir Crit Care Med* 2000;161: 1355–1367.
50 Rom WN, Evans L, Uppal A. The sentinel event of climate change: Hurricane Sandy and its consequences for pulmonary and critical care medicine. *Am J Respir Crit Care Med* 2013;187:iii–iv.
51 Sterman DH, Haas A, Moon E, Recio A, Schwed D, Vachani A, Katz SI, Gillespie CT, Cheng G, Sun J, et al. A trial of intrapleural adenoviral-mediated interferon-α2b gene transfer for malignant pleural mesothelioma. *Am J Respir Crit Care Med* 2011;184: 1395–1399.