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REBUTTALS OF: Bezdek, Lindzen, Happer

NO SURREBUTTALS

p.3 "The notion that humans will flourish in a climate warmed by CO2 emissions is deeply irresponsible and factually incorrect. The harmful public health impacts of a warming climate are well established and well understood. At a minimum, the externality estimates of the socioeconomic damages from CO2 must incorporate these very real threats to the public health. An externality figure of zero clearly fails to take into account the global and local health damages caused by a warming climate."

p.4 "By way of contrast, Dr. Bezdek's statements come from someone trained as an economist, and Prof. Lindzen has been trained as an applied mathematician. Neither appear to have any training or experience in medicine or environmental health. Their statements are almost entirely based on industry funded reports that are not peer reviewed by the medical or public health community." (*This arguably might be denigration of expertise, but for last comment.*)

"Dr. Bezdek's assertion that "cold is a much greater health danger than heat" is directly contradicted by the National Climate Assessment, which states that "heat stress . . . has been the leading weather-related cause of death in the United States since 1986, when record keeping began."

p.5 "The scientific evidence simply does not support Dr. Bezdek's and Professor Lindzen's assertion."

"Dr. Bezdek's assertion that cold is a greater health danger appears to be based on an overly simplistic bar graph published in a newspaper and one citation to a journal article from 2004."

p.8 "although I support the use of the SCC as a reasonable estimate of the environmental and socioeconomic costs of CO2 emissions, the SCC underestimates the costs of CO2 emissions and includes only a bare minimum of estimates of damage to the public health."

pp.21-93 CV

OA Docket No. 80-2500-31888

REBUTTAL TESTIMONY

OF

DR. WILLIAM N. ROM, M.D., M.P.H.

SUBMITTED ON BEHALF OF:

**DR. BRUCE SNYDER, DR. PHILIP MURRAY, DR. MICHAEL MENZEL,
MINNESOTA PUBLIC HEALTH ASSOCIATION
AND THE
TWIN CITIES MEDICAL SOCIETY
("DOCTORS FOR A HEALTHY ENVIRONMENT")**

AUGUST 12, 2015

1 REBUTTAL TESTIMONY OF DR. WILLIAM N. ROM

2 MPUC DOCKET NO. E-999/CI-14-643

3 OAH DOCKET NO. 80-2500-31888

4

5 **Q: Please state your name, job title, and business address.**

6 **A:** William N. Rom M.D., M.P.H., Professor, NYU Langone Medical Center One Park Ave.
7 New York, NY and Bellevue Hospital Center, 462 First Ave., New York, NY 10016.

8 **Q: For whom are you testifying?**

9 **A:** I am testifying on behalf of Doctors for a Healthy Environment.

10 **Q: Have you testified in front of the Public Utilities Commission (“PUC”) before?**

11 **A:** No.

12 **Q: What is your background and educational experience?**

13 **A:** I am a Professor of Medicine and Environmental Medicine at the NYU School of
14 Medicine where my research centers on environmental lung disease, lung cancer,
15 tuberculosis, and the health effects of air pollution. I received an M.D. from the
16 University of Minnesota, after which I was a resident in internal medicine at the
17 University of California Davis Medical Center and a clinical fellow in pulmonology at
18 the Mount Sinai Medical Center. For 25 years I was Director of the Division of
19 Pulmonary, Critical Care, and Sleep Medicine at NYU School of Medicine. Currently I
20 direct the William N. Rom Environmental Lung Disease Laboratory at NYU/Bellevue
21 Hospital Center. I have authored or co-authored over 400 peer reviewed articles and
22 edited or co-edited many textbook editions, including *Environmental and Occupational*
23 *Medicine; Tuberculosis; Environmental Policy and Public Health: Air Pollution, Global*
24 *Climate Change, and Wilderness; and Global Climate Change and Public Health.*

25 **Q: What is the purpose of your testimony?**

26 **A:** The purpose of my testimony is to rebut certain assertions made in the Direct Testimony
27 of Dr. Roger H. Bezdek, Professor Richard Lindzen, and Dr. William Happer, on behalf
28 of Peabody Energy Corporation.

1 **Q: Which assertions would you like to rebut?**

2 **A:** There are several. First, Dr. Bezdek asserts, “if an environmental externality figure for
3 carbon dioxide is to be used in any regulatory proceeding, it should be set at a value of
4 approximately zero.”¹ Second, he asserts that “cold is a much greater health danger than
5 heat,” and that “humans would flourish in a warmer climate.”² Third, he asserts that “CO₂
6 is not a pollutant: it is not known to have any negative impacts on human health.”³ In this
7 same vein, Professor Lindzen asserts, “any increase in temperature . . . will probably
8 result in only mild warming at most, which will be beneficial to the planet and to society
9 as a whole.”⁴ Warmer temperatures, Professor Lindzen argues, will be a boon to public
10 health by reducing cold-related mortality.⁵ Professor Lindzen’s Exhibit 2 also contains
11 the statement “concentrations [of CO₂] under 5000 ppmv (12.5 times present ambient
12 levels, and much higher than the burning of all fossil fuels would produce) present no risk
13 to health.”⁶ Dr. Happer also contends that “a small increase [in temperature] will be a net
14 benefit to the Earth.”⁷

15 **Q: What are your objections to these assertions?**

16 **A:** The notion that humans will flourish in a climate warmed by CO₂ emissions is deeply
17 irresponsible and factually incorrect. The harmful public health impacts of a warming
18 climate are well established and well understood. At a minimum, the externality estimates
19 of the socioeconomic damages from CO₂ must incorporate these very real threats to the
20 public health. An externality figure of zero clearly fails to take into account the global
21 and local health damages caused by a warming climate.

22 **Q: Are you qualified to testify about the health impacts of global climate change?**

23 **A:** Yes. As my background makes clear, I have extensive professional experience in the area
24 of environmental health, and climate change in particular. I have an M.D. degree, a

¹ Bezdek Direct at 5.

² Bezdek Direct at 6.

³ Bezdek Direct at 9.

⁴ Lindzen Direct at 2.

⁵ Lindzen Direct at 7; Lindzen Direct, Exhibit 2 at ln. 582-605.

⁶ Lindzen Direct, Exhibit 2 at ln. 606-608.

⁷ Happer Direct at 5.

1 Masters in Public Health, and decades of experience in medical practice and research in
2 the area of human responses to air pollutants and environmental background conditions,
3 such as temperature. I have published extensively in the area and edited books on climate
4 change and the public health. By way of contrast, Dr. Bezdek's statements come from
5 someone trained as an economist, and Prof. Lindzen has been trained as an applied
6 mathematician. Neither appear to have any training or experience in medicine or
7 environmental health. Their statements are almost entirely based on industry funded
8 reports that are not peer reviewed by the medical or public health community.

9 **Q: Why specifically is the assertion that “cold is a much greater health danger than**
10 **heat” misleading or incorrect?**

11 **A:** The harmful public health impacts of a warming climate are extremely well established
12 and based on comprehensive, peer-reviewed scientific evidence. Dr. Bezdek's assertion
13 that “cold is a much greater health danger than heat” is directly contradicted by the
14 National Climate Assessment, which states that “heat stress . . . has been the leading
15 weather-related cause of death in the United States since 1986, when record keeping
16 began.”⁸ A recent peer-reviewed report from the U.S. EPA (discussed in detail below) did
17 note that warmer temperatures would likely reduce deaths from extreme cold, but
18 concluded that increased temperatures would produce a net increase in weather-related
19 mortality, noting that “the projected increase in deaths due to more frequent extremely
20 hot days is much larger than the projected decrease in deaths due to fewer extremely cold
21 days, a finding that is consistent with the conclusions of the assessment literature.”⁹ The
22 report concluded that warmer temperatures are forecasted to result in a net increase of
23 2,600 deaths in 2050 and 13,000 deaths in 2100.¹⁰ These mortality rates are from extreme
24 temperatures alone – other vectors of climate change related mortality are discussed
25 separately. These deaths are also only calculated for the U.S., and as climate change is

⁸ Garfin, G, Franco, G, Blanco, H, Comrie, A, Gonzalez, P, Piechota, T, Smyth, R, and Waskom, R. Climate Change Impacts in the United States: The Third National Climate Assessment, J.M. Melillo, Terese (T.C.) Richmond, and G.W. Yohe, eds., U.S. Global Change Research Program, 2014. Ch. 20: Southwest, 462-486.

⁹ See U.S. EPA, Climate Change in the United States: Benefits of Global Action, June 22, 2015, Health Sector at 26, available at <http://www2.epa.gov/cira/downloads-cira-report>.

¹⁰ *Id.*

1 projected to impact developing countries more severely, the global health impacts from
2 extreme temperatures are likely to be much more severe than national impacts.¹¹ A
3 similarly comprehensive report produced by a multidisciplinary, international
4 collaborative commission at British medical journal *The Lancet* concluded that though
5 “there may be modest reductions in cold-related deaths . . . these reductions will be
6 largely outweighed at the global scale by heat-related mortality.”¹² The scientific
7 evidence simply does not support Dr. Bezdek’s and Professor Lindzen’s assertion.

8 Dr. Bezdek’s assertion that cold is a greater health danger appears to be based on
9 an overly simplistic bar graph published in a newspaper¹³ and one citation to a journal
10 article from 2004.¹⁴ The journal article referred to suffers four fatal flaws: 1) it is based
11 on an outdated understanding of the public health impacts of a warming climate, 2) it
12 entirely excludes data from the tropics, where public health effects of climate change are
13 likely to be severe, 3) the article only assesses heat stress, leaving aside other well known
14 avenues of public health impact, and 4) the article offers only a “simple assessment”
15 based on the assumption that “particular degrees and patterns of heat or cold will
16 continue to produce the same mortality rates as they did previously.”¹⁵ This last
17 assumption is unsupported by current medical understanding. The authors themselves
18 readily admit that the assumption that mortality rates will continue as they always have is
19 unduly optimistic, noting that “sudden heat waves can be expected to produce record high
20 temperatures every few years as the climate warms. These will expose populations to
21 higher environmental temperatures than they have ever experienced before. The record
22 heat is accordingly liable to cause high mortality rates for a few days among people who

¹¹ Watts, N et al. Health and Climate Change: Policy Responses to Protect Public Health. *The Lancet*, June 23, 2015. [http://dx.doi.org/10.1016/S0140-6736\(15\)60854-6](http://dx.doi.org/10.1016/S0140-6736(15)60854-6), at p. 8.

¹² *Id.* at 9.

¹³ Bezdek Direct at 7.

¹⁴ Bezdek Direct at footnote 2. Although Dr. Bezdek’s citation is incomplete, he appears to be referring to Keatinge, WR and Donaldson, GC. The Impact of Global Warming on Health and Mortality. *South Med J* 2004; 97(11).

¹⁵ Keatinge, WR and Donaldson, GC. The Impact of Global Warming on Health and Mortality. *South Med J* 2004; 97(11).

1 are not prepared for it. This happened in France in the summer of 2003, with around
2 15,000 excess deaths in 2 weeks.”¹⁶

3 **Q: Are there other sources you wish to respond to?**

4 **A:** Yes. Exhibit 3 attached to Mr. Bezdek’s testimony contains a bibliography of articles that
5 he believes to be supportive of the notion that “humans would flourish in a warmer
6 climate.”¹⁷ This conclusion does not follow from the sources cited. One can look at a
7 single location and a single time period and conclude that, to cite one example, “malaria
8 in Finland was a sociological disease and malaria trends were strongly linked to changes
9 in the human household size and housing standard.”¹⁸ This of course cannot be
10 generalized to the conclusion that “humans will flourish in a warmer climate.” Another
11 article cited concludes that large-scale human crises in *pre-industrial* societies were
12 caused by a cooling climate.¹⁹ This of course says nothing whatsoever about the health
13 impact of a warming climate in the 21st century. The articles cited, in other words, are an
14 assemblage of marginalia that give only the appearance of support for what is otherwise
15 an unsupportable argument. One cannot glean useful information on human health and
16 climate change in the 21st century from papers discussing the incidence of natural
17 disasters in China during AD 10-1900.²⁰ Nor can an economist be expected to
18 meaningfully ascertain trends in the medical literature, a field in which he has no training
19 or experience. By contrast, every major peer-reviewed study that has addressed the issue
20 comprehensively rather than piecemeal has concluded that a warming climate poses a
21 human health risk, not a benefit. A recent multidisciplinary collaboration concluded in
22 *The Lancet* that climate change is the “biggest global health threat of the 21st century.”²¹
23 On this point health professionals are nearly unanimous.

¹⁶ *Id.* Also of note is the fact that the authors write that “Global warming has been under way for at least 25 years, and there is strong evidence that it is largely man-made and is continuing,” despite Dr. Bezdek’s assertions that anthropogenic climate change is a “myth.”

¹⁷ Bezdek Direct, Exhibit 3 at 107-114.

¹⁸ *Id.*, Exhibit 3 at 108.

¹⁹ *Id.*

²⁰ *Id.*, Exhibit 3 at 110.

²¹ Watts, N et al. Health and Climate Change: Policy Responses to Protect Public Health. *The Lancet*, June 23, 2015. [http://dx.doi.org/10.1016/S0140-6736\(15\)60854-6](http://dx.doi.org/10.1016/S0140-6736(15)60854-6), at p. 2.

1 **Q: If humans will not “flourish” in a warming environment, then what will be the**
2 **human health impacts of climate change?**

3 **A:** The impacts are well known to those that actually conduct research in the field. Two
4 recent developments in the literature amply demonstrate just how discredited is the
5 argument that human health will be improved by warmer temperatures. The U.S. EPA
6 recently issued a report from its Climate Change Impacts and Risk Analysis (CIRA)
7 project, a peer-reviewed study analyzing the physical and monetary benefits of
8 greenhouse gas emission reductions.²² The project received significant contributions from
9 academic institutions (MIT’s Joint Program on the Science and Policy of Climate
10 Change), government organizations (the National Renewable Energy Laboratory, the
11 Pacific Northwest National Laboratory’s Joint Global Change Research Institute) and
12 private consulting firms (Industrial Economics, Inc., Stratus Consulting, RTI
13 International, and ICF International).²³ The methods and results of the CIRA project have
14 been subjected to a level of independent, external peer review that is well beyond typical
15 review for a journal article.²⁴ This comprehensive, collaborative report concluded that:

16 “Climate change is projected to harm human health in a variety of ways through
17 increases in extreme temperature, increases in extreme weather events, decreases
18 in air quality, and other factors. Extreme heat events can cause illnesses and death
19 due to heat stroke, cardiovascular disease, respiratory disease, and other
20 conditions. Increased ground-level ozone is associated with a variety of health
21 problems, including reduced lung function, increased frequency of asthma attacks,
22 and even premature mortality. Higher temperatures and changes in the timing,
23 intensity, and duration of precipitation affect water quality, with impacts on the
24 surface water we use. There are a variety of other impacts driven by climate
25 change that are expected to pose significant health hazards, including increases in
26 wildfire activity.”²⁵

²² See U.S. EPA, Climate Change in the United States: Benefits of Global Action, June 22, 2015, available at <http://www2.epa.gov/cira/downloads-cira-report>.

²³ *Id.*

²⁴ *Id.* at Technical Appendix p. 10.

²⁵ *Id.* at Health Sector, p. 23.

1 The second recent publication was a comprehensive treatment of human health
2 and climate change from the British medical journal, the *Lancet*. The *Lancet* Commission
3 on Health and Climate Change is a multidisciplinary, international academic
4 collaboration that brought together climate scientists, geographers, environmental
5 scientists, biodiversity experts, engineers, energy policy experts, economists, political
6 scientists, public policy experts, and health professionals. This collaboration issued a
7 report on June 23, 2015 with over 40 authors, concluding that climate change is the
8 “biggest global health threat of the 21st century.”²⁶ The report found that climate change
9 will directly affect human health through heat stress, floods, droughts, and storms, as well
10 as indirectly through changes in air pollution, the spread of disease vectors, food
11 insecurity and under-nutrition, population displacement and mental ill health.²⁷ These
12 impacts are so severe that they have the potential to “reverse the health gains from
13 economic development.”²⁸ The Commission is strongly supportive of governmental
14 efforts to achieve “accurate quantification of the avoided burden of disease, reduced
15 health-care costs, and enhanced economic productivity associated with climate change
16 mitigation.”²⁹ Utilizing the SCC is a first step in this quantification, but the SCC is not a
17 complete quantification of the health impacts of climate change.

18 **Q: Some of these health impacts are not included in the SCC estimates?**

19 **A:** That’s correct. The SCC omits several key damages incurred by the public as a result of
20 CO₂-induced climate change, particularly exacerbated health harms from ozone and
21 PM_{2.5} and increased air pollution from wildfires. The SCC should therefore be used as
22 an extremely optimistic estimate of the actual economic damages of CO₂ emissions. In
23 other words, although I support the use of the SCC as a reasonable estimate of the
24 environmental and socioeconomic costs of CO₂ emissions, the SCC underestimates the
25 costs of CO₂ emissions and includes only a bare minimum of estimates of damage to the
26 public health. When used in a regulatory setting, the SCC estimates should be considered

²⁶ Watts, N et al. Health and Climate Change: Policy Responses to Protect Public Health. The Lancet, June 23, 2015. [http://dx.doi.org/10.1016/S0140-6736\(15\)60854-6](http://dx.doi.org/10.1016/S0140-6736(15)60854-6), at p. 2.

²⁷ *Id.*

²⁸ *Id.*

²⁹ *Id.*

1 *lower* bounds of the actual forecasted damages. This is in accordance with guidance from
2 the federal agencies themselves, who note that:

3 Current integrated assessment models do not assign value to all of the important
4 physical, ecological, and economic impacts of climate change recognized in the
5 climate change literature due to a lack of precise information on the nature of
6 damages and because the science incorporated into these models understandably
7 lags behind the most recent research. The limited amount of research linking
8 climate impacts to economic damages makes the modeling exercise even more
9 difficult. These individual limitations do not all work in the same direction in
10 terms of their influence on the SCC estimates, though taken together they suggest
11 that the SCC estimates are likely conservative.³⁰

12 I agree with this caution, and emphasize that the goal of obtaining a accurate accounting
13 of the economic damage from climate change is so important that the SCC should be
14 used, but used as an extremely optimistic estimate.

15 **Q: What public health impacts *are* included in the three IAMs used in the SCC?**

16 **A:** The three IAMs used to calculate the SCC range of estimates - FUND, DICE, and PAGE
17 – incorporate various costs attributable to the public health effects of CO₂-induced
18 climate change. These effects include mortality and morbidity from: 1) increased
19 incidence of vector-borne diseases such as malaria and dengue fever, 2) diarrhea, 3) heat-
20 related cardiovascular and respiratory diseases (as distinguished from cardiovascular and
21 respiratory diseases cause by air pollutants), and 4) increased storm activity.³¹

22 **Q: Is there reason to believe that these cost estimates are incomplete?**

23 **A:** Yes. According to Peter Howard’s report, the FUND model limits mortality and
24 morbidity from cardiovascular disease to urban areas, even though those impacts will be

³⁰ U.S. EPA, Regulatory Impact Analysis for the Proposed Carbon Pollution Guidelines for Existing Power Plants and Emission Standards for Modified and Reconstructed Power Plants, June 2, 2014, at 409, available at <http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule-regulatory-impact-analysis>.

³¹ Peter Howard, Omitted Damages: What’s Missing from the Social Cost of Carbon. Cost of Carbon Project, March 13, 2014 at 30.

1 felt in rural areas as well.³² FUND also limits the total change in mortality to a maximum
2 of 5% of baseline mortality per cause,³³ but the actual mortality experienced may prove
3 to be much larger than a 5% increase. Of equal importance is the exclusion of any health
4 impact from the air pollution generated by increased incidence of wildfire in a warming
5 climate.³⁴ The health impacts from wildfires can be devastating. In Russia's heat wave of
6 2010, over 25,000 wildfires covering 1.1 million hectares raised concentrations of carbon
7 monoxide, nitrogen oxides, and aerosols, and doubled the concentration of particulate
8 matter in Moscow.³⁵ Such events are likely to become commonplace in a climate warmed
9 by higher concentrations of CO₂.³⁶ The SCC also contains no accounting for the serious
10 health impacts of drought and flood.³⁷

11 **Q: Are there other notable omissions aside from those identified in the Peter Howard**
12 **Report?**

13 **A:** Yes. An especially notable omission from the health impacts modeled in the SCC is the
14 interaction between warmer temperatures and exposure to ozone and PM2.5. Climate
15 change affects human exposure in two ways: through effects on the pollution levels
16 themselves, and through interactions between temperature and pollutant exposure in the
17 body. Increasing temperatures from climate change can affect pollutant levels by
18 influencing the formation, transportation, dispersion, and deposition of pollutants such as
19 ozone and PM2.5.³⁸ Once those pollutants come into contact with human tissues, ambient
20 temperatures can impact how significantly those pollutants affect the patient's health.³⁹

³² *Id.*

³³ *Id.*

³⁴ *Id.*

³⁵ Watts et al at 8.

³⁶ *Id.*

³⁷ Howard, *Omitted Damages* at 30.

³⁸ Watts et al at 12.

³⁹ See, e.g., Kahle, JJ, Neas, LM, Devlin, RB, Case, MW, Schmitt, MT, Madden, MC, Diaz-Sanchez, D. Interaction effects of temperature and ozone on lung function and markers of systemic inflammation, coagulation, and fibrinolysis: a crossover study of healthy young volunteers. *Environ Health Perspec* April 2015; 123(4): 310-316; Roberts, S. 2004. Interactions between particulate air pollution and temperature in air pollution mortality time series studies. *Env. Res*, 96:328-337; Li, Y, Ma, Z, Zheng, C, Shang, Y. 2015. Ambient temperature enhanced cardiovascular-respiratory mortality effects of PM2.5 in Beijing, China. *Int. J. Biometeorology*, in print. DOI 10.1007/s00484-015-0984-z.

1 As noted in the EPA's Clean Power Plan Regulatory Impact Analysis, none of the
2 IAMs used in the SCC calculation include damages from temperature modification of
3 ozone and PM2.5 risks. As these increased effects are not incorporated into the SCC, the
4 SCC's range of costs estimates are almost certainly underestimates of the effects on the
5 public health. The EPA's analysis sought to estimate the economic benefits of reduced
6 CO₂ emissions for its proposed regulations, as well as the co-benefits of reducing ozone
7 and PM2.5 as a corollary effect of implementing CO₂ reducing strategies and
8 technologies. The analysis calculated the benefits of reducing ozone and PM2.5, and
9 added those numbers to the estimates of CO₂ reductions derived from the SCC models.
10 Those estimated co-benefits, however, only included the direct benefits of reduced ozone
11 (via NO_x reductions) and PM2.5 emissions. They did not include effects from the
12 *interaction* between increased temperatures and exposure to ozone and PM2.5. But there
13 are two vectors of health impact from ozone and PM2.5 – direct production of those
14 pollutants and *heightened or exacerbated* exposure through warmer temperatures. Ozone,
15 for instance, is formed through atmospheric reactions of nitrogen oxides and volatile
16 organic compounds in the presence of sunlight and heat.⁴⁰ Therefore two things cause
17 ozone's health impact – the production of pollutants such as NO_x and the increase of
18 temperatures from global climate change.⁴¹ When valuing the economic impact of ozone,
19 some of the damage is due to NO_x production, and another portion of the health impact is
20 attributable to CO₂ via warmer temperatures.⁴² But the *modification* of ozone and PM2.5
21 risks through warmer temperatures are not accounted for in any economic model of CO₂
22 damages, including the SCC. As the Regulatory Impact Analysis states, “the estimated
23 health co-benefits also do not consider temperature modification of PM2.5 and ozone
24 risks . . . Excluding temperature modification of air pollution risks and international air
25 pollution-related health benefits implies that the quantified health co-benefits likely lead

⁴⁰ Bloomer, BJ, Stehr, JW, Piety, CA, Salawitch, RJ, Dickerson, RR. Observed relationships of ozone air pollution with temperature and emissions. *Geophys Res Lett* 2009: 36.

⁴¹ Fang, Y, Mauzerall, DL, Liu, J, Fiore, AM, Horowitz, LW. Impacts of 21st century climate change on global air pollution-related premature mortality. *Climatic Change* 2013; 121:239-253; Watts, N et al. Health and Climate Change: Policy Responses to Protect Public Health. *The Lancet*, June 23, 2015. [http://dx.doi.org/10.1016/S0140-6736\(15\)60854-6](http://dx.doi.org/10.1016/S0140-6736(15)60854-6), at p. 12.

⁴² Fang et al.

1 to underestimation.”⁴³ Recent literature demonstrates that increased temperatures may
2 heighten both the concentrations of ozone and PM2.5, as well as the seriousness of the
3 health impacts from exposure to ozone and PM2.5.⁴⁴ Warmer temperatures increase
4 surface concentrations of both pollutants, and also cause stagnant weather systems that
5 create greater exposure times.⁴⁵ There is also evidence that warmer temperatures may
6 increase susceptibility to the damaging effects of ozone and PM2.5.⁴⁶

7 None of the health impacts from the interaction of temperature and exposure to
8 ozone and PM2.5, however, have been included in the IAMs used in the SCC. The
9 Regulatory Impact Analysis calculated the benefit of reduced CO₂ by adding together the
10 SCC values and the co-benefit of reduced production of ozone and PM2.5, but it made
11 clear that the economic value of the *interaction* between temperature and ozone/PM2.5
12 was not accounted for in the SCC or in its Regulatory Impact Analysis. The Analysis
13 states:

14 First, these estimated health co-benefits do not account for any climate-related air
15 quality changes (e.g., *increased ambient ozone associated with higher*
16 *temperatures*) but rather changes in precursor emissions affected by this
17 rulemaking. Excluding climate-related air quality changes may underestimate
18 ozone-related health co- benefits. Second, the estimated health co-benefits also do
19 not consider *temperature modification of PM2.5 and ozone risks* . . . Excluding
20 temperature modification of air pollution risks and international air pollution-
21 related health benefits implies that the quantified health co-benefits likely lead to
22 underestimation.⁴⁷

23 **Q: What are the health effects of exposure to ozone?**

⁴³ U.S. EPA, Regulatory Impact Analysis for the Proposed Carbon Pollution Guidelines for Existing Power Plants and Emission Standards for Modified and Reconstructed Power Plants, June 2, 2014, at p. 4-14, 15, available at <http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule-regulatory-impact-analysis>.

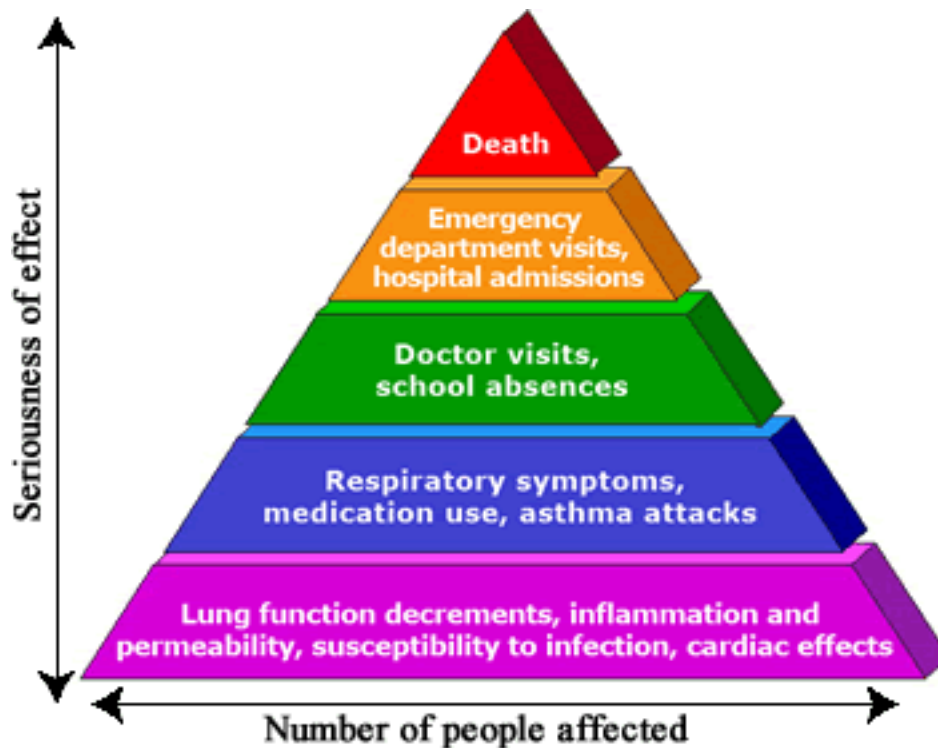
⁴⁴ Garcia-Menendez, F, Saari, K, Monier, E, Selin, NE. U.S. Air quality and health benefits from avoided climate change under greenhouse gas mitigation. *Environ Sci Technol*, June 8, 2015, DOI: 10.1021/acs.est.5b01324.

⁴⁵ Fang et al; Watts et al.

⁴⁶ Kahle et al.

⁴⁷ EPA Clean Power Plan Analysis at 4-14, 15 (emphasis added).

A: The medical consensus is that ozone is a dangerous pollutant that poses risks to the body's respiratory, cardiovascular and nervous systems, with possible impacts on reproductive systems and development.⁴⁸ Health outcomes range from hospitalizations and emergency room visits to premature mortality. The seriousness of impact and the proportion of the population experiencing that impact can be expressed as a pyramid, seen below.⁴⁹



In infants under one month, ozone can cause respiratory problems and hospitalizations at levels lower than the current National Ambient Air Quality Standard (NAAQS).⁵⁰ Although ozone is particularly dangerous for children, it affects adults as well, and the

⁴⁸ U.S. EPA. Integrated science assessment of ozone and related photochemical oxidants (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-10/076F, 2013; Bates, DV. Ambient ozone and mortality. *Epidemiology* 2005; 16: 427.

⁴⁹ U.S. EPA. Health effects of ozone in the general population, available at <http://www.epa.gov/apti/ozonehealth/population.html>.

⁵⁰ Dales, RE et al. Gaseous air pollutants and hospitalization for respiratory disease in the neonatal period. *Env Health Perspec* 2006; 114: 1751; Triche EW et al. Low-level ozone exposure and respiratory symptoms in infants. *Env Health Perspec* 2006; 114: 911.

effect is linear – the more ozone, the more damage to the lungs.⁵¹ The decreased lung function from ozone exposure can cause respiratory infections, asthma exacerbations, and airway inflammation in both vulnerable populations and otherwise healthy adults.⁵² Even short-term exposures can shorten lives.⁵³ Epidemiological studies document clear associations between premature mortality and ozone exposures below the current 8-hour NAAQS standard.⁵⁴ In the Twin Cities metro area, 1% of all deaths and up to 5% of respiratory hospitalizations and ER visits have been attributed to ozone exposure.⁵⁵

Q: What are the health effects of exposure to PM2.5?

A: PM2.5 is a deadly pollutant. Research clearly demonstrates that inhalation of PM2.5 causes premature mortality, systemic inflammation, alters vascular reactivity and cardiac rhythms, and worsens asthma, chronic bronchitis, and cardiopulmonary illnesses.⁵⁶ Chronic or acute exposure to PM2.5 increases the risk of dying from lung cancer, cardiovascular disease and respiratory disease for all individuals, not just vulnerable populations, but is especially dangerous for those vulnerable populations (children,

⁵¹ Schelegle, ES et al. 6.6-hour inhalation of ozone concentrations from 60 to 87 parts per billion in healthy humans. *Am J Resp & Crit Care Med* 2009; 180: 265; Adams, WC. Comparison of chamber 6.6 hour exposures to .04-.08 PPM ozone via square-wave and triangular profiles on pulmonary responses. *Inhalation Toxicology* 2006; 18: 127.

⁵² National Research Council. Estimating mortality risk reduction and economic benefits from reducing ozone air pollution: Executive summary. April 2008; p. 9.

⁵³ Ball, ML et al. A meta-analysis of time-series studies of ozone and mortality with comparison to the national morbidity, mortality, and air pollution study. *Epidemiology* 2005; 16: 436; Levy, JI et al. Ozone exposure and mortality: An empiric Bayes metaregression analysis. *Epidemiology* 2005; 16: 458; Ito, K et al. Associations between ozone and daily mortality: Analysis and meta-analysis. *Epidemiology* 2005; 16: 446.

⁵⁴ Pinkerton, KE et al. Ozone, a malady for all ages. *Am J Resp & Crit Care Med* 2007; 176: 107.

⁵⁵ Minnesota Dept. of Health and Minnesota Pollution Control Agency. Life and Breath: How Air Pollution Affects Public Health in the Twin Cities. July 2015, at 5.

⁵⁶ Pope, CA III, Dockery, DW. Health Effects of Fine Particulate Air Pollution: Lines that Connect. *J Air Waste Manage Assoc* 2006; 56: 709-742; U.S. EPA, Expanded Expert Judgment Assessment of the Concentration-Response Relationship between PM2.5 Exposure and Mortality: Final Report, vii, 3-23, 3-24 (Sept. 21, 2006); Health Effects Institute. Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Air Pollution and Mortality, 2000; Pope, CA III et al. 2004. Cardiovascular mortality and year-round exposure to particulate air pollution: Epidemiological evidence of general pathophysiological pathways of disease. *Circulation* 109: 71.

1 infants, elderly, and the chronically ill).⁵⁷ As fine particulate matter moves into the deep
2 airways of the lung, those airways become inflamed, impacting lung development,
3 increasing the risk of lung diseases, and increasing the likelihood of severe vascular
4 events.⁵⁸ PM2.5 increases the risk for heart attack and stroke, as exposure can inhibit
5 proper platelet functioning and harm vascular reactivity and heart rate variability.⁵⁹ The
6 body's inability to vary heart rate can result in arrhythmia, the immediate cause of death
7 for most heart attacks. In the Twin Cities, up to 13% of all deaths and 2% of respiratory
8 hospitalizations and ER visits are attributable to PM2.5 exposure.⁶⁰

9 **Q: In what ways might increased temperatures attributable to CO₂ affect the health**
10 **impacts of exposure to ozone and PM2.5?**

11 **A:** Some of the mechanisms of interaction are known, while others are observed effects
12 whose precise physiological mechanisms are still under study. Although some of the
13 exact interactions are unclear, the epidemiological data is clear that ambient temperatures
14 have synergistic effects with exposure to ozone and PM2.5, resulting in enhanced

⁵⁷ Pope, CA III et al. Lung Cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *J Am Med Assoc* 2002; 287: 9; Franklin, M et al. Association between PM2.5 and all-cause and specific-cause mortality in 27 U.S. communities. *J Exposure Sci & Env Epi* 2007; 17: 279, 285; Tonne, C et al. A case control analysis of exposure to traffic and acute myocardial infarction. *Env Health Perspec* 2007; 115: 53; Hong, YC et al. Effects of air pollutants on acute stroke mortality. *Env Health Perspec* 2002; 110: 187, 190; Roman, H et al. Expert judgment assessment of the mortality impact of changes in ambient fine particulate matter in the U.S. *Env Sci Tech* 2008; 42: 2268; Pope, CA III. Mortality effects of longer-term exposures to fine particulate air pollution: Review of recent epidemiological evidence. *Inhalation Tech* 2007; 19:33; Jerrett, M et al. Spatial analysis of air pollution and mortality in Los Angeles. *Epidemiology* 2005; 16: 727, 732.

⁵⁸ Chen, JC, Schwartz, J. Metabolic syndrome and inflammatory responses to long term particulate air pollutants. *Env Health Perspec* 2008; 116: 612, 616; Ghio, AJ et al. Concentrated ambient air particles induce mild pulmonary inflammation in healthy human volunteers. *Am J Resp. & Crit Care* 2000; 162: 981.

⁵⁹ Baccarelli, A et al. Exposure to particulate air pollution and risk of deep vein thrombosis. *Arch Int Med* 2008; 168: 920; Ghio, AJ et al. Exposure to concentrated ambient air particles alters hematologic indices in humans. *Inhalation Toxicology* 2003; 15: 1465; Devlin, RB et al. Elderly humans exposed to concentrated air pollution particles have decreased heart rate variability. *Euro Resp J Supp* 2003; 21: 76; Huang, YC et al. The role of soluble components in ambient fine particles-induced changes in human lungs and blood. *Inhalation Toxicology* 2003; 15: 327; Urch, B. Relative contributions of PM2.5 chemical constituents to acute arterial vasoconstriction in humans. *Inhalation Toxicology* 2004; 16: 345.

⁶⁰ MDH and MPCA, supra note 55, at 4.

1 morbidity and mortality from natural causes as well as cardiorespiratory causes.⁶¹ It is
2 well known that higher temperatures increase surface concentrations of ozone and
3 PM2.5.⁶² Atmospheric models predict that warmer temperatures will increase PM2.5
4 concentrations, primarily from changes in precipitation patterns that affect deposition of
5 particulates.⁶³ Warmer temperatures are also implicated in increased ozone formation
6 over populated areas (by complex chemical processes detailed in Fang et al, 2013).⁶⁴
7 Both of these increased pollutant concentrations from warmer temperatures are tied to
8 serious health impacts. Epidemiological studies, for instance, demonstrate that higher
9 temperatures produce higher rates of ozone-related mortality, indicating that higher

⁶¹ Ren, C, Kyun Park, S, O'Neill, MS, Sparrow, D, Vokonas, P, Schwartz, J. 2011. Ambient temperature, air pollution, and heart rate variability in an aging population. *Am. J. Epidemiology*, March 8, 2011. DOI: 10.1093/aje/kwq477.

⁶² World Health Organization, 2008. The Global Burden of Disease: 2004 update. http://www.who.int/healthinfo/global_burden_disease/2004_report_update/en/index.html; Fang et al, at 240; Ren et al 2011; Bloomer, BJ, Stehr, JW, Piety, CA, Salawitch, RJ, Dickerson, RR. Observed relationships of ozone air pollution with temperature and emissions. *Geophys Res Lett* 2009; 36; Knowlton K, Rosenthal JE, Hogrefe C, Lynn B, Gaffin S, Goldberg R, Rosenzweig C, Civerolo K, Ku J-Y, Kinney PL. Assessing ozone-related health impacts under a changing climate. *Env Health Perspect* 2004;112:1557–63; Murazaki K, Hess P. How does climate change contribute to surface ozone change over the United States? *J Geophys Res* 2006;111:D05301; Doherty RM, Heal MR, Wilkinson P, Pattenden S, Vieno M, Armstrong B, Atkinson R, Chalabi Z, Kovats S, Milojevic A, Stevenson DS. Current and future climate- and air pollution-mediated impacts on human health. *Environ Health* 2009;8 Supp 1:S8. Ren, C, Williams, GM, Morawska, L, Mengensen, K, and Tong, S. 2008. Ozone modifies associations between temperature and cardiovascular mortality: analysis of the NMMAPS data. *Occup and Env Med*, 65:255-260; Ren, C, Williams, GM, Morawska, L, Mengensen, K, and Tong, S. 2008. Does temperature modify short-term effects of ozone on total mortality in 60 large eastern U.S. communities? 2008. An assessment using the NMMAPS data. *Env Int*, 34: 451–458; Ren, C, Tong, S. 2006. Temperature modifies the health effects of particulate matter in Brisbane, Australia. *Int J of Biometeorology*, 51:87–96; Ren C; Williams, GM, Tong, S. 2006. Does particulate matter modify the association between temperature and cardiorespiratory diseases? *Env Health Perspect* 114:1690–1696; Roberts, S. 2004. Interactions between particulate air pollution and temperature in air pollution mortality time series studies. *Env Res*, 96:328–337; Li, Y, Ma, Z, Zheng, C, Shang, Y. 2015. Ambient temperature enhanced cardiovascular-respiratory mortality effects of PM2.5 in Beijing, China. *Int J Biometeorology*, in print. DOI 10.1007/s00484-015-0984-z.

⁶³ Fang et al at 243-44.

⁶⁴ *Id.*

1 temperatures *heighten* the physiological damage from ozone exposure.⁶⁵ Other studies
2 using Poisson regression models establish that ozone and temperature are causal
3 intermediates affecting mortality.⁶⁶ It is hypothesized that the combined exposure to both
4 ozone and heat may impair the fibronolytic pathway, decreasing the ability to dissolve
5 clots in the blood and thereby affecting cardiovascular mortality.⁶⁷ Another possible
6 mechanism is an increase in cardiovascular events from autonomic nervous system
7 dysfunction attributable to a combination of ozone and heat.⁶⁸ It is also generally true that
8 the in vivo toxicity of most chemicals is exacerbated with rising body temperatures, and
9 the role of environmental stress in the physiological response to toxicants is well
10 studied.⁶⁹ It is most likely that many of these pathways are simultaneously involved in
11 enhancing the destructive effects of ozone through warmer temperatures.

12 Similar synergies are seen with temperature and exposure to PM2.5, in addition to
13 increased PM2.5 concentrations from decreased deposition. Exposure to PM2.5 may
14 make susceptible populations more vulnerable to heat stresses, and heat may make
15 susceptible populations more vulnerable to the effects of PM2.5 inhalation.⁷⁰ The body
16 responds to heat by activating three heat dissipation mechanisms: cardiovascular,
17 respiratory, and sudomotor (sweating).⁷¹ These mechanisms (e.g. increased respiration)
18 can affect the rate at which particulates are introduced to the body.⁷² Other studies
19 suggest a variety of mechanisms of enhanced PM2.5 impact from heat: ion channel
20 function in myocardial cells, ischemic response in the myocardium, and pulmonary and

⁶⁵ Ren, C, Williams, GM, Mengersen K, Morawska, L, Tong S. 2009. Temperature enhanced effects of ozone on cardiovascular mortality in 95 large U.S. communities, 1987-2000: assessment using the NMMAPS data. *Arch Environ Occup Health* 64: 177-184.

⁶⁶ Burkart, K, Canario, P, Breitner, S, Schneider A, Scherber, K, Andrade, H, et al. 2013. Interactive short-term effects of equivalent temperature and air pollution on human mortality in Berlin and Lisbon. *Environ Pollut* 183: 54-63; Reid, CE, Snowden, JM, Kontgis, C, Tager, IB. 2012. The role of ambient ozone in epidemiologic studies of heat-related mortality. *Environ Health Perspect* 120:1627-1630; doi:10.1289/ehp.1205251.

⁶⁷ Kahle et al, at 314.

⁶⁸ Ren et al 2011.

⁶⁹ *Id.*

⁷⁰ Ren et al 2006.

⁷¹ Stafoggia, M, Schwartz, J, Forastiere, F, Perucci, CA. 2008. Does temperature modify the association between air pollution and mortality? A multicity case-crossover analysis in Italy. *Am J Epidemiology* 167(12): 1476-1485.

⁷² *Id.*; Ren et al 2011.

1 systemic oxidative stresses and inflammatory responses that trigger endothelial
2 dysfunction, atherosclerosis, and thrombosis.⁷³ Other possible means by which
3 temperature and PM2.5 exposure interact are primarily environmental rather than
4 physiological, including increased exposure times from stagnant weather systems and the
5 simple fact that warmer temperatures prompt people to open windows, thereby increasing
6 exposure to particulates.⁷⁴

7 For both ozone and PM2.5, in other words, warmer temperatures have two
8 primary effects with serious public health implications: they affect the prevalence of the
9 pollutants themselves and they affect how the body responds to those pollutants. Neither
10 of these two pathways is accounted for in the SCC, as the EPA itself made clear.⁷⁵

11 **Q: For those health impacts that are not included in the SCC, have those impacts been**
12 **economically quantified?**

13 **A:** Some of them have, others have not. The EPA's CIRA report assessed four key avenues
14 of public health impacts from climate change: air quality, extreme temperature mortality,
15 labor, and water quality (the report did not analyze impacts from extreme weather events,
16 air pollution from wildfires, or increases in vector-borne disease).⁷⁶ The report concluded
17 that reductions in greenhouse gas emissions would avoid 13,000 premature deaths in
18 2050 and 57,000 deaths in 2100 from air quality improvements alone (reducing ozone
19 and PM2.5 exposure through reduced temperatures), representing economic benefits of
20 \$160 billion in 2050 and \$930 billion in 2100.⁷⁷ Other studies suggest that these numbers
21 may be underestimates. Fang et al used relatively conservative CO₂ emissions scenarios
22 to study the effect of increased concentrations of ozone and PM2.5 from warmer
23 temperatures. They found that climate change increased PM2.5 mortality by 8% and
24 years of life lost by 4%, representing global annual deaths of 93,000-100,000 and
25 900,000 years of life lost.⁷⁸ Changes in ozone concentrations from climate change were
26 forecasted as increasing ozone mortality by 1-2% and years of life lost by 0.5%,

⁷³ Ren et al 2011.

⁷⁴ *Id.*; Fang et al 2013.

⁷⁵ EPA Clean Power Plan Analysis at 4-14, 15.

⁷⁶ *Id.*

⁷⁷ *Id.* at Health Sector, p. 25.

⁷⁸ Fang et al at 245-46, 248.

1 representing 6,300 global annual deaths and 38,000 years of life lost.⁷⁹ *None* of these
2 estimates – optimistic or not - are included in the SCC estimates.

3 The EPA report, however, did not quantify the economic value of: 1) health care
4 costs of non-fatal illnesses, hospitalizations, and days of work lost from climate change
5 exacerbated exposure to ozone and PM2.5, 2) the health impacts of droughts and floods,
6 3) the health impacts of air pollution from wildfires, and 4) health impacts from reduced
7 drinking water quality and harmful aquatic blooms. None of these four health impacts are
8 included in any of the SCC's IAMs.

9 Although the health impacts of air pollution from wildfires are difficult to
10 quantify economically, their economic impact is likely to be significant, and entirely
11 unaccounted for in the SCC. Russia's 2010 heat wave, for instance, resulted in 11,000
12 additional deaths in Moscow, from a combination of heat and doubled concentrations of
13 particulate matter when a large wildfire smoke plume covered the city.⁸⁰ Establishing
14 relative causation between heat and wildfire pollution is difficult, but the pollution is
15 certainly a major component of damage. Most studies suggest that particles in wildfire
16 smoke are more toxic to the lung than particulate matter from other sources of
17 pollution,⁸¹ and the concentrations of particulate matter can quickly skyrocket in a
18 wildfire episode. In North Carolina in 2008, maximum daily smoke-related particulate
19 matter levels reached as high as four times the EPA daily standard of 35 µg/m³. Exposure
20 to wildfire smoke has been associated with asthma and chronic obstructive pulmonary
21 disease emergency room visits and hospitalizations, congestive heart failure episodes, and
22 overall mortality.

23 **Q: So is it your conclusion that the SCC likely underestimates the health impacts of**
24 **climate change by at least \$930 billion (in 2100), and likely much more in**
25 **unquantified health impacts?**

26 **A:** Yes.

⁷⁹ *Id.*

⁸⁰ Watts et al at 8.

⁸¹ Wegesser, TC, Pinkerton KE, Last, JA. California Wildfires of 2008: coarse and fine particulate matter toxicity. *Environ Health Perspect* 2009; 117:893-7.

1 **Q: Is this conclusion based on your professional background and experience?**

2 **A:** My understanding of what health impacts are included in the IAMs is based on my
3 reading from secondary sources. I am not an environmental economist or a climatologist,
4 and my understanding of the technical aspects of the IAMs, including what public health
5 impacts they may or may not include, is founded on sources such as the EPA's Clean
6 Power Plan Regulatory Impact Analysis⁸² and economist Peter Howard's *Omitted*
7 *Damages* report.⁸³ The economic value of those health impacts is derived from the recent
8 EPA report, *Climate Change in the United States: Benefits of Global Action*, discussed
9 above. My conclusions about the health impacts of global climate change, however, are
10 based on my first hand experience and professional training as an expert in environmental
11 health, as well as on my review of the medical literature on the subject.

12 **Q: Does this conclude your testimony?**

13 **A:** Yes.

⁸² U.S. EPA, Regulatory Impact Analysis for the Proposed Carbon Pollution Guidelines for Existing Power Plants and Emission Standards for Modified and Reconstructed Power Plants, June 2, 2014, available at <http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule-regulatory-impact-analysis>.

⁸³ Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon*, March 13, 2014.

Date Prepared: 1June2015

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Born San Francisco, California

Citizenship United States of America

Education:

Year	Degree	Field	Institution
1963	Certificate		Ely Memorial High School
1967	BA	Political Science	University of Colorado
1971	MD	Medicine	University of Minnesota
1973	MPH	Environ. & Occup Health	Harvard School of Public Health

Internships and Residencies:

1971-1972 Intern in Straight Medicine, Univ Calif, Davis-Sacramento Medical Center, Sacramento, CA

1973-1975 Resident, Internal Medicine, Univ Calif, Davis-Sacramento Medical Center, Sacramento, CA

Clinical and Research Fellowships:

1975-1977 Fellow, Pulmonary Disease and Environmental Medicine, Mount Sinai School of Medicine

Licensure and Certification:

1972 National Board of Medical Examiners

1975 American Board of Internal Medicine

1975 New York Medical License 123,849

1976 Pulmonary Diseases, American Board of Internal Medicine

1977 Occupational Medicine, American Board of Preventive Medicine

2004 B Reader NIOSH International Classification of the Radiographs of the Pneumoconioses

Academic Appointments:

1977-1981 Assistant Professor of Internal Medicine, University of Utah School of Medicine, and Chief, Division of Occupational and Environmental Medicine

1981-1983 Associate Professor (tenured) of Internal Medicine, University of Utah School of Medicine

1983-1989 Senior Investigator, Pulmonary Branch, National Heart, Lung, and Blood Institute, NIH, Bethesda, MD

1989-Present Professor of Medicine and Environmental Medicine, NYU School of Medicine

1989- 2015 Director, Division of Pulmonary, Critical Care, and Sleep Medicine, NYU School of Medicine

1990-Present Adjunct Professor in Cellular Physiology and Immunology, Rockefeller University

2002-Present Sol and Judith Bergstein Professor of Medicine, NYU School of Medicine

2004-Present Professor (Environmental Policy), Robert F. Wagner Graduate School of Public Service

2014-present Professor, Global Institute of Public Health, New York University

Hospital Appointments:

1977-1983	Director, Rocky Mountain Center for Occupational and Environmental Health, Chief, Division of Occupational and Environmental Health, University of Utah Health Sciences Center
1989-Present	Director (1989-2014) and Senior Attending Physician, Chest Service, Bellevue Hospital Center
1990-2006	Program Director, General Clinical Research Center, NYU School of Medicine

Other Professional Positions and Major Visiting Appointments:

1983-1989	Senior Investigator, Pulmonary Branch, National Heart, Lung, and Blood Institute, National Institutes of Health, Bethesda, Maryland
1999-2000	Special Assistant to the Assistant Secretary of Interior for Fish, Wildlife and Parks, Washington, D.C.
2003-2004	Environmental and Health Policy Fellow, Senator Hillary Rodham Clinton, Washington, D.C. Legislative Fellow. (Sabbatical September 2013-June 2014).
2004-Present	Adjunct Scholar, Center for American Progress
2013	Visiting Professor, University of Addis Ababa, Ethiopia
2014-present	Senior Adviser, Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment (Sabbatical Sept 2014-February 2015). Member of Climate Change and Human Health Working Group (CCHHWG), U.S. Global Change Research Program.

Awards and Honors:

1967	Cum laude BA in political science, University of Colorado “The West’s Conservation Controversy 1901-08”
1977	American College of Physicians; Fellow 1989
1992	Harriet Hardy Award for Excellence in Occupational Medicine presented by New England Occupational Medicine Association
1992	Senior author on 1 AFCR Henry Christian Award
1993	Senior author on 2 AFCR Henry Christian Awards
1996	Health Achievement in Occupational Medicine Award, American College of Occupational and Environmental Medicine
1998	Charles C. Shepard Science Award from CDC/ATSDR, Co-recipient
1999	Association of American Physicians
1999	Irving J. Selikoff Award for Cancer Research, Ramazzini Society
2007, 2009	NCI Early Detection Research Network Award for Providing Creative, Outstanding Leadership in Building a Strong, Effective Translational Research Program on the Application of Biomarkers in Cancer Detection and Prevention
2009-2012	Institute of Medicine Roundtable on Environmental Health Sciences, Research, and Medicine
2011	Harvard School of Public Health Alumni Achievement Award
2012	Robert Kehoe Award, American College of Occupational and Environmental Medicine
2013	Champion of Change, The White House, Council on Environmental Quality and Environmental Protection Agency-Climate Change.
2013	Global TB/HIV and The Environment. Murray Kornfeld Honor Lecture, American College of Chest Physicians, Chicago, IL.
2014	Distinguished Achievement Award, American Thoracic Society San Diego, CA.
2015	Val Vallyathan Award, Senior Investigator in Environmental Health, ATS Assembly on Environmental, Occupational, and Population Health

Major Committee Assignments:

1981	Office of Technology Assessment Advisory Panel Health Implications of Oil Shale Development
1982	The Role of Genetic Testing to Prevent Occupational Disease, National Institute for Occupational Safety and Health
1980	NIOSH, National Objectives Planning Committee
1983-1986	NIOSH, Mine Health Research Advisory Committee
1977-1983	Utah Lung Association/Intermountain Thoracic Society, Occupational Health Committee
1983	World Health Organization Review Panel on Environmental Health Criteria-Acrylonitrile, Prague, Czechoslovakia
1980-1983	American Lung Association, Occupational Health Committee
1995	American Federation for Medical Research, Pulmonary and Critical Care Medicine Annual Meeting
1993-1994	New York Thoracic (Trudeau) Society, Annual Meeting Committee
1996	International Advisory Committee for the Sixth International Meeting on the Toxicology of Natural and Man-made Fibrous and Non-fibrous Particles, Lake Placid, NY
1996-2000	New York Lung Association, Legislative Committee
2001-2012	Health Effects Institute, Cambridge, MA, Review Committee, Air Toxics Committee
2005-2010	External Advisory Committee of Center for Environmental Genetics, University of Cincinnati, Cincinnati, OH
2007	Reviewer for McGill University Center for Innovative Medicine and Center for Translational Biology, Montreal, Quebec, CANADA
2011-present	WTC Health Program Scientific/Technical Advisory Committee International Conference on Occupational and Environmental Lung Disease
6th – 1999	Vancouver, B.C., Co-Chair
5th – 1995	Orlando, FL, Co-Chair
4th – 1991	Montreal, Quebec, Planning Committee
3rd – 1986	Montreal, Quebec, Planning Committee
1975-present	American Thoracic Society Member and Fellow
1984-1985	ATS Scientific Assembly on Environmental and Occupational Health, Chairman.
1980-1985, 2004	ATS International Conference Abstract Reviewer
1984-1985	ATS International Conference Meeting Committee
1992, 2001	ATS Amberson Lecture Selection Committee
1993-1994	ATS Research Awards Committee
2000-2001	ATS Research Awards Committee
2001	Introducer of Distinguished Achievement Awardee (Dr. Roberta Goldring)
2005-2012	ATS Environmental Health Policy Committee Chairman, 2005, 6, 7, 8
2007	ATS Research Committee
2007	ATS Officers Nominating Committee
2007	ATS Scientific Advisory Committee

University of Utah School of Medicine

Chairman - Park City Environmental Health Conferences.

Proceedings published by Ann Arbor Science, Ann Arbor, MI

1979	Health Implications of New Energy Technologies
1980	Health and Exposures in the Smelter Environment
1981	Legal and Ethical Dilemmas in Occupational Health
1982	Health Issues Related to Metal and Non-metallic Mining

New York University School of Medicine

1995-present	The Bellevue Association
1989-2015	Bellevue Medical Board
1989-2006	Executive Advisory Committee, GCRC
1995-2010	Center for AIDS Research; Opportunistic Infections Program Director
2000-present	NYU Perelman Cancer Institute
1998-1999	Gene Therapy Steering Committee
1998	Research Funding Committee
	Search Committees- Bellevue Medicine Chief, Anesthesiology Chair
1989-2014	Executive Committee, Department of Medicine
2001	Search Committees, Cardiology, Infectious Disease
2000	Functional Genomics Committee
2006-7	CTSA Steering Committee

Memberships, Offices and Committee Assignments in Professional Societies:

Fellow	American College of Preventive Medicine American College of Physicians American College of Chest Physicians The Explorer's Club (Leader Four Flag Expeditions)
Master	American College of Occupational and Environmental Medicine
Member	Association of American Physicians Conservation Lands Foundation American Association for the Advancement of Science American Thoracic Society Association of Pulmonary and Critical Care Medicine Program Directors European Respiratory Society American Federation for Medical Research New York Academy of Medicine New York Academy of Sciences The Harvey Society International Union Against Tuberculosis and Lung Disease The Wilderness Society Sierra Club Friends of the Boundary Waters Wilderness Natural Resources Defense Council Environmental Defense Fund

Editorial Positions:

Editorial Boards	Lung (1995-2015) American Journal of Industrial Medicine (1989- present) Respiratory Research (2002- present) Cancer Biomarkers (2008-present) American Journal of Translational Research (2009- present) BMC Cancer (2009- present) Tuberculosis Research and Treatment (2009-present)
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Ad Hoc Reviewer for	American Journal of Preventive Medicine
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Archives of Environmental Health
 American Journal of Public Health
 Archives of Internal Medicine
 American Journal of Industrial Medicine
 Environmental Research
 New England Journal of Medicine
 American Journal of Respiratory and Critical Care Medicine
 American Journal of Pathology
 American Journal of Respiratory, Cell and Molecular Biology
 Journal of Occupational and Environmental Medicine
 Journal of Applied Physiology, Cellular Immunology, Cellular Physiology, Clinical Science
 International Journal of Occupational Medicine and Toxicology
 Journal of Clinical Investigation
 Journal of Experimental Medicine
 PLoS One

Principal Clinical and Hospital Service Responsibilities

Major Administrative Responsibilities

1977-1983	Founder and Director, Rocky Mountain Center for Occupational and Environmental Health, Chief, Division of Occupational and Environmental Health, Salt Lake City, Utah, University of Utah Health Sciences Center
1989-2015	Director, Division of Pulmonary, Critical Care, and Sleep Medicine, NYU School of Medicine
1989-2015	Director, Chest Service, Bellevue Hospital Center
1990-2006	Program Director - General Clinical Research Center at New York University School of Medicine
2006-2007	PI of CTSA Planning Grant
1989-2006	Member of GCRC Advisory Committee and Co-Chair 1989-1991
2013-present	Director, NYU/Bellevue Environmental Lung Disease Laboratory
2000-present	Director, NYU Lung Cancer Biomarker Center

NIH Assignments

2001-2010	EDRN Executive Committee (29 Committee meetings and 8 Workshops).
1990-present	NHLBI- Academic Awards on TB, Prevention, and EOM. NIEHS-Chair of Site Visits to Tulane, and RTP on Program Projects on ILD.
2001, 2007, 2012	NCI-SPORE Reviewer on Lung Cancer.
2006	NCRR-GCRC Site Visits to University of New Mexico, UT-Southwestern, Tulane.
2001	K23 SEP Panels.
2006	CTSA Inaugural Reviewer.
2006- 2012	NHLBI Member of Protocol Review Team of IPFNet
2011	NCRR CTSA Reviewer
2013	Latent TB/HIV Reviewer

Teaching Experience:

1977	Medical Grand Rounds: Asbestos-Related diseases. St. Paul-Ramsey Hospital, St. Paul, MN Medical Grand Rounds: PBB Contamination Episode in Michigan, Univ.of Utah, Salt Lake City, UT
1978	Medical Grand Rounds: Mesothelioma. University of Utah, Salt Lake City, UT

- 1979 Asbestos-related Disease: John Durrance Conference, Aspen, CO
- 1980 Occupational Lung Disease: DHHS Conference on Work and Health, San Francisco, CA
- 1981 Oil Shale Pneumonconiosis: John Durrance Conference, Aspen, CO
- 1982 Dental Laboratory Pneumoconiosis: Department of Environmental Health, Seattle, WA
Keynote Occupational Lung Disease: Western Occupational Medical Assoc., San Francisco, CA
- 1983 Pathogenesis of Pneumoconiosis: American College Occupational Medicine, Salt Lake City, UT
Visiting Professor, University of Oregon Health Sciences Center, Portland, OR
- 1984 Visiting Professor, University of Sherbrooke, Sherbrooke, Quebec
Medical Grand Rounds: Boston University, Boston, MA
- 1985 Keynote Pathogenesis of Pneumoconiosis: NATO Conference on Pulmonary Fibrosis. Black Forest, West Germany
- 1986 Medical Grand Rounds: Sibley Hospital, Washington, DC
Visiting Professor, University of Kentucky, Lexington, KY, "Occupational Lung Diseases"
- 1987 Cell Biology of Occupational Lung Disease: Roanoke, VA
Toxicology of Asbestos: National Academy of Sciences, Washington, DC
- 1988 Pathogenesis of Pneumoconioses: DRDS, NIOSH, Morgantown, WV
- 1989 Pulmonary Grand Rounds: Albert Einstein College of Medicine, Bronx, NY
Medical Grand Rounds: NYU Medical Center, New York, NY
Environmental Medicine Grand Rounds: Mt. Sinai, New York, NY
Environmental Health Grand Rounds: University of Cincinnati, Cincinnati, OH
- 1990 Visiting Professor: University of Vermont, Burlington, VT
Medical Grand Rounds: Yale University, New Haven, CT
Pulmonary Grand Rounds: Yale University, New Haven, CT
Pulmonary Grand Rounds: Tropical Pulmonary Eosinophilia: Mt. Sinai, NY
Pulmonary Grand Rounds: Columbia University, New York, NY
Pulmonary Grand Rounds: Cornell University, New York, NY
IGF Receptors: Keynote at Pulmonary Fibrosis Symposium in Trapp Lodge, Stowe, VT
Macrophage Particle Analysis Overburden Phenomena: International Aerosol Assoc., Rochester, NY
Macrophage Growth Factors: Third Wave of Asbestos Disease: New York Academy of Sciences, New York, NY
Asbestos-related Disease: New York Academy of Medicine, New York, NY
- 1991 Pulmonary Grand Rounds: Long Island Jewish, New York, NY
Medical Grand Rounds: SUNY-Downstate Medical Center, Brooklyn, NY
Visiting Pulmonary Scholar NIEHS, Duke & Univ. of North Carolina, Research Triangle Park, NC

- Mechanisms of Pulmonary Fibrosis: Keynote IV International Conference on Occupational Lung Disease, Montreal, Canada
 Pulmonary Grand Rounds: Robert Wood Johnson Medical School, Piscataway, NJ
 Pulmonary Grand Rounds: New York Medical College, Valhalla, NY
 Pulmonary Grand Rounds: NYU Medical Center, New York, NY
 American Occupational Health Conference, "TB in the Workplace", Atlanta, GA
 New York Trudeau Society, "Growth Factors and Asbestosis"
 Pulmonary Grand Rounds: University of Rochester, Rochester, NY
- 1992 Harriet Hardy Occupational Medicine Award/Lecture: Boston, MA
 "Molecular Host Response to Tuberculosis": Aaron Diamond Center for AIDS Research
 "Molecular Host Response to Tuberculosis": Public Health Research Institute
 "Molecular Host Response to Tuberculosis": New York Department of Veterans Affairs Hospital
 Pulmonary Grand Rounds: NYU Medical Center, "HAPE, Kilimanjaro, Denali, and Chomolungma"
 Visiting Professor and Medical Grand Rounds: University of Minnesota, Minneapolis, MN
- 1993 Pulmonary Grand Rounds: Montefiore Hospital of Albert Einstein Medical School "Molecular Host Response to Mycobacterium tuberculosis"
 Medical Grand Rounds: Winthrop University Hospital, Tuberculosis
 Medical Grand Rounds: Booth Memorial Hospital, Asbestos-related Diseases
 Rabin Lecture, "Molecular Biology of Tuberculosis," Mt. Sinai, NY, "Multi-drug Resistant TB"
 Pulmonary Grand Rounds: NYU Medical Center, Pneumoconiosis Research
 Minnesota Thoracic Society, "Tuberculosis in the 1990s"
 University of Manitoba, Winnipeg, Manitoba "Recent Advances in Asbestos-related Diseases", Annual Canadian Occupational Health Meeting
 Carey Pratt McCord Banquet Speech, Michigan State Occupational Medical Society, Detroit, MI, "Tuberculosis"
 NYU Pulmonary Grand Rounds: "Molecular Host Response to Tuberculosis" Brooklyn Hospital, "Tuberculosis Host Response"
- 1994 NYU Medical Grand Rounds: "Human Host Response to Mycobacterium tuberculosis"
 NYU Rheumatology Grand Rounds
 American College of Physicians - Virginia, "Tuberculosis in the 21st Century"
 Tuberculosis - Host Response ATS Meet the Professor, Boston, MA
 NYU Obstetrics and Gynecology Grand Rounds
 First Congress on Pediatric Pulmonology, Nice, France, "Multidrug-Resistant TB in Children"
 Medical Grand Rounds: North Shore University Hospital "Tuberculosis"
 State of Art Address, 8th International Colloquium on Pulmonary Fibrosis, Dijon, France, "What Growth Factors and Cytokines Recovered from Clinical Samples Tell Us About Lung Fibrosis?"
 Medical Grand Rounds: SUNY-Stony Brook, "Molecular Host Response to Tuberculosis"
 Pulmonary Grand Rounds: NYU Medical Center, "What Role do Growth Factors and Cytokines Have in Pulmonary Fibrosis?"
- 1995 Keystone Symposia Molecular Mechanisms in Tuberculosis, Tamarron, CO, "Evaluation of Human Host Response to Tuberculosis by Bronchoalveolar Lavage"
 5th International Conference on Occupational and Environmental Lung Disease, Co-Chairman, Orlando, FL, "Occupational Risks for Tuberculosis"

Annual Congress of the Swiss Respiratory Society, Fribourg, Switzerland "Molecular Mechanisms of Tuberculosis"

NYU Pulmonary Grand Rounds: "Host Response to Tuberculosis"

Plenary Session, American College of Chest Physicians, New York, NY "Research and Policy Issues in Asbestos-Related Diseases"

- 1996 Medical Grand Rounds: Albany Medical College, "Molecular Host Response to M. tuberculosis"
 Pediatrics Grand Rounds: NYU Medical Center, "Death to Mycobacterium tuberculosis"
 Pulmonary Grand Rounds Albert Einstein College of Medicine (Jacobi), "Molecular Biology of Lung Cancer"
 Visiting Professor, Boston University School of Medicine, "Molecular Host Response to M. TB"
 ATS - Tropical Pulmonary Eosinophilia, and Summary of Host Response to TB New Orleans, LA
 14th Asia Pacific Congress on Diseases of the Chest, Bali, Indonesia, "Cytokines and the Lung", and "Host Response to TB"
 Pulmonary Grand Rounds: Columbia University, College of Physicians and Surgeons, "Occupational Lung Disease and Lung Cancer"
 American College of Chest Physicians, San Francisco, CA, "Top 10 Papers on Occupational Lung Disease 1996"
 9th International Pulmonary Fibrosis Colloquium, "Pulmonary Alveolar Proteinosis", Oaxaca, Mexico
- 1997 Pathology Grand Rounds: NYU, "Molecular Host Response to M. tuberculosis"
 Duke University Thoracic Oncology Conference at The Breakers, Palm Beach, FL, "Solitary Pulmonary Nodule"
 New York City TB Bureau: "TB Host Response"
 Interurban Clinical Club, 175th Annual Meeting, New York, NY, "New Molecular Approaches to Lung Cancer"
 CPC Discussant, ATS Annual Meeting, "Lymphocytic Interstitial Pneumonitis in AIDS"
 Rose Kline Lecture, Mercer Hospital, Trenton, NJ, "Molecular Mechanisms of Lung Cancer"
 Pulmonary Grand Rounds: NYU, "High Altitude Physiology -- First American Ascent of Mt. Geladaintong at the Source of the Yangtze"
- 1998 First American Ascent of Mt. Geladaintong - the Source of the Yangtze River. The Explorer's Club, New York, NY
 ATS International Conference, Chicago, IL "How to Jazz Up the Host Response to TB"
 19th Annual Scientific Meeting UOSHERC: Occupational Cancer, "Biological Mechanisms of Occupational Lung Cancer," Mt Sinai Medical Center, New York, NY
 Pulmonary Grand Rounds: St. Lukes-Roosevelt Hospital, New York, NY "Occupational Lung Disease"
 Visiting Professor: Tohoku University in Sendai, Japan and Nippon Medical College in Tokyo, Japan, "Endemic Tuberculosis in New York City", and Institute of Medical Science, University of Tokyo
 Pulmonary Grand Rounds: NYU Medical Center, "Mechanisms of Host Response to TB"
 Gordon Research Conference on Cancer, Salve Regina College, Newport, RI
 Visiting Professor: NIOSH, Divisions of Respiratory Disease Studies and Toxicology, "Mechanisms of Inflammatory Lung Disease", Morgantown, WV
 10th International Colloquium on Lung Fibrosis, Siena, Italy, "The Role of Apoptosis and IL-1b in Silicosis"

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| 1999 | 6th International Conference on Environmental and Occupational Lung Disease,
Vancouver, B.C. Co-Chair
"Molecular and Genetic Aspects of Lung Cancer"
"Mechanisms of Apoptosis in IL-1b Knockout Mice"
IUATLD North American Conference, Chicago, IL "TB/HIV Interaction"
Pulmonary Grand Rounds: Montefiore- Albert Einstein College of Medicine "Regulation of
HIV-1 and Cytokine Production in Alveolar Macrophages"
ATS Conference San Diego, CA "p53/Cell Cycle in Lung Cancer"
Pulmonary Grand Rounds: Brooklyn VA Medical Center
Pulmonary Grand Rounds: NYU School of Medicine "p53- Cell Cycle Deregulation in Lung
Cancer"
Tuberculosis: Basic and Clinical Aspects, Porto, Portugal "Molecular Host Response to
Mycobacterium Tuberculosis and Interferon-Gamma Aerosol Therapy"
Pulmonary Grand Rounds: North Shore and Long Island Jewish Hospitals "Biology of Lung
Cancer" |
| 2000 | Millennium 2000 Conference on Environmental Health UMDNJ- Robert Wood Johnson Medical
School "Future Developments in Occupational Health"
Rheumatology Grand Rounds: NYU "Molecular Host Response to Tuberculosis"
NYU Medicine Grand Rounds: "Mountain Illnesses in the Kun Lun, Chomolungma, and Denali"
9th International Conference- Health and the Environment: Global Partners for Global Solutions-
United Nations, NY "The Role of Environmental Protection to Control Lung Diseases in
Developing Countries"
Albert Einstein School of Medicine Medical Grand Rounds: "Molecular Host Response to
Tuberculosis"
4th Environmental Health Seminar, Bangkok, Thailand, Mettaphracharak Hospital "The
Pathogenesis of Asbestosis and Silicosis"
"Molecular and Genetic Aspects of Lung Cancer" |
| 2001 | Pulmonary and Critical Care Medicine Grand Rounds: NYU School of Medicine "The 2001
Commemorative Shackleton Crossing of South Georgia Island"
Explorer Club Flag #61 Expedition
Medicine Grand Rounds and Visiting Professor at Louisiana State University, New Orleans, LA
"TB/ HIV Interaction and Host Response to TB"
University of Minnesota Tobacco Research Center "Biomarkers for Tobacco Exposure:
Application to Clinical and Epidemiological Studies"
ATS International Conference, San Francisco, CA "The Search for the Biomarker Gene"
NYU Pulmonary & Oncology Grand Rounds: "Molecular Biology of Lung Cancer"
Weil Medical College of Cornell University, Institute of Genetics Grand Rounds: "HIV/TB
Interaction"
UMDNJ- New Jersey Medical School Medicine Grand Rounds: "Host Response to
Tuberculosis" |
| 2002 | NYU Division of Clinical Pharmacology Grand Rounds: "Molecular Aspects of Lung Cancer"
ATS International Conference, Atlanta, GA "Global Warming"
Yale Occupational Health Grand Rounds: Acute Eosinophilic Pneumonia in NYC Firefighter
exposed to World Trade Center Dust"
Medicine Grand Rounds: New York Medical College, St. Vincent's Hospital "HIV/TB
Interaction at the Molecular Level" |

- 2003 Medicine Grand Rounds: Roosevelt Hospital/Columbia "Global Warming and Environmental Lung Disease"
 Pulmonary Grand Rounds: Columbia "Molecular Aspects of Lung Cancer"
 Medicine Grand Rounds and Visiting Professor, University of Cape Town, Groote Schuur Hospital
 "Molecular Host Response to M tb/HIV co-infection", "Molecular Aspects of Lung Cancer"
 Pulmonary Rounds, "Global Warming and Environmental Lung Disease" Respiratory Institute Lecture Minnesota Thoracic Society: "Global Warming" and "Molecular Aspects of Lung Cancer"
- 2004 UN WIT Environmental Health Conference: "Environmental Health Policy in the U.S. Senate"
 NYU Medicine Grand Rounds
 NYU Department of Environmental Medicine Grand Rounds
 SUNY-Stony Brook Medicine Grand Rounds: "Health and Environmental Policy Perspectives as a Legislative Fellow in the U.S. Senate"
 SUNY-Stony Brook Pulmonary Grand Rounds: "Molecular Host Response to TB"
 NYU Downtown Medical Grand Rounds: "Environmental Lung Disease"
 West Virginia Health Sciences Center Lung Cancer Conference Keynote "Molecular Aspects of Lung Cancer"
 Mailman Columbia School of Public Health, Department of Health Policy "Health and Environmental Policy"
 Mt. Sinai School of Medicine Scleroderma Foundation: "Scleroderma Lung"
 American College of Physicians - Saratoga Springs, NY "Health Policy"
 Montefiore Pediatric Grand Rounds: "Health and Environmental Policy"
 13th International Colloquium on Pulmonary Fibrosis in Banff, Alberta "Asbestos/BaP Interaction in Lung Cancer in dnp53 Transgenic Mice"
 SUNY, Downstate School of Medicine: "Occupational Environmental Lung Disease"
 Interurban Clinical Club Banquet Speech: "Health and Environmental Policy in the U.S. Senate"
- 2005 ATS International Conference San Diego, CA "Molecular Markers As Surrogate Endpoints For Lung Cancer"
 Gordon Cancer Biomarker Conf. in Santa Barbara, CA "S-Adenosyl Methionine in Lung Cancer"
 EDRN Semi-annual meeting "Biomarkers and Lung Cancer" Fred Hutchinson Cancer Center
- 2006 Chair, 4th EDRN Workshop on Early Detection of Cancer, Philadelphia, PA.
- 2007 Gordon Research Conference New Frontiers in Cancer Detection and Diagnosis in Ventura, CA
 "Acrolein causes p53 Adducts at Codons Mutated by Cigarette Smoke"
 "Current Issues in Environmental Policy" Spring Semester in Wagner Graduate School of Public Service. This 4 credit course covers policy issues in Air Pollution, Tobacco Regulation, Global Warming, Wilderness Preservation, Endangered Species and NEPA. 14 Students.
 14th Annual Executive Meeting of NCI Early Detection Research Network, Denver, CO, "Lung Cancer Collaborative Group Results on the Early Detection of Lung Cancer"
 School of Medicine Earth Day "Global Climate Change."
 ATS Symposium "Air Pollution: From Science to Policy" Co-Chair and Speaker
 NYU Pulmonary Grand Rounds: "Archeology: Hiva Oa to Rapa Nui."
 University of Pennsylvania Respiratory Research Institute Alf P. Fishman Lecture "Early Molecular Diagnosis of Lung Cancer."

- 15th Annual Executive Meeting of NCI Early Detection Research Network Ann Arbor, MI,
 “Lung Cancer Collaborative Group Update.”
 Heidelberg International Cancer Meeting, “Lung Cancer Biomarkers” NYU School of Medicine.
 NYU Medical Grand Rounds “Global Tuberculosis: from Bellevue to the Groote Schuur.”
 “PM and COPD” New York Academy of Medicine Meeting on COPD.
- 2008 Global Medicine Club, NYU “Global Tuberculosis”
 Traffic and Health, Environmental Defense Fund, “Congestion Pricing, Traffic and Respiratory
 Disease”
 “Global Climate Change and Lung from Biomass,” Environmental Risks and Respiratory
 Disease, Chandigarh, India, U.S.-Indo Workshop.
 “Climate Change and Health” Medical Grand Rounds, SUNY-Downstate Medical School,
 Brooklyn, NY.
 “Climate Change and Health” Medical Grand Rounds. Weill Cornell Medical School, New
 York.
- 2009 “Global Tuberculosis” to Microbiology and Immunology Dept., Albert Einstein, New York.
 “Global Climate Change and Health” Medical Grand Rounds, NYU School of Medicine, New
 York.
 “NW Greenland Polar Inuit: Global Warming Up Close” The Explorer’s Club, New York, NY
 Return of Flag #176.
 House Appropriations Environment Subcommittee Testimony on EPA Budget, Washington DC.
 “Asbestos- Related Disease” at the National Museum of the American Indian, Smithsonian
 Institution, Washington DC.
 “Global Climate Change and Health” Medical Grand Rounds, Albert Einstein College of
 Medicine, Bronx, NY.
 “Global Climate Change and Health” Medical Grand Rounds, University of Connecticut Health
 Sciences Center, Farmington, CT.
 “Global Climate Change and Health” Medical Grand Rounds, Mt. Sinai School of Medicine,
 New York, NY.
 “Emerging Exposures and Respiratory Health: World Trade Center Dust” Giles Filley, MD
 Lecture, Aspen Lung Conference, Aspen, CO.
 “Early Detection and Molecular Mechanisms of Lung Cancer,” Beth Israel Pulmonary Grand
 Rounds, New York, NY
 Green Energy and Public Health, The White House, Washington, D.C.
 Global Climate Change and Public Health, NIH Stone House Workshop, Bethesda, MD.
- 2010 Early Detection of Lung Cancer-the NYU Lung Cancer Biomarker Center, NYU Medical Grand
 Rounds, New York, NY.
 NYU Lung Cancer Biomarker Center Rheumatology Grand Rounds, New York, NY
 Biomarker Discovery and Verification of a Lung Cancer with Somamer Signature Proteomic
 Technology, Aspen Lung Conference, Aspen, CO.
 Global Climate Change: Respiratory and Ecology, ATS International Conference, New Orleans,
 LA.
 Workshop on Climate Change and Respiratory Health, Co-Chair, ATS International Conference,
 New Orleans, LA
- 2011 Climate Change and Global Public Health, Medicine Grand Rounds, University of Cape Town
 Early Detection of Lung Cancer, Pulmonary Grand Rounds, University of Cape Town.
 Climate Change and Global Public Health, Environmental Health Grand Rounds and Visiting
 Professor, University of Cincinnati, Cincinnati, Ohio.
 New Medical Devices and Diagnostics in MDR-TB, American College of Chest Physicians,
 Honolulu, Hawaii
- 2012 Novel Biomarker Panels Utilizing Molecular Pathways for the Early Detection of Lung Cancer,

- Pulmonary Grand Rounds, USC, Los Angeles, CA. Global Climate Change and Public Health, Dean's Translational Medicine Grand Rounds, USC, Los Angeles, CA.
- The Bellevue Chest Service: The Nobel Prize, Tuberculosis, Lung Cancer, and WTC Dust, William Harris Memorial Lecture, NYU Langone Medical Center, New York, NY
- Sigurd Olson's Friends: Robert Marshall and the Muries in the Brooks Range, Alaska, Sigurd Olson Lecture, Vermilion Community College, Ely, MN
- 2013 Following Sigurd Olson's Dreams of Canoeing the Churchill River to Hudson's Bay, the Back River in the Barrenlands, and the South Nahanni. Sigurd Olson Lecture, Vermilion Community College, Ely, MN.
- Understanding Environmental Factors and Climate Change on Global Public Health, ATS International Conference, Philadelphia, PA.
- Potholes in the Road to an Early Detection of Lung Cancer Biomarker, NIH EDNRN Workshop, Washington, DC.
- Tropical Pulmonary Eosinophilia, Early Diagnosis of Lung Cancer, Global TB/HIV, and Climate Change and Global Public Health, University of Addis Ababa, Addis Ababa, Ethiopia
- NYU Lung Cancer Biomarker Center: Biomarkers to Distinguish Aggressive versus Non-aggressive Lung Cancer. EDNRN Steering Committee Meeting, NIH Seattle, WA.
- Global Climate Change and Public Health. Medical Grand Rounds, West Virginia University Health Sciences Center and Visiting Professor for Pulmonary and Critical Care Rounds, Honor's Seminar, and Graduate Forestry and Public Health Seminar.
- Global TB/HIV and The Environment. Murray Kornfield Honor Lecture, American College of Chest Physicians, October 29, 2013, Chicago, IL.
- 2014 Global TB-HIV and The Environment. Albert Einstein College of Medicine Pulmonary Grand Rounds
- Global TB-HIV and The Environment. Winthrop Hospital Medical Grand Rounds. Mineola, NY
- Anti-Glycan Autoantibodies and Early Detection of Lung Cancer; EDNRN 9th Workshop, Washington, DC.
- Climate Change and Public Health U.S. GCRP-Burma Exchange in Climate Change, Washington, DC
- Biomarkers for Lung Cancer after Biomass Exposure. Global Alliance for Clean Cookstoves, Washington, DC.
- 2015 Global Climate Change and Public Health Alta Internal Medicine Conference Alta, Utah
- Autoantibodies, Metabolomics, and N-Glycosylation as Biomarkers for the Early Detection of Lung Cancer, 29th Executive Meeting of the EDNRN, National Cancer Institute, Atlanta, Georgia
- Global Climate Change and Public Health, Medical Grand Rounds, University of Mississippi, Jackson, MS

Mentoring of Graduate Students, Residents, Post-Doctoral Fellows

15 Occupational Medicine Residents (Utah) 1977-83

Name	Type of position	Time period	Present Position
Lee, T.	Postdoc	1991-93	Pfizer, New York
Zhang, Y.	Postdoc	1990-94	Johns Hopkins University
Guillemin, B	Postdoc	1991-93	U. Strasbourg, France
Giron, F	Postdoc	1991-2	Beekman Downtown Hospital
Aston, C	Postdoc	1992-95	Columbia Genome Center, NYU
Nakata, K	Postdoc	1992-95	U. Tokyo, Japan Found for AIDS Prevention
Cassino, C	Postdoc	1993-94	Pfizer, New York
Schluger, N	Postdoc	1992-95	Professor and Director, Pulmonary/CC, Columbia
Armstrong, L	Postdoc	1992-96	Pfizer, New York

Tchou-Wong, KM	Postdoc	1993-96	Associate Prof, NYU School of Medicine
Fishman, C	Postdoc	1994-95	Clin Asst Prof, Albert Einstein
Park, MM	Postdoc	1996-97	Chief, Pulm & Crit. Care, East Orange VA
Addrizzo-Harris, D	Postdoc	1995-97	Assoc. Prof and Director of Fellowship, NYU SoM
Salazar, J	Postdoc	1995-96	Asst. Prof, Harlem Hospital
Pancoast, T	Postdoc	1995-96	USAF, Dayton, Ohio
Klingler, K	Postdoc	1995-97	Asst Prof, U. Zurich
Divinagracia, R	Postdoc	1994-96	Asst Prof, U. Philippines
Condos, R	Postdoc	1995-97	Associate Professor, NYU School of Medicine
O'Brien, J	Postdoc	1994-96	Clinical Faculty, U. Oregon
Kim, R	Postdoc	1997-99	Clinical Faculty, Cornell Univ.
Baram, D	Postdoc	1999-00	Asst Prof, SUNY-Stony Brook
Srivastava, K	Postdoc	1999-00	Research Scientist, Mt. Sinai
Jiang, Y	Postdoc	1996-98	MD Anderson, Asst Prof
Greenberg, A	Postdoc	1999-01	Clin Asst Prof, NYU School of Medicine
LaRosa, J	Postdoc	2000-02	Asst Professor, SUNY, Downstate
Hosomi, Y	Postdoc	2002-04	Asst Prof, Nippon Medical School, Tokyo
Su, T	Postdoc	2002-04	Research Assoc, NYU School of Med
Qiu, B	Postdoc	2003-04	Research Assoc, NYU School of Med
Rimal, B	Postdoc	2004-05	Clinical Faculty, Medical Center of Central GA
Aguila, E	Postdoc	2004-05	Clinical Faculty Northern Dutchess Hospital, NY
Maksimova, E	Postdoc	2004-07	Pharmaceutical
Hajjou, M	Postdoc	2004-06	Proteome Pharmaceuticals
Khilkin, Michael	Postdoc	2007-08	Critical Care Faculty, Asst Prof, Albert Einstein
Rivera, PJ	Postdoc	2007-08	Instructor, Pulmonary, NYU/Bellevue
Liu, Li	Postdoc	2004-08	Senior Research Scientist/NYUSOM
Rinella, Erica	Postdoc	2008-09	NYU Human Genetics
Lee, Robert	Postdoc	2008-09	Assistant Professor, Memorial Sloane Kettering
Bonura, Eric	Postdoc	2009-10	Kaiser Permanente Portland, OR
Cai, Zhenjian	Postdoc	2009-12	Cleveland Cliniiic-pathology resident
Kim, Connie	Postdoc	2010-12	Seoul, South Korea University
Tsay, James	Postdoc	2011-15	Assistant Professor, NYU School of Medicine
DeCotiis, Chris	Postdoc	2013-14	Kaiser Permanente, CA

Pulmonary and Critical Care Fellows

<u>Dates</u>	<u>College</u>	<u>Medical School</u>	<u>Residency</u>
1988-1990			
Michael Bronstein	Columbia University	George Washington Univ	NYU
Elizabeth Dolly	CUNY of NY	Mt. Sinai	Beth Israel, NYC
Theodore Lee	Yale Univ	Univ of Pennsylvania	NYU
Steven Meixler	Boston University	Boston University	NYU
Claudia Plottel	Bryn Mawr	Med Coll of Pennsylvania	NYU
Paul Weinstein	Tufts Univ	Mt. Sinai	Beth Israel, NYC
1989-1991			
Robert Alexander	John Hopkins Univ	St. Louis Univ	St. Vincent Hosp
Kenneth Baron	Emory Univ	Univ of Texas Med Branch	Westchester County
Assia Bromberg	Orenburt, USSR	Kishinev, USSR	Englewood Hosp
Federick Dewil	Adelphi	SUNY/Stonybrook	Bronx Municipal

Timothy Harkin	Fordham Univ	Downstate Med Ctr	Long Island Hosp
Kenneth Trestman	SUNY/Buffalo	NY Medical Coll	Lenox Hill

1990-1992

Jon Beacher	Univ of Chicago	Univ of Chicago	St. Lukes, Chicago
Anita Bhola	Univ of Delhi, India	Univ of Delhi, India	Beekman Downtown
Michael Brescia	Boston Univ	Universidad Del Noreste	SUNY Health Sci Ctr
Thomas Chan	Lehigh Univ	Med Coll of Pennsylvania	Beekman Downtown
Stephen Pastores	U of St. Thomas, Phil	LYCEUM, Philippines	Metropolitan Hospital
Vincent Donnabella	Columbia Univ	Univ of Med & Dentistry	NYU

1991-1993

Carlo Ciotoli	Univ of Pennsylvania	NYU	NYU
Charles Fishman	Univ of Pennsylvania	Mt. Sinai	Montefiore Med Ctr
Jason Karp	SUNY/Binghampton	SUNY/Downstate	Montefiore Med Ctr
Kevin Law	Colgate Univ	NYU Sch of Med	Boston City Hosp
Felicia Relkin	Clark Univ, Worchester	Albert Einstein	Beth Israel Med Ctr
David Ryon	Duke Univ	Univ of Miami	NYU
John Concato	Cooper Union	NYU	NYU

1992-1994

Kenneth Berger	Boston Univ	Boston Univ	Montefiore Med Ctr
Rany Condos	Barnard College	Columbia Univ	ColumbiaPresbyterian
Daria Lee	Haverford Coll	Baylor Coll	Beth Israel Hosp
Eric Leibert	Brandeis Univ	Columbia Phy & Surgeons	NYU
Diana Nilsen	Columbia Univ	Downstate Med Ctr	NYU
Maryann Park	Smith Coll	UMDNJ Med Sch	Montefiore

1993-1995

Fabio Giron	Columbia Univ	SUNY/Stony Brook	NYU
Doreen Addrizzo	Univ of Pennsylvania	NYU	NYU
Adam Yu	China Med Coll	China Med Coll	Montefiore Med Ctr
James O'Brien	Iowa State Univ	Univ of Minnesota	Hennepin County
Deborah Shapiro	Tufts Univ	NY Medical College	Montefiore
John Salazar-Schicchi	Buenos Aires Univ	Buenos Aires Univ	NYU

1994-1996

Ruth Divinagracia	Univ of the Philippines	Univ of the Philippines	Montefiore Med Ctr
Matthew Epstein	SUNY at Albany	McGill University	Graduate Hospital
Omar Burschtn	Univ of Uruguay	Univ of Uruguay	New York Downtown
Loren Tierney	Rutgers Univ	SUNY-Brooklyn	NYU
Muge Erkan	Brown Univ	Columbia Univ	Yale-New Haven Hos
Souheil Samaha	Int'l Coll	Univ of Saint Joseph	Montefiore Med Ctr

1995-1997

Javier Jover	Univ of Paraguay	Univ of Paraguay	NYU
Jacques Conaway	Univ of Delaware	Univ of Maryland	NYU
Neil Shapiro	Univ of Pennsylvania	NYU	NYU
Richard Kim	Yale Univ	Albert Einstein College	NYU
Apurva Marfatia	KC College, India	BYL Nair Hospital, India	NYU

Linda Rogers	SUNY Binghamton	NYU	Columbia-Presbyterian
1996-1998			
Daniel Baram	Univ of Pennsylvania	Jefferson Medical College	Cornell Medical College
Wanda Choy	Harvard University	Columbia University	Univ of Michigan
Thompson Pancoast	Vassar College	George Washington Univ	NYU
Bindu Raju	Boston University	Boston University	Boston University
Harald Sauthoff	Univ Berlin	Univ of Berlin	NYU
1997-1999			
Frank Hull	Univ. of Pretoria	Univ. of Pretoria	Albert Einstein
Bryon Quick	Temple Univ.	UMDNJ	Yale-New Haven
Alissa Greenberg	Yale Univ.	Columbia Univ.	Columbia Univ.
Denise Harrison	Queensboro Comm.Col.	Univ. of Pennsylvania	NYU
Soucheat Siou	Cornell Univ.	Mount Sinai Hospital	Mount Sinai Hospital
1998-2000			
Michael Waller	Louisiana State Univ.	Columbia Univ.	Johns Hopkins
Leah Schiffman	Brandeis Univ.	NYU	NYU
Jason Shatkin	SUNY Stony Brook	Albert Einstein	North Shore Hosp.
Jeffrey Gold	SUNY Binghamton	NYU School of Medicine	Columbia Univ.
Barbara Chatr-Aryamontri	Experimental Lyceum	Univ. "La Sapieza"	Beth Isreal
Ana Krieger	Univ. of Rio Grande	Univ. of Rio Grande	Univ. of Rio Grande
1999-2001			
Cielo Maca	Univ. of Philippines	Univ. of Philippines	Montefiore Med.Ctr
Ronald Goldenberg	Univ. of Albany	Temple Univ.	Boston Medical Ctr
Cesar Alinsorin	De La Salle Univ.	Univ. of Philippines	Montefiore Med.Ctr
Mona Bashar	NYU	NYU	NYU
Subooa Zafar	Johns Hopkin's Univ.	Thomas Jefferson College	NY Medical Hosp.
2000-2002			
Sholeh Bagheri	Hunter College	SUNY Brooklyn	North Shore
Emmanuel Bayongan	Univ. of Philippines	Univ. of Philippines	Metropolitan Hospital
Hsien-Wen Hsu	Univ. of Buenos Aires	Univ. of Buenos Aires	Mercy Catholic
Jennifer LaRosa	George Washington Univ.	George Washington Univ.	Univ. of Arizona
Anna Nolan	Barnard College	SUNY Brooklyn	St. Luke's Roosevelt
Pratan Vathesatogkit		Ramathibodi Med School	UMDNJ
2001-2004			
Benjamin Chang	Duke University	Columbia University	Georgetown Univ.
Kevin Felner	Emory University	Emory University	UT-Southwestern
David Fridman	Tbilisi, USSR	St. George's Univ.	UMDNJ
Nicos Hadjiangelis	Univ. of Athens	Univ. of Athens	Englewood Hospital
Beno Oppenheimer	Buenos Aires Univ.	Buenos Aires Univ.	NYU Downtown
Peter Shih	SUNY-Oswego	St. George's Univ.	Lenox Hill Hospital
2002-2005			
Elvira Aguila	Boston University	Boston University	Boston Medical
Khalid Ismail	Univ. of Alexandria	Univ. of Alexandria	St. Joseph's Chicago

Steven Jacoby	Dartmouth College	Yale University	NY Presbyterian
Nehal Mehta	Adelphi Univ.	St. George's Univ.	UMDNJ
Binaya Rimal	Tribhuvan Univ., Nepal	Tribhuvan Univ.	St. Luke's Roosevelt
Mazen Sabbaq	Damascus Univ.	Damascus Univ.	Englewood Hosp.
Ed (Joon Woo) Kim	Univ. of Pennsylvania	Tufts University	NYU

2003-2006

James Gasperino	Pace University	SUNY Stony Brook	NYU
Marilyn Kline	UC Berkeley	University of Maryland	NYU
Khalid Puthawala	Case Western Reserve U.	Case Western Reserve U.	NY Presbyterian
Elvio Ardilles	NYU	SUNY Stony Brook	Stony Brook U Hosp

2004-2007

Nishay Chitkara	UC Berkeley	UT Galveston	NYU Medical Center
Pablo Herscovici	Univ. Favaloro, Argentina	Univ. Favaloro, Argentina	St. Luke's Roosevelt
Jerry Hung	University of Rochester	SUNY Stony Brook	Montefiore Med Ctr
Michael Jagen	Rutgers University	NYU	NYU
Sam Parsia	Sarah Lawrence College	Albert Einstein College	Beth Israel
Amees Patrawalla	Brown University	Mount Sinai	Boston Medical Center
Vijay Seelall	Rutgers University	New York Medical College	St. Luke's Roosevelt
Jessica Stoeckel	East Stroudsburg Univ.	Temple University	Mount Sinai Hospital

2005 - 2008

Emily Chism	University of California	Tulane University	Vanderbilt University
Ezra Dweck	Columbia College	NYU	NYU
Joshua Filner	Reed College	Oregon Health & Science	Legacy Clinic
Sheryl Goldyn	Georgetown	Loyola University	Georgetown
Michael Khilkin	Cornell University	NY Coll Osteopath Med	Jacobi Medical Center
Peter Kim	Princeton/Columbia	SUNY Stony Brook	Jacobi Medical Center

2006 - 2009

Tshering Amdo	Maulana Azad Med/India	Maulana Azad Med/India	Harbor Hospital/Baltimore
Allison Friedenberg	University of Minnesota	University of Wisconsin	Brown Medical School
Robert P. Lee	Rutgers University	UMDNJ	Georgetown University
Amit Vinod Patel	Northwestern University	Northwestern University	Georgetown University
David Poch	Brown University	St. Vincent's	Brown Medical University
Hesham Abdelrazek			

2007-2010

Khader Abounasr	Creighton University	Creighton University	George Washington
Eric Bonura	Cornell University	UMDNJ	Georgetown University
Stephanie Lau	Barnard College	Albert Einstein College	Lenox Hill Hospital
Ming-Tyh Maa	Old Dominion University	Eastern Virginia Medical School	Montifore Medical Cen
Paru Patrawalla	Brown University	Brown University	Boston University
Kristy Bauer	Loyola College	SUNY Downstate	NYU
Leopoldo Segal	Universidad Nacional de La Plata	Universidad Nacional de La Plata	Morristown
Memorial Hospital			
Violet Kramer	University of Notre Dame	Indiana University	NYU
Pedro Rivera	University of Puerto Rico	Universidad Autonoma de Guadalajara	St. Lukes-Roosevelt

2008-2011

Dina Abifadel	Lebanese University	Lebanese University	Staten Island University
Elaine Fajardo	George Washington University		University of
Chicago/UCLA			
Derrick Raptis	Univeristy of Rochester	St. George's University	Drexel University
Cyrus Shariat	UC-Berkeley	UC-Davis	UC-San Francisco
Versha Taparia	Northwestern	Northwestern	Boston University
Amit Uppal	John Carroll University	Ohio State University	UC-Irvine

2009-2012

Cynthia Callahan		Tufts University	Tufts University
Soo Jung Cho		Seoul National University	Lincoln Medical Center
Joseph Huang		Oregon Health and Sci Med	Tulane University
Matthias Kugler		Technische Universitat Muchen	NYUMC
Richard Lee		Drexel University	George Washington
Yves Makhoul		Universite Libanaise	Staten Island University
James Tsay		Temple University	NYUMC
Sarah Tapyrik		University of Rochester	Brown University

2010-2013

Rosemary Adamson		Guy's, King's & St. Thomas	NYUMC
Ashwin Basavaraj		New York Medical College	Georgetown University
Thomas Martin		Medical College of Georgia	Wake Forest
Alexandra McGann		SUNY Syracuse	University of Rochester
Lymaris Garcia Medina		University of Puerto Rico	St. Lukes-Roosevelt
Deepak Pradham		Jefferson Medical College	Brown University
Edward Schenck		Temple University	New York Presbyterian

2011-2014

Keren Bakal		UMDNJ	Boston University
Christopher DeCotiis		UMDNJ	Georgetown University
Mauricio Danckers Degregori	Universidad Nacional Mayor de San Marcos		St. Lukes - Roosevelt
Conrad Jablonski	St. George's University		UMDNJ
Young Im Lee	Ewha Womans University		St. Lukes - Roosevelt
Elizabeth Mulaikal	Georgetown Univeristy		Georgetown University
Benjamin Seides	Tulane University		NYUMC

2012-2015

William Bender		Georgetown University	Georgetown University
John Egan		George Washington	Weill Cornell
Hee Jin Kim		Hallym University	St. Lukes- Roosevelt
Daniel Laurie		Imperial College	Long Island Jewish
Vikramjit Mukherjee		Armed Forces Medical	Washington Hosp. Center
Israa Soghier		Univ. Of Alexandria	Jacobi Med. Center
Natoushka Trenard		Howard University	Stony Brook Medical
Bishoy Zakhary		Creighton University	NYU School of Medicine

2013-2016

Priya Agarawala		UMDNJ	NYU School of Medicine
Daniel Burke		Columbia University	NYU School of Medicine

Dena Daglian
 Bradley Hayward
 Melissa Lesko
 Mandana Mahmoudi
 Christina Rager
 Benjamin Wu

Sackler SoM – NYS
 Temple University
 PCOM
 Charite – Univ. Berlin
 SUNY Downstate
 SUNY Stony Brook

Hofstra North Shore – LIJ
 Temple University
 St. Lukes- Roosevelt
 Yale – Griffin Hospital
 UCLA – Olive View
 NYU School of Medicine

Environmental Policy Master's Students in Wagner Graduate School of Public Service

2007

Javier Bronfman
 Nelson Harvey
 Rachel Marcus
 Stephen Roberts
 Jordan Smith

Andrea Daniel
 Mark Hellermann
 Tamar Matalon
 Daniel Saccardi
 Erica Waples

Kristin Gilliss
 Susanne Huerta
 Michael Provenza
 Justin Schultz

2008

Seth Brown
 Pedro Farinas
 Martha Kenton
 Comfort Otune
 Stephanie Phillips
 Olga Tsoupros
 Jennifer Wiemer

Kevin Cromar
 Rebecca Gluskin
 Elizabeth Langsdorf
 Devang Panchal
 Dasha Rettew
 Jon VanOeveren
 Jonathan Wozinak

Alison Culp
 Daniel Guilbeault
 Karen Leu
 Margaret Phelan
 Brian Ross
 Devon Whitley
 Jiang Zhou

2009

Aaron Ampaw
 Avril David
 Jenny Law
 Kevin Lyu
 Nathalie Verhaegen

Robyn Baitcher
 Kristen Ellis
 Rebecca Lipman
 Nicholas Prigo

Caroline Barth
 Edward Kiernan
 Levita Lowe
 Molly Sugrue

2010

Mary Stead
 Lee Frankel-Goldwater
 Emily Driscoll
 Hyein Lee
 David Miller

Lauren Neag
 Sean Quarry
 Victoria Watts
 Adina Wolf

2011

Kelly Chang
 Jessica Harris
 Harshi Hettige
 Michael Kinney
 Carly Knudson

Caitlin LaMorte
 Sara Oliver
 Kiran Savage-Sangwan
 Elizabeth Woodworth

Major Research Interests

- 1) Environmental Lung Disease and Air Pollution Health Effects
- 2) Global AIDS and Tuberculosis
- 3) Lung Cancer
- 4) Environmental Policy

Grants Received

1. Fellowship, NIH/NIEHS, 1972-1973, \$7,500.
2. Fellowship, American Lung Association, 1975-1977, \$20,000.
3. NIEHS Environmental Epidemiology Training Grant, PI, \$350,000 1982-7, PI.
4. Dental Laboratory Worker's Research Grant, PI, \$350,000 1980-3, PI.
5. Smelter Environmental Research Association Grant, PI, \$150,000, 1980-3, PI.
6. NIOSH Trona Health Hazard Evaluation, PI, \$350,000 1980-3, PI.
7. Hill AFB Solvents Research Planning Grant, PI, \$100,000, 1981-3, PI.
8. NIOSH Oil Shale Worker Health Effects Contract, subcontract PI to University of Utah, \$400,000, 1979-83.
9. Coal Workers' Pneumoconiosis Health Grant, Utah State Department of Health, \$50,000, PI, 1977-79.
10. Kennecott Sulfur Dioxide Pulmonary Research Grant, PI, \$150,000, 1981-3.
11. T15OH07141, NIOSH Educational Resource Center, Rocky Mountain Center for Occupational and Environmental Health, PI and Director, 1978-1988, \$6,899,828.
12. Fellowship, NHLBI/NRSA, Mechanism of Occupational Lung Diseases, 1983-1984, \$30,000.
13. Charles A. Dana Foundation, Multidisciplinary Research on the Cause and Prevention of Environmentally Related Disease, 1989-1995, \$464,532, PI.
14. Aaron Diamond Foundation, Pulmonary Macrophages and Immune Responses in HIV-infected Individuals, 1990-1992, \$250,000, PI.
15. U60/CCU 206153, CDC/NIOSH, Model Program: Diagnosis, Treatment and Rehabilitation of Individuals with Occupational Respiratory and Musculoskeletal Disorders, 1990-1995, \$2,448,471, PI.
16. U50/CCU210075, CDC/NIOSH, Occupationally-related TB and TB Infection in Health Care Workers, 1994-1999, \$875,000, PI.
17. MO1-RR00096, NIH, General Clinical Research Center, 1990-1993, \$9,456,092, Program Director.
18. MO1-RR00096, NIH, General Clinical Research Center, 1993-1998, \$15,136,360, Program Director.
19. RO1 AI35233, NIAID, Exaggerated Release of IL-1 β and TNF- α in Tuberculosis, 1993-1996, \$616,302, PI.
20. RO1 HL51494, NHLBI, Cytokine/Adhesion Molecules in TB Pathogenesis, 1994-1998, \$1,120,901, PI.
21. U60/CCU 206153, CDC/NIOSH, Model Clinic on Occupational Respiratory Disorders, 1995-2000, \$2,500,000, PI.
22. MO1-RR00096, NIH, General Clinical Research Center, 1998-2003, \$18,417,970, Program Director.
23. RO3 AI30989, NIAID, Anti-Growth Factor Therapy in Kaposi's Sarcoma, 1990-1991, \$45,000.
24. Private Foundations, 13 Training Grants at NYU, \$650,000
25. Con Edison, Asbestos-Exposed Worker Program, 1991-2010, 2010-2014, \$2,660,000.
26. T32 ES07267, NIEHS, Molecular and Cell Biology in Environmental Medicine Training, 1992-7; 1997-2002; 2002-7; 2007-2012, \$1,904,191, PI. Extension 2013-2015.
27. R01 HL59832, NHLBI, Host Response to TB and AIDS, 1997-2008, \$3,500,000, PI.

28. RO1 HL62055, NHLBI, Immune Response in the Lung to TB Proteins in AIDS, 1998-2003, \$1,000,000, PI.
29. Contract # 200-93-0691, CDC, Clinical Trials of New Methods for Treatment and Prevention of Tuberculosis, 1999-2009, \$2,464,292, PI.
30. U01CA8617-01-14, NCI, NYU Lung Cancer Biomarker Clinical and Epidemiologic Center, 2000-2010, \$10,540,946, PI. Renewed 2010-2015, \$5,070,000, PI.
31. U01CA8617 Administrative Supplement \$200,000 Biomarkers to Distinguish Aggressive vs Nonaggressive Lung Cancer PI.
32. M01 RR00096, NIH, General Clinical Research Center, 2004-2009, \$25,000,000, Program Director.
33. CTSA Planning Grant NCRR, 2006-2007, \$150,000 PI.
34. RO1 HL090316 NHLBI, Longitudinal Studies of HIV-Associated Bacterial Pneumonia, 2007-2012, \$2,500,000. PI. Hurricane Sandy Extension 2013-2014

Board and Community Organizations

- | | |
|--------------|--|
| 2000-present | Board of Directors, Health and Environment Association, World Information Transfer, Inc (Nonprofit with the United Nations). |
| 2001-2012 | Board of Directors, The Survivor Fund- Climb for Courage |

Military Service

- 1972-77 U.S. Air Force Reserves (inactive)

Bibliography

Original Reports

1. Rom WN, Benner EJ. Toxicity by interaction of tricyclic anti-depressants and monoamine oxidase inhibitor. California Med 1972; 117:65-66.
2. Rom WN, Palmer PES. The spectrum of asbestos-related diseases. West J Med 1974; 121:10-21.
3. Rom WN. Effects of lead on the female and reproduction: A review. Mt Sinai J Med NY 1976; 43:542-552.
4. Lorimer WV, Lilis R, Nicholson WJ, Anderson H, Fischbein A, Daum S, Rom WN, Rice C, Selikoff IJ: Clinical studies of styrene workers: Initial findings. Environ Health Perspect 1976; 17:171-181.
5. Lilis R, Fischbein A, Eisinger J, Blumberg WE, Diamond S, Anderson H, Rom WN, Rice C, Sarkozi L, Kon S, Selikoff IJ. Prevalence of lead disease among secondary smelter workers- biological indicators of lead exposure. Environ Res 1977; 14:225-285.
6. Rom WN, Anderson HA. Asbestos disease from household contact. Clin Notes Respir Dis 1977; 16:15-16.
7. Daum SM, Knittle J, Rosenman K, Rom WN, Holstein EC. A simple technique for fat biopsy of PBB-exposed individuals. Environ Health Perspect 1978; 23:183-185.

8. Bekesi JG, Holland JF, Anderson HA, Fischbein A, Rom WN, Wolff MS, Selikoff IJ. Lymphocyte function of Michigan dairy farmers exposed to polybrominated biphenyls. *Science* 1978; 199:1207-1209.
9. Rom WN, Miller A. Unexpected longevity in patients with severe kyphoscoliosis. *Thorax* 1978; 33:106-110.
10. Rom WN. The polybrominated biphenyl contamination episode in Michigan. In: *Proceedings of the VII International Congress of Rural Medicine*, Sept. 1978; 17-21, Salt Lake City, Utah, pp. 291-295.
11. Rom WN. Medicine re-enters the workplace. A new era in occupational medicine? *N Engl J Med* 1979; 300:672-673.
12. Rom WN. The Rocky Mountain Center for Occupational and Environmental Health (in the forefront). *West J Med* 1980; 133:264-269.
13. Livingston GK, Rom WN, Morris M. Asbestos-induced sister chromatid exchanges in cultured Chinese hamster ovarian fibroblast cells. *J Environ Pathol Toxicol* 4-2, 1980; 3:375-382.
14. Rom WN. Occupational health aspects of fossil fuel electric power plants. In: *Symposium on Energy and Human Health: Health Costs of Electric Power Generation*, U.S. Environmental Protection Agency, 1980; 600/9-80-030:231-255.
15. Rom WN. Epidemiology of toxic substances--PBB and Cummingtinite-Grunerite contamination. In: *Toxic Substances vs. Public Health Proceedings*, Department of Health, Helena, Montana, March 19-20, 1980; pp. 76-93.
16. Rom WN. Occupational lung disease: An overview - 1980. Is work and health inseparable in the 80's? DHHS (NIH) No. 81-2293, 1980; pp. 37-45.
17. Rom WN. Effects of lead on reproduction. In: *Proceedings of a Workshop on Methodology for Assessing Reproductive Hazards in the Workplace*. DHHS (NIOSH) Publication No. 81-100, 1980; pp. 33-42.
18. Wright WE, Rom WN. A preliminary report: Investigation for shalosis among oil shale workers. In: *Health Implications of New Energy Technologies*. Rom WN, Archer VE (eds). Ann Arbor Science Publishers, Inc., Ann Arbor, MI. 1980; pp.481-489.
19. Rom WN, Kanner RE, Renzetti AD Jr, Shigeoka JW, Barkman HW, Nichols M, Turner W, Coleman M, Wright WE. Respiratory disease in Utah coal miners. *Am Rev Respir Dis* 1981; 123:372-377.
20. Rom WN. Administration of occupational and environmental programs in a medical school: should they be a department? *J Med Educ* 1981; 56:914-916.
21. Greaves WW, Rom WN, Lyon JL, Varley G, Wright DD, Chiu G. Relationship between lung cancer and distance of residence from non-ferrous smelter stack effluent. *Am J Ind Med* 1981; 2:15-23.
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23. Casey KR, Rom WN, Moatamed F. Asbestos-related disease. In: Clinics in Chest Medicine. Brooks SM, Lockey JE, Harber P (eds). Philadelphia, PA: W.B. Saunders, 1981; pp. 179-202.
24. Rom WN, Varley G, Lyon JL, Shopkow S. Lung cancer mortality among residents living near the El Paso smelter. *Br J Ind Med* 1982; 39:269-272.
25. Rom WN, Lockey JE. Diffuse malignant mesothelioma. *West J Med* 1982; 137:548-554.
26. Rom WN, Casey KR, Parry W, Mjaatvedt CH, Moatamed F. Health implications of natural fibrous zeolites for the Intermountain area. *Environ Res* 1983; 30:1-8.
27. Rom WN, Livingston GK, Casey KR, Wood SD, Egger MJ, Chiu GL, Jerominski L. Sister chromatid exchange frequency in asbestos workers. *J Natl Cancer Inst* 1983; 70:45-48.
28. Miner JK, Rom WN, Livingston GK, Lyon JL. Lymphocyte sister chromatid exchanges (SCE) frequencies in coke oven workers. *J Occup Med* 1983; 25:30-33.
29. White G, Wood S, Rom WN. Prevalence of antinuclear antibodies in a normal male population. *Military Med* 1983; 148:536-538.
30. Rom WN, Greaves W, Bang KM, Holthouser M, Campbell D, Bernstein R. An epidemiologic study of the respiratory effects of trona dust. *Arch Environ Health* 1983; 38:86-92.
31. Rom WN, Lee J. Energy alternatives: What are their possible health effects? *Environ Sci Tech* 1983; 17:13A-144A.
32. Ball AL, Rom WN, Glenne B. Arsenic distribution in soils surrounding the Utah copper smelter. *Am Ind Hyg Assoc J* 1983; 44:341-348.
33. Rom WN, Turner WA, Kanner RE, Renzetti AD, Peebles C, Tan E, Olsen D. Antinuclear antibodies in Utah coal miners. *Chest* 1983; 83:515-519.
34. Rom WN, Moshell A, Greaves W, Bang KM, Holthouser M, Campbell D, Bernstein R. A study of dermatitis in trona miners and millers. *J Occup Med* 1983; 25:295-299.
35. Wood S, Rom WN, White GL, Logan D. Pentachlorophenol poisoning. *J Occup Med* 1983; 25:527-530.
36. Rom WN, Key M, Peterson R. Algorithm for investigation of outbreaks of occupational skin disease. *Fam Com Health* 1983; 6:24-29.
37. Rom WN, Lee JS. Occupational lung diseases in the mining industry. *Fam Com Health* 1983; 6:30-43.
38. Wright WE, Rom WN, Moatamed F. Characterization of zeolite fiber sizes using scanning electron microscopy. *Arch Environ Health* 1983; 38:99-103.
39. Rom WN, Lockey JE, Bang KM, DeWitt C, Johns RE. Reversible beryllium sensitization in a prospective study of beryllium workers. *Arch Environ Health* 1983; 38:302-307.

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41. Sadler TD, Rom WN, Lyon JL, Mason JD. The use of asbestos-cement pipe for public water supply and incidence of cancer in selected communities in Utah. *J Community Health* 1984; 9:285-293.
42. Cheson BD, Rom WN, Webber RC. Basophilic stippling of red blood cells - a non-specific finding of multiple etiology. *Am J Ind Med* 1984; 5:327-334.
43. Rom WN, Lockey JE, Lee JS, Kimball AC, Bang KM, Leaman H, Johns RE, Perrotta D, Gibbons HL. Pneumoconiosis and exposure of dental laboratory technicians. *Am J Publ Health* 1984; 74:1252-1257.
44. Rom WN. Research on the mechanisms of the occupational lung diseases. *Arch Environ Health* 1984; 39:186-189.
45. Kanner RE, Barkman HW, Rom WN, Taylor AT. Gallium-67 citrate imaging in coal miners. *Am J Ind Med* 1985; 8:49-55.
46. Rom WN, Krueger G, Zone J, Attfield MD, Costello J, Burkart J. Morbidity survey of U.S. oil shale workers employed during 1948-1969. *Arch Environ Health* 1985; 40:58-62.
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50. Rom WN, Wood SD, White GL, Bang KM, Reading JC. Longitudinal evaluation of pulmonary function in copper smelter workers exposed to sulfur dioxide. *Am Rev Respir Dis* 1986; 133:830-833.
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62. Rom WN, Travis WD and Brody AR. Cellular and molecular basis of the asbestos-related diseases. *State of the Art. Am Rev Respir Dis* 1991; 143:408-422.
63. Rom WN. Human mononuclear phagocytes express the insulin-like growth factor-II/Mannose 6-phosphate receptor. *Am J Respir Cell Mol Biol* 1991; 4:555-559.
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66. Rom WN. Activated Alveolar Macrophages from Individuals with Asbestosis Release Peptide Growth Factors. in *Cellular and Molecular Aspects of Fiber Carcinogenesis*. Harris CC, Lechner JF, Brinkley BR, Eds. Cold Spring Harbor; NY: Cold Spring Harbor Laboratory Press, 1991, pp. 103-114.
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69. Rom WN and Travis WD. Lymphocyte-macrophage alveolitis in nonsmoking individuals occupationally exposed to asbestos. *Chest* 1992; 101: 779-786.

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72. Chan TK, Aranda CP, Rom WN. Bronchogenic carcinoma likely a coincidental disease in young patients at risk for HIV. *Chest* 1993; 103:862-64.
73. Zhang Y, Lee TC, Guillemin B, Yu MC, Rom WN. Enhanced interleukin-1 β and tumor necrosis factor- α release and mRNA expression in macrophages from idiopathic pulmonary fibrosis or following asbestos exposure. *J Immunol* 1993; 150:4188-96.
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76. Zhang Y and Rom WN. Regulation of the interleukin-1 β gene by mycobacterial components and lipopolysaccharide is mediated by two NF-IL6-like motifs. *Mol Cell Biol* 1993; 13:3831-3837.
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82. Schluger N, Kinney D, Harkin T, Rom WN. Clinical utility of the polymerase chain reaction in the diagnosis of infections due to *Mycobacterium tuberculosis*. *Chest* 1994; 105:1116-1121.
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100. 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.
101. de la Hoz R, Schlueter D, Rom WN. Chronic lung disease following ammonia inhalation injury. *Am J Ind Med* 1996; 29:209-214.
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