

CURRICULUM VITAE

ROBERT ALAN SANDHAUS, M.D., Ph.D., F.C.C.P.

Professor of Medicine
Director, Alpha₁-Antitrypsin Deficiency Program
National Jewish Health
1400 Jackson Street, Rm M306
Denver, CO 80206
(303) 270-2051

Medical Director, Alpha-1 Foundation
Executive Vice President and Senior Medical Director, AlphaNet, Inc.
Medical Director, AlphaNet Canada
3300 Ponce de Leon Blvd.
Coral Gables, FL 33134
(305) 648-9543

EDUCATION

George W. Hewlett High School, New York		1964-1967
Haverford College, Pennsylvania	B.A.	1967-1971
Molecular Biology		
Stony Brook University, New York	M.D.	1971-1976
Stony Brook University, New York	Ph.D.	1971-1976
Experimental Pathology/Cell Biology		
Beth Israel Hospital, Boston, MA		1976-1978
Resident in Medicine		
University of California, San Francisco		1978-1980
Pulmonary Fellow		

ACADEMIC APPOINTMENTS

Harvard Medical School		1976-1978
Clinical Fellow in Medicine		
Cardiovascular Research Institute, U.C.S.F.		1978-1980
Research Fellow		
Laboratory of Radiobiology, U.C.S.F.		1980-1981
Research Associate		
University of California, San Francisco		1980-1981
Instructor in Residence		
Department of Medicine		
University of Colorado, School of Medicine		1981-1987
Assistant Professor of Medicine		
University of Colorado, School of Medicine and National Jewish Health		1996-2003
Clinical Professor of Medicine		
National Jewish Health		2003-Present

Professor of Medicine

CLINICAL APPOINTMENTS

Medical Resident, Beth Israel Hospital	1976-1978
Pulmonary Fellow, U.C., San Francisco	1978-1980
Staff Physician, U.C., San Francisco	1980-1981
Senior Staff Physician, National Jewish Health	1981-1987
Consulting Physician, National Jewish Health	1987-1996
Staff Physician, Swedish Medical Center	1986-2000
Staff Physician, Porter Memorial Hospital	1986-2000
Staff Physician, Craig Hospital	1987-2000
Staff Physician, Littleton Hospital	1989-2000
Staff Physician, Vencor Hospital	1990-1995
Medical Director of Intensive Care Unit Littleton Hospital	1989-1994
Medical Director of Cardiopulmonary Department Littleton Hospital	1990-1994
Medical Director of Cardiopulmonary Department Porter Memorial Hospital	1992-1994
Director of Continuing Medical Education Porter Memorial Hospital	1992-1994
Medical Executive Committee Porter Memorial Hospital	1992-1994
Lung Transplant Committee University of Colorado Medical Center	1992-1996
Director, Alpha ₁ -Antitrypsin Deficiency Program National Jewish Health	1996-Present
Co-director, Center for Genetic Lung Disease University of Colorado Health Science Center	2000-2003

INDUSTRY, NOT-FOR-PROFIT, AND COMMITTEE APPOINTMENTS

Senior Associate Director of Clinical Development Cortech, Inc.	1994-1995
Director of Clinical Development and Drug Safety Cortech, Inc.	1995-1996
Director/Vice President, Medical Affairs NeXstar Pharmaceuticals	1996-1999
Director, Clinical Research Gilead Sciences	1999-2000
Medical/Clinical Director Alpha-1 Foundation AlphaNet Canada	2000-Present
Executive Vice President and Medical Director AlphaNet, Inc.	2000-Present
Co-chairman, IRB	2012-2016
Member, IRB National Jewish Health	2016-Present

SOCIETIES

American College of Chest Physicians, Fellow
American Thoracic Society, member

BOARD CERTIFICATION

Diplomate, American Board of Internal Medicine 1979
Subspecialty certification, Pulmonary Disease 1980
Subspecialty certification, Critical Care Medicine (not renewed) 1987 & 1998

HONORS, FELLOWSHIPS, AND TRAINING GRANTS

Alpha Omega Alpha, Medical Honor Society
Haverford College: Founders Club; Chairman, Honor Council
Investigator, Arthritis Foundation, New York Chapter 1971-1973
Medical Scientist Fellowship 1973-1976
National Institutes of Health
American College of Pathology-Sheard Sanford- 1975
Bausch & Lomb Award for meritorious research
Fellowship, American Thoracic Society/
American Lung Association 1978-1980
Clinical Investigator Award Grant 1980-1985
NHLBI, National Institutes of Health

ADVISORY/BOARD POSITIONS

Medical Advisory Board 1991-1994
NMC Homecare
Board of Directors, Alpha-1 Association 1992-1997
Board of Directors, Alpha-1 Foundation 1995-2000
Board of Directors, AlphaNet 1997-Present
Medical and Scientific Advisory Committee, COPD Foundation 2004-Present
Board of Directors, Osteogenesis Imperfecta Foundation 2005-2011
Board of Directors, Association for the Accreditation of Human
Research Protection Programs 2008-2011
Board of Directors, Global Implementation Solutions 2009-Present
Medical Advisory Committee, Osteogenesis Imperfecta Foundation 2011-Present
Board of Directors, The Alpha-1 Project 2012-Present

TEACHING EXPERIENCE

Special topic lectures, General Pathology, 1975-1976
School of Medicine, SUNY at Stony Brook
Clinical instruction of Harvard medical students 1976-1978
Clinical instruction of UCSF medical students and residents 1978-1980

Attending Physician, Respiratory Intensive Care Unit, San Francisco General Hospital	1980
Attending Physician, Family Medicine Residency Program Swedish Medical Center	1994
Attending Physician; National Jewish, Denver Health, and University Hospitals, Denver, CO	1981-1987 & 1996-2000

INVITED LECTURES

Numerous talks at scientific meetings and invited lecturer throughout the country on topics including Alpha₁-Antitrypsin Deficiency; Management of the Patient Requiring Intensive Care; Interpretation of Pulmonary Function Testing, Arterial Blood Gases and Oximetry; Performance of Clinical Trials; Alpha-1 and COPD disease management; and Medical Computing.

PUBLICATIONS

1. Rosenberg R, **Sandhaus R**, and Janoff A: Further studies of human alveolar macrophage alanine-p-nitrophenyl esterase. *Am Rev Respir Dis* **106**:114-115 (1972).
2. Janoff A, **Sandhaus RA**, Hospelhorn VD, Rosenberg R: Digestion of lung proteins by human leukocyte granules in vitro. *Proc Soc Exper Bio Med* **140**:516-519 (1972).
3. **Sandhaus RA**, Janoff A: Degradation of human alpha 1-antitrypsin by hepatocyte acid cathepsins: possible role in clinical alpha 1-antitrypsin deficiency. *Am Rev Respir Dis* **110**:263-272 (1974).
4. Janoff A, Sloan B, Weinbaum G, Damiano V, **Sandhaus RA**, Elias J, Kimbel P: Experimental emphysema induced with purified human neutrophil elastase: tissue localization of the instilled protease. *Am Rev Respir Dis* **115**:461-478 (1977).
5. Werb Z, Banda MJ, McKerrow JH, Sandhaus RA: Elastases and elastin degradation. *J Invest Derm* **79**:154-159s (1982).
6. **Sandhaus RA**, Janoff A: Elastase-induced emphysema: retention of instilled protease in the rat. *Am Rev Respir Dis* **126**:914-920 (1982).
7. **Sandhaus RA**, MacCarthy K, Musson R, Henson P: Elastolytic proteinases of the human macrophage. *Chest* **83s**:60-62 (1983).
8. Downey GP, **Sandhaus RA**, Irvin CG: From wheezes to lymphocytes via the esophageal balloon. *Respir Care* **30**:52-55 (1985).
9. **Sandhaus RA**: Modems and the M.D. The microcomputer as a communications tool. *Chest* **87**:4-5 (1985).
10. **Sandhaus RA**: Genetic basis of chronic obstructive pulmonary disease. *Seminars in Respiratory Medicine* **7**:353-357 (1986).
11. Smedley LA, Tonnesen MG, **Sandhaus RA**, Haslett C, Guthrie LA, Johnston RB, Jr, Henson PM, Worthen GS: Neutrophil-mediated injury to endothelial cells. Enhancement by endotoxin and essential role of neutrophil elastase. *J Clin Invest* **77**:1233-1243 (1986).
12. Sugahara K, Cott GR, Parsons PE, Mason RJ, **Sandhaus RA**, Henson PM: Epithelial permeability produced by phagocytosing neutrophils in vitro. *Am Rev Respir Dis* **133**:875-881 (1986).
13. **Sandhaus RA**: Elastase may play a central role in the migration of neutrophils through connective tissue, in: Second International Symposium on Pulmonary Emphysema and Proteolysis, Charles Mittman (ed.). Academic Press, New York (1986).

14. Beard BR, Cheronis JC, **Sandhaus RA**, Berger EM, White CW, Repine JE: O₂ metabolites and neutrophil elastase synergistically cause edematous injury in isolated rat lungs. *J Appl Physiol* **61**:2224-2229 (1986).
15. Fittschen C, **Sandhaus RA**, Worthen GS, Henson PM: Bacterial lipopolysaccharide enhances chemoattractant-induced elastase secretion by human neutrophils. *J Leukoc Biol* **43**:547-556 (1988).
16. **Sandhaus RA**: The New England Journal of Medicine: CD Product Review. CD-ROM World **8**:74-76 (1993).
17. Survival and FEV₁ decline in individuals with severe deficiency of alpha₁-antitrypsin. The Alpha-1-Antitrypsin Deficiency Registry Study Group, *Am J Respir Crit Care Med* **158**:49-59 (1998).
18. Mayer AS, Stoller JK, Bucher Bartelson B, Ruttenber AJ, **Sandhaus RA**, Newman LS: Occupational exposure risks in individuals with PI*Z alpha₁-antitrypsin deficiency. *Am J Respir Crit Care Med* **162**:553-588 (2000).
19. **Sandhaus RA**: Alpha₁-antitrypsin deficiency therapy: pieces of the puzzle. *Chest* **119**:676-678 (2001).
20. Stoller JK, Fallat R, Schluchter MD, O'Brien RG, Connor JT, Gross N, O'Neil K, **Sandhaus RA**, Crystal RG: Augmentation therapy with alpha₁-antitrypsin: patterns of use and adverse events. *Chest* **123**:1425-34 (2003).
21. Sharp RR, de Serres F, Newman L, **Sandhaus RA**, Walsh JW, Hood E, Harry GJ: Environmental, occupational, and genetic risk factors for α -1 antitrypsin deficiency. *Environ Health Perspect* **114**:1749-1752 (2003).
22. **Sandhaus RA**: α 1-Antitrypsin deficiency -- 6: New and emerging treatments for α 1-antitrypsin deficiency. *Thorax* **59**:904-909 (2004).
23. Campos M, Wanner A, **Sandhaus RA**: Trends in the Diagnosis of Symptomatic Patients with Alpha-1 Antitrypsin Deficiency between 1968 and 2003. *Chest* **128**:1179-1186 (2005).
24. Stoller JK, **Sandhaus RA**, Turino G, Dickson R, Rodgers K, Strange C: Delay in diagnosis of α ₁-antitrypsin deficiency: a continuing problem. *Chest* **128**:1189-1194 (2005).
25. Mayer AS, Stoller JK, Vedal S, Ruttenber AJ, Strand M, **Sandhaus RA**, Newman LS: Risk factors for symptom onset in PI*Z alpha-1 antitrypsin deficiency. *Int J Chron Obstruct Pulmon Dis* **1**:485-492 (2006).
26. Strange C, Stoller JK, **Sandhaus RA**, Dickson R, Turino G: Results of a survey of patients with alpha-1 antitrypsin deficiency. *Respiration* **73**:185-190 (2006).

27. Stocks JM, Brantly M, Pollock D, Barker A, Kueppers F, Strange C, Donohue JF, **Sandhaus R**: Multi-center study: The biochemical efficacy, safety and tolerability of a new α_1 -proteinase inhibitor, Zemaira. *J COPD* **3**:17-23 (2006).
28. **Sandhaus RA**: Alpha-1 antitrypsin deficiency: doing the right thing (or start kissing those frogs). *J COPD* **3**:123-124 (2006).
29. DeMeo DL, **Sandhaus RA**, Barker AF, Brantly ML, Eden E, McElvaney NG, Rennard S, Burchard E, Stocks JM, Stoller JK, Strange C, Turino GM, Campbell EJ, Silverman EK: Determinants of airflow obstruction in severe alpha-1 antitrypsin deficiency. *Thorax* **62**:806-813 (2007).
30. DeMeo DL, Campbell E., Barker AF, Brantly ML, Eden E, McElvaney NG, Rennard S, **Sandhaus RA**, Stocks JM, Stoller JK, Strange C, Turino GM, Silverman EK: IL10 polymorphisms are associated with airflow obstruction in severe alpha1-antitrypsin deficiency. *Am J Respir Cell Mol Biol* **38**:114-20 (2008).
31. Campos MA, Alazemi S, Zhang G, **Sandhaus RA**, Wanner A: Influenza vaccination in subjects with α_1 -antitrypsin deficiency. *Chest* **133**:49-55 (2008).
32. **Sandhaus RA**, Turino G, Stocks J, Strange C, Trapnell BC, Silverman EK, Everett SE, Stoller JK: Alpha-1 antitrypsin augmentation therapy for PI*MZ heterozygotes: a cautionary note. *Chest* **134**:831-834 (2008).
33. Demeo DL, Campbell EJ, Brantly ML, Barker AF, Eden E, McElvaney NG, Rennard SI, Stocks JM, Stoller JK, Strange C, Turino G, **Sandhaus RA**, Silverman EK: Heritability of lung function in severe alpha-1 antitrypsin deficiency. *Hum Hered* **67**:38-45 (2009).
34. Campos MA, Alazemi S, Zhang G, Wanner A, **Sandhaus RA**: Effects of a disease management program in individuals with alpha-1 antitrypsin deficiency. *J COPD*, **6**:31-40 (2009).
35. Campos MA, Alazemi S, Zhang G, Salathe M, Wanner A, **Sandhaus RA**, Baier H: Clinical characteristics of subjects with symptoms of α_1 -antitrypsin deficiency older than 60 years. *Chest*, **135**:600-608 (2009).
36. Campos MA, Alazemi S, Zhang G, Wanner A, Salathe M, Baier H, **Sandhaus RA**: Exacerbations in subjects with alpha-1 antitrypsin deficiency receiving augmentation therapy. *Respir Med* **103**:1532-1539 (2009).
37. Silverman EK, **Sandhaus RA**: Clinical practice. Alpha1-antitrypsin deficiency. *N Engl J Med*, **360**:2749-2757 (2009).
38. Castaldi PJ, Demeo DL, Kent DM, Campbell EJ, Barker AF, Brantly ML, Eden E, McElvaney NG, Rennard SI, Stocks JM Stoller JK, Strange C, Turino G, **Sandhaus RA**, Griffith JL, Silverman EK: Development of Predictive Models for Airflow Obstruction in Alpha-1-Antitrypsin Deficiency. *Am J Epidemiol*. **170**:1005-1013 (2009).

39. **Sandhaus RA**: Augmentation therapy in alpha-1 antitrypsin deficiency. *COPD* **6**:147-148 (2009).
40. Yamashiro T, Matsuoka S, Estepar RS, Diaz A, Newell JD, **Sandhaus RA**, Mergo PJ, Brantly ML, Murayama S, Reilly JJ, Hatabu H, Silverman EK, Washko GR: Quantitative airway assessment on computed tomography in patients with alpha1-antitrypsin deficiency. *COPD* **6**:468-477 (2009).
41. Nagabhushanam V, Harbeck RJ, **Sandhaus RA**: Alpha-1 Antitrypsin Deficiency: Which Test? When? *Clinical Chemistry* **50**:15-29 (2010).
42. **Sandhaus RA**: Alpha-1 antitrypsin deficiency: whom to test, whom to treat? *Semin Respir Crit Care Med* **31**:343-347 (2010).
43. Stocks JM, Brantly ML, Wang-Smith L, Campos MA, Chapman KR, Kueppers F, **Sandhaus RA**, Strange C, Turino G: Pharmacokinetic comparability of Prolastin-C to Prolastin in alpha-antitrypsin deficiency: a randomized study. *BMC Clin Pharmacol* **10**:13 (2010).
44. Flotte TR, Trapnell BC, Humphries M, Carey B, Calcedo R, Rouhani F, Campbell-Thompson M, Yachnis AT, **Sandhaus RA**, McElvaney NG, Mueller C, Messina LM, Wilson JM, Brantly M, Knop DR, Ye GJ, Chulay JD: Phase 2 clinical trial of a recombinant adeno-associated virus vector expressing alpha-1 antitrypsin: interim results. *Human Gene Ther* **22**:1239-1247 (2011).
45. **Sandhaus RA**: Gene therapy meets stem cells. *N Engl J Med* **366**:567-569 (2012).
46. Kim WJ, Wood AM, Barker AF, Brantly ML, Campbell EJ, Eden E, McElvaney G, Rennard SI, **Sandhaus RA**, Stocks JM, Stoller JK, Strange C, Turino G, Silverman EK, Stockley RA, DeMeo DL: Association of *IREB2* and *CHRNA3* polymorphisms with airflow obstruction in severe alpha-1 antitrypsin deficiency. *Respir Res* **13**:16 (2012).
47. Barr RG, Berkowitz EA, Bigazzi F, Bode F, Bon J, Bowler RP, Chiles C, Crapo JD, Criner GJ, Curtis JL, Dass C, Dirksen A, Dransfield MT, Edula G, Eriksson L, Friedlander A, Galperin-Aizenberg M, Geftter WB, Gierada DS, Grenier PA, Goldin J, Han MK, Hanania NA, Hansel NN, Jacobson FL, Kauczor HU, Kinnula VL, Lipson DA, Lynch DA, MacNee W, Make BJ, Marmay AJ, Mann H, Marchetti N, Mascalchi M, McLennan G, Murphy JR, Naidich D, Nath H, Newell JD Jr, Pistolesi M, Regan EA, Reilly JJ, **Sandhaus R**, Schroeder JD, Sciruba F, Shaker S, Sharafkhaneh A, Silverman EK, Steiner RM, Strange C, Sverzellati N, Tashjian JH, van Beek EJ, Washington L, Washko GR, Westney G, Wood SA, Woodruff PG: A combined pulmonary-radiology workshop for visual evaluation of COPD: study design, chest CT findings and concordance with quantitative evaluation. *COPD* **9**:151-159 (2012).
48. Rahaghi FF, **Sandhaus RA**, Strange C, Hogarth DK, Eden E, Stocks JM, Krowka MJ, Stoller JK: The prevalence of alpha-1 antitrypsin deficiency among patients found to have airflow obstruction. *COPD* **9**:352-358 (2012).
49. Siedlinski M, Klanderman B, **Sandhaus RA**, Barker AF, Brantly ML, Eden E, McElvaney NG, Rennard SI, Stocks JM, Stoller JK, Strange C, Turino GM, Campbell EJ, Demeo DL:

- Association of cigarette smoking and CRP levels with DNA methylation in alpha-1 antitrypsin deficiency. *Epigenetics* **7**:720-728 (2012).
50. Hoth KF, Ford DW, **Sandhaus RA**, Strange C, Wamboldt FS, Holm KE: Alcohol use predicts ER visits in individuals with alpha-1 antitrypsin deficiency (AATD) associated COPD. *COPD* **9**:417-425 (2012).
 51. Hoth KF, Wamboldt FS, Strand M, Ford DS, **Sandhaus RA**, Strange C, Bekelman D, Holm KE: Prospective impact of illness uncertainty on outcomes in chronic lung disease. *Health Psychol* **32**:1170-1174 (2013)
 52. Mueller C, Chulay JD, Trapnell BC, Humphries M, Carey B, **Sandhaus RA**, McElvaney NG, Messina L, Tang Q, Rouhani FN, Campbell-Thompson M, Fu AD, Yachnis A, Knop DR, Ye GJ, Brantly M, Calcedo R, Somanathan S, Richman LP, Vonderheide RH, Hulme MA, Brusko TM, Wilson JM, Flotte TR: Human Treg responses allow sustained recombinant adeno-associated virus-mediated transgene expression. *J Clin Invest* **123**: 5310-5318 (2013).
 53. Holm KE, Wamboldt FS, Ford DW, **Sandhaus RA**, Strand M, Strange C, Hoth KF: The prospective association of perceived criticism with dyspnea in chronic lung disease. *J Psychosom Res* **74**:450-453 (2013).
 54. Holm KE, Borson S, **Sandhaus RA**, Ford DW, Strange C, Bowler RP, Make BJ, Wamboldt FS: Differences in Adjustment between Individuals with Alpha-1 Antitrypsin Deficiency (AATD)-Associated COPD and Non-AATD COPD. *COPD* **10**:226-234 (2013).
 55. **Sandhaus RA**, Turino G: Neutrophil elastase-mediated lung disease. *COPD* **10s**:60-63 (2013).
 56. **Sandhaus RA**, Stoller JK: Introduction to the 50th anniversary of the description of alpha-1 antitrypsin deficiency. *COPD* **10s**:1-2 (2013).
 57. **Sandhaus RA**, Stocks J, Rouhani FN, Brantly M, Strauss P: Biochemical Efficacy and Safety of a New, Ready-to-Use, Liquid Alpha-1-Proteinase Inhibitor, GLASSIA (Alpha-Proteinase Inhibitor (Human), Intravenous). *COPD* **11**:17-25 (2014).
 58. Holm KE, Plaufcan MR, Ford DW, **Sandhaus RA**, Strand M, Strange C, Wamboldt FS: The impact of age on outcomes in chronic obstructive pulmonary disease differs by relationship status. *J Behav Med* **37**:654-663 (2014).
 59. Tan L, Dickens JA, Demeo DL, Miranda E, Perez J, Rashid ST, Day J, Ordonez A, Marciniak SJ, Haq I, Barker AF, Campbell EJ, Eden E, McElvaney NG, Rennard SI, **Sandhaus RA**, Stocks JM, Stoller JK, Strange C, Turino G, Rouhani FN, Brantly M, Lomas DA: Circulating polymers in alpha-1-antitrypsin deficiency." *Eur Respir J* **43**:1501-1504 (2014).
 60. Hoth KF, Wamboldt FS, Ford DW, **Sandhaus RA**, Strange C, Bekelman DB, Holm, KE: The social environment and illness uncertainty in chronic obstructive pulmonary disease. *Int J Behav Med* **22**:223-232 (2015).

61. Chapman KR, Burdon JG, Piitulainen E, **Sandhaus RA**, Seersholm N, Stocks JM, Stoel BC, Huang L, Yao Z, Edelman JM, McElvaney NG, and RTS Group: Intravenous augmentation treatment and lung density in severe alpha-1 antitrypsin deficiency (RAPID): a randomised, double-blind, placebo-controlled trial. *Lancet* **386**:360-368 (2015).
62. Strange C, Senior RM, Sciruba F, O'Neal S, Morris A, Wisniewski SR, Bowler R, Hochheiser HS, Becich MJ, Zhang Y, Leader JK, Methe BA, Kaminski N, **Sandhaus RA**, and GRADS Study Group: Rationale and design of the Genomic Research in Alpha-1 Antitrypsin Deficiency and Sarcoidosis study: Alpha-1 protocol. *Ann Am Thorac Soc* **12**:1551-1560 (2015).
63. **Sandhaus R**, Knebel AR: Might your respiratory patient have alpha-1 antitrypsin deficiency? *Heart Lung* **44**:463-464 (2015).
64. Wanner A, Groft SC, Teagarden JR, Krischer J, Davis BR, Coffey CS, Hickam DH, Teckman J, Nelson DR, McCaleb ML, Loomba R, Strange C, **Sandhaus RA**, Brantly M, Edelman JM, Farrugia A: Clinical trial design for alpha-1 antitrypsin deficiency: a model for rare diseases. *Chronic Obstr Pulm Dis.* **2**:177-190 (2015).
65. Holm KE, Casaburi R, Cerreta S, Gussin HA, Husbands J, Porszasz J, Prieto-Centurion V, **Sandhaus RA**, Sullivan JL, Walsh LJ, Krishnan JA: Patient involvement in the design of a patient-centered clinical trial to promote adherence to supplemental oxygen therapy in COPD. *Patient* **9**:271-279 (2016).
66. **Sandhaus RA**, Turino G, Brantly ML, Campos M, Cross CE, Goodman K, Hogarth DK, Knight SL, Stocks JM, Stoller JK, Strange C, Teckman J: Clinical Practice Guidelines: The diagnosis and management of alpha-1 antitrypsin deficiency in the adult. *Chronic Obstr Pulm Dis.* **3**:668-682 (2016).
67. **Sandhaus RA**: Randomized, Placebo-Controlled Trials in Alpha-1 Antitrypsin Deficiency. *Ann Am Thorac Soc* **13 Suppl 4**:S370-373 (2016).
68. Shuren M, Lin YY, Cantor JO, Chapman KR, **Sandhaus RA**, Fries M, Edelman JM, McElvaney MG, Turino GM: The effect of alpha-1 proteinase inhibitor on biomarkers of elastin degradation in alpha-1 antitrypsin deficiency: an analysis of the RAPID/RAPID extension trials. *Chronic Obstr Pulm Dis.* **4**:34-44 (2017).
69. Perkins JT, Choate R, Mannino DM, Browning SR, **Sandhaus RA**: Benefits among patients with alpha-1 antitrypsin deficiency enrolled in a disease management and prevention program. *Chronic Obstr Pulm Dis.* **4**:56-64 (2016).
70. Foreman MG, Wilson C, DeMeo DL, Hersh CP, Beaty TH, Cho MH, Ziniti J, Curran-Everett D, Criner G, Hokanson JE, Brantly M, Rouhani FN, **Sandhaus RA**, Crapo JD, Silverman EK; COPDGene Investigators: Alpha-1 antitrypsin Pi MZ genotype is associated with COPD in two racial groups. *Ann Am Thorac Soc* **14**:1280-1287 (2017); Epub 2017/04/16. doi: 10.1513/AnnalsATS.201611-838OC. PubMed PMID: 28380308; PubMed Central PMCID: PMC5566271.
71. Tortorici MA, Rogers JA, Vit O, Bexon M, **Sandhaus RA**, Burdon J, Chorostowska-

- Wynimko J, Thompson P, Stocks J, McElvaney NG, Chapman KR, Edelman JM: Quantitative disease progression model of alpha-1 proteinase inhibitor therapy on CT lung density in patients with alpha-1 antitrypsin deficiency. *Br J Clin Pharmacol.* (2017); Epub 2017/07/01. doi: 10.1111/bcp.13358. PubMed PMID: 28662542; PubMed Central PMCID: PMC5651313.
72. Beiko T, Janech MG, Alekseyenko AV, Atkinson C, Coxson HO, Barth JL, Stephenson SE, Wilson CL, Schnapp LM, Barker A, Brantly M, **Sandhaus RA**, Silverman EK, Stoller JK, Trapnell B, Strange C, for QUANTUM-1 Investigators: Serum proteins associated with emphysema progression in severe alpha-1 antitrypsin deficiency. *Chronic Obstr Pulm Dis.* **4**:204-216 (2017); Epub 2017/08/30. doi: 10.15326/jcopdf.4.3.2016.0180. PubMed PMID: 28848932; PubMed Central PMCID: PMC5556912.
73. Barker AF, Campos MA, Brantly ML, Stocks JM, **Sandhaus RA**, Lee D, Steinmann K, Lin J, Sorrells S: Bioequivalence of a Liquid Formulation of Alpha1-Proteinase Inhibitor Compared with Prolastin(R)-C (Lyophilized Alpha1-PI) in Alpha1-Antitrypsin Deficiency. *COPD.* **14**:590-596 (2017). Epub 2017/10/07. doi: 10.1080/15412555.2017.1376044. PubMed PMID: 28985109.
74. Holm KE, Mannino DM, Choate R, **Sandhaus RA**. Genotype is associated with smoking and other key health behaviors among individuals with alpha-1 antitrypsin deficiency-associated lung disease. *Respir Med.* 2018;**143**:48-55. Epub 2018/09/29. doi: 10.1016/j.rmed.2018.08.016. PubMed PMID: 30261992.
75. Tam A, Chen S, Schauer E, Grafe I, Bandi V, Shapiro JR, Steiner RD, Smith PA, Bober MB, Hart T, Cuthbertson D, Krischer J, Mullins M, Byers PH, **Sandhaus RA**, et al. A multicenter study to evaluate pulmonary function in osteogenesis imperfecta. *Clin Genet.* **94**:502-511 (2018). doi: 10.1111/cge.13440. PubMed PMID: 30152014.
76. Serban KA, Mikosz A, Strange C, Janciauskiene SM, Stolk J, Jonigk D, **Sandhaus RA**, Petrache I. Lectin Complement Pathway in Emphysema. *Am J Respir Crit Care Med.* 2018. Epub 2018/12/18. doi: 10.1164/rccm.201807-1380LE. PubMed PMID: 30557515.

DISSERTATION

Sandhaus RA: Retention, localization, and fate of endotracheally administered protease in an animal model of pulmonary emphysema, Dissertation presented for the degree of Doctor of Philosophy, Department of Pathology, SUNY at Stony Brook, New York (1976).

CHAPTERS

1. Janoff A, Blondin J, **Sandhaus RA**, Mosser A, and Malemud C: Human neutrophil elastase: in vitro effects on natural substrates suggest important physiological and pathological actions, in: Proteases and Biological Control, Reich E, Rifkin D, and Shaw E (eds), Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY (1975) pp 603-620.
2. **Sandhaus RA**: Newer agents, in: Drugs for the Respiratory System, Cherniack RM (ed), Grune & Stratton, Inc., Orlando, FL (1986) pp 227-236.
3. **Sandhaus RA**: Alpha₁-proteinase inhibitor deficiency, in: Current Therapy of Respiratory Disease -2, Cherniack RM (ed), B.C. Decker, Inc, Philadelphia, PA (1986) pp 125-126.
4. **Sandhaus RA**: Pulmonary medicine, in: Essentials of Internal Medicine in Clinical Podiatry, W.B. Saunders, Philadelphia, PA (1990).
5. **Sandhaus RA**: Alpha₁-Antitrypsin Augmentation Therapy, in: Proteases, Protease Inhibitors and Protease-Derived Peptides, Cheronis JC and Repine JE (eds), Birkhauser Verlag, Basel, Switzerland (1993) pp 97-102.
6. Fielding RM, Mukwaya G, **Sandhaus RA**: Clinical and preclinical studies with low-clearance liposomal amikacin (MiKasome®), in: Long-Circulating Liposomes: Old Drugs, New Therapeutics, Woodle MD and Storm G (eds), Landes Bioscience, Austin, TX (1998) pp 213-225.
7. **Sandhaus RA**: α₁-Antitrypsin Deficiency, in Pediatric Respiratory Medicine (Second Edition), Taussig LM and Landau LI (eds), Mosby Elsevier, Philadelphia, PA (2008) pp 1015-1024.
8. **Sandhaus RA**: Pulmonary Function in Osteogenesis Imperfecta, in Osteogenesis Imperfecta: A Translational Approach to Brittle Bone Disease, Shapiro J (editor), Academic Press/Elsevier, (2013) pp 335-342.
9. **Sandhaus RA**: Lung Disease in Alpha-1 Antitrypsin Deficiency, in Alpha-1 Antitrypsin: Role in Health and Disease, Wanner A and Sandhaus RA eds., Respiratory Medicine, Springer International Publishing AG, Switzerland (2016).

BOOKS

1. Alpha-1 Disease Management and Prevention Program: The Big Fat Reference Guide to Alpha-1; Senior Editor and primary author: **Robert A. Sandhaus**. Multiple contributing authors. AlphaNet Press (2004).

2. Alpha-1 Antitrypsin: Role in Health and Disease; Adam Wanner and **Robert A. Sandhaus** eds., Respiratory Medicine, Springer International Publishing AG, Switzerland (2016).