13). Camner, et al. (*BP 8*) reported on clearance rates in 17 young and middle-aged ex-smokers who had stopped smoking for 3 months. These workers noted that mucociliary clearance of 6 μm. fluorinated ethylene propylene (Teflon 120) particles tagged with Tc^{99m} measured at 2 hours post-inhalation had improved at 3 months post-quitting in 11 of 17 patients. Mean retention of particles was significantly higher prior to stopping smoking than at 3 months ($P < .05$), and also was higher at 1 week post-cessation compared to 3 months post-cessation ($P = .005$). In this study, the volume of inhaled aerosol was not controlled. In addition, coughing after inhalation of the particles was reported to be conspicuously absent or rare, whereas in the Thomson study (*BP 67*), the effect of coughing during the study was not discussed.

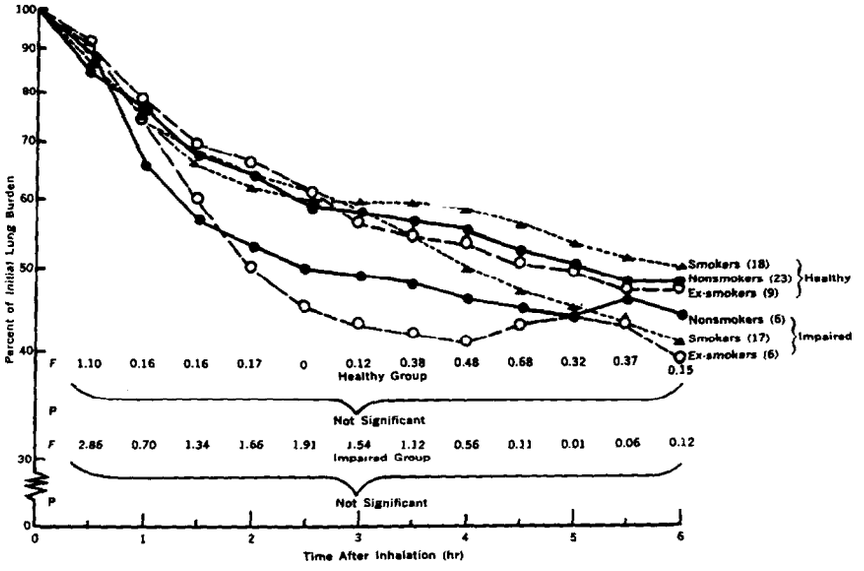

FIGURE 13.—Mean clearance curves for smokers, ex-smokers, and nonsmokers in the healthy group and the group with respiratory impairment. F=Snedecor's F; the values required for significance at the 5 percent level are 3.19 for the healthy group and 3.35 for the impaired group.

SOURCE: Thomson, M. L., Pavia, D. (*BP 67*).

The question of whether the short-term effect of cigarette smoking on enhancing mucociliary transport is specific to cigarette smoke, or is due to a nonspecific reaction of the tracheobronchial tree, was investigated by Camner, et al. (*BP 7*) who found that inhalation of inert carbon particles by 8 normal subjects (including 2 smokers) resulted in similar or enhanced

pulmonary clearance rates compared to the control states. These results suggest that the increased mucociliary transport effected by short-term exposure to cigarette smoke may be a nonspecific reaction.

Westergaard and Olsen (*BP 68*) studied ciliary activity in biopsy specimens from the larynx and carina in 20 patients and found that there was no ciliary activity in epithelial cells from these sites in the entire group of 16 moderate and heavy smokers, while in 3 nonsmokers and 1 cigar smoker normal ciliary activity was observed.

Studies in Animals

Binns and Clark (*BP 1*) described a new experimental model for testing the short- and long-term effects of cigarette smoke on pulmonary physiology. By using male cynomolgus monkeys which were fitted with a specially designed smoking device, these authors demonstrated marked increases in total pulmonary resistance in animals smoking approximately 12 cigarettes per day, for 5 days per week. These changes stabilized at about 20 weeks of exposure and extended through the 6-month test period. The changes in pulmonary resistance were statistically significant ($P < .001$). After 6 months, no changes in tidal volume, respiratory rate, or dynamic compliance were noted. Histologic sections of lungs from smoking monkeys showed clumping of pulmonary alveolar macrophages containing pigmented granules and foamy cytoplasm. These nonspecific cytologic changes have been observed in other animals exposed to cigarette smoke.

Previous editions of this report (1972, 1973) have described experimental evidence concerning the production of emphysematous changes in rat and guinea pig lungs by exposure to nitrogen dioxide (NO_2), one of the gaseous components of cigarette smoke. Freeman, et al. (*BP 18*) described experiments whereby low (10 to 15 p.p.m.), intermittent doses of NO_2 administered over the normal life span of rats resulted in more severe changes of the pulmonary parenchyma than those previously reported; these changes included fibroblastic proliferation, epithelial hypertrophy, loss of cilia in the respiratory bronchioles, fibrosis of alveolar ducts, destruction of alveolar walls, and enlargement of alveolar air spaces. These authors calculated a 29 percent loss of ventilatory surface in the NO_2-exposed rats, occurring in a panlobular distribution. The lungs of the NO_2-exposed rats had greater residual volumes than the controls, and these rats suffered from hypoxemia, hypercarbia, and acidosis, as well as a compensatory polycythemia. Thus, by administering lower doses of NO_2 intermittently, survival of these rats was prolonged (compared with survival of rats receiving continuous NO_2), and the

development of a full-blown picture of emphysema similar to that seen in humans was produced. The relative role of NO_2 in the causation of emphysema in humans is still unknown.

In another series of experiments, Giordano and Morrow (*BP 21*) studied mucociliary clearance rates in female rats exposed continuously to low doses of NO_2 (6 p.p.m.) over a period of 6 weeks. They found a significantly decreased rate of clearance in rats exposed to NO_2 than in nonexposed rats ($P < .02$). In those animals with a decrease in mucociliary activity, the effect of NO_2 was reversible within 7 days following this long-term low dose exposure.

Goldstein, et al. (*BP 22*) reported on the effects of low level NO_2 exposure on bactericidal activity of the mouse lung. They first infected mice with radioactively labelled Staphylococcus aureus and then exposed them to different concentrations of NO_2 for 4 hours. The authors then measured pulmonary radioactivity and bacterial concentrations. They found that at concentrations of 7, 9.2, and 14.8 p.p.m. NO_2 the level of radioactivity was unchanged, but bacterial counts were greater in the NO_2-exposed mice ($P < .05$), and they concluded that the bactericidal activity of the NO_2-exposed animals was significantly less than that of control animals at these concentrations of NO_2. In a series of experiments where mice were first exposed to 1.0, 2.3, and 6.6 p.p.m. NO_2 for 17 hours and then infected with the labelled Staphylococcus aureus, pulmonary bactericidal activity was decreased in the mice exposed to the latter two concentrations of NO_2 ($P < .05$ and $P < .01$). In both sets of experiments, the physical removal rates of bacteria by the pulmonary tree (as measured by the degree of remaining radioactive label) was not influenced by NO_2. These experiments suggest that the retardation of pulmonary bactericidal activity was due to dysfunction of the cellular elements of the pulmonary defense mechanism (i.e., pulmonary alveolar macrophages [PAMs]) in the NO_2-exposed mice.

Fenters, et al. (*BP 15*) exposed four monkeys to low dose NO_2 (1 p.p.m.) for 16 months and infected these animals with influenza virus. Three control monkeys were exposed to the virus, but not to the NO_2. The NO_2-exposed animals had higher hemagglutination-inhibition and serum neutralizing antibody responses against the virus than the nonexposed animals. Pathologic examination of the lungs of these animals demonstrated slight to moderate emphysema in the NO_2-exposed and virus-infected monkeys, along with thickening of the bronchial and bronchiolar epithelium, and no such changes in those animals only infected with virus.

Dalhamn (*BP 18*) conducted experiments on 40 live rats, exposing them to cigarette smoke of different chemical compositions. The cigarette smoke was analyzed for "tar", nicotine, pH, acrolein, nitrogen oxides (NO), acetaldehyde, hydrogen cyanide (HCN), and carbon monoxide (CO). The author found an inverse correlation between the number of puffs required to produce ciliostasis of the tracheobronchial tree and the amount of acrolein, HCN, CO, "tar", and nicotine found in the cigarette smoke. The data appeared to indicate that the majority of the effect was caused by the "tar" and acrolein content of the cigarette smoke.

Gairola and Aleem (*BP 19*) studied the effect of the water soluble and insoluble fractions of tobacco smoke on rat liver mitochondrial function. These investigators found that both fractions were effective in inducing a decline in energy production by the mitochondria, but to differing degrees, thereby suggesting some difference in their mechanisms of action on mitochondria.

Snider, et al. (*BP 59*) exposed rats to 0.1 percent cadmium chloride solution by aerosol, and were able to demonstrate centrilobular emphysema in these animals after 10 days. Since cadmium has been found in cigarette smoke, and smokers and patients with emphysema have been shown to have elevated tissue levels of cadmium at postmortem, further studies defining the role of cadmium in the development of pulmonary emphysema in man would be useful. In Snider's experimental protocol, animals exposed to 1 percent of $CdCl_2$ developed a severe hemorrhagic necrotizing chemical pneumonia, and the lower dose of $CdCl_2$ also elicited a hemorrhagic response, although no evidence of such an inflammatory response was evident 10 days post-exposure.

CYTOLOGIC AND HISTOLOGIC STUDIES

Experimental evidence indicates that cigarette smoke can impair the function of pulmonary alveolar macrophages (*BP 53*). Pulmonary macrophages appear to be the primary defense against bacterial invasion of the pulmonary parenchyma and also serve to remove particulate contaminants from inspired air. In recent experimental work, Powell and Green (*BP 53*) investigated the mechanism of action of cigarette smoke on macrophage function. By using histochemical staining techniques, these workers found that the filtered gas phase of cigarette smoke (FGP) inhibited aldehyde dehydrogenase activity in rabbit pul-

monary alveolar macrophages (PAMs). This effect of FGP was inhibited by prior addition of cysteine to the medium. The loss of enzyme activity correlated with the loss of macrophage phagocytic function (which was also prevented by the prior addition of cysteine). No other enzyme was inhibited by cigarette smoke (except for G6PD in those preparations of cells which adhered to glass). By using crystalline glyceraldehyde 3-phosphate dehydrogenase, the authors demonstrated that FGP inhibited activity of this enzyme, and the degree of inhibition was directly related to the period of incubation (most of the inhibition occurring within the first five minutes). This enzyme was not inhibited by FGP in the presence of cysteine. When enzyme activity was assayed in cell preparations, glyceraldehyde 3-phosphate dehydrogenase activity was reduced by FGP. This inhibition was dose-related to FGP. FGP did not influence G6PD or LDH activity in the pulmonary alveolar macrophages. These experiments suggest that FGP inhibited the glycolytic pathway within the pulmonary alveolar macrophages concurrent with the impairment of phagocytic activity of these cells. The authors postulated that FGP may act as a sulfhydryl agent (thereby explaining the protective effect of cysteine) in the disruption of the activity of glyceraldehyde 3-phosphate dehydrogenase.

York, et al. (*BP 72*) showed that incubation of sheep pulmonary macrophages with tobacco extract resulted in an initial stimulation, then inhibition of macrophage oxygen consumption. When cigarette smoke extract was incubated with the macrophages, a continuous decrease in oxygen consumption was observed, proportional to the incubation period and concentration of smoke extract (figure 14). The enzymatic mechanism of the inhibition of macrophage respiration was not examined in these experiments.

Invertase placed in a medium of calf's serum results in enhanced pinocytosis by sucrose-laden mouse peritoneal macrophages (monocytes). Schwartz, et al. (*BP 56*), utilizing this test system, reported that nicotine inhibited invertase-induced pinocytosis by sucrose-laden mouse peritoneal monocytes by 29 and 18 percent, depending on the concentration of nicotine added to the medium. The contribution of this type of pinocytosis to the bactericidal activity of these monocytes is unclear at present.

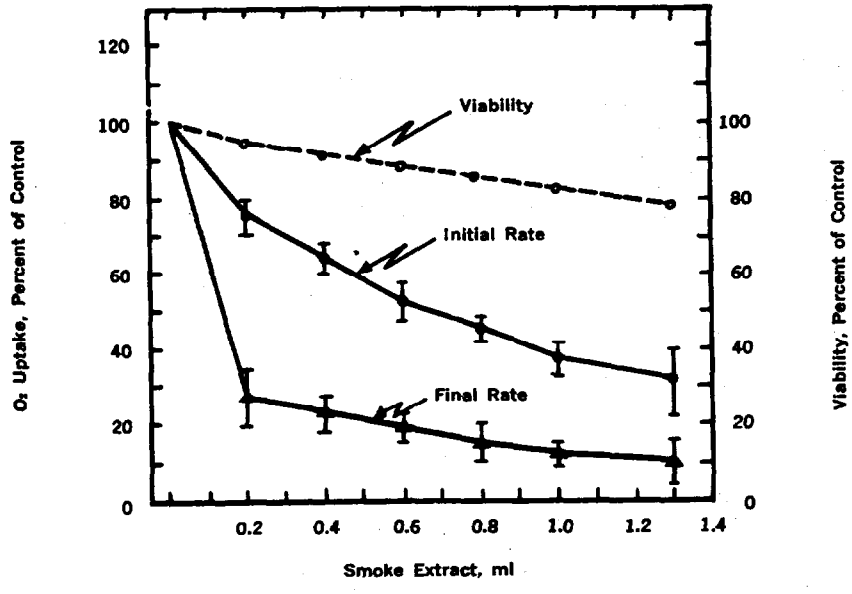

FIGURE 14.—Effects of aqueous cigarette smoke extract on initial oxygen uptake, final oxygen uptake, and cell viability of pulmonary macrophages.

SOURCE: York, G. K., et al. (*BP 72*).

SUMMARY OF RECENT NON-NEOPLASTIC BRONCHOPULMONARY FINDINGS

1. Results from epidemiologic studies on elderly populations demonstrate an increased prevalence of respiratory symptoms and impairment of pulmonary function among smokers of both sexes compared to nonsmokers.
2. Data from several recent studies indicate that standard pulmonary function tests and physical work capacity are impaired in apparently healthy smokers compared to nonsmokers.
3. Recent epidemiologic data suggest that smokers who retain their cigarettes in their mouths continuously while smoking ("droopers") have a higher prevalence of chronic bronchitis than those smokers who remove the cigarette from their mouths between puffs.
4. A recent epidemiologic study confirms the observation that cigarette smoke and air pollution act synergistically in the development of symptoms of respiratory disease.
5. Results from several recent studies indicate that cigarette smokers have a higher prevalence of functional abnormalities of the small airways than do nonsmokers.

6. Results from a recent study suggest that although a history of lower respiratory disease as an infant is related to the prevalence of cough at age 20, cigarette smoking is a far more important factor in the development of cough in young adulthood.
7. Data from a major retrospective study indicate that cigarette smoking is related to the development of bullous disease of the lung.
8. Experimental studies in animals have shown that exposure to nitrogen dioxide, a constituent of the vapor phase of cigarette smoke, results in emphysema-like changes in the pulmonary parenchyma, diminished mucociliary clearance, and impairment of bactericidal activity of alveolar macrophages.
9. Data from experimental studies have demonstrated that the filtered gas phase of tobacco smoke may effect changes in pulmonary alveolar macrophage metabolism through inhibition of the glycolytic pathway; cigarette smoke may also impair oxygen consumption and pinocytic activity of pulmonary alveolar macrophages.

BRONCHOPULMONARY DISEASE REFERENCES

1. BINNS, R., CLARK, G. C. An experimental model for the assessment of the effects of cigarette smoke inhalation on pulmonary physiology. Annals of Occupational Hygiene 15(2–4): 237–247, November 1972.
2. BROOKS, A. G. F., WALLER, R. E. Peak flow measurements among visitors to a public health exhibition. Thorax 27(5): 557–562, September 1972.
3. BUIST, A. S., ROSS, B. B. Closing volume as a simple, sensitive test for the detection of peripheral airway disease. Chest 63(4, Supplement): 29S–30S, April 1973.
4. BUIST, A. S., ROSS, B. B. Predicted values for closing volumes using a modified single breath nitrogen test. American Review of Respiratory Disease 107(5): 744–752, May 1973.
5. BUIST, A. S., VAN FLEET, D. L., ROSS, B. B. A comparison of conventional spirometric tests and the test of closing volume in an emphysema screening center. American Review of Respiratory Disease 107(5): 735–743, May 1973.
6. CAIRD, F. I., AKHTAR, A. J. Chronic respiratory disease in the elderly. Thorax 27(6): 764–768, November 1972.
7. CAMNER, P., HELSTRÖM, P.-Å., PHILIPSON, K. Carbon dust and mucociliary transport. Archives of Environmental Health 26(6): 294–296, June 1973.
8. CAMNER, P., PHILIPSON, K., ARVIDSSON, T. Withdrawal of cigarette smoking. A study on tracheobronchial clearance. Archives of Environmental Health 26(2): 90–92, February 1973.

9. CHEW, P. K., CHIA, M., CHEW, S. F., SUPRAMANIAM, J. M. J., CHAN, W., CHEW, C. H., NG, Y. K., GANDEVIA, B. Asbestos workers in Singapore. A clinical, functional, and radiological survey. Archives of Environmental Health 26(6): 290–293, June 1973.

10. CLARK, T. J. H. Assessment of airway closure using the closing volume method. Proceedings of the Royal Society of Medicine 64(12): 1245–1246, December 1971.

11. COLEMAN, A. E., BURFORD, C. L., KREUZER, P. Aerobic capacity of relatively sedentary males. Journal of Occupational Medicine 15(8): 628–632, August 1973.

12. COLLEY, J. R. T., DOUGLAS, J. W. B., REID, D. D. Respiratory disease in young adults: Influence of early childhood lower respiratory tract illness, social class, air pollution, and smoking. British Medical Journal 3(5873): 195–198, July 28, 1973.

13. DALHAMN, T. Some factors influencing the respiratory toxicity of cigarette smoke. Journal of the National Cancer Institute 48(6): 1821–1824, June 1972.

14. DA SILVA, A. M. T., HAMOSH, P. Effect of smoking a single cigarette on the "small airways". Journal of Applied Physiology 34(3): 361–365, March 1973.

15. FENTERS, J. D., FINDLAY, J. C., PORT, C. D., EHRLICH, R., COFFIN, D. L. Chronic exposure to nitrogen dioxide. Immunologic physiologic, and pathologic effects in virus-challenged squirrel monkeys. Archives of Environmental Health 27(2): 85–89, August 1973.

16. FOX, A. J., TOMBLESON, J. B. L., WATT, A., WILKIE, A. G. A survey of respiratory disease in cotton operatives. Part II. Symptoms, dust estimations, and the effect of smoking habit. British Journal of Industrial Medicine 30(1): 48–53, January 1973.

17. FRANK, S. T., WEG, J. G., HARKLEROAD, L. E., FITCH, R. F. Pulmonary dysfunction in rheumatoid disease. Chest 63(1): 27–34, January 1973.

18. FREEMAN, G., CRANE, S. C., FURIOSI, N. J., STEPHENS, R. J., EVANS, M. J., MOORE, W. D. Covert reduction in ventilatory surface in rats during prolonged exposure to subacute nitrogen dioxide. American Review of Respiratory Disease 106(4): 563–579, October 1972.

19. GAIROLA, C., ALEEM, M. I. H. Cigarette smoke: Effect of aqueous and nonaqueous fractions on mitochondrial function. Nature 241(5387): 287–288, January 26, 1973.

20. GELB, A. F., ZAMEL, N. Simplified diagnosis of small-airway obstruction. New England Journal of Medicine 288(8): 395–398, February 22, 1973.

21. GIORDANO, A. M., MORROW, P. E. Chronic low-level nitrogen dioxide exposure and mucociliary clearance. Archives of Environmental Health 25(6): 443–449, December 1972.

22. GOLDSTEIN, E., EAGLE, M. C., HOEPRICH, P. D. Effect of nitrogen dioxide on pulmonary bacterial defense mechanisms. Archives of Environmental Health 26(4): 202–204, April 1973.

23. GREEN, M., TRAVIS, D. M. A simplified closing-volume method suitable for field use. Lancet 2(7783): 905–906, October 28, 1972.

24. GRIMES, C. A., HANES, B. Influence of cigarette smoking on the spirometric evaluation of employees of a large insurance company. American Review of Respiratory Disease 108(2): 273–282, August 1973.

25. HEIDENAL, G.-K., FONTANA, R. S., TAUXE, W. N. Radioactive xenon pulmonary studies in the smoker. Cancer 30(5): 1358–1367, November 1972.

26. HIGGINS, M. W., KELLER, J. B. Seven measures of ventilatory lung function. Population values and a comparison of their ability to discriminate between persons with and without chronic respiratory symptoms and disease, Tecumseh, Michigan. American Review of Respiratory Disease 108(2): 258–272, August 1973.

27. HUTCHINSON, D. C. S., BARTER, C. E., COOK, P. J. L., LAWS, J. W., MARTELLI, N. A., HUGH-JONES, P. Severe pulmonary emphysema. A comparison of patients with and without α_1-antitrypsin deficiency. Quarterly Journal of Medicine 41(163): 301–315, July 1972.

28. INGRAM, R. H., JR., SCHILDER, D. P. Association of a decrease in dynamic compliance with a change in gas distribution. Journal of Applied Physiology 23(6): 911–916, December 1967.

29. KALACIC, I. Chronic nonspecific lung disease in cement workers. Archives of Environmental Health 26(2): 78–83, February 1973.

30. KALACIC, I. Ventilatory lung function in cement workers. Archives of Environmental Health 26(2): 84–85, February 1973.

31. KASS, I., O'BRIEN, L. E., ZAMEL, N., DYKSTERHUIS, J. E. Lack of correlation between clinical background and pulmonary function tests in patients with chronic obstructive pulmonary diseases. A retrospective study of 140 cases. American Review of Respiratory Disease 107(1): 64–69, January 1973.

32. KILBURN, K. H., MERCHANT, J., LUMSDEN, J., HAMILTON, J. Chronic bronchitis in cotton textile workers. Evidence for addition of effect of cigarette smoking and occupational exposure. IN: Brzezinski, Z., Kopczynski, J., Sawicki, F. (Editors.) Ecology of Chronic Nonspecific Respiratory Diseases. International Symposium, Warsaw, Poland, September 7–8, 1971. Warsaw, Panstwowy Zaklad Sydawnictw Lekarskich, 1972. pp 76–82.

33. KRUMHOLZ, R. A., HEDRICK, E. C. Pulmonary function differences in normal smoking and nonsmoking, middle-aged, white-collar workers. American Review of Respiratory Disease 107(2): 225–230, February 1973.

34. LANCET. Closing volume. Lancet 2(7783): 908–910, October 28, 1972.

35. LASZLO, G., ARCHER, G. G., DARRELL, J. H., DAWSON, J. M., FLETCHER, C. M. The diagnosis and prophylaxis of pulmonary complications of surgical operation. British Journal of Surgery 60(2): 129–134, February 1973.

36. LEBLANC, P., RUFF, F., MILIC-EMILI, J. Effects of age and body position on "airway closure" in man. Journal of Applied Physiology 28: 448–451, 1970.

37. LEPINE, C., MYRE, M. L. L'emphyseme pulmonaire. Confrontations cliniques et physiopathologiques, avec une reference speciale a l'usage de la cigarette. (Pulmonary emphysema. Clinical and physiopathological comparisons with a special reference to cigarette usage.) Medecine d'Afrique Noire 17(3): 261–267, March 1970.

38. LINN, W. S., HACKNEY, J. D. Nitrogen and helium "closing volumes" simultaneous measurement and reproducibility. Journal of Applied Physiology 34(3): 396–399, March 1973.

39. McCarthy, D. S., Craig, D. B. Why the difference in closing volume? (Letter). Lancet 2(7790): 1321, December 16, 1972.

40. McCarthy, D. S., Spencer, R., Greene, R., Milic-Emili, J. Measurement of "closing volume" as a simple and sensitive test for early detection of small airway disease. American Journal of Medicine 52(6): 747–753, June 1972.

41. Macklem, P. T. Obstruction in small airways—a challenge to medicine. American Journal of Medicine 52(6): 721–724, June 1972.

42. Macklem, P. T., Mead, J. Resistance of central and peripheral airways measured by a retrograde catheter. Journal of Applied Physiology 22(3): 395–401, 1967.

43. Macklem, P. T., Proctor, D. F., Hogg, J. C. The stability of peripheral airways. Respiration Physiology 8: 191–203, 1970.

44. Matsuba, K., Thurbeck, W. M. Disease of the small airways in chronic bronchitis. American Review of Respiratory Disease 107(4): 552–558, April 1973.

45. Milne, J. S., Williamson, J. The relationship of respiratory function tests to respiratory symptoms and smoking in older people. Respiration 29(3): 206–213, 1972.

46. Milne, J. S., Williamson, J. Respiratory symptoms and smoking habits in older people with age and sex differences. Respiration 29(4): 359–370, 1972.

47. Mittman, C. Chronic obstructive lung disease: The result of the interaction of genetic and environmental factors. Heart and Lung 2(2): 222–226, March–April 1973.

48. Mittman, C., Barbela, T., Lieberman, J. Alpha$_1$-antitrypsin deficiency as an indicator of susceptibility to pulmonary disease. Journal of Occupational Medicine 15(1): 33–38, January 1973.

49. Mittman, C., Barbela, T., Lieberman, J. Antitrypsin deficiency and abnormal protease inhibitor phenotypes. Archives of Environmental Health 27(3): 201–206, September 1973.

50. Olziihutag, A., Dondog, H., Badamtseden, B., Chagnajav, L. The prevalence of chronic bronchitis under the conditions of Mongolia. Sante Publique; Revue Internationale 15(2): 201–207, 1972.

51. Osman, H. A., Wahdan, M. H., Noweir, M. H. Health problems resulting from prolonged exposure to chemical agents in rubber industry. Journal of the Egyptian Public Health Association 47(5): 290–311, 1972.

52. Paterson, N. A. M., Ahmad, D., Lefcoe, N. M. Airways narrowing in exercise in normal subjects and the effect of disodium cromoglycate. British Journal of Diseases of the Chest 67: 197–207, July 1973.

53. Powell, G. M., Green, G. M. Cigarette smoke—a proposed metabolic lesion in alveolar macrophages. Biochemical Pharmacology 21(13): 1785–1798, July 1, 1972.

54. Reintjes, M., Swierenga, J., Bogaard, J. M. Effect of smoking one cigarette on airway resistance. Scandinavian Journal of Respiratory Diseases 53(3): 129–134, 1972.

55. Rimington, J. Chronic bronchitis: Method of cigarette smoking. British Medical Journal 1(5856): 776–778, March 31, 1973.

56. SCHWARTZ, S. L., EVANS, D. E., LUNDIN, J. E., BOND, J. C. Inhibition of pinocytosis by nicotine. Journal of Pharmacology and Experimental Therapeutics 183(2): 370–377, November 1972.

57. SCOTT, K. W. M. An autopsy study of bronchial mucous gland hypertrophy in Glasgow. American Review of Respiratory Disease 107(2): 239–245, February 1973.

58. SHERMAN, J., WOLFE, S., HRICKO, A., METS, M. A Health Research Group Study on Disease Among Workers in the Auto Industry. Health Research Group, Washington, D.C. September 7, 1973. 43 pp.

59. SNIDER, G. L., HAYES, J. A., KORTHY, A. L., LEWIS, G. P. Centrilobular emphysema experimentally induced by cadmium chloride aerosol. American Review of Respiratory Disease 108(1): 40–48, July 1973.

60. SPAIN, D. M., SIEGEL, H., BRADESS, V. A. Emphysema in apparently healthy adults. Smoking, age, and sex. Journal of the American Medical Association 224(3): 322–325, April 16, 1973.

61. SPEIZER, F. E., FERRIS, B. G., JR. Exposure to automobile exhaust. I. Prevalence of respiratory symptoms and disease. Archives of Environmental Health 26(6): 313–318, June 1973.

62. SPEIZER, F. E., FERRIS, B. G., JR. Exposure to automobile exhaust. II. Pulmonary function measurements. Archives of Environmental Health 26(6): 319–324, June 1973.

63. STANESCU, D. C. Age and smoking dependency of the single-breath oxygen test in healthy subjects. Pneumonologie 147(1): 46–51, 1972.

64. STOLOFF, I. L., VICTOR, S. B. Another hazard of smoking: Bullous disease of the lung. Archives of Environmental Health 25(6): 415–419, December 1972.

65. STONE, D. J., SARKAR, T. K., KELTZ, H. Effect of adrenergic stimulation and inhibition on human airways. Journal of Applied Physiology 34(5): 624–627, May 1973.

66. SUSSKIND, H., RICHARDS, P., SKOLNICK, M., ATKINS, H. L. Detection of impaired pulmonary function with a mass-spectrographic tracer technique. 24th ACEMB, International Hotel, Las Vegas, October 31-November 4, 1971. 1 p.

67. THOMSON, M. L., PAVIA, D. Long-term tobacco smoking and mucociliary clearance. Archives of Environmental Health 26(2): 86–89, February 1973.

68. WESTERGAARD, O., OLSEN, P. Smoking and ciliary movement in the upper respiratory tract. Archiv fur Klinische und Experimentelle Ohren-Nasen- und Kehlkopfheilkunde 203(3): 179–183, 1973.

69. WOOLCOCK, A. J., COLMAN, M. H., BLACKBURN, C. R. B. Chronic lung disease in Papua New Guinea and Australian populations. Papua New Guinea Medical Journal 16(1): 29–35, March 1973.

70. WOOLCOCK, A. J., COLMAN, M. H., BLACKBURN, C. R. B. Factors affecting normal values for ventilatory lung function. American Review of Respiratory Disease 106(5): 692–709, November 1972.

71. WOOLCOCK, A. J., VINCENT, N. J., MACKLEM, P. T. Frequency dependence of compliance as a test for obstruction in the small airways. Journal of Clinical Investigation 48: 1097–1106, 1969.

72. YORK, G. K., ARTH, C., STUMBO, J. A., CROSS, C. E., MUSTAFA, M. G. Pulmonary macrophage respiration as affected by cigarette smoke and tobacco extract. Archives of Environmental Health 27(2): 96–98, August 1973.

73. ZARKOVIC, G. Etiology of non-specific chronic respiratory illness and cor pulmonale in Bosnia and Hercegovina. International Journal of Epidemiology 1(2): 167–176, 1972.

BRONCHOPULMONARY DISEASE SUPPLEMENTAL REFERENCES

Part I

(Articles which were reviewed but not discussed in the text, providing data confirming well-established relationships between smoking and bronchopulmonary disease.)

72–1082. ANDERSON, J. A., DUNNILL, M. S., RYDER, R. C. Dependence of the incidence of emphysema on smoking history, age, and sex. Thorax 27(5): 547–551, September 1972.

ANTHONISEN, N. R., DANSON, J., ROBERTSON, P. C., ROSS, W. R. D. Airway closure as a function of age. Respiration Physiology 8: 58–65, 1969–1970.

73–0048. BÉRARD, J., EMONOT, A. Enquête sur l'étiologie due pneumothorax spontané, dit idiopathique. (Survey on the etiology of so-called idiopathic spontaneous pneumothorax.) Journal de Médecine de Lyon 53: 281–284, 287–290, February 20, 1972.

73–0156. BOUDIK, F., ULRICH, J., SVEC, F., BOBAK, J., GOLDSMITH, J. R. Prevalence of respiratory symptoms in three areas of Bohemia with different air pollution. IN: Brzezinski, Z., Kopczynski, J., Sawicki, F. (Editors). Ecology of Chronic Nonspecific Respiratory Diseases, International Symposium, Warsaw, Poland, September 7–8, 1971. Warsaw, Panstowowy Zaklad Wydawnictw Lekarskich, 1972. pp. 34–42.

72–0934. BRILLE, D. Épidémiologie de la bronchite chronique données actuelles d'après les études statiques. (Epidemiology of chronic bronchitis current data according to static studies.) Evoluation Medicale 15(3–5): 287–299, 1971.

71–0611. BRILLE, D. Fréquence de la bronchite chronique chez la femme. Rôle du tabac. (Incidence of chronic bronchitis in women. The role of tobacco.) Revue de Tuberculose et de Pneumologie 33(6): 794–797, 1969.

72–1083. BRINKMAN, G. L., BLOCK, D. L. Chronic bronchitis in a working population. Journal of Occupational Medicine 14(11): 825–827, November 1972.

72–0648. BRINKMAN, G. L., BLOCK, D. L., CRESS, C. Effects of bronchitis and occupation on pulmonary ventilation over an 11-year period. Journal of Occupational Medicine 14(8): 615–620, August 1972.

72–0979. CUNNINGHAM, D. A., MONTOYE, H. J., HIGGINS, M. W., KELLER, J. B. Smoking habits, chronic bronchitis and shortness of breath and physical fitness. Medicine and Science in Sports 4(3): 138–145, 1972.

73–0465. DELOFF, L., PUDELSKI, J., OKLEK, K., ROZANOWICZ, A., SEDLACZEK, A. Obraz epidemiologiczny przewleklych nieswoistych chorob pluc u mezczyzn miasta Zabrza. Wplyw palenia papierosow i pracy zawodowej. (Epidemiological picture of chronic nonspecific pulmonary diseases in men, at Zabrze. The effect of smoking and of professional work.) Gruzlica i Choroby Pluc 40(10): 889–896, October 1972.

72–0360. ELLEFSEN, P., TOS, M. Goblet cells in the human trachea. Quantitative studies of a pathological biopsy material. Archives of Otolaryngology 95(6): 547–555, June 1972.

73–0160. FELKEL, H., KUBIK, A., FEUEREISL, R., GALLAS, I., REIL, I. Chronic bronchitis in manual workers employed in the open air and in a factory hall. IN: Brzezinski, Z., Kopczynski, J., Sawicki, F. (Editors). Ecology of Chronic Nonspecific Respiratory Diseases, International Symposium, Warsaw, Poland, September 7–8, 1971. Warsaw, Panstwowy Zaklad Wydawnictw Lekarskich, 1972. pp. 114–116.

73–0037. FERRIS, B. G., Jr., HIGGINS, I. T. T., HIGGINS, M. W., PETERS, J. M. Chronic nonspecific respiratory disease in Berlin, New Hampshire 1961 to 1967. A follow-up study. American Review of Respiratory Disease 107(1): 110–122, January 1973.

74–0069. FERRIS, B. G., Jr., RANADIVE, M. V., PETERS, J. M., MURPHY, R. L. H., BURGESS, W. A., PENDERGRASS, H. P. Prevalence of chronic respiratory disease. Asbestosis in ship repair workers. Archives of Environmental Health 23(3): 220–225, September 1971.

72–1108. FEUEREISL, R., KRZHIVANEK, I., REIL, I., KUBIK, A., FELKEL, K. Deistvie Kureniya na Serdechno-Legochnuyu Funkktsiyu. (Effect of smoking on cardiopulmonary function.) Klinicheskaya Meditsina 50(7): 82–84, 1972.

73–0296. FOX, A. J., TOMBLESON, J. B. L., WATT, A., WILKIE, A. G. A survey of respiratory disease in cotton operatives. Part I. Symptoms and ventilation test results. British Journal of Industrial Medicine 30(1): 42–47, January 1973.

73–0643. FRAPPIER-DAVIGNON, L., ST.-PIERRE, J. Étude de l'effet combiné de la pollution atmosphérique, de l'exposition professionnelle et des habitudes de tabac dans les affections pulmonaires obstructives. 2. Firme d'alimentation: exposition professionnelle nulle. (A study of the combined effects of atmospheric pollution in occupational exposure and smoking habits on obstructive pulmonary diseases. II. The food industry: No occupational exposure). L'Union Médicale du Canada 102(7): 1542–1546, July 1973.

73–0299. GOTTLIEB, L. S., BALCHUM, O. J. Course of chronic obstructive pulmonary disease following first onset of respiratory failure. Chest 63(1): 5–8, January 1973.

73–0807. GREGG, I., NUNN, A. J. Peak expiratory flow in normal subjects. British Medical Journal 3(5874): 282–284, August 4, 1973.

72–1260. HAENSZEL, W., HOUGEN, A. Prevalence of respiratory symptoms in Norway. Journal of Chronic Diseases 25(9) : 519–544, September 1972.

72–1089. HÜTTEMANN, U., OSWALD, P., LODE, H., HUCKAUF, H. Über den Einfluss langjährigen Zigarettenrauchens auf die Lungenfunktion jugendlicher Normalpersonen. (Lung function studies in young apparently healthy cigarette smokers versus non-smokers.) Respiration 29(3) : 270–287, 1972.

73–0054. HÜTTEMANN, U., SCHÜREN, K. P. Cronisch obstruktive Lungenerkrankungen: Klinische Erscheinungsformen und ihre Korrelation zur gestörten Atmungsfunktion. (Chronic obstructive lung disease: Clinical symptoms and their correlation to lung function disorders.) Klinische Wochenschrift 50(20) : 944–952, October 15, 1972.

73–0475. IMBUS, H. R., SUH, M. W. Byssinosis. A study of 10,133 textile workers. Archives of Environmental Health 26(4): 183–191, April 1973.

73–0413. IRAVANI, J. Effects of cigarette smoke on the ciliated respiratory epithelium of rats. Respiration 29(5/6) : 480–487, 1972.

72–0760. JAIN, B. L., ABRAHAM, E., KOKAN, A. R. A study of ventilatory lung functions in smokers from a tropical area. Journal of Tropical Medicine and Hygiene 75(6): 103–108, June 1972.

73–0301. JEDRYCHOWSKI, W. Badania epidemiologiczne wplywu warunkow srodowiska pracy na wystepowanie przewleklych nieswoistych chorob ukladu oddecliowego. (Epidemiological studies concerning the influence of working conditions on the incidence of chronic nonspecific respiratory diseases.) Przeglad Lekarski 29(8) : 737–743, 1972.

73–0478. KIBELSTIS, J. A. Diffusing capacity in bituminous coal miners. Chest 63(4) : 501–504, April 1973.

73–0303. KOSTREWSKI, J. Chronic non-specific lung disease in Krakow. Sante Publique; Revue Internationale 15(2) : 209–216, 1972.

73–0166. KOZAREVIC, D., ROBERTS, A., PIRC, B. Prevalence of chronic obstructive lung diseases among rural and urban populations in two different areas of Yugoslavia. IN: Brzezinki, A., Kopczynski, J., Sawicki, F. (Editors.) Ecology of Chronic Nonspecific Respiratory Diseases, International Symposium, Warsaw, Poland, September 7–8, 1971. Warsaw, Panstowowy Zaklad Wydawnictw Lekarskich, 1972. pp. 178–184.

73–0168. KUBIK, A., FEUEREISL, R., GALLAS, J., KAVAN, F., FELKEL, H., REIL, I. Air pollution and prevalence of chronic non-specific respiratory disease in males aged 16 and 18 years residing in Prague 7. IN: Brzezinski, Z., Kopczynski, J., Sawicki, F. (Editors). Ecology of Chronic Nonspecific Respiratory Diseases, International Symposium, Warsaw, Poland, September 7–8, 1971. Warsaw, Panstwowy Zaklad Wydawnictw Lekarskich, 1972. pp. 50–54.

73–0041. KUBO, R., ONO, M. Kitsuen no koto poripu ni oyobosu eikyo ni tsuite. (Influence of smoking on the development of laryngeal polyps.) Jibi to Rinsho 17(2) : 122–125, 1971.

73–0482. KUPERMAN, A. S., RIKER, J. B. The variable effect of smoking on pulmonary function. Chest 63(5): 655–660, May 1973.

73-0058. LUZ, T. P., BUSTAMANTE, H. T. DE, SZKLO, M., STROZENBERG, A. "Complexo de sintomas respiratorios" e "rinite vasomotora". Prevalencia em operarios da fabril juta de Parintins, Amazonas; (Junho de 1971). ("Respiratory symptoms complex" and "vasomotor rhinitis." Prevalence among the jute manufacturing plant workers in Parintins, Amazonas; [June 1971].) Revista Brasiliera de Medicina 29(4): 184–187, April 1972.

73-0038. MCCALLUM, R. I. Respiratory disease in foundrymen. British Journal of Industrial Medicine 29(3): 341–343, July 1972.

72-1092. MARTIN, R. R., ANTHONISEN, N. R., ZUTTER, M. Flow dependence of the intrapulmonary distribution of inspired boluses of ^{133}Xe in smokers and non-smokers. Clinical Science 43(3): 319–329, September 1972.

MARTIN, R. R., LINDSAY, D. L., DESPAS, M. D., MACKLEM, P. T., ANTHONISEN, N. R. Reversible small airway obstruction associated with cigarette smoking. Chest 63(4, Supplement): 31S, April 1973.

72-1284. MATHUR, K. C., MISRA, S. N. Incidence of pulmonary diseases among wool workers. Indian Journal of Chest Diseases 14(3): 172–178, July 1972.

73-0485. MERCHANT, J. A., LUMSDEN, J. C., KILBURN, K. H., O'FALLON, W. M., UJDA, J. R., GERMINO, V. H., Jr., HAMILTON, J. D. An industrial study of the biological effects of cotton dust and cigarette smoke exposure. Journal of Occupational Medicine 15(3): 212–221, March 1973.

73-0486. MERCHANT, J. A., LUMSDEN, J. C., KILBURN, K. H., O'FALLON, W. M., UJDA, J. R., GERMINO, V. H., Jr., HAMILTON, J. D. Dose response studies in cotton textile workers. Journal of Occupational Medicine 15(3): 222–230, March 1973.

72-0042. RISPOLI, J. A., DESOBEL, N. L., SPECTOR, C. H., TORTI, D. D., URQUIJO, C., MASSUN, A. L. Epidemiologic surveys on air pollution. IN: Englund, H. M., Beery, W. T. (Editors). Proceedings of The Second International Clean Air Congress, Washington, D. C., December 6–11, 1970. New York, Academic Press, 1971. pp. 201–209.

72-0772. ROBBINS, W. T. Bronchial epithelium in cigarette-smoking college students. Journal of the American College Health Association 20(3): 209–211, February 1972.

72-1057. SAKAKURA, Y., PROCTOR, D. F. The effect of various conditions on tracheal mucociliary transport in dogs. Proceedings of the Society for Experimental Biology and Medicine 140(3): 870–879, July 1972.

72-0775. SCHLESINGER, Z., GOLDBOURT, U., MEDALIE, J. H., RISS, E., NEUFELD, H. N., ORON, D. Pulmonary function and respiratory disease among adult male Israelis. Variations by age and birthplace. Israel Journal of Medical Sciences 8(7): 957–964, July 1972.

73-0314. SUCIU, I., PRODAN, L., ILEA, E., COCÂRLA, A., COROIU, M., OPREA, V. Factori care intervin în grabirea sau prelungirea timpului de instalare si evolutie a silicozei. (Factors promoting and hindering the time of apparition and evolution of silicosis.) Clujul Medical 45(2/3): 303–307, 1972.

73-0651. TSE, K. S., WARREN, P., JANUSZ, M., MCCARTHY, D. S., CHERNIACK, R. M. Respiratory abnormalities in workers exposed to grain dust. Archives of Environmental Health 27(2): 74–77, August 1973.

72-0222. VAN GANSE, W. F., FERRIS, B. G., Jr., COTES, J. E. Cigarette smoking and pulmonary diffusing capacity (transfer factor). American Review of Respiratory Disease 105(1): 30–41, January 1972.

73-0316. WALTON, M. Industrial ammonia gassing. British Journal of Industrial Medicine 30(1): 78–86, January 1973.

73-0503. WILSON, R. W. Cigarette smoking, disability days and respiratory conditions. Journal of Occupational Medicine 15(3): 236–240, March 1973.

72-0663. WYSOCKI, M. Testy spirometryczne TQT i FEV%—wlasciwosci i przydatnosc w rozpoznawaniu przewleklego zapalenia oskrzeli. (Spirometry tests TQT and FEV—their properties and usefulness in diagnosis of chronic bronchitis.) Gruzlica i Chorogy Pluc 40(1): 35–44, January 1972.

Part II

(Additional articles which were reviewed but not discussed in the text.)

AILSBY, R. L., GHADIALLY, F. N. Atypical cilia in human bronchial mucosa. Journal of Pathology 109(1): 75–78, January 1973.

73-0047. ALBERT, R. E., LIPPMANN, M., PETERSON, H. T., JR., BERGER, J., SANBORN, K., BOHNING, D. Bronchial deposition and clearance of aerosols. Archives of Internal Medicine 131(1): 115–127, January 1973.

72-0647. ASTIN, T. W. Reversibility of airways obstruction in chronic bronchitis. Clinical Science 42(6): 725–733, 1972.

73-0157. CARILLI, A. D., KOTZEN, L. M., FISCHER, M. J. The chest roentgenogram in smoking females. American Review of Respiratory Disease 107(1): 133–136, January 1973.

DAVIDSON, F. F., GLAZIER, J. B., MURRAY, J. F. The components of the alveolar-arterial oxygen tension difference in normal subjects and in patients with pneumonia and obstructive lung disease. American Journal of Medicine 52: 754–762, 1972.

73-0583. ESBER, H. J., MENNINGER, F. F., JR., BOGDEN, A. E., MASON, M. M. Immunological deficiency associated with cigarette smoke inhalation by mice. Primary and secondary hemagglutinin response. Archives of Environmental Health 27(2): 99–104, August 1973.

73-0128. EVANS, M. J., CABRAL, L. J., STEPHENS, R. J., FREEMAN, G. Cell division of alveolar macrophages in rat lung following exposure to NO_2. American Journal of Pathology 70(2): 199–208, February 1973.

73-0129. EVANS, M. J., CABRAL, L. J., STEPHENS, R. J., FREEMAN, G. Renewal of alveolar epithelium in the rat following exposure to NO_2. American Journal of Pathology 70(2): 175–198, February 1973.

73-0474. HIRST, R. N., JR., PERRY, H. M., JR., CRUZ, M. G., PIERCE, J. A. Elevated cadmium concentration in emphysematous lungs. American Review of Respiratory Disease 108(1): 30–39, July 1973.

72–0614. Ho, W., Benton, M., Furst, A. The clearance of benzo(a)pyrene and ferric oxide from mouse lungs. Proceedings of the Western Pharmacology Society 15: 58–60, 1972.

73–0810. Holt, P. G., Keast, D. Acute effects of cigarette smoke on murine macrophages. Archives of Environmental Health 26(6): 300–304, June 1973.

73–0254. Holt, P. G., Keast, D. Cigarette smoke inhalation: Effects on cells of the immune series in the murine lung. Life Sciences 12(8, Part 2): 377–383, April 22, 1973.

73–0411. Holt, P. G., Keast, D. The effect of tobacco smoke on protein synthesis in macrophages. Proceedings of the Society for Experimental Biology and Medicine 142(4): 1243–1247, 1973.

Ichioka, M. Model experiments on absorbability of the airway mucous membrane of SO_2 and NO_2 gases. Bulletin of the Tokyo Medical and Dental University 19: 361–375, 1972.

72–1046. Iravani, J. Flimmeraktivitat im Respirationstrakt nach chronischer Zigarettenrauchexposition. (Ciliary activity in the respiratory tract after chronic exposure to cigarette smoke.) Rehabilitation, Praventivmedizin, Physikalische Medizin, Sozialmedizin 25(1/2): 40–42, 1972.

73–0415. Jones, R., Bolduc, P., Reid, L. Goblet cell glycoprotein and tracheal gland hypertrophy in rat airways: The effect of tobacco smoke with or without the anti-inflammatory agent phenylmethyloxadiazole. British Journal of Experimental Pathology 54(2): 229–239, April 1973.

73–0476. Kanner, R. E., Klauber, M. R., Satanabe, S., Renzetti, A. D., Jr., Bigler, A. Pathologic patterns of chronic obstructive pulmonary disease in patients with normal and deficient levels of $alpha_1$-antitrypsin. American Journal of Medicine 54(6): 706–712, June 1973.

73–0346. Kosmider, S., Felus, E., Wysacki, J. Ocena niektórych h wyynuczników odpornosci humoralnej u palaczy papierosów. (Evaluation of some humoral resistance determinants in smokers.) Polski Tygodnik Lekarski 28(2): 47–50, January 8, 1973.

72–1240. Lewis, A. J., Nicholls, P. J. Effect of inhaled cigarette smoke on content, release and breakdown of histamine in guinea-pig lung. Life Sciences 11(23, Part 2): 1167–1171, December 8, 1972.

73–0646. Lewis, C. I., McGeady, J. C., Tong, H. S., Schultz, F. J., Spears, A. W. Cigarette smoke tracers: Gas chromatographic analysis of decachlorobiphenyl. American Review of Respiratory Disease 108(2): 367–370, August 1973.

72–0590. Lewis, C. I., McGeady, J. C., Wagner, J. R., Schultz, F. J., Spears, A. W. Dichlorbenzophenone as a nonradioactive tracer for cigarette smoke-gas chromatographic analysis of tracer. American Review of Respiratory Disease 106(3): 480–484, September 1972.

72–0766. McFadden, E. R., Jr., Linden, D. A. A reduction in maximum mid-expiratory flow rate. A spirographic manifestation of small airway disease. American Journal of Medicine 52(6): 725–737, June 1972.

Macklem, P. J., Despas, P. J., Leroux, M. Site of airway obstruction in asthma. Chest 63(4, Supplement): 28S, April 1973.

73–0306. MARTIN, R. R. Altered morphology and increased acid hydrolase content of pulmonary macrophages from cigarette smokers. American Review of Respiratory Disease 107(4): 596–601, April 1973.

MITCHELL, C. A., ZUSKIN, E., BOUHUYS, A. The effect of cigarette smoke and β-adrenergic antagonists on small airways. American Review of Respiratory Disease 107(6): 1098–1099, June 1973.

72–1286. OSCHERWITZ, M., EDLAVITCH, S. A., BAKER, T. R., JARBOE, T. Differences in pulmonary functions in various racial groups. American Journal of Epidemiology 96(5): 319–327, November 1972.

73–0423. PARKINSON, D. R., STEPHENS, R. J. Morphological surface changes in the terminal bronchiolar region of NO_2-exposed rat lung. Environmental Research 6(1): 37–51, March 1973.

71–1180. RYLANDER, R. Free lung cell studies in cigarette smoke inhalation experiments. Scandinavian Journal of Respiratory Diseases 52(2): 121–128, 1971.

7866. SIMONSSON, B. G. Clinical and physiological studies on chronic bronchitis. I. Clinical description of the patient material. Acta Allergologica 20(4): 257–300, 1965.

73–0313. STEBBINGS, J. H., JR. Two observed associations between respiratory allergies and hypertension in nonsmokers. American Journal of Epidemiology 97(1): 4–15, January 1973.

73–0497. STOLOFF, I. L. Bullous lung disease in short order cooks. Journal of Occupational Medicine 15(3): 202–203, March 1973.

73–0781. TASHKIN, D. P., LEVY, S. E., THOMPSON, J. H., SIMMONS, D. H., GORDON, B. M. Pulmonary effects of chronic nicotine administration in young and old Fischer-344 rats. Proceedings of the Western Pharmacological Society 16: 209–214, 1973.

73–0610. THOMAS, W., HOLT, P. G., KEAST, D. Effect of cigarette smoking on primary and secondary humoral responses of mice. Nature 243 (5404): 240–241, May 25, 1973.

THURLBECK, W. M. Small airways disease. Human pathology 4(2): 150–152, June 1973.

73–0434. VASSALLO, C. L., DOMM, B. M., POE, R. H., DUNCOMBE, M. L., GEE, J. B. L. NO_2 effects on alveolar macrophage phagocytosis and metabolism. Archives of Environmental Health 26(5): 270–274, May 1973.

73–0652. WARR, G. A., MARTIN, R. R. Response of human pulmonary macrophage to migration inhibition factor. American Review of Respiratory Disease 108(2): 371–373, August 1973.