FILE NAME: aŜNJŎ] ó a Yú

DATE: мфпо

DOC#: a Yллм

5OCUMENT DESCRIPTION: .ƶƶ] 9ÈŎŜNJLJű π aŜNJŎ] ƛy˝ [ƛăű ƶŦ /ƶyűNJƛōdzűƶNJă ώ¢KŜ tNJƛyŎƛLJfŜă ƨ tNJl·ŐűƛŐŜ ƶŦ LyŘdžăúNJƛl·f aŜŘƛŎƛyŜ

The Principles and Practice of INDUSTRIAL MEDICINE

Edited by

FRED J. WAMPLER, M.D.

Professor, Preventive and Industrial Medicine

MEDICAL COLLEGE OF VIRGINIA

CONTRIBUTORS

Otis L. Anderson
R. N. Anderson
Anna M. Baetjer
J. J. Bloomfield
J. A. Calhoun
J. M. Carlisle
George H. Cross
Donald E. Cumming
Charles F. Engel
John H. Foulger
Augustus Gibson
T. Lyle Hazlett
Albert Hemming
F. F. Heyroth
Joanna Johnson
R. T. Johnstone
Robert A. Kehoe
M. H. Kronenberg
B. E. Kuechle
Matthew Luckiesh
Willard Machle
R. W. McKee
Sarah I. Morris
Kenneth Morse
Frank K. Moss
C. M. Peterson
D. F. Robertson
F. S. Rossiter
William A. Sawyer
Louis Schwartz
Lorin A. Thompson
Fred J. Wampler
George Zur Williams

A William Wood Book

BALTIMORE

THE WILLIAMS & WILKINS COMPANY

1943

LIST OF CONTRIBUTORS

ANDERSON, OTIS L., B.Sc., M.D., F.A.C.P.
Surgeon, United States Public Health Service, Assistant Chief, Division of Venereal Diseases, National Institute of Health, Bethesda, Maryland.

ANDERSON, RICHARD N., B.A., M.A.
Director of the Division of Rehabilitation, Special and Adult Education of the Virginia State Department of Education, Richmond, Virginia.

BAETJER, ANNA M., Sc.D.
Associate in Physiological Hygiene, School of Hygiene and Public Health, The Johns Hopkins University, Baltimore, Maryland.

BLOOMFIELD, J. J.
Sanitary Engineer, United States Public Health Service, and Chief, States' Relations Section, Division of Industrial Hygiene, National Institute of Health, Bethesda, Maryland.

CALHOUN, J. A., M.D.
Medical Director, American Viscose Corporation, Wilmington, Delaware.

CARLISLE, J. M., M.D.
Medical Director, Merck and Company, Rahway, New Jersey; Professor of Industrial Medicine, Temple University School of Medicine, Philadelphia, Pennsylvania; Executive Director, Bureau of Industrial Health and Hygiene, New Jersey State Department of Health.

CROSS, GEORGE H., M.D.
Associate Professor of Ophthalmology, University of Pennsylvania, Graduate School of Medicine, Chester, Pennsylvania.

CUMMING, DONALD E., B.S.*
Associate Professor, Department of Medicine, and Director, Division of Industrial Hygiene, University of Colorado School of Medicine, Denver, Colorado.

ENGEL, CHARLES F., M.D.
Assistant Medical Director, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.

FOULGER, JOHN H., M.D., PH.D., F.A.C.P.
Medical Director, Haskell Laboratory of Industrial Toxicology, Wilmington, Delaware; Associate Professor of Industrial Medicine, Medical College of Virginia, Richmond, Virginia.

* Deceased December, 1942.

GIBSON, AUGUSTUS, M.D.
Physician, Merck and Company, Rahway, New Jersey.

HAZLETT, T. LYLE, M.D.
Medical Director, Westinghouse Electric and Manufacturing Company; Professor, Industrial Hygiene, University of Pittsburgh, Pittsburgh, Pennsylvania.

HEMMING, ALBERT, M.B., Ch.B.
Physician, Merck and Company, Rahway, New Jersey.

HEYROTH, FRANCIS F., M.D.
Assistant Professor of Research Physiology, Kettering Laboratory of Applied Physiology, College of Medicine, University of Cincinnati, Cincinnati, Ohio.

JOHNSON, JOANNA, R. N.
Supervisor, Industrial Nursing Division, Employers Mutual Liability Insurance Company, Milwaukee, Wisconsin.

JOHNSTONE, RUTHERFORD T., A.B., M.D.
Director of the Department of Occupational Diseases, Golden State Hospital, Los Angeles, California; Formerly Assistant Professor of Medicine, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania.

KEHOE, ROBERT A., M.D.
Research Professor of Physiology, Director, Kettering Laboratory of Applied Physiology, College of Medicine, University of Cincinnati, Cincinnati, Ohio.

KRONENBERG, MILTON H., M.D.
Chief, Division of Industrial Hygiene, and Industrial Medical Supervisor, Department of Public Health, State of Illinois; Assistant Professor of Bacteriology and Public Health, University of Illinois Chicago, Illinois.

KUECHLE, B. E., A.B.
Vice-President and Claims Manager, Employers Mutual Liability Insurance Company, Wausau, Wisconsin.

LUCKIESH, MATTHEW, D.Sc., D.E.
Director, Lighting Research Laboratory, General Electric Company, Nela Park, Cleveland, Ohio.

MACHLE, WILLARD, M.D.
Associate Professor of Research Physiology, Associate Director, Kettering Laboratory of Applied Physiology, College of Medicine, University of Cincinnati, Cincinnati, Ohio.

McKEE, R. W., PH.D.
Instructor in Industrial Hygiene, School of Public Health, Harvard University, Boston, Massachusetts.

MORRIS, SARAH I., M.D., F.A.C.P.
Professor of Preventive Medic
sylvania, Philadelphia, Penn

MORSE, KENNETH, M.S.
Industrial Engineer, Division
Department of Public Heal

MOSS, FRANK K., E.E.
Physicist, Lighting Research I
Nela Park, Cleveland, Ohio

PETERSON, C. M., M.D.
Secretary, Council on Industr
tion, Chicago, Illinois.

ROBERTSON, D. F., M.D.
Associate Medical Director,
Jersey.

ROSSITER, FRANK S., M.D.
Medical Director, Carnegie
Pennsylvania.

SAWYER, WILLIAM A., M.D.
Medical Director, Eastman K

SCHWARTZ, LOUIS, M.D.
Medical Director, United St
Dermatoses Investigations
National Institute of Healt

THOMPSON, LORIN A., PH.D.
Director, Population Study,
mond, Virginia.

WAMPLER, FRED J., M.A., M.D.,
Professor, Preventive and I
Out-Patient Clinic, Medica
Southern Biscuit Company

WILLIAMS, GEORGE ZUR, M.D.
Associate Professor of Patho
mond, Virginia; Member o

)any, Rahway, New Jersey.

ouse Electric and Manufacturing Com-
Hygiene, University of Pittsburgh, Pitts-

)any, Rahway, New Jersey.

rch Physiology, Kettering Laboratory of
ge of Medicine, University of Cincinnati,

ng Division, Employers Mutual Liability
aukee, Wisconsin.
B., M.D.
of Occupational Diseases, Golden State
'alifornia; Formerly Assistant Professor
f Pittsburgh School of Medicine, Pitts-

ology, Director, Kettering Laboratory of
ge of Medicine, University of Cincinnati,

Hygiene, and Industrial Medical Super-
blic Health, State of Illinois; Assistant
and Public Health, University of Illinois

Manager, Employers Mutual Liability
ısau, Wisconsin.
E.
Laboratory, General Electric Company,
io.

rch Physiology, Associate Director, Ket-
plied Physiology, College of Medicine,
Cincinnati, Ohio.

iene, School of Public Health, Harvard
chusetts.

MORRIS, SARAH I., M.D., F.A.C.P.
Professor of Preventive Medicine, Womans Medical College of Pennsylvania, Philadelphia, Pennsylvania.

MORSE, KENNETH, M.S.
Industrial Engineer, Division of Industrial Hygiene, Illinois State Department of Public Health, Chicago, Illinois.

MOSS, FRANK K., E.E.
Physicist, Lighting Research Laboratory, General Electric Company, Nela Park, Cleveland, Ohio.

PETERSON, C. M., M.D.
Secretary, Council on Industrial Health, American Medical Association, Chicago, Illinois.

ROBERTSON, D. F., M.D.
Associate Medical Director, Merck and Company, Rahway, New Jersey.

ROSSITER, FRANK S., M.D.
Medical Director, Carnegie-Illinois Steel Company, Pittsburgh, Pennsylvania.

SAWYER, WILLIAM A., M.D.
Medical Director, Eastman Kodak Company, Rochester, New York.

SCHWARTZ, LOUIS, M.D.
Medical Director, United States Public Health Service, and Chief, Dermatoses Investigations Section, Division of Industrial Hygiene, National Institute of Health, Bethesda, Maryland.

THOMPSON, LORIN A., PH.D.
Director, Population Study, Virginia State Planning Board, Richmond, Virginia.

WAMPLER, FRED J., M.A., M.D., M.P.H.
Professor, Preventive and Industrial Medicine, and Administrator, Out-Patient Clinic, Medical College of Virginia; Health Consultant, Southern Biscuit Company, Richmond, Virginia.

WILLIAMS, GEORGE ZUR, M.D.
Associate Professor of Pathology, Medical College of Virginia, Richmond, Virginia; Member of Armed Forces, Lt. Com. U.S.N.M.C.R.

CONTENTS

I. Notes on History 1
Fred J. Wampler, M.D.

II. Methods Employed in the Appraisal and Control of Industrial Health Hazards 7
J. J. Bloomfield

III. Industrial Accidents: Their Cause and Prevention 23
Donald E. Cumming, B.S.

IV. Medical Services in Industry and the Industrial Physician 35
Fred J. Wampler, M.D.

V. The Lay-Out of the Medical Department 43
Fred J. Wampler, M.D.

VI. Governmental Agencies in Industrial Hygiene 48
J. J. Bloomfield

VII. Industrial Health Program of the American Medical Association 65
C. M. Peterson, M.D.

VIII. The Effects of Temperature and Humidity on Industrial Workers 69
Anna M. Baetjer, Sc.D.

IX. The Effects of Abnormal Atmospheric Pressures 91
Anna M. Baetjer, Sc.D.

X. Light, Lighting and Seeing 101
Matthew Luckeish, M.D., and Frank K. Moss, E.E.

XI. Fatigue 133
Lorin A. Thompson, Ph.D.

XII. The Physical Examination 144
Fred J. Wampler, M.D.

XIII. Medical Control of Industrial Exposure to Toxic Chemicals 150
John H. Foulger, M.D.

XIV. Survey of Substances which Cause Occupational Poisoning 180
Willard Machle, M.D., and Francis F. Heyroth, M.D.

XV. Industrial Lead Exposure and Lead Poisoning 202
Robert A. Kehoe, M.D.

XVI. Carbon Disulfide 241
Ralph W. McKee, Ph.D., and J. A. Calhoun, M.D.

XVII. The Toxicity of Certain Organic Solvents in Industry 256
J. M. Carlisle, M.D.

XVIII. Carbon Monoxide Poisoning 269
Frank S. Rossiter, M.D.

XIX. Some of the Poisonous Gases 278
Frank S. Rossiter, M.D.

XX. Electricity 288
Charles F. Engel, M.D.

XXI. Occupational Diseases of the Skin 296
Louis Schwartz, M.D.

XXII. Pneumoconiosis (Dust Diseases of the Lung) 345
George Zur Williams, M.D.

XXIII. Occupation and Tuberculosis 375
Sarah I. Morris, M.D.

XXIV. Venereal Disease Control in Industry 394
Otis L. Anderson, M.D.

XXV. What Industry Can Do to Improve Nutrition 409
William A. Sawyer, M.D.

XXVI. Eyes in Industry: Care and Prevention of Injury 421
George H. Cross, M.D.

XXVII. Traumatic Shock and Burns 435
J. M. Carlisle, M.D., Augustus Gibson, M.D., Albert Hemming, M.B., Ch.B., and D. F. Robertson, M.D.

XXVIII. The Industrial Back 458
Rutherford T. Johnstone, M.D.

XXIX. The Nurse in Industry 483
Joanna Johnson, R.N.

XXX. Compensation 498
B. E. Kuechle, A.B.

XXXI. Vocational and Industrial Rehabilitation 507
Richard N. Anderson, M.A.

XXXII. Industrial Medical Service for the Smaller Plant 518
Fred J. Wampler, M.D.

XXXIII. Women in Industry 523
Milton H. Kronenberg, M.D., and Kenneth Morse, M.S.

C

NOTES

Fred J.

Industrial medicine is largely
forty-three years—the machine a
from before the Christian era.
the development of our knowle
lined in this chapter.

In the early days labor was p
approach to our modern indus
slaves would become proficient i
would then contract for this pa
known to have been done in this
could easily have followed this

Hippocrates (about 460–370]
have been hookworm; those suf
great intestinal disturbances an
up until modern times made the
disease.

Other diseases described by H
gists, fullers, tailors, horsemen, f
the metal worker as being pale
tended, hard abdomen, large sp

Pliny the Elder (23–79) descr
consisted of a bladder tied ove
sonous dusts and vapors. Pliny
cabbage and bitter almonds as a
He described poisoning with zi

Galen (131–201), the founder
erences to occupational diseases.
of Cyprus and was nearly overco
men who carried out a vitriolic
avoid death in the midst of th
scholars are exposed to a hazard
were forced to use. Other occu
cerned runners, farmers, wrestle
who used their voices excessivel

VII. OTHER PNEUMOCONIOSES

There is considerable disagreement in the medical literature concerning the exact etiology of certain types of pulmonary fibrosis due to dust inhalation other than silica dust. Asbestosis, siderosis, and anthracosis are the most important of these fibroses.

Asbestosis

It has been well proven that a peculiar type of linear pulmonary fibrosis is caused by minute asbestos fibers inhaled by workers in industries utilizing asbestos for the manufacture of fire resisting material, insulation, certain fabrics and ropes, paints, roofing, tile, etc., as well as the manufacture of asbestos itself.

Asbestos is magnesium silicate and is the only silicate which has experimentally been proven to produce a pulmonary fibrosis without exposure to silica.

The onset and clinical course of asbestosis is similar to that of slowly progressing silicosis and the symptoms in the later stages are identical. Fatal termination is usually by complicating pneumonitis, cardio-vascular decompensation, or tuberculosis. The roentgenopathology is typical and not difficult to differentiate from silicosis. Gloyne and Merewether state that the roentgenological appearances of asbestosis are revealed typically as a general lack of translucency with a fine pinhead mottling. This is the characteristic "ground glass" appearance. The film should always be compared with a film of a normal patient and a film of a silicotic patient taken with the same exposure.

The diagnosis depends upon a definite history of exposure to asbestos dust including sufficient period of exposure, roentgenological appearance, decreased pulmonary capacity, and the finding of asbestos bodies in the sputum of patients not yet removed from exposure to the dust. These asbestos bodies are well described and usually illustrated in most text books of clinical pathology. The pathology may be summarized in the single statement that it consists of a persistent, progressive, diffuse perialveolar fibrosis of the lungs. The fibers may be seen on histological examination to lie embedded in the fibrous walls of alveoli and bronchioli and each fiber appears to be encrusted by an iron-containing yellow pigment. As would be expected, in the later stages the fibrosis becomes confluent and massive.

Siderosis

Siderosis is chiefly a red pigmentation of the lung tissue due to inhalation of iron-containing dust frequently found in hematite miners. Experimentally, fibrosis has not been produced by pure iron or iron oxide dust

and only when mixed with hazard
fibrosis result. Therefore, unless th
siderosis by itself is asymptomatic
clinical findings.

Anth

Black pigmentation of the lungs
types of carbon particles is comm
industrial cities. Most marked bl
There is some controversy concerni
carbon dust of itself can produce a
clusive experimental evidence that
It is the author's opinion that all in
are due to an admixture of silica dus
fibrosis due to respiratory disease
produces no clinical findings or disal

REFE

American Public Health Association: Re
coniosis and the Committee on Stan
tional Diseases, Year Book, 1933, p.
Belt, T. H., Irwin, D., and King, E. J
persons without occupational exposu
J., **34** (2): 125–133, 1936.
Burke, H. E.: The detection of mineral
Hyg., **17**: 27, 1935.
Cole, L. G., and Cole, W. G.: Dyspne
113: 1216, 1939.
Cummins, S. L.: The augmentation of ac
tubercle bacilli. Brit. J. Exp. Path
Drinker, P., and Hatch, T.: Industrial
Ellman, P.: Pulmonary asbestosis: its
tures, and associated risk of tubercu
Gardner, L. U.: Pathology of so-called
1240, 1933.
Gardner, L. U.: The pathology and ro
coniosis. J. A. M. A., **114**: 535–545,
Gardner, L. U.: Recent developments i
Feb. 1940.
Gardner, L. U.: Studies on experimenta
of healing primary tubercles in the lu
carborundum dusts. Am. Rev. of Tu
Gloyne, S. R., and Merewether, E. R.
Hatch, T., and Thompson, E. W.: A rapi
quantitation for routine plant opera
International Labour Office: Pneum
reports, series F (Ind. Hyg.), No. 15.