FUNCTIONAL ANATOMY AND HISTOLOGY OF THE LUNG

By

CHUZO NAGAISHI, M.D.
Emeritus Professor of Kyoto University

With the Collaboration of

NAOYUKI NAGASAWA, M.D. MASAYUKI YAMASHITA, M.D
YOSHIO OKADA, M.D. NOBUO INABA, M.D.

from the Department of Thoracic Surgery,
Chest Disease Research Institute, Kyoto University

UNIVERSITY PARK PRESS
Baltimore and London

Library of Congress Cataloging in Publication Data

Nagaishi, Chuzo, 1907–
Functional anatomy and histology of the lung.

Bibliography: p.
1. Lungs. 2. Anatomy, Surgical and topographical. I. Nagasawa, Naoyuki. II. Title. [DNLM: 1. Lung—Anatomy and history. 2. Lung—Pathology. WF600 N147f 1972]
QM261.N34 611'.24 72–1241
ISBN 0–8391–0580–0

Printed and Bound in Japan

To my respected teachers

Late Emeritus Professor TEIJI HOSHINO, M.D.

Emeritus Professor YASUMASA AOYAGI, M.D.

and

To my wife FUMIKO NAGAISHI

for her patience and devotion

FOREWORD

It is a great pleasure for me to learn that the publication of "Functional Anatomy and Histology of the Lung" is now being realized. This accomplishment represents a major landmark in the career of Professor CHUZO NAGAISHI.

As Professor NAGAISHI says in his preface, the important characteristic of his book lies in the point that this study of the structure of the lung has been carried out by an author who is preeminently a specialist in thoracic surgery; the book was developed and written taking into consideration various important clinical problems. Accordingly, there naturally is an understandable difference as compared with books written by professional anatomists; in this point, the volume assumes a unique position.

The well-known anatomist TIEDEMANN once said "Ärzte ohne Anatomie gleichen Maulwürfen; sie arbeiten im Dunklen und ihrer Hände Tagewerk sind Erdhügel" (Doctors who do not know anatomy are like moles; they work in the darkness only to make a heap of earth). His words are severe, but eternally meaningful. Supposedly, this saying by TIEDEMANN refers not only to anatomy but includes also the relationships of basic and clinical sciences in the broader sense; it is certainly true that a firm foundation in the basic sciences is the key to excellence in the clinical sciences and the practice of medicine.

In this regard, Professor NAGAISHI has had an excellent viewpoint; he has always insisted on the importance and necessity of the closest relationship between the clinical and basic sciences; more to the point, he himself is an exemplar of this attitude.

This book is the fruit of scholarly research carried out by Professor NAGAISHI and his associates during his many years as a very active and dedicated clinician. As I read this book, I am strongly impressed by his considerate and integrated attitude, and by his never-failing scholarly enthusiasm. Noteworthy in this book is the description of individual items, and without loss of an integrated attitude toward the entire subject. In recent years, research has tended to be analytic; this book contains ample examples of a healthy and desirable contrary trend.

Professor NAGAISHI was born in Kyoto in 1907. After graduating from Kyoto University, he entered the Department of Otorhinolaryngology where he studied particularly on the problems of tuberculosis of the larynx, under the direction of the late Emeritus Professor TEIJI HOSHINO. When the Tuberculosis Research Institute (presently the Chest Disease Research Institute) was founded at Kyoto University in 1941, Dr. NAGAISHI was transferred to the Institute to develop a program in thoracic surgery.

To prepare for this activity, he entered the Department of Surgery in the School of Medicine, and studied for five years under the direction of Emeritus Professor YASUMASA AOYAGI. Since then, Dr. NAGAISHI has continued his activity as Head of the Department of Thoracic Surgery. His academic and clinical philosophy has required that he concentrates not only on thoracic surgery, but also on morphology, physiology, pathology, chemotherapy, and on other related basic studies in the respiratory system.

He and his associates have reported a great number of fine works, and he has gradually cultivated deep friendship with a worldwide community of scholars.

Knowing Professor NAGAISHI, I must admire his originality, and testify to his indomitable spirit in overcoming difficulties. At the same time, he is a man of affection. He has a sincere and warm respect for his patients, and they cannot but be attracted by his personality.

When I look at the history of science, I well know that there is no end to the search for truth. The investigations of VESALIUS, of WILLIAM HARVEY, of SCHLEIDEN and SCHWANN, of VIRCHOW, of DARWIN, of MENDEL, of FLEMING, and of many other scholars, were all epoch-making achievements, and constituted splendid contributions to the development of science. However, from a strict scientific viewpoint, even their achievements were not complete, but required to be followed by concentrated efforts for attainment of further progress. In this sense, Professor NAGAISHI's studies reported in this book do not mean that they have been completed by this publication, but will have to be continued further by the author and others in Japan and abroad toward unstated and now unimaginable goals.

This book will surely be a memorable milestone in the history of science. I wish to express my highest esteem to Professor NAGAISHI for his painstaking work.

I am convinced that this book will warrant a favorable acceptance and warm welcome, at home and abroad.

February 1, 1971

Kō HIRASAWA, M.D.
Formerly President and Professor Emeritus
Kyoto University
Member of the Japan Academy

FOREWORD

This impressive monograph summarizes a considerable part of the life work of a distinguished thoracic surgeon, Professor Emeritus CHUZO NAGAISHI of Kyoto University, who follows in the splendid traditions of scholar-surgeons represented more than a century ago by WILLIAM BOWMAN of England, and more recently by HARVEY CUSHING of America and WILDER PENFIELD of Canada. This book presents those aspects of functional pulmonary anatomy which have proved to be useful for the clinical thinking of a lung surgeon. It does not present the author's many advances in thoracic surgical technique, nor does it summarize his extensive contributions to understanding and management of chest diseases, particularly tuberculosis.

Surgeons come face to face with structural details as they carry out their procedures and develop rationale of management. A thorough understanding of structure and of its significance, then, becomes a necessity to a surgeon. HARVEY CUSHING thought it essential to master details of the gross anatomy of every part he was to invade, and, in addition, in order to improve his judgment as to the best procedure to follow, he made pioneering explorations into the microscopic anatomy and function of organs of surgical interest to him, such as the pituitary. In the same tradition, WILDER PENFIELD perceived that a neurosurgeon must understand the potentialities and characteristics of the several types of cells which can engender tumors of the central nervous system. These magnificent neurosurgeons pursued detailed, sustained, highly specialized microscopic studies of the hypophysis and of glial cells respectively, and in the course of their research, initiated to improve the rationale for surgical management, they made far-reaching innovative discoveries of general value to medicine and to science, as well as of specific value to surgery.

Professor NAGAISHI's name is rendered in Japanese by two Chinese characters which can be assigned the meanings, "long" and "stone", respectively. Though his name can hence be translated as "Longstone" in English, the first of the two characters often carries the significance of "chief" or "principal" or "leader" or "head person". Hence one can, without loss of accuracy, provide an alternative translation of the characters, as "chief stone", or "principal stone", conveying an idea often implied by use of the English term, "cornerstone". It is gratifying to see how Professor NAGAISHI's life work has conformed to this alternative rendering of the Chinese characters which express his name. For he has indeed made for us a cornerstone work on the anatomy of the lung. He perceived that a surgeon must be guided in his judgment by profound understanding of the structure and function of the organ towards which his surgical interests are addressed. He has carried out over the years many detailed descriptive and experimental studies of the lung. He mastered the relevant literature of the past and contributed substantially to that of his own lifetime. Like BOWMAN, CUSHING and PENFIELD before him, he grasped that surgical anatomy encompasses all the structural concepts of value to a surgeon in formulating rationale and judgments exercised in planning operations and regimen. Hence, to these scholars, surgical anatomy includes gross and microscopic anatomy, and to Professor NAGAISHI, includes ultrastructure and molecular anatomy as well. In extending surgical anatomy into the realm of ultrastructure, Dr. NAGAISHI and his associates have made skilful use of opportunities offered by recent technical advances in electron microscopes and in methods for utilizing these powerful instruments for studies of fine structural details of cells and tissues.

Professor NAGAISHI has been fortunate in living in a country which has pioneered in development of electron microscopes and electron microscopy and whose skilled workers, imaginative designers and well-organized manufacturers have created electron microscopes in considerable numbers and variety, of advanced design, with reliability and capability as good as any in the world. The author and his associates have taken excellent advantage of these movements, have mastered the necessary skills, and have included much of their handiwork for the benefit and enlightenment of readers of this book. Particularly interesting are the scanning electron micrographs of lung alveoli, showing communications between

adjacent alveoli in accordance with the concepts of KOHN, which have been subject to considerable controversy. There are also included many fine transmission electron micrographs, presenting important details of cell relationships in various parts of the lung, and contributing substantially to understanding of lung function.

In 1957 and 1958 the author and his associates published in Japanese a forerunner of this present monograph, presenting in it the structure of the lung as conceived at that time. We welcome the present text in English, which makes available to scholars in all parts of the world a revised and up-to-date summary of the functional surgical anatomy of the lung.

April 5, 1971

H. STANLEY BENNETT, M.D.
Sarah Graham Kenan Professor of Biological and Medical Sciences
Professor of Anatomy
Chairman, Department of Anatomy
Director, The Laboratories for Reproductive Biology
University of North Carolina

FOREWORD

The history of the search for knowledge about the structure of the lungs, can be seen as a wonderful adventure, whose path has been unwinding over the course of several centuries. The attractive problems involved in this task have engaged the keen investigating minds of some of the most learned men. For millennia these problems remained obscure and without answer.

Primitive man; the poet of Homer's age; the bard of the ancient oriental civilization; each instinctively thought that the "breath of life" was derived from the chest and the lungs. Aristotle postulated the concept that breathing was a method of cooling the blood; the lungs, fulfilling this function, thus also "accidentally" were able to become the region for infiltration of air.

It is shortly after the first half of the seventeenth century, that the true story of lung structure begins. The initiators were two scholars belonging to the same epoch: MARCELLO MALPIGHI, Professor of Bologna University (Italy), and THOMAS WILLIS, Professor of London Medical College (England).

In the epistolae "De Pulmonibus" written in 1661 by MALPIGHI, as in the "Opera Omnia" of WILLIS, for the first time, the lungs were considered to be, not a solid, compact, fleshy mass, but rather a membranous, vesicular, canalized structure. It is from these early workers that the present-day rudimentary facts are derived. WILLIS and MALPIGHI realistically differentiated and gave a nomenclature to lobules, alveoli, bronchial ramifications, arteries and veins.

Based upon these very early fundamental elements that drew their origin from a finite period of time, 1661–1676, the bulk of ensuing knowledge has gradually developed.

Just how much has been recognized and discovered in these three-hundred years of journeying and exactly what is the present state of understanding of the fine structural components of the lungs, are illustrated in this book, with notable descriptive precision and superior systematic clarity.

It is with great honour and much pleasure that I introduce this impressive book; which also receives importance from the eloquent works of Professor CHUZO NAGAISHI, Head of the Department of Thoracic Surgery, in the Chest Disease Research Institute of Kyoto University, Kyoto, Japan.

Friendship of more than ten years binds us together; but, above all, I feel the highest appreciation for and deep admiration of his impassioned and discerning work as a scientist.

Sentiments, such as these, have been strengthened at each of our numerous encounters in Italy (Naples, Parma, Brindisi), in Japan (Tokyo, Kyoto), in Brasil (Bahia), in Denmark (Copenhagen), and in Switzerland (Lausanne).

At our meeting in this Institute at Kyoto, in September 1967, I first learned of his work and studied on the fine structure of the lungs. On that occasion, I saw the Japanese Edition (Vol. I, 1957 and Vol. II, 1958) of this book and I also learned then that he was in the process of preparing a new revised version in English.

He has now completed his book which surely will be of far-reaching interest and will receive well-deserved success.

Essentially, this is a work of systematic anatomy, however, not written by an anatomist, instead, it is an "exposé", by one of the most famous thoracic surgeons. For this very reason, the investigations and analyses, which have been undertaken in the various sections on the structure of organs are not only admirable from the point of view of morphology, but also remain firmly anchored to the requirements of physiology, pathology, clinical medicine and surgery. This is particularly valid for the bronchial anatomy, for the parts devoted to the lymphatic system and for the pulmonary and bronchial vascular systems.

The reader will also find, in the various chapters, many historical notes and there are noteworthy

memories of the older pioneers, who studied the lungs from a morphological point of view; included, too, are recent contributions, and special mention is made of the achievements of electron microscopy.

The wonderful adventure continues, and to it, this book of Professor NAGAISHI, an eminent surgeon and an eminent anatomist, brings one of the most significant and outstanding contributions of modern times.

February 28, 1971

Professor ANTONIO BLASI, M.D.
Director, Tuberculosis Clinic and Graduate School
of Respiratory Diseases
University of Naples

FOREWORD

This book is an encyclopedic survey of the detailed anatomy of the lungs involving all systems—broncho-alveolar, vascular, lymphatic, muscular, neural and pleural—ranging from the gross anatomical to the microscopic and ultramicroscopic, from clinical applications to experimental approaches, from the normal to the pathologic, from studies on man to those on experimental animals—the whole supplemented by comprehensive surveys of the literature, including historical aspects of the subject, and by detailed surveys of technical methods of investigation, many of them original.

It is indeed amazing that an active chest surgeon with administrative responsibilities could find the time to establish a Chest Disease Research Institute, such as the one in Kyoto, to work in it himself with his students, and finally to organize the first Asia Pacific Congress on Diseases of the Chest (APCDC, 1969) to which physicians from all over the world contributed.

From another standpoint this book fills a long-anticipated need. Western investigators, who for many years have been aware of the high quality of Japanese studies that have appeared in the German and English languages but who have not been able to read the many treatises in the Japanese language—such as the former edition of this book—will welcome this comprehensive survey of Japanese studies on the lung that have now been made available in the English language.

The only field not represented in this anatomical approach is the developmental side of pulmonary anatomy. But obvious this is a specialty in itself.

Finally, one wishes to pay tribute to the kindly personality of this scholar and surgeon. Those of us who have become acquainted with him through the International Congresses on Diseases of the Chest, and in the home of friends, have always found it a privilege to know this charming, gifted, cosmopolitan gentleman.

March 10, 1971

EDWARD A. BOYDEN, Ph.D. (Med. Sc.),
F.A.C.C.P. (Hon.)
Research Professor, Department of Biological Structure
School of Medicine, University of Washington

FOREWORD

Professor NAGAISHI has now added another scholarly achievement to his earlier two-volume work "The Structure of the Lung" and has greatly widened his audience by writing it in English. This new volume comes, quite appropriately, at a time when there is increasing interest in many old functions of the lung and discoveries of new functions. The discovery of pulmonary surfactant and its unique role in stabilizing alveolar volume and preventing atelectasis has led to examination of biosynthetic activities of cells lining the alveoli, alveolar ducts and terminal bronchioles. The discovery that the lung can actively take up substances (such as 5-hydroxytryptamine, some prostaglandins and bradykinin) present in mixed venous blood, can transform substances in mixed venous blood (*e.g.*, convert angiotensin I to angiotensin II) and can store and subsequently release chemical substances into the pulmonary venous blood, has led to renewed interest in the cells lining the pulmonary arteries, arterioles and capillaries.

The world-wide interest in air pollution has generated numerous studies on alveolar macrophages (that phagocytose foreign matter) and on sensory receptors in the bronchioles (that initiate bronchoconstriction in response to smog). And the Ciba Foundation Symposium (1968) on Breathing (marking the centennial of the discovery of the Hering-Breuer reflex) has led to much curiosity about receptors in the intrapulmonary airways that initiate the inflation and "deflation" reflex and may contribute to the sensation of dyspnea. And the possibility that surgical transplantation of the lung may soon be a reality has led physiologists to study the pulmonary nerves and lymphatics and the rate at which they regenerate after transsection.

Professor NAGAISHI in this volume combines his own rich experience with the gross and fine structure of the lung with a critical report on studies from many other laboratories and a valuable look at the classic literature of the 19th and early 20th century. Clinicians and basic medical scientists interested in the lung will benefit greatly from Professor NAGAISHI's integrated presentation of gross structure, of functional anatomy viewed by fluorescence microscopy, of fine structure examined by the light microscope and ultrastructure explored with both the scanning electron microscope and the transmission electron microscope. It is of particular value that this information is synthesized by an experienced thoracic surgeon who knows well the importance of basic knowledge to an understanding of clinical problems. It is almost unique that a thoracic surgeon has produced a definitive work on gross and fine structure; the sections dealing with the terminal bronchioles, alveoli, bronchial and pulmonary circulations and their interrelationships, lymphatics and nerves are covered with thoroughness not to be found elsewhere.

Professor NAGAISHI spent a sabbatical year at the University of California, San Francisco in 1959–60; subsequently a number of his very capable young staff have spent fellowships in this Institute. The interchange of ideas has been mutually beneficial and we regard the Institute in Kyoto as a sister Institute.

April 8, 1971

JULIUS H. COMROE, Jr., M.D.
Professor, Director, Cardiovascular Research Institute
University of California, San Francisco

FOREWORD

It was my pleasure to meet Professor CHUZO NAGAISHI in February 1963 when we were attending the Eighth International Congress on Diseases of the Chest in New Delhi, India. Later I was his guest in Kyoto where I had the opportunity of seeing his magnificent book on thoracic surgery. It was written in Japanese, of course, but its superb illustrations had English subtitles. Since then, Dr. NAGAISHI and I have met frequently in various parts of the world, and I have heard him speak on a wide variety of subjects including tuberculosis, carcinoma of the lung, and pulmonary embolism. No wonder that he has such an extensive bibliography on so many different scientific subjects.

Dr. NAGAISHI is not only an eminent thoracic surgeon but also an expert in the fields of anatomy, pathology, and cardiopulmonary physiology. He has held positions of leadership in the major societies in Japan which are devoted to the thoracic disciplines. He was President of the First Asia Pacific Congress on Diseases of the Chest in 1969 and was the principal organizer of this Congress. He has been active in the international activities of the American College of Chest Physicians and has served as a governor for Japan.

This volume, "Functional Anatomy and Histology of the Lung" is an outgrowth of the many years of painstaking research which Professor NAGAISHI and his capable associates have carried out. The original works were published in 1957 and 1958 and, of course, many advances in methodology have developed and numerous contributions to our knowledge of the anatomy of the lung have appeared since that time. Dr. NAGAISHI has been cognizant of the great importance of electron microscopy and its role in the understanding of the entire structure and function of the lung even to the cellular level. It should be emphasized that although he has utilized all of the extensive studies carried out by his research group at the Chest Disease Research Institute, Kyoto University, he is the sole author of this volume. To be sure he has been most generous in giving credit to his co-workers, all of whom have attained distinction in academic careers of their own. However, this monumental work is indeed the product of his own pen.

In the six chapters of this book, Dr. NAGAISHI has described the bronchoalveolar system, the vascular system, the lymphatic system, the nervous system, the muscular system, and the pulmonary pleura. In each chapter the world literature has been exhaustively reviewed. The historical aspects are thoroughly covered, and the important embryologic data are emphasized. The work of the morphology study group in Kyoto is described in detail, and the techniques of tissue preparation also are outlined. Particular emphasis has been placed on the recent studies of the fine structure of the lung and the great fund of new knowledge that electron microscopy has contributed.

Dr. NAGAISHI not only has provided us with an authoritative treatise on the anatomy and histology of the lung but also has correlated this information with clinical, pathologic, and physiologic problems; hence, this book should be of great interest to the practicing physician and surgeon. As a thoracic surgeon with a strong background in basic science he was well qualified to accomplish this task. It is indeed a fittting culmination to a distinguished career.

At my request, my colleague, Professor MATTHEW DIVERTIE, reviewed the manuscript. Dr. DIVERTIE has been involved in studies of the morphometry of the lung in various diseases for many years. Professor W. H. HOLLINSHEAD, Chairman of the Department of Anatomy of the Mayo Graduate School of Medicine, also has been kind enough to read the book. Both have expressed their admiration for the thoroughness of Professor NAGAISHI's work and the excellence of his presentation. With its encyclopedic approach to the subject, the book is certain to become a standard reference for all who are interested in the anatomy of the lung.

March 11, 1971

ARTHUR M. OLSEN, M.D.
Professor of Medicine
Mayo Graduate School of Medicine
University of Minnesota
Chairman, Division of Thoracic Diseases
Mayo Clinic and Mayo Foundation

FOREWORD

It is a personal honor to be invited to write a note of introduction to the author of this volume. I first enjoyed acquaintanceship with Dr. NAGAISHI during his stay in San Francisco as a visiting professor in 1959–60. Subsequent chances of fate made it possible to extend our relationship in Kyoto (1961, 1966), and again on several occasions in San Francisco, during his trips to attend various national and international conferences. Derivative from this more than casual relationship has been an increasing appreciation of Professor NAGAISHI's studies, and of his contributions to the anatomy, physiology, and surgery, of the chest and lungs. The anatomical studies were published (in Japanese) in 1957 and 1958, in two copiously illustrated and thoroughly documented volumes representing ten years of studies by the Professor and his group of younger followers and collaborators. These volumes summarized the multitude of studies then extant, particularly those in Japanese. Subsequently a whole new series of studies have been carried out in Japan, and in the author's laboratories, using newer modalities and techniques; these, in sum, have led Professor NAGAISHI to place on record a newer scanning of the structure of the lung. He has chosen to prepare this new publication in English, in order that references to previously unavailable or untranslated Japanese works may become available to workers in other countries. The results of this effort are here available in this comprehensive and thoroughly illustrated and documented monograph. Even the casual reader cannot but be impressed by the magnitude of the task and the care exhibited in its execution. For the first time, we have available a scholarly evaluation and critical interpretation of a particular segment of Japanese medical science. The work will stand on its merits; that it will contribute importantly to antiparochialism and to a breakdown of provincialism in medical science is of transcendent importance.

The accomplishment of this objective is the work of a well trained and far sighted investigator. Dr. NAGAISHI graduated in Medicine from Kyoto University's Medical School in 1933, and after the usual prolonged postdoctoral training, became Assistant Professor and then Professor, Head (1953) of the Department of Thoracic Surgery of the Tuberculosis Research Institute, Kyoto University. He was appointed Director of that Institute in 1964, of its successor, the Chest Disease Research Institute (1966), and subsequently of its newly built Hospital (1968–1970). He became Emeritus Professor of Kyoto University on April 1, 1971. His authorship of this new volume marks a kind of reverse Festschrift, dedicated to his students and collaborators in memory of many years of endeavor. During his career, Professor NAGAISHI has attained a national and international reputation. He has been President of the Japanese Association for Thoracic Surgery (1955), of the Japan Society of Chest Diseases (1969), and he was President and Organizer of the First Asia Pacific Congress on Diseases of the Chest (1969). He has been an officer and member of distinguished Japanese societies of surgery, thoracic surgery, chest diseases, cancer therapy, lung cancer, anaesthesiology, circulation, organ transplantation, blood transfusion, bronchoesophagology, clinical cytology, etc., and he has held honorary memberships of clinical and investigative societies in Argentina, Brazil, Chile, and Germany. He has represented Japan at various international clinical congresses, and he has been a Governor of the American College of Chest Physicians for Japan, since 1964. Such recognition has been awarded to Professor NAGAISHI primarily for his extensive studies in tuberculosis and lung cancer. But honors such as these have accrued to a man who has created a school of followers who have become experts in morphology, physiology, pathology, and in clinical medicine and surgery. We have then an example, par excellence, of the skilful surgeon, schooled himself in all of the sciences basic to his art, who has made significant contributions to the teaching and learning of his subject, in all its diversities and complexities; in this respect, Professor NAGAISHI is a "compleat" physician. Further, he combines all of his scholarly accomplishments with charming and attractive qualities. How may

I forget the afternoons in Kyoto when, without notice, Dr. NAGAISHI would appear in my laboratory and announce that the time was immediately correct to view the blooming of the iris, the cherry blossoms, or the wisteria; and off we would go to the Heian Shrine to enjoy rare and unique displays. I remember well, and am grateful for those times.

The first anatomical dissection of the human body was carried out in 1754 in Kyoto in the presence of a physician, YAMAWAKI TŌYŌ. His description (of the chest viscera) was brief and rich with imagery—

> ". . . Through a tube someone blows through the airway, and then both lungs expand—a very beautiful color (purple brocade) like the opening of the cicada wing. The heart hung between the lungs, an as yet unopened lotus blossom. . ." ("Zōshi", 1759).

It is the belief of the undersigned that something of this poetic quality will also be evident in this scholarly work of Dr. NAGAISHI, a spiritual descendant of the pioneer anatomist, scholar and physician of Kyoto.

April 7, 1971

WILLIAM O. REINHARDT, M.D.
Professor of Anatomy and Associate Dean
School of Medicine
University of California, San Francisco

FOREWORD

Prof. NAGAISHI's book is dedicated to the study of all the structures of the lung with special reference to the finest elements of its constituent parts.

The work concerns the morphological study of the finest structures of the lungs, but being written by a clinician who has devoted many years of his life to thorough investigations of clinical aspects of specific and non-specific pulmonary diseases, this book acquires special significance and rouses special interest. The reader will find here a detailed description of the bronchoalveolar system, the vascular system, the lymphatic system, the nervous system, the muscular system and the pulmonary pleura.

Although this is a book on the anatomy and histology of the above-mentioned systems it differs from similar books written by anatomists. Prof. NAGAISHI's book will render an invaluable assistance to each researcher studying one or another aspect of pulmonary pathology.

At present, this book in which a detailed description of the elements of the lymphatic, nervous, and bronchoalveolar systems is given assumes still greater importance and value in the light of recent data on the pathogenesis of chronic pneumonia. The thorough consideration of the finest structures of the tracheobronchial tree, particularly of the tracheobronchial epithelium, helps us to understand more clearly the mechanism of bronchial drainage function impairment responsible for turnig an acute and protracted pneumonia into a chronic one.

The lymphatic system of the lung is circumstantially described which is of great importance for the clinicians-pneumonologs. The more we study pulmonary diseases the more often we are compelled to recognize the significant part the lymph nodes of the tracheobronchial tree play not only in keeping up certain respiratory system diseases but also in initiating them. Being an experienced clinician and ingenious diagnost Prof. NAGAISHI understands very well the role of the lymphatic system of the lung. He pays, therefore, particular attention to this system and suggests his own nomenclature of the bronchopulmonary lymph nodes.

The author describes in detail the nervous system of the lung. The whole Chapter IV is dedicated to this matter. There are very interesting findings obtained during histological investigations of nerve endings of the lung. This is of high significance for better understanding of the pathogenesis of a number of diseases, in particular of bronchial asthma. Only the study of the condition of the finest structures of the bronchial nerve endings can shed light on the nature of this severe disease which is very difficult for understanding.

The problem of relationship between pulmonary and bronchial vascular systems in certain lung diseases is extremely important. In the literature it is not elucidated at all. The study of this relationship will assist not only the clinician in better understanding of the mechanism of some symptoms in various diseases but also the surgeon-pneumonolog in choosing a rational approach to the management of certain lung diseases.

One could have told very much about the value of the book and its author speak for themselves. The subject shows the publishment of the book to be well-timed and utterly important. The author is well-known for his works on clinical aspects of lung diseases as well as on the anatomy and histology of the lung. These matters have been extensively and successfully investigated by Prof. NAGAISHI in cooperation with his collaborators during many years. In his present monograph the author sums up the results of the all enormous long-term work done by himself and his collaborators, and because of that the book acquires particular value.

The book will be read with great interest and benefit by a representative of theoretical and experimental medicine engaged in studying the lungs as well as by any clinician interested in deep investigation of one or another aspect of the pulmonary pathology.

This monograph is a fruit of many years' work of the prominent specialist in the field of the pulmonary surgery. It will undoubtedly win a high approval among all the clinicians, and particularly among the pneumonologs.

March 2, 1971

Professor FEDOR G. UGLOV
Member of the Academy of Medical Science of the USSR
Lenin Prize Winner
Director of the All-Union Research Institute of Pneumonology
Head of the Department of Surgery
1-st Leningrad Medical Institute

FOREWORD

Prof. NAGAISHI's experience and rich scientific background have enabled him to write this comprehensive treatise on the lung and its anatomic structure. During his busy professional life he has always been preoccupied with the structure, function and diseases of the lung as a whole. His research work was undertaken in view of trying to improve the method of diagnosis and therapy.

This document gives impressiveness to what he writes regarding his knowledge and research. With great confidence, the author leads the physician towards the fundaments of the anatomy of the respiratory organ, giving consideration to practical aspects of physiology and pathology. The thoracic surgeons from all over the world will especially welcome a thorough presentation of the macro- and microscopic observations of the structure, because diagnosis, indication, operative methodology and post-operative treatment depend greatly on the value of these observations.

As will be seen from the title of the book, Prof. NAGAISHI, as a thoracic surgeon, discusses the macro-microscopic anatomy of the tracheobronchial system and the pulmonary vessels in detail, referring to all the differences between the right and left sides. I am deeply impressed by the abundance of the contents and the orderly and elucidative presentation of the description and illustration.

The author has particularly been interested in the observation of the alveolar system, and therefore, in this book, this art is specially noted. By the descriptive presentation he brings the past and new phenomena into a harmonious unity, *i.e.* the state of knowledge of our time. The fine structures of the alveolar epithelium and the alveolar capillary are studied just as emphatically as those of the pulmonary vascular and the bronchial vascular systems.

The lymph vessels and their functional roles have been examined very carefully. For many decades, this separate circulatory system has played a role in the pulmonary and pleural diseases, and moreover, in the case of pulmonary tuberculosis, the elucidation of its pathogenesis was impossible without the knowledge of the lymphatic ways. With the development of the modern surgery of the bronchial carcinoma, the anatomy of the lymphatic system has gained a new significance, in deciding the operability in the open chest as well as the indication for a thoracotomy. Next to the anatomy and the microscopic structure of the lymph node and lymphatic system, the author is especially interested in the lymph flow and predisposing sites of metastases with regard to the pre-operative estimation of the operability with the aid of mediastinoscopy. By subtle scrutiny, Prof. NAGAISHI has succeeded in differentiating the common positional order of the groups of lymph nodes, and in doing so he has proposed a new theory for the topographic systematology, which deserves particular attention.

Among the functional systems examined by the microscopic observation I wish to remark upon the vegetative nervous system whose afferent and efferent courses are pursued to their endings in the bronchopulmonary tissues. Concerning present advanced anatomical knowledge, it may be stated that, in spite of all endeavours by many investigators in the past, the problem of the correlation to the function of the nervous system has been solved only to a limited extent.

The book can be considered as a compact and rich presentation of the macroanatomic and the fine-structured component elements of the lung, and by these characteristics it has the value of an encyclopedia on the morphology of the respiratory organ. Conceived out of the daily experience and the desire for learning in the clinical field, enriched substantially by operative observation and experience, this book was written with the intention of introducing specialized findings on the anatomy of the lung; thus the accomplishment of this piece of work should be considered as a contribution to science which has great and reliable value to the practical duties of the physicians, and the surgeons in particular: Prof. NAGAISHI is most