

Diagnosis of Diseases of the Chest

VOLUME I

THIRD EDITION



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Robert G. Fraser, M.D.
Professor of Radiology
University of Alabama at Birmingham
Birmingham, Alabama

J.A. Peter Paré, M.D.C.M., F.A.C.P., F.R.C.P.(C)
Professor Emeritus
Department of Medicine
McGill University
Montreal, Canada

P.D. Paré, M.D.
Professor of Medicine
University of British Columbia
Head, Respiratory Division
University of British Columbia and
St. Paul's Hospital
Vancouver, British Columbia, Canada

Richard S. Fraser, M.D.
Associate Professor of Pathology
McGill University
Pathologist, Montreal General Hospital
Head, Department of Pathology
Montreal Chest Hospital Institute
Montreal, Canada

George P. Genereux, M.D.
Professor of Radiology
University of Saskatchewan, Saskatoon
Radiologist, University of Saskatchewan Hospital
Saskatoon, Saskatchewan, Canada

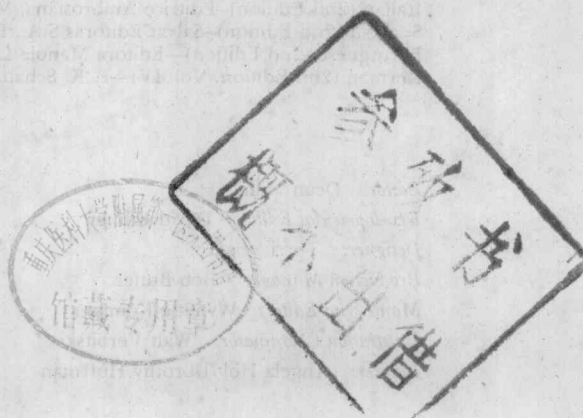
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DEDICATION

This book is dedicated to the many scholars and scientists who over these many decades have applied themselves with diligence and devotion to the enrichment of our knowledge of the normal and diseased chest.

PREFACE TO THE THIRD EDITION

—*vanity of vanities; all is vanity.*
What profit hath a man of all his labour which
he taketh under the sun?
One generation passeth away, and another
generation cometh.

—ECCLESIASTES 1:2

It has been 20 years since the two senior authors began writing the first edition of this book, and during the preliminary stages of planning for the third edition, we grudgingly acknowledged a mild but inescapable attrition in the motivation and initiative we possessed formerly. More importantly, we recognized the need to prepare to hand over the reins for the writing of future editions to dependable and tested hands. As a result, we felt obliged to augment the authorship of this edition with young, fertile minds, and we didn't have far to look: our two sons, RSF and PP, were devoting much of their professional lives to the pathologic and physiologic manifestations of chest disease respectively, and it was logical that they should take up the cudgel to prevent their fathers from wallowing in their own misconceptions. We also felt the need for the addition of a third creative mind, this time a radiologist, to bring about renewed vigor and enthusiasm to the description and illustration of roentgenologic pathology; again we had to look no further than our own back yard to find GG, an internationally renowned radiologist with a vast clinical experience in chest disease. As the first volume of this third edition has evolved, it has become abundantly clear that we possessed much wisdom in seeking the collaboration of these three. The new authors have reorganized many chapters and have greatly improved the text by preparing a much more accurate description and illustration of the pathologic manifestations of thoracic disease, a more thorough discussion of normal and pathologic physiology, and fresh new material on the roentgenologic manifestations of many conditions.

It was stated in the Preface to the First Edition that the book was written with the aim of emphasizing the value of the roentgenogram as the *first* rather than the *major* step in the diagnosis of chest disease. In the subsequent 15 year interval, we have not seen cause to alter this opinion. However, despite the usefulness of this approach from a practical day-to-day viewpoint, we have come to realize more fully that the ultimate foundation upon which diagnosis must be based is a knowledge of chest disease itself. In addition to a thorough familiarity with normal structure and function, this includes a detailed knowledge of physiologic and pathologic alterations as well as the etiologies and pathogenetic mechanisms behind them. Although intimated in the first two editions, this belief has reached full fruition in the present text in which all aspects of the normal and diseased chest have been given roughly equal coverage. Whatever emphasis was formerly placed on roentgenology is now of necessity less evident. This should not be interpreted as a diminution in our belief of the importance of the roentgenogram in diagnosis but rather as an extension of the previously unstated but implied importance of the broader view. This approach has necessarily involved the inclusion of a vast amount of new information and has resulted unavoidably in a comprehensive reference work rather than a textbook. The scope of the text is such that it will find its greatest use in the hands of specialists such as respirologists, thoracic surgeons, and radiologists and pathologists whose particular interest lies in diseases of the chest. However, those with a more general outlook, such as internists and house officers, will also find the book useful as an occasional reference source.

What will the reader find new? In addition to the more extensive coverage of pathology and physiology and the addition of new knowledge that has appeared in the literature over the seven or eight year span, fresh material has appeared on the control of breathing, the respiratory muscles in health and disease, breathing during sleep, the development of the lung, host defense mechanisms, opportunistic infections, pulmonary vasculitides, the acquired

immunodeficiency syndrome, the lung in transplantation, and drug-induced pulmonary disease. In addition, there is a complete reorganization of the chapter on neoplasms based on the 1982 WHO classification, and there are extensive additions to the discussion of the obstructive airway diseases, particularly with regard to pathophysiology and bronchial reactivity. A number of illustrations have been replaced and many new ones added, with emphasis on computed tomography and, to a lesser extent, magnetic resonance imaging. Virtually all illustrations of gross and microscopic pathology are new, and it is hoped that they will provide new insights into pathologic/radiologic correlation.

Since the publication of the Second Edition, a spectacular expansion of knowledge has occurred concerning the structure and function of the lung in health and disease; as a result, it has proved impossible to carry out a simple revision, and in most areas the book has been almost completely rewritten. However, all attempts have been made not to increase its length: the addition of new material, particularly in sections dealing with pathology and pathophysiology, has been balanced by the removal of out-of-date text. To achieve a roughly equal size of the new volumes, it has been necessary to alter the order of chapters somewhat from that in the first two editions. The tables of differential diagnosis and decision trees have been incorporated into Volume IV rather than occupying a separate volume as in the second edition. The rapidity with which new knowledge is appearing has also made it necessary to publish the four volumes sequentially rather than simultaneously. We regret the necessity for this, but were we to await completion of the later volumes, the first volume would be long out of date, requiring thorough revision; the inevitable result would be a vicious cycle whereby none of the volumes would ever be published!

As anticipated, the writing style of each of the five authors has varied considerably, requiring considerable subediting in an attempt to unify syntax and nomenclature. In this regard, we and others have been concerned with the variable terminology employed by physicians in the description of the normal and diseased thorax. In an attempt to obviate this variability, in 1975 a joint committee of the American College of Chest Physicians and the American Thoracic Society published a glossary of pulmonary terms and symbols pertinent to the medical and physiologic aspects of the normal and diseased chest (Chest 67:583, 1975). At about the same time, the Fleischner Society formed a committee on nomenclature that designed and subsequently published a glossary of words and terms that they recommended for roentgenologic terminology (AJR 143:509, 1984). Since several of the terms recommended by the ACCP/ATS Committee for use in the classification of diseases, in physical examination, and in respiratory therapy are at variance with those used in this book, we have chosen to include only the terms and symbols used in respiratory physiology and pathophysiology. Both the modified ACCP/ATS and the Fleischner glossaries are printed before Chapter 1, and the reader is urged to review them and use them regularly.

The burgeoning of knowledge in the field of chest disease continues unabated. The 20-odd journals that the two senior authors reviewed in the preparation of the first and second editions have been expanded not only by the profligation of new biomedical publications and the inclusion of a number of recognized journals in other specialized clinical disciplines, but also by the many physiology and pathology journals that were not included in the original review. As a consequence, the near-10,000 references cited in the second edition will certainly be exceeded in the third. Bibliographies have been placed at the end of each chapter and their position indicated by a black slash on page edges, thus facilitating their identification.

Once again, we invite our readers to inform us of differences of opinion they may have with the contents of this book or to offer their advice as to how future editions may be improved. It is only through such interchange of information and opinion that we can hope to establish on a firm basis the knowledge necessary for a full understanding of respiratory disease.

RGF
JAPP
PDP
RSF
GPG

ACKNOWLEDGMENTS

Coordination of the contributions of two authors in the preparation of the first two editions of this book proved to be a formidable undertaking, but in fact was comparatively simple compared with the enormous problems created by attempts to assimilate material from five separate sources. The writing of the manuscript and the choice and preparation of new illustrations were the most formidable part of the undertaking, but the many steps necessary to the final product required the unselfish and enthusiastic contributions of many hands and minds, and the support and encouragement we received from many of our friends are greatly appreciated and duly acknowledged.

It is not possible to overstate our gratitude to our secretaries who handled magnificently the tedious and necessarily exacting task of listing and filing references, transcribing manuscript from tape, typing the several drafts up to and including the final, and cheerfully coping with the innumerable problems encountered. Anne Paré of Val Morin, Quebec; Peggy Stewart and Diane Ford of St. Paul's Hospital, Vancouver; Donna O'Conner and Wendy Segall of the Montreal General Hospital; Joan Matlock of the University of Saskatchewan Hospital; and Marianne Constantine of the Montreal Chest Hospital exhibited exemplary patience and devotion in accomplishing these thorny chores. Although these individuals have earned our heartfelt thanks, the efforts by RGF's secretaries, Shelley McCain, Marcia Segers, and Lynn Hogan of the Hospital of the University of Alabama at Birmingham deserve special praise since it was their lot to type not only the contributions from their boss but also the edited manuscript from the other four authors; they also carried out the tedious job of recording, filing, and checking the innumerable references, an extremely frustrating chore that they performed with meticulous accuracy. The devotion and diligence with which all these people carried out their tasks are deeply appreciated.

The majority of the case histories and roentgenograms reproduced here are of patients of staff members of the Royal Victoria Hospital, the Montreal General Hospital, the Montreal Chest Hospital Institute, the Hospital of the University of Alabama at Birmingham, and the Medical Center of the University of Saskatchewan, Saskatoon. All illustrations of pathology derived from patients in the Montreal General Hospital and the Montreal Chest Hospital Institute. Our indebtedness to our colleagues who were caring for these patients cannot be overemphasized, not only for their generosity in permitting us to publish these case reports but also for the benefit of their experience and guidance over the years.

The superb photographic work throughout these volumes was the accomplishment of the Department of Visual Aids of the Royal Victoria Hospital, Susie Gray of the Department of Radiology, UAB, David Mandeville of the University of Saskatchewan Hospital, and Joseph Donohue and Anthony Graham of Montreal. Their craftsmanship and rich experience in photography are readily apparent in these pages. We would also like to thank Sally Osborne of St. Paul's Hospital, Vancouver, for many of the physiologic illustrations, and Elizabeth Baile, also of St. Paul's, for her help in preparation of the section on the bronchial circulation.

Throughout our labors, we received much support and cooperation from the publishers, notably Suzanne Boyd, who effectively and sympathetically minimized the many obstacles we encountered. Jack Hanley, the former president of the company, gave us much encouragement during the formative stages, and we shall miss his enthusiasm and guidance. Since taking over as medical editor in 1986, Dean Manke has assisted us in many ways in our endeavors.

Finally, and with immense gratitude, we recall the patience and understanding displayed by our wives and children throughout our labors. Without their continuous encouragement, this book surely would not have been completed, and we acknowledge their many virtues with much love.

RGF
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PDP
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PREFACE TO THE FIRST EDITION

This book was written with the aim of defining an approach to the diagnosis of diseases of the chest based on the abnormal roentgenogram. Experience over the years has led the authors to the conclusion that the chest roentgenogram represents the focal point or sheet anchor in the diagnosis of the majority of pulmonary diseases, many patients presenting with either no symptoms and signs or entirely nonspecific ones. This emphasis on the roentgenogram as the first step in reaching a diagnosis does not represent an attempt to relegate history and physical examination to a position of no importance, but merely an effort to place them in proper perspective. In no other medical field is diagnosis so dependent upon the intelligent integration of information from roentgenologic, clinical, laboratory, and pathologic sources as in diseases of the chest. We submit that the roentgenogram is the starting point in this investigation; the knowledge of structural change thus obtained, when integrated with pertinent clinical findings and results of pulmonary function tests and other ancillary diagnostic procedures, enables one to arrive at a confident diagnosis. Some patients manifest symptoms and signs that themselves are virtually diagnostic of some chest disorders, but even in such cases the confirmation of diagnosis requires the presence of an appropriate roentgenographic pattern.

A glance through the pages will reveal an abundance of roentgenographic illustrations that might create the illusion that this book is written primarily for the roentgenologist, but this is not our intention. In fact, the clinical, morphologic, and laboratory aspects of many diseases are described at greater length than the roentgenologic, a fact pointing up the broad interest we hope the book will engender among internists, surgeons, and family practitioners interested in chest disease. The numerous illustrations reflect the aim of the book—to emphasize the value of the roentgenogram as the *first* rather than the *major* step in diagnosis.

During the writing of the book, our original plan was considerably modified as the format unfolded and we became even more aware of the complexities of design and organization. Originally, our approach to differential diagnosis suggested a division of chapters on the basis of specific roentgenographic patterns. It soon became apparent, however, that since many diseases give rise to various different roentgenographic patterns, this method of presentation would require tedious repetition of clinical and laboratory details in several chapters. To obviate this, we planned tables of differential diagnosis, listing etiologic classifications of diseases that produce specific roentgenographic patterns and describing briefly the clinical and laboratory characteristics of each disease, thus facilitating recognition of disease states. The tables are designed to be used with the text in the following manner. When a specific pattern of disease is recognized, the appropriate table should be scanned and those conditions selected that correspond most closely with the clinical picture presented by the patient. Additional information about the likeliest diagnostic possibilities can be obtained by referring to the detailed discussions in the relevant sections of the text (page numbers are cited after each diagnosis). The tables relate to 17 basic patterns of bronchopulmonary, pleural, and mediastinal disease; they are grouped together in Chapter 5 in Volume I and may be located with ease from the black marks found on the upper corners of their pages. Each table is preceded by a detailed description and representative illustrations of the specific roentgenographic pattern. An attempt has been made to indicate the relative incidence of the diseases.

Although our original plan called for a one volume presentation, it soon became apparent that the length of the text and the number and size of illustrations necessary for full coverage of the subject required two volumes. Volume I includes descriptions of the normal chest, methods and techniques of investigation, clinical features, and roentgenologic signs of chest diseases, the tables of differential diagnosis, and chapters devoted to diseases

of developmental origin and the infectious diseases; in Volume II appear detailed discussions of the morphologic, roentgenologic, and clinical aspects of all other diseases of the thorax arranged in chapters according to etiology.

The roentgenograms have been reproduced by two different techniques, the majority in Volume I by the logEtronic method and those in Volume II by direct photography. The publishers have been generous in allotting sufficient space for the reproduction of the roentgenograms in a size adequate for good detail recognition.

Much of the material in the book has been based on our personal experience gained in the past almost two decades, during which we have had a predominant interest in pulmonary disease. Obviously, this experience has been greatly enhanced by the extensive literature that has accumulated during these years, and we are mindful of the tremendous help we have received from the contributions of others. Our free use of the literature is reflected in the extensive bibliography.

Certain differences from the contents of other books on respiratory disease will be noted. First, this text contains no reference to treatment. Since drug therapies and surgical techniques are constantly changing, any attempt to include them would make the book out of date almost before it was published. Second, we have intentionally made only passing reference to pulmonary disease peculiar to children, a full description of which would require a complete separate text.

The relative incidence of respiratory diseases has changed considerably over the last quarter century. In some diseases, such as tuberculosis and bronchiectasis, a decreased frequency reflects improved public health measures and therapeutic innovations; in others, man's therapeutic triumphs have proved a mixed blessing, enabling patients with disabling chronic respiratory disease to live longer despite formerly fatal pneumonias. Perhaps even more important, man himself is responsible for varying the spectrum of respiratory disease as a result of his irresponsible insistence upon increasing the amount and variety of atmospheric pollutants. Inhaled contaminated air not only is regarded as the major etiologic factor in chronic obstructive pulmonary disease and the inorganic dust pneumoconioses, but also has been incriminated in the etiology of several hypersensitivity diseases of the lungs. This last group comprises the "extrinsic" form of allergic alveolitis. The number of conditions involved, when added to the better known "intrinsic" counterpart—the collagen diseases—is largely responsible for the length of the chapter devoted to immunologic diseases. Other changes that have contributed to the "new face" of pulmonary disease include increasing knowledge of the hormonal effects of neoplasms; the discovery that various immunologic defects may reduce host resistance to infection; and finally the appearance in the western world of parasitic infestations and bacterial infections formerly considered so rare in those areas as to warrant little consideration in differential diagnosis, but now of some importance because of the modern day ease of intercontinental travel. Although the novelty of these recent changes may have led the authors to consider them in greater detail and length than is their due, the emphasis may serve to bring them into proper perspective.

Finally, we recognize our fallibility. It is inevitable that some observations in a text of this magnitude will prove erroneous in time or will find disagreement among our knowledgeable readers. This we expect and accept. We sincerely hope that such differences of opinion will be made known to us, so that they may be weighed and, where appropriate, introduced into subsequent editions or revisions. It is only through such interchange of information and opinion that we can hope to establish on a firm basis the knowledge necessary to a full understanding of respiratory disease.

R.G.F.

J.A.P.P.

GLOSSARY

Glossary of Words, Terms and Symbols in Chest Medicine and Roentgenology

"Then you should say what you mean," the March Hare went on.

"I do," Alice hastily replied; "at least—at least, I mean what I say—that's the same thing, you know."

"Not the same thing a bit!" said the Hatter. "Why, you might just as well say that 'I see what I eat' is the same thing as 'I eat what I see!'"

This well-known excerpt from Lewis Carroll's *Alice's Adventures in Wonderland* points out a problem that confronts many physicians in today's constantly expanding scientific literature—the use of words and terms that mean different things to different people. The frequency with which imprecise or frankly erroneous words are employed to describe roentgenographic images (for example) is astonishing; common usage has created a jargon that has led to confusion if not to actual communication breakdown. In 1975, a joint committee of the American College of Chest Physicians and the American Thoracic Society published a glossary of pulmonary

terms and symbols* pertinent to the medical and physiologic aspects of chest disease, but it omitted words that specifically related to chest roentgenology. As a consequence, the Fleischner Society formed a Committee on Nomenclature several years ago to draw up a glossary of roentgenologic words and terms and this task now has been completed and the glossary published.† We list herewith a number of words, terms, and symbols selected from the two publications that we hope our readers will refer to and use. The precise definition of some words has been altered slightly to coincide with usage in this book.

*Pulmonary Terms and Symbols: A report of the ACCP/ATS Joint Committee on Pulmonary Nomenclature. Chest 67:583, 1975.

†Glossary of Terms for Thoracic Radiology: Recommendations of the Nomenclature Committee of the Fleischner Society. Am J Roentgenol 143:509, 1984.

WORDS OR TERMS USED IN ROENTGENOLOGY

Word or Term	Comments
abscess <i>n., pl. -es</i> . 1. (pathol.) An inflammatory mass, the central part of which has undergone purulent liquefaction necrosis. It may communicate with the bronchial tree. 2. (radiol.) Within the lung, a mass presumed to be caused by infection. The presence of gas within the mass, with or without a fluid level, represents a cavity (<i>q.v.</i>) and implies a communication with the bronchial tree. Otherwise, a pulmonary mass can be considered to represent an abscess in the morphologic sense only by inference. <i>Qualifiers</i> : Expressing clinical course: acute, chronic. Expressing etiology: bacterial, fungal, etc. Expressing site of involvement: lung, mediastinum, etc.	Should be used only with reference to masses of presumed infectious etiology. The word is not synonymous with cavity (<i>q.v.</i>).

WORDS OR TERMS USED IN ROENTGENOLOGY *Continued*

Word or Term	Comments
acinar pattern <i>n.</i> (radiol.) A collection of round or elliptic, ill-defined, discrete or partly confluent opacities in the lung, each measuring 4 to 8 mm in diameter and together producing an extended, inhomogeneous shadow. <i>Synonyms:</i> Rosette pattern; acinonodose pattern (used specifically with reference to endobronchial spread of tuberculosis); alveolar pattern.	An inferred conclusion usually used as a descriptor. An acceptable term, preferred to cited synonyms (especially "alveolar pattern," which is an inaccurate descriptor).
acinar shadow <i>n.</i> (radiol.) A round or slightly elliptic pulmonary opacity 4 to 8 mm in diameter presumed to represent an anatomic acinus rendered opaque by consolidation. Usually employed in the presence of many such opacities (<i>see</i> acinar pattern).	An inferred conclusion sometimes applicable as a roentgenologic descriptor.
acinus <i>n.</i> (anat.) The portion of lung parenchyma distal to the terminal bronchiole and consisting of respiratory bronchioles, alveolar ducts, alveolar sacs, and alveoli (<i>see</i> acinar shadow, acinar pattern).	A specific feature of pulmonary anatomy.
aeration <i>n.</i> (physiol./radiol.) 1. The state of containing air. 2. The state or process of being filled or inflated with air. <i>Qualifiers:</i> overaeration (preferred) or hyperaeration; underaeration (preferred) or hypoaeration. <i>Synonym:</i> Inflation.	An acceptable term with reference to the inspiratory phase of respiration. Inflation is preferred in sense 2.
air , <i>n.</i> (radiol.) Inspired atmospheric gas. The word is sometimes used to describe gas within the body regardless of its composition or site.	With reference to pneumothorax, subcutaneous emphysema, or the content of the stomach, colon, etc., gas is the more accurate term and is preferred.
air bronchiologram <i>n.</i> (radiol.) The equivalent of air bronchogram but in airways assumed to be bronchioles because of their peripheral location and diameter.	An acceptable term.
air bronchogram <i>n.</i> (radiol.) The roentgenographic shadow of an air-containing bronchus peripheral to the hilum and surrounded by airless lung (whether by virtue of absorption of air, replacement of air, or both), a finding generally regarded as evidence of the patency of the more proximal airway. Hence, any bandlike tapering and/or branching lucency within opacified lung corresponding in size and distribution to a bronchus or bronchi and presumed to represent an air-containing segment of the bronchial tree.	A specific feature of roentgenologic anatomy whose identify is often inferred. A useful and recommended term.
air-fluid level <i>n.</i> (radiol.) A local collection of gas and liquid that, when traversed by a horizontal x-ray beam, creates a shadow characterized by a sharp horizontal interface between gas density above and liquid density below.	A useful roentgenologic descriptor. Since with rare exception (<i>e.g.</i> , fat-fluid level) the upper of the two absorbant media is "air" (gas), it is sufficient to describe such an appearance as a "fluid level."
air space <i>n.</i> (<i>adj.</i> air-space) (anat./radiol.) The gas-containing portion of lung parenchyma, including the acini and excluding the interstitium and purely conductive portions of the lung. <i>Synonyms:</i> Acinar consolidation, alveolar consolidation (when used as an adjective in relation to air-space consolidation).	An inferred conclusion usually used as a roentgenologic descriptor. An acceptable term whose use as an adjective is also appropriate.

WORDS OR TERMS USED IN ROENTGENOLOGY *Continued*

Word or Term	Comments
air-trapping <i>n.</i> (pathophysiol./radiol.) The retention of excess gas in all or part of the lung at any stage of expiration.	A specific roentgenologic sign to be employed only if excess air retention is demonstrated by a dynamic study, <i>e.g.</i> , inspiration-expiration roentgenography or fluoroscopy. <i>Not</i> to be used with reference to overinflation of the lung at full inspiration (total lung capacity).
airway <i>n., adj.</i> (anat./radiol.) A collective term for the air-conducting passages from the larynx to and including the respiratory bronchioles. <i>Synonyms:</i> Conducting airway; tracheobronchial tree.	A useful anatomic term. May be used as an adjective in relation to disease or abnormality. Note that the respiratory bronchioles are both conducting and gas-exchanging airways and thus constitute the transitory zone.
alveolarization <i>n.</i> (radiol.) The opacification of groups of alveoli by a contrast medium.	A misnomer whose use is to be deplored. Excessive filling of peripheral lung structure by contrast media usually employed for bronchography may opacify respiratory bronchioles but not alveoli. Thus, the correct term is "bronchiolar filling or opacification."
anterior junction line <i>n.</i> (radiol.) A vertically oriented linear or curvilinear opacity approximately 1 to 2 mm wide, commonly projected on the tracheal air shadow. It is produced by the shadows of the right and left pleurae in intimate contact between the aerated lungs anterior to the great vessels (and sometimes the heart); hence, it never extends above the suprasternal notch (<i>cf.</i> posterior junction line). <i>Synonyms:</i> Anterior mediastinal septum, line, or stripe.	A specific feature of roentgenologic anatomy; to be preferred to cited synonyms.
aortopulmonary window <i>n.</i> 1. (anat.) A mediastinal space bounded anteriorly by the posterior surface of the ascending aorta; posteriorly by the anterior surface of the descending aorta; superiorly by the inferior surface of the aortic arch; inferiorly by the superior surface of the left pulmonary artery; medially by the left side of the trachea, left main bronchus, and esophagus; and laterally by the left lung. Within it are situated fat, the ductus ligament, the left recurrent laryngeal nerve, and lymph nodes. 2. (radiol.) A zone of relative lucency in the mediastinal shadow that is seen to best advantage in the left anterior oblique or lateral projection and that corresponds to the anatomic space defined above. On a posteroanterior roentgenogram of the chest, the lateral margin of the space constitutes the aortopulmonary window interface. <i>Synonym:</i> Aortic-pulmonic window.	A specific feature of roentgenologic anatomy.
atelectasis <i>n.</i> (pathophysiol./radiol.) Less than normal inflation of all or a portion of the lung with corresponding diminution in volume. <i>Qualifiers</i> may be employed to indicate severity (mild, moderate, severe), mechanism (resorption, relaxation, cicatrization, adhesive), or distribution (<i>e.g.</i> , lobar, platelike [<i>q.v.</i>], discoid). <i>Synonyms:</i> Collapse, loss of volume, anectasis.	Generally this term is preferable to "collapse" in describing loss of volume. The word "collapse" connotes total atelectasis in which lung tissue has been reduced to its smallest volume. Anectasis is usually used in reference to failure of lung expansion in the neonate.

WORDS OR TERMS USED IN ROENTGENOLOGY *Continued*

Word or Term	Comments
azygoesophageal recess <i>n.</i> 1. (anat.) A space or recess in the right side of the mediastinum into which the medial edge of the right lower lobe (crista pulmonis) extends. It is limited superiorly by the arch of the azygos vein, inferiorly by the diaphragm, posteriorly by the azygos vein in front of the vertebral column, and medially by the esophagus and its adjacent structures. (The exact relationship between the medial edge of the lung and the mediastinal structures is variable.) 2. (radiol.) In a frontal chest roentgenogram, a vertically oriented interface between air in the right lower lobe and the adjacent mediastinum that represents the medial limit of the anatomic azygoesophageal recess.	A specific feature of roentgenologic anatomy. The use of the term "recess" to identify an interface is inappropriate; thus, azygoesophageal recess interface is preferred.
<i>Synonyms:</i> Infraazygos recess; right pleuroesophageal line or stripe; right paraesophageal line or stripe.	
bat's-wing distribution <i>n.</i> (radiol.) A spatial arrangement of roentgenographic opacities in a frontal roentgenogram that bears a vague resemblance to the shape of a bat in flight; said of coalescent, ill-defined opacities that are approximately bilaterally symmetric and that are confined to the medulla of the lungs (<i>q.v.</i>).	A roentgenologic descriptor of limited usefulness.
<i>Synonym:</i> Butterfly distribution.	
bleb <i>n.</i> 1. (pathol.) A gas-containing space within or contiguous to the visceral pleura of the lung. 2. (radiol.) A local, thin-walled lucency contiguous with the pleura, usually at the lung apex.	An inferred conclusion seldom justifiable by roentgenogram alone. Bulla or air cyst is preferred.
<i>Synonyms:</i> Type I bulla (pathol.); bulla; a form of pulmonary air cyst (radiol.)	
bronchiole <i>n.</i> (anat./radiol.) An airway that contains no cartilage in its wall. A bronchiole may be purely conducting (up to and including the terminal bronchiole) or transitory (the respiratory bronchioles that carry out both conduction and gas exchange).	A specific feature of pulmonary anatomy.
bronchocele <i>n.</i> <i>See</i> mucoid impaction.	
bronchus <i>n.</i> (anat./radiol.) A conducting airway distal to the tracheal bifurcation that contains cartilage in its wall.	A specific feature of pulmonary anatomy.
bulla <i>n., pl. -lae.</i> 1. (pathol.) A sharply demarcated region of emphysema; a gas-containing space that may contain nothing but gas or may contain overdistended and ruptured alveolar septa and blood vessels. 2. (radiol.) Sharply demarcated hyperlucent area of avascularity within the lung, measuring 1 cm or more in diameter and possessing a wall less than 1 mm in thickness. <i>Qualifiers:</i> small, medium, large.	The preferred term to describe all thin-walled air-containing spaces in the lung with the exception of pneumatocele (<i>q.v.</i>).
butterfly distribution <i>n.</i> (radiol.) <i>See</i> bat's-wing distribution.	To be distinguished from the use of this term in general medicine to describe the distribution of certain cutaneous lesions.

WORDS OR TERMS USED IN ROENTGENOLOGY *Continued*

Word or Term	Comments
calcification <i>n.</i> 1. (pathophysiol.) (a) The process by which one or more deposits of calcium salts are formed within lung tissue or within a pulmonary lesion. (b) Such a deposit of calcium salts. 2. (radiol.) A calcific opacity within the lung that may be organized (<i>e.g.</i> , concentric lamination), but which does not display the trabecular organization of true bone. <i>Qualifiers</i> : "eggshell," "popcorn," target, laminated, flocculent, nodular, etc.	An explicit conclusion; may be used as a descriptor. To be distinguished from ossification (<i>q.v.</i>).
carina <i>n.</i> (anat./radiol.) The keel-shaped ridge that separates the right and left main bronchi at the tracheal bifurcation.	A specific feature of pulmonary anatomy.
carinal angle <i>n.</i> (anat./radiol.) The angle formed by the right and left main bronchi at the tracheal bifurcation. <i>Synonyms</i> : Bifurcation angle; angle of tracheal bifurcation.	A definitive anatomic and roentgenologic measurement.
cavity <i>n.</i> 1. (pathol.) A mass within lung parenchyma, the central portion of which has undergone liquefaction necrosis and has been expelled via the bronchial tree, leaving a gas-containing space, with or without associated fluid. 2. (radiol.) A gas-containing space within the lung surrounded by a wall whose thickness is greater than 1 mm and usually irregular in contour.	A useful descriptor without etiologic connotation. The word must not be used interchangeably with abscess (<i>q.v.</i>), which may exist without bronchial communication and therefore without cavitation.
circumscribed <i>adj.</i> (radiol.) Possessing a complete or nearly complete visible border.	An acceptable descriptor.
clot <i>n.</i> (pathol.) A semisolidified mass of blood elements.	<i>Cf.</i> thrombus.
coalescence <i>n.</i> (radiol.) The joining together of a number of opacities into a single opacity; confluence (<i>q.v.</i>).	An acceptable descriptor.
coin lesion <i>n.</i> (radiol.) A sharply defined, circular opacity within the lung suggestive of the appearance of a coin and usually representing a spherical or nodular lesion. <i>Synonyms</i> : Pulmonary nodule, pulmonary mass.	A roentgenologic descriptor, the use of which is to be condemned. The term "coin" may be descriptive of the shadow, but certainly not of the lesion producing it.
collapse <i>n.</i> (radiol.) A state in which lung tissue has undergone complete atelectasis.	The term is acceptable when employed strictly as defined, but "atelectasis" is preferred, since the degree of loss of lung volume can be qualified by mild, moderate, or severe.
collateral ventilation <i>n.</i> (physiol./radiol.) The process by which gas passes from one lung unit (acinus, lobule, segment, or lobe) to a contiguous unit via alveolar pores (pores of Kohn), canals of Lambert, or direct airway anastomoses. <i>Synonym</i> : Collateral air drift.	An inferred conclusion usually based on fairly reliable signs. A useful term. The channels of peripheral airway communication also function as a mechanism for transmission of liquid from one unit to another (<i>e.g.</i> , in acute air-space pneumonia).
confluence <i>n.</i> (radiol.) The nature of opacities that are contiguous with or adjacent to one another. <i>Antonym</i> : Discrete (<i>q.v.</i>).	A useful descriptor; confluence is to be distinguished from coalescence (<i>q.v.</i>), which is the act of becoming confluent.

WORDS OR TERMS USED IN ROENTGENOLOGY *Continued*

Word or Term	Comments
consolidation <i>n.</i> 1. (pathophysiol.) The process by which air in the lung is replaced by the products of disease, rendering the lung solid (as in pneumonia). 2. (radiol.) An essentially homogeneous opacity in the lung characterized by little or no loss of volume, by effacement of pulmonary blood vessels, and sometimes by the presence of an air bronchogram (<i>q.v.</i>).	An inferred conclusion, applicable only in an appropriate clinical setting when the opacity can with reasonable certainty be attributed to replacement of alveolar air by exudate, transudate, or tissue. Not to be used with reference to all homogeneous opacities.
corona radiata <i>n.</i> (radiol.) A circumferential pattern of fine linear spicules, approximately 5 mm long, extending outward from the margin of a solitary pulmonary nodule through a zone of relative lucency.	A sign of limited usefulness in the differentiation of benign and malignant nodules.
cor pulmonale <i>n.</i> 1. (pathol./clin.) Right ventricular hypertrophy and/or dilatation occurring as a result of an abnormality of lung structure or function. 2. (radiol.) The combination of pulmonary arterial hypertension and chronic lung disease, with or without evidence of enlargement of right heart chambers. <i>Qualifiers:</i> acute, chronic.	An inferred roentgenologic conclusion based on usually reliable signs. An acceptable descriptor. Despite the pathologic definition, roentgenologic evidence of cardiomegaly need not be present.
cortex <i>n.</i> (radiol.) The peripheral 2 to 3 cm of lung parenchyma adjacent to the visceral pleura, either over the convexity of the thorax or in the interlobar fissures. (<i>See</i> medulla and hilum.)	The peripheral part of an arbitrary subdivision of the lung into three zones from the hilum to the visceral pleura. Of limited usefulness.
CT number <i>n.</i> (radiol./physics) In computed tomography, a quantitative numerical statement of the relative attenuation of the x-ray beam at a specified point; loosely, the relative attenuation of a specified tissue absorber, usually expressed in Hounsfield units (HU).	
cyst <i>n.</i> 1. (pathol.) A circumscribed space whose contents may be liquid or gaseous and whose wall is generally thin and well defined and lined by epithelium. 2. (radiol.) A gas-containing space of any size possessing a thin wall. <i>Qualifiers:</i> foregut (bronchogenic, esophageal duplication); postinfectious.	This term is entirely nonspecific and should not possess inferred conclusion as to etiology. It is the preferred term to describe any thin-walled gas-containing space in the lung possessing a wall thickness greater than 1 mm.
defined <i>adj.</i> (radiol.) The character of the border of a shadow. <i>Qualifiers:</i> well, sharply, poorly, distinctly.	An acceptable descriptor.
demarcated <i>adj.</i> (radiol.) Distinct from adjacent structures. <i>Qualifiers:</i> well, sharply, poorly.	An acceptable descriptor. (<i>Cf.</i> defined.)
dense <i>adj.</i> (radiol.) Possessing density (<i>q.v.</i>). Usually used in describing or comparing roentgenographic shadows with respect to their light transmission.	A recommended term in the context defined. Should not be used in referring to the opacity of an absorber of x-radiation. (<i>See</i> opaque, opacity.)
density <i>n.</i> 1. (physics) The mass of a substance per unit volume. 2. (photometry/radiol.) The opacity of a roentgenographic shadow to visible light; film blackening. 3. (radiol.) The shadow of an absorber more opaque to x-rays than its surround; an opacity or radiopacity. 4. The degree of opacity of an absorber to x-rays, usually expressed in terms of the nature of the absorber (<i>e.g.</i> , bone, water, or fat density).	In sense 2, the term refers to a fundamental characteristic of the roentgenogram, and its use is recommended. In senses 3 and 4, it refers to the character of the absorber and has an exactly opposite connotation with respect to film blackening. Because of this potential confusion, the term should <i>never</i> be used to mean an "opacity" or "radiopacity."

WORDS OR TERMS USED IN ROENTGENOLOGY *Continued*

Word or Term	Comments
diffuse <i>adj.</i> 1. (pathophysiol.) Widely distributed through an organ or type of tissue. 2. (radiol.) Widespread and continuous (said of shadows and by inference of the states or processes producing them). <i>Synonyms:</i> Disseminated, generalized, systemic, widespread.	A useful and acceptable term. In the context of chest radiology, "diffuse" connotes widespread, anatomically continuous but not necessarily complete involvement of the lung or other thoracic structure or tissue; "disseminated" connotes widespread but anatomically discontinuous involvement; and "generalized" connotes complete or nearly complete involvement whereas "systemic" connotes involvement of a thoracic structure or tissue as part of a process involving the entire body.
discrete <i>adj.</i> (radiol.) Separate, individually distinct; hence, with respect to opacities, usually circumscribed. <i>Antonyms:</i> Confluent, coalescent.	An acceptable descriptor.
disseminated <i>adj.</i> 1. (pathophysiol.) Widely but discontinuously distributed through an organ or type of tissue. 2. (radiol.) Widespread but anatomically discontinuous (said of shadows and by inference of the states or processes producing them). <i>Synonyms:</i> Diffuse (<i>q.v.</i>), generalized, systemic.	A useful and acceptable term.
doubling time <i>n.</i> (radiol.) The time span over which a pulmonary nodule or mass doubles in volume (increases its diameter by a factor of 1.25).	An acceptable term. The concept should be used with caution as a criterion for distinguishing benign from malignant nodules.
embolus <i>n.</i> 1. (pathol.) A clot or mass of foreign material that has been carried by the bloodstream to occlude partly or completely the lumen of a blood vessel. 2. (radiol.) (a) A lucent defect or obstruction within an opacified blood vessel presumed to represent an embolus in the pathologic sense. (b) An acutely dilated pulmonary artery presumed to represent the presence of blood clot or other embolic material. <i>Qualifiers:</i> acute, chronic; air, fat, amniotic fluid, parasitic, neoplastic, tissue, foreign material (<i>e.g.</i> , iodized oil, mercury, talc); septic, therapeutic, paradoxical.	In sense 2(a), an inferred conclusion based on reliable evidence (arteriography); in sense 2(b), based on highly suggestive evidence (conventional roentgenography) in the appropriate clinical setting. A useful descriptor, particularly in arteriography.
emphysema <i>n.</i> 1. (pathol.) (a) A morbid condition of the lung characterized by abnormally expanded air spaces distal to the terminal bronchiole, with or without destruction of the air-space walls (per Ciba Conference, 1959). (b) As above, but "with destruction of the walls of involved air spaces" specified (per World Health Organization, 1961, and American Thoracic Society, 1962). 2. (radiol.) Overinflation of all or a portion of one or both lungs, with or without associated oligemia (<i>q.v.</i>), presumed to represent morphologic emphysema.	In radiology, an inferred conclusion based on usually reliable signs (if the disease is moderate or advanced). Applicable only in an appropriate clinical setting and, in the sense of the ATS definition, not applicable to spasmodic asthma or compensatory overinflation.
fibrocalcific <i>adj.</i> (radiol.) Of or pertaining to sharply defined, linear, and/or nodular opacities containing calcification(s) (<i>q.v.</i>), usually occurring in the upper lobes and presumed to represent old granulomatous lesions.	A widely used and acceptable roentgenologic descriptor.

WORDS OR TERMS USED IN ROENTGENOLOGY *Continued*

Word or Term	Comments
fibronodular <i>adj.</i> (radiol.) Of or pertaining to sharply defined, approximately circular opacities occurring singly or in clusters, usually in the upper lobes, and associated with linear opacities and distortion (retraction) of adjacent structures. A finding usually presumed to represent old granulomatous disease.	An inferred conclusion usually employed as a roentgenologic descriptor. Its use is not recommended.
fibrosis <i>n.</i> 1. (pathol.) (a) Cellular fibrous tissue or dense acellular collagenous tissue. (b) The process of proliferation of fibroblasts leading to the formation of fibrous or collagenous tissue. 2. (radiol.) Any opacity presumed to represent fibrous or collagenous tissue; applicable to linear, nodular, or stellate opacities that are sharply defined, that are associated with evidence of loss of volume in the affected portion of the lung and/or with deformity of adjacent structures, and that show no change over a period of months or years. Also applicable with caution to a diffuse pattern of opacity if there is evidence of progressive loss of lung volume or if the pattern of opacity is unchanged over time.	In radiology, an inferred conclusion often used as a descriptor. An acceptable term if used in strict accordance with the criteria cited.
fissure <i>n.</i> 1. (anat.) The infolding of visceral pleura that separates one lobe or a portion of a lobe from another. 2. (radiol.) A linear opacity normally 1 mm or less in width that corresponds in position and extent to the anatomic separation of pulmonary lobes or portions of lobes. <i>Qualifiers:</i> minor, major, horizontal, oblique, accessory, anomalous, azygos, inferior accessory.	A specific feature of anatomy.
<i>Synonym:</i> Interlobar septum.	
Fleischner's line(s) <i>n.</i> (radiol.) A straight, curved, or irregular linear opacity that is visible in multiple projections; is usually situated in the lower half of the lung; is usually approximately horizontal but may be oriented in any direction; and may or may not appear to extend to the pleural surface. Such lines vary markedly in length and width; their exact pathologic significance is unknown.	An acceptable term. However, the term "linear opacity," properly qualified with respect to location, dimensions, and orientation, is preferred. There are no synonyms ("platelike," "discoid," and "platter" atelectasis should <i>not</i> be employed as synonyms; in the absence of clear histologic evidence of the significance of Fleischner's lines, the inferred identification of such lines with a form of atelectasis is unwarranted).
fluffy <i>adj.</i> (radiol.) In describing opacities: ill-defined, lacking clear-cut margins; resembling down.	An imprecise descriptor of limited usefulness.
<i>Synonyms:</i> Shaggy, poorly defined.	
ground-glass pattern <i>n.</i> (radiol.) Any extended, finely granular pattern of pulmonary opacity within which normal anatomic details are partly obscured. Term derived from a fancied resemblance to etched or abraded glass.	A nonspecific roentgenologic descriptor of limited usefulness; the synonym is preferred.
<i>Synonym:</i> Granular pattern.	
hernia <i>n.</i> (clin./morphol./radiol.) The protrusion of all or part of an organ or tissue through an abnormal opening.	An inferred conclusion to be used only within the precise terms of the definition. Thus, in the thorax the word is appropriate in relation to the diaphragm but should not be used with reference to pulmonary overinflation and mediastinal displacement.