

DISEASES OF THE CHEST

Edited by

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CHEST**

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PREFACE

THIS book on Diseases of the Chest by thirty-one authors has involved considerable organization, and our thanks are due to the patience and good-humour of the authors of the various sections. An attempt has been made to render the volumes reasonably comprehensive, and to avoid undue overlapping. Advances, especially in the field of Chemotherapy, are developing rapidly. Valuable as they are, they may be regarded as powerful accessories to, rather than as substitutes for, established scientific techniques; and we hope that there is little in this book which will have to be discarded after standing the test of time.

A chapter on Physiotherapy has been included, a small acknowledgment of the importance of this subject to those who are responsible for the treatment of patients suffering from diseases of the chest.

Our thanks are due to Drs. M. H. Jupe, R. S. Murray, E. G. Sita-Lumsden and L. B. Stott for supplying us with x-ray photographs for reproduction; to Dr D. Barron Cruickshank, Mr. J. P. Entract, and Mr. T. Cawley for assistance in checking the Bibliography; and to Drs. I. C. Lodge Patch, H. C. Hamilton and C. Bartley for help in reading the proofs.

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June, 1952

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CHAPTER 1

BRONCHO-PULMONARY ANATOMY

A. F. FOSTER-CARTER

IN THE past twenty years the detailed anatomy of the bronchial tree and lungs has acquired great practical importance and much has been written on the subject. Nevertheless, in spite of recent advances, we must still acknowledge and admire the work of William Ewart who published his monograph on the bronchi and pulmonary blood vessels in 1889. Ewart may fairly be called the father of bronchial anatomy; with great ingenuity he succeeded in making casts of the pulmonary vessels in Wood's metal and his anatomical description was so accurate that much of it has remained unchanged to this day. He was also the first to describe the broncho-pulmonary segment, which has since become the key to our conception of pulmonary anatomy. Ewart wrote of separate "territories of ventilation" within the pulmonary lobes, each supplied by a bronchial branch and having no communication with its neighbours. The existence of these territories, which we now call broncho-pulmonary segments, has been amply confirmed by recent anatomical and embryological studies.

It is customary to think of the lung as consisting of functionally separate lobes isolated by fissures. In the early stages of development, the lung bud divides into a number of bronchial buds and these, in turn, develop into small broncho-pulmonary units within the lobes. At this early stage, the surface of the lung somewhat resembles that of a blackberry, it is covered with small protuberances, each of which is a developing bronchial bud. It is easy to picture how these buds jostle one another during development, and some may grow more strongly at the expense of their neighbours. For this reason, the broncho-pulmonary segments, which are the finished products of the bronchial buds, vary somewhat in their relative sizes in different lungs.

A broncho-pulmonary segment is a wedge of lung tissue supplied by a single bronchus and, just as the pulmonary lobes are independent of one another, so the areas of lung supplied by different bronchi within a lobe are independent, right down to the terminal lobules. For practical purposes, there is no communication between adjacent broncho-pulmonary units. When a substance, such as gelatine is injected into a given bronchus, the segment of lung supplied by that bronchus is distended with the injection mass but none of it reaches the neighbouring segments. In fact, the broncho-pulmonary units are separated by fine fibrous partitions which can be traced microscopically in the normal lung, although they are not obvious. When a broncho-pulmonary segment is infected, its limiting septa often become thickened and oedematous and they can then be seen with the naked eye (Fig. 1). Also it is not unusual to find actual partial fissures between individual broncho-pulmonary segments.

It will be seen that the lung can be divided into an almost unlimited number of segments, depending upon the size of the parent bronchi selected for description.

BRONCHO-PULMONARY ANATOMY

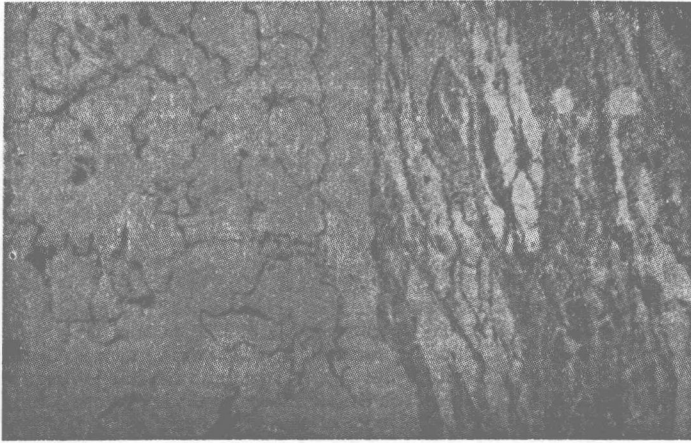


FIG. 1.—Inter-segmental boundary. The thickened and oedematous inter-segmental septum can be seen in the centre, with a normal segment on the left and a collapsed segment on the right.

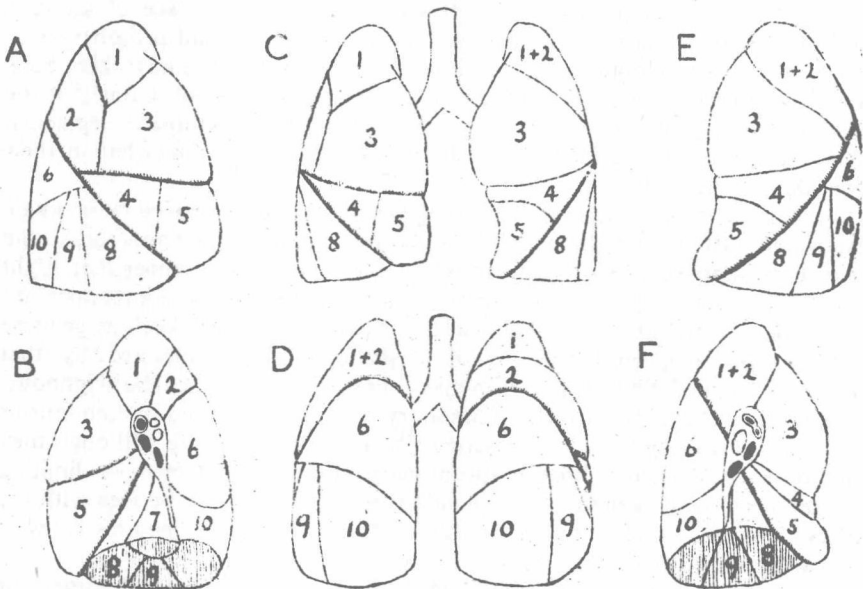


FIG. 2.—Diagram of the broncho-pulmonary segments.

A. Right lung, lateral view.

C. Both lungs, anterior view.

E. Left lung, lateral view.

B. Right lung, medial view.

D. Both lungs, posterior view.

F. Left lung, medial view.

(For key to numbering see Table.)

NORMAL BRONCHIAL ANATOMY

An arbitrary choice must be made and it is convenient to define a broncho-pulmonary segment as the area of lung supplied by a principal branch of a lobar bronchus (the upper and lower divisions of the left upper lobe bronchus must be regarded as lobar bronchi for the purposes of this description, since they are equivalent to the upper and middle lobe bronchi of the right lung). If these branches are chosen as segmental bronchi, the lungs will be divided into a reasonable number of large segments which vary very little in their distribution (Fig. 2), whereas if smaller branches are described, the whole picture becomes very complicated and the smaller units do vary considerably in their relative sizes. More important still, pathological processes usually involve the large segments and they can often be recognized radiologically.

Figs. 2 and 3 show the common arrangement of the human bronchial tree and the broncho-pulmonary segments; they are based on studies of injected specimens, dissections and casts and the nomenclature and numbering is that recommended by the Thoracic Society of Great Britain (1950) in consultation with an International Committee (*see Table*).

TABLE
NOMENCLATURE OF BRONCHIAL TREE AND BRONCHO-PULMONARY SEGMENTS

<i>Right upper lobe bronchus</i>	<i>Left upper lobe bronchus</i>
Anterior (3)	Upper division
	Anterior (3)
	Apico-posterior (1 and 2)
Apical (1)	Apical (1)
Posterior (2)	Posterior (2)
<i>Right middle lobe bronchus</i>	<i>Lingula (lower division)</i>
Lateral (4)	Superior (4)
Medial (5)	Inferior (5)
<i>Right lower lobe bronchus</i>	<i>Left lower lobe bronchus</i>
Apical (6)	Apical (6)
Medial basal (cardiac) (7)	
Anterior basal (8)	Anterior basal (8)
Lateral basal (9)	Lateral basal (9)
Posterior basal (10)	Posterior basal (10)

Fig. 4 shows a series of bronchograms corresponding to the diagrams of the bronchial tree. The bronchi of the left lung are seen best in the right anterior (or left posterior) oblique view, which should be taken with the chest at an angle of 45° to the film. This view is also demonstrated by the cast shown in Fig. 5.

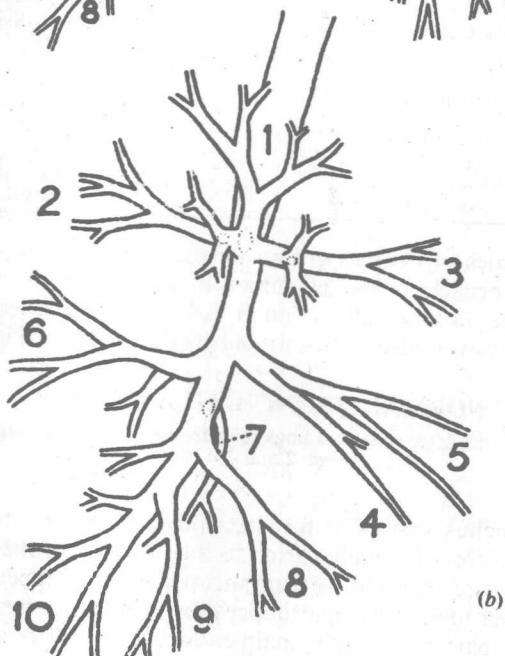
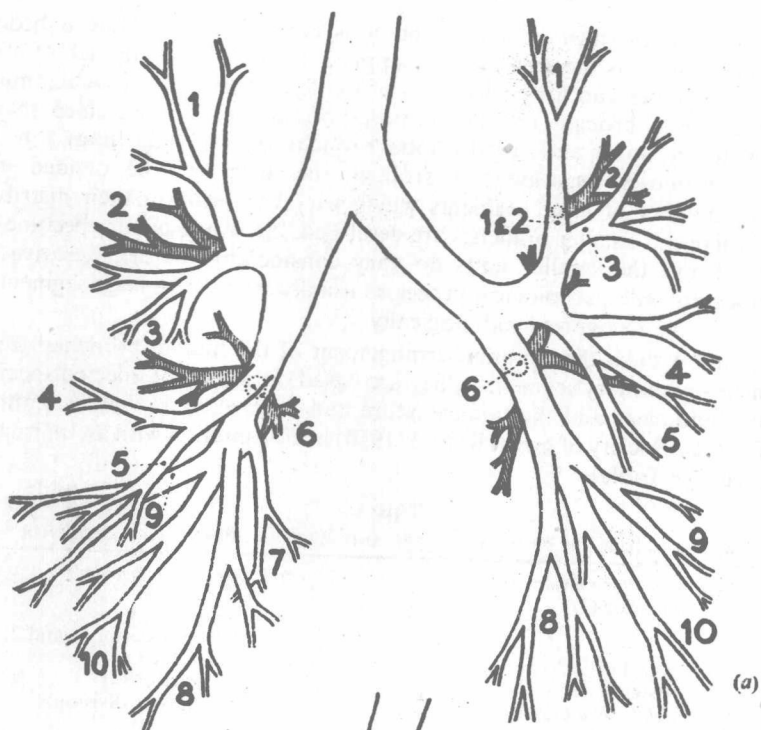
NORMAL BRONCHIAL ANATOMY

(The numerals appearing after some headings refer to the bronchi and segments shown in Figs 2 and 3.)

Right upper lobe

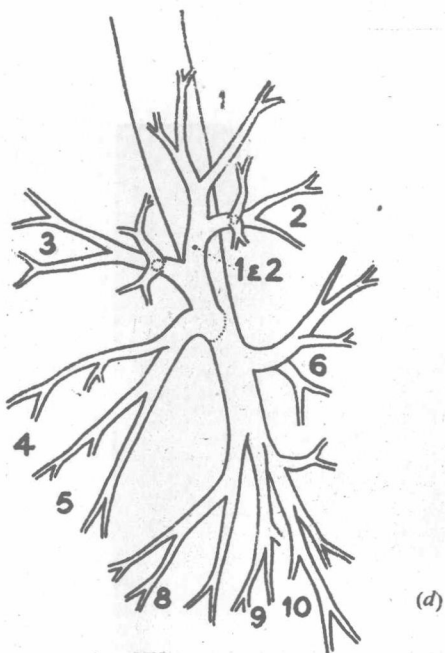
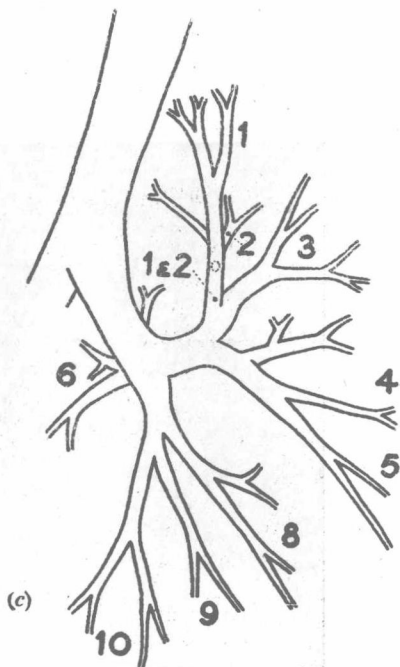
The right main bronchus is divided for descriptive purposes into two parts—an upper part extending from the main carina to the lower lip of the right upper lobe bronchus and a lower part extending from this point to the upper lip of the apical bronchus of the lower lobe. The right upper lobe bronchus arises from the lateral aspect of the upper part of the right main bronchus and after a short course of about 1 centimetre it divides into three branches.

BRONCHO-PULMONARY ANATOMY



NORMAL BRONCHIAL ANATOMY

FIG. 3.—Diagrams of the normal bronchial tree. (a) Anterior view; (b) Right lateral view; (c) Right anterior oblique view; (d) Left lateral view. (For key to numbering see Table on page 3.)



BRONCHO-PULMONARY ANATOMY

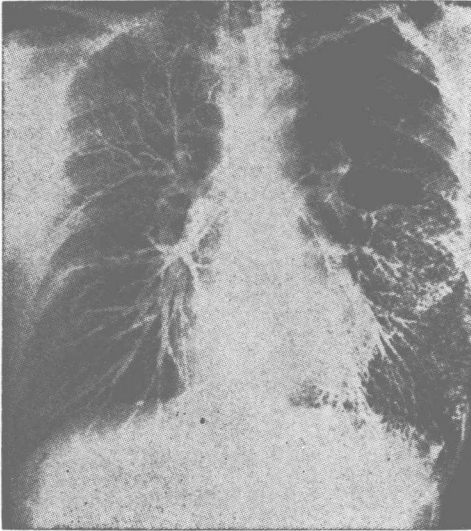
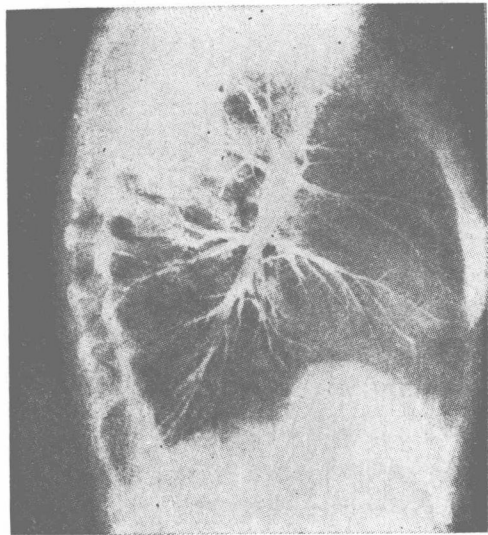


FIG. 4.—Normal bronchograms: (a) postero-anterior; (b) right lateral; (c) right anterior oblique. These bronchograms should be compared with the corresponding diagrams in Fig. 3 to identify the individual branches. (By kind permission of Dr. G. Simon.)



(b)

NORMAL BRONCHIAL ANATOMY

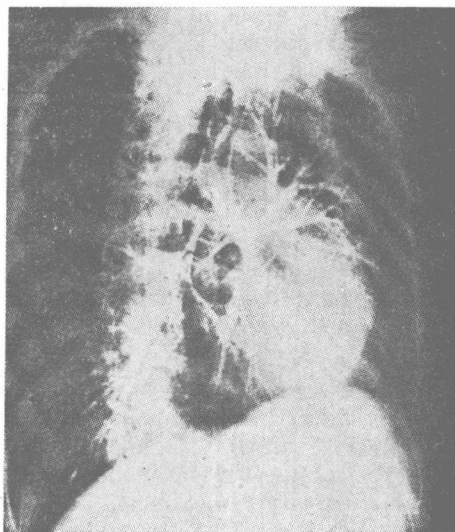


FIG. 4 (c)

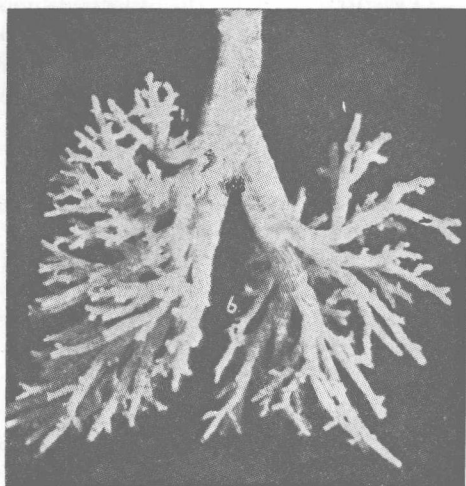


FIG. 5.—Celloidin cast of the bronchial tree at birth: Right anterior oblique view (for comparison with Fig. 3 (c)). Note the long descending, paravertebral branch of the left lower apical bronchus (6). Also the upward displacement of the apical branch of the right upper lobe bronchus (1).