

# Pulmonary Disease of the Fetus Newborn and Child

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# Preface

This text is the promised "companion volume" to *Pulmonary Physiology of the Fetus, Newborn, and Child*, which appeared in 1975. More than a companion, it is the natural continuation of ideas and principles presented in that text. Indeed contemporary physiology provides the base that generates performance in clinical medicine. We present in this volume the constituents of performance—pathophysiology, diagnostics, and therapeutics—in the field of pulmonology of the fetus, newborn, and child.

When planning this enterprise, we were asked to consider the kind of "specialist" who might be concerned with the apparently diffuse array of interests that were suggested by the title of the book. Would it be the fetologist, obstetrician, or perinatologist; or would it be the anesthesiologist or pediatrician? Our answer was, "Hopefully one and all." In other words, all these specialties might be considered properly in the domain of one specialist, a kind of developmental pulmonologist whose concern is the pulmonary system and its aberrations before, during, and after birth and continuing to adulthood. We do not believe the array diffuse; we think it is natural—as natural for the developing lung to have a specialist as it is for the "adult" lung to have a single "chest physician." We know no rational course for pre-adult pulmonary medicine outside the hands of one "specialist" who will take it from fetal life through



adolescence. If this idea comes through clearly in this book, the credit goes to the authors.

Again we must confess the book is incomplete, but the bibliographies will take the interested reader beyond its present limits. We are also aware of the seemingly uneven distribution of space among individual topics; but emphasis was placed on areas of active research and development, and on contemporary advances. We are grateful to our colleagues who have provided the material to realize these aims, and to our secretaries and the staff of our highly professional publishers, who have taken it from there to here.

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## 1

Pulmonary activity may now be examined at most stages of human development. Examination of the fetus is a clinical practicality in which techniques are in an early stage of development but hold great promise for the future. Examination of the newborn infant often presents special problems to the responsible physician, whose initial analysis in the delivery room needs to be thorough but rapid, especially when there is neonatal distress or when prior examination of the fetus has forecast a neonate at risk. The more detailed examination of the infant in the relatively serene atmosphere of the nursery begins to approach the standard examination that one would plan for a more cooperative individual. Through infancy and childhood the techniques of pulmonary examination come to include all methods that require the assistance of the patient, in addition to those in which he need be only passive.

Special features of the examination of the fetus and newborn infant with regard to the respiratory system are mentioned in this section. General principles of pulmonary physical diagnosis, which may be applicable to



both the newborn and child, are covered in the remaining sections of this chapter.

## THE FETUS

Important clinical information may be obtained by examining amniotic fluid and by monitoring several parameters of fetal cardiovascular-pulmonary function.

**Amniotic Fluid.** Because morphologic and biochemical maturation of the lung are the determinants of pulmonary stability at birth and thus of susceptibility of the newborn to respiratory distress, the recently described *amniotic fluid tests for pulmonary maturation* are now widely used clinical laboratory procedures. The tests are based on observations that (1) the fetal lung synthesizes and secretes into fetal pulmonary fluid the surface active phospholipids that establish alveolar stability at birth; (2) development of these processes determines functional maturation of the lung; and (3) examination of the phospholipid content and/or surface activity of amniotic fluid can provide a reliable estimate of fetal lung development. The most popular tests are:

(1) The *L/S ratio*, in which amniotic fluid lipids are separated by thin layer chromatography and the relative amounts of lecithin (L) and sphingomyelin (S) are compared (Fig. 1-1).

(2) The *shake test*, in which serial dilutions of amniotic fluid in ethanol are prepared, the mixtures are shaken in test tubes to produce foam, and foam stability (persistence) is evaluated (Fig. 1-2).

An L/S ratio of 2.0 or more indicates pulmonary maturation and negligible risk of respiratory distress syndrome, whereas a ratio of 1.0 or less indicates high risk. Similarly a stable foam from amniotic fluid: ethanol, 1:2, signals low risk of respiratory distress syndrome, whereas an unstable foam from a 1:1 dilution indicates high risk. It should be noted that in complicated pregnancies the relationship of the L/S ratio to gestational age may be altered. Thus, certain conditions

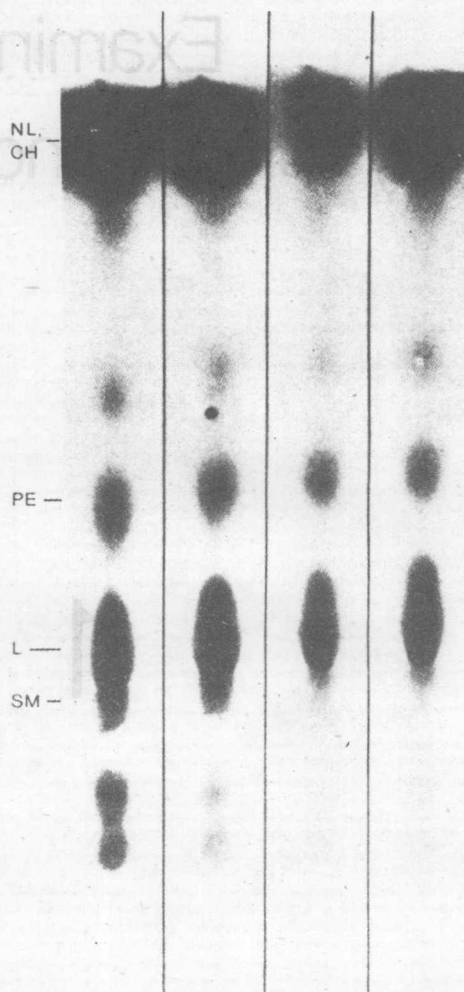


FIG. 1-1. Lecithin/sphingomyelin amniotic fluid test for fetal lung maturity. Duplicate thin layer chromatograms of lipid extracts of amniotic fluid of pregnant women. Iodine stain. NL = neutral lipids; CH = cholesterol; PE = phosphatidyl ethanolamine; L = lecithin; SM = sphingomyelin. Just below the large lecithin spot in the two chromatograms on the left is a relatively dense sphingomyelin spot, whereas the sphingomyelin spot is extremely light in the two chromatograms on the right. According to the amniotic fluid test, the lungs of the fetus in the amniotic fluid compartment of the right are more mature than those of the left. (From Scarpelli, E. M.: *Physiology and pathology of pulmonary surfactants*. *Triangle, The Sandoz Journal of Medical Science*, 10:47, 1971.)