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Breathing of Amniotic Fluid as a Normal Function of Fetal Respiration.

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The demonstration of rhythmical respiratory movements of the fetus long before term raises the question whether or not amniotic fluid normally enters the lungs before birth as a result of these movements.[1, 2, 3] In order to determine the existence of a tidal flow of amniotic fluid in the respiratory tract, India ink was added to the amniotic fluid. In a typical experiment the uterus of a rabbit at term, *i. e.*, 32 days, was exposed by laparotomy carried out beneath the surface of a bath of Ringer solution at 37°. General anesthesia was avoided by section of the spinal cord in the lumbar region, and inhibition of uterine contractions was obtained by injection of one cc. (100 rat units) of Antuitrin S (Parke, Davis & Co.) on the 25th day of pregnancy. The head of a fetus was distinguished readily through the transparent uterine wall. One cc. of 50% India ink was injected within the amniotic sac in the dorsal neck region between the ears. After intervals ranging from one to 60 minutes the trachea was closed by clamping the neck of the fetus. The lungs were examined and fixed in formalin before removal of the clamp.

Comparison was made of the lungs of fetuses which had been showing respiratory movements with those of litter-mates in which breathing had been suppressed by injection of pentobarbital sodium. In breathing fetuses, the lungs were blackened, while in contrast in apneic fetuses the lungs were normal. Microscopical examination showed carbon particles in the alveoli of the lungs of the former but not the latter.

In litter-mates which were breathing at different rates, it was found that the lungs were darker in those which showed the greater respiratory activity. For example, in a fetus breathing at a rate of 96 per min. for 5 min. after addition of one cc. of ink to the amniotic fluid, the lungs were much darker than those of a litter-mate removed after 16 minutes of breathing ink-stained fluid

1 Snyder, F. F., and Rosenfeld, Morris, *Am. J. Physiol.*, 1937, in press.

2 Wislocki, G. B., *Contrib. to Embryol., Carnegie Inst. of Washington*, 1920, **11**, 47.

3 Klemperer, H. H., *Arch. f. Gynak.*, 1933, **154**, 108.

at a rate of 10 per minute. The magnitude of the exchange afforded by fetal respiratory movements was illustrated by lungs removed within the first minute following introduction of ink within the amniotic sac. Darkening of the lung was clearly evident.

Observations are based upon 25 fetuses obtained from 7 rabbits. Fourteen fetuses were breathing at the time of injection while 11 were apneic.

In conclusion, it is clear that amniotic fluid normally occupies the alveoli of the fetal lung. The spontaneous respiratory movements of the fetus are responsible for a tidal flow in the respiratory tract. There is evidence that intrauterine respiration is of functional significance in the development of a normal lung, aiding in dilatation of the alveoli and elastic walls of the future air passages.

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Choline-Esterase Activity of Human Sera, with Special Reference to Hyperthyroidism.*

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Until 1932, the rate of enzymatic destruction of acetylcholine was determined biologically. In that year, Stedman[1] and his coworkers described a chemical method for assaying the acetylcholine splitting enzyme in the blood by titrating the acid liberated from the hydrolysis of acetylcholine at a constant pH. This esterase also acted upon butyrylcholine. In 1933, they found that the cholinesterase of human serum was relatively high and showed considerable individual variation.[2] This activity also varied widely in the different species.

In 1933, Ammon[3] employed a gasometric method by which he determined the amount of carbon dioxide liberated from a carbonate solution by the acid formed from the hydrolysis of the acetylcholine substrate. The carbon dioxide was measured in the Bar-

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1 Stedman, E., Stedman, E., and Easson, L. H., *Bioch. J.*, 1932, **26**, 2056.

2 Stedman, E., Stedman, E., and White, A. C., *Bioch. J.*, 1933, **27**, 1055.

3 Ammon, R., *Pflügers Arch. f. d. ges. Physiol.*, 1933, **233**, 486.