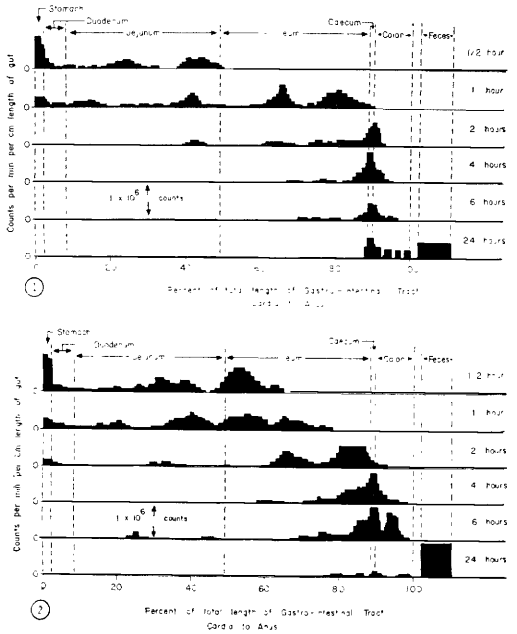

FIG. 1. Location of radiostrontium in intestine of fasted rats.

FIG. 2. Location of radiostrontium in intestine of rats previously fed *ad lib.*

2 shows similar data for the fed group. It is apparent that previous feeding increased the emptying of stomach and movement of the dose through duodenum and jejunum, but resulted in longer retention in the ileum. In the fed group, emptying of colon also occurred earlier. In all cases, distribution of the isotope was not uniform, but was concentrated in separated areas.

The method described using a radio-tracer as indicator of its progress in the gut has advantages over the bead methods of Elliott(1). Alvarez(2) and other use of inert indicators because there is no lag or separation of the tracer. The radioactive indicator does not alter progress of food as does barium(2), and unlike dye indicators it can be located accurately when mixed with feces. That progress of Sr^{89} was measured while absorption was occurring is an advantage in accord with the purpose for which the method was designed. Endogenous excretion of absorbed Sr^{89} was only 2% of administered dose in 6 hours, and only 6% dose in 24 hours(3). Krzywanek (4) observed that frequent feeding increased the rate of progress of barium meal through the intestinal tract. The present study shows that feeding also increased the movement of indicator from specific gut sites, when the indicator was administered some time after the food intake had ceased.

Advice of Dr. D. H. Copp is gratefully acknowledged.

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Plasmalogen in the Developing Brain.* (25300)

NILS E. ERICKSON† AND WILLIAM E. M. LANDS (Introduced by A. A. Christman)
Dept. of Biological Chemistry, University of Michigan, Ann Arbor

Concentration of plasmalogen is quite different for different tissues(1,2). Furthermore, Yarbro and Anderson(3) showed that plasmalogen level in a tissue may change during rapid development or differentiation of tissue so that a "characteristic" plasmalogen level must be described not only in terms of specific tissue studied but also in terms of stage of development. Since brain tissue is known to change during early development as myelin is formed(4), we were interested in the relationship of plasmalogen concentration to stage of development of the brain. Analysis of rat brain showed that the plasmalogen level

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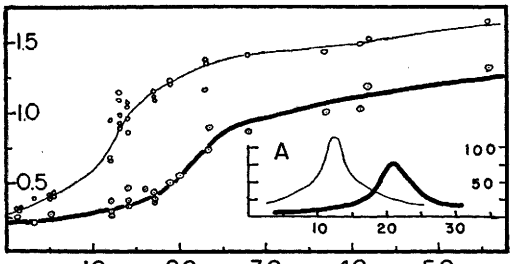
† Present address: Univ. of Washington, Seattle.



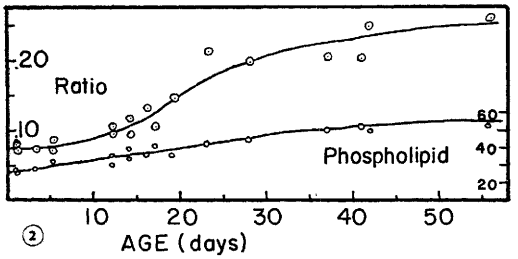


FIG. 1. Brain wt (thin line) is expressed as g of fresh tissue. Plasmalogen concentrations (heavy line) are in terms of μmoles of plasmalogen/100 mg of fresh tissue. Fig. 1A. Rate of change of brain wt (mg/day) is shown by the thin line and represents the slope of the brain wt curve. Increase in plasmalogen concentration (μmoles/g of tissue/day × 100) is shown by heavy line.

FIG. 2. Phospholipid concentrations are in terms of μmoles of phospholipid/g of fresh tissue. Ratio was calculated as μmoles of plasmalogen/μmole of total phospholipid.

is very low in 1-day-old rats but rises rapidly during second and third weeks of life. The high levels of plasmalogen, so far considered characteristic of brain, do not occur in the rat until the fourth week.

Methods. White rats (Sprague-Dawley strain), 1 to 56 days old were lightly anesthetized with ether and exsanguinated. Brains were removed, weighed, and stored at −20°C until lipid analyses were run. Lipid extract was prepared by homogenizing the frozen tissue in 4 ml of methanol, centrifuging, and treating precipitate with 3 ml of methanol. The remaining lipids were then extracted from the dehydrated tissue with two 5 ml portions of chloroform:methanol(2:1). All extracts were combined, 15 ml of chloroform were added, and the solution was washed with water(5). Phosphorus analyses were run by the Fiske and Subbarow(6) method. Plasmalogen analyses were run with Feulgen's reagents for aldehyde according to Rapport and Alonzo(7), and to avoid turbidity that occurred in the aqueous system, the colored pigment was extracted with 4 ml of isoamyl alcohol and read at 550 mμ.

Results in Fig. 1 show that the brain increased markedly in wet weight between 8 and 18 days, whereas plasmalogen concentration was relatively low for the first 2 weeks.

If rate of change of brain weight is compared with that of plasmalogen concentration (as in Fig. 1a), the rate of accumulation of plasmalogen is optimal about 10 days after maximum rate of brain growth. Burton *et al.* (8) showed that enzyme activity for cerebroside synthesis varied with time and was maximal in 11- to 18-day-old animals. This observation agrees with the concept that cerebrosides are an important constituent of myelin and are formed at a high rate during times of myelin formation. In contrast, the results in Fig. 1 suggest that plasmalogen may not be involved in the earliest steps of myelin formation. Myelin is believed to be repeated layers of oriented lipid and protein derived from the Schwann cell membrane by simply an infolding process(9). If the plasmalogen in adult nervous tissues is located almost entirely in the myelin sheath as reported by Brante(10) and the major histological development of myelin in rat is between 10 and 20 days, then plasmalogen may be added to the Schwann cell membrane after its arrangement into the characteristic spiral formation around the axon.

During brain development the concentration of both plasmalogen and total phospholipid increased (Figs. 1 and 2). If these increases were due merely to formation of more cytoplasm and cellular membranes of the same type that existed in the newborn animal, one would expect the fraction of plasmalogen in the phospholipid to remain constant. This would be in keeping with the suggestion of Rapport and Lerner(11), who found that the plasmalogen-lipid phosphorus ratio for a given organ is relatively constant. These authors also showed that a variety of neoplastic tissues had a plasmalogen to phospholipid ratio comparable to that of corresponding normal tissue. On the other hand, there is no doubt that an organ can undergo a change in lipid

composition if one type of structure within the organ develops to a disproportionate extent at some stage. Such a change occurs in the brain during myelination.

During the first 2 weeks accumulation of plasmalogen parallels that of other phospholipids so that the ratio (Fig. 2) is relatively constant (0.09 ± 0.02). This result agrees with the idea that more material of the same type is being formed. After 12 to 16 days, however, ratio increases, indicating a differential accumulation of plasmalogen. During the following 4 weeks the total phospholipids in the brain develop increasingly larger amounts of plasmalogen until a fairly constant composition (about 0.24) characteristic for adult mammalian brain tissue(1.2.11) is reached in the seventh week.

This shift in phospholipid composition to higher levels of plasmalogen does not occur in developing adipose tissue or liver. In these organs the per cent of plasmalogen in phospholipids actually decreases during the first 3 weeks(3). Although the plasmalogen-phospholipid ratio in brains of 1- to 14-day-old rats is similar to that found in a variety of other animal organs(11), ratios as high as those found in brain after 40 days have been found in only a few other sources of lipid, *viz.* ram spermatozoa(12), heart and skeletal muscle, and white matter(11). There is no apparent similarity in these sources that might relate plasmalogen content of an organ with function, but whatever the functional role of this phospholipid may be, plasmalogen becomes an increasingly significant constituent during the development of the brain.

Summary. Plasmalogen content in brains of newborn rats is about 2 μmoles/g of wet tissue and represents about 10% of total phospholipid. During growth, and after major increase in brain weight, phospholipid composition shifts to one containing about 20 to 25% plasmalogen (12 μmoles/g). Maximal rate of accumulation of plasmalogen in brain occurs in 20- to 24-day-old rats.

ADDENDUM: Somewhat similar results were reported by Korey and Orchen(13) as this manuscript was being prepared for publication.

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Progress and Rate of Absorption of Radiostrontium Through Intestinal Tracts of Rats.* (25301)

C. F. CRAMER AND D. H. COPP

Physiology Dept., University of British Columbia, Vancouver, B.C.

In the following study a method was developed for estimating the effective absorption of radiostrontium from different parts of intestinal tract. This involves not only rate of absorption in each part, but also amount available for absorption. Since strontium is very similar to calcium in its behavior (despite biological discrimination factors) it is

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