

CONTENT AND DISTRIBUTION OF PHOSPHOLIPID
FRACTIONS IN THE SPINAL CORD

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Seven phospholipid fractions were found in the entire lumbar enlargement of the cat spinal cord and also in the gray matter of the anterior, lateral, and posterior horns and in the white matter of the spinal cord. Quantitative differences were found in the content of individual phospholipids between functionally and morphologically distinct structures of the spinal cord.

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Phospholipids perform various functions in the cells and tissues of the body, for they play a structural role, they participate in the transfer of ions through membranes and the transport of electrons during oxidative phosphorylation, and they participate in a number of enzymic processes, concerned in particular with protein biosynthesis [1, 7, 10, 11]. Nerve tissue has the highest content of phospholipids. However, the study of the spinal cord from this point of view is incomplete.

The object of the present investigation was to study the qualitative and quantitative composition of phospholipids in various structures of the spinal cord: the gray matter of the anterior, lateral, and posterior horns, and the white matter. Some data have already been published [2, 3].

EXPERIMENTAL METHOD

Experiments were carried out on adult cats. After decapitation the spinal cord was removed from the animals and divided in the cold into regions selected for testing by a method developed previously [4]. Extraction of the phospholipids from the test tissues and elution were carried out by the method of Smirnov and co-workers [8]. Chromatographic fractionation of the mixture of phospholipids was carried out on paper soaked with silicic acid by Marinetti's method [12] as modified by Smirnov and co-workers [9]. Chromatograms were stained in a 0.001% aqueous solution of rhodamine 6Zh, a general test for all phospholipids. Usually 7 stains were distinguished on moist chromatograms in ultraviolet light, and these were identified by comparison with published data [9]. The content of each fraction was determined quantitatively by elution of the stains with methanol and measurement of the concentration on the FÉK-M photoelectric colorimeter.

EXPERIMENTAL RESULTS

Altogether 7 phospholipids were discovered and identified in the lumbar enlargement of the cat spinal cord: diphosphoinositide, monophosphoinositide, sphingomyelin, lecithin, serinephosphatide, ethanolaminephosphatide, and polyglycerophosphatide. These substances were found in functionally and morphologically different regions of the lumbar enlargement of the spinal cord: in the gray matter of the anterior and lateral horns, the gray matter of the posterior horns, and the white matter.

The relative percentage content of these phosphatides in the entire lumbar enlargement of the cat spinal cord and in its various parts is given in Table 1.

It is clear from Table 1 that the various phospholipids are unevenly distributed in the lumbar enlargement of the spinal cord as a whole, and in parts of it with different functional and morphological properties:

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TABLE 1. Content of Individual Phospholipids in Cat Spinal Cord (content of P in individual phospholipids given as percentage of P content in total phospholipids; $M \pm m$)

Phospholipids	No. of expts.	Whole lumbar enlargement	Gray matter		White matter
			anterior and lateral horns	posterior horns	
Diphosphatidylinositol	13	$3,3 \pm 0,34$	$3,6 \pm 0,51$	$3,9 \pm 0,36$	$2,8 \pm 0,32$
Monophosphatidylinositol	13	$5,4 \pm 0,54$	$5,7 \pm 0,26$	$5,5 \pm 0,50$	$4,9 \pm 0,46$
Sphingomyelin	13	$22,2 \pm 1,10$	$21,4 \pm 1,01$	$21,6 \pm 1,29$	$25,0 \pm 1,08$
Lecithin	13	$28,5 \pm 0,79$	$30,7 \pm 1,07$	$29,7 \pm 1,35$	$26,1 \pm 0,99$
Serinephosphatide	13	$17,8 \pm 1,28$	$16,9 \pm 0,81$	$17,0 \pm 1,28$	$17,9 \pm 1,39$
Ethanolaminephosphatide	13	$18,3 \pm 1,23$	$18,1 \pm 1,32$	$17,5 \pm 0,89$	$18,2 \pm 0,78$
Polyglycerophosphatide	13	$4,3 \pm 0,05$	$4,5 \pm 0,42$	$3,2 \pm 0,40$	$3,5 \pm 0,37$

motor and sensory regions, region of nerve fibers. Among the phospholipids detected, lecithin was present in the greatest quantity: its content was about equal in the gray matter, but somewhat lower in the white matter.

If the phospholipids are arranged in descending order, sphingomyelin occupies the second place. Its content in the white matter was higher than in the gray.

The third and fourth places are occupied by ethanolaminephosphatide and serinephosphatide, respectively. The content of these fractions was about the same in all investigated structures of the spinal cord.

The fifth place was occupied by monophosphoinositide and the sixth by polyglycerophosphatide.

Of all the phospholipids, that present in the smallest quantity was diphosphatidylinositol, and its level in the white matter was lower than in the gray matter of the posterior horns ($P < 0.05$).

These results illustrate the heterogeneity of phospholipids in the spinal cord. Functionally and morphologically different regions of the lumbar enlargement of the spinal cord contain the same phospholipids, but they differ in their quantitative content.

The hypothesis is thus confirmed that different parts (or regions) of the spinal cord, differing in structure and subserving different functions, also differ in their biochemical organization [2, 3, 6].

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