When studying the nervous system it is extremely useful to have quantitative data to reflect objectively the distinguishing features of nerve cells in different brain structures. In this respect an interesting test object is the cervical spinal cord, for it contains centers for the regulation of reflex activity of the muscles of the forelimbs, neck, chest, and diaphragm. Morphological investigations of the neuronal or fiber composition of the cervical segments [6, 7, 8, 11] have been carried out chiefly on motoneurons (laminae IX [9]); the question of the functionally important neurons of the intermediate zone of gray matter (laminae IV-VIII) have received very little attention. This paper accordingly gives certain quantitative data on the dimensions of the interneurons of these laminae in segments C1, C4, and C7 of the cat spinal cord.

Material was fixed by immersion in formalin (1 : 9). The major (a) and perpendicular minor (b) axes of nerve cells were measured in a plane passing through the nucleolus of the neuron in transverse sections 30 μ thick stained by Nissel's method. The volumes of the neurons were calculated by the equation for a triaxial ellipsoid: \( V = \frac{1.04}{3}abc \), where c is the third axis of the neuron [10]. A correction was used for the calculations of the total number of cells [5]. Altogether 4792 neurons were measured in preparations from 5 adult animals. Changes in the nerve tissue during histological treatment also were allowed for. The mean linear coefficient of shrinkage relative to the native state for gray matter, according to the writer's observations, was 0.896 ± 0.08 (M ± m).

All nerve cells measured were divided into three groups depending on the shape of their cell bodies: fusiform, triangular, and multipolar. The ratio between these groups of neurons for the cervical segments is on average close to 1 : 1 : 1, but significant differences exist between the three segments investigated [3].

Mean values of the lengths of the axes of the neurons were calculated from their individual measurements (Table 1, rows 1 and 2). Analysis showed that the mean lengths of the axes a and b for fusiform and triangular neurons were greatest in segment C7 and least in segment C4 (P = 0.01); differences between the axes of the multipolar neurons in the three segments were not significant.

Mean values of the coefficients of correlation of the axes a and b for the intermediate zone of gray matter (laminae IV-VIII) varied from 0.45 to 0.72 (Table 1, row 3). The value of this coefficient in segment C7 was
higher than in segments C₁ and C₄ for all three groups of neurons (P = 0.01). Differences between segments C₁ and C₄ were significant for fusiform and multipolar neurons (P = 0.05). The increase in the coefficient of correlation of the axes in segment C₁ could indicate some degree of stability of shape of the cell bodies, probably connected with the higher degree of specialization of the neuron nets in this segment.

Data on the distribution of neurons with different lengths of a axis are given in Table 1 (rows 4, 5, and 6). Neurons whose a axis did not exceed 30 μ were called small, those with an a axis from 30 to 50 μ long were called medium-sized, and those with an a axis over 50 μ long were called large. On average for the three segments the number of small neurons was 57.7% of medium-sized 40%, and of large 6.3%. By contrast with the results described in [4], obtained for the brain stem of man and the dog, where a higher proportion of neurons are medium-sized, the results of this investigation indicate that small neurons are predominant in the cervical spinal cord of the cat.

The mean volumes of the cell bodies of the fusiform and triangular neurons were greatest in segment C₇ and least in segment C₄ (P = 0.01). Differences between the mean volumes of the multipolar neurons in the three segments were not significant (Table 1, row 7).

Why are the values of these parameters of the interneurons greatest in segment C₇?

According to data in the literature, the relationship between growth of the brain as a whole and of individual neurons can be expressed by an equation of allometric growth: \( y = cX^k \), where \( y \) is the volume of a neuron, \( X \) the volume of the brain, \( c \) a constant of dimensionality, and \( k \) the allometric index [1]. The volumes of segments C₁, C₄, and C₇ were calculated from the mean dimensions of these segments in the cat [2] and the values obtained were compared with the mean volumes of interneurons of different shapes. The volume of segment C₇ was the greatest and that of segment C₄ the smallest. Since in this case the mean volumes of the neurons of different shapes were greatest in segment C₇, this equation proved to be completely unsuitable. An attempt was therefore made to compare the mean volumes of interneurons with the mean volumes of intermediate gray matter in these segments. Excluding volumes occupied by motoneurons of laminae IX and VIII, as well as the volumes of laminae I-III which were not studied, the result was obtained that the volume of the intermediate gray matter was greatest in segment C₇ and smallest in segment C₄. Application of the equation of allometric growth with a value of \( k = 0.886 \) gives sufficiently close agreement between the mean volumes of the fusiform and triangular neurons and the calculated values of the volumes of intermediate gray matter in these three segments. No such correlation could be found for the multipolar neurons.

The differences between the mean volumes of interneurons in segments C₁, C₄, and C₇ are thus evidently connected with differences found between the volumes of the intermediate gray matter in these segments. Meanwhile, the greater volume