

# SILICON CONTENT OF VARIOUS FORMATIONS OF THE HUMAN BRAIN

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In our earlier communications [3, 4] data were presented relating to the silicon content of human cerebrospinal fluid, blood serum, and cerebral cortex. The mean silicon contents of the cerebrospinal fluid, blood serum, and cerebral cortex were found to be 0.0193, 0.0183, and 0.0140%, respectively (as in the present paper, the figures relate to percent of ash obtained from the given material). We also found that silicon was unevenly distributed among the different cytoarchitectonic fields of the cortex. The highest silicon content (0.0239-0.0312%) was found in cytoarchitectonic fields 17 and 19, which form part of the visual analyzer. The silicon content of some of the cytoarchitectonic fields of the frontal lobe (44, 47.6 r), and in most of those of the temporal lobe (20, 21, 22), was much below the average figure (0.0066-0.0090%).

In the present paper we report our findings for the silicon content of other formations of the human brain (white matter, subcortical ganglia, stem, choroid plexus, meninges).

Only for some of these formations are there any published data for silicon content. According to G. A. Babenko [1], the thalamus has a lower silicon content than the cerebral cortex and the white matter.

## EXPERIMENTAL METHODS

For analysis we took formations of the brain of middle-aged men and women who had died as a result of traumatic injuries or drowning. Following autopsy in the Department of Forensic Medicine, in which, at our special request, examination of the brain was restricted, making sagittal and coronal sections we dissected out the parts of the brain chosen for analysis. Precaution was taken to avoid contamination of the tissues with any extraneous matter. The material was dry-ashed at 400-450°, and the resulting ash was subjected to emission spectrum analysis for silicon, using an ISP-22 spectrograph. The silicon contents were read from standard calibration curves. The results given are the means of 10 parallel determinations.

## EXPERIMENTAL RESULTS

The silicon contents of white matter taken from nine different brain formations are given in Table 1.

The silicon content of white matter was found to be from one-half to two-thirds that of cortex, and, in distinction from the cortex, to be practically the same irrespective of the part of the brain from which the sample was taken. The silicon content of the white matter of the frontal and parietal lobes was, however, slightly below that of the temporal and occipital lobes. There is thus some degree of correlation in the topography of regions of maximum and minimum silicon content of grey and white matter. The same would apply to distribution of silicon in the various parts of the corpus callosum. The dorsal parts of the corpus callosum, through which proceed a high proportion of fibers from the temporal lobe (which has the lowest silicon content), contain less silicon.

The subcortical ganglia and the various formations of the brain stem also have a lower silicon content than does the cortex (Table 2).

The formations of the neostriate system (internal capsule and caudate nucleus) have a slightly higher silicon content than do the globus pallidus and the diencephalic formations (thalamus, hypothalamus). The pons has a lower silicon content than the cerebral peduncles together with the corpora quadrigemina and the medulla oblongata.

The data of Table 3 relate to the meninges and the choroid plexuses of the brain. These formations are richer in silicon than are any other parts of the brain, including the cortex. The silicon content is particularly high in the dura mater, being ten times as great as in blood serum and in the cerebral cortex. Accumulation of silicon in the meninges and choroid plexuses seems to be related to that aspect of the biological role of this element, of contributing to the strength of epithelial and connective tissue formations [2].

TABLE 1. Silicon Content of White Matter of Different Human Brain Formations (mean percentage content of ash)

Formation examined	Silicon content
Frontal lobe	0.0033
Parietal lobe	0.0048
Occipital lobe	0.0041
Temporal lobe	0.0036
Genu of corpus callosum	0.0058
Trunk of corpus callosum	0.0022
Splenium of corpus callosum	0.0039
Cingulum	0.0047
Fornix	0.0049

TABLE 2. Silicon Content of Subcortical Ganglia and Brain-Stem Formations (mean percentage content of ash)

Formation examined	Silicon content
Putamen	0.0043
Globus pallidus	0.0036
Caudate nucleus	0.0044
Thalamus	0.0038
Hypothalamus	0.0024
Cerebral peduncles with corpora quadrigemina	0.0041
Pons	0.0034
Medulla oblongata	0.0049

TABLE 3. Silicon Content of the Meninges and Choroid Plexus of the Brain (mean percentage content of ash)

Formation examined	Silicon content
Dura mater	0.1946
Pia mater	0.0747
Choroid plexus	0.0202

Thus the different formations of the brain have different silicon contents. The meninges and choroid plexuses have the greatest capacity for accumulating silicon, followed by the cerebral cortex. The silicon content of white matter, subcortical ganglia, and the brain stem is relatively small, being highest in the white matter of the genu of the corpus callosum, the neostriate system, and the medulla oblongata.

#### SUMMARY

The silicon content of various parts of the human brains (white matter, subcortical ganglia, stem, choroid plexus, meninges) was determined by means of emission spectrum analysis. The highest values (0.020-0.1946% of ash) were found in the meninges and choroid plexuses. The silicon content of white matter varied from 0.0022 to 0.0058% of ash, higher values being found for material from the parietal and occipital lobes than from the frontal and temporal lobes. In subcortical formations, relatively low values were found for the ganglia (0.0024-0.0044% of ash), while the neostriate system and the medulla oblongata had a somewhat higher silicon content.

#### LITERATURE CITED

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