

SILICON CONTENT IN THE HUMAN CEREBRAL CORTEX

V. A. Del'va

A. M. Gorkii Medical Institute, Stalino, Donbass

(Presented by S. E. Severin, Active Member, Academy of Medical Sciences, USSR)

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Silicon is a constant mineral component of the human and animal brain. This was shown by the research scientists A. O. Voinar and A. K. Rusanov [3], V. N. Galakhova, [4], G. A. Babenko, [2] King, Dolan, [8] and other authors. According to Babenko's findings, individual sections of the human brain contain different amounts of silicon. Most of the silicon is in the cerebral cortex - up to 0.3% in the ash content; the white matter and subcortical ganglia contain less. G. A. Babenko also found unequal amounts of silicon in the cortex of different lobes of the cerebrum and an asymmetry in the content of this microelement in similar formations of the right and left hemispheres. The content of silicon in the human brain changes with age.

In a previous report [7] we showed that silicon is constantly present in human cerebrospinal fluid. Under conditions close to the normal, the amount of silicon in human cerebrospinal fluid does not exceed 0.02% of the ash content, approximately the same as the silicon content in human blood serum. In some diseases of the nervous system (infectious and post-traumatic), we noted an increase in the amount of silicon in the cerebrospinal fluid - up to 0.07% of the ash content - which was accompanied by a lowering of the silicon content in the blood.

In the present communication we furnish data on the topography of silicon in the cortex of the human brain, with reference to the cytoarchitecture.

Amount of Silicon in Different Cytoarchitectonic Fields of the Human Cerebral Cortex

Cytoarchitectonic fields and sub-fields	Ave. content of Silicon (in percent of the ash)
10	0,0137
9	0,0127
8	0,0131
46	0,0127
47	0,0090
45	0,0111
44	0,0090
4	0,0104
6 (Middle Sector)	0,0208
6p	0,0069
6op	0,0163
1 (Upper Sector)	0,0150
1 (Middle Sector)	0,0127
1 (Lower Sector)	0,0155
40	0,0110
7	0,0123
39	0,0107
37	0,0100
20	0,0066
21	0,0077
22	0,0072
17	0,0312
19	0,0239
23	0,0163
24	0,0140
25	0,0177
13	0,0236
14	0,0217

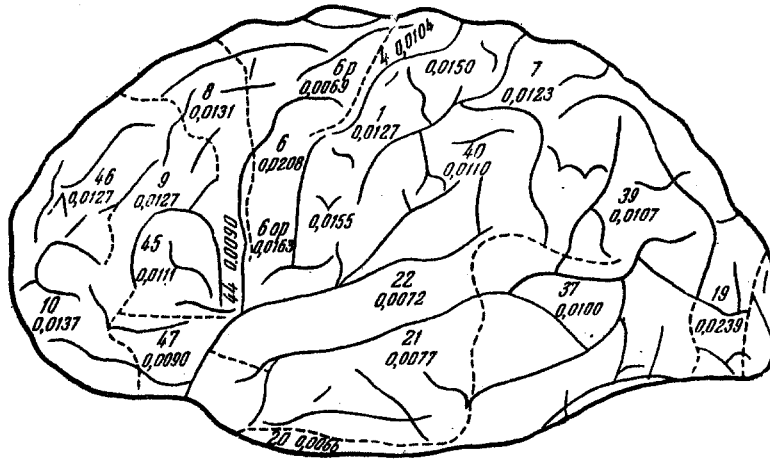
METHOD

We studied the cerebral cortex of middle-aged men and women who had died as a result of mechanical trauma in accidents and were being entered for autopsy at the Department of Forensic Medical Expertise of the A. M. Gorkii Medical Institute in Stalino (Department Head - B. N. Zorin). After forensic medical examination of the brain, which, at our request, was as sparing as possible and limited generally to one sagittal and horizontal section, we established the territory of the fields we were examining in the cortex of the brain, on the basis of an atlas of the cytoarchitectonic fields. [1] We used the fissures and gyri as orientation in judging the boundaries of a field. We separated the soft cerebral membrane from the cytoarchitectonic field designated for study. We removed a block of the cortex from the center of the field, avoiding the limitrophic zones located at the edges of the field. We carefully separated the cortex from the attached white matter. The glass containers into which we placed the blocks of cortex taken for study, and also the pincers and scalpel with which the preparations were made, were washed in distilled water before they were used.

The amount of silicon in the cytoarchitectonic fields was assayed, by emission spectral analysis, at the Department of Biochemistry of the Stalino Medical Institute (Department Head - Prof. A. O. Voinar). Details of the spectrochemical method were reported earlier by us [7]. In all, 280 analyses of the cerebral cortex from 28 different cytoarchitectonic fields were made. The content of silicon was determined in percent of the ash.

RESULTS

It can be seen from the data in the table that the amount of silicon in the majority of the cytoarchitectonic fields examined ranged within the limits 0.0100-0.0177 percent of the ash. The average value of the silicon content in the cerebral cortex was 0.0140% of the ash.



Content of Silicon in the Cytoarchitectonic Fields of the Dorso-Lateral Surface of the Human Brain.

It is possible to single out a field with higher or lower silicon than the average. The highest silicon content (0.0312-0.0239% of the ash) was detected in the 17th and 19th cytoarchitectonic fields, which enter into the composition of the optical analyzer. At the present time there are no data on whether silicon plays any determining role in the processes connected with the functions of sight. Nevertheless, it is known that the cortex of the optical analyzer, in particular, of the 17th field, is characterized by unusual physico-chemical properties in addition to the morphological features noted macroscopically. Thus, according to the findings of A. O. Danilova [6] the cells of the 17th field are distinguished from the cells of all other cytoarchitectonic fields by the fact that they possess the highest level of absorption of ultraviolet rays. A large amount of silicon has been reported in the cytoarchitectonic fields of the insula - in the 13th and 14th. A low content of silicon (one thousandth of one percent of the ash) was found in the 20th, 21st and 22nd fields, which make up the temporal lobe, and also in some of the cytoarchitectonic fields of the frontal lobe (47, 44 and 6r). In the frontal lobe fields the content of silicon ranges within extreme limits (see Figure). According to the findings of G. Ya. Gorodinsskaya [5] the irregularity of distribution of lipoids in the frontal lobe is also significantly expressed.

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