# CHANGE IN SORPTION PROPERTIES OF BRAIN TISSUE OF MICE UNDER THE INFLUENCE OF CERTAIN NARCOTIC DRUGS AND OF CAMPHOR

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(Received for Publication on December 18, 1955. Submitted by Acting Member of the Acad. Med. Sci. USSR D. N. Nasonov.)

It has been shown that when living protoplasm is subject to various stimuli its capacity to take up basic and acid dyes is increased. D. N. Nasonov and V. Ya. Aleksandrov [1] established that upon denaturation of native proteins, intensification of their sorption properties in relation to dyes also occurs. On the basis of a number of findings these authors have advanced the hypothesis that upon stimulation by this or that agent there occur reversible changes in proteins akin in nature to the initial stages of denaturation of native albumens. Subsequently it was established that intensification of staining of nerve cell protoplasm and outgrowths can also be observed under the influence of natural, physiological stimuli [2, 3, 4, 5, 9].

It was shown by us [4] that upon narcosis swelling of the colloids of the brain decreases and the amount of water in the brain tissue correspondingly diminishes. It is known that these shifts are one of the signs of a reversible denaturated state of albumens. According to D. N. Nasonov and K. S. Ravdonik [6] the most typical sign of paranecrosis and denaturation is, alongside a fall in hydrophilia, an increase in the capacity of the protoplasm to take up dyes.

Our investigations on the state of cerebral colloids with narcosis and also the findings in the literature on the sorption properties of muscular albumens in different states of the animal led us to investigate the sorption properties of the cerebral tissue upon inhibition of the central nervous system induced by various narcotic drugs and with excitation produced by camphor.

In the first series of experiments the influence of ether, urethane, Barbamyl and Medinal was studied. Ether fumes, mixed with air, were inhaled by the mice under a glass bell jar. The sorption properties of the brain were investigated at the moment of excitation (3-5 minutes after administration of the ether), then after 40 minutes of deep sleep and finally when the animals awoke. Urethane was introduced subcutaneously at a volume of 0.3 ml 10% solution, Barbamyl 0.1 ml of 2.5% solution and Medinal 0.3 ml of 1% solution. The sorption properties of the brain tissue under the influence of these narcotic drugs were determined at the same times as with ether narcosis.

In the course of the first few minutes of the effect of the narcotic drug the mice were in a state of excitation after which sleep set in. In the various phases of the action of the narcotic drug the animals were decapitated, the brain extracted and examined for change in sorption properties in this state of the animal.

In the second series of experiments, for the purpose of comparison, the sorption properties of the brain tissue under the influence of convulsion doses of camphor were investigated. The camphor was introduced subcutaneously in white mice at a volume of 0.4 ml of 20% solution. 5-7 minutes after introduction the first convulsion appeared, then after a pause lasting from 10-15 minutes, the second bout of convulsions started. Some of the mice were decapitated at the moment of the first bout of convulsions and some in the period of the second bout, the extracted brain was examined for sorption capacity.

In each experiment both the control (without the influence of the substances) and the experimental (under the influence of the narcotic drugs or camphor) white mice were decapitated, the brain rapidly extracted and placed for 10 minutes in Ringer solution. Then the brain was removed from the solution, dried by means of a piece of filter paper and placed for 30 minutes in 0.05% neutral red in Ringer solution at a temperature of 20°C. After 30 minutes the brain was removed, rinsed with Ringer solution, dried with filter paper and placed for 12-16 hours in acidified 70° spirit for extraction of the sorbed dye. In order to determine the amount of extracted dye the alcoholic extract was subjected to colorimetry, conversion was made to one unit of brain weight, and the results were determined in percentages in relation to the control. Where, in the experiment, the staining exceeded the control, the result was designated with the sign +, when this was not the case, with the sign -.

The findings were subjected to statistical treatment in order to establish the reliability of the results obtained (see table).

TABLE

Influence of Narcosis and of Consulsion Doses of Camphor on the Sorption Properties of Brain Tissue

| Designation of active substance and its dose | Time of taking of tissue for investigation | Number of experiments | Excess concentration of dye in brain tissue (in %) | |
|---|---|---|---|---|
| | | | Average arithmetical mean (M) | Average quadratic error (m) |
| Ether | in 4-7 minutes | 20 | +5.9 | ±2.2 |
| | in 40 minutes | 22 | + 19.8 | ±5.60 |
| | upon waking up after 40 minutes sleep | 18 | +9.80 | ±1.96 |
| Urethane (0.3 ml of 10% solution) | in 3-5 minutes | 10 | +7.7 | ±0.003 |
| | in 40 minutes | 60 | +14.1 | ±4.60 |
| | upon waking up after 4-6 hours sleep | 14 | -0.4 | |
| Barbamyl (0.1 ml of 2.5% solution) | in 4-5 minutes | 15 | +9.0 | ±0.8 |
| | in 40 minutes | 17 | +15.0 | ±4.70 |
| | upon waking up after 2-6 hours sleep | 16 | -1.4 | |
| Medinal (0.3 ml of 1% solution) | in 4-5 minutes | 9 | +6.2 | ±1.1 |
| | in 40 minutes | 10 | +15.0 | ± 1.85 |
| | upon waking up after 2-4 hours sleep | 13 | -2.3 | |
| Camphor (0.4 ml of 20% solution) | in 1st bout of convulsions | 21 | +7.6 | ±2.5 |
| | in 2nd bout of convulsions | 15 | +9.9 | ±3.6 |

The findings were subjected to statistical treatment in order to establish the reliability of the results obtained (see table).

The findings provide evidence that ether narcosis intensifies the sorption capacities of nerve tissue. With this at the first moment of action of ether (in a state of excitation) and when the animal awoke from narcotic sleep the brain tissue took up the dye to a lesser degree than with deep ethereal sleep.

In addition, it is clear from the data presented that urethane, Barbamyl and Medinal in the first few minutes of their action raise the capacity of brain tissue to take up dye. These properties of the nerve tissue appeared even more markedly within 40 minutes of the effect of these narcotic drugs, while, when the animal awoke, the sorption properties of the nerve tissue fell in comparison with the control.

The results of the experiments with camphor show that both the first and second bout of convulsions are accompanied by an increase in the sorption properties of brain tissue.

The degree of increase in the sorption properties of the brain tissue of the experimental animals under the influence of convulsion doses of camphor was similar to that observed in the first phase of action of the narcotic drugs but less than those sorption properties which were noted in the brain of white mice in the period of deep narcotic sleep.

Consequently both in a state of excitation, induced by the convulsion doses of camphor, and in inhibition induced by various narcotic drugs the sorption capacity of the brain tissue rises and in the latter case to a larger degree than under the influence of camphor.

It is noteworthy that different phases of narcotic effect correspond to different degrees of sorption activity of the brain tissue and deeper narcotic sleep corresponds to greater increase in the sorption properties of brain tissue.

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* In Russian.