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THE NATURE OF AXONAL ARBORIZATION OCCURRING UNDER THE ACTION OF LOW-FREQUENCY ELECTROMAGNETIC FIELDS

Pivovarenko Y.V. ✉ The nature of axonal arborization occurring under the action of low-frequency electromagnetic fields.
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ABSTRACT. Background. Previously, it was found that the drying of salt solutions prepared on water with a negative charge is accompanied by the arborization of salt crystals, i.e. – the formation of needle- or plant-shaped crystals. It was also found that low-frequency electromagnetic fields stimulate the regeneration of damaged neurons. **Objective**. The aim of the work was to test the hypothesis that negative electrization of the cytoplasm of neurons, as well as their axonal arborization, can occur under the influence of low-frequency electromagnetic fields. **Methods**. For the negative electrization of aqueous solutions of chlorides, various low-frequency (0 ÷ 100 Hz) EMF generators were used. Negative electrization of aqueous solutions of chlorides was visualized using the method of sensitive crystallization. **Results**. It is shown that under the action of low-frequency electromagnetic fields, arborization of chlorides, which are the main salt components of the cytoplasm of cells, including neurons, occurs. This made it possible to explain the nature of axonal arborization of damaged neurons, which is observed under the influence of low-frequency electromagnetic fields in vivo. **Conclusion**. Under the action of low-frequency electromagnetic fields, negative electrization of aqueous solutions of chlorides occurs. By preliminarily optimizing the content of chlorides in the body, it is possible to create optimal conditions for the axonal arborization of neurons and the formation of new capillaries using low-frequency electromagnetic fields.
Key words: arborization, neuron, regeneration, axonal arborizations, electromagnetic field.

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Introduction

It was previously shown that the shape of the crystals formed after evaporation of salt solutions depends on the sign of the electric potential of the water used for preparing such solutions. It has been particularly shown that the evaporation of salt solutions with positive electric potential is accompanied by the formation of cubic crystals and the evaporation of salt solutions with negative electric potential is accompanied by the formation of needle-like crystals (fig. 1, 2) [1-4].

It is especially important that the described regularities are performed for chloride crystals (fig. 3), which are the main salt component of human cells [1].

A particularly clear confirmation of the validity of the established dependence, with respect to sodium chloride, was obtained by using sorbents that acquire opposite surface charges in an aqueous medium. First, it is activated carbon, which acquires a positive surface charge due to the sorption of aqueous hydrogen ions H^+, and, secondly, it is silica gel acquiring a negative surface charge due to sorption of aqueous hydroxyl ions OH^- [5].

Fig. 1. It is the crystals that formed after the drying of solutions of KH_2PO_4 prepared on water potentials of +250 mV (left) and –250 mV (right) [1-4].

Thus, it was found that numerous cubic crystals are formed on the surface of the drying activated carbon, which was previously moistened with an aqueous solution of sodium chloride (fig. 4, left); even more numerous filamentous crystals, the plexus of which resembles cotton wool, are formed on the surface of the drying silica gel, which was also pre-moistened with an aqueous solution of sodium chloride (fig. 4, right) [1].

Fig. 2. It is the crystals that formed after the drying of solutions of $CuSO_4$ prepared on water potentials of +250 mV (left) and –250 mV (right).

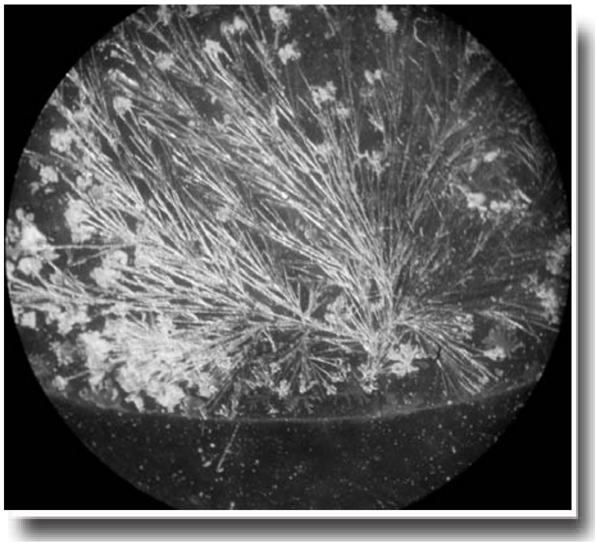

Fig. 3. Crystals formed after drying of the NaCl solution prepared with water with the potential of –200 mV [1].

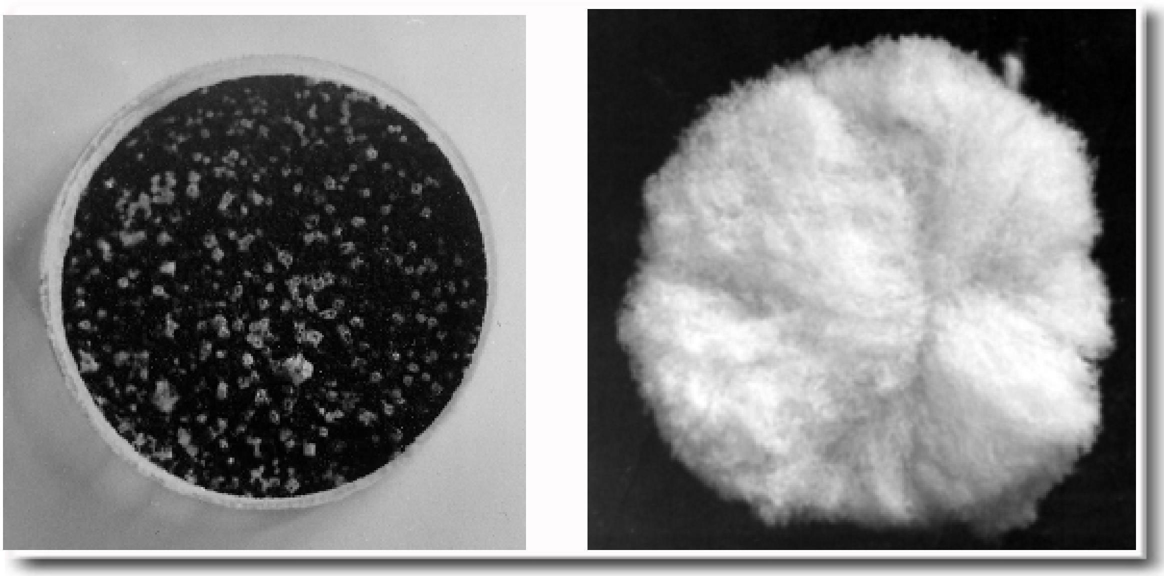

Fig. 4. This is how NaCl crystals appear on the positively charged surface of activated carbon (left) and on the negatively charged surface of silica gel (right) [1].

No less important, in the aspect of the topic of this article, was the confirmation of the detected correlation with respect to substances of non-salt nature (fig. 5) [2, 3].

All these results have led to the conclusion that in contact with the negatively charged water is the formation of filamentous or tree-like structures of substances of different chemical nature. This conclusion stimulated the emergence of interest in the conditions and physical factors causing arborization. To a large extent, these studies were stimulated by the ideas of those neurophysiologists and neurologists who identify the conditions that cause the arborization of salt crystals, with the conditions under which the arborization of neural axons occurs [6]. In this aspect, it was impossible not to pay attention to the successful regeneration of damaged neurons under the influence of low-frequency EMFs [7-20]. This suggested that low-frequency EMFs can cause negative electrization of aqueous solutions, i.e. – to form the conditions necessary for the arborization of their contents. Here are the results of experimental verification of this assumption.

Aim

The aim of the work was to test the hypothesis that conditions for the arborization of chlorides arise in low-frequency electromagnetic fields, and, consequently, for the arborization of neural axons.

Materials and methods

A sensitive crystallization method was used.

Various low-frequency (0 ÷ 100 Hz) EMF generators were used for negative electric power of chloride aqueous solutions. All salts were purchased from «Ukreachim» (Ukraine).

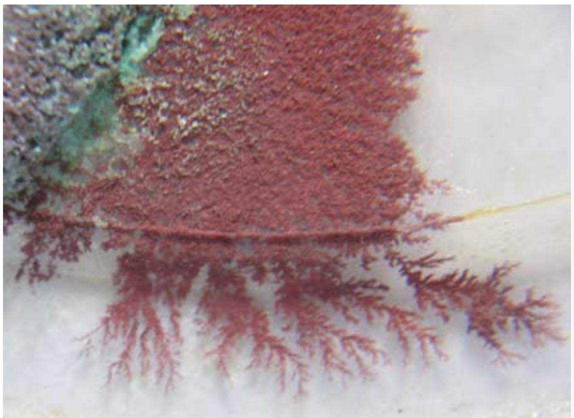

Fig. 5. It is a copper powder located near the boundary of waters with positive (above the line) and negative (below the line) potentials [2, 3].

Results and discussion

Since chlorides are the main salt components of the neural cytoplasm, the effect of low-frequency EMFs on the crystallization of various chlorides was studied in the first place. In the course of numerous experiments it was found that the tree crystals are formed by drying different solutions of chlorides, previously exposed to variable EMFs low frequency (0 – 100 Hz), including direct (fig. 6,7). Thus, the assumption made by a priori was confirmed experimentally.

Fig. 6. Crystals formed after drying of an aqueous solution of CuCl2, previously exposed to low-frequency (0÷100 Hz) EMFs. For contrast, the crystals formed were treated with ammonia vapors.

Fig. 7. Crystals formed after drying of an aqueous solution of CuCl2, in which was previously a direct current.

The results obtained allow us to offer a clear explanation of how low-frequency EMFs can cause negative electrization in the cytoplasm of neurons. This explanation is convenient to present in the form of a chain of facts:

1) Under the influence of low-frequency EMFs in the cytoplasm of neurons there are electric currents.

2) When electric currents flow in solutions containing chloride anions, at least two chemical reactions occur [5]:

1. $H_2O \rightarrow H_2 + O^*$ (in fact, the electrolysis of water);

2. $O^* + Cl^- \rightarrow ClO^-$.

These reactions show how the concentration of dissolved hydrogen gas can increase in the cells of intact nerve fibers under the action of low-frequency EMFs. As at contact with gaseous hydrogen water and water solutions receive a negative charge [5], there will be a negative electrization of intact nerve fibers. Therefore, under the influence of low-frequency EMFs can be created conditions that contribute to the arborization of the contents of the cytoplasm of neurons, and as a consequence-the formation of new dendroid residues of neurons.

Thus, due to the obtained results and clear explanation, the described cases of restoration of innervation of the affected tissues under the action of low-frequency EMFs [7-20], received a clear physico-chemical justification. It should be noted that the proposed explanation of the mechanism of restoration of neurons under the action of low-frequency EMFs is not consistent with the previously proposed explanations of other authors, who, however, did not explain the nature of arborization [19, 20].

It seems appropriate to make two relevant additions. Given that sodium chloride is the most common salt component of blood plasma, it can be assumed that the capillaries are also able to be updated and under the influence of low-frequency EMFs.

Also, given that the heart is the most powerful source of low-frequency EMFs in the human body, it can be assumed that the activity of the heart determines the ability of neurons and capillaries to regenerate. Agree, this assumption allows you to expand existing ideas about the functions of the heart. It is advisable, for example, to consider the possible effect of cardiac EMFs on the formation of both the nervous and circulatory systems of the developing fetus.

Conclusion

The low-frequency EMFs can cause negative electrization of aqueous solutions, i.e. – to form the conditions necessary for the arborization of their contents. For this reason, low-frequency EMFs can stimulate the arborization of both neural axons and blood capillaries, stimulating their regeneration.

Feather research perspectives

To demonstrate that low-frequency EMFs stimulate arborization axons and capillaries in vivo.

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Пивоваренко Ю.В. Природа аксональної арборизації, що відбувається за дії низькочастотних електромагнітних полів.

РЕФЕРАТ. Актуальність. Раніше було встановлено, що висихання сольових розчинів, приготованих на воді з негативним зарядом, супроводжується арборизацією сольових кристалів, тобто – утворенням кристалів голко- або рослинної форми. Також було встановлено, що низькочастотні електромагнітні поля стимулюють регенерацію ушкоджених нейронів. **Мета.** Метою роботи була перевірка гіпотези про те, що за дії низькочастотних електромагнітних полів можуть відбуватися негативна електризація цитоплазми нейронів та їх аксональная арборизация. **Методи.** Для негативної електризації водних розчинів хлоридів застовували різні низькочастотні (0 ÷ 100 Гц) генератори ЕМП. Негативну електризацію водних розчинів хлоридів візуалізували за допомогою методу чутливої кристалізації. **Результати.** Показано, що за дії низькочастотних електромагнітних полів відбувається арборізація хлоридів, які є основними сольовими компонентами цитоплазми клітин, в тому числі нейронів. Це дозволило пояснити природу аксональной арборізаціі пошкоджених нейронів, яка спостерігається під впливом низькочастотних електромагнітних полів in vivo. **Підсумок.** За дії низькочастотних електромагнітних полів відбувається негативна електризація водних розчинів хлоридів. Попередньо оптимізувавши вміст хлоридів в організмі, за допомогою низькочастотних електромагнітних полів можна створити оптимальні умови для аксональної арборизації нейронів та утворення нових капілярів.

Ключові слова: арборизації, нейрон, регенерація, аксон, електромагнітне поле.

Пивоваренко Ю.В. Природа аксональной арборизации, происходящей под действием низкочастотных электромагнитных полей.

РЕФЕРАТ. Актуальность. Ранее было установлено, что высыхание солевых растворов, приготовленных на воде с отрицательным зарядом, сопровождается арборизацией солевых кристаллов, т.е. – образованием кристаллов игло- или растениевидной формы. Также было установлено, что низкочастотные электромагнитные поля стимулируют регенерацию поврежденных нейронов. **Целью** работы была проверка гипотезы о том, что под действием низкочастотных электромагнитных полей могут происходить отрицательная электризация цитоплазмы нейронов и их аксональная арборизация. **Методы.** Для отрицательной электризации водных растворов хлоридов использовались различные низкочастотные (0 ÷ 100 Гц) генераторы ЭМП. Отрицательную электризацию водных растворов хлоридов визуализировали с помощью метода чувствительной кристаллизации. **Результаты.** Показано, что под действием низкочастотных электромагнитных полей происходит арборизация хлоридов, являющихся основными солевыми компонентами цитоплазмы клеток, в том числе нейронов. Это позволило объяснить природу аксональной арборизации поврежденных нейронов, которая наблюдается под воздействием низкочастотных электромагнитных полей in vivo. **Заключение.** Под действием низкочастотных электромагнитных полей происходит негативная электризация водных растворов хлоридов. Предварительно оптимизировав содержание хлоридов в организме с помощью низкочастотных электромагнитных полей, можно создавать оптимальные условия для аксональной арборизации нейронов и образования новых капилляров.

Ключевые слова: арборизации, нейрон, регенерация, аксон, электромагнитное поле.