но со снижением биодоступности NO из-за его взаимодействия с кратковременно образующимися активными формами кислорода.

Дилатация кольца аорты контрольных крыс начиналась при концентрации 10^{-7} М и составляла 22,7%. При этом максимальная дилатация развивалась при концентрации ацетилхолина в перфузионном растворе 3×10^{-5} М и достигала 63,6%. Введение параквата *in vivo* (внутрибрюшинно) не приводило к изменению эндотелий зависимой вазодилатации. В группе животных, у которых изолированный фрагмент аорты был обработан паракватом *in vitro*, снижался вазодилататорный ответ изолированного кольца аорты на 20% при кумулятивном добавлении в перфузионный раствор ацетилхолина по сравнению с контрольной группой животных. Для объяснения полученных результатов следует учитывать, что непродолжительная инкубация фрагментов аорты крысы в присутствии параквата будет сопровождаться отвлечением НАДФН из реакций, обеспечивающих образование вазодилататора монооксида азота [3].

Заключение. Продемонстрирована возможность изучения тонуса аорты крыс: 1) при прямом окислительном повреждении структурно- ферментативных ансамблей клеток эндотелия за счет циклических окислительно-восстановительных реакций введенного *in vivo* параквата; 2) за счет отвлечения НАДФН из реакций, катализируемых эндотелиальным изоферментом NO-синтазы и 1, 2, 4 и 5 изоферментами НАДФ-оксидазы, что приводит к нарушению сигнальных путей, регулирующих контрактильные функции гладких мышечных клеток.

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EFFECT OF COPPER SULFATE (II) ON THE BIOCHEMICAL PARAMETERS IN TISSUES GASTROPODS HYDROBIONTS

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In recent decades, in the ecosystems of water bodies there are changes that occur due to natural environmental factors, and under the influence of human activities. Therefore, special importance is research the laws of shellfish reactions to changing environmental conditions. Threaten aquatic life activity by heavy metals and their compounds [1].

One of the priorities now is to identify early changes morphofunctional state shellfish when exposed to pollutants. These biomarkers can determine the toxic effects of pollutants on ecosystems, before they occur at the population level [2].

The purpose of the study – evaluate the effect of copper sulfate (II) on the metabolism of pulmonary freshwater aquatic organisms living in natural waters.

Material and methods. For studies of clams were collected manually, and then subjected to a 15-day acclimatization: volume 100 liter aquariums, density planting shellfish 3 copies/L, water temperature 20–22 ° C, pH 7.2–7.7. The tanks used to stand for one day tap water. Every day is being replaced 1/3 of its volume. The animals are fed with fresh dandelion leaves or lettuce. To simulate contamination of reservoirs salts of heavy metals is performed toxicological experiments (2 days) with copper sulfate (II).

Findings and their discussion. Since the contamination of aquatic ecosystems is one of the leading positions occupied by heavy metals has been analyzed and complex changes in the body of freshwater shellfish lung by the action of toxicants. The aquatic organism heavy metals arrive by diffusion or by adsorption from the environment.

The action of copper sulfate salts exhibits rapid physiological response - mucus enveloping body; swelling of the head and legs (an extreme form - falling out through the mouth of the shell). A decrease in body weight and total immobilization.

Table 1 – Effect of copper sulfate (II) to glucose (mlmol/l), glycogen (mg/g), catalase activity (micromoles/min/g), ALT (U/L) in the hepatopancreas *Lymnaea stagnalis* ($M \pm m$)

Group, (n = 9)	Indicator			
	Glucose, mlmol/l	Glycogen, mg/g	Catalase activity, micromoles/min/g	ALT activity, U/L
Control	0,37±0,011	26,91±0,474	5,07±0,15	45,91±1,47
CuSO4, 0,01mg/l	0,6±0,027*	27,72±0,502*	3,92±0,26*	37,80±1,11
CuSO4, 0,1 mg/l	1,0±0,032*	21,15±0,26*	4,52±0,16*	39,93±1,41*
CuSO4, 1,0 mg/l	1,54±0,036*	13,74±0,271*	4,58±0,27	37,39±5,64*

Note: * P <0.05 compared with the control group

The action of copper sulfate (II) at a concentration of 1 mg/L in *Lymnaea stagnalis* observed reduction in glycogen content hepatopancreas 2.2 times compared with the control group. The action of copper sulfate (II) in concentrations of 0.1 and 1 mg/l in *Lymnaea stagnalis* observed reduction in glycogen content hepatopancreas 1.3 and 2 times, respectively, compared with the group CuSO4, 0,01 mg/l. The action of copper sulfate (II) at a concentration of 1 mg/L in *Lymnaea stagnalis* observed reduction in glycogen content hepatopancreas 1.5 times as compared with a group of CuSO4 0,1 mg/l (Table 1).

When exposed copper sulfate (II) concentration of 0.1 mg/l glucose level is an increase in the hemolymph mollusks 1.6 times, and under the action of copper sulfate (II) concentration of 1 mg/L in mollusks glucose concentration increased 4.2 times compared with the control group. When exposed copper sulfate (II) in concentrations of 0.1 mg/l and 1.0 mg/l glucose level is an increase in the hemolymph mollusks 1.7 and 2.7 times respectively as compared with the group CuSO4, 0,01 mg/l. When exposed copper sulfate (II) concentration of 1 mg/l glucose level is an increase in the hemolymph mollusks 1.5 times compared group CuSO4, 0,1 mg/l.

Copper sulfate (II) at a concentration of 0.01 mg/L in *Lymnaea stagnalis* causes reduction of catalase activity in the hepatopancreas of 1.3 times compared with the control group.

Copper sulfate (II) at a concentration of 0.01; 0.1 and 1.0 mg/l in *Lymnaea stagnalis* causes a decrease in ALT activity in hepatopancreas 1.2 times compared with the control group (Table 1).

Table 2 – Effect of copper sulfate (II) on the performance of glucose (mlmol/l), glycogen (mg/g), catalase activity (micromoles/min/g), ALT (U/L) in the hepatopancreas *Planorbarius corneus* ($M \pm m$)

Group, (n = 9)	Indicator			
	Glucose, mlmol/l	Glycogen, mg/g	Catalase activity, micromoles/min/g	ALT activity, U/L
The control	0,37±0,011	26,91±0,474	5,46±0,08	48,13±4,62
CuSO4, 0,01 mg/l	0,6±0,027*	27,72±0,502*	5,18±0,24	44,78±2,22
CuSO4, 0,1 mg/l	1,0±0,032*	21,15±0,26*	4,90±0,14*	45,86±2,87
CuSO4, 1,0 mg l	1,54±0,036*	13,74±0,271*	5,24±0,16	40,60±1,98

Note: * P <0.05 compared with the control group

Copper sulfate (II) at a concentration of 0.01 mg/L in *Planorbarius corneus* causes a reduction in glycogen content hepatopancreas 1.5 times, 0.1 mg/l - 1.6, 5.0 - 2.8 times compared with the control group. When exposed copper sulfate (II) in concentrations of 0.1 and 1.0 mg/L in the coils has decreased glycogen content in the hepatopancreas of 1.1 times and 1.9 times respectively as compared with the group CuSO4, 0,01 mg/l. When exposed copper sulfate (II) at a concentration of 1.0 mg/L in the coils has decreased glycogen content in the hepatopancreas 1.7 times as compared with a group of CuSO4, 0,1 mg/l.

When exposed copper sulfate (II) concentration of 0.1 mg/l glucose level is an increase in the hemolymph coils 1.7 times compared with the control group. When exposed copper sulfate (II) at a concentration of 1.0 mg/L is an increase in glucose level in the hemolymph coils 1.6 times compared

group CuSO4, 0,01 mg/l. When exposed copper sulfate (II) concentration of 1 mg/L is an increase in glucose level in the hemolymph coils 1.5 times compared group CuSO4, 0,1 mg/L (Table 2).

When exposed copper sulfate (II) in concentrations of 0.01; 0.1 and 1.0 mg/l in *Planorbarius corneus* not observed significant reduction of catalase activity in hepatopancreas (Table 2).

When exposed copper sulfate (II) at a concentration of 1.0 mg/L in the coil horn decreased ALT activity in hepatopancreas 1.2 times compared with the control group (Table 2).

Significant differences were noted in the interspecific level. In comparison with *Planorbarius corneus* glucose in the hemolymph *Lymnaea stagnalis* in the control group was 4.2 times lower; under the action of copper sulfate (II) in concentrations of 0.01 mg/L - 2.7 times, 0.1 mg/l - 1.7-fold and 1.0 mg/l - 1.7 times lower.

When comparing the glycogen content in the hepatopancreas *Planorbarius corneus Lymnaea stagnalis* and control groups showed statistically significant differences were not; under the action of copper sulfate(II) at a concentration of 0.01 mg/L in the coil horn glycogen content 1.7 times lower than that of ordinary truncatula; 0.1 mg/l - 1.4 times below, and at a concentration of 1.0 mg/l - 1.5 times lower [3].

Conclusion. Through the use of a pulmonary bioassay freshwater mollusks that immediately respond to physiological, morphological, cytogenetic and behavioral changes, you can quickly diagnose early disturbances in the water system. This in turn will ensure the implementation of preventive measures, preventing water pollution and the development of diseases in humans.

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CHANGE RATIO IN METABOLIC EFFECTS OF ZINC SULFATE (II)

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Pulmonary freshwater clams *Lymnaea stagnalis*, *Planorbarius corneus* with different oxygen carriers (copper-containing hemocyanin and iron-containing hemoglobin, respectively) represent the test organisms to assess biodiversity and aquatic biological and ecological studies.It is known that high levels of inorganic pollutants in water bodies due to date mainly anthropogenic load on the hydrosphere. Metallic waste water agro-industrial complexes, as well as upstream and downstream manufacturing plants are the primary source of heavy metals in aqueous medium [1, 2].

The purpose of the study – to determine the content of marker indices in the haemolymph and hepatopancreas pulmonary freshwater clams by the action of zinc sulfate (II).

Material and methods. We used two representatives of the pulmonary mollusks - common pond snail (*L. stagnalis*) and horn coil (*P. corneus*). Clams were collected in the reservoirs of the Vitebsk region. Most shellfish were collected manually. Some individuals were captured using a net. Before the experiment acclimatization for molluscs in heated tanks with settled tap water for 2 days, the density of planting shellfish - 3 copies/L, water temperature – 20–22°C. The animals were fed leaves of dandelion. Then, water was added zinc sulphate at concentrations0.05; 0.5 and 5.0 mg/l. Duration of acute experiment 24 hours. It served as a control specimen contained in the settled tap water.

Findings and their discussion. Since the contamination of aquatic ecosystems is one of the leading positions occupied by heavy metals has been analyzed and complex changes in the body of freshwater shellfish lung by the action of toxicants. The aquatic organism heavy metals arrive by diffusion or by adsorption from the environment [3].

Tables 1–2 present data on the content of glucose in the hemolymph, ALT and catalase in hepatopancreas *Lymnaeastagnalis, Planorbariuscorneus* and under the action of zinc sulfate (II).