

CONTENT OF VITAMINS IN TISSUES OF LAMBS UNINFECTED AND INFECTED WITH  
*HAEMONCHUS CONTORTUS* (In Bulgarian).

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SUMMARY

The content of vitamins A, C, E and B<sub>12</sub> in liver of lambs uninfected and infected with gastrointestinal nematode *Haemonchus contortus* was determined. The results showed a decrease in the values of four vitamins of the group of infected lambs compare to the control group. Lower levels of these vitamins has been associated with the development of oxidative stress and anemia caused by pathogenic parasite *H. contortus*.

Key words: *Haemonchus contortus*, lambs, vitamins A, C, E and B<sub>12</sub>.

EFFECT OF EXPERIMENTAL FASCIOSIS AND DIETHYLNITROSAMINE  
INTOXICATION ON TRACE ELEMENTS CONTENT IN RAT LIVER.

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ABSTRACT

The aim of the work was to be investigated the trace elements content in rat liver after the effect of chronic fasciolosis and diethylnitrosamine (DNA) intoxication. The Mo, Rb, Br and Cu contents were near to the controls or slightly increased. The highly increased quantity of Cu and low values of Zn, Fe and Co were established. The obtained results pointed that the combined action of *Fasciola hepatica* and DNA led to a specific mineral imbalance in the liver, which might take place in the pathogenesis of the interaction between experimental fasciolosis and chemical intoxication.

Key words: Experimental helminthosis, chemical intoxication, liver, trace elements.

BONE REGENERATION IN CRITICAL-SIZE CALVARIAL DEFECT IN RATS USING  
INNOVATIVE NANO COMPOSITE MATERIAL OF CHITOSAN/NANO-  
HYDROXYAPATITE COMPOSITE.

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## ABSTRACT

Healing of standardized critical-size calvarial defects in rats was performed with nano composite material of nano-hydroxyapatite/3 % solution of chitosan in citric acid, and electrospinning fibres of poly lactic acid. Histologically at the 84 day, the implanted rats exhibited full closure of the defect by new developed connective and osteoid tissues penetrating in reticular pattern within the implant components. These results indicate that by using a newly created composite paste critical cranial defects can be successfully retrieved and probably is also suitable for other cases in bone augmentation surgeries.

Key words: calvarial defect in rats, chitosan/nano-hydroxyapatite, bone regeneration.

## BIOACCUMULATION OF METALS IN TISSUES AND HELMINTHS OF HARES IN KARDZHALI REGION.

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## ABSTRACT

This study was aimed to evaluate content of heavy metals in *Lepus europeas* Pallas 1778 and its helminth *Trichuris sylvilagi* (Nematoda) in Kardzhali region, Bulgaria. The contents of Cd, Pb, Zn, Mo, Mn, and Co were determined in liver, kidney, muscle and helminths. A metal bioaccumulation factors were calculated. Significant differences in the concentrations were found between parasites and host tissues. The content of Zn, Pb and Cd was higher in the nematodes than in the hare tissues. The studied model could be a promising bioindication system to evaluate the ecological state in terrestrial habitats.

Key words: *Trichuris sylvilagi*, hare, heavy metals.

## SERUM TRACE ELEMENTS AND ENZYMES IN LAMBS WITH INTRODUCED HAEMONCHOSIS

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## ABSTRACT

Haemonchosis is an important parasitic infection in sheep and goats. The aim of our study was to

evaluate the levels of trace zinc (Zn), manganese (Mn), copper (Cu), iron (Fe), cobalt (Co) and ultra-trace molybdenum (Mo), selenium (Se) elements and the activity of enzymes in serum (alkaline phosphatase, alanine aminotransferase, aspartate aminotransferase and lactate dehydrogenase). Levels of Zn, Cu, Fe, Se, Mo and Co were decreased in the serum from infected lambs compared to control. Mn level was non-significantly higher in the serum of infected animals than non-infected ones. Serum ALP, ALT and AST activity was increased in the infected lamb compared to the controls. LDH activity was not significantly changed in the infected lambs compared with healthy lambs. In this study increased pathological marker enzymes and an imbalance in the trace elements profile was observed. *Haemonchus contortus* plays an imperative task as anemia and oxidative stressors on lambs.

Key words: haemonchosis, lamb, trace elements, enzymes, serum

## HEAVY METALS IN A HOST-PARASITE SYSTEM FROM A COPPER MINING REGION IN BULGARIA

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### ABSTRACT

A host-parasite system *Rattus norvegicus*/ *Hymenolepis* spp. has been used as a bioindicator of heavy metals in the copper mining region of Chelopech, Bulgaria. The region has been polluted from the mining industry for copper and gold. Studies were done for contents of heavy metals zinc (Zn), copper (Cu), cadmium (Cd), lead (Pb), nickel (Ni), aluminium (Al), iron (Fe), manganese (Mn) in tissues (liver and kidney) of rats (infected with tapeworms and non-infected) as well as in strobila of the parasites in comparison aspect using ICP-OES. Bioaccumulation factor was determined as a ratio between the content of metal in cestodes to a content of the same metal in rat tissue (liver or kidney). The high BF-s for Pb and Cu indicated that the amount of metals in the environment may result in significant uptake by the tapeworms and their host.

Key words: *Hymenolepis* spp., rat, heavy metals

## ANTIBIOFILM POLY (CARBOXYBETAINE METHACRYLATE) HYDROGELS FOR CHRONIC WOUNDS DRESSINGS

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#### ABSTRACT

The current study demonstrates the benefits of poly (carboxybetaine methacrylate) hydrogels in chronic wound healing. These hydrogels demonstrate high absorbing capacity upon swelling in salt solutions thus revealing great potential as dressings for highly exuding chronic wounds. Moreover, upon swelling they expand, increasing their volume by 25%, which makes them patient friendly ensuring also the proper wound healing. Poly (carboxybetaine methacrylate) hydrogels were also shown to absorb collagenase and myeloperoxidase, two enzymes that are specific for chronic wounds, reducing in this way their amount by 30–45% in the wound bed without entirely inhibiting their activity, as the latter is necessary for the wound healing process. The hydrogels were also shown to be non-cytotoxic as well as to prevent the biofilm formation of *S. aureus*. The in vivo implantation in rats showed no immune response to moderate immune reaction for both studied PCB hydrogels. Thus, the properties of the PCB networks revealed in the study demonstrate their potential as chronic wounds dressing materials.

#### DYNAMICS OF TRACE METALS IN THE SYSTEM WATER – SOIL – PLANT – WILD RATS – TAPEWORMS (HYMENOLEPIS DIMINUTA) IN MAGLIZH AREA, BULGARIA

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#### ABSTRACT

Background: The impact of chemical elements on the biosphere is a function of their concentration and chemical form. Elucidation and prognosing of the latter in water basins and soil extracts is of

particular significance for the assessment of their bioaccumulation in plants and animals. Objectives: Trace metals dynamics in the system water – soil–plant–wild rats – *Hymenolepis diminuta* in two agroindustrial zones (East and West) around Maglizh city, Bulgaria were investigated through experimental studies and thermodynamic modelling of the chemical species. Methods: Samples from surface waters of rivers, their nearby uncultivated soils, meadow uncultivated vegetation (*Ranunculus acris* and Gramineae) and field rats were collected. In situ measurements and laboratory analyses were performed for the determination of the physico-chemical characteristics and total concentrations of Al, Fe, Mn, Ni, Cu, Zn and Pb. The distribution of their dissolved chemical species in water samples and in the aqueous soil extracts was calculated using a thermodynamic approach. The relationship chemical species – bioaccumulation was discussed.

Results: Waters and soils in the East zone of Maglizh area were found to be more polluted compared to those in the West one, regarding Ni, Mn, Zn, Pb and Cu, while Mn and Cu displayed the highest mobility in West zone soils. Trace metals contents in *Ranunculus acris* exceed that in Gramineae, since the highest accumulation factors were calculated for Cu and Zn. The highest accumulation in rats was found for Zn followed by Cu, being higher in the West zone. Thermodynamic modelling shows that  $Mn^{2+}$  free ions are dominant in both waters and aqueous soil extracts.  $Ni^{2+}$  and  $Zn^{2+}$  ions followed by metal-organic complexes are dominant in waters of East zone while metal-organic complexes followed by free ions are dominant in waters of West zone and both soil extracts. Metal-organic complexes are dominant for Fe, Cu and Pb in all samples studied, while mainly hydroxy forms ( $Al(OH)_4^-$ ) followed by metal-organic complexes are typically for Al depending on pH. Conclusions: Experimentally established bioaccumulation of trace metals in the studied vegetation and rats is a consequence of the total concentration of trace metals in waters and soils, their mobility and chemical species. The dominance of organic complexes of trace metals is a prerequisite for their bioaccumulation in plants. Rats are in direct contact with the soil solution and therefore, of importance is the content of free ions of  $Mn^{2+}$ ,  $Ni^{2+}$ ,  $Zn^{2+}$ , which are easily absorbed through the skin. The host-helminth system wild rat/*H. diminuta* could be used as a bioindicator for trace metals pollution.

## INHIBITION OF FASCIOLA HEPATICA INFECTION IN GALBA TRUNCATULA SNAILS BY APPLICATION OF MONOSACCHARIDES TO THE AQUATIC ENVIRONMENT

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### ABSTRACT

*Fasciola hepatica* is one of the etiological agents of fasciolosis, a widespread disease in domestic animals and occasionally in humans. Fasciolosis may be reduced by blocking the parasite transmission through its intermediate hosts. In the present work, different monosaccharides have been tested for their ability to impact on ligand/receptor interactions at the interface between the

parasite and the intermediate host. Laboratory snails were subjected to miracidia in the presence of methyl- $\alpha$ -Dmannopyranoside (MetMan),  $\alpha$ -D-glucose (Glc), N-acetyl-D-glucosamine (GlcNAc), D-(+)-galactose (Gal), N-acetyl-Dgalactosamine (GalNAc) or L(-)-fucose (Fuc), in 10 mM concentration. The snail survival rates and the prevalence of infection were determined after 50 days. Survived snails in the study groups varied from 78% to 97%. A remarkable reduction in the number of parasite-infected snails was observed in groups subjected to MetMan, Glc, or GlcNAc – 36.9%, 10.9%, and 11.9%, respectively, compared to 92.7% in the control group. Other tested monosaccharides had a low impact on snail infection. The results point to the implication that surface carbohydrate/receptor interactions are among the determining factors concerning the transmission of *F. hepatica* by the specific vector *Galba truncatula*. Biological recognition between the two organisms can be interfered with appropriate monosaccharides and this can be used to develop an alternative method for control of fasciolosis at the intermediate host level.

Keywords *Fasciola hepatica*. *Galba truncatula*. Lectin/carbohydrate interactions. Carbohydrate inhibition.

## NEWLY SYNTHESIZED POLYMER HYDROGELS AND HYDROXYAPATITE NANOPARTICLES (NHAP) FOR BIOMEDICAL APPLICATION: HISTOLOGICAL AND BIOCHEMICAL STUDIES IN RATS

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### ABSTRACT

The development of biocompatible zwitterionic polymers and polymer-reinforced calcium phosphate pastes and cements in combination with specific drugs, has been considered as a promising strategy in bone tissue engineering and dental medicine. The main purpose of this work was to evaluate the relationship between physicochemical and mechanical properties of newly synthesized polymer hydrogels and hydroxyapatite nanoparticles (nHAP) and their biocompatibility in vivo. Standard hematological, biochemical and histological laboratory tests with Wistar rats and statistical analysis of the data obtained were performed. The results from the histological, hematological and biochemical analyses revealed that all tested materials are characterized by good biocompatibility and biodegradation. No hard inflammatory effects were noticed, only slight foreign body reaction responses were observed. The histological findings made

by us confirmed the acceptance of the implanted materials and the good tolerance to their componential compounds.

Key words: zwitterionic polymers, histological, hematological and biochemical tests

## COMBINED EFFECTS OF FASCIOLA HEPATICA INFECTION AND COPPER INTOXICATION ON OXIDATIVE/ANTIOXIDATIVE STATUS IN RATS

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### Summary

The aim of our study was to investigate parameters of oxidative/antioxidative status in rats experimentally infected with *Fasciola hepatica* and treated with a copper salt. The experiment was carried out on 24 male Wistar albino rats, divided into 4 groups with 6 animals in each: group 1 – healthy untreated animals, group 2 – rats orally infected with *F. hepatica*; group 3 – rats treated with  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  and group 4 – rats experimentally infected with *F. hepatica* and treated with  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ . Rats from group 2 and 4 were orally infected with 15 viable *F. hepatica* metacercariae per animal. Rats from group 3 and 4 received  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  dissolved in drinking water at a dose of 150 mg/kg body weight after post infestation week 2. Copper administration lasted 2 weeks. The rats were euthanized on the 35th day post infestation. The levels of malondialdehyde, glutathione, and the activity of Cu, Zn-superoxide dismutase and glutathione peroxidase in the liver of all rats were established. Increased liver MDA level was observed in groups infected and untreated with copper compared to control level. Reduced Cu,Zn-SOD activity was found in all infected rats as well as insignificant increase of the enzyme in group 3 compared to control group value. GPx activity was reduced in similar manner in the treated and infected groups compared to the control group. GSH level was lower in all treated rats than in controls ( $P < 0.01$ ). Copper liver content was increased in groups receiving  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  compared both to control and infected only group. Substantial imbalance in oxidative/antioxidative status in groups 2, 3 and 4 was demonstrated compared to the control group. Combined effect of chronic copper administration and experimental *F. hepatica* infection increased significantly MDA level, reduced the activity of Cu,Zn-SOD and the GSH content in host livers. Elevated copper level influenced defense system in *F. hepatica* infected rats at a high extent. Parasites and copper acted together to increase the oxidative stress. Parasitism in the presence of copper pollution compromises the health of the host, even at low intensities.

Key words: copper, *Fasciola hepatica*, oxidative/antioxidative status, rat

## ANTHELMINTIC EFFICACY OF MORINGA OLEIFERA SEED METHANOLIC EXTRACT AGAINST FASCIOLA HEPATICA

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**Abstract** The current study was carried out to assess in vitro and in vivo effects of *Moringa oleifera* seed methanolic extract on *Fasciola hepatica* to develop an alternative source of treatment. The in vitro ovicidal effect of *M. oleifera* seed extract on immature *F. hepatica* eggs has provided evidence of inhibitory activity on the vitality and hatchability of *F. hepatica* eggs. This inhibitory activity was concentration-dependent and also correlated strongly with the exposure time. In the in vivo trial, the oral administration of *F. hepatica* experimentally infected rabbits with doses of 150 mg/kg BW prepared extract per day for 3 consecutive days on the 63rd day post infection confirmed potent fasciolicide activity of the extract. A gradual decrease in fecal egg count (FEC) was detected from the 1st day post treatment until reaching 100% FEC reduction by the 7th day post treatment. No flukes could be found at post mortem examinations. Significant increments of serum total protein, globulin, the activities of ALT and AST, total cholesterol, triglycerides and urea were recorded during the period of infection, which were improved by treatment. Remarkable histopathological alterations were observed in the infected liver and gallbladder tissues which decreased clearly in the treated rabbits. This study proposes that the used extract has promising and potent fasciolicide activity.

**Keywords** Fasciolosis, *F. hepatica*, *Moringa oleifera*, In vitro, In vivo, Anthelmintic activity, Rabbits.

#### TRACE ELEMENT CONTENTS IN RAT TISSUES AFTER EXPERIMENTALLY INDUCED FASCIOLA HEPATICA INFECTION

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(Submitted by Academician V. Golemansky on May 21, 2018)

#### ABSTRACT

The structural, functional and metabolic changes in host tissues caused during penetration, migration and localization of helminths in the host body, are associated with specific changes in trace element levels in body tissues, including these of liver and spleen. The aim of the present study is determination of the quantities of trace elements zinc (Zn), copper (Cu), cobalt (Co) and iron (Fe) in liver and spleen tissues of rats at acute or chronic phases of fasciolosis. Statistically significant reducing of Zn, Cu, Co and Fe quantities is established in the livers of rats with acute and chronic fasciolosis compared to the controls. The decreasing of trace elements levels was slighter in chronic phase of fasciolosis. Significant reducing of spleen Fe quantity and slighter decreasing of Zn and Cu levels were established in the spleens of rats with acute fasciolosis. Statistically significant increased quantity of Zn, markedly increased level of Fe, slightly increased Cu and unchanged level of Co were detected in the spleens of rats with chronic fasciolosis compared to controls. The results were obtained point that the infection with *F. hepatica* leads to specific mineral imbalance in the host body as a result of parasite-associated host liver and spleen



structural changes and alterations of biochemical and immunological mechanisms and show the important role of the investigated biogenic trace elements in pathogenesis of fasciolosis.

Key words: acute and chronic fasciolosis, trace elements contents, livers, spleens, rats.

#### EVALUATION OF DIFFERENT HAEMONCHUS CONTORTUS ANTIGENS FOR DIAGNOSIS OF SHEEP HAEMONCHOSIS BY ELISA AND THEIR CROSS REACTIVITY WITH OTHER HELMINTHES

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Abstract. *Haemonchus contortus* (*H. contortus*) remains important nematode that infecting sheep all over the world. Truthful diagnosis of haemonchosis needs reliable Enzyme linked immune sorbent assay test as well as the immunoreactive protein profile of different prepared *H. contortus* antigens; larval (L), excretory secretory product (ESP) and adult somatic *H. contortus* (AS). The current study fulfilled that L antigen is the talented antigen for such serological diagnosis. Immunodominant band at molecular weight 57 kDa were answerable for highest specificity and accuracy of positive predictive value of this antigen. Moreover, the highest apparent prevalence value was 92 and 75% obtained by L and ESP antigens, respectively. The results of cross reactivity among AS, *Monezia expansa* (*M. expansa*) and *Fasciola* spp. revealed that AS antigen appeared major cross reactivity with other cestode and trematode. Best dilution of serum was (1:800) to rise above this phenomenon.

Keywords *Haemonchus contortus*, *Monezia expansa*, *Fasciola* spp, ELISA, Cross reactivity.

#### OXIDATIVE STRESS STATUS IN MOUFLONS INFECTED WITH LUNG WORM DICTYOCAULUS VIVIPARUS

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ABSTRACT. The purpose of our study is to examine the lung oxidative stress status in mouflons naturally infected with the nematode *Dictyocaulus viviparus* by determination of the malondyaldehyde (MDA) concentration as a biomarker of lipid peroxidation and its relation to the antioxidant status (glutathione, vitamin A, vitamin E, vitamin C, enzymes SOD, CAT, GPx and the trace elements selenium and zinc ). 16 mouflons, non-infected and infected with *D. viviparus* were studied. Animals were shot in a hunt during the hunting season in ecological areas (naturally and anthropogenically non-polluted) in the Rhodope Mountains in Bulgaria. Antioxidant/ oxidant imbalance occurred in the animals with dictyocaulosis. Levels of vitamin A, C and E, GSH and selenium were reduced, SOD, GPx and CAT activity was suppressed, whereas MDA level was

increased in the lungs infected with *D. viviparus* compared to the non-infected. The zinc level was not changed in the infected animals. The results of the present study indicate that the antioxidant/oxidant imbalance was expressed mainly by significant reduction of the antioxidant enzyme activities. The present findings confirm that parasitic infection correlates well with OS status which can be assessed using enzymatic and nonenzymatic biomarkers. The pathogenesis of *D. viviparus* infection needs to be re-examined in order to understand more deeply the consequences of such an infection in the animal body.

#### INVESTIGATIONS ON SOME HEMATOLOGICAL PARAMETERS IN SHEEP EXPERIMENTALLY INFECTED WITH HAEMONCHUS CONTORTUS

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#### ABSTRACT

The large stomach worm, *Haemonchus contortus*, commonly known as “the barber’s pole worm”, is a blood-sucking nematode found in the abomasa of sheep and goats. Haemonchosis is a serious health problem which causes lower production due to high morbidity, mortality, and cost of treatment and control measures. A range of hematological measures were significantly different between infected groups and uninfected controls at one or more time points. The concentrations of packed cells volume, erythrocyte sedimentation rate, blood eosinophil number were increased, while the concentration RBC, haemoglobin, and some erythrocyte indices were significantly decreased ( $P < 0.05$ ) in haemonchus infected animals. It was concluded that decreased hemoglobin concentration, total serum proteins, total RBC and some erythrocyte indices were important indicators of haemonchosis in sheep.

#### ALTERATIONS OF ANTIOXIDANT TRACE ELEMENTS AND RELATED METALLOENZYMES IN RABBITS WITH EIMERIOSIS

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#### ABSTRACT

The aim of this study was to investigate the levels of antioxidant trace elements (zinc, copper, selenium) and the activity of related metalloenzymes (superoxide dismutase: SOD and glutathione peroxidase, GPx) in the blood of rabbits experimentally infected with *Eimeria stiedae*. The results showed that blood Se and serum Zn concentrations, the GPx activity were significantly decreased,

serum Cu concentration and blood Cu/ZnSOD activity were increased. As shown in our data the levels of trace elements Zn, Cu and Se and the activity of metallo-enzymes Cu/ZnSOD and GPx were significantly changed. Antioxidant trace elements and related metalloenzymes play a vital role in maintaining the antioxidant defense system during eimeriosis. The importance of the distribution of trace elements used for antioxidant enzyme synthesis should be taken in account in the therapeutic support of the parasitized animals, to adjust the nutritional supplementation to their specific needs and to propose nutritional support recommendation.

Key words: Eimeriosis, SOD, CAT, Se, Zn, Cu

#### ANTIOXIDANT STATUS AND HISTOLOGICAL STUDIES AFTER IMPLANTATION OF MODIFIED HYDROXYAPATITE IN RAT CALVARIA

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#### ABSTRACT

The study was carried out on the biochemical indices (oxidant/ antioxidant status) and histological response after implantation of hybrid material of chitosan/nano hydroxyapatite in rat calvarial defects. Three groups of rats were used in the experiment: 1st group – control – healthy animals, 2nd group – rats received critical size skull defect with no scaffold implantation and 3rd group – animals received a critical size skull defect and hydroxyapatite implants. Biochemical and histological studies were done 3 months after the implantation. Serum was analyzed for free radical index contents MDA, SOD, GPx and GSH. Quantitative tissue response towards the implant was histologically investigated. MDA level was higher in group 2 compared to the rest groups. GSH content was the highest in group 1. GPx is the lowest in group 3. There were no differences in SOD activity among the groups. No signs of inflammation were noted from the scaffold 2 months after the implantation. Evidence was provided in our study for good biocompatibility of the newly biomaterial.

Key words: calvaria, hydroxyapatite implant, MDA, SOD, GPx, GSH

#### BIOCHEMICAL AND HISTOLOGICAL STUDIES IN RAT MODELS WITH EXPERIMENTAL IMPLANTS BASED ON MODIFIED BETA – TCP

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#### ABSTRACT

Calcium-phosphate (Ca-P) cements are widely used as bone substitutes in orthopedic, reconstructive and maxillofacial surgery because they have good biocompatibility and extensive bone conductivity. Many bivalent trace metallic ions have demonstrated their beneficial effects in bones tissues engineering applications. A bone-related enzyme alkaline phosphatase (ALP) together with bone – related minerals (Ca, P, Mg and Zn) act actively in bone formation. The aim of this study was to asses some bone turnover parameters (alkaline phosphatase, Ca, P, Mg and Zn) and histological response in rat models with experimental subcutaneous beta - TCP implants modified with doped trace elements (Zn and Mg). The newly synthesized three types cements -  $\beta$ -tricalcium phosphate doped with Zn/Mg were studied in a rat experimental model during 12 week. Slight deviations were observed in the studied bone turnover markers. There was an absence of inflammation and necrosis, suggesting that there were no toxic effects in the surrounding tissues and no disorders observed during degradation of materials. Results obtained showed that TCP with dual dopants of Mg and Zn has the potential to be used in orthopedics and dentistry.

Key words: rats, Ca, P, Mg, Zn, ALP,  $\beta$  – TCP, histological study.

#### RAT BLOOD BIOCHEMICAL MARKERS TESTED AFTER CALVARIA IMPLANTATION WITH ION-MODIFIED CALCIUM PHOSPHATE BIOMATERIALS

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#### ABSTRACT

The present study was carried out for evaluation of some blood biochemical markers in rats with artificially created calvarial defects, implanted with modified calcium phosphates cements. Cements were synthesized on the bases of TTCP/DCPA, carboxylic acids, xanthan gum and glycerin. Rat blood biochemical parameters alanine aminotransferase (ALT), aspartate aminotransferase (AST), total protein and total glucose were investigated. No significant differences in their levels were established between the animals from the both groups with

implants. The obtained data might be useful in future for in vivo experiments with new biomaterials.

Key words: blood biochemical markers, biomaterials, bone implantation, calvaria, rats.

## BLOOD ANTIOXIDANT/OXIDANT PARAMETERS IN RATS EXPERIMENTALLY INFECTED WITH FASCIOLA HEPATICA AND EXPOSED TO LEAD

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### ABSTRACT

The aim of this study was to study antioxidant/oxidant status of blood of rats infected experimentally with *Fasciola hepatica* combined with chronic lead administration. Parameters of antioxidant/oxidant status were malondialdehyde (MDA), CuZn- superoxide dismutase, total antioxidant capacity in the blood of rats experimentally infected with *Fasciola hepatica*. The level of lead was determined as well. The data showed that oxidative/ antioxidant imbalance was developed due to an increased MDA level, reduced TAC concentration and SOD- activity in double treated animals compared to control animals and these with only one treatment. The Pb level was significantly increased in all rats received Pb (non-infected and infected with *F.hepatica*). Our study leads us to conclude that coexposure to Pb and helminths causes a more pronounced increase in the blood oxidative stress in the hosts.

Key words: lead, *Fasciola hepatica*, oxidative/antioxidative imbalance.

## GEOCHEMICAL ECOLOGY AND ITS ROLE IN PRESENTDAY BIOSPHERE STUDIES

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Fundamental concepts, major provisions and the role of geochemical ecology of organism as a new scientific area in the biogeochemistry of general ecology are elucidated. The formation and development of this scientific area and its role in dealing with ecological problems is considered. Geochemical ecology addressed the regularities in interactions between individual organisms and

their associations with the natural technogenic environment due to formation and running of migration processes of chemical element atoms in the biosphere and transformation of solar energy. The core of geochemical ecology comprises: specific features of chemical elemental composition of organisms and geochemical environment, biogeochemical food chains and parameters, biogenic migration of chemical elements and their biogeochemical cycles, different biological response of organisms, including ferment adaptations, threshold or critical concentrations of chemical elements in organisms and environment, biogeochemical model of homeostatic regulation processes in organisms, associations, biogeocenoses and their sustainable development, evolution of the chemical composition of living matter and biosphere as a representation of planetary and cosmic processes. The central place is geochemical ecology is occupied by the geochemical factor of influence (chemical elements or their associations). The problems of geochemical ecology are getting particularly pressing today. Studying technogenic provinces is a new scientific problem that needs to be solved for the general ecological assessment of biosphere development in the present-day Psychozoic era and search for more efficient technologies, for the assessment of the interaction between technogenic and natural factors. The complexity of the problem consists in the necessity of differentiating between technogenic and natural flows and forms of chemical element migration, in the assessment of interaction between technogenic and natural factors and manifestation of unforeseen biological response in organisms [2]. However, except for toxicosis, caused by an excess of minerals, there is a large group of hypomicroelementoses. Deficiency in trace elements – copper, zinc, manganese, cobalt, iodine, selenium – in fodder, especially in the winter stabling period, makes 30 to 70 percent of respective requirements of animals on all farms of the Central Chernozem zone. As a result, their levels in the animal body (in organs, tissues, milk) are 5 to 10 times lower than the normal level. The said trace elements determine the intensity of all metabolism processes and performance of all organs and systems of the body. Long-term deficiency, or even short-term reduction in the intake of the said trace elements by animals with forage results in pathological conditions – chronic complex hypomicroelementosis. In all kinds of animals, it manifests itself through severe disorders and does much harm to the health of animals and their productivity. In addition, the invasion by parasites of animals, including wild animals, results to the gypomicroelementoses [1].