MINISTRY CABINET OF UKRAINE
National University of Life and Environmental
Science of Ukraine

ADOPTED

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Prof. M. Tsivichovskiy
Dean
Department of Veterinary Medicine

«____»_____2016

GENERAL ZOOLOGY

Working Program
for training students
in specialty **6.110101**
'Veterenary Medicine'

by Dr. I. Kurbatova
Associate Professor
Department of Water Bioresources and
Aquaculture

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Sub-department of General Zoology and Ichthyology
Course – 1
Semester – 1
Number of weeks – 8
Labs – 8/32
Individual tuition – 10 hours
Exam in 1 semester

Kiev - 2016

Working Program is developed by Dr. I. Kurbatova, Associate Professor, on the base of the Model Program in Zoology for Specialty 7.130501 'Veterinary Medicine' at the Agricultural Universities of the III-IV Ranges of accreditation and adopted by the Department of Personnel Policy, Agrarian Education and Science of the Ministry of Agrarian Policy of Ukraine (05.03.2002).

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Working Program had been discussed during the workshop of the Sub-department of General Zoology and Ichthyology

' 14 ' Apr. 2016

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Dr. P. Shevchenko,
Associate Professor
Head
Sub-department of
General Zoology and Ichthyology

Adopted by the Methodical Commission of the Department of Veterinary Medicine

'____' _____ 2016

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Prof. M. Tsivichovskiy

CONTENT OF THE COURSE
Themes and their content

Chapter 1. Introduction. Objectives of the course.

Theme 1.1. Zoology as the system of biological (animal) sciences. History of zoology. Earlier visions of the natural history of animals and their classification. General principles of the modern systematics. Taxons, binary system of species. Terminology. Importance of animals for nature as well as for human survive, animal husbandry, agronomy and aquaculture.

Chapter 2. Unicellular animals (Protozoa)

Theme 2.1. General description of protozoans. Sarcomastigophora. Development of microscopic technologies and their importance for investigation of microscopic organisms. Sub-kingdom of Protozoa: definitions and general peculiarities. Sarcodina and Mastigophora. Structural features of the Class Sarcodina. Peculiarities of structure of Rhizopoda, Heliozoa, Radiolaria. Diversity of living forms in Class Mastophora.

Theme 2.2. Phytomastigina and Zoomastigina. Representatives of Sarcomastigophora, parasitic and patogenous forms, their importance. Colonial Mastigophora. Sporozoa and Microsporidia, their features connected with parasitic living strategy. Characteristics if Coccidia. diseases caused by Coccidia. Living cycle of the Eimeria. Parasitic blood-dwelling Sporozoa. Malaria disease and malaria plasmodium. Living cycles of Microsporidia and Mixosporidia, and diseases caused by them. Infectious disease transmission. Infusoria – the highest unicellular organisms. Complicated cell structure of Infusoria. Living cycle, conjugation. Order Ciliata, their general characteristics, living forms – free-living, symbiotic, parasitic. Order Suctoria. Planktonic, benthic, sessile, predatory, parasitic, mutualistic Infusoria and their role in ecosystems.

Theme 2.3. Parasitism. Definitive and intermediate hosts. Measures for infectious disease prophylaxis and control.

Chapter 3. Multicellular invertebrates (Metazoa)

Theme 3.1. Existing theories of the Metazoa origination. Comparison of the theory by E.Heckel and by I.Mechnikov.

Theme 3.2. Phylum Spongia (Porifera). Sponges as the most primitive Metazoa. Absence of the difference between cells of internal and external layers. Main types of cells. Body shapes: ascon, cycon, leycon. Sponge reproduction and development, inversion of embryo blasts. Classification. Classes: Calcispongia, Hyalospongia, Demospongia. Role of sponges in the nature, use of sponges.

Theme 3.3. Phylum Coelenterata (Cnidaria). Radial symmetry. Diploblastic organization. Differentiation of cells. functions of different cells; cnidocyles. Gastral and cell digestion. Living cycles: metagenesis of hydroid and scyphoid medusa, shift of medusa and polyp stages in cnidarians. Characteristics of Classes: Hydrozoa, Scyphozoa and Anthozoa. Role of cnidarians in the nature, use of cnidarians, poisoned cnidarians.

Theme 3.4. Phylum Ctenophora. Appearance of the third embryoblast. Main structural features. Planktonic and benthic forms. Classification.

Chapter 4. Triploblastic animals

Theme 4.1. Differentiation of embryoblasts in ontogenesis. Bilateral symmetry. Complication of body structure, increasing of living capacity and organization level. Embryoblast theory. General characteristics of flat worms. Worms as the special group of animals. Features of flat worms similar with the same of diploblastic animals in structure of alimentary and nervous systems as well as regenerarion capacity. Appearance of new organic systems caused by development of the third embryoblast. Dermal-muscular sack. Class Turbellaria. Structural features in connection with living strategy. Reproduction and

development. Class Trematoda. Adaptation to the parasitism. Representatives: Fasciola hepatica, Opistarchis felineus etc. Living cycle of the *Fasciola hepatica*. Control of the trematod parasites. Class Cestoda – high-specialized parasites. Complication of adaptation to parasitism, simplification of organic systems that do not maintain parasitic living strategy. Structural features. Living cycles of the *Diphyllobothrium latum, Taeniarhynchus saginatus, Taenia solium, Echinococcus granulosus*. Parasitic diseases caused by Cestoda. Control of those diseases.

Theme 4.2. Phylum Nemathelminthes – haemocoelic worms Biological progress and regress. Appearance of haemocoel, its function. Complication of the nervous system. Through gut. Peculiarities of the dermal-muscular sack structure. Dioecious Nemathelminthes, sexual dimorphism. Origination of the Nemathelminthes. Classes: Gasrtotricha, Nematoda, Rotatoria. Living cycle of the *Ascaris lumbricus, Trichinella spiralis*, *Ancylostoma duodenale*. V.O.Dogel Theory on the parasitism origination. Main features of parasitic worms.

Theme 4.3. Phylum Annelida – higher worms. Appearance of the coelom and new organic systems. Increasing of the organization level, complication of the nervous, alimentary and excretory systems. Body segmentation, parapods other structural features. Class Polychaeta – marine free-living and sessile species. Peculiarities of the reproduction and development. Trochophore (trochosphere) – planktonic larva of the polychaets. Role of polychaets in the evolution of invertebrates and vertebrates. Function of polychaets in aquatic ecosystems. Polychaet introduction to the Caspian Sea. Polychaet expansion to the Dnieper River reservoirs. Class Oligochaeta. Structural features. Reproduction and development, secondary hermaphroditism. Role of oligochaets in soil conditioning. Aquatic oligochaets. Oligochaet farming. Class Hyrudinea. Predatory and semi-parasitic leeches. Peculiarities of body structure and development. Role in the nature, medicine and fish farming.

Chapter 5. Phylum Arthropoda

Theme 5.1. Origination of arthropods, similar structural features with Annelids. Special structural features. Mixocoel. Molting. Body segmentation and tagmata. Segmented limbs. Exosceleton and cross-striated muscles. Adaptation to the wide spreading in nature. Classification.

Theme 5.2. Sub-phylum Branchiata, Class Crustacea. Peculiarities of segmentation. Crustacean limbs and diversity of their functions.. Organic systems and sensory organs of crustaceans. Reproduction and development. Sub-classes Branchiopoda, Maxillopoda, Ostracoda. Sub-class Malacostraca – higher crustaceans. Parasitic crustaceans and intermediate hosts. Spreading. Role of Crustaceans in aquatic ecosystems (trophic role in marine and fresh waters).

Theme 5.3. Sub-phylum Chelicerata. Aquatic and terrestrial Chelicerata. Adaptation to the terrestrial environment. Class Xiphosura. Horseshoe crabs and measures of their protection. Class Arachnida. Peculiarities of body structure of scorpions, spiders and ticks. Importance of arachnids for natural ecosystems, cattle husbandry and medicine.

Theme 5.4. Sub-phylum Tracheata. Structural features. Body segmentation in Myriapoda and Insecta.. Structure of head tagma, mouth limbs of various types complex eyes. Structure of thorax, 3 pairs of limbs, two pairs of wings. Wing origination. Tracheal respiratory system of insects. Correlation of the respiratory and circulatory systems. Centralization of the nervous system. Diversity of sensory organs. Excretory system and adaptation to dry environment. Reproduction and development (direct and undirect), sexual dimorphysm. Spreading of insects and their importance for nature and agriculture. Characteristics of the main orders of insects. Holometabola: Coleoptera, Lepidoptera, Aphaniptera, Hymenoptera, Diptera. Heterometabola: Hemiptera, Homoptera, Blattoidea, Odonata. Role of the insects in the nature and agriculture.

Chapter 6. Phylum Mollusca

Theme 6.1. Origination of Mollusca. Similar structural features with Annelids. Special structural features. Body division: head, abdomen, foot. Radula. Mantle, mantle cavity and its role. Radula. Structure of shell. Reproduction and development in different classes. Systematics of the phylum. Class Polyplacophora. Class Gastropoda, features of their structure. Class Bivalvia. Spreading of mollusks and their importance for nature and aquaculture and agriculture. Cultivated mollusks: snails, mussels, scallops etc. Mollusks as intermediate hosts for parasites.

Chapter 7. Phylum Chordata, Anamnia

Theme 7.1. Systematics of Chordata. Sub-phylum Acrania. Cephalochordata. Sub-phylum Tunicata. Ascidiae and Salpae. Sub-phylum Craniata (Chordata). Classes Cyclostomata, Chondrichthyes, Osteichthies. Amphibia, Reptilia, Aves, Mammalia. Sub-phylum Acrania. Progressive and primitive features of Acrania. Similarity of invertebrates and chordates; animal kingdom unitary. Class Cephalochordata. History of investigations, systematics, theory of chordates origination. Sub-phylum Tunicata. Regressive evolution in morphology – simplification because of the sessile life style. Class Ascidia. Comparative characteristics of larval and adult ascidia.

Theme 7.2. Sub-phylum Craniata (Chordata). Biological progress. Differentiation of the nervous system. Complication of skeleton, appiarence of cranium and extremities, another aromorphoses. Origination of Chordata. Agnatae. Class Cyclostomata – the primitivest Chordata. Structural fetures of nervous system, craniumand other organic system. Reproduction and development, special lamprey larva. Myxiniformes and Petromyzoniformes, their structural features and role in aquatic ecosystems.

Theme 7.3. General characteristics of Supra-class Pisces

Primary-aquatic Chordata. Morphological and structural features, feeding, spreading. Adaptation to the aquatic environment, structure of fins, scales, gills. Body division. Class Chondrichthyes. Peculiarities of the internal and external structure. Placoid scales, teeth, gills. Cartilaginous sceleton, structure of cranium, vertebral column, fins. Nervous system and sensor organs. Latteral line. Alimentary system. Reproduction and development. Sub-class Elasmobranchii, Supra-orders Selachoidei and Batoidei. Sub-class Holocephali. Role of sharks and scates in marine ecosystems. Use of sharks and scates, fish oil, medicines. Class Osteichthyes. Peculiarities of the external structure. Vertebral column, cranium, another bones. Air bladder, its functions. Gill, lung and skin resperation. Blood circulation system, its structural features. Alimentary and excretory system. Nervous system and sensor organs. Reproduction and development. Ecological groups of fishes, reasons of migrations. Systematics of the Class Osteichthyes. Characteristics of the main ecological groups. Sub-classes Dipnoi and Crossopterygii. Appearence of structural features necessary for terrestrial dwelling. Fish species important for fishing and aquaculture. Fishes – supplementory hosts of parasitic worms.

Theme 7.4. Class Amphibia, origination of amphibians, Stegocephals. Amphibian structure and living style as adaptation to the aquatic and terrestrial environment. Nervous system, gill and lung resperation, three-chamber heart, circulatory system. Reproduction and development. Similarity of amphibian and fish larvae. Systematics of the Class Ampibia. Role of amphibians in aquatic and terrestrial ecosystems. Practical use. Frog as the object of laboratory examination.

Chapter 8. Phylum Chordata, Amniota

Comparative characteristics of primary-aquatic and primary-terrestrial animals. Origination of embrionic membranes: amnion, allantoid, chorio, their role in embryogenesis.

Theme 8.1. Class Reptilia – the first real terrestrial Chordata. External structure: skin, extremities. Skeleton and muscular system. Nervous system, origination of cerebral cortex. Sensory organs. Alimentary system. Kidney. Reproduction and development. Embryonic membranes. Systematics. Role in the nature and in Chordata evolution.

Theme 8.2. Class Aves. Origination and similar features with reptiles. Bird adaptation to flight and caused changes in their structure. Feathers. Thermoregulation. Nervous system and its cerebral part; sensoric organs. Features of sceleton and muscular structure. Circulatory system, four-chapter heart. Double respiration. Alimentary system. Reproduction and development. Nidifugous and nesting birds. Migratory birds. Ecological groups; adaptation to the environment. Systematics. Role in the natureand agriculture.

Theme 8.3. Class Mammalia. Origination. Warm-blooded organisms and their adavntage in adaptation to the environment. External structure: skin, fir. Complication of nervous system; sensory organs. Peculiarities of circulation system, four-chamber heart. Respiratory system, diaphragm. Complication of alimentary system: lyps, vestibulum osculum, teeth differentiation, symple and complex stomack, alimentary glands. Excretory system. Reproduction and development. Placenta. Systematics, main orders of mammals. Role in the nature and agriculture.

Chapter 9. Phylogenetic system of animals and their role in human life

Theme 9.1. Main phases of animal evolution. Phylogenetic connections of animal phyla. Acclimatization and re-acclimatization of animals. Parasitism, mutualism and symbiosis. Breeding and selection of agricultural animals. Animal protection, National conservation legislation, international agreements. Red Book of Ukraine. IUCN Red Data List. Role of protected areas in biodiversity conservation.

Literature

1. Borradaile L.A., Potts F.A. The Invertebrata. A Manual for the Use of Students - Cambridge: the University Press. – 1959. – 794 p.
2. Parker T.J., Haswell W.A. A text-book of Zoology. – La Havana: Edicion Revolucionaria. – 1966. – 952 p.
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17. Биологический энциклопедический словарь / Под ред. М.С.Гилярова. – М.: Советская энциклопедия. – 1989. – 864 с.
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2.2. Themes of Labs

Theme 1. Introduction. Sub-kingdom Protozoa (Unicellular)
Phyla: Sarcomastigophora, Mixosporidia, Microsporidia, Infusoria. Comparative characteristics of the main groups of Protozoa. Structure of the Amoeba proteus, A. hystolitica, Euglena viridis, Volvox sp (colony), Paramecium caudatum. Living cycles of parasitic protozoans: Trypanosoma rhodesiense, Leishmania tropica, Trichomonas sp., Toxoplasma gondii, Eimeria sp., malarial plasmodium etc.
Colloquium.

Sub-kingdom Metazoa

Theme 2. Diploblastic animals. Phylum Porifera. Structural features ofs sponges. Living shapes: ascon, sycon, leycon. Structure of *Spongilla sp*. Phylum Cnidaria. Structure of *Hydra sp*., medusa, actinia, coral polyp. Cell differentiation, gastral cavity and gastrovascular system.

Theme 3. Triploblastic animals. Phylum Plathelminthes. Structure of Planaria sp. Class Trematoda – structure, living cycles, stages of the development of the *Fasciola hepatica* and *Dicrocoelium dendriticum*. Class Cestoda – morphology, living cycles and stages of development of the *Taeniarchynchus saginatus, Taenia solium* and *Diphyllobotrium latum*.
Colloquium.

Theme 4. Haemocoelic animals. Phylum Nemathelminthes. External and internal structure, living cycle of Ascaris lumbricus, Enterobius vermicularis, Trichinella spiralis.
Coelomic animals. Phylum Annelida. Class Oligochaeta. Morphological and anatomic structure of the Lumbricus terrestris and Hyrudo medicinalis.
Colloquium.

Theme 5. Phylum Arthropoda. Class Crustacea. Structure of Daphnia magna and Cyclops sp. Malacostraca. Structure of the *Astacus sp*. Class Arachnida. External and internal structure of scorpion, spider and tick.
Colloquium.

Theme 6. Phylum Mollusca. Structure of gastropods and bivalves. Phylum Chordata. Sub-phylum Acrania. Structure of *Branchiostoma sp*. Sub-phylum Craniata. Class Cyclostomata. Structure of lamprey.

Theme 7. Supra-class Pisces. Classes Chondrichthyes and Osteichthyes. Morphological and anatomic structure. Comparison of development of perch and shark. Characteristics of main groups of Chondrichthyes and Osteichthyes.
Colloquium.

Theme 8. Class Amphibia. External and internal structure of the frog. Class Reptilia. Morphological and anatomic structure of lizard. Features of the main orders of Amphibia and Reptilia.
Colloquium.

Theme 9. Class Aves. External and internal structure of pigeon. Main features of orders and ecological groups of birds. Class Mammalia. Morphological and anatomic structure of rabbit. Features of the main orders of mammals.
Colloquium.

Applied Zoology
Approximate time-table of tutorials

No		Number of hours		
		Total	Lectures	Labs
1.1.	Introduction. Objectives of the course of zoology. General biological laws	1	-	1
2.1.2.3.	Sub-kingdom Protozoa (Unicellular) Phyla: Sarcomastigophora, Mixosporidia, Microsporidia, Infusoria.	3.5	-	3.5
3.1.2.3.4.	Sub-kingdom Metazoa. Phyla: Porifera, Cnidaria, Ctenophora.	0.5	-	0.5
4.1.2.3.	Triploblastic animals. Phylum Plathelminthes. Haemocoelic animals. Phylum Nemathelminthes. Coelomic animals. Phylum Annelida.	3,5	-	3.5
5.1.2.3.4.	Phylum Arthropoda. Class Crustacea. Sub-phylum Tracheata. Class Insecta. Sub-phylum Chelicerata	3	-	3
6.1.7.1.2.	Phylum Mollusca. Phylum Chordata. Sub-phylum Acrania. Sub-phylum Craniata. Class Cyclostomata.	3.5	-	0.5
7.3.	Supra-class Pisces. Classes Chondrichthyes and Osteichthyes.	1.5	-	1.5
7.4. 8.1.	Class Amphibia. Class Reptilia	1.5	-	1.5
8.2.	Class Aves. Class Mammalia	2	-	2
9.1.	Phylogenesis of the Animal Kingdom. Main phases of the animal evolution. Animal protection	1	-	1
	Total	16	-	16

Structural logic scheme of the course
'Applied Zoology'

	Introduction. Objectives of the course. General biological laws	Lect.		
			Lab	Colloq
Self.	Sub-kingdom Protozoa	Lect.	Lab	
Self.	Sub-kingdom Metazoa. Phyla: Porifera, Cnidaria	Lect.	Lab.	
				Colloq
Self.	Triploblastic animals. Phyla: Plathelmithes, Nemathelminthes, Annelida	Lect.	Lab	
Self.	Phylum Arthropoda. Sub-phyla: Brancheata, Tracheata, Chelicerata	Lect.	Lab	Colloq
Self.	Phylum Mollusca. Phylum Chordata. Sub-phylum Acrania	Lect.	Lab	
				Colloq
Self.	Sub-phylum Craniata. Supra-Class Pisces. Classes Chondrichthyes.and Osteichthyes.			
		Lect.	Lab	
Self.	Sub-phylum Craniata. Classes Amphibia and Reptilia			
				Colloq
	Sub-phylum Craniata. Classes Aves and Mammalia			
		Lect.	Lab	
	Phylogenetic connections of Animal Kingdom. Animal protection.			
	Exam			

Self. – self-learning (individual study)
Lect. – lecture
Colloq – colloquium

Structural logic scheme of the course
'Applied Zoology' (II)

Previous courses and themes that used in zoology

Bio-inorganic chemistry:
Elements, atoms and molecules, thief features. Chemical reactions, dissociation. Water. Features of solutions

Biophysics:
Molecular Physics. Thermodynamics. Optics. Acustics

Genetics:
Cytological peculiarities of sexual reproduction. Genetic of sex. Genetic populations. Gene expression. Biosynthesis of protein

Botany:
Structure of plant cell, tissues and organs. Reproduction and development of higher plants.

Applied Zoology

Following courses that use knowledge of zoology

Animal anatomy
Morphological and anatomy structure of animal body. Structure of organs and organic systems

Veterinary ecology
Components of ecosystem. Feeding chain. Circulation of mineral biogenous elements

Parasitology
Development and spreading of parasitic organisms. Epizooties. Prophylaxy

Plant physiology
Functions of organic systems of animals. Respiration, circulation, digestion, metabolism.

Monitoring of the self-learning of students in zoology

Monitoring of self-learning is provided during the semester according to the Program of the Course.

Methods:

1. Express-monitoring. Verbal questioning during lab of several students on the theme indicated before.
2. Checking note-books with pictures on structure of representatives of animal phyla.
3. Checking fulfilling tasks for self-learning according to the Time-table.
4. Colloquia:
    - **1.** Unicellular animals (Protozoa). Phylum Sarcomastigophora. Sporozoa and Microsporidia. Infusoria. Multicellular invertebrates (Metazoa). Phylum Spongia (Porifera). Phylum Cnidaria.
    - **2.** Phylum Plathelminthes; Phylum Nemathelminthes; Phylum Annelida
    - **3.** Phylum Arthropoda (Crustacea, Insecta, Chelicerata.
    - **4.** Phylum Chordata. Anamnia.
    - **5.** Phylum Chordata. Amniota.

Criteria for marks in Applied Zoology

‘Excellent’: for students who expressed deep and systematical knowledge in this course, able to fulfill all the labs by themselves, deeply familiar with the literature recommended for the Course as well as understand connection of zoology with veterinary medicine.

‘Good’: for students who expressed all the knowledge according to the curriculum, good knowledge of zoological objects proposed for labs, good familiar with recommended literature as well as express systematical knowledge in zoology during the semester and are able to enhance their knowledge by themselves.

‘Satisfactory’: for students expressed basic knowledge in zoology enough for further study and professional activity, fulfill all practical tasks including labs, generally familiar with recommended literature, but making mistakes during answerings (exams) which can be overcome with assistance of the lecturer.

‘Unsatisfactory’: for students with serious gaps in knowledge, who are not able to continue professional study and fulfill professional activities; also unsatisfactory mark should be put for students who have not fulfill all the tasks according to curricula.

‘Pass’: for students, who fulfilled all the labs, obtained practical skills for appropriate solo activity, able to make preparations as well as provide morphological and anatomy investigations.