



**Department of Animal Resources**

**College of Agriculture Engineering Sciences**

**University of Salahaddin-ERBIL**

**Subject: Avian Physiology**

**Course Book – YEAR 3 – 2<sup>end</sup> Semester**

**Theory Lecturer's name**

**Dr. Pakiza Hamira Wasman BSc, MSc, PhD (Lecturer)**

**Dr. lanja assad MSc.**

**Practical Lecturer's names**

**M. Delman Dler Maulood**

**Academic Year: 2022/2023**

**Course Book**

<b>1. Course name</b>	<b>avianPhysiology</b>
<b>2. Lecturer in charge</b>	<b>Dr. Pakiza Hamera</b>
<b>3. Department/ College</b>	<b>Animal Resource/Agriculture</b>
<b>4. Contact</b>	<b>e-mail: pakiza.wasman@su.edu.krd Korek Mobil: 07504472821</b>
<b>5. Time (in hours) per week</b>	<b>Theory: 2      Practical: 3</b>
<b>6. Office hours</b>	<b>Saturday, Sunday, Monday, Tuesday &amp; Wednesday ( 9.0 to 12 AM.)</b>
<b>7. Course code</b>	
<b>8. Teacher's academic profile</b>	<b>Dr.Pakiza HW BSc.,MSc.,PhD.</b>
<b>9. Keywords</b>	<b>Animals, physiology, body systems, endocrine</b>
<b>10. Course overview:</b>	
<p>The aim of this course is to study the organs and body parts of poultry that the material studied is very important because the physiology of poultry has to be knowledge and know all the members and parts of the body and to know every part of every part and function of these parts.</p> <p>The fact that the physiology of poultry a basis function in breeding and production of chicken, whether it for the purpose of egg production of egg production of meat, so is the integrated study of the aspects of different physiological entire input to increase production in the fields of poultry and could include some of these important aspects in the study of this course is to know the cell and its parts and functions, as well as the definition of blood and its parts and functions of their parts and their relationship to images and then the doll with different physiological situations for poultry, especially for its contribution in determining the capacity of the health of poultry as well as the knowledge of organs of the body and the physiology of each part of the members of the body.</p> <p>Physiology and the fact that a poultry breeding grounds in the job and production therefore is the integrated study of all aspects of the different physiological input to increase the production of meat and eggs and could include some of these important aspects in the study of this course is the following:</p> <p>Knowledge of the cell and its parts and functions, as well as the definition of blood and its parts and functions of parts and images puppet and its relationship with the cases different avian physiological, in particular for their contribution in determining the health of poultry as well as the knowledge of organs of the body and the physiology of each part of the body.</p> <p>And the student during this course and article to learn all blood and find out all parts of the body and find out all the equipment needed to this article and how to work out as well useful knowledge of how to take blood from birds and go to the field study the material in practice for themselves as well as see all parts of the body and the anatomy of birds and at the end of this course will be the student has the knowledge and pictures related with blood and body parts and other materials easier for them will be studied by that in the fourth stage and even during their work after graduation from college.</p>	
<b>11. <u>Course objective (Theory):</u></b>	
<ol style="list-style-type: none"> <li><b>1. Anatomy and physiology of poultry</b></li> <li><b>2. Describe the circulatory system, the parts and the functions.</b></li> <li><b>3. Describe blood regulation the parts and the functions.</b></li> <li><b>4. Describe the digestive system and steps of digestion, also the parts of digestive system and their functions.</b></li> <li><b>5. Describe the male and femal Reproductive System, the parts and the functions.</b></li> </ol>	

6. Endocrin system.
7. Nerves system.
8. Resperotary syastem.

**Course objective (Practical):**

The aim of the course for this article is to try effort possible to students all that is needed in this field and the most important points to be learned from the beginning until the end of the course is:

- The most important actions that take place within the coefficient of avian physiology from the beginning of the internal and external environment.
- The most important actions performed on the body systems.
- Specifications of each organ.
- How to make the blood cells analysis.
- How to anatomization the most systems, the hormones and enzymes that effects.
- Teach students the process of breathing and thermoregulation mechanisms in animals.

**12. Student's obligation**

Students should attend the lectures (theory and practical) and participate in all quizzes during the course, also monthly examination and home work with reports required.

**13. Forms of teaching**

The forms of teaching include data show, power point, well labeled diagrams, graphs, flowcharts and tables have been incorporated systems also white board for explaining the subjects which needs more explanation.

**14. Assessment scheme**

Theoretical + Practical (100%)

40% = 25% Theoretical +15% Practical

60% = 40% Theoretical +20% Practical

Two monthly theoretical examination (10+10) marks plus 5 marks ( Quizzes)

**15. Student learning outcome:**

During this semester the student should learn the reasons for studying physiology events of avian, and how each organ or system achieved their functions in different parts of the body, methods of blood determination and breakdown of feeds in the animal digestive system.

Also learn how body systems are classified according to stomach type of diet consumed, steps of digestion.

In addition, the importance and the role of hormones and enzymes in each part of avian body. Finally, the student will learn physiological events, anatomy, growth and reproduction of avian.

**16. Course Reading List and References:**

1. Anatomy and physiology of farm animal ( Rowen D. Frandson, W. Lee Wilke and Anna Dee Fails 7<sup>th</sup> Edition , 2010 )
2. Essential of Animal Physiology ( S.C. Rastogi, 4<sup>th</sup> Edition, 2007)
3. Animal Physiology ( Richard W. Hill, Gordon A. Wyse and Margaret Anderson, 3<sup>rd</sup> Edition 2012 )
4. Hormonal regulation of farm animal growth ( K.L. Hossner , 2005)
5. Poultry physiology (Randall 2000).
6. Laboratory Manual of Human Anatomy and Physiology. 2002, The McGraw-Hill Companies.

<b>Magazines and Review (Internet)</b>	
<ul style="list-style-type: none"> <li>• Journal of poultry Science</li> <li>• International Journal of Animal Science</li> <li>• Journal poultry Reproductive</li> <li>* Endocrinology Journal</li> </ul>	
<b>17. The Topics: Theory lectures</b>	<b>Lecturer's name</b>
<b><u>Lecture – 1:</u> Introduction Learning Objectives</b>	<b>Dr. pakiza hamira wasman (2 hrs.) 8/01/2023</b>
<p><b><u>Lecture - 2-</u> digestive system.</b></p> <p><b>Beak / Mouth:</b> Chicken’s obtain feed with the use of the beak. The feed then enters the digestive system via the mouth. The mouth contains glands that secrete saliva containing enzymes which begins the digestion of the feed consumed.</p> <p><b>Esophagus:</b> The esophagus is a flexible tube that connects the mouth to the crop with the rest of the digestive tract. It carries food from the mouth to the crop and from the crop to the proventriculus.</p> <p><b>Crop:</b>The crop is an out-pocketing of the esophagus and is located just outside the body cavity in the neck region. Consumed feed and water are stored in the crop until the remainder of the digestive tract is ready to receive more feed. crop where feed is mixed with water to soften feed particles to enable the penetration of acid which improves the digestion process, availability of water is most important.</p> <p>- In birds the stomach consists of two parts:</p> <p><b>A. Glandular stomach (or proventriculus):</b> Is located near the end of the crop. This is the first section of the gastrointestinal tract, where digestion really begins. (Digestion means <i>breaking up</i> into small absorbable portions). The cells lining the glandular stomach secrete enzymes that digest proteins to amino acids.</p> <p><b>B. Muscular stomach (or gizzard):</b> The gizzard is near the end of the proventriculus , is much larger and more muscular in appearance when compared to the proventriculus.</p> <p><b>Small Intestines:</b></p> <p><b>Three sections: Duodenum , Ileum, Jejunum</b></p> <p><b>Small intestine and enzyme actions:</b> In the small intestine most by the wall of the small intestine into the blood stream and carried to the different body parts where they fulfil.</p> <p><b>Pancreas:</b> The pancreas plays important roles in both the digestive and hormonal systems. It also secretes hormones into the blood system that are important in the regulation of blood sugar.</p>	<b>Dr. pakiz hamira wasman (2 hrs.) 15/01/2023</b>

<p><b>Liver: Multi-lobed organ, The color varies somewhat depending on the fat content. Each lobe of the liver is drained by a bile duct, The duct from the right lobe is enlarged to form the gallbladder, Both ducts enter the small intestine together.</b></p> <p><b>Ceca: The ceca are two blind pouches at the junction of the small and large intestines.</b></p> <p><b>Cloaca: The cloaca, also known as the vent, serves as a temporary storage organ of the indigestible feed residues and uric acid. In adult males the sperm ducts (tubes).</b></p>	
<p><b><u>Lecture – 3</u> The Circulatory System</b></p> <p><b>The circulatory system is responsible for the transport of the various essential compounds and other factors around the body, as well as the removal of the metabolic wastes that accumulate in the tissues from body activities, to the appropriate places. The compounds and other factors transported around the body are blood, nutrients, medications and antibodies to fight infection, the residue of worn out cells and the wastes of metabolism. There are times when undesirable compounds and factors are found in the system as well, such as poisons or toxins and disease causing organisms.</b></p> <p><b>Heart: In broad terms the heart acts as the pump that pumps in two directions:</b></p> <ol style="list-style-type: none"> <li><b>1. To the lungs where the carbon dioxide in the blood is removed and the oxygen replaced</b></li> <li><b>2. To the rest of the body to deliver the nutrients and oxygen to the cells and to collect wastes and carbon dioxide.</b></li> </ol> <p><b>The blood leaves the heart via arteries called the aorta (to the body) and the pulmonary artery (to the lungs). The blood always enters the heart via the vena cava vein (from the body) and the pulmonary vein (from the lungs).</b></p>	<p><b>Dr. pakiza hamira wasman (2 hrs.) 22/01/2023</b></p>
<p><b><u>Lecture – 4</u>- Blood:</b></p> <p><b>Blood is a liquid connective tissue which represents internal medium of the body and save the life of cells by supplying them with necessary food and oxygen for life. And the advantage of relatively stable blood continued its contents where the changes that occur in very narrow so it knew the relative stability Homeostasis by Cannon, a result of this relative stability in birds body cells, its functions are performed only.</b></p> <p><b>Components of Blood: Red Blood Cells (erythrocyte) ,White Blood Cells (leukocyte) Thrombocytes (platelets), Plasma and serum.</b></p> <p><b>Blood consists, carries and function:</b></p> <ol style="list-style-type: none"> <li><b>1. Liquid intercellular substance or plasma</b></li> <li><b>2. Suspended formed elements</b></li> </ol> <p><b>The formed elements include the red corpuscles or erythrocytes, the white corpuscles or leukocytes and the thrombocytes that correspond to the mammalian platelets. Blood</b></p>	<p><b>Dr. pakiza hamira wasman (2 hrs.) 22/02/2023</b></p>

<p><b>also carries a great number and variety of other substances and factors. These include: Products from metabolism (wastes), Hormones, Enzymes, Antibodies, Effete products of tissues and organs (effete = worn out), Many other organic and inorganic compounds</b></p> <p><b>Components of Blood: 1. Red Blood Cells (erythrocyte) 2. White Blood Cells (leukocyte) 3. platelets (thermbocytes) 4. plasma and serum</b></p>	
<p><b><u>Lecture- 5- Reproductive system:</u></b></p> <p><b>Different from mammals:</b> young are not carried in the hens body. develop inside a fertilized egg outside the hens body</p> <p><b>Process:</b> begins with male placing the sperm into oviduct of the female. male papillae deposits sperm in cloacal wall of female. sperm move up the oviduct to the funnel where the egg is fertilized. sperm cells remain in oviduct 2-3 weeks after matins. sperm have full fertilizing ability for about 6 days. after then - ability of sperm to fertilize egg is decreased.. 10th day - 50% ability. 19th day - 15% ability. after yolk is fertilized it moves through the tract where the rest of the egg is added.</p> <p><b>The Reproductive System:</b> The avian <b>reproductive system</b> is heterosexual and requires both a male and a female, each to contribute half of the genetic constitution of the offspring. The male contributes his half by way of the sperm produced by the testes and carried in the semen. The female contributes hers in the ovum carried by the egg yolk produced by the ovary.</p> <p><b>Male reproductive system</b>The male reproductive organs in the domestic fowl consist of two testes, each with a deferent duct that leads from the testes to the cloaca. Fowls do not have a penis such as is found in other animals. The testes are bean shaped bodies located against the backbone at the front of the kidney. Their size is not constant and they become larger when the birds are actively mating. The left testes is often larger than the right. On the inside of each is a small, flattened area that is believed to correspond to the epididymis of mammals. The deferent duct starts at this flattened area.</p> <p><b>Deferent Duct:</b></p> <p><b>Parts of male chicken reproductive system:</b></p> <ol style="list-style-type: none"> <li>1. Two testes located internally in the body</li> <li>2. Sperm</li> <li>3. Ducts Deferens</li> <li>4. Rudimentary phallus</li> </ol>	<p><b>Dr. pakiza hamira wasman (2 hrs.) 29/01/2023</b></p>

**Female reproductive system:** The female reproductive system in the domestic fowl consists of the ovary and the accompanying oviduct. While the female embryo in chicken has two sets of reproductive organs, only one of these, the left survives and reaches maturity to produce eggs. The single surviving ovary is located in the laying hen just in front of the kidneys in the abdominal cavity and is firmly attached to the wall of the cavity. developing yolk.

**Ovary:** The ovary consists of a mass of yellowish, rounded objects called follicles, each containing an ovum or yolk. There are many such follicles but only a small number in comparison, will ever reach maturity to produce an egg. When the hen is in lay the ovary will be active. **It is possible to find five stages of development in the active ovary:**

1. **Primary follicles** – follicles that have not yet commenced to grow.
2. **Growing follicles.**
3. **Mature follicles** – follicles ready or nearly so for release.
4. **Discharged follicles** – where the yolk has just been released.
5. **Atretic follicles** – those from which the yolk has been released some time ago.

**Oviduct:** The function of the oviduct is to produce the albumen, shell membranes and the shell around the yolk to complete the egg. There are many glands found in its walls that produce the albumen, the shell membranes and the shell. In the non-layer, the oviduct is quite short and small in diameter. **The oviduct consists of five distinct parts or sections, each having different functions:**

**Infundibulum (or funnel):** located adjacent to the ovary and with long segments enclosing the ovary, the infundibulum collects the yolk after its release from the follicle as a funnel and directs it into the oviduct. Fertilisation of the ovum by the male sperm occurs here.

**Ampulla or magnum:** at approximately 40 centimetres long it secretes more than 40% of the albumen.

**Isthmus:** at about 12 centimetres in length, it secretes some albumen and the shell membranes.

**Uterus or shell gland:** at approximately 12 centimetres in length it secretes about 40% of the albumen and the egg's shell.

**Vagina:** at approximately 12 centimetres in length, it secretes the egg's outer cuticle and possibly the shell pigment.

**Androgen, Oestrogen and Progesterone:** In addition to the production of eggs, the female reproductive system also produces hormones that aid in the control of body functions. These include: **Androgen** causes comb growth and condition and has a function in the formation of albumen. **Oestrogen** causes the growth of the female plumage, mating and nesting behaviour, oviduct development together with the nutrient supply to the ovary/oviduct for egg formation. **Progesterone**, with androgen, is involved in the production of albumen and the carriage of the message to the pituitary gland to release luteinising hormone.

**The formation of the hen's egg:** The normal egg consists of the following major parts:

1. **Yolk carrying the ovum** – produced by the ovary
2. **Albumen or white** – produced mainly in the magnum
3. **Shell membranes** – produced in the isthmus
4. **Shell** – produced in the uterus or shell gland

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(2 hrs.)  
5/02/2023**

**Ovulation:** The release of the yolk (the process of ovulation), is the major controlling factor influencing the subsequent steps in the formation and laying of the egg. The presence of a mature yolk in a follicle causes hormones from the ovary to stimulate the release of **luteinising** hormone (LH) by the pituitary gland. The presence of LH in the blood stream causes the follicle that contains the mature yolk to split along the stigma thus releasing it into the oviduct abdominal cavity adjacent to the oviduct.

**Sexual Maturity:** Sexual maturity is reached when the hen lays the first egg in her life. Generally sexual maturity is genetically controlled; however, environmental factors play a very significant role. It will be in the age range of 18-24 weeks depending on fowl genotype, but it can be manipulated by controlled feeding practices, light intensity and day length management and other management practices.

**Egg Formation Time:** The time taken from ovulation until when the egg passes through the vent varies with individuals within the range of 23 to 26 hours.

**Ovulation Time:** The releasing of the egg yolk from the ovary to begin its journey through the oviduct. Hens that produce long clutches release the yolk very shortly after first light (whether natural or artificial light). Successive ovulations occur very shortly after the laying of the previous egg.



**Lecture – 6 - Immune system: The avian immune system operates on the same general principles as the mammalian immune system. It is divided into two mechanisms – non-specific and specific.**

**1. Non-specific immune mechanism includes the inherent ways in which the chicken resists disease. This protective system is often not considered when designing a poultry health program. The non-specific mechanisms include:**

**1. Genetic factors. 2. Body temperature. 3. Anatomic features. 4. Normal microflora. 5. Respiratory tract cilia.**

**2. Specific immune mechanisms (acquired system) are characterized by specificity, heterogeneity, and memory. This system is divided into cellular and non-cellular (humoral) components.**

**Production of antibodies: Antibodies are proteins. You will also recall that proteins are chemical substances, occurring widely in nature and are the substances of meat, feathers, nails, liver tissue; too many to mention.**

**Secondly, those amino acids are the building blocks of proteins. It thus means that a chicken will only be able to make antibodies if it is healthy and consuming feed.**

**Organs that make antibodies: Organs involved in the production of antibodies are for example the Harderian gland, the thymus glands, the spleen, the cecal tonsils, the Bursa of Fabricius or the gland-like tissue in the gut wall, known as Peyer's patches. An organ that plays a very important role especially to protect the day-old chicken is the bursa of Fabricius.**

**Lymphatic system: The lymphatic system of chickens does not contain lymph nodes and in general is poorly developed when compared with mammals.**

**1. Thymus: gland consists of about five pairs of pale pink, flattened, irregularly shaped lobes strung out along both sides of the neck, near the jugular veins. The thymus decreases in size as the bird matures.**

**2. Spleen: a small, round, soft organ similar in color to the liver.**

**The normal spleen is about 19 millimeters in diameter, located near the ventricular (gizzard) in the body cavity. The functions of the spleen include phagocytosis of worn-out erythrocytes in red pulp, lymphocyte production in white pulp, and antibody production in both the red and white pulp.**

**3. bursa of Fabricius: In birds, the bursa of Fabricius (Latin: Bursa cloacalis or Bursa fabricii) is the site of hematopoiesis, is necessary for B cell (part of the immune system) development in birds.**

**4. Lymph nodes: The lymphatic system of chickens does not contain lymph nodes and in general is poorly developed when compared with mammals they are found in aquatic birds.**

**5. Mural lymphoid nodules: They are very numerous and occur in all birds. They are usually confined to one side of a vessel and may protrude into the lumen.**

**Solitary and aggregated lymphoid nodules: are found in varying amounts in all tissues and organs of bird's body.**

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(2 hrs.)  
12/02/2023**

**A. Examination**

**The Non-specific immune mechanism includes what?**

**How antibodies are Product?**

**Define the Erythrocyte Sedimentation Rate (ESR), the rate of deposition of red blood cells on the two main forces explains it.**

**Explain Solitary and aggregated lymphoid nodules?**

**What are the meanings of this two term (MCHb  $\alpha$  MCHC)?**

**Practical lectures**

**1: Blood: including: Functions of the blood, Composition of blood,**

**The major types of blood cells and Anticoagulants types**

**2: Collection of Blood samples from animals in the field, plasma and serum preparation, Ta**

**3:Osmosis: Kinds of membranes, Preparation of different solutions (hypertonic, hypotonic and isotonic solutions) then application of osmotic fragility experiment.**

**4: Blood CBC: Red blood cell count. White blood cell count.**

**5: Packet Cell Volume (PCV)**

**6:Blood groups (ABO system and Rh system)**

**7: Erythrocytes Sedimentation Rates (ESR)**

**8: Hemoglobin Determination (HB).**

**9: Bleeding and clotting Times (3 experiments).**

**10: Respiratory system: Lung volumes and respiration abnormality.**

**11: Digestive system: Parts of digestive tracts in ruminant and study their functions**

**12: Circulatory system: Cardiac cycle and blood pressure.**

**19- Sample of practical examination**

**Q\ Explain the following sentence: For example\**

**Plasma membrane is semi permeable membrane.**

**Answer\ Movement of water across a semi-permeable membrane from an area of high [water potential](#) to an area of low water potential.**

**Q\ define this following term:**

**For example\**

**Osmosis:**

**Answer\ The movement of water molecules from an area of high concentration to an area of low concentration.**

**Q\ write the function of these following items:**

**For example\**

**Blood plasma:**

**Answer\ Plasma transports materials needed by cells and materials that must be removed from cells:**

**Various ions (Na<sup>+</sup>, Ca<sup>2+</sup>, HCO<sub>3</sub><sup>-</sup>, etc.)**

**glucose and traces of other sugars**

**amino acids**

**other organic acids**

**cholesterol and other lipids**

**hormones**

**urea and other wastes**

**What is the principle of HB estimation?**

**Answer: Principle: this method based on conversion of hemoglobin to acid hematin, which is brown in color.**

**Fill the blanks with correct answer:**

**There two methods blood clotting measurement ..... And.....**

**(test tube method and capillary method)**

**Answer by true or false and correct the false words:**

**If RBCs number increase this lead to decrease Hb and PCV. (False)**

**20. Extra notes:**

**Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks.**

**21. Peer review**

**پیداچوونہوہی ہاوہل**

**This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.**