



**Diyala University  
College of Agriculture  
Department of Animal Resources**



## **Principles of poultry science**

# **Poultry industry**

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٢٠١١

**Poultry industry** refers to operation including many processes such as poultry breeding , hatching , farming and marketing the products with providing all requirements which achieve economic income .

Commercial poultry breeding was initiated in the USA and began in Europe 10 to 15 years later . In 1940 poultry meat was mainly a by-product from commercial egg production , because at this time the technique of **sexing chickens** was still unavailable , and purebred males and females could be distinguished only after they were several weeks old , for economic reasons it was necessary to keep the cockerels until they had reached a marketable weight .

This situation changed radically with the introduction of **chick sexing** which very important in the development of the industry in general and for commercial breeding in particular .

It is well known that the genetic progress in the efficiency in egg production is antagonistic with the efficiency in meat performance and this influence the broiler breeding because genetic progress in growth performance makes compromises with respect to higher reproduction costs of broiler chicks .

From the beginning , chicks produced for meat were crossbreds of the heavy breeds of domestic fowl , using dams from the breed with the better egg production and sires from that with better growth rate was the logical approach . This helped to neutralize some of the effects of the antagonism between the traits , particularly if the cross also resulted in heterosis for growth and viability , and it is not surprising that by 1942 about 97% of commercial broiler were crossbred .

The important point for the shaping of the broiler breeding industry in North America were the ( **Chicken-of-Tomorrow contests**) which came from the sector of the industry closest to the consumer that represent the market forces , this contests created a challenge and a favourable reaction and resulted a development of superior meat-type chickens .

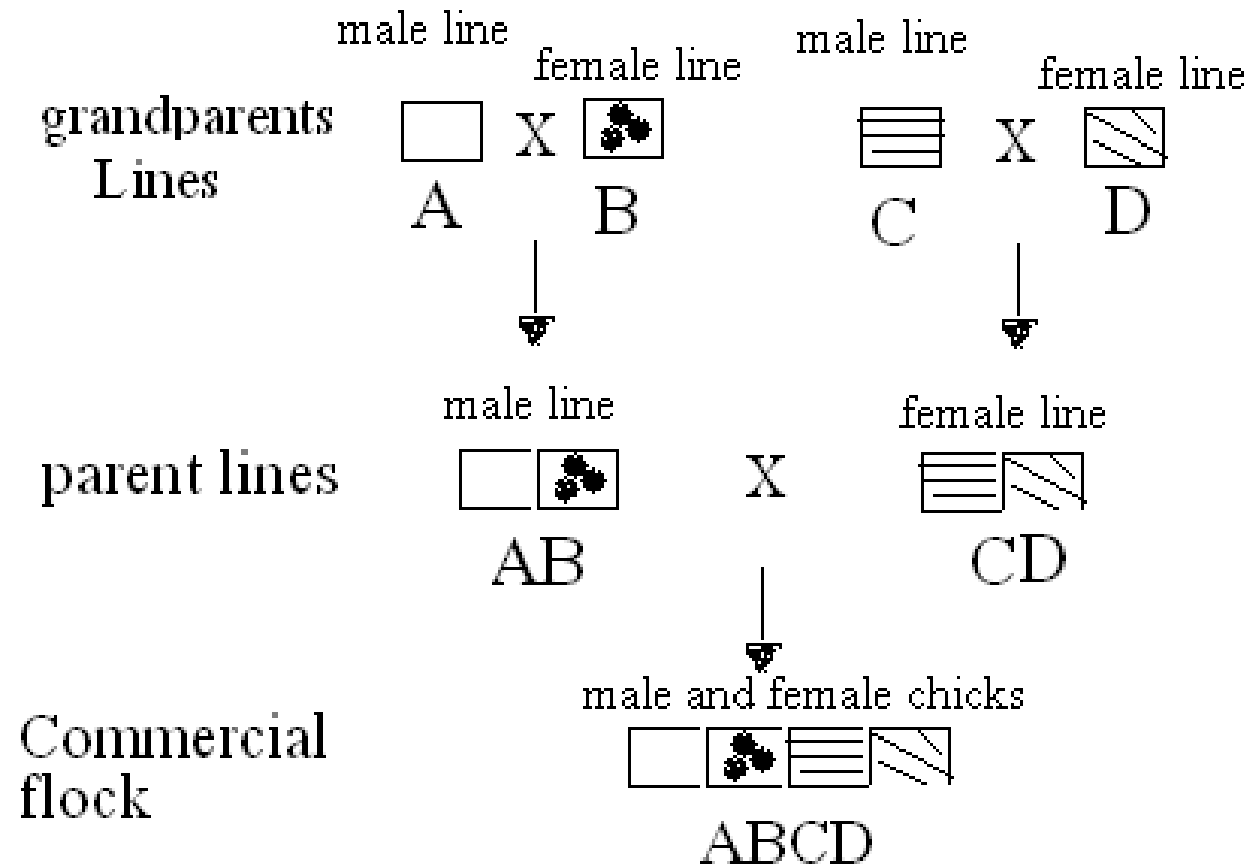
Thus the competitive situation was maintained by continuing comparative tests of the different broiler stocks .

comparative tests were similarly important for progress in egg production efficiency ,thus **random sample egg production tests** became the main driving force for genetic progress .

there were a good progress made in the performance of broilers , such as , broilers required only half the time to reach a weight of 1.6 kg in 1975 compared with 1945 and had consumed one-third less food . Now a days broilers grow to 1.6 kg in only 37 days and require about 1.75 kg of food for each kilogram of body weight .

The primary breeding companies for broilers in the USA are Aviagen ( which includes the formerly separate companies of Arbor-Acres , Ross breeders , and Nicholas turkeys ) , Cobb – Vantress , Hubbard-Isa and Hybro . Most of these companies are multi-national enterprises and they dominate the world market for conventional broiler production .

These companies typically use a system of four-way crossing to produce the parents of the birds that are raised as broilers, as the following diagram :



They select and develop certain strains to use •  
as their **Male Line** , with respect of growth  
performance and body conformation , while at  
the same time developing different **Female Line**  
with respect of reproductive performance . This  
cross-breeding system protects each companys  
genetic research , because the genetics of the  
original grandparents cannot be reproduced  
from their offspring.

Most of the primary breeding companies •  
produce more than one strain of Cornish cross.

The world broiler production is estimated to be •  
32-42 billion birds per year .Estimated global  
market shares for the different broiler breeder  
companies as following :

Company	Global market shares percent
Aviagen	35 – 45 (USA)
Cobb	30 – 40 (USA)
Hubbard	10 – 20 (USA)
Hybro	5 – 10 (Holland)
Others	10 – 20



# The production process in the broiler industry

The components of production are : •

**The Hatching – Egg farms** , providing fertile eggs to the hatchery •

**The Hatchery** , including fertile eggs to produce Day-Old Chicks(DOC) . •

All healthy DOC are sent to **Broiler grow-out** facilities . •

The DOC are raised for about forty-two days , and at that time they are ready for **slaughter** or to be **sold live** . •

At the **processing plants** birds are slaughtered and either converted to **Ready-to-cook** chicken / **Cut-up parts** or further processed to products like deboned chicken , polony , viennas , etc. •







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# **Structure of the Chicken**

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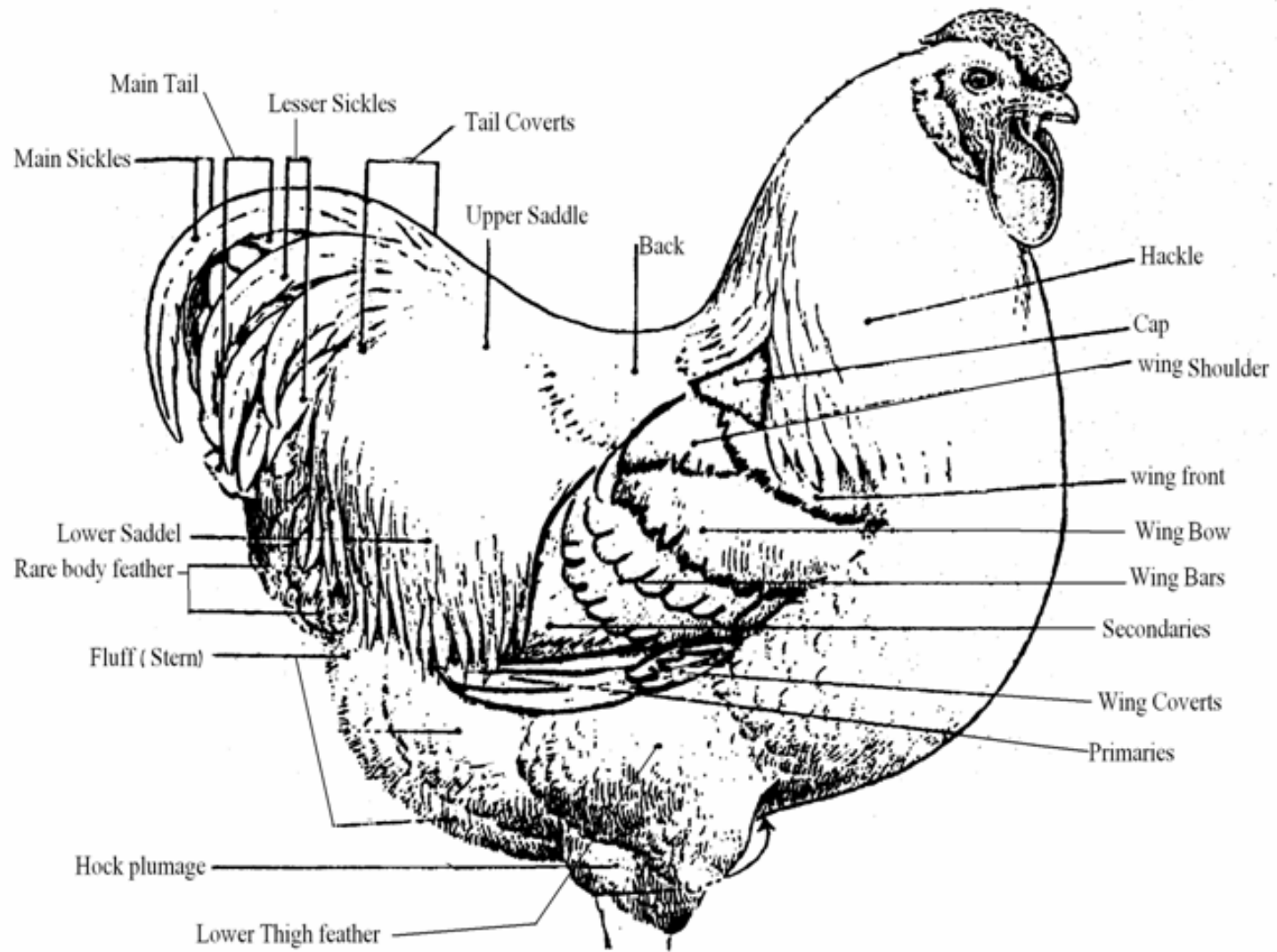
# Introduction

The chicken is a warm-blooded vertebrate with a high metabolic rate, the body temperature of day-old chicks have a temperature of 39 C and the average in the adult birds is between 40.6 and 41.7 C

The chicken is covered with feathers, skin and scales, the latter being a derivative of reptiles from which birds evolved

# The feather in chickens

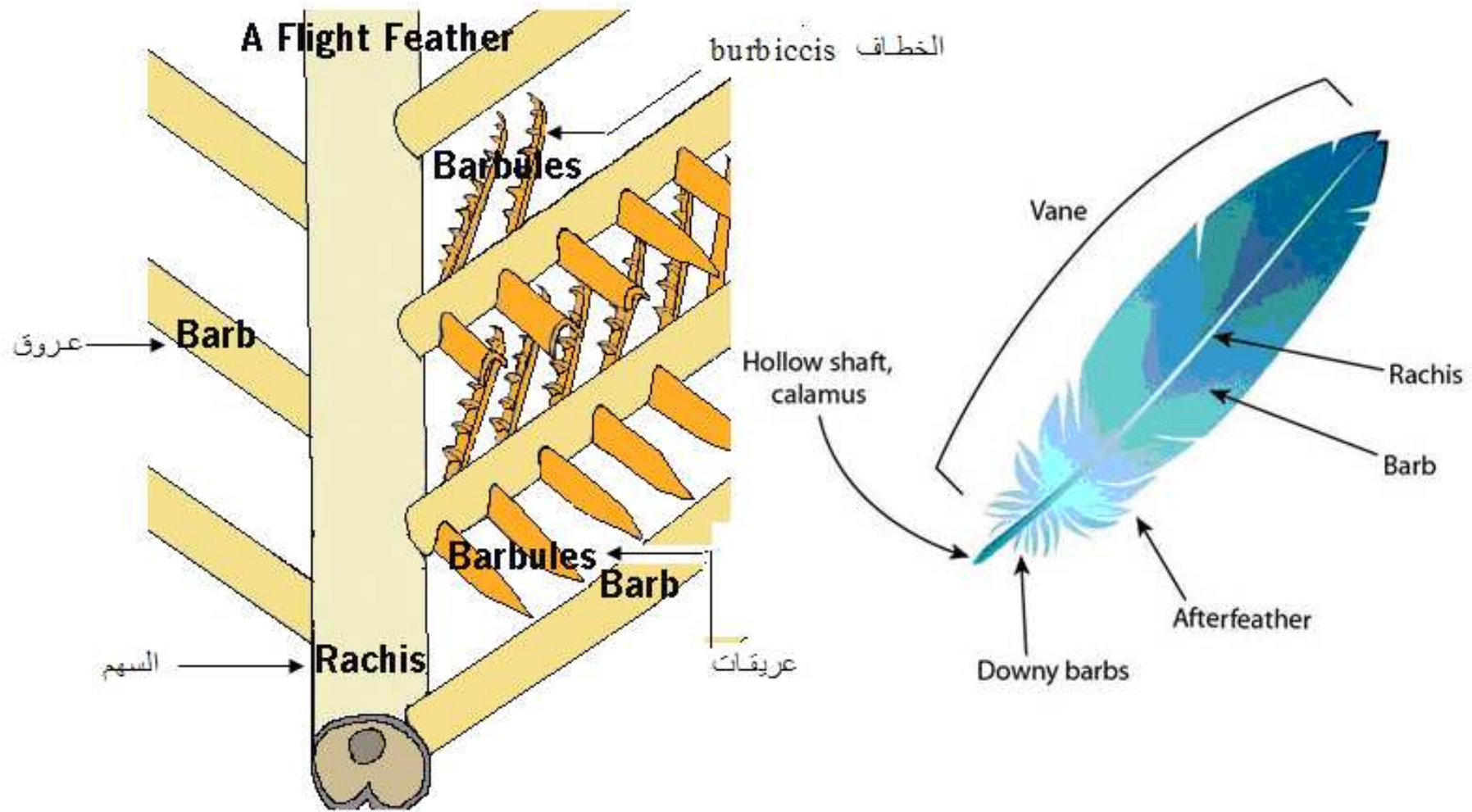
All birds are covered with feathers, collectively called **plumage**, which are specialized structures of the epidermis, or outer layer of skin. The main component of feathers is keratin, a flexible protein that also forms the hair and fingernails of mammals. Feathers provide the strong yet lightweight surface area needed for powered, aerodynamic flight. They also serve as insulation, trapping pockets of air to help birds conserve their body heat. The varied patterns, colors, textures, and shapes of feathers help birds to signal their age, sex, social status, and species identity to one another. Some birds have plumage that blends in with their surroundings to provide camouflage, helping these birds escape notice by their predators. Birds use their beaks to preen their feathers, often making use of oil from a gland at the base of their tails. Preening removes dirt and parasites and keeps feathers waterproof and supple. Because feathers are nonliving structures that cannot repair themselves when worn or broken, they must be renewed periodically. Most adult birds molt—lose and replace their feathers—at least once a year.



**MALE**

Distribution of the feathers on body cock .

***Parts of a feather:*** A feather is composed •  
of a root called the ***calamus***; a long ***quill***  
or ***shaft***, known as the ***rachis*** to give  
rigidity; ***barbs*** extending from the quill;  
***barbules*** extending from the barbs; and  
***barbicells*** extending from the barbules. All  
parts except the quill tend to mesh  
together in the flat portion of the feather.  
Meshing is not pronounced at the base of  
the feather and the loose construction  
gives rise to ***fluff***, often different in color  
than the main web.





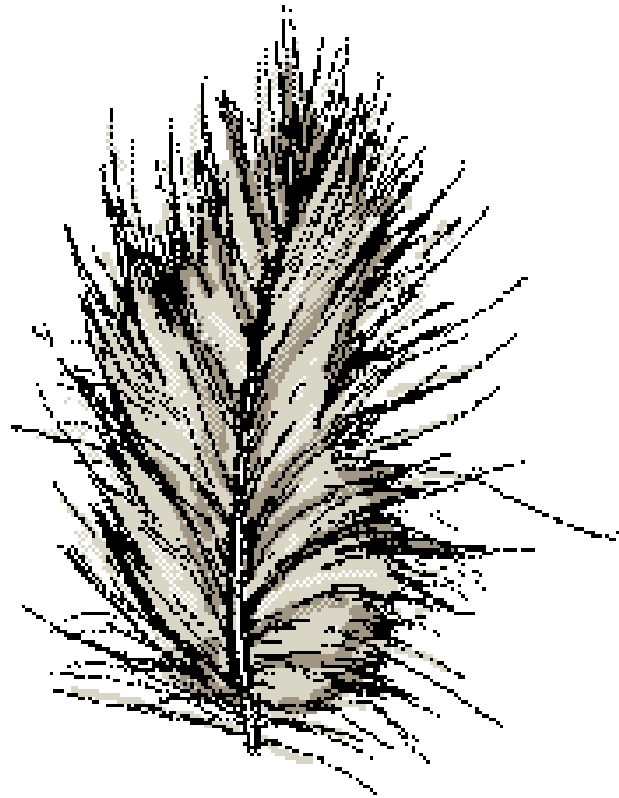
There are three Kinds of Feathers : •

The following picture shows the kinds of feathers - •

**Down feathers**, left, cover a bird's entire body in a loose, irregular layer that traps air to keep the bird warm. •  
**Contour feathers**, center, hooked together by barbs and barbules, provide the flat, strong surfaces of the wings and tail over which air flows during flight.  
**Hairlike filoplumes**, right, grow between the contour feathers.

***How feathers are replenished:*** When the chick hatches, it has almost no feathers. Except for the wings and tail, it is covered with *down*. Soon the down grows longer, and most of the particles develop a shaft. Within a few days the shaft erupts, and the web of the feather makes its appearance. By the time the chick is 4 or 5 weeks of age it has become fully feathered. The first feathers are soon molted, and a new set is grown by the time the bird is eight weeks old. The third set is completed just prior to the time the bird reaches sexual maturity, and is the first **mature plumage**. •

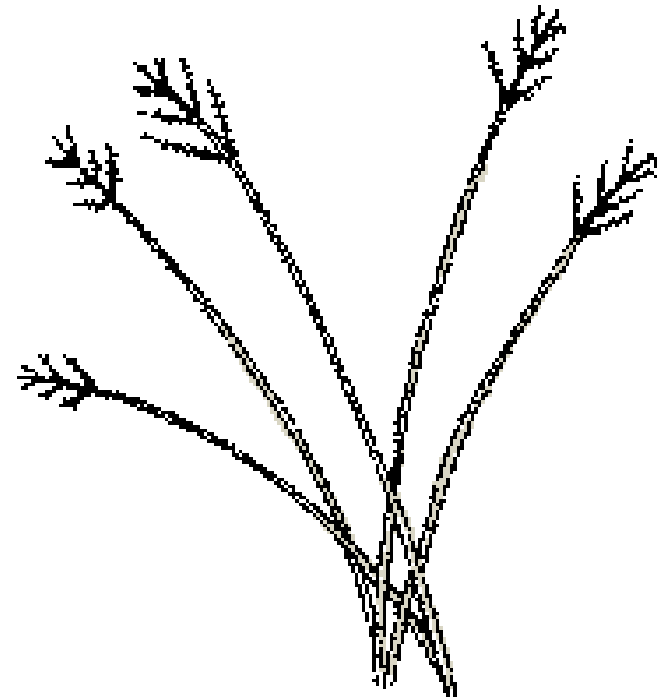
Feathers make up between 4 and 8% of the live weight of the bird, the variability being related to age and sex; older birds and males have a lower percentage. •



Down



Contour ▲



Filoplume

Because feathers wear away, become broken, or are pulled out, nature has provided the adult bird with a method of renewing its feathers approximately once a year through a process of dropping the remaining feathers, and growing a new set. The process is known as **molting**. •

***Shape of the feather:*** Not only do feathers vary greatly in size over the surface of the body, but certain shapes are associated with sex. Gonadal hormones play an important part in this sex variation. They increase the length and narrow the width of certain feathers of the male bird, including the hackle, saddle, sickle, and lesser sickle feathers. •

***Color of feathers:*** There are many feather colors and many color patterns on the individual feathers. In many instances, there are differences in the color according to the location of the feathers on the body. Feather colors and feather patterns are genetic characteristics, and their inheritance has been worked out by scientists. •

# The feathers of chicken wing :

wing front – the extreme front portion of the wing at the shoulder , forward of

the wing bow ( also called wing-butts).

2-wing bow :the surface part of the wing below the shoulder , and between the

wing covert and wing front .

3-wing bars- the distinct bar of color across the middle of the wing .

4-Secondary- the long stiff wing feathers growing from the middle wing segment,

next to the primaries , when the wing is folded the exposed secondaries form a triangular area known as the **wing bay** .

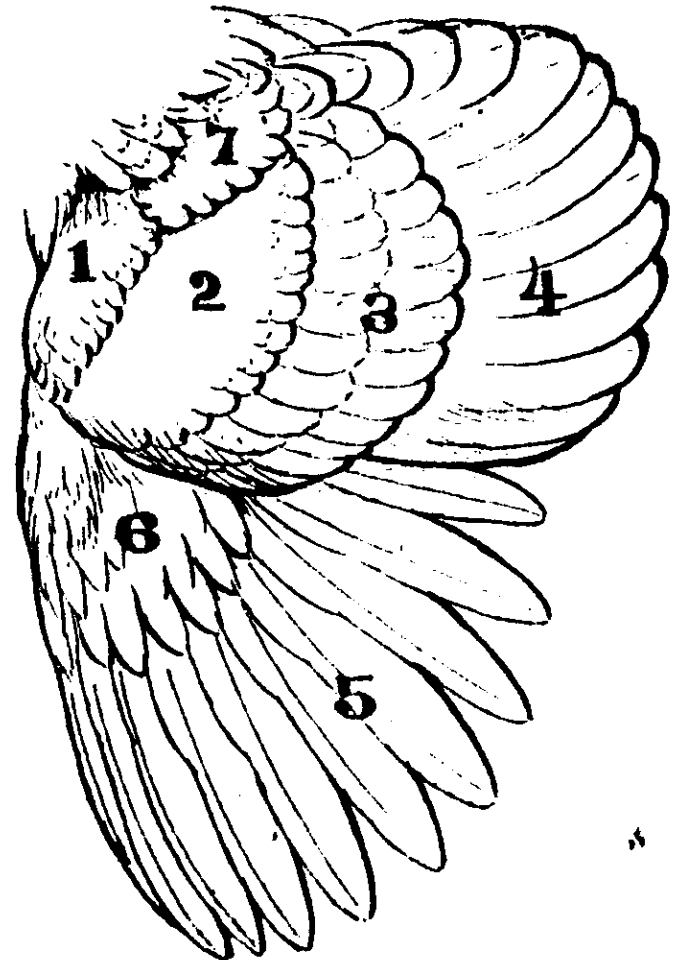
5- Primaries – the long, stiff feathers of the wing , growing from the pinion or outer

Segment, next to the secondaries , also called **flight feathers** .

6- wing coverts – the two rows of broad feathers that cover the lower portion of the

secondaries .

7- wing shoulder .



# The Molt :

Each year chickens molt , or lose the older feathers , and grow new ones .

The molt is the most significant factor associated with egg production , most hens stop laying , others appear decline in the rate of lay and some hens may not affected but their molting time is longer . In the case of good egg-producers, the molt is late in the season, and rapid. Poor egg-producers molt early and slowly .The areas of the body in which the feathers are molted follow a definite or-der and pattern.

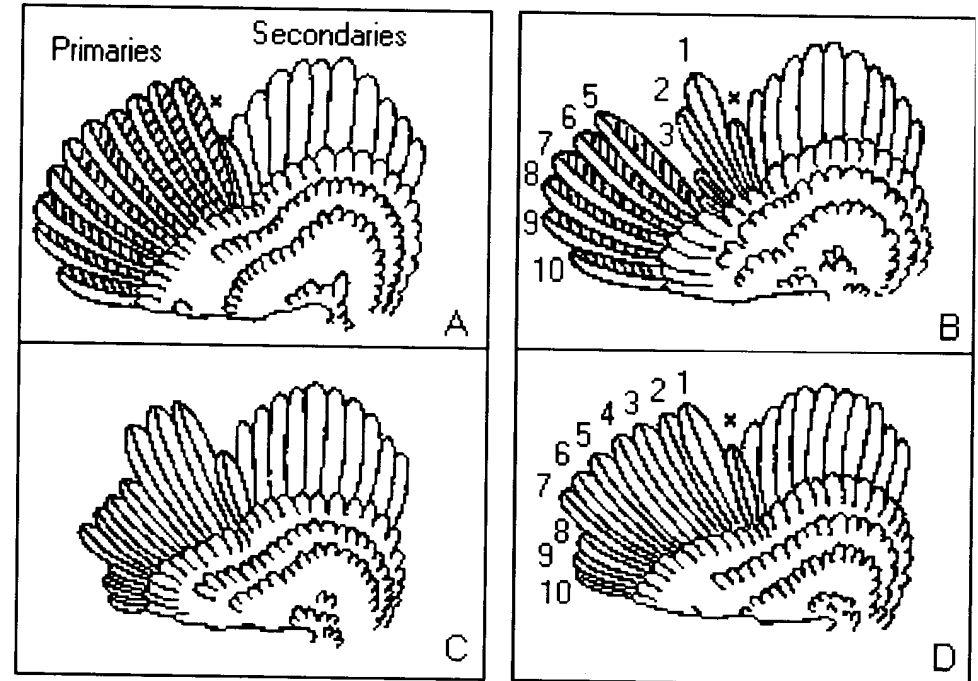
**Body molt:** The feathers are dropped from the various sections of the body in the following order: •

- (1) head
- (2) neck
- (3) breast
- (4) back
- (5) fluff •
- (6) abdomen •
- (7) wings •
- (8) tail •

**Wing molt:** When the wing of the bird is extended, three groups of feathers will be observed as follows; •

- (1) Primaries: These are farthest removed from the body, and usually 10 in number. •
- (2) Secondaries: Normally there are 14 secondary feathers located in the section of the wing closest to the body. •
- (3) Axial feather: Between the two sections of the wing is a single, short feather known as the axial feather. •

The primary feather closest to the axial feather is the first to be molted. The remaining are molted in regular order to the outside of the wing. Consequently, these feathers are numbered from 1 (next to the axial feather) to 10 (next to the wing tip). Normally, one primary feather is dropped at a time, and it takes approximately six weeks for a new feather to fully grow back in. Thus, it would take 16 weeks to complete the primary wing molt and to grow all new feathers to their full length.









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## **The Parts of Chicken Body**

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# Head

The head of the chicken is represented by the following parts:

1-Comb: There are several types of combs, but only the first three of the following list are common:

- single
- walnut
- pea
- "V" shape"
- cushion
- buttercup

Comb type is the result of gene interaction, but comb size is associated with gonadal development and the intensity of light, either natural or artificial. The lower the light intensity, the larger the comb.



2-Eyes •

3- Eyelids •

4- Eye-rings: Inner margin of the eyelids. •

5- Eyelashes: Bristle feathers composed of a straight shaft. •

6- Ears •

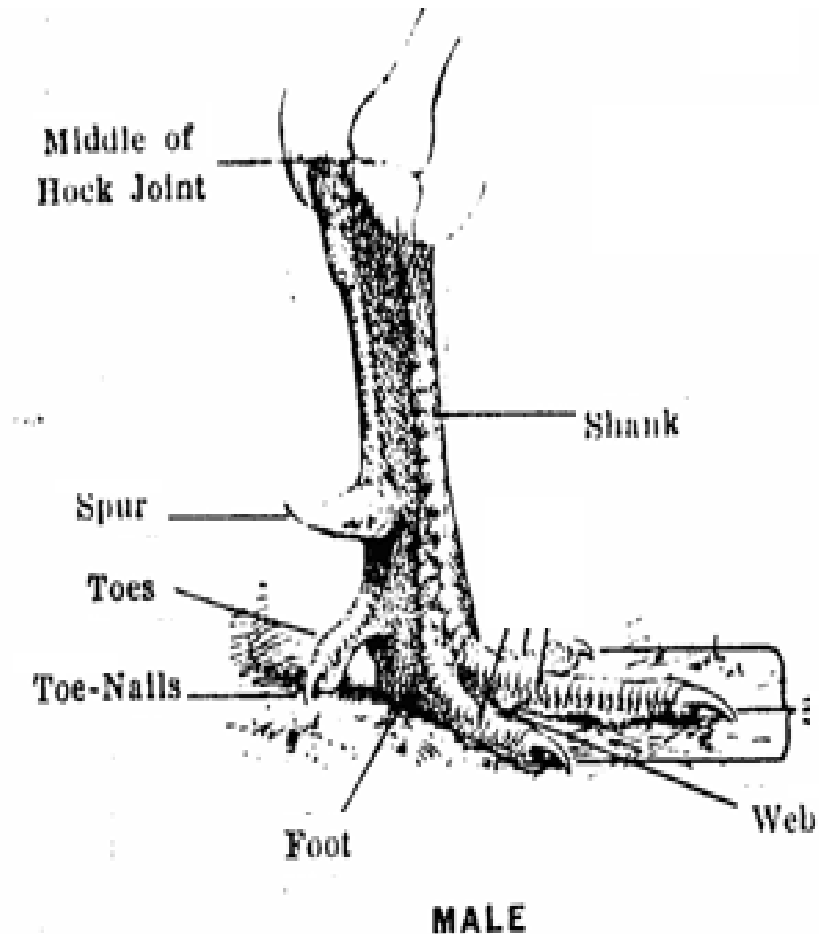
7- Earlobes •

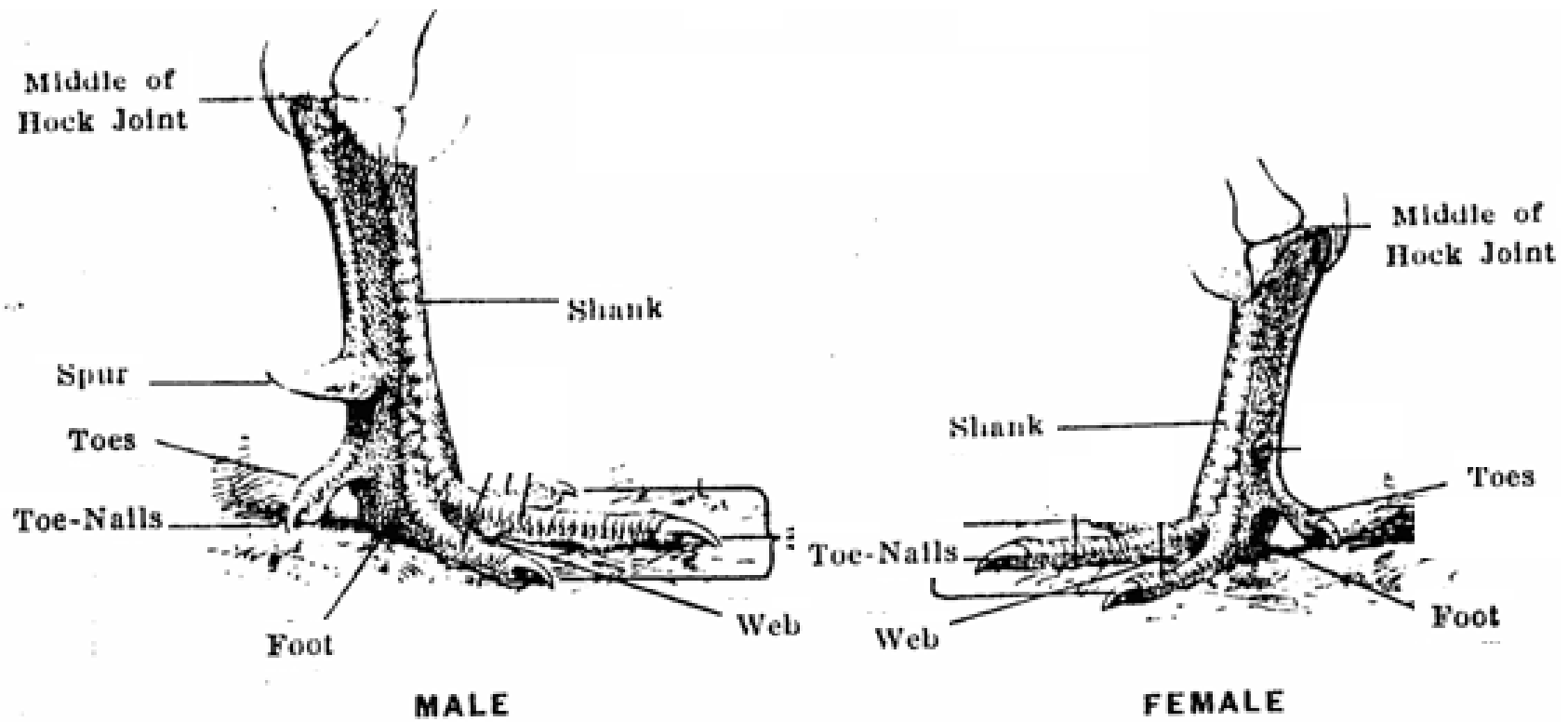
8- Wattles •

9- Beak •

# Feet and Shanks

- The shanks and most of the feet are covered with scales of various colors. Yellow color is due to dietary carotenoid pigments in the epidermis when melanic pigment is absent . varying shades of black are the result of melanic pigment .The complete absence of both kinds of pigment led to be the shanks are white .
- Most chickens have four toes on each foot, but there are a few breeds with five.





## SHANKS AND TOES

# Skin

Most of the chicken is covered with a thin skin. •  
With the exception of the **uropygial gland** (preen gland) located on the upper side of the base of the tail, the skin is void of glands. The absence of sweat glands makes it impossible for the bird to sweat to lose moisture.

The skin takes a different texture in the area of •  
the comb, wattles, earlobes, scales, spurs and claws. Except for certain specialized areas, the color skin is either white or yellow.

# Skeleton

The skeleton supports the body and to which the muscles are attached. The rib cage protects some of the vital organs. •

The skeleton of the neck is long and freely movable, but the remaining portion •

of the vertebral column is rigid, containing many fused bones. •

Several of thoracic vertebrae are united to form a firm base for the attachment of the wing

and its muscles. There is a heavy keel. •

Bones found in the skull, keel, clavicle and some vertebrae are •

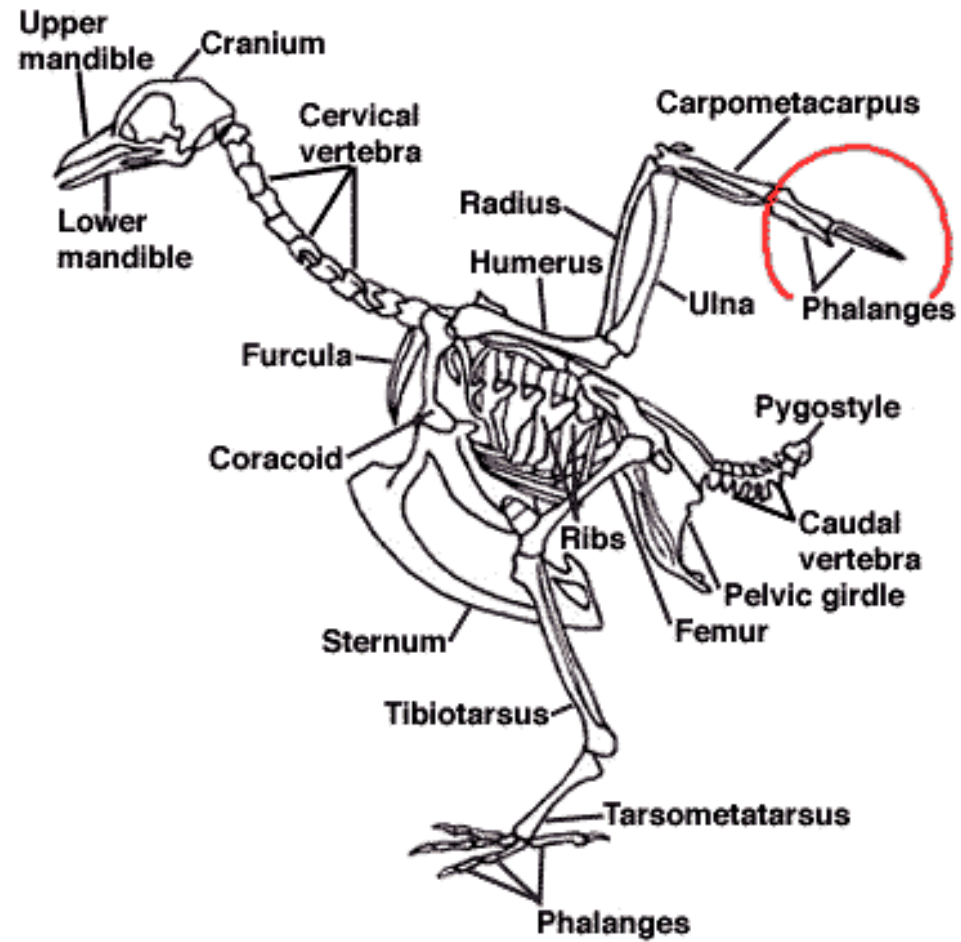
Hollow and connected to the respiratory system, with air continually moving •

and out of these specialized bones. •

(Most bones are light in weight, yet very strong. However, a soft, spongy which known as medullary bone is present in varying amounts in the femur, and certain other bones of the skeleton of females in egg production. This medullary bone is used as a part of the source of calcium for eggshell production. The storage capacity of this specialized bone is highly variable, depend-upon the length and rate of egg production. Most of the calcium needed for the production of eggshells comes directly from the feed eaten each day. •



# Skeleton



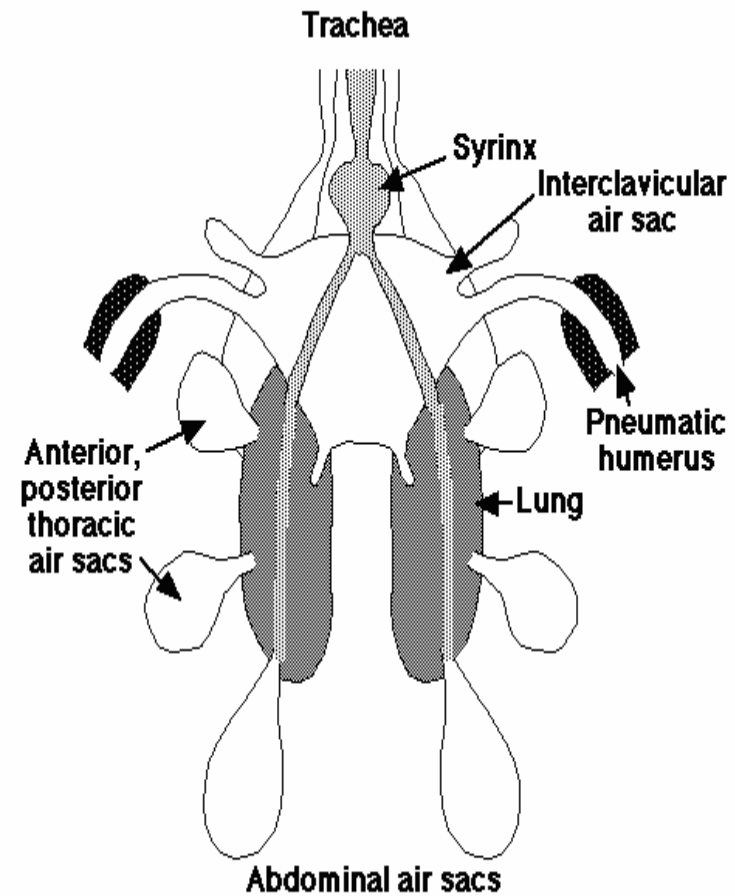
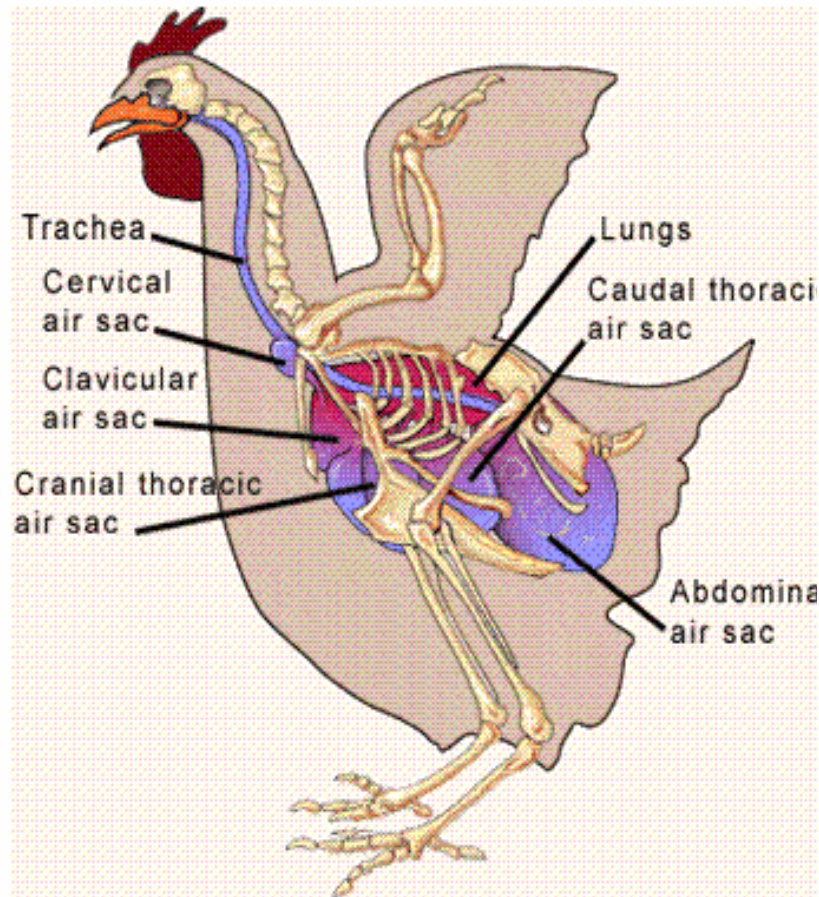
# RESPIRATORY SYSTEM

The respiratory system of the chicken consists of: •

- 1-nasal cavities •
- 2-larynx •
- 3-trachea (windpipe) •
- 4- syrinx (voice box) •
- 5-bronchi •
- 6-lungs •
- 7-air sacs •
- 8-certain air-containing bones •

Compared with mammals, the lungs of the chicken are small but are •  
supple-mented by the air sacs and the air-containing bones. Birds •  
have four pairs of air sacs, plus a single sac (the interclavicular sac).  
The paired ones may be di-vided equally into thoracic and abdominal  
air sacs. Air moves in and out of the lungs and the air sacs freely, but  
the lungs are responsible for most of the res-piration.

# RESPIRATORY SYSTEM





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# **Structure of the Chicken**

**DIGESTIVE SYSTEM**

**BLOOD SYSTEM**

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# DIGESTIVE SYSTEM

## 1-Mouth •

The chicken has no lips, soft palate, or teeth, but there are an upper and lower horny mandible to enclose the mouth, the upper being attached to the skull while the lower is hinged .

The two mandibles are referred to as the *beak*. The dagger-like tongue has a very rough surface at the back to help force food into the esophagus. Saliva, with its enzyme *amylase*, is secreted in the glands of the mouth. However, food passes through the mouth so rapidly that there is little chance for digestion here.

## 2-Esophagus •

The esophagus or gullet is the tube through which the food passes on its route from the back of the mouth (pharynx) to the proventriculus.

## 3-Crop •

Just before the gullet enters the body cavity it extends on one side into a pouch known as the *crop*, which acts as a storage place for food. Little or no digestion takes place here except for that involved with the salivary secretion of the mouth.

#### 4-Proventriculus •

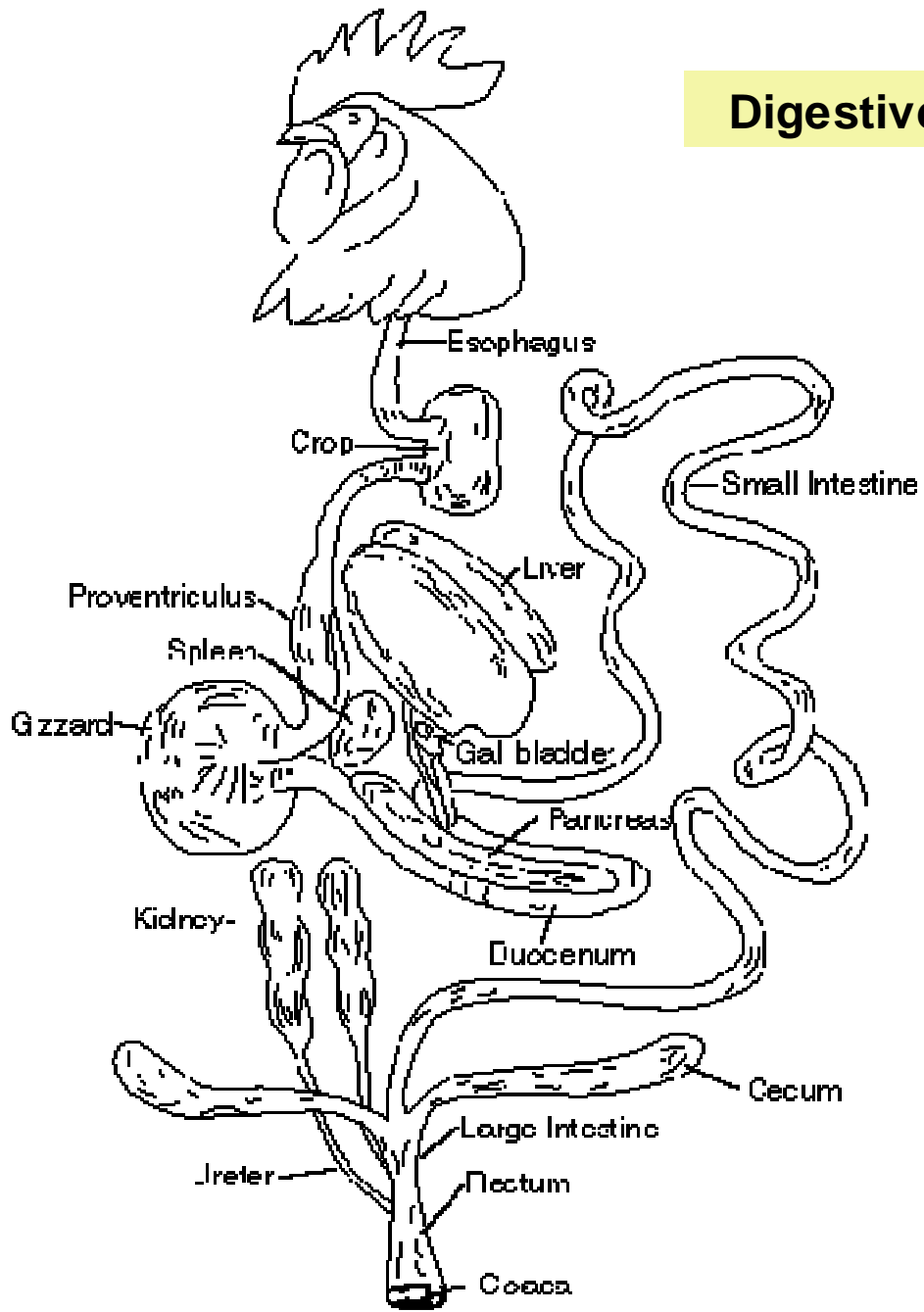
An enlargement of the gullet just prior to its connection with the gizzard is known as the proventriculus, sometimes called the *glandular stomach* or *true stomach*. It is here that gastric juice is produced. *Pepsin*, an enzyme to help protein digestion, and hydrochloric acid are secreted by the glandular cells. Because the food passes quickly through the proventriculus there is no digestion of food material here, but the secretions pass into the gizzard where the enzymic action takes place. •

#### 5-Gizzard •

The gizzard presents two highly specialized morphological features: •  
Massive muscle development and a thick, hard covering over the •  
mucous membrane which related to its functions as a food grinding chamber and as a site for peptic proteolysis .

The gizzard, sometimes called the *muscular stomach*, lies between the •  
proventriculus and the upper limit of the small intestine. It has two pairs of very powerful muscles capable of exerting great force, and a very thick mucosa. The gizzard re-mains quiet when empty, but once food enters, the muscular contractions of its thick walls begin. The larger the particles of food, the more rapid the contrac-tions. As the gizzard usually contains some abrasive material, such as grit, rock, gravel, etc., the food particles are soon ground or reduced to small parti-cles capable of being taken into the intestinal tract. When fine material enters the gizzard it leaves in a few minutes, but when the food is coarse it will remain in the gizzard for several hours. •

# Digestive system of the chicken



## 6-Small Intestine •

The small intestine is about 62 in. (1.5 m) long in the average adult chicken. The first part forms a loop known as the *duodenal loop*. Imbedded in the loop is the *pancreas* which secretes pancreatic juice containing the enzymes *amylase*, *lipase*, and *trypsin*. Other enzymes are produced by the wall of the small intestine and these further the digestion of protein and sugars.

## 7-Ceca •

Between the small and large intestines lie two blind pouches known as the ceca. Each cecum is about 6 in. (15 cm) long in the normal, healthy adult bird, and contains soft feed material which passes in and out. The exact function of the ceca is not known, but evidently they have little to do with digestion; only minor water absorption and a small amount of carbohydrate and protein digestion plus some bacterial action takes place.



## **8-Large Intestine •**

**The large intestine is a relatively short rectum in the chicken, being only 4 in. (10 cm) long in the adult bird, and about twice the diameter of the small intestine. It extends from the end of the small intestine to the cloaca .**

## **9-Cloaca •**

**The bulbous area at the end of the alimentary tract is known as the cloaca**

**and into the cloaca empty the digestive, urinary and reproductive canals.**

## **10-Vent •**

**The vent (anus) is the external opening of the cloaca. Its size varies greatly in the female, depending on whether or not she is producing eggs.**

# BLOOD SYSTEM

Blood is composed of fluid plasma plus *erythrocytes* (red cells) and *leucocytes* (white cells). The red blood cells (RBC) of birds contain a nucleus in contrast to the unnuceated cells of mammals. The *spleen* serves as a reservoir of erythrocytes and expels its contents into the circulatory system. Blood has a number of functions:

- (1) Moves O<sub>2</sub> to the body cells and removes CO<sub>2</sub>; from them. •
  - (2) Absorbs nutrients from the alimentary tract and transports them to the tissues •
  - (3) Removes the waste products of cellular metabolism •
  - (4) Moves hormones produced by certain endocrine glands to various sections of the bird •
  - (5) Helps regulate the water content of the body tissues •
- Blood constitutes about 5% of the weight of the newly hatched chick, and 9% of the mature bird. •

# The circulatory system consist of the following parts :

## 1-Heart •

The heart of most birds is located in the thorax • slightly to the left of the median line, the heart is surrounded by the pericardial sac.

The bird heart has four chambers as in mammals: • two atria and two ventricles. In chicken it beats at a comparatively rapid rate of about 300 pulsations per minute. The smaller the bird, the more rapid the contractions . The beat of individual chickens is highly variable and often it may double as the result of excitement alone.

The heart beats in turkey ( 198) and duck • (189)beats/min.

## **2-Blood vessels •**

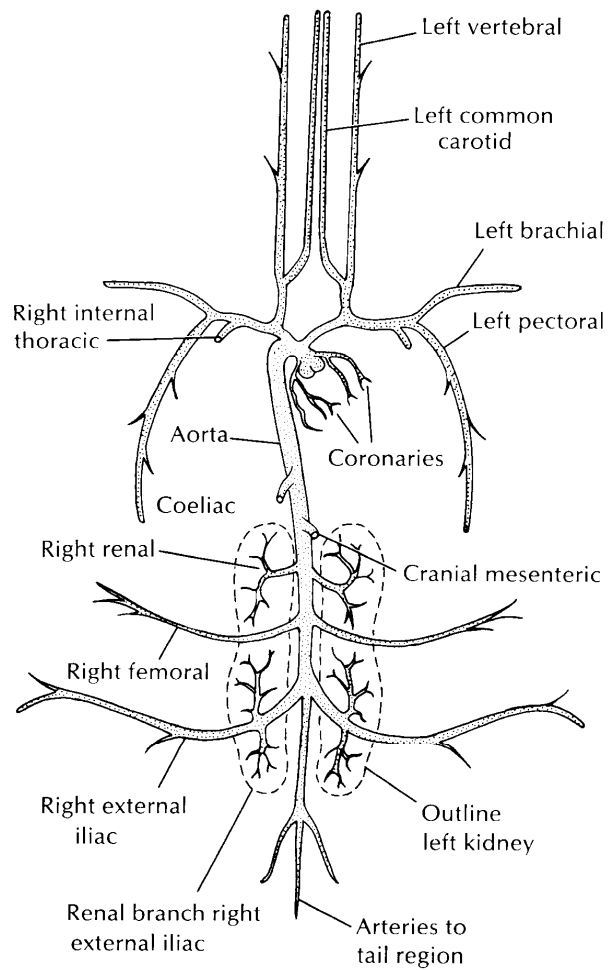
**The arterial supply to most organs is • similar to that in mammals, except that the arrangement of carotid arteries in birds varies among different species as following :**

**1-They may be paired . •**

**2-They may be fused into a median vessel . •**

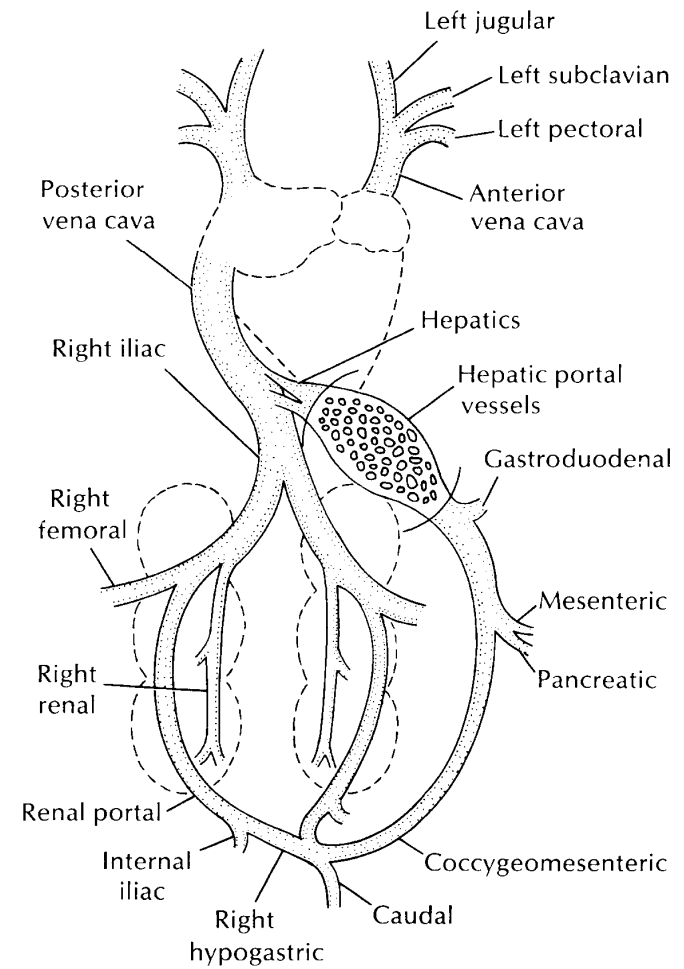
**3-the right or left vessel may be unpaired . •**

**The principle arteries and veins are • presented in the following two figures :**



2-Principal arteries (ventrodorsal view). The outline of the heart is indicated by the coronary arteries. (After Akester, 1971.)

1-Venous system in ventral view. (After Portmann, 1950.)





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# **Structure of the Chicken**

## **THE REPRODUCTIVE SYSTEM**

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# THE FEMALE REPRODUCTIVE SYSTEM

**ANATOMY :** The reproductive organs of the avian female include the left ovary and left oviduct. Although the right ovary and oviduct are formed in the embryonic stages, they usually do not persist in adult life. A persistent right ovary and oviduct have been reported in some avian species (raptors) and in rare instances in ducks and chickens where both ovaries and oviducts were functional .

## 1- Ovary •

The left ovary is situated on the left side of the body at the cephalic end of the kidneys and is attached to the body wall by the mesovarian ligament. The ovary consists of an outer cortex, made up of follicles containing ova, and an inner medulla .The ovary of the immature bird is made up of a mass of small ova, at least 2000 of which are visible to the naked eye in the chicken; there are also about 12,000 ova of microscopic size. Only a relatively few of these (200-300) reach maturity and are ovulated in certain domesticated species and considerably fewer do in wild ones.

## 2-Oviduct: •

The oviduct consists of five parts : •

A- **Infundibulum** : The infundibulum (IF) is the thin portion that engulfs the ovum when it is ovulated into the body cavity. •

If a foreign body is placed in the abdominal cavity at the time of ovulation and the ovum is removed, the IF will engulf the foreign body. It is done at some time before or after ovulation. •

B- **Magnum** : The ovum passes to the magnum, the largest single portion of the oviduct, measuring 33 cm in length. Here most of the protein of the egg (albumen) is formed. A number of workers reveal that the magnum is highly glandular and contains two types of glands: **tubular** and **unicellular**. The tubular glands are composed of nongoblet cells that are not ciliated, but the unicellular glands are of the goblet type. •

C- **Isthmus** : The inner and outer shell membranes are formed in the isthmus. Some researchers have believed that some albumen is added to the egg here, but another researchers suggest that no albumen and only insignificant amounts of water are added. •

D- **Uterus or shell gland** : The ovum receives the shell in the uterus and water and salts are added to the albumen. The pigment of the shell is formed in the uterus during the last 5 hr before the egg is laid . •

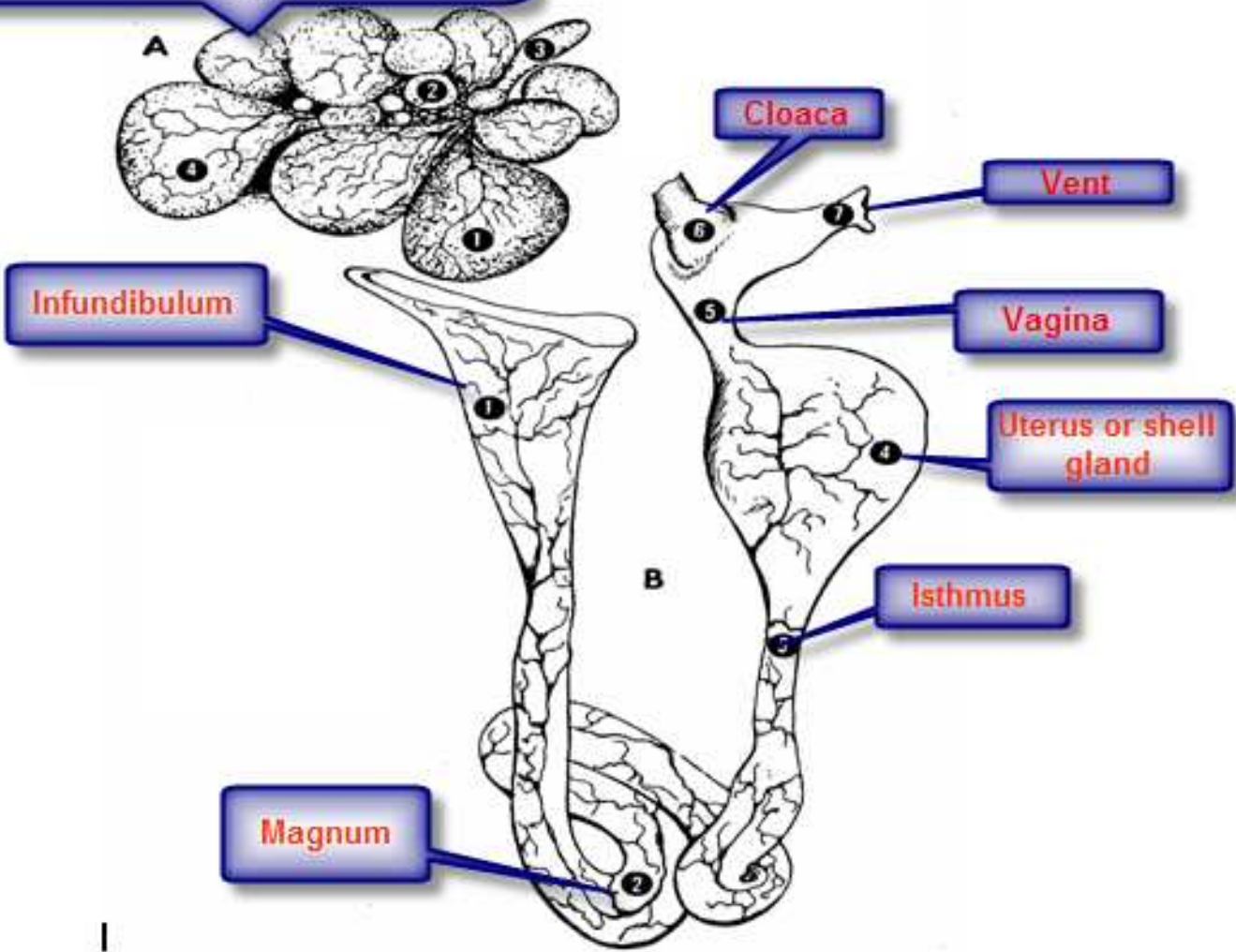
E-**Vagina** : this part of the oviduct( about 12 cm. in length in a bird in egg production ) leading from the uterus to the **cloaca** ( the cloaca is the reservoir for holding the completed egg prior to oviposition ) which open outside the body by the **vent** . •



**There are a uterovaginal glands in the uterovaginal region where sperms are store in this glands after insemination .**

**Duration of egg passage down tract. The av-erage time of passage of ovum through the various parts of the tract are as follows: Infundibulum, 18 min ; magnum, 2 hr and 54 min (2-3 hr) ; isthmus, 1 hr and 14 min. The time elaps-ing from the ovum's engulfment by the funnel to its reaching the uterus therefore averages 4 hr and 26 min. The egg remains in the uterus for approxi-mately 20 hr and 46 min. These figures are for chickens , but the figures for turkeys (22-24 hr) and *Coturnix coturnix japonica* (19-20 hr) are approximately the same (except eggs are held longer in the uterus of tur-keys.**

ovary  
 1.. mature yolk  
 2... immature yolk  
 3... Empty Follicle  
 4.. Stigma



**THE FEMALE  
 REPRODUCTIVE SYSTEM**

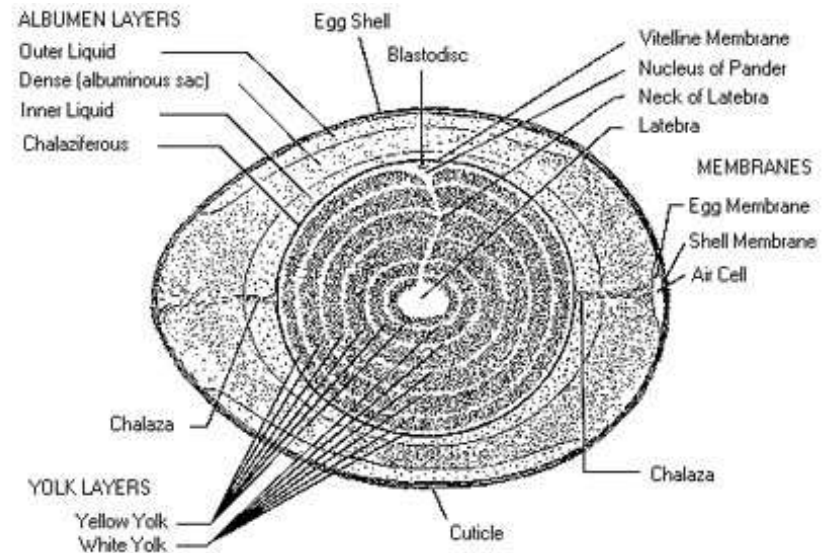
# The Egg :

The egg is formed in the mature hen by a reproductive system composed of an ovary and oviduct. Most females have two functional ovaries, but chickens and most other birds have only one ovary and one oviduct. In this oviduct, all parts of the egg, except the yolk, are formed. The developing embryo, protected from drying out, can survive outside of water and in a variety of habitats. The yolk provides it with food, and the albumin supplies water and nutrients. Wastes are released to the allantois, an extension of the embryonic gut. Oxygen diffuses easily through the thin outer shell of the egg; its passage to the embryo is regulated by the chorion.

The yolk is formed in the follicular sac by the deposition of continuous layers of yolk material. Ninety-nine percent of the yolk material is formed within the 7-9 days before the laying of the egg. When the yolk matures, the follicular sac ruptures

or splits along a line with few, if any, blood vessels called stigma. If any blood vessels cross the stigma, a small drop of blood may be deposited on the yolk as it is released from the follicle called blood spots in eggs.

The shell is added in the uterus or shell gland portion of the oviduct. The shell is composed mainly of calcium carbonate. It takes about 20 hours for the egg shell to form. If the hen lays brown eggs, the brown pigments are added to the shell in the last hours of shell formation.

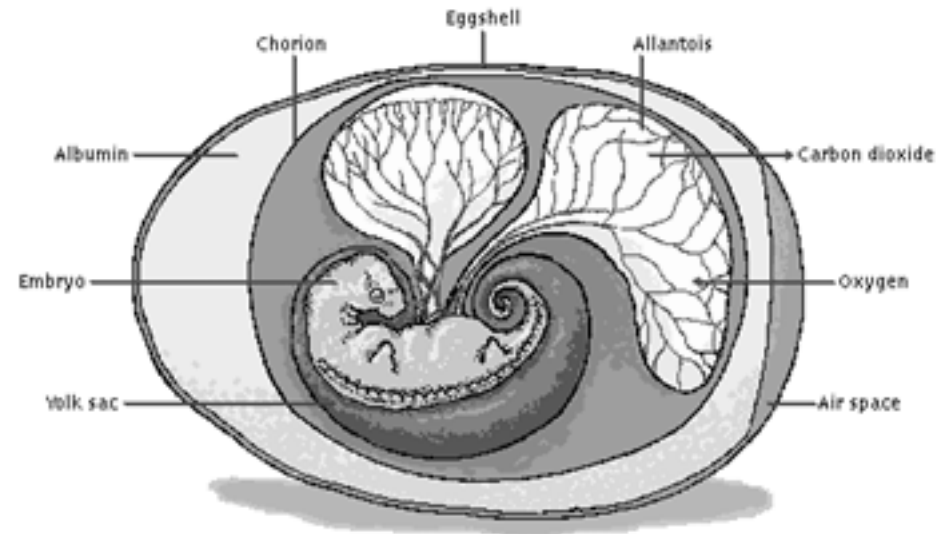


STRUCTURE OF THE HEN'S EGG  
SHOWN BY A SECTION THROUGH THE LONG AXIS

When an egg is laid, it fills the shell. As it cools, the inner portion of the egg contracts and forms an air cell between the two shell membranes. A high quality egg has a tiny air cell, indicating the egg was collected soon after being laid

and was stored properly. The air cell is usually located in the large end of the egg where the shell is most porous and air can enter easily .

After fertilization , the embryo develop and the egg consist of the following :



The parts of bird egg

# THE MALE REPRODUCTIVE SYSTEM

**ANATOMY** : The reproductive system of the male •  
consists of :

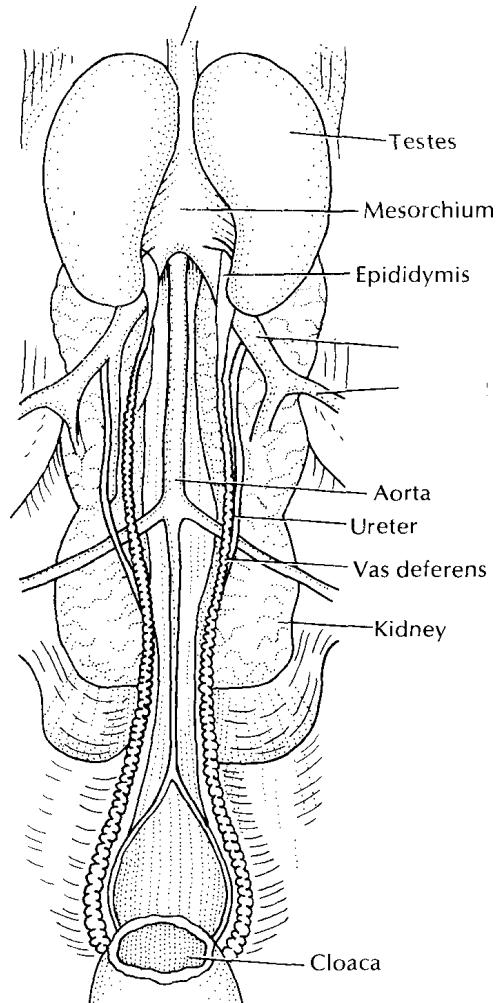
**Testes** – Pair of testes located near the cephalic end of the kidneys , the weight of the testes in chickens about 1% of the total body weight or about 9-30 g per single testis at sexual maturity , depending on breed and state of nutrition . •

**Epididymi** : in the birds are small in comparison to those in mammals . •

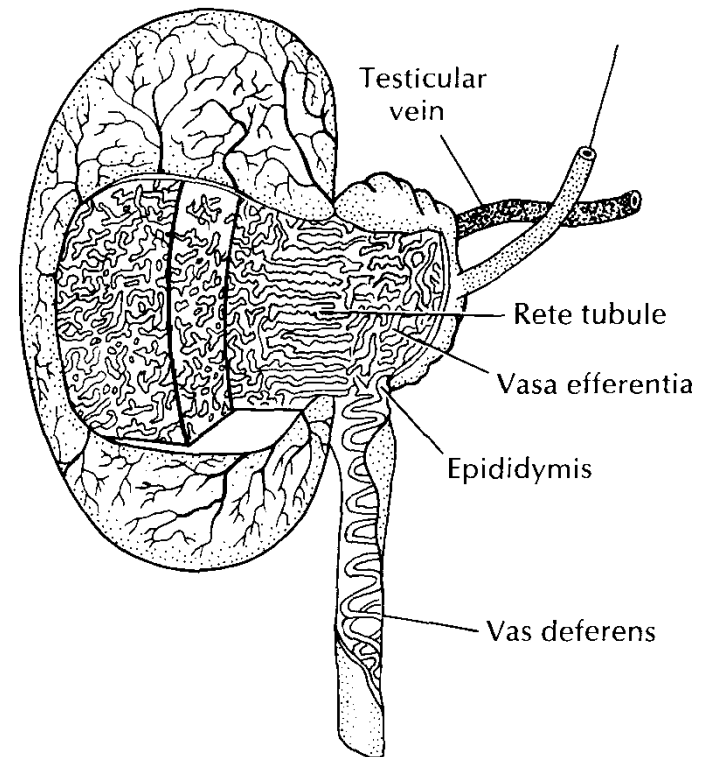
**Vasa deferentia** : Long tubular part leading from epididymi to the penis , and its function is transport the spermatozoa to the penis . •

**Penis**: The penis of chickens is quite small and when erected is engorged with lymph from the lymph folds . •

## Urogenital system of the male chicken



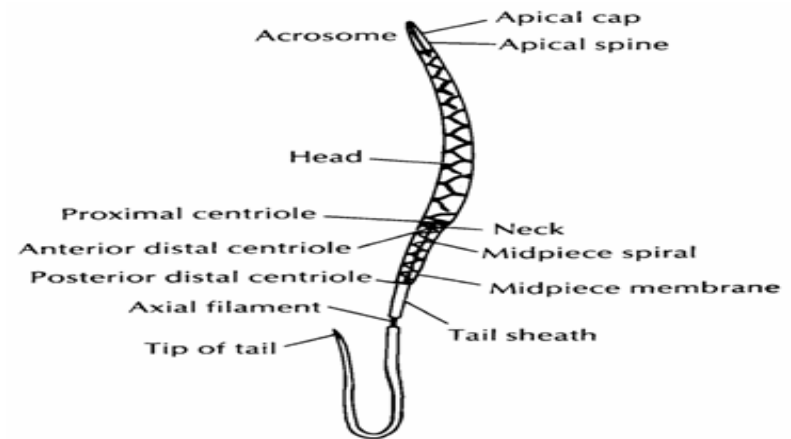
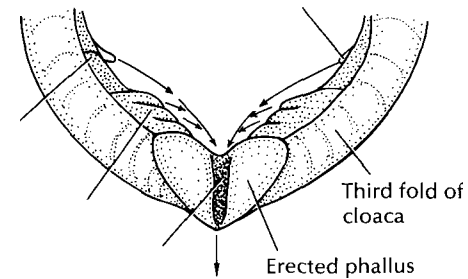
## Internal structure of the chicken testes



# Spermatozoa

Mature spermatozoa of birds • exhibit a great deal of variation in size and shape, depending on the species. In the chicken, the spermatozoon has a long headpiece with a pointed acrosome and a short midpiece, to which is attached the long tail.

Avian spermatozoa are small • compared to those of mammals; their average volume is  $9.2 \mu\text{m}^3$ . The acrosome is simple; the midpiece is a cylindrical distal centriole surrounded by a sheath of mitochondria. The chicken acrosome is about  $1.75 \mu\text{m}$  in length, the head is about  $12.5 \mu\text{m}$  long, the midpiece is  $4 \mu\text{m}$  long, and the principal tail piece is  $80 \mu\text{m}$  long.







**Diyala University  
College of Agriculture  
Department of Animal Resources**



## **Principles of poultry science**

# **Classification of the fowl**

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# The ancestors of the chicken

Most students of genetics believe that the chicken originated from the jungle fowl of Asia which existed as early as 1400 B.C.( \* ) ,there were four subspecies or types of the wild fowl as following :

**Gallus bankiva** or the Red jungle fowl ( Gallus gallus ) .

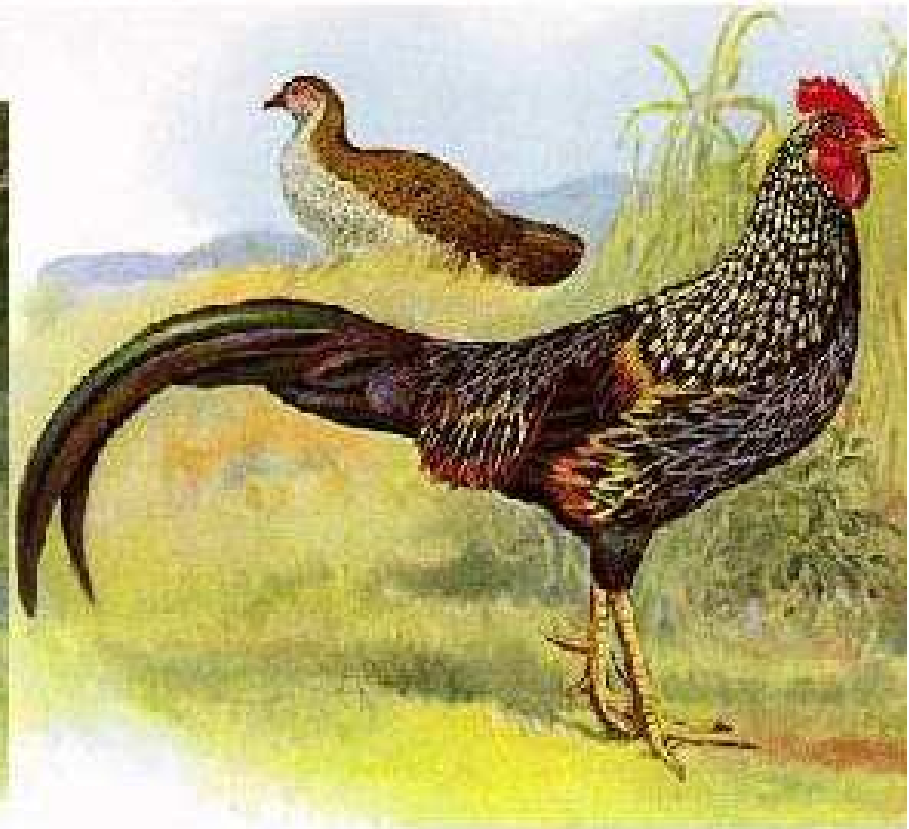
**Ceylon jungle fowl** ( Gallus lafayetti ) .

**Gray jungle fowl** ( Gallus sonnerati ) .

**Javan jungle fowl** ( Gallus varius ) . some time called Green jungle fowl.



**Green Jungle Fowl**



**Gray Jungle Fowl**

# Origins of domestic fowl

Though we know little about the exact origin of poultry, we do know that breeds came into existence in different parts of the world and that they possessed characters that were vastly different.

Domestic fowl probably originated in south east Asia, Charles Darwin considered them descendants of a single wild species, the red jungle fowl, which is found in the wild state in the area from India through south east Asia to the Philippine. Genetic analysis have shown that every breed of domestic chicken can be traced to the red jungle fowl.

# Domestication :

The chicken was one of the first domestic animals , it is referred that introduced into china about 1400 B.C. , fowl were depicted in Babylonian carving of about 600 B.C. , the Romans considered chickens sacred and their god of war .

Today domestic fowl are distributed virtually all over the world , the current trend is toward specialization ,some poultry raisers producing hatching eggs , others eggs for table use , and others raising chickens to market as broilers .

# Classification of the fowl

There are many methods to •  
classify the fowl depending on  
different principles such as :

**Biological classification** : •  
Some times referred as  
**scientific classification** .

There are about 8580 species •  
of the birds spread in the world  
and classified according to the  
biological classification system  
, for example for chicken , as  
following :

<b>Kingdom</b>	:	<b>Animalia</b>	•
<b>Phylum</b>	:	<b>Chordata</b>	•
<b>Subphylum</b>	:	<b>Vertebrata</b>	•
<b>Class</b>	:	<b>Aves</b>	•
<b>Order</b>	:	<b>Calliformes</b>	•
<b>Family</b>	:	<b>Phasianidae</b>	•
<b>Genus</b>	:	<b>Gallus</b>	•
<b>Species</b>	:	<b>Domesticus</b>	•

The scientific name of the chicken ( or any animal ) • consist of two levels of its taxonomic classification , the genus and species , the genus printed capitalized and the species not capitalized. so the scientific classification for chicken is Gallus domesticus or *Gallus domesticus*

**Geographical classification** : The chicken classified to • many classes according to the geographic region which developed in it , such as :

**Asiatic class** ; chickens in this class possessed great size , – heavy feathering and were feathered on the legs , for example :

**A-Brahma** : There are many varieties – •

(1) Light •

(2) Dark •

(3) Buff •

**Standard Weights (Light):** •  
Cock-12 pounds; hen-9-1/2  
pounds; cockerel-10 pounds;  
pullet-8 pounds.

**Standard Weights (Dark and** •  
**Buff):** Cock-11 pounds; hen-8-  
1/2 pounds; cockerel-9  
pounds; pullet-7 pounds.

**Skin Color:** Yellow. •

**Egg Shell Color:** Brown. •

**Use:** A very heavy fowl for the •  
production of heavy roasters or  
capons. Fair egg layers.

**Origin:** The ancestry of the •  
Brahma traces back to China  
although much of their  
development took place in the  
U.S. between 1850 and 1890.



**Light Braumas**



**B- Cochin** : There are many varieties –

- (1) Black
- (2) Buff
- (3) Partridge
- (4) White

Standard Weights: Cock-11 pounds; hen-8-1/2 pounds; cockerel-9 pounds; pullet-7 pounds.

**Skin Color:** Yellow.

**Egg Shell Color:** Brown.

**Use:** Mainly an ornamental fowl, but their ability as mothers is widely recognized and Cochins are frequently used as foster mothers for game birds and other species.

**Origin:** Cochins came originally from China but underwent considerable development in the U.S. and now are found and admired in many parts of the world.



**White Cochins**

**C- Langshan** : There are •  
many varieties –

(1) Black •

(2) White •

Standard Weights: Cock-9-1/2 •  
pounds; hen-7-1/2 pounds;  
cockerel-8 pounds; pullet-6-1/2  
pounds.

**Skin Color:** White. •

**Egg Shell Color:** Brown. •

**Use:** A general purpose fowl •  
for the production of meat and  
eggs. The general shape of the  
Langshan makes them better  
suited to roaster and capon  
use than as fryers.

**Origins:** Langshans originated •  
in China and are considered  
one of our oldest breeds.



**White Langshan**

D- **Malay** •

**Varieties:** Black Breasted •  
Red.

**Standard Weights:** Cock- •  
9 pounds; hen-7 pounds;  
cockerel-7 pounds; pullet-  
5 pounds.

**Skin Color:** Yellow. •

**Egg Shell Color:** Brown. •

**Use:** Strictly an •  
ornamental fowl.

**Origin:** A very old breed •  
coming from Asia, they  
have changed little in  
modern times.



**Black-Breasted red Game**

**2-English class** : This class include important economic breeds , characterized with good body conformation and rapid growth rate, an example for the breed of the class :

**A- Cornish** •

Varieties: •

1-Dark •

2-White •

3-White Laced Red •

4-Buff •

Standard Weights: Cock-10-1 /2 pounds; hen-8 pounds; cockerel-8-1/2 •  
pounds; pullet-6-1/2 pounds.

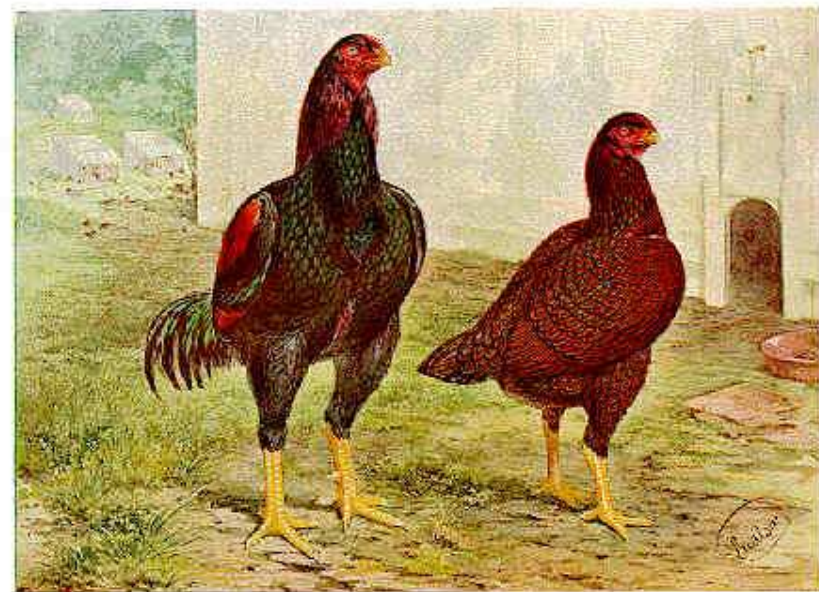
**Skin Color:** Yellow. •

**Egg Shell Color:** Brown. •

**Use:** Developed as the ultimate meat bird, the Cornish has contributed its •  
genes to build the vast broiler industry of the world, Its muscle development  
and arrangement give excellent carcass shape.

**Origin:** Cornish were developed in the shire of Cornwall, England where they were known as "Indian Games". They show the obvious influence of Malay and other oriental blood. They were prized for their large proportion of white meat and its fine texture.

**Characteristics:** The Cornish has a broad, well muscled body. Its legs are of large diameter and widely spaced. The deep set eyes, projecting brows and strong, slightly curved beak give the Cornish a rather cruel expression. Cornish males are often pugnacious and the chicks tend to be more cannibalistic than some breeds.



## B- Dorking •

Varieties: •

1-White •

2-Silver Gray •

3-Colored •

Standard Weights (White): Cock-7-1/2 pounds; hen-6 pounds; •  
cockerel-6-1/2 pounds; pullet-5 pounds.

Standard Weights (Silver Gray and Colored): Cock-9 pounds; hen-7 •  
pounds; cockerel-8 pounds; pullet-6 pounds.

**Skin Color:** White. •

**Egg Shell Color:** White. •

**Use:** A good, general purpose fowl for producing meat and eggs. It •  
was developed for its especially fine quality meat.

**Origin:** The Dorking is believed to have originated in Italy, having •  
been introduced into Great Britain at an early date by the Romans.  
Much of its development took place in England where it gained  
much acclaim for its table qualities.

**Mediterranean class** : chickens were much smaller in size , rapid in feathering and possessed considerable egg laying ability, an example of breeds for this class :

**A- Leghorn**

Varieties:

- 1-Single Comb Dark Brown 2-Single Comb Light Brown
- 3-Rose Comb Dark Brown 4-Rose Comb Light Brown
- 5-Single Comb White 6-Rose Comb White
- 7-Single Comb Buff 8-Rose Comb Buff
- 9-Single Comb Black 10-Single Comb Silver
- 11-Single Comb Red 12-Single Comb Black Tailed Red
- 13-Single Comb Columbian

Standard Weights: Cock-6 pounds; hen-4-1/2 pounds; cockerel 5 pounds; pullet-4 pounds.

**Skin Color:** Yellow.

**Egg Shell Color:** White.

**Use:** An egg-type chicken, Leghorns figured in the development of most of our modern egg-type strains.

**Characteristics:** A small, noisy bird with great style, Leghorns like to move about. They are good foragers and can often glean much of their diet from ranging over fields and barnyards. Leghorns are capable of considerable flight and often roost in trees if given the opportunity. The Leghorn has relatively large head furnishings (comb and wattles) and is noted for egg production. Leghorns rarely go broody.



**Single Comb White Leghorns**



**B- Minorca** •

Varieties: •

1-Single Comb Black •

2-Rose Comb Black

3-Single Comb White •

4-Rose Comb White

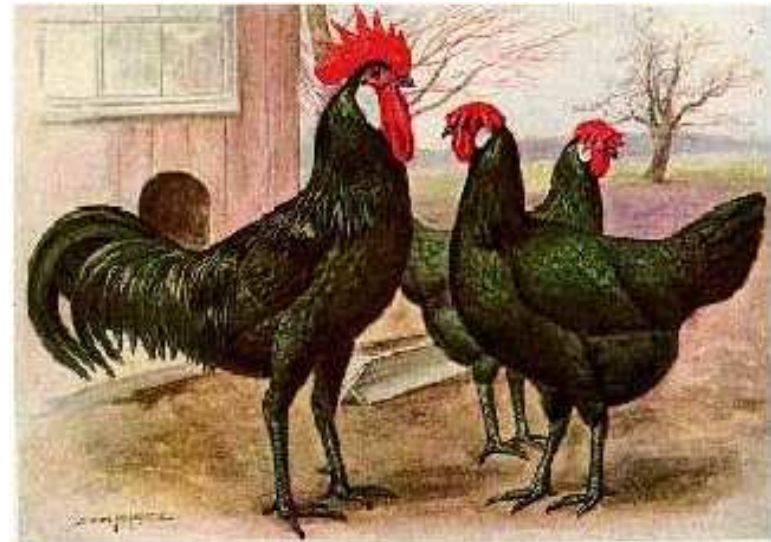
5-Single Comb Buff •

Standard Weights: Single Comb Black: Cock-9 pounds; hen 7-1/2 pounds; cockerel-7-1/2 pounds; pullet-6-1/2 pounds. All others: Cock-8 pounds; hen-6-1/2 pounds; cockerel-6-1/2 pounds; pullet-5-1/2 pounds.

**Skin Color:** White. •

**Egg Shell Color:** White. •

**Use:** Developed for the production of very large chalk-white eggs, the Minorca is today principally an exhibition fowl. •



**Single-Comb Black Minorca**

## American class •

The breeds of this class were originated in America as a combination of the previous classes to have chickens with dual purpose, which would be a good table fowl and yet have considerable egg production ability. •

Most of these American breeds were made by crossing the oriental and Mediterranean types of chickens , such as Rhode Island , New Hampshire •

Plymouth rock and Wyandotte . •

## A- Rhode Island Red •

Varieties: •

1-Single Comb •

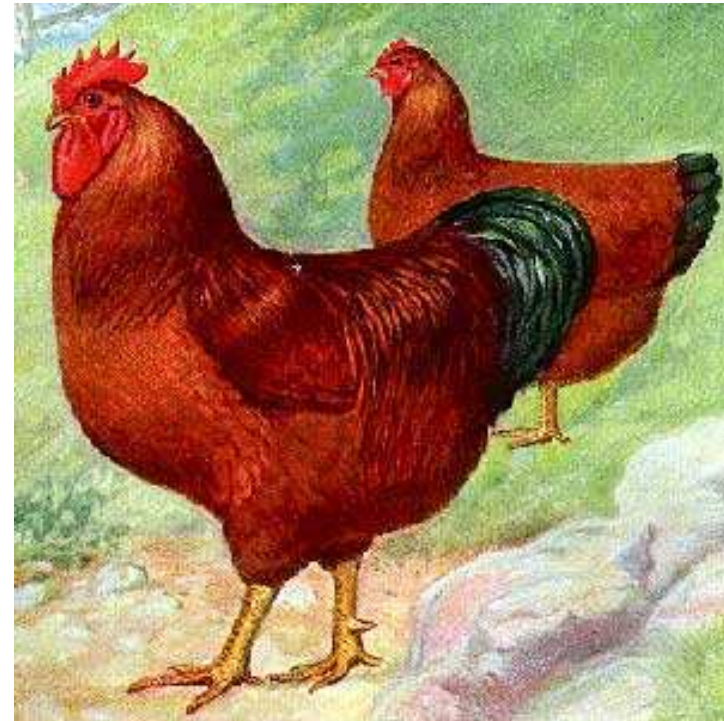
2-Rose Comb •

**Standard Weights:** Cock-8-  
1/2 pounds; hen-6-1/2 pounds;  
cockerel-7-1/2 pounds; pullet-  
5-1/2 pounds. •

**Skin Color:** Yellow. •

**Egg Shell Color:** Brown •

**Use:** A dual purpose medium  
heavy fowl; used more for egg  
production than meat  
production because of its dark  
colored pin feathers and its  
good rate of lay. •



## B- Plymouth Rock •

Varieties: •

- 1-[Barred](#) 2-[White](#) 3-[Buff](#) 4-  
[Partridge](#) 5-Silver Penciled •
- 6-Blue 7-Columbian •

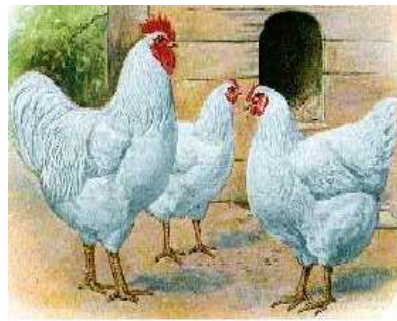
**Standard Weights:** Cock-9-1/2 •  
pounds; hen-7-1/2 pounds; cockerel-8  
pounds; pullet-6 pounds.

**Skin Color:** Yellow. •

**Egg Shell Color:** Brown. •

**Use:** Meat and eggs. •

**Origin:** Developed in America in the •  
middle of the 19th century and was  
first exhibited as a breed in 1869.  
Several individuals claimed its  
invention, using crosses of [Dominique](#),  
[Java](#), [Cochin](#), and perhaps [Malay](#) and  
[Dorking](#). The first Plymouth Rock was  
barred and other varieties developed  
later. The Breed became popular  
very rapidly, and in fact, until World  
War II, no breed was ever kept and  
bred as extensively as the Barred  
Plymouth Rock.



White plymouth Rock



Barred plymouth Rock

## C-New Hampshire Red •

Standard Weights: Cock-8-1/2 pounds; hen-6-1/2 pounds; cockerel-7-1/2 pounds; pullet-5-1/2 pounds. •

**Skin Color:** Yellow. •

**Egg Shell Color:** Brown. •

**Use:** A dual purpose chicken, selected more for meat production than egg production. Medium heavy in weight, it dresses a nice, plump carcass as either a broiler or a roaster. •

**Origin:** New Hampshires are a relatively new breed, having been admitted to the Standard in 1935. They represent a specialized selection out of the Rhode Island Red breed. •



Newhampshire

# 3- Economical classification

**A- Meat-type chickens** : Including many varieties and lines of chickens have been bred with emphasis on the production of meat rather than eggs . They are capable of producing rapid and economic weight gains when raised as broilers or roasters , such as ; Cornish , Cochin , Brahma , Langshin .

**B-Egg-type chickens** : Egg production lines are those used to produce egg-type pullets for the production of commercial eggs with either a white shell or a brown shell. The birds are relatively small in size , lay a large number of eggs with good shells , live well and produce eggs economically . such as ; White Leghorn , Minorca , Ancona .

**C –Dual-purpose chickens** : his lines are a good egg producer with a fairly

Meaty body of intermediate size , such as : Rhod Island Red ( RIR) , Wyandotte

New Hampshire , Sussex .



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## **Principles of poultry science**

### **Classification of the fowl**

### **The different species of poultry**

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# Terms

**Poultry** as a term refer to the domestic fowl in general, for example chickens , turkeys , ducks , geese , Guinea Fowl , Pigeon ,Pheasant  
Raised for meat or eggs . •

**Poultry science** , concerned with the study of principles and practices involved in the production and marketing of poultry and poultry product , including breeding , incubation , brooding , housing , feeding , disease , marketing and poultry-farm management . •

**Chickens** : •

Refers to young birds of both sexes , such as broilers and fryers . •

The previous chapter covered the different breeds of chickens that important for the poultry industry . •



# Chickens

The most important •  
species of poultry is  
chicken , because of  
its role in the world  
poultry industry .

We gave the chickens •  
wide area of our  
previous lectures .  
So, we will study the  
other species .



# Turkeys :

Studies regarding the origin of the turkey suggest that its native land was north and central America and northern Mexico , these wild species from which all domesticated breeds have been developed. •

Buss (1989) reported that when Spanish explorers took the turkey from central America to Spain early in the sixteenth century, and when the English colonists came to America they brought the turkey back to its native land •

Turkeys belong to the family **Phasianidae** of the order **Galliformes**. They are sometimes placed in a separate family, **Meleagrididae**. The wild turkey is classified as *Meleagris gallopavo* and the ocellated turkey as *Agriocharis ocellata*. •

The designations of •  
races were determined  
largely by the places in  
which the turkeys were  
found , however , some  
slight variations in  
pigmentation of feathers  
were noted , *Silvestris*  
had extremely dark  
feathers whereas  
*gallopavo* had pure white  
tips in the rectrices and  
tail coverts .



**Bourbon-tom**



**Bronze**

# Quail

Quail, common name for two groups of bird species • within the galliform family: the odontophorine quails of the Americas, and a group comprising the smallest members of a Eurasian subfamily. Species of the latter group are widely distributed, with representatives on all continents and such islands as Madagascar, Japan, New Guinea, New Zealand, and the Philippines. The common quail of Europe, the similar Japanese quail of eastern Asia, and the rain quail of southern Asia, are all a plump 20-cm (8-in) ♂migratory. The Japanese quail bird, is widely used in laboratory studies, as it breeds readily and rapidly in captivity.

Scientific classification: •

Quails belong to the family *Phasianidae* of the order *Galliformes*. American quails make up the subfamily *Odontophorinae*. Eurasian quails make up the subfamily *Phasianinae*. The common quail is classified as *Coturnix coturnix*,



# Goose

- Common name for a number of species of water birds of the same family as ducks and swans. When applied to individual birds, the word goose strictly speaking refers to the female, the male being called **gander**. Only the word goose, however, is used in the names of species
- Several groups of waterfowl, all generally larger than ducks and smaller than swans, have been called geese.



## **1- Greylag Goose : •**

the greylag is the parent species from which •  
many breeds of domesticated geese descend.  
The greylag goose is found throughout Europe  
and Asia.

## **2-Saltwater Goose or American Brant**

The American brant or brent goose, related to the swans and true geese and confined in its distribution to the northern portion of eastern North America, breeds farther north than any other species of goose. This saltwater goose feeds primarily on eel grass common to the subtidal areas of salt marshes and other intertidal areas. In areas where eel grass is in short supply the brant will eat sea lettuce, an intertidal green algae



**Saltwater Goose or American Brant**



### 3-Canada Goose, •

common name of the most •  
well-known and widely  
distributed goose in North  
America. It ranges from arctic  
Canada and Alaska into  
Siberia, and winters as far  
south as Japan, the southern  
United States, and central  
Mexico. It has been  
successfully introduced into  
Great Britain and continental  
Europe. The Canada goose  
normally lives near wooded  
lakes, ponds, bays, and  
marshes, but is becoming a  
year-round resident in  
urbanized areas, including golf  
.courses and city parks



Canada goose

# Duck

Name collectively applied to numerous species of a family of waterfowl. Ducks differ from geese and swans of the same family by their shorter necks and legs and other anatomical differences.

Some island species have lost the power of flight, but most ducks of northern continents are highly migratory. In a few species, the sexes are alike in color, but in most the males are brighter and more boldly patterned.

Ducks belong to the family **Anatidae** of the order **Anseriformes**. The wood duck is classified as *Aix sponsa*, the spectacled eider as *Somateria fischeri*, and the blue-winged teal as *Anas discors*. The mallard is classified as *Anas platyrhynchos* and the muscovy duck as *Cairina moschata*.

Eight tribes of duck use their webbed feet to paddle quickly and powerfully through watery worldwide habitats. Ducks feed on a variety of plants and animals, including algae and other aquatic plants, roots, seeds, grain, acorns, small fruits, aquatic insect larvae, adult insects, small crustaceans, mollusks, and fish. Their bills reflect their feeding habits; diving ducks have narrow bills with sharp, serrated edges to grasp fish, while dabbling ducks have wide bills for bottom feeding. Ducks also use these bills to waterproof their feathers, spreading a waxy secretion on the surface. Though an inner layer of down feathers provides added insulation from cold and wet during breeding season, many ducks migrate to warmer water in the winter.

All except one breed of domestic duck are derived from the mallard, originally tamed in Eurasia. The exception is the muscovy duck, a large species of the American tropics. Wild muscovies are mostly black, but the commonest domestic variety is white, with knobby, naked red skin around the face and bill.

# KINDS OF DUCKS:

## Call •

There are two varieties of •  
Call ducks, the Gray and  
the White. They are  
bantams in the duck  
family, and are bred for  
smallness of size. They  
should have short legs,  
an upright, almost  
horizontal carriage of  
body, slender neck, and  
comparatively short, well  
rounded body.



**Call Duck**

## Khaki Campbell •

The Khaki Campbell was admitted to the American Standard in 1941. Though originally a cross of Indian Runner, Mallard, and Rouen, Campbells exceed all of these and most chicken breeds in egg production, with some strains averaging 300 eggs per year. They do not require special care or artificial lighting to produce a large number of eggs, which are white and weight about 2.5 ounces (not much larger than a Leghorn egg).



Khaki Campbell

## Muscovy •

Originating from Brazil, Muscovies are the only domestic ducks that is not derived from mallard stock.

Wild muscovies coloration is black and white, but domestication has produced many different colors.

These colors are; blue, blue and white, chocolate, chocolate and white, white, black, black and white, lavender, and calical. The males can grow to be quite large, weighing 10-15 lbs. Most of the females are 5-7 pounds but can reach up to 9 and sometimes 10 lbs. Their feet are equipt with strong sharp claws for grabbing tree branches and roosting.

Muscovys are unique because of their bright red crest around their eyes and above the beak.



Muscovy-Duck

## **Pekin •**

The most popular market duck in America is the Pekin. It is bred in one variety, white; and a creamy white plumage and orange shanks and toes are desired. The bill should be rich yellow in color, and black in the bill or beak is a serious defect. Pekin ducks should weigh not less than, adult drake, 9 lbs.; young drake, 8 lbs.; adult duck, 8 lbs.; young duck, 7 lbs. The correct shape is of a long, broad, deep and full breasted type, to carry an abundance of meat. The Pekin breed is of Chinese origin .



**Pekin**

# Swan

Swans are larger than geese and are recognizable by their long, arched necks. Noted for their graceful movements in the water, they have been the subject of many poems, fairy tales, legends, and musical compositions. •

Swans may live up to 35 years, and they pair for life. •

Swans belong to the family Anatidae. The mute swan is classified as *Cygnus color*, the trumpeter swan as *Cygnus buccinator*, the whooper swan as *Cygnus cygnus*, the tundra swan as *Cygnus columbianus*, the black swan as *Cygnus atratus*, the black-necked swan as *Cygnus melanocorypha*, and the coscoroba swan as *Coscoroba coscoroba*. •



## **mute swan** •

about 1.5 m (about 5 ft) in length and weighs up to 13.5 kg (30 lb). It originated in the eastern hemisphere but is now seen as a domesticated bird in many North American parks . It lives on freshwater lakes and rivers in areas of Europe, Asia, and North America. The mute swan rarely ventures far from the water, where it feeds and nests .



mute swan