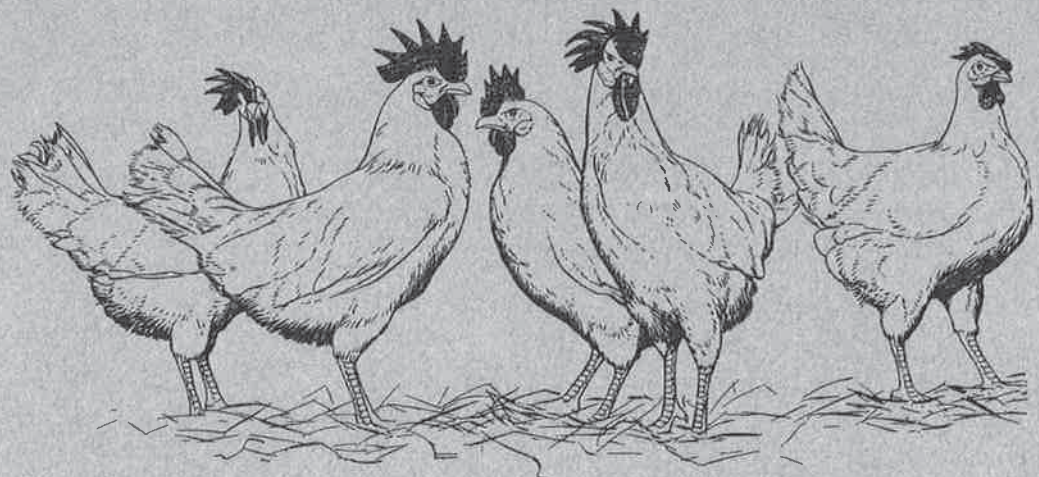




Avian Systems



THE REPRODUCTIVE SYSTEM

Female Reproductive System

(See Figure 3)

The female reproductive system of the chicken is divided into two main parts: the **ovary** and the **oviduct**. The **ovary** is a cluster of developing **yolks** or **ova** and is located midway between the neck and tail of the bird, attached along the back. The ovary is fully formed although very small when the female chick is hatched. It is made up of 13,000 to 14,000 minute yolks or ova which grow by the addition of yolk fluid. It starts out as a single cell surrounded by a **vitelline membrane** which keeps water out. The color of the yolk or ova comes from fat soluble pigments called xanthophylls (*zantho fills*) contained in the hen's diet.

Ovulation is the release of the mature yolk from the ovary into the second part of the female reproductive system. The ova or yolk, which is enclosed in a sac, ruptures along the **suture line** or **stigma**. This release of the ova occurs 30 to 75 minutes after the previous egg has been laid.

The second major part of the female chicken's reproductive system is the oviduct. The **oviduct** is a long convoluted tube (25 to 27 inches long) which is divided into five major sections. They are the **infundibulum** or **funnel**, the **magnum**, the **isthmus**, the **shell gland**, and the **vagina**. Unlike mammals, there is only one functional oviduct in the chicken; the oviduct on the left side of the chicken is functional, the right ovary is **rudimentary** (imperfectly developed).

The first part of the oviduct, the **infundibulum** or **funnel**, is 3 to 4 inches long, and it engulfs the ovum released from the ovary. The ovum or yolk remains here 15 to 18 minutes, and it also serves as a reservoir for spermatazoa so that fertilization can take place.

The next section of the oviduct is the **magnum** which is 13 inches long and is the largest section of the oviduct as its name implies. The ovum or yolk remains here 3 hours during which time the thick white or albumen is added.

The third section of the oviduct is the **isthmus** which is 4 inches long. The "egg" remains here for 75 minutes. The isthmus, as its name implies, is slightly constricted. In the isthmus, the shell membranes are added.

The next section of the oviduct is the **shell gland**. The shell gland is 4 to 5 inches long, and the "egg" remains here for 20-plus hours. As its name implies, the shell is placed on the egg here. The shell is made up of **calcium carbonate**, and the hen mobilizes 47 percent of her body calcium from her bones and her diet to make the egg shell. Pigment deposition is also done in the shell gland.

The last part of the oviduct is the **vagina** which is about 4 to 5 inches long and does not really play a part in egg formation. The vagina is made of muscle which helps push the egg out of the hen's body. There are also glands located in the vagina where spermatazoa are stored.

Male Reproductive System

(See Figure 4)

The male reproductive tract is comprised of two **testes**, both of which are functional. Inside the testes are the **seminiferous tubules**, where sperm is produced. Leading from the testes is the **ductus deferens** which move the sperm to the outside of the body.

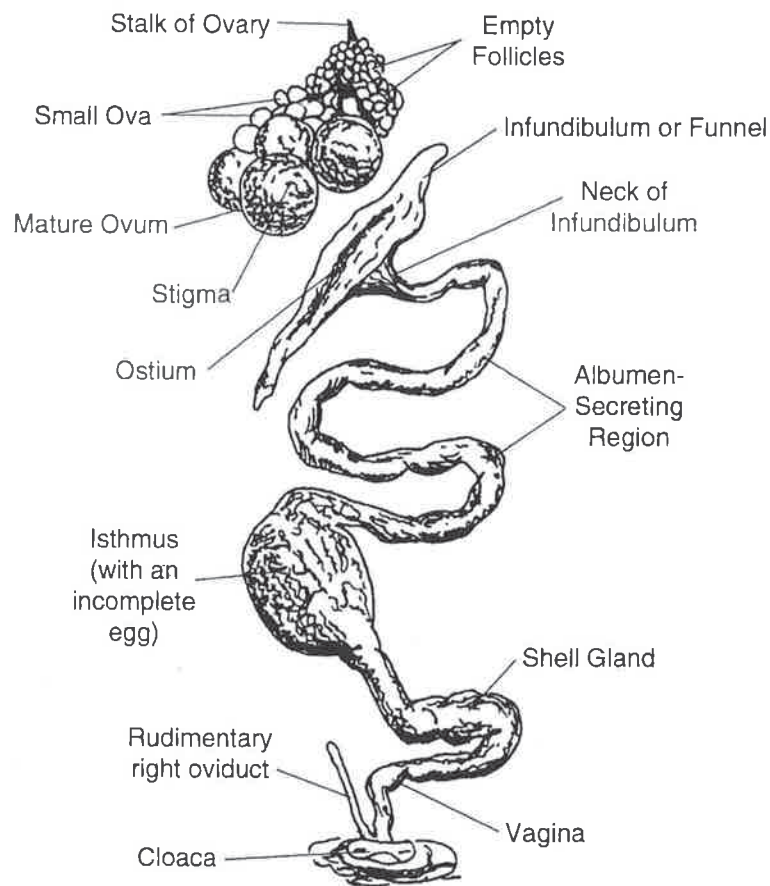


Figure 3. Female Reproductive System

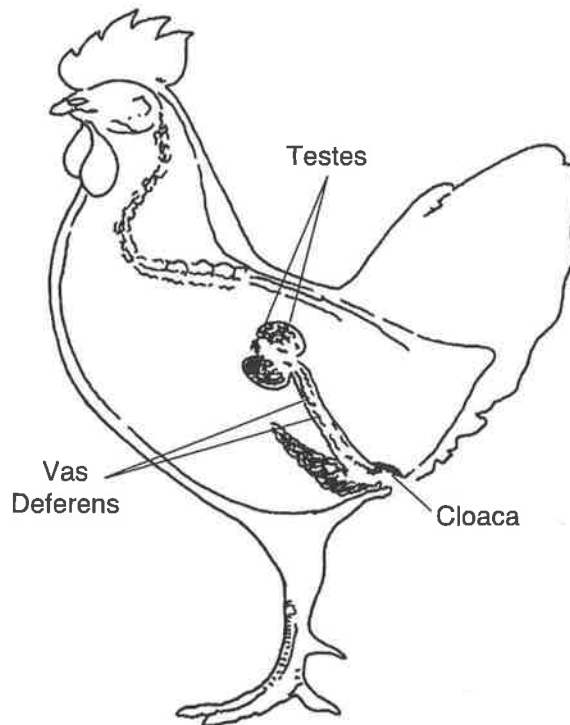


Figure 4. Male Reproductive System

THE CIRCULATORY SYSTEM

The chicken has a four-chambered heart similar to a human heart, including two ventricles and two atria. The heart rate of a Leghorn female is about 350 beats per minute, and a New Hampshire male has a heart rate of 250 beats per minute. The function of the circulatory system is to transport oxygen, carbon dioxide, metabolites, hormones, and nutrients throughout the body and to aid in temperature regulation, keeping the chicken's body temperature at 107 °F. The red blood cells and white blood cells are formed in the spleen. A bird's red blood cells are unique in that they are **nucleated** whereas a mammal's are not. This means there is a nucleus in the red blood. See Figure 5 below.



Figure 5. Red Blood Cells

THE NERVOUS SYSTEM

The nervous system is divided into two main parts which are the **central nervous system (CNS)** and the **autonomic nervous system (ANS)**. The CNS is responsible for the voluntary actions of the body such as movement or flight, and the ANS is responsible for the coordination of involuntary actions of the organs, intestines, blood vessels, and glands. The primary function of the nervous system is to integrate the functions of the body.

THE EXCRETORY SYSTEM

(See Figure 7, page 42)

The main organ of the excretory system is the **kidney**. The functional units of the kidney are **nephrons**. The functions of the excretory system are to excrete water and metabolic wastes and to regulate the acid-base balance in the bird's body.

The primary component of poultry waste is **uric acid**, the major end product of protein utilization. Uric acid is a white, pasty substance. Poultry waste is comprised of urine and feces; these are not separate.

THE MUSCLE SYSTEM

Muscle is the principle contractile organ of the body which is responsible for movement. There are three types of muscle in a bird's body: **smooth**, **cardiac**, and **skeletal**. **Smooth** muscle is controlled by the **autonomic nervous system** and is found in the blood vessels, gizzard, intestines, and organs. The **cardiac** muscle is the specialized muscle of the heart. The **skeletal** muscle is the type of muscle responsible for the shape of the bird and for its voluntary movement. This is the muscle which makes up the edible portion of the carcass. The most valuable skeletal muscles on a poultry carcass are the breast, thigh, and leg.

THE SKELETAL SYSTEM

The skeletal system is important to the bird for **support** and has two additional functions which are unique: **respiration** and **calcium transport**. The skeletal system of the bird is compact and lightweight, yet strong. The tail and neck vertebrae are movable, and the body vertebrae are fused together to give the body sufficient strength to support the wings.

There are two special types of bones which make up the bird's skeletal system: they are **pneumatic bones** and **medullary bones**. The pneumatic bones are important to the bird for respiration. They are hollow bones which are connected to the bird's respiratory system and are important for the bird to breathe. Examples of pneumatic bones are the skull, humerus, clavicle, keel (sternum), pelvic girdle, and the lumbar and sacral vertebrae.

The medullary bones are an important source of calcium for the laying hen. Calcium is the primary component of egg shell and a hen mobilizes 47 percent of her body calcium to make the egg shell. Examples of medullary bones are the tibia, femur, pubic bone, ribs, ulna, toes, and scapula.

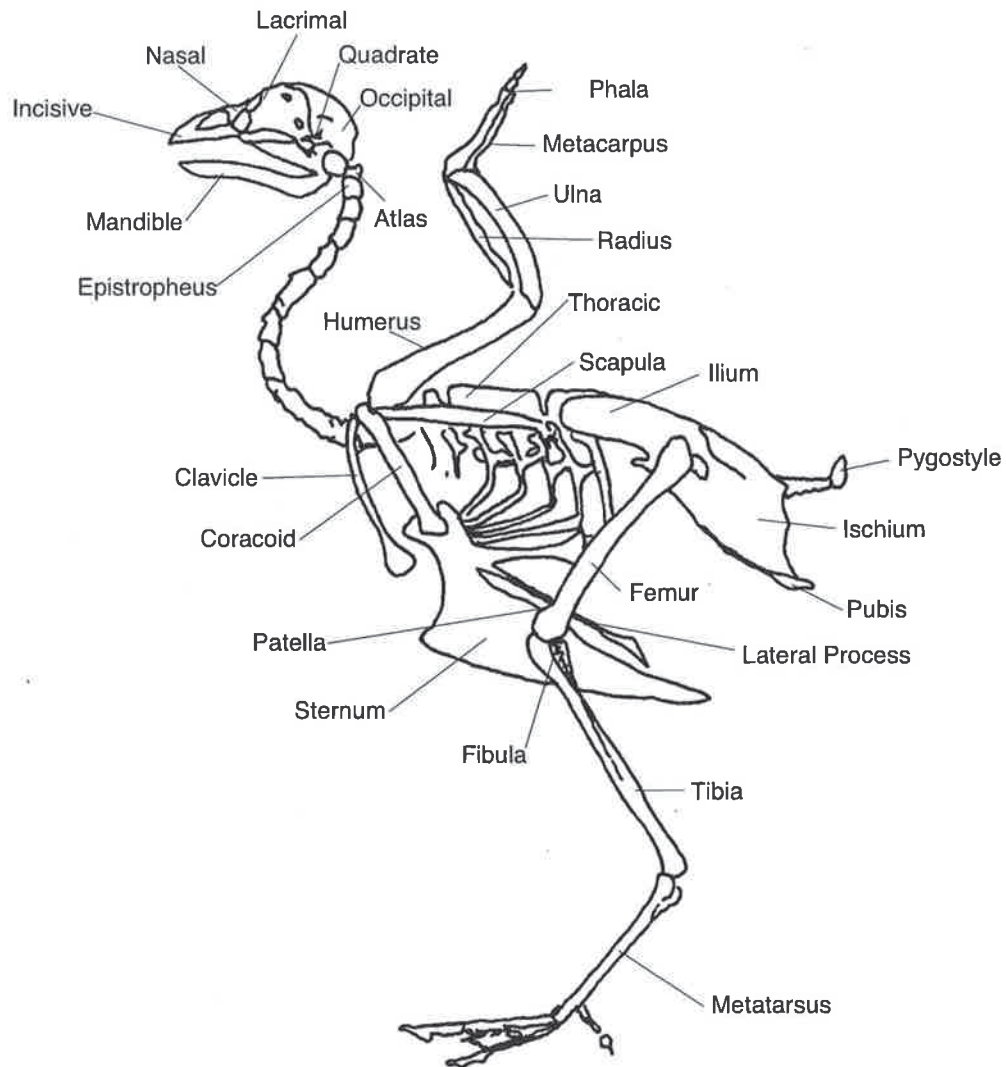


Figure 6. Skeletal System

THE RESPIRATORY SYSTEM

The respiratory system is made up of **lungs**, **pneumatic bones**, and **air sacs**. The lungs of the bird are different from that of a mammal's in that they are rigid. They function in the exchange of blood gases such as CO₂ and O₂. **Air sacs** are unique to the bird and are flexible. The air sacs open up to the pneumatic bones which aid in the exchange of air throughout the bird's body. There are four pair of air sacs and one single air sac, two **interclavicular** air sacs, two **abdominal** air sacs, two **anterior thoracic** air sacs, two **posterior thoracic** air sacs, and one **cervical** air sac. The respiratory system is important for air exchange and also for temperature regulation in the bird.

THE DIGESTIVE SYSTEM

(See Figure 7, page 42)

The digestive system functions to utilize food material for the maintenance of all the other systems of the bird's body. The bird's digestive system depends on enzymes (proteins) which chemically break down the food. The digestive system is made up of many different parts. The **mouth** contains salivary glands that secrete saliva containing enzymes which begin to break down food. A bird does not have teeth to chew its food but does have a tongue which pushes the food to the back of the mouth so that it can begin its passage down the rest of the digestive tract. The **esophagus** is the tube that connects the mouth with the rest of the digestive tract. The **crop** is located in the neck region and is used to store food until the bird is ready to digest more food. The **proventriculus** or **true stomach** secretes two enzymes: hydrochloric acid (HCl) and pepsin. Another unique part of the bird's digestive tract is the **gizzard**. The gizzard is made up of two smooth muscles and contains grit or stones and acts as the bird's teeth by grinding the food.

The **small intestine** is made up of the duodenum and the lower small intestine. The small intestine is important for the absorption of nutrients. The **cecum** are two blind pouches that, like our appendix, have no real function. The last portion of the digestive tract is the **rectum** or **large intestine** where additional absorption of water takes place.

The **pancreas**, which is in the center of the duodenal loop, secretes pancreatic juice which neutralizes the HCl secreted by the proventriculus and helps break down fat. The **liver** produces a dark green substance called bile which is necessary for the absorption of fats. The bile is stored in the gall bladder, and when food passes into the duodenum, it causes the gall bladder to empty the bile into the small intestine.

The **cloaca** is where the **digestive tract**, the **reproductive tract**, and the **excretory tract** all end up. The cloaca is important for absorbing any moisture from foodstuffs which will leave the body. It is also important since it is here that the egg from the female's reproductive tract is flipped in order that it will be laid large end first.

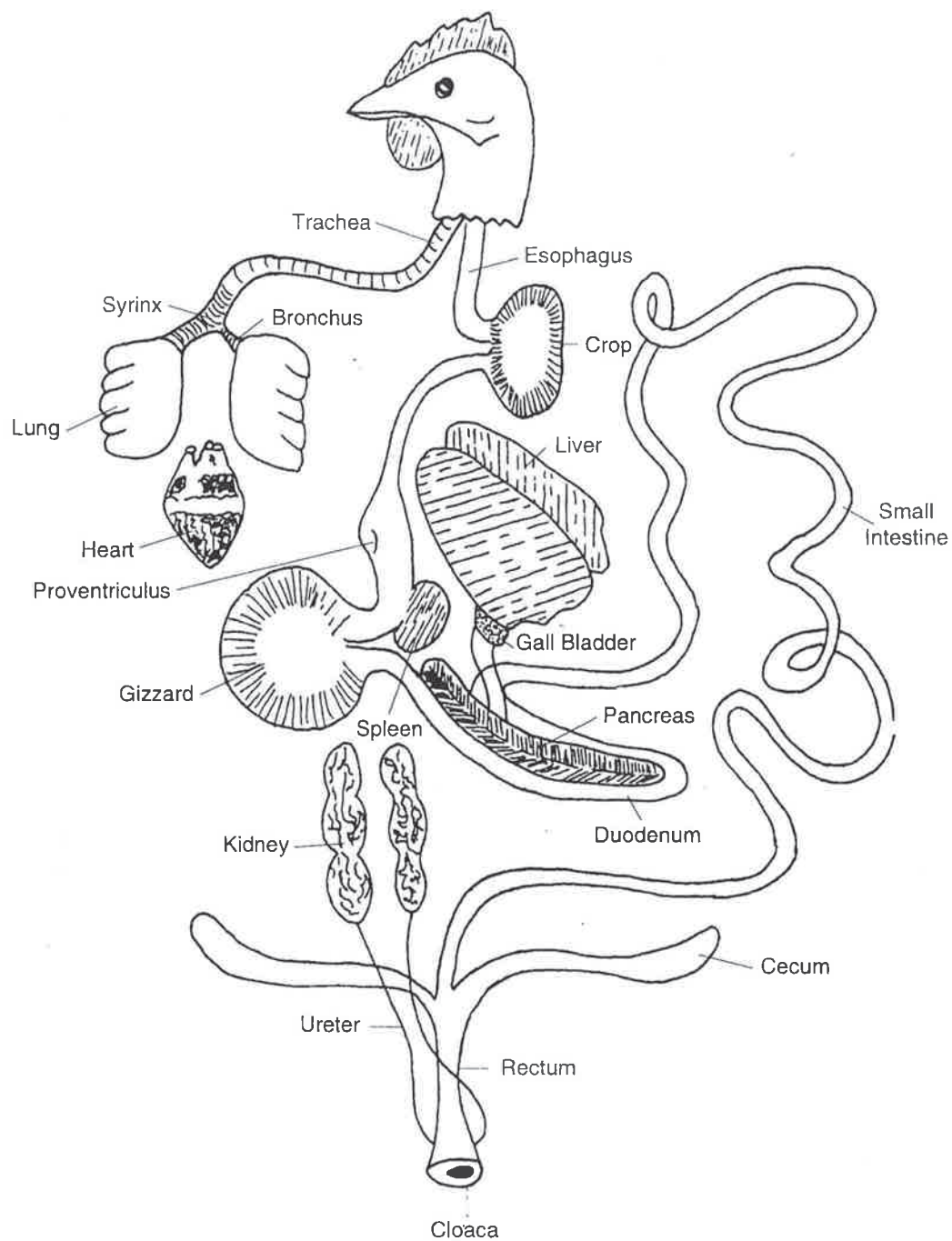


Figure 7. Digestive System and Excretory System

THE FEATHER

Although the feather is not a system of the bird, it is what makes the bird totally unique from all other animals. Figure 8 shows the parts of the feather. The feather is important for **flight, protection, and temperature regulation**. When a bird rearranges its barbules and barbicels, it is called **preening**. Birds also lose their feathers once a year during a **molt**. These feathers are replaced in about 21 days.

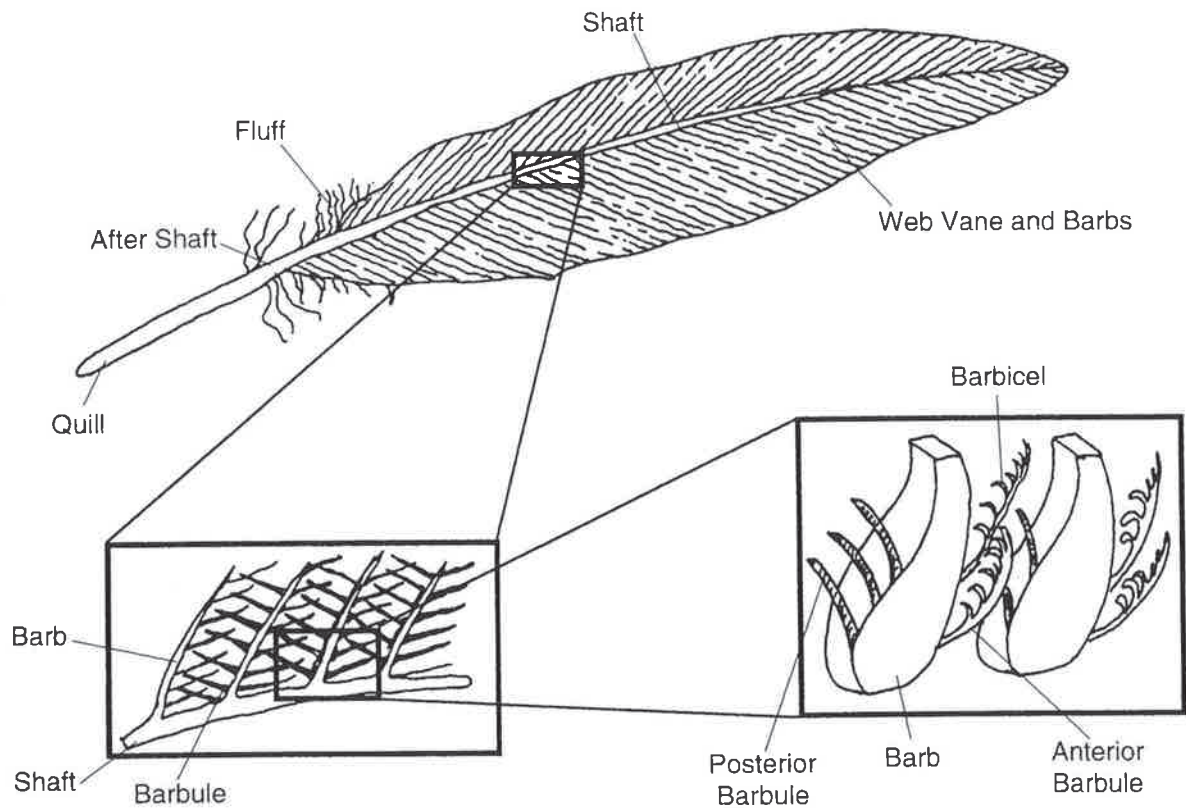


Figure 8. Parts of the Feather

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