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SOME POULTRY DISEASES

By B. F. KAUPP

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Some Poultry Diseases Met With in Colorado

By B. F. KAUPP

When we consider the price of individual birds of common stock, most of us are apt to give little thought to the magnitude of the poultry industry of the United States or of our own State.

With the increase in value of birds, particularly pure bred, some of which are worth as much as the average dairy cow, it is evident that more attention to their diseases is needed.

It is estimated that the poultry population of Colorado is approximately 2,700,000, of which about 2,500,000 are chickens, 100,000 turkeys, 50,000 ducks, and 50,000 geese and other birds.

It is estimated that 15,000,000 dozen eggs and 25,000,000 pounds of chickens are consumed in Colorado annually. Of this quantity consumed, it is probable, according to the estimates made by Mr. W. E. Vaplon, of the Poultry Department of this Station, that only about one-half is produced within the State. He further estimates that there is imported into the State annually about $4,000,000 worth of eggs and poultry products. It will thus be seen that there is excellent opportunity, in this State, for increased production of this kind of foods.

With these facts before me, and with the additional stimulus of frequent requests for information on diseases of poultry, I undertook the task of studying these diseases, and have been greatly aided by the Poultry Department of the college and others, particularly local poultry raisers. The present paper gives a brief account of this work. I have endeavored to give illustrations which will aid poultry people to recognize disease conditions and symptoms, and to understand the treatment of sick birds and the means of eradicating contagion when such exists.

Plate I is a drawing made by Mr. W. E. Landt, from a healthy hen, prepared in the laboratory for the purpose. It is hoped that this object lesson, with the explanation which will be found on the opposite page, will be helpful to a better understanding of the anatomy of the hen.

The paper includes parasitic and other diseases, as well as a brief discussion of methods of detecting hens with diseased ovaries, and non-layers due to other causes. The non-laying hen is too expensive to keep.
THE NORMAL VISCERAL ANATOMY OF THE HEN

Digestive and Genito-Urinary Tracts

At 1 is the beak; 2, the tongue; 3, the pharynx (throat), through which the food passes to the oesophagus or gullet (4); 5, the crop, a storehouse or granary where the food accumulates during feeding. From the crop the food passes through the second portion of the oesophagus; 6, a part of the abdominal organs laid over to the left so that the proventriculus or true stomach (7), lays over the liver (26). The second portion of the oesophagus empties into the proventriculus in whose walls are found secreting glands similar to those in the true stomach of higher animals. The food, after being soaked in this fluid, passes into the gizzard (8), a muscular organ, where the grain and other coarse particles are ground with the aid of grit by the contractions of the muscular walls. From here the food passes into the duodenum (9). At 10 is shown the loop of the first portion of the small intestines in which is located the pancreas (25), which pours its digestive secretion into the small intestines. At 11 is represented the floating portion of the small intestines, supported by the mesentary, a web-like membrane (19) carrying the blood vessels in their course to that part. Numbers 12 and 13 represent the caeca or two blind guts, the blind extremities being at 13. These empty into the balance of the intestine at 14. At 15 is shown the rectum or straight gut, which is joined by the egg sac (23) at 17, forming the cloaca or common pouch (16). At 20 the ureter from the kidney (21) empties the secretion from that gland into the rectum. The cloaca communicates through the anus (18) with the external world. The right ovary perishes as the hen develops so that only one ovary, the left, remains, which is indicated by 22. The egg canal (23) has a muscular wall for the purpose of forcing the egg along as it develops; it is also provided with glands which aid in the formation of the albumin, egg shell, etc. This sac at its anterior end receives the ovum (yolk) from the ovary as soon as it is mature. At 26 is seen the liver, which has been turned back and is crossed by the proventriculus (7). At 27 is the gall bladder, where the bile (liver secretion) is stored up till active digestion takes place in the small intestines when it is poured out into the latter. At 28 is the spleen, a blood forming organ.

The Respiratory Tract and Heart.

The air passes from the nostrils (29) through the nasal passage, indicated by the dotted line, enters the pharynx through the opening (posterior nares) at 33; 32 is the turbinated bone of the right nasal chamber; 30, the frontal, and 31, the maxillary (infra-orbital) sinuses, analogous to the same in the higher animals. The air passes through the pharynx (3) into the larynx (35) through the opening or glottis (34). From the larynx the air passes through the trachea or windpipe (36). At 37 there is noted a flattened portion, the false larynx, provided with vocal cord-like structures—the organ of sound. Just below this point will be noted the bifurcation (branching) of the trachea to the lungs. At 38 is the left lung. The heart is pulled down so that these parts are brought into view. At 39 is the heart; 40, the main artery (aorta) leading from it; 42, its branch supplying the neck and head; and 41, the left wing.

PARASITIC DISEASES

LICE

There have been four genera of lice studied in this laboratory, namely, Menopon, Goniodes, Goniocotes, and Lipeurus.

THE LARGE HEN LOUSE—Menopon biseriatum. This is the largest louse found upon the hen. It is about one-twelfth of an inch in length, light in color, with mouth parts arranged for mastication as illustrated in Fig. 2-a. The free extremities of the legs are provided with hooklets which aid in holding on.
The smaller variety of this genus, *Menopon pallidum*, also has been studied, but is far less common in this state. This louse is found on young and old chickens.

![Figure 2](image)

Figure 2.—*Menopon biseriatum* (from a hen), greatly enlarged; a, head, which is provided with mouth parts; b, thorax provided with three pairs of legs; c, abdomen.

**THE TURKEY LOUSE—*Goniodes stylifer***. This louse is found on turkeys and is thicker than the one just described. Like it, the mouth parts are arranged for mastication. It is illustrated in Fig. 3.

**Lipeurus infuscatus***. This is another louse that may infest chickens. A study of Fig. 5 shows its mouth parts and legs similar to the other lice. Its general shape is different. It is not so common as the large hen louse.

**THE PIGEON LOUSE—*Lipeurus baculus***. This is a long, slender, light colored louse with mouth parts arranged for biting, and its legs are provided with hooklets which aid it in holding to the feathers. It is illustrated in Fig. 7.

**Goniocotes holoaster***.—This is still another louse that sometimes infests chickens. In many respects it resembles the louse of the turkey, but it is a distinct species. It is illustrated in Fig. 6. Like the others, its mouth parts are arranged for biting.

**LIFE HISTORY**.—The females are slightly larger than the males. The females lay oval, white, or whitish-yellow eggs (nits) and securely cement them to the barbs of the feathers. This is illustrated in Fig. 4. The lice hatch in from ten days to two weeks in warm weather, by breaking open the ends of the eggs. The young have much the same shape as the adults, but are usually lighter in color. The males are usually less numerous than the females.

**CONDITIONS PRODUCED**.—Chicks hatched in the incubator are free from lice and stay free until placed with lousy hens or chicks, or in lousy quarters. Lice produce much irritation. The effect of large numbers upon chickens is quite marked. The hens scratch and pick at the feathers, show signs of being drowsy, may refuse to eat, and in growing birds, body development is interfered with. Young chicks often sit around, moping, with wings hanging down, and finally in a week or two may die. For this reason, brooder chicks thrive better, grow faster, and are free from many ailments than chicks hatched by the hen. It has been said that a lousy bird will have more of a tendency to dust than one not lousy.

The effect upon the older birds is not so severe as upon younger ones, but it is shown in condition of flesh and low production of eggs. The irritation is sometimes so severe that hens desert their nests. Their combs may become dark.

Birds unable to rest day or night become emaciated and die.
POULTRY DISEASES

Figure 3.—*Goniodes stylifer*, (from a turkey), ventral view; a, mouth parts; b, antennae; c, legs, provided with hooklets on the free extremity of the last segments. To the right of the head is a line indicating the actual size of the louse.

Figure 4.—An egg of the turkey louse. The egg is cemented to the barb of the feather at a.

Figure 5.—*Lipeurus infuscentus*, (from a hen). female; a, mouth parts; b, abdomen.

To find the lice, part the feathers; the lice will be found running over the skin or bases of the feathers. A favorite location for the lice is under the wings where the temperature is warmer, although they may be found on any part of the body.

Lice may be found at all seasons of the year, but are more common in the hotter months of July and August. In these months, conditions are more favorable to their propagation.

**TREATMENT OF INFESTED BIRDS AND ERADICATION OF LICE.**—

The chickens should be dusted with insect powder (pyrethrum) or pyrethrum and sulphur equal parts, or a combination of these with tobacco dust, which can be secured from a tobacco factory. This powder can best be dusted among the feathers by aid of a powder gun, which can be secured at a drug store. It can also be placed in the dusting places. In ridding the birds of lice, it will be well to keep in mind that frequent dusting with powder will be necessary, as the eggs or nits are not all likely to be killed by the powder. Another means of ridding chickens of lice is to dip them in a five per cent solution of Creolin, Kreso dip, or the same per cent of Zenoleum.

After the flock has been freed from lice, care should be exercised that a reinfestation is not brought about by the introduction of lousy birds. The henhouse in which lousy birds are located should be thoroughly and frequently cleaned and the walls whitewashed. The whitewash should contain in it some parasiticide as carbolic acid five per cent, creolin five per cent, or corrosive sublimate one part to a thousand. The roosts should be scrubbed with boiling water, and after drying in the sun, should be saturated with kerosene. If the hen house be tightly closed and thoroughly fumigated with sulphur, it will aid in destroying lice or other parasites that may be in the cracks and crevices and difficult to reach with the whitewash. The litter and straw should be removed from the nests and burned, and the nests should be disinfected and new straw provided. Before refilling with straw, an inch of slaked lime should be placed in the bottom.
Figure 6.—*Goniocotes holoaster*, a louse (from a hen), ventral view; a, mouth parts; b, antennae; c, hooklets on free extremity of leg. The small mark to the right indicates the natural size.

Figure 7.—*Lipeurus baculus*, from the pigeon. Letters indicate same parts as in Fig. 6.

Figure 8.—*Sarcoptes mutans*, variety *gallinae*, the scab parasite producing scaly legs in the hen. a, the mouth parts with which it wounds the skin and causes serum to exude; b, the short legs; c, the small dot indicates its natural size.

**MITES**

Scaly Legs (Scabies)

This disease is caused by a parasite (*Sarcoptes mutans* variety *gallinae*), which belongs to the same family as the scab parasite of cattle, horses, sheep, hogs, cats and dogs. The parasite is often called a mite, owing to its small size. In Fig. 8 its size is indicated by a small mark, to the right of the drawing of the parasite, which is magnified 100 times. In the drawing, note the short, strong, stubby legs, and the mouth parts arranged for biting.

CONDITION PRODUCED.—This parasite attacks chickens, turkeys, and cage birds, but the writer has not observed it on geese and ducks. It attacks the unfeathered portion of the leg above the foot and often the top portion of the toes. The minute parasite crawls under the scale of the legs and there irritates the tissue, for the purpose of obtaining food with the mouth parts as pictured in the drawing referred to above. As a result of this irritation, a vesicle or small blister appears. The blister, practically microscopic in size, after a time ruptures, the serum dries, and makes a minute scale. As the parasites become more numerous, by continually irritating the parts, they cause a pilling up of scab and the leg presents an appearance like Fig. 9. The parasites can be found as minute white specks in the serum between the scab and leg. Both legs are usually affected at the same time. Itching is present and the birds may be noted to pick at the parts. Itching is more intense at night. The bird may become weak, stop laying and even may die.

LIFE HISTORY.—The female mite lays her eggs under the scabs where, in about ten days, if conditions are favorable, they hatch. The larvae (young mites) now moult several times and finally arrive at the mature stage.

The tearing off of scabby patches favors the escape of the parasite, and other birds become infested by being placed in quarters occupied by infested birds, or by introducing an infested one into the flock.

TREATMENT.—Soak the scabby patches with soapy water and the
scabs can be easily removed. After removal of all scabs possible, with a nail
brush, scrub thoroughly with kerosene or a kerosene emulsion made as
follows:

Kerosene, $\frac{1}{2}$ gallon; common soap, 2 ounces; water, $\frac{1}{4}$ gallon. Dissolve
the soap in boiling water; add this solution boiling hot to the kerosene, and
stir with an egg beater. When ready to use, take one part of the emulsion
and add to it nine parts of water.
The lime and sulphur dip used warm and scrubbed thoroughly under the
scales is very effective. The lime and sulphur dip is made as follows:
Unslaked lime, $\frac{1}{2}$ pound; sulphur, 1 pound; water, 4 gallons. This
mixture should be boiled for two hours. The lime acts as a solvent for the
sulphur.
Other antiseptics which are parasiticides may be used. Isolate diseased
birds and avoid reinestation by the introduction of new birds to the flock.
CHIGGER, *Trombidium holosericeum*

DESCRIPTION.—The chigger is a very small mite, as shown by the mark by the side of Fig. 10. The body, oval in shape, is provided, in the adult state, with four pairs of legs. The terminal end of the leg is provided with two hooklets which enable it to hold to objects and to move about easily. It is provided with conical shaped mouth parts illustrated in Fig. 10.

LIFE HISTORY.—The mites lay their eggs in cracks and crevices and filth of the hen houses. The eggs hatch in a few days, if conditions are favorable, and multiply very rapidly in the hotter months of summer, July and August.

CONDITIONS PRODUCED.—By means of its mouth parts the mite wounds the skin and sucks blood. When engorged it is blue to red color, due to the blood taken into its digestive tract. During the summer of 1911, the writer studied one flock of chickens in which the infested birds showed symptoms similar to birds infested by lice. The hosts became unthrifty and ceased laying and the setting hens with feathers ruffled, deserted their nests and many died. Many were found dead under the roosts in the mornings. Examination of the nests, roosts and the birds revealed millions of the parasites. This was in the month of August.

TREATMENT.—Give the same treatment as for lice. Absolute cleanliness, and plenty of kerosene on the roosts and air slaked lime on floors and in nests is essential.

Figure 10.—The chicken chigger, *Trombidium holosericeum*, ventral view. a, mouth parts; b, palpi; c, hooklets on the free extremity of leg, with which the mite holds on; d, uterus filled with eggs. The small mark to the right indicates its natural size.

Figure 11.—The chicken flea, *Pulex avium*. a, antennae; b, stylette with which it wounds the skin; c, hooklets on free end of legs. Note the stout legs which give the flea great power to jump.
FLEA

THE CHICKEN FLEA (Pulex avium)

DESCRIPTION.—This flea resembles, to some extent, the fleas of dogs, cats and man. A microscopic study shows it to be a distinct species for birds. It is illustrated in Fig. 11. It is provided with jointed feelers (antennae), mouth parts for wounding the skin and sucking blood, and legs provided with hooklets on the free extremities. The posterior legs are longest, giving them great power to jump. The body is flattened laterally and is brown in color.

LIFE HISTORY.—The female lays about twenty brown, oval eggs, in the fifth of the hen house, where they hatch in a few days, if the weather be warm. They are now in a worm-like stage and practically microscopic in size. They develop rapidly into the adult stage. (Illustrated in Fig. 11.)

CONDITION PRODUCED.—One outbreak of flea infestation was studied during the past summer. The presence of the fleas was first noticed by the insects getting upon persons whenever they went into the hen house. Investigation showed the fleas in large numbers. It is noteworthy in this outbreak that all lice and chiggers disappeared from the flock. Although these parasites irritate the skin and suck blood, no effect upon these birds was noted by the owner. Perhaps it was because the birds were largely out of doors. Symptoms similar to those produced by lice have been recorded.

TREATMENT.—Dipping the hens in five per cent Kreso Dip rid these birds of fleas, and the premises treated as indicated under “Lice” were rid of the pest.

LARGE ROUND WORM, (Ascaris indlexa)

DESCRIPTION.—This is quite a common worm, found in the first portion of the intestinal tract of chickens. It is round, white or yellowish-white in color, and from one to two inches in length. Its natural size is illustrated in Fig. 12. The male is smaller than the female, and it has a complete digestive tract and robs the bird of nutrients. Ten per cent of the birds examined in the laboratory during the past three years have been found to be infested by this worm.

LIFE HISTORY.—This worm reproduces by laying eggs, microscopic in size, which pass out with the feces. Other birds become infested by drinking or eating food contaminated or soiled with the excrement of the infested birds. In this way, one infested bird introduced into the flock, may spread the disease to all birds of the flock.

CONDITION PRODUCED.—A few worms may produce no noticeable effect upon the health of the bird. At times they are found in large masses, obstructing the bowel and causing constipation, diarrhoea, catarrh of the bowel and possibly, irritation sufficiently to cause inflammation. There may be a loss of appetite, unthrifty condition, unkept appearance of plumage, dull, languid and droopy wings, emaciation, loss of color to comb and mucous membranes; and death may occur in a few weeks.

Careful examinations by opening the digestive tracts of the birds killed for food purposes keeps one informed as to whether parasitism is present in the flock. If there are worms present in the birds, one will occasionally note that worms are passed in the feces. Reports have been made that worms answering this description have been found in eggs. By referring to Fig. 11 it will be seen that a live worm, possessing power of movement as these worms do, passing into the cloaca (No. 16) from the rectum (No. 15) can pass up the egg canal (No. 23) and thus be incorporated in the albumen of the egg, as it is formed around the yolk. It is not beyond a possibility that the following described worm (Heterakis papillosa) may, at times, do the same thing. These conditions are probably rare.

TREATMENT.—It is necessary to keep the yard and hen house clean. Lime should be scattered on the floor and about the yard, and the birds should be watered and fed from a clean trough made for the purpose and disinfected daily and so constructed that birds cannot step into it. If possible, birds should be moved occasionally upon new ground. The parasite eggs in the
excrement removed from the hen house may be destroyed by mixing with unslaked lime.

The birds may be given one teaspoonful of turpentine followed by a tablespoonful of olive oil. If the crop be full, the dose of turpentine should be doubled. Five to ten grain doses of powdered areca nut is good treatment and can be mixed with the soft feed, and fed from a clean trough. The areca nut also acts as a cathartic.

![Figure 12](image12.png) ![Figure 13](image13.png) ![Figure 14](image14.png)

**Figure 12.** *Ascaris infaexa*, round worms from the first portion of the intestines of a hen. Natural size. a, female; b, male.

**Figure 13.** *Heterakis papillosa*, round worm, head end only, from the caecum (blind gut) of a hen, magnified; a, mouth; b, oesophagus (gullet).

**Figure 14.** *Heterakis papillosa*, natural size; a, female; b, male.

**SMALL ROUND WORM, (Heterakis papillosa)**

**DESCRIPTION.**—This worm is much smaller than the preceding (*Ascaris infaexa*) and is found principally in the caecum or blind pouches of the intestinal tract. It is white in color and one-fourth to one-half inch in length. Figure 14 shows the worm natural size. It has been found in more than 50 per cent of the birds examined in this laboratory during the past three years.

**LIFE HISTORY.**—So far as known, the life history is the same as for the worms in the first part of the intestines described above.

**CONDITION PRODUCED.**—When in large numbers, the worms produce considerable irritation and an unthrifty condition. Figure 13 shows the head part of the worm provided with papillae. It takes in food and robs its host of nutrients.

**TREATMENT.**—Areca nut in the food as prescribed for the preceding.

**THE GIZZARD WORM, (Spiroptera hamulosa)**

**DESCRIPTION.**—Figure 15 shows the gizzard worm, male and female, natural size. It will be noted that the female is larger than the male. They taper abruptly at both ends.

**LIFE HISTORY.**—Birds become infested by taking ova or young immature worms into the digestive tract, with contaminated food or water.

**CONDITION PRODUCED.**—This worm has been found in one outbreak in which one gizzard was sent to this laboratory. It produces tumors in the walls of the gizzard and thus weakens and interferes with the normal function of the organ. The chickens thus affected show unthrifty condition, digestive derangements, and many birds die.

**TREATMENT.**—This is difficult, owing to the fact that the worms cause the formation of tumors in the walls of the gizzard in which they live. Turpentine and olive oil as prescribed for the large round worm are indicated. Powdered areca nut may be tried as prescribed before for worms.
THE GAPE WORM OR FORKED WORM, (Syngamus trachealis)

DESCRIPTION.—The male is very small as compared with the female. Figure 16 illustrates these worms as always found; B, the male; C, the female; and A, the mucous membrane to which they are attached. It will be noted that the male is scarcely one-half inch in length while the female is one inch and sometimes a trifle longer. The mouth parts are surrounded by a capsular arrangement with which to hold firmly to the mucous membrane of the trachea (wind pipe). These worms wound the mucous membrane and suck blood.

LIFE HISTORY.—The female produces eggs, which escape from her body only after the parent worm is expelled from the bird and the body decomposed. The embryos thus escaping from the decomposing female live in the earth, water, or earthworms. Thus, chicks drinking contaminated water or eating infested earth worms in turn become infested, or if the chick should pick up an expelled female containing the mature eggs, the embryos would be liberated in the stomach of the chick, in which case they migrate to the air passages and grow to maturity.

CONDITION PRODUCED.—Wild as well as tame birds may become infested by the gape worm. Our trouble is usually with young chicks and turkeys. The small immature gape worms or eggs containing the embryos find their way to the intestinal tract of the young bird as indicated above, and finding their way to the trachea (wind pipe) and its branches, attach themselves, and by growing in size gradually obstruct the passage of air to the lungs. As a result, the bird finds breathing difficult, and after a while gasps for air, extending its head into the air, and finally dies. Usually a lump can be found by feeling along the trachea.

TREATMENT.—Hatch chicks by incubator and do not allow them to run out in the wet grass where they may find infested earth worms or contaminated water. Feed from clean containers, constructed for the purpose.

By grasping the bird in the left hand and forcing its mouth open, a doubled horse hair may be forced down the trachea. Twisting, and again withdrawing, usually dislodges the worms. Gentle pressure over the region of the mass may so injure the worms as to cause them to let loose their hold and be expelled by the chick sneezing. Care must be exercised lest the trachea be injured. A feather, from which all the bars except the tip have been removed, dipped in turpentine, forced down the trachea and, when the tip is past the mass of worms, twisted as it is pulled out usually removes them. By referring to Fig. 1, No. 34, the location of the opening of the trachea through the larynx may be seen.
TAPE WORMS

DESCRIPTION.—So far, only round worms, possessing a complete digestive tract and distinct sex, male and female, have been discussed. The tape worms differ from the round worms, in that they have no digestive tract, and both sexes are in the same individual. The tape worms all live in their adult state in the intestinal tract and absorb through their integument, nutrients taken in and digested by their host, thus robbing the host of food nutrients. The species studied in this laboratory was from chickens, and is the Taenia infundibuliformis. Its natural size is represented in Fig. 17. The worm is white; the head is scarcely as large as a pin head and is provided with four sucker discs and a circle of hooklets. By these means, the worm holds to the mucous membrane of the first portion of the intestines. Following the head, there is a short unsegmented neck, which is narrower than the head. From this there is gradually developed segments which become a trifle longer and wider as the distance from the head grows greater. A short distance from the neck the segments become mature, that is, provided with fully developed sexual organs ready for fertilization. Each segment is a hermaphrodite, being provided with both male and female generative organs. At the end of the chain of flat segments we find one or more ripe and filled with fully developed eggs. These segments as soon as ripe detach themselves and pass out to the ground with the feces, to contaminate water and feed and be again taken up by other birds. Other segments now develop in a like manner and the process goes on almost indefinitely.

CONDITION PRODUCED.—If a hen be infested with large numbers of this worm, it is robbed of much nutrient material and becomes unthrifty. As a result of their irritation, the worms cause a loss of appetite, derangement of digestion, catarrhal condition of the bowel and loss in egg production. In feces of birds infested by tape worms will be noted occasional segments of the worms. These will be upon fresh feces and if observed closely or placed in warm water will be seen to possess the power of contraction and expansion as they change their shape.

TREATMENT.—A few teaspoonfuls of a decoction of pumpkin seeds usually rids the intestinal tract of these worms. Powdered areca nut as prescribed for round worms may also be used.
NON-PARASITIC DISEASES

FOWL CHOLERA, OR CHICKEN CHOLERA

CAUSE.—Chicken cholera is caused by a germ (*B. avisepticus*) and is a blood disease (*septicaemia*). The germ is rather short and plump and, with aqueous fuchsin, stains at the poles or ends deeper than at the middle, hence it is called a polar staining bacillus. Figure 18 shows the germ magnified 1,000 times. This drawing was made from the blood smear from an outbreak among turkeys and chickens. The cells are varieties of blood cells. One of these, a white blood cell (a phagocyte) has apparently taken up one of the germs. See figure 18.

![Figure 18](image)

Figure 18.—Blood smear from a case of fowl cholera, magnified 1,000 times. The germs, *B. avisepticus*, are scattered among the various blood cells. One white blood cell (*polymorphonuclear neutrophile*) has apparently taken up one of the germs.

MODE OF SPREAD.—Show birds often bring home the disease, or infected birds are introduced into the flock. Sometimes it is spread by eggs from an infected flock, by chicks recently hatched, or by infected droppings from infected hen houses tracked on the feet of men and animals, carried by streams or irrigation water, or dried and carried by dust or by wild birds.

The disease has been studied in this laboratory from one outbreak among turkeys and chickens, another among chickens, and still another among ducks. It may also infect pigeons, geese and wild birds. Buzzards are common carriers of the disease and insects have been known to carry the contagion. The germ retains its power to produce disease for weeks and even months. It resists, for a long time, both drying and severe cold weather. The period of incubation, that is from the time the germ enters the body until the disease symptoms appear, is given as from 12 to 48 hours. In our experimental work in which the virus (germs) was introduced into the peritoneal cavity, the period of incubation was 6 to 12 hours, and by the mouth 24 to 36 hours. The birds died 12 to 72 hours later.

SYMPTOMS.—The signs of the disease may be of so short duration that they will pass unobserved and the birds be found dead in the nests or under the roosts, or the birds may live 6 or 7 days. In these latter cases the bird mopes or sits around with tail and head down giving the so-called “ball” appearance. There is loss of appetite, great prostration, stairst feathers, dark comb, swaying gait, trembling, convulsions, thirst and intense diarrhoea. There is a high fever. The bird rapidly becomes emaciated. The disease spreads rapidly in the flock, and the percent of loss, if not treated, is very great. Pure breeds are more susceptible than scrubs. In the outbreak studied among ducks, the disease progressed very slowly, only from one to five or six dying in the course of a week. There were about 500 in the flock.

AUTOPSY.—Upon opening the abdominal cavity, one will first note the greatly enlarged liver, very dark in color, inflamed and easily torn, showing congestion and cloudy swelling. Sometimes the liver weighs 120 grams, or three times its normal weight. The intestines are congested and contain
a frothy material, dark in color. There are occasional hemorrhages in the lining of the intestines. The spleen may be enlarged and its contents soft. Small hemorrhages may be found in the heart, its coverings and other parts. The kidneys are dark, enlarged and soft, indicating active and passive congestion and cloudy swelling. The blood does not coagulate readily and is found upon microscopic examination to be teeming with germs.

MODE OF PERFORMING AUTOPSY.—Lay the hen on her back. With a sharp knife open the abdominal wall, commencing close to the anus, passing the knife forward between the ribs and breast bone to a point just back of the "wish-bone." In like manner open the other side being careful not to injure any of the organs in the cavities. Now grasp the sternum or breast bone, forcing it forward so that it will break. It can then be removed easily. This will lay the cavities open so that all organs can be observed as illustrated and named in Fig. 1, to which the reader is referred.

TREATMENT.—Eradication.—The germs are found in the discharge from the bowels, and by the feet of other birds the infection is carried into feed and water troughs, or is picked up from the ground with food. Birds should be fed and watered in troughs frequently disinfected with five per cent carbolic acid. Sick birds should be immediately removed from the flock, and the dead ones should be cremated. The hen house and nests should be disinfected with formaldehyde as follows: Close tightly all doors, windows and other openings and for each 1,000 square feet of space in the building, use 20 ounces of formaldehyde (40 per cent) and 16 2/3 ounces permanganate of potash. Place these two materials in a vessel and place in the middle of the room and leave for several hours. The yard should be cleaned every day. If the yard is small, it may be disinfected by covering with straw and burning. For the birds, intestinal antiseptics are indicated, the 30 grain veterinary sulphocarbolates compound giving us by far the best results. Other intestinal antiseptics are, hydrochloric acid, one teaspoonful to each quart of water; one percent copperas; one-half percent permanganate of potash. Vaccination with vaccine made from the germs has given excellent results.

BLACK HEAD (Entero-hepatitis)

CAUSE.—This disease is due to a protozoon, microscopic in size, which is found in the diseased areas of the caeca (blind pouches) and liver of turkeys, and rarely in chickens.

MODE OF SPREAD.—As will be seen later, the protozoon escapes from ulcers in the caeca and passes out with the feces. Foods or water contaminated with the excrements carry the disease germ to other birds. Chronic cases in older turkeys or chickens may keep the premises infected for a long time. These germs entering the liver and mucous membrane of the caeca cause inflammation and degeneration. Usually the caeca become infected first, and later the liver becomes invaded.
Figure 19.—Liver from a case of Black-Head, *Enteritis hepatis*, in a turkey. Photograph about $\frac{3}{4}$ natural size; weight is 452 grams (about one pound). a indicates the yellowish-white necrotic areas, lesions of the disease.

POST MORTEM.—Upon first opening the abdominal cavity, one's attention is attracted by the enlarged liver with areas of dead tissue. Figure 19 shows a liver about $\frac{3}{4}$ natural size, weighing nearly one pound. One or both of the caeca are enlarged. The enlargement is usually a short distance from the blind point and ulcerated areas are observed. There will also be noted a straw-colored fluid in the loose tissue about the heart. Figure 20 is from tissue taken from an area in the edge of the necrotic portion marked b in Figure 19. The liver cells, as they are first affected, are shown at A
(cloudy swelling). At B the cells are farther along in the disease process and it will be noted that the nucleus has disappeared and the cell is disintegrating. At C are the congested vessels; and at D the white blood cells referred to above. There may also be noted in these areas some giant cells. At E are the protozoa causing the disease. A microscopic examination of sections from the kidneys, shows that poisonous products have been taken up by the blood. In these sections we found degenerative changes.

Figure 20.—A section of liver, No. 19, from the area marked by b, magnified 900 diameters; stained with hematoxylin and eosin. a, liver cells showing cloudy swelling; b, liver cells undergoing disintegration; c, congested blood vessels, passive congestion; d, white blood cells (eosinophiles) so abundant in the blood and diseased tissues in this disease; e, the protozoan causing the disease.

SYMPTOMS.—This disease is most common in turkeys of one month to a year old, although we have noticed it in birds much older. Only one case was found in the hen. The symptoms are not manifest till the disease in the organs has progressed to a considerable extent. The bird is at first dull, later the wings and tail may droop, feathers become ruffled and the bird sits around most of the time. Diarrhoea and loss of appetite is now noted, the discharge being of a greenish-yellow color. Gradually growing weaker, the bird usually dies in from three to ten days from the first signs of the disease. In the cases that live longer, the birds become emaciated. A blood study shows eosinophilia. The head may or may not turn purple, from which it gets its name—"black head."

TREATMENT.—Thorough cleansing of the hen house and yard, with disinfection; care as to feeding and watering, and intestinal antiseptics are indicated, as recommended for fowl cholera. The sulphocarbolates tablets as used in chicken cholera gave the best results in our experiments. It is best to secure these tablets from your veterinarian or druggist as they are on the market in 30 grain veterinary tablets. Dissolve one tablet in each quart of water. This solution can be given as a drink or used to mix soft feed. In one outbreak, a lady reports as follows: "Some turkeys were too sick to eat. In these cases a small piece of the tablet one-half the size of a sweet pea was dissolved and given twice a day. Nearly all these recovered."
WHITE DIARRHOEA

CAUSES.—There are two causes of white diarrhoea, one, a bacillary form due to a very short, plump, rod-shaped germ (Bacterium pullorum) with rounded ends; and one due to a protozoan, (Coccidium tenellum). The germ of the bacillary form has been isolated at this station from the liver, spleen, kidneys, and other organs of chicks dead of the disease, and the protozoan of the coccidian form, from the ulcers of the caecum and intestines.

SYMPTOMS.—The bacillary form is accompanied by droopy wings, ruffled feathers, sleepiness, a tendency to huddle together, and little or no appetite. The abdominal yolk is not properly absorbed, and the whitish or whitish-brown, frothy discharge from the bowel adheres more or less to the vent fluff; the eyes are closed part of the time and there is apparently no interest in life. The appearance in many is stilty, with abdomen prominent behind, and they peep much of the time. In these cases, after death, one finds the yolk unabsorbed, or only partially so, and the intestines are more or less full. Chicks that hatch in late fall, winter or early spring are freer from this disease than summer hatched. This may be explained by the fact that hens with diseased ovaries gradually become poorer layers as the disease processes advance, and hence, only lay in late spring or early summer when nature intends reproduction of birds. Finally the hen may cease laying altogether. In the coccidian form the symptoms as studied by the writer are similar to those of the bacillary form, except that, as a rule, the heavy death rate takes place later.

MODE OF SPREAD.—In the bacillary form the ovaries of laying hens, diseased but still functioning, may be infected by the germ. The germ can be isolated, particularly from the yolk, of at least some of the eggs formed in such an ovary. The chicks from infected eggs, as a result, have the disease more or less developed when hatched, as conditions which favor hatching also favor the multiplication of the germs to such an extent that sufficient toxic poisons have already been produced in the young to cause the disease, or at least manifest itself within a few hours after hatching. From these chicks the whitish, frothy, pasty bowel discharge, more or less sticky and with a tendency to paste up the vent, is laden with the germ, and others of the flock soon become infected from contaminated food picked up from the ground. In the bacillary form, chicks may begin to die soon after hatching; in the coccidian form in from three to ten days, a few dying each day. The death rate is high, reaching in many cases, 75 per cent or more. Those that recover are stunted and do not make satisfactory growth. The greatest loss is from the first few days to two or three weeks. It is probable that the disease carriers are recovered chicks, which have established immunity, but still carry the organism, especially in the ovary, as typhoid carriers among people do in the infected kidneys or bowel ulcers.

Coccidian form.—The mode of spread of this form is at present problematical. It is possible that a chronic type occurs in some birds and thus perpetuates and scatters the organism.

POST MORTEM.—In the bacillary form the liver in general is usually pale, showing areas of active and passive congestion and cloudy swelling. The yolk is only partially absorbed and congestion of the intestines may or may not be present. The kidneys are normal size, but show congestion and cloudy swelling, and the carcass is more or less pale and emaciated.

Coccidian form.—Upon post mortem examination the conditions are found to be similar to the bacillary form, except that there will be noted more or less congestion of the intestinal lining with ulcers in the intestines, principally the caeca. The caeca appear to be interfered with functionally, containing considerable ingesta. Figure 21 shows a transverse section through an ulcerated area. In these areas we find cloudy swelling followed by retrogressive changes and death of the cells. The remains of the dead cells forms a cheesy mass. It will be noted in this drawing that only rem-
nants of a few glands normally present are yet intact, the balance of the mucous membrane, and in places the submucous layers, are invaded by the germ. In Fig. 22, section B has been magnified 900 times. As explained under the cut, all stages of the organism are observed in a mass of dying and disintegrating cells, the remains of the diseased mucous lining of the bowel. Repeated examinations have been made of healthy chicks killed for the purpose, and chicks dying from other causes and, thus far, no case has shown these conditions.

TREATMENT.—Unsanitary conditions, spolit food, dirty stagnant water, improperly ventilated incubators, brooders and buildings, or badly regulated heat are factors in weakening the physical condition of chicks and favor ravages of disease.

Most of our experimental work with various remedies has been with the coccidian form. In one outbreak referred to above, 80 per cent of the first 2,000 chicks had died. We began trying to improve sanitary conditions, and administered various dilutions of permanganate of potash, copperas and carbolic acid. The loss was unaffected. By this time the writer had examined many dozen of birds in the laboratory, and in about 50 per cent of the cases the organism (Bact. pullorum) was isolated from the heart, blood, liver, spleen and kidneys, and in every case the coccidian ulcers described above were observed. These chicks began dying in numbers when about ten days old, very few dying before that time, and from this period to the end of the third week the great loss occurred. After this time but few died, but those having the disease in light form were stunted and did not make satisfactory growth.

With this data before me, I began on another line of treatment. For the past ten years I have used, to some extent, dilutions of bi-chloride of mercury as an intestinal antiseptic in chickens. This was used in this outbreak in a 1 to 10,000 dilution with sulphocarbolorates of zinc, sodium and calcium. The latter had not given the satisfactory results when used alone.
that it gives in diarrhoea in colts and calves. Instructions were given to
fumigate the incubators and the nursery trays with formaldehyde gas, as
recommended under "chicken cholera," before filling with eggs.

After the chicks were hatched they were not to receive any feed for 48
to 72 hours as the yolk contained in their abdominal cavity will furnish food
for that length of time, and an engorgement of the intestines might interfere
with its absorption by pressing on the absorbing vessels. The following dilu-
tion was kept before them from the time of hatching to four weeks of age,
and then given twice a week for the next few weeks: One of the 30 grain
sulphocarbolates tablets as used for fowl cholera, and bichloride of mercury,
6 grains; and citric acid 3 grains. This quantity was dissolved in a gallon of
water. The result was that 80 per cent of the next hatch was saved. The
problem of obtaining the proper solution seemed a serious one. It was
finally solved by the Abbott Alkaloidal Company, who kindly made up a
quantity of the tablets, each containing the above proportions of ingredients
for this experiment.

OTHER DISEASES OF THE INTESTINAL TRACT

ARSENCAL POISONING.—We have had cases brought to our atten-
tion in which birds became poisoned by eating poisoned grasshoppers. In
these cases the grasshoppers were given arsenic in bran. The birds devour-
ning large numbers of grasshoppers, became ill, and many died. The symptoms
were dullness, loss of appetite, black comb, sitting, moping and unsteady gait.
The birds must have been in considerable pain although they did not show
it, but birds do not manifest pain as most other animals do. The autopsies
showed the livers to be normal, except a trifle dark. There were no notice-
able changes in the other abdominal organs except the intestinal tract. Upon
opening the intestines there were noted patches of hemorrhage and areas of
congestion and inflammation.

PTOMAIN POISONING.—In one flock there were 24 hens. A can of
spoiled corn, that had been left sitting in the basement in a glass container
with top removed, was given to the birds at 11 o’clock, and at 6 o’clock five
were dead. At 2 p. m. next day, thirteen were dead and three more showing
symptoms of poisoning. A flock of small chicks with the old hen, as well as
three sitting hens that had not eaten any of the corn, were not in any way
affected. There was no visible evidence of great pain, as spasms were absent.
The birds had, at first, an unsteady gait with incoordination of movement.
Prostration came quickly. The comb turned black. In some cases diarrhoea
appeared with occasionally a small amount of blood. The birds lay on the
ground in a relaxed condition, with head and neck curled over toward the
breast, but not rigid. Whenever they were disturbed, they made a struggle.
Death occurred in a few hours.

At post mortem the crop and gizzard contained some corn of a sour odor.
The only tissue change noted was a congestion of the intestines, liver and
kidneys (active and passive congestion and cloudy swelling). This condition
is often due to rotten meat or other food stuffs and is called "limber neck."
As a remedy, give a tablespoonful of castor oil and one-fifth grain doses
of sulphate of strychnine, the latter every 4 to 6 hours.

TYMPANY OF THE CROP.—Birds sometimes have enormously dis-
tended crops, which, upon examination, are found to be filled with gas. This
condition often affects young chicks as well as older birds. It is due to a gas
forming germ.

As a remedy, give intestinal antiseptics, such as 1 to 500 carbolic acid;
1 to 10,000 bichloride of mercury; or sulphocarbolates compound as recom-
mended in diarrhoea.

CROP BOUND, OR OBSTRUCTION OF THE CROP.—This is due to
foreign bodies, such as hog bristles, small feathers, straw, etc., closing the
opening of the crop to the proventriculus, or stomach. A case came to the
laboratory which may be of interest to the readers of this bulletin. Two
incubator chicks, just old enough to begin to feather out, had been given
potato parings. After death there was found in the crop of each chick, a potato paring extending from the crop through the second portion of the oesophagus into the stomach. Figure 1 shows these parts.

GANGRENE OF THE CROP has been observed several times in this laboratory. Upon opening the crop a very offensive odor is noted, and the lining is in a sloughing (necrotic) state. There may be given in these cases, in the earlier stages, salol, subnitrate of bismuth, or sulphocarboxylates compound as recommended for diarrhoea.

INFLAMMATION of the various parts of the digestive tract has been included under diarrhoea.

DISEASES OF THE OVARY AND OVIDUCT

PROLAPSE OR EVERSION OF THE OVIDUCT.—This condition is often seen in hens that are heavy layers. It is perhaps most often found in old hens. Overfeeding and aggravated constipation have been found associated with this condition, and are, no doubt, some of the causes. Where the eggs are large, the straining that takes place, and inflammation of the oviduct are important factors. The upper portion of the oviduct, or that part that receives the yolk as soon as it is formed in the ovary and delivered, is lined with secreting cells. In this part the albumen which surrounds the yolk is formed. Farther along there are glands that secrete the shell that surrounds the outer surface of the albumen. It can be readily seen that all these cells require a rich or abundant blood supply. Any inflammation of the egg duct means an arrest of function of these glands and also others whose function it is to secrete a mucous which lubricates the passage and a stopping of the egg passage results. Inflammation of the oviduct is not an uncommon occurrence, and may be due to non-specific germs from the cloaca.

If the prolapsed or protruding mucous membrane is allowed to remain out, inflammation and swelling will soon result and the parts may become ulcerated later.

As a remedy, use a three per cent to five per cent carbolized vaseline and return the protruded part. Keep the hen on light diet for several days so that the parts may have a rest and the irritation causing the trouble will subside. Also give the hen a tablespoonful of castor oil and plenty of water.

EGG BOUND is the stopping or arresting of the passage of the egg at the time when it should be expelled from the oviduct. It is alluded to above, and in addition to those causes may be mentioned a weakness of the muscles whose duty it is to expel the egg.

SYMPTOMS.—The hen goes to the nest frequently and attempts to lay but is not successful. Lubricate the fore-finger with carbolized vaseline and insert it into the oviduct (Fig. 1 shows the relation of these organs) and remove the egg. In one case brought to the laboratory, the writer found inflammation of the oviduct, a lack of secretion and a very large egg which lay crosswise of the duct. It was necessary to break the egg shell to remove it. The hen was given a tablespoonful of olive oil, put on bran mash and sent home in three days.

TUMORS OF THE OVARY.—These often consist of yolks or ova which have formed but have failed to enter the oviduct. Later these masses become rather hard and yellowish in color, and are found to be made up of apparent concentric layers of cheesy matter. (Fig. 23 illustrates one of these grape-like masses.)

CYSTIC CONDITIONS are at times found. These cysts are imperfectly developed ova, which contain a colorous liquid. They appear like tumors and are attached by more or less long pedicles.

HEMATOMA or blood tumors, are sometimes found. Figure 24 illustrates one of these conditions.

SARCOMA was studied in the laboratory in two cases. They were generalized and affected other organs besides the ovary. Sarcomas are a variety of malignant tumors.
Fig. 23.—Degeneration of ovary of a hen showing tumor-like mass; a, shows ova, which have undergone degeneration. Note the shrunken appearance and in some, shrivelled pedicle-like structures joining them to the ovary mass. The contents of these masses are cheesy (caseation necrosis). Natural size.
Figure 24.—Hematoma or blood tumors of an ovary (of a hen), natural size; a, shows diseased ova. Note the shrunken atrophied condition; b, the sectioned surfaces of two of the tumors showing the coagulated blood.

BROKEN EGGS in the oviduct, as well as injury to those ova still undelivered, are often found and are the results of the hen being kicked or stepped upon by large animals. Death usually follows. We have also studied cases of ruptured ova due to heavy hens roosting on high perches and jumping upon the hard floor.

PROLAPSE OF THE CLOACA may occur in heavy laying hens that roost on high perches and fly a long distance to the ground, and especially when the wings are clipped. If these birds are allowed low roosts, and are put on a light diet, recovery takes place.

CLOACITIS.—The writer has observed one case in a cock in which there was inflammation of the cloaca with ulceration. The bird died later of inflammation extending the whole length of the rectum, infection having been progressive.
DISEASES OF THE LIVER

Reference has been made to diseases of the liver in conjunction with other conditions, as fowl cholera, entero-hepatitis, etc.

FATTY DEGENERATION is a condition in which the true liver tissue is replaced by fat. Such a liver may be smaller in size and rather hard in texture.

FATTY INFILTRATION may be healthy or not. In fattening animals there is always an excess of fat stored in the liver, which gives it a grayish-yellow color and makes it rather soft in texture. When such livers are cut through, the knife will have upon it some fatty material.

CONGESTION AND INFLAMMATION.—Congestion may be brought about by overfeeding and lack of exercise, or by a defective or weak heart. Active congestion and inflammation may be brought about also by tainted food or food that is mouldy or fermenting. In the latter case a toxic or poisonus substance is given off and on account of the liver being a destroyer of such poisons, they are taken there, and an excess amount overwhelms the cells and the irritation causes congestion and inflammation. The liver is enlarged and dark. The symptoms are not definite but the hen will be off feed and dull. The feathers will appear unkept and the hen will remain on the roost or in a corner. Give a tablespoonful of olive oil and soft feed.

RUPTURE of the liver may be caused by a kick or by being stepped upon by a large animal, or in case of congested livers, from concussion by the hens jumping from high places.

TUBERCULOSIS.—One case of tuberculosis has come to this laboratory. This bird had access to the sputum of a person suffering with the disease. The liver was slightly larger than normal and about natural in color. The surface was studded with pearl-like nodules from the size of a pin head to a millet seed. The tubercles were also scattered over the peritoneum. A microscopic examination showed the tubercle bacillus.

![Image](image_url)

**Fig. 25.**

Figure 25.—Abscess in the soft structures between the toes of a hen; a, indicates the opening due to lancing, from which a cheesy-like pus was removed with a pus scoop (curette). This abscess was caused by a thorn of a Russian thistle penetrating the soft parts.
CATARRH OR COLD

Birds that roost in drafts, or are exposed to sudden changes in the weather, are liable to catarrh and colds. Exposure to cold rains is often a factor.

SYMPTOMS.—The appetite may be somewhat diminished. The bird sneezes, throws it head and may expel some mucus. The discharge is at first watery and later becomes more or less thick. The eyes may appear red and show more or less inflammation, and the lids may stick together. The characteristic offensive odor of roup is absent.

TREATMENT.—The same treatment as outlined for roup has given us uniformly good results.

BRONCHITIS.—We have noted in some cases that catarrh commencing in the head, principally the nasal chambers, extends down and involves the windpipe or trachea and even the branches of the trachea into the lung tissue. Sudden changes in the weather, dampness, roosting near a crack so that cold winds blow upon the birds, or any kind of a draft are the principal causes.

SYMPTOMS.—There is a rattling in the region of the trachea and the bird may gasp for air by extending the head upward. This is due to the fact that an accumulation of mucus in the air passage partially plugs the tubes and interferes with the passage of a normal amount of air to the lungs. As a result the bird will cough. There may be dullness and partial loss of appetite. The condition may pass off in a few days, respond to treatment, or it may last for several weeks and finally end in the death of the bird.

TREATMENT.—Give a tablespoonful of castor or olive oil. Also give one-grain doses of quinine three times a day, and place the bird in a warm, clean, comfortable quarter, free from drafts. Give plenty of clean water and soft food.

CONGESTION OF THE LUNGS

This is an engorgement of the blood vessels of the lungs. It has been observed in young birds and in birds during their moulting season, when they are poorly clad with feathers and exposed to inclement weather. The young chicks that are allowed to run out early in the mornings and become wet with the cold dew, or the chicks that are allowed to become wet and chilled with the cold spring rains are the ones that suffer from this condition. A contraction of the blood vessels of the skin and superficial parts, forces an abnormal amount of blood to the internal organs and congestion is the result. These birds appear sleepy, stupid, breathe rapidly, and in some cases with difficulty. The comb becomes bluish and the bird may die from a lack of sufficient air (asphyxiation). Upon opening the bird after death, the lungs will be found gorged with blood.

PNEUMONIA, OR INFLAMMATION OF THE LUNGS

Bronchitis, as described above, often terminates in pneumonia (bronchopneumonia). It has been the experience of the writer that this form is the more common. Upon opening the bird the affected part of the lung will be found to be dark red, and when cut through it will appear liver-like. Serum and blood exude from the cut surface. The causes of pneumonia are exposure to cold and inclement weather as mentioned under catarrh.

SWELL HEAD IN YOUNG TURKEYS

The most characteristic symptoms are swellings of certain parts of the head, especially in the region of the maxillary sinus, which becomes filled with a gelatinous colorless substance. (For location of sinus, see Fig. 1, No. 31.)

These swellings may disappear in a few days or weeks, or may remain for several months. In the latter instance, the swelling may contain a cheesy material of foul odor, and in some cases death of the bird results.
POULTRY DISEASES

CHICKEN POX

CAUSES.—This disease is called contagious epithelium. It affects chickens, turkeys, pigeons and geese. Some investigators claim it is due to an ultramicroscopic germ, and that the germ is also the cause of avian diphtheria or roup. An ultramicroscopic germ is one that will pass the pores of the finest filters and which cannot be seen with the microscope nor grown in visible quantities upon culture media. There are just as many who are certain that their results show that the germs are not the same, and that the infection at one time will not produce roup and at another chicken pox. Our experiments do not lead us to the conclusion that they are the same disease caused by the same germ.

Chicken pox is contagious and can be transmitted from material of one bird to healthy birds by inoculation. Several germs have from time to time been isolated, among them protozoa, but none are constantly present in these cases.

![Figure 26](image_url)

*Figure 26.—Chicken pox (contagious epithelioma) slightly reduced; a, some well formed pock nodules consisting of masses of proliferated epithelium. It will be noted that some of these have obstructed the eye; b, shows some nodules at the base of the beak. This condition is sometimes found accompanying roup.*

SYMPTOMS.—Figure 26 shows a photograph in which nodules of irregular size are seen over the comb, face and in the wattles. These nodules vary in size up to a pea and even larger. We have observed roup and chicken pox in the same flock.

ROUP OR AVIAN DIPHTHERIA

This condition is sometimes called swelled head, because usually there is swelling about the head.

CAUSE.—The cause appears to be far from settled. American and European investigators have from time to time isolated different germs, all of which perhaps contributed to the production of conditions found, but there
are none of these germs that are constantly found by all. With the view of 
determining whether or not the type of roup existing in Colorado is due to 
an ultramicroscopic germ, two diseased hens were secured through the aid 
of Mr. Vaplon. These birds had swollen eyes, with an accumulation of 
catarrhal product in the maxillary sinuses (the bulging observed below and 
in front of the eye) and a discharge from the nostrils of an offensive odor. 
There were also characteristic yellowish-white diphtheritic patches in the 
mouth. Material from all these lesions from both birds was prepared in 
physiological salt solution (.85 per cent common table salt) and filtered 
through a Pasteur filter calculated to take out all germs that can be seen by 
aid of the microscope or that could be produced in visible growth upon artifi-
cial culture media. The fluid that passed through this filter was used in in-
oculating experimental birds. These birds were from flocks in which roup 
had not appeared. In all, fifteen inoculations were made. Tubes of media 
were inoculated with the filtrate and no visible growth of germs was seen 
after being incubated at 37 degrees C. for 72 hours.

Observations were continued on the inoculated birds for thirty days and 
roup did not appear in any of them. So far as this one experiment goes, it 
does not indicate that our type of roup is due to a filterable virus.

MODE OF SPREAD.—The disease is spread by the introduction of birds 
from infected premises, and by exposure of birds at poultry shows to the con-
tagion. A chronic type of the disease in some birds of the flock may serve to 
infect others, when they are weakened by predisposing causes; as by exposure 
to cold, damp, roosting places, drafts and badly ventilated buildings.

SYMPTOMS.—There are three forms of the disease. In the nasal form 
there it at first a thin watery discharge from the nostrils, with an offensive 
odor which is characteristic of roup. Later the catarrhal product becomes 
somewhat thicker and the nostrils become glued shut, and quite frequently 
there is a bulging of the maxillary sinus below and in front of the eye. This 
is due to an accumulation of the inflammatory products in this sinus, or cav-
ity. Figure 27 illustrates this common swelling. The second part affected is 
the mouth. This affection often accompanies the nasal form. Figure 28 
illustrates these diphtheritic ulcerations, which are covered with a yellowish-

![Fig. 27](image)

Figure 27.—Hen afflicted with roup; a shows the swelling; the eye is swollen 
shut and the sinus beneath and in front of the eye is bulging as a result of the 
secretions from the inflammation caused by the germ of the disease. The mucous 
membrane surrounding the anterior portion of the eye ball is greatly inflamed 
(conjunctivitis) and is filled with a mucopurulent material.
white crust of coagulated exudate. From these necrosing patches the disease receives the name, avian diphtheria. The third location is the eye. There is at first an inflammation of the mucous membrane lining the anterior part of the eye-ball. As the disease progresses, the catarrhal product accumulates as a watery clot-like mass, whitish in color. The eyelids stick together and hold the material as it accumulates till the parts bulge outward. There is sneezing, shaking of the head and expulsion of mucous and loss of appetite; the bird appears weak, and has a tottery walk and becomes rapidly emaciated. Breathing is difficult at times, and often there is diarrhoea, and the bird dies in a few days.

TREATMENT.—Correct any condition which may be a predisposing cause. The hen house should be well ventilated, but without drafts on the birds, and it should be cleaned and disinfected daily. If the bird is not valuable, kill and burn it. Treatment with medicines differs with the location of the lesion. For the ulcers or diphtheritic patches in the mouth, nothing is better than burning with stick nitrate of silver (lunar caustic). For the eyes, press open the lids and remove the material with clean absorbant cotton; then apply the material as for injection into the nostrils. Wash out the nostrils with a 20 per cent solution of common baking soda, then with peroxide of hydrogen. With a medicine dropper or small syringe, inject some of the following; oil of thyme, 1 dram; oil of eucalyptus, 20 drops; oil of petrol, 2 ounces. Give plenty of clean water and soft feed. Give one grain of quinine three times a day, as well as a tablespoonful of castor oil.

Figure 28. — Roup, Avian diphtheria, natural size, showing inner portion of upper and lower jaws; a, diphtheritic patches on edge of mouth and top portion of the tongue; b, same on roof of the mouth including hard palate.
Figure 29.—A case of asphyxiation due to a small piece of corn grain lodging in the wind pipe.