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Chicken-Pox or Sore-Head in Poultry

By

C. A. CARY

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CHICKEN-POX, SORE-HEAD OR CONTAGIOUS EPITHELIOMA IN POULTRY

BY C. A. CARY.

INTRODUCTION.

This disease occurs in nearly every county in Alabama during the spring summer or fall of every year. It is more prevalent among young chickens, from broilers to maturity; yet younger and older chickens may have this disease. It is a common poultry disease and very probably more deaths occur from sore-head than from any other poultry disease in Alabama. Such a high mortality can be avoided with proper care and treatment.

The poultry industry in Alabama is not as extensive and as carefully and thoroughly worked as it should be. The extensive home markets in the mining and manufacturing regions of the South will take care of a much larger supply of chickens, ducks, turkeys and pigeons. The conditions in the South are ideal if the poultry business is conducted with that care and knowledge which are required in any place to bring success. With a small capital, plenty of regular work applied intelligently, it will bring as good returns as any line of the live-stock industry.

FORMS OF THIS DISEASE.

There are no positive differences between the various forms of diphtheria, roup and chicken pox or "sore-head" other than the locality in which the lesions occur; and possibly the per cent. of mortality in the different forms of the disease. Usually when the mouth, throat, air passages or alimentary canal in one or more places is peculiarly inflamed so that an organized or solid exudate is formed on the surface of the inflamed mucous membrane and that mem-

brane bleeds rather freely when the diphtheritic exudate is torn away—such a diseased condition is called fowl (avian) *diphtheria*.

If the nasal passages and the cavities connected therewith have their mucous membrane inflamed producing a catarrhal (mucous) exudate, or solid, dried pus-like exudate in the nasal cavities, and sometimes pushing outward the tissues around the eyes—such a diseased condition is called “roup.”

If the skin of the wattles, comb, ear lobes, eyelids or of the head and sometimes the conjunctiva (the mucous membrane lining, the eye-lids and reflected over the front part of the eye-ball) becomes inflamed in such a way as to produce crusts or scabs or an exudate of dried pus, broken down epithelial cells, etc—such a condition is called chicken-pox or “sore-head” or *epithelioma contagiosum*.

CAUSES.

The causes of these diseases, or this disease, have been attributed to coccidia (one-celled protozoa) to various bacteria and to ultra-microscopical organisms.

Neumann (11) gives the following:

“*Coccidia* or *Psorospermiae oviformes* constitute, in the class of sporozoa, an order in which the majority of the species belonging to it live as parasites in the interior of epithelial cells of the liver, intestine, skin, etc. At the commencement of their development these coccidia form small protoplasmic regularly rounded masses, which are usually nucleated. Gradually each of these masses increases in volume and becomes surrounded by a transparent membrane—the *cyst* or *shell*—and rupturing the cell into which it had penetrated, it falls into the biliary ducts, the intestine, the epidermic layers, etc. Thus liberated, the encysted coccidium passes through a phase of segmentation—its protoplasm becoming condensed, then dividing into several spheres or spores,

Each spore in its turn subdivides into a number of corpuscles—*falciform corpuscles*—which, meeting with favorable conditions each becomes a new amœboïd individual that invades an epithelial or epidermic cell, grows there and recommences the cycle of its progenitor.”

Oslertag (9) says:

“Coccidia are parasites of epithelia. They are small, spherical or oval structures which destroy the epithelial cells by their rapid growth and then divide into a number of parts. These penetrate into the intact epithelia of the infested organ (*merozoites*) or become changed into microgametes and macrogametes (male and female sexual cells). By the copulation of these forms sporoblasts are produced and, finally, permanent forms with shells (*sporozoites*) arise. The latter cause infestation of new hosts.” The sporoblasts (a) are elongated, oval and surrounded by a double capsule, at first the protoplasm entirely fills the capsule as a coarsely granular mass, but soon becomes contracted into a sphere from which four sporozoits arise. In the rabbits’ liver infested with coccidia, round, white, abscess-like foci are formed.

Friedberger and Frohner (13) give the following:

Coccidia “are at first naked inhabitants of epithelial cells. By penetrating into the cells of the mucous membrane and by filling up these cells (in many cases completely, so that the enclosed coccidia assume the appearance of large nuclei), they produce grave disturbance of nutrition and this tends to induce necrosis of the parts attacked.” “Gregarinous croupy diphtheritis is distinguished by the ease with which the disease extends from the mouth to the skin of the head. It can be readily transmitted artificially, and is generally not difficult to cure, especially when it is confined to the mucous membrane of the mouth, pharynx, upper part of larynx and skin.”

“The clinical phenomena of avian gregarinous (coccidian) diphtheritis agrees in all particulars with those of bacterial

diphtheritis when these respective complaints affect the mucous membrane of the head. Here, also, the symptoms are essentially those of croupy diphtheritis of the mucous membrane of the mouth, pharynx, air passages of the head, larynx, conjunctiva, etc., with secondary intestinal affections. Gregarines may also give rise to primary and independent enteritis (Zurn)."

"In gregarinous diphtheritis, the skin is much more frequently implicated than in diphtheritis caused by bacteria. The cutaneous affection consists of hypertrophied nodules on the skin, which are known as gregarinous epitheliomata (*epithelioma gregarinosum* of Bollinger, and are identical with *molluscum contagiosum* of man.). Their favorite seats are those parts of the head that are not covered with feathers; root of the beak, neighborhood of the nostrils, angles of the mouth, lobes of the ear, parts adjacent to the auditory meatus, wattles, surface of the face, edges of the eyelids, intermaxillary space, and especially the comb. They sometimes spread over the feathered parts of the head, throat and neck, and may occur on the outer surface of the thighs, abdomen, under the wings and in the vicinity of the cloaca. At first these epitheliomata appear in the skin, as flat nodules, which soon become prominent, and which vary in size from a poppy seed to a millet seed. Later on, they usually attain the size of a hemp seed. They are of a reddish-grey or yellowish-grey color, often show distinctly in their earlier stages of development a peculiar greasy, nacreous lustre; and are rather firm to the touch. Their surface soon becomes covered with a dirty-grey, yellow-brown or red-brown crust. They are discrete and disseminated in considerable numbers on the erectile tissues, etc. They vary in size according to their age; and frequently lie rather close to one another, so that the affected parts looks as if coarsely granulated; or they are crowded together in such a manner as to give the appearance of large warts with divisions through them, or mulberry-like hypertrophies. Even single

nodules, to say nothing of groups, may attain the size of a lentil, pea, cherry-stone, broad bean or larger object. The older they become the rougher, and more covered with knobs will be their incrustated surface."

"If the edges of the eye-lids be affected by these tumors, the lids will become nodular, swollen and closed. The conjunctiva in this case also suffers; it projects outward; becomes catarrhally inflamed; assumes a yellowish color at the seat of eruption; and its surface become covered with crusts. Purulent conjunctivitis may appear and the inflammation may spread to the sclerotic and cornea, with keratitis and panophthalmia as the result. If, as sometimes happens with pigeons, the eruption of nodules extends over the whole of the skin of the eye-lids and its neighborhood, the entire eye will become covered with mulberry-like proliferations of various sizes.

COCCIDIA IN ANIMALS.

Coccidia (*C. oviforme* and *perforans*) have been reported as occurring in the following places in animals.

1. Leuckart (7) and many others have found coccidia in the bile ducts of rabbits there attacking the epithelium of the ducts, and in many cases causing the death of the rabbits.

2. Johne (8) and Ostertag (9) report coccidia in the liver of swine.

3. Birch-Hirschfeld (10) states that coccidia have been found "in the respiratory passages of rabbits, dogs, cats, calves, sheep, and birds, producing circumscribed or diffuse inflammation of the mucosa and submucosa, even superficial ulceration, which in many instances appears as infectious and results in numerous fatalities. He calls especial attention to the diphtheritic inflammation in the mucosa of fowl; its extension to the intestinal mucosa and the mesenteric lymph glands.

4. Ostertag (9) says *C. perforans* is found in the intestinal epithelia of rabbits producing a desquamative catarrh

of the entire intestinal tract and in consequence profuse diarrhœa.

5. Ostertag (9) also reports that in some of the Swiss cantons there is a disease called "dysentery hæmorrhagica coccidiosa." The coccidia are found in the longitudinal folds of the mucous membrane of the colon and were oval or spherical and contained nuclei three times as large as those of epithelial cells. One observer says these are *C. ovi-forme*.

6. Ostertag (9) also reports *Coccidium tenellum* as an opizootic, croupous, diphtheritic enteritis in poultry and during the progress of the disease or infestation the coccidia invade the mesenteric lymph glands producing disintegration foci.

7. Friedberger and Frohner (13) state that coccidia are very widely distributed as parasites in the animal kingdom and are found in birds, rabbits, rats, dogs, fish, snails, and earthworms. The diphtheritic products contain cast-off epithelial cells which contain in their interior a rounded body which fills up half or more of the cell-space and looks like a greatly enlarged nucleus. These bodies are highly refractive and have a greasy, glassy lustre, and swollen homogenous appearance. These spherical formations are also found free and in varying numbers in the croupy diphtheritic excretions of skin nodules in coccidian diphtheria of chickens.

8. Moussu and Marotel (15) report coccidia in the intestines of sheep producing hyperæmia and necrotic lesions in the mucosa.

9. Eckardt (16) found *Coccidium tenellum* in great numbers in the intestines of chickens, producing diarrhœa, great emaciation and intensely blue comb and wattles.

10. According to Nocard and Leclainche, (14) Rivolta, in 1869 found coccidia in the false membranes of diphtheria.

11. Thoma (18) says *C. perforans* has been reported as occurring in man, dogs, cats, rabbits and mice.

Coccidia (*Coccidium oviforme*) has been reported as occurring in the following diseases or conditions in man:

1. In the intestinal canal in two instances (2).
2. In *contagious epithelioma (molluscum contagiosum)* (1) a skin disease in man.
3. According to Leuckart (3) numerous cases of coccidia in the liver of man have been reported by Virchow, Dressler, Sattler, Peris, etc.
4. Padwyssozki (4) reports a case of extensive infestation of the liver of a man.
5. Peters (5) reports "ingekapselta gregarinen"—coccidia—in the diphtheritic membrane of six cases of diphtheria in man.
6. Leuckart (3) reports the records of Lindemann who found coccidia in the human kidney and also in one instance on the hair of the head of a young girl, where it was supposed to cause considerable irritation.
7. L. Pfeifer (6) reports coccidia in small-pox lymph.

The life history of coccidia has not been completely worked out. Johne, in Birch-Hirschfeld's book, (10) gives the characters and life history of *coccidium oviforme* as studied in rabbits. He says it is 0.03 to 0.037 Mm. long and 0.015 to 0.02 Mm. broad. The mature form consists at first, of the finely granular protoplasm which occupies the entire space in the cell (a fig. 5). In this stage the shell or wall of the cell may be quite thin but later it becomes thicker and apparently double contoured. In the next stage the protoplasm becomes contracted into a spherical granular mass (b fig. 5). In about four weeks (?) the protoplasm is divided into 4 round granular spore-like bodies (c fig. 5) which later become the C-shaped bodies as observed in d. e. and f. in fig. 5. When these are taken into the stomach of a rabbit, the old capsule is dissolved and the spores or embryonic masses are set free and have amoeba-like movements and characters; in this condition they pass

from the intestine into the bile ducts where they penetrate the epithelial cells and develop into the stage (a) in fig. 5. In doing this they destroy the epithelial cells.

The following bacteria have been found in diphtheria, roup and sore-head in fowls:

Loeffler (26) in 1884 found a bacterium in diphtheria of pigeons and claimed that he produced the disease by inoculation with pure cultures of the germ.

Loir and Ducloux (27), Haushalter (23) and Quaranta (29) have found a bacillus or motile germ in the diphtheritic exudate of fowls.

Moore (25) in 1895 isolated from chicken diphtheria a bacterium belonging to the haemorrhagic septicaemia group. In later years he failed to find this germ in other outbreaks. Moore states that the real cause of diphtheria, roup and chicken-pox has not been discovered.

Cornil and Megin (30) in 1885 found a germ similar to Loeffler's bacterium in lesions of the mucous membrane and of the skin of fowls.

Von Krajewski (31) discovered the bacterium of Loeffler in the lesions of poultry and transmitted the disease to pigeons and young chickens by inoculation on the mucous membrane.

Babes e Puscarin (32) found the Loeffler germ in the diphtheria of pigeons and described its mode of action in the tissues.

Eberlein (33) in 1894 found a bacillus in the diphtheria of the partridge.

Harrison and Streit (21) discovered in the blood under the diphtheritic exudate of roup or diphtheria in chickens and pigeons a short motile germ (*Bacillus cacosmus*); and after passing the pure culture through pigeons to intensify its virulency, produced the disease in healthy chickens by inoculation. They also isolated the green pus germ (*Pseudomonas pyocyanae*) from the lesions in chickens and produced the disease by inoculation. Moreover they found

bodies in and among the epithelial cells of the exudates and tissues; these bodies may represent stages in coccidial life. They also found yeast cells in the diphtheritic exudates.

Gallez (34) isolated from the lesions in nasal mucuous membrane of chickens having contagious coryza (roup) a germ that he claimed was identical with the Klebs-Loeffler germ of human diphtheria.

Ferre (35) reports that he found the human diphtheria germ in the lesions of chicken diphtheria and he also found the germ on the mucous membranes of healthy chickens.

Gratia and Lienaux (36) isolated from diphtheritic pigeons a germ that closely resembles the human diphtheria microbe.

Harrison (23) made a number of tests with human diphtheria antitoxine and for the human diphtheria germ in chickens and pigeons and could not produce diphtheria in chickens by inoculating them with the human diphtheria germ. He also failed to find the germ of human diphtheria by examining over two hundred chickens affected with roup or diphtheria. He concludes that there is no relation between human and fowl diphtheria.

Guerin (37) makes a positive statement that there is no relation between human and avian diphtheria.

Moore, in his Pathology of Infectious Diseases of Animals gives the following records:

"The non-identity of these diseases (human and avian diphtheria) has been clearly pointed out by Menard (43). Although these maladies are shown by several observations to be unlike in their etiology and character of the lesions, the transmission of fowl diphtheria to the human species, and vice versa, is affirmed by several writers."

"Gerhardt (38) reports four cases of diphtheria in Wesselhausen, Baden, among six workmen who had charge of several thousand fowls, many of which died of diphtheria. There were no other cases of diphtheria in the neighbor-

hood and the evidence was quit conclusive that the disease was contracted from the affected fowls."

"Debrie (39) reports briefly the transmission of human diphtheria to fowls. He is inclined to believe that human diphtheria is transmissible to fowls and fowl diphtheria to man. Cole (42) reports a case of supposed transmission of the disease from a fowl to a child."

"The diphtheritic disease of fowls reported by Loir and Ducloux (27) in Tunis, in 1894, spread to the people of that place, resulting in an epidemic of serious proportions. Menard (41) refers to the fact that men employed to feed young squabs contracted diphtheria by blowing the masticated food into the mouth and crop of squabs suffering with that disease. Schrevens (40) reports several cases of diphtheria in children in which he traces the sources of infection to certain poultry."

"Guerin (37) has pointed out with emphasis that there is no relation between diphtheria in man and in fowls."

Moore further states that until the relation between human and fowl diphtheria is positively determined it is wise to handle diseased fowls with care and especially keep all susceptible children away from diphtheritic chickens and pigeons.

M. Juliusberg (*Deut. Med. Wochenschr.*, 30 (1904), No. 43, pp. 1576-1577), study of contagious epithelioma of pigeons and chickens is reviewed by Wilcox in the *Experiment Station Record*, for April, 1905, as follows:

"As a result of the study of the cause and symptoms of these diseases as well as the virus, it is found that the virus of pigeon-pox may be filtered in the same manner as the virus of chicken pox.

The incubation period of both pigeon and chicken pox after inoculation with filtered virus is about twice as long as after direct inoculation with the substance of the tumors (nodules or crusts). It was found that the repeated passage of the virus of pigeon-pox through animals

attenuated it to such an extent that it finally became non-virulent. The addition of erythrosin in 1 per cent. solution destroyed the virus. None of the pure cultures of yeasts, cocci, or bacilli obtained from contagious epithelioma were found to be pathogenic for pigeons or chickens.

BACTERIA OBTAINED FROM SORE-HEAD CASES.

(a) Dec. 2 1903. Obtained following germ from crust of naturally infected chicken:

Long, round end bacillus, usually in filaments forms spores: 1.6 to 2.8 long and 0.5 micro-millimeters wide; slightly motile, flagella peritrichic; takes Gram's stain. Blood serum growth crumpled becoming mealy and greyish white.

Agar plate—growth on surface irregular, streaming and to naked eye appears like ground glass. Agar stroke is rugose, becoming mealy and grey-white. Gelatine liquified and pellicle on surface. Bouillon—at first a crumpled film; then mealy, flaky pellicle; flaky precipitate. Litmus milk coagulated and peptonized slowly. Gas is produced in lactose bouillon.

Potato growth is at first watery, and later becomes white crumpled and mealy.

This germ is closely related to bacillus subtilis. Inoculated a field lark with negative results.

(b). Dec. 6, 1903, obtained following germ from eye exudate of sore-head chicken:

Bacillus 1.5 to 2 times as long as broad. In old cultures it appears beaded. It is motile. Does not liquify gelatine; in gelatine stab the growth is filamentous; colony on surface has wavy edges and is finely granular. Colony on agar surface white, finely granular, edges even or slightly lobed; colony two-zoned. Hydrogen and carbon dioxide gas in glucose bouillon. No gas in sacchrose bouillon. Inoculated field lark by smearing scarified conjunctiva. Negative re-

sults. Inoculated chicken by smearing scarified conjunctiva—negative results.

(c). Germ from sore-head chicken, taken from blood under crust on comb. Oval or short rod with round ends; 1 to 1.6m long by 0.4 broad; and agar white round raised colony: does not take Gram's stain; motile with peritrichie flagella; forms irregular light grey growth on surface of litmus gelatine; does not liquify gelatine; on neutral agar light gray growth. On potato the growth is gray in 24 hours and later becomes brown. It decolorizes litmus milk and coagulates it. Produces gas in acid, lactose agar and increases the acid color.

Tested by smearing sacrificed surface on chicken and by injection under skin. Negative results.

(d) Germ obtained from sore-head crust; coccus occurring in masses, sometimes single and sometimes short chains; growth on gelatine surface a wax-like yellow and very slight growth in depth. Gelatine not liquified; germ non-motile; takes Gram's stain; a lustrous yellow growth on blood serum. No gas in glucose, sacchrose or lactose bouillon. This germ was not tested by inoculation.

(e) Germ derived from crust of sore-head chicken. Large germ round ends; not motile; does not take Gram's stain; very slow growth in depth of gelatine at room temperature; in agar stab growth largely along depth of stab; slight brownish growth on blood serum; alkaline bouillon slight turbidity; acid bouillon heavy turbidity and precipitate at bottom of tube. This germ produces fermentation in glucose sacchrose and lactose bouillon. It may be a coli group germ or the *Bacterium aerogenes* of Escherich.

Inoculation of one chicken failed to give positive results.

(f) Obtained from crust of sore-head chicken, a coccus with following characters: It appears in two's, chains of six or eight and in masses; is motile and has one flagellum; it takes Gram's stain; yellow line growth from stroke on blood serum; milk not coagulated, yellow growth collects at

bottom; in bouillon yellow or white cloudy growth at bottom; colonies on agar surface produce diffuse cloudiness; does not liquify gelatine; on potato the growth is slow and yellow. Inoculated pigeons (b) and (c) with negative results. This germ corresponds closely to Chester's description of *Pianococcus citreus*.

(g) Yeast.

(h) A streptococcus—negative results from inoculation.

(i) A germ that stained like a young culture of human diphtheria bacilli. Unable to transmit it by inoculation.

(j) *Pseudomonas pyocyanae*. Found quite common in all forms of sore-head, roup and avian diphtheria.

(k) Molds of various kinds are often found in sore-head crusts.

INOCULATION TESTS.

Inoculation tests with *Pseudomonas pyocyanae*, other germs, and exudate from natural cases of sore-head.

1. Brown chick, 3 months old. December 1, scraped rose comb and left wattle; then rubbed into raw places green pus germ (pure culture from sore-head case).

December 8—Very slight indications of the inoculation taking hold.

December 15—Distinct thickening of skin on comb.

December 25—Well developed sore-head growth on comb.

2. Gray chick, 3 months old. Injected December 15 aqueous suspension of some green pus germ into left wattle and into comb.

December 25—Fairly good case of sore-head on comb.

3. Hen, 1 to 2 years old. Injected 1cc of acid bouillon culture of green pus germ under skin of head and into wattle. No appreciable effects.

4. January 17, 1903. Brown chick, 5 months old. Inoculated by scarifying comb and injecting under skin with a big coccus obtained from Adam's sore-head rooster. Result negative.

January 17, 1903. Injected under skin in 4 places and into comb of young chick a short thick bacterium from

Adam's cock. Chick died January 20. Liver, kidneys, intestines, lungs, all contained the germ (septicaemia). This germ was a short bacterium that coagulates milk; does not liquify gelatine and forms white growth on surface and a villous growth along the gelatine stab; white, even cloudy, growth on surface of agar; white, watery, glistening growth on potato; white even surface growth on Loeffler's blood serum. In neutral bouillon, it gave a thin film on the surface and slight turbidity; a granular growth formed finally at the bottom of the tube.

5. Oct. 3. Scarified inner surface of eye-lid of hen and smeared over this *streptococci* obtained from sore-head case. Negative results.

6. Feb. 2, 1903. Black chick 5 months old inoculated with a coccus and a mould obtained from sore-head case. Injected the coccus and mold under skin below the eye and into the base of the comb; chick died February 6 of septicaemia without showing any signs of sore-head.

7. Dec. 1. Inoculated *cockerel*, 16 months old, in right wattle with 1-4 cc of big bacillus (bouillon culture). No results from this. At same time rubbed in *pseudomonas pyocyanae* on sacrificed comb.

Dec. 4. The comb above the scarified place showed red and swollen papillæ and skin at base of papillæ was yellowish green.

Dec. 10. One tooth of the single comb slightly involved.

Dec. 15. Digit or tooth on comb still involved and other teeth or digits of comb appear slightly involved.

Dec. 30. Scab came off and comb recovered.

Jan. 12. Scarified side of comb and rubbed in material from fresh natural case of sore-head—no results beyond the effects of scarification.

8. Post-mortem on chicken (4 mos. old) died of sore-head; it had small white diphtheritic patches in mouth, pharynx, oesophagus and larynx. Had been sick 10 days. Body light and very poor. Indications of diarrhoea by

soft feces covering feathers below the anus. Crust on comb, wattles, skin of head and on eye-lids, and in corners of mouth. Yellowish exudate in conjunctival sac larger than eye-ball, cornea partly destroyed and whole eye inflamed. Plate cultures from the eye exudate gave a large bacillus apparently *bacillus subtilis*; *micrococcus albus* and a germ that liquifies loefflers blood serum and stain like the human diphtheria germ showing the beading. But this germ from cultures did not produce any form of the disease by smearing over scarified surfaces of skin, comb, eye-lid and mouth.

Archibald R. Ward (20) makes the following records:

Inoculated 17 cockerels with solid or semi-solid exudates applied to broken skin of head. Only one developed sore-head. Four out of the 17 developed nasal discharges resembling roup. The same case that showed sore-head developed diphtheritic lesions (not stated where). One case developed nasal (roup) discharge by exposure to another chicken in same cage. This would seem to indicate that roup, sore-head and diphtheria in some cases were associated in the same chicken or that the causes of these so-called diseases were sometimes found in one chicken. Ward has proven that faulty ventilation or exposure to draughts in California does not cause roup or sore-head.

INOCULATIONS OF PIGEONS WITH GERMS AND MATERIAL FROM SORE-HEAD IN CHICKENS.

(a) Inoculated pigeon with bacillus from blood obtained of a sore-head chicken. Blood taken from directly under sore-head crust. Hanging dop showed almost pure culture of short oval, motile germ. Blood was injected and injected under skin of head with *Planococcus citreus* and smeared. This had no effect on pigeon.

(b) Pigeon smeared on scarified inner surface of eye-lid and injected under skin of head with *planococcus citreus*

obtained from sore-head case and cultivated in alkaline chicken bouillon. No results.

(c) Pigeon—Used the same germ as in (2) in the eye, the nose and under skin. No results.

(d) Oct. 18, 1905. Inoculated a pigeon with aqueous suspension of material from eye of sore-head chick. Injected material under skin of breast and smeared it over eye-lid. This material contained numerous green pus germs and a few micrococci.

October 31 this pigeon died. At point of inoculation was an abscess surrounded by characteristic green coloration of the green pus germ. Liver hyperæmic, also lungs and kidneys. Cocci in blood.

Oct. 31. Inoculated under skin another pigeon with blood from heart of above pigeon. Results negative.

TESTS WITH MOSQUITOES AS CARRIERS OF THE VIRUS.

(a) One Cockerel—Rhode Island Red.

Previously had one attack of nasal roup.

Two pigeons—grown.

Three grown hens.

Two chicks half grown.

One hen that had sore-head the year.

One young common cockerel.

All were exposed for three months from May 1 to August 1, 1905, to mosquitoes, (*Culex* and *Stegomyia* varieties). Rain barrels were kept close to the coops where numerous mosquitoes could be grown and easily get at the chickens. Not one case of sore-head. All kept in shed and the weather was quite damp and air very moist most of the time.

(b) Oct. 24, 1903, confined two hens and one rooster in a coop which was placed over a barrel of water from which mosquitoes were constantly hatching. Nov. 3 one hen had developed sore-head. All three of these chickens had a

naturally acquired case of sore-head the previous winter.

At the same time (Oct. 24) four chicks (one-half grown) were confined in another coop in same room, and on November 3, two (2) chicks developed sore-head.

These chickens and the barrel of water were all confined in a room, where green pus germs were plentiful and the germ was present in the water in which the mosquitoes were developed and also found in the sore-head lesions. The mosquitoes were not tested for the green pus germ.

(c). At my home in Auburn, a hen with six chicks kept her chicks at night under a dense growth of honeysuckle vines. Three out of the six chicks developed sore-head. This was in November and mosquitoes were quite numerous about the honeysuckle vine. Another hen had four chicks in a coop 100 feet away from this vine and they did not contract sore-head. The chicks of the two hens mingled more or less in the day time.

A lady in Texas has recently reported to me that she has found that roaches are the carriers or the cause of sore-head in chickens; that when she exterminated the roaches the sore head cases disappeared. This is by no means conclusive, but suggestive.

The CAUSE or CAUSES of avian diphtheria, roup and sore-head have not been definitely determined. It appears that Loeffler's Bacterium and Harrison's Bacillus cacosmus and the Pseudomonas pyocyanae have some claim as casual factors. But the records and tests do not seem to place any one of them as always the primary or real cause. There is much evidence that the real or primary cause is an ultra-microscopic organism and belongs to that group of disease-producing organisms which are classed with the causes of small pox, cow pox, sheep pox, contagious foot-and-mouth disease, possibly yellow fever and some other diseases.

According to Ward exposure to air draughts does not cause "roup" in California.

Transmission and Dissemination.—It is evidently infectious; because the disease in all its forms, spread rather rapidly from one chicken or pigeon to another. Ward, **Harrison** and others have transmitted, in some cases quite readily by carrying small amount of diseased material (exudate and blood), from a sore-head chicken to healthy chickens. It is also, quite certain that chicken pox and pigeon pox are identical or one and the same disease.

Mosquitoes, gnat flies, chicken mites, (ticks) chicken lice, chicken foot mites (*sarcoptes mutans*) and possibly cockroaches may sometimes be the carriers of the real virus. It seems quite certain that mosquitoes can transmit the virus from water or some other source, under certain conditions. Warm and wet weather seems to increase the virulency of the virus and favor the rapid transmission of the disease. It is not impossible that ants may have a role to play in the transmission or cause of sorehead.

Pathological Anatomy.—On the skin the small, greasy-like nodules, or hypertrophied nodules of the skin, contain epithelial cells that have in them “greasy” refractive bodies that stain yellow with picro-carmin and the nuclei of the epithelial cells become “reddish brown” in color. Nearly all of the epithelial cells in the nodule appear larger than normal and contain the refractive bodies. In the younger epithelial cells these bodies (young coccidia?) are relatively small and occupy one-fourth to one-third of the epithelial cell cavity. In the older or outer or cast-off epithelial cells these refractive bodies are said by Friedberger and Frohner to occupy the entire cavities of the epithelial cells. The invaded or infested epithelial cells are unusually larger than the epidermal cells of the healthy neighboring skin. Among the cast-off mass of epithelial cells are found round refractive bodies and numerous nuclei of leucocytes or pus cells. The subcutaneous connective tissue is hyperaemic (congested) and is infiltrated with cells (leucocytes and nuclei of disintegrated cells).

Possibly some of the small nuclei-like bodies among the cells in the subcutis (see fig. 7) may represent one stage in the development of coccidia. Many observers have, also, found various bacteria in the nodule and subcutis.

In the diphtheritic membranes on the mucuous surfaces of the mouth, pharynx, larynx and oesophagus, the epithelial cells are sometimes invaded by refractive bodies in the same manner as the epithelial cells of the skin and in the mass of diphtheritic exudate and cast-off cells on the mucous surface may be found the well formed coccidia, usually in the stages (a) and (b) as indicated in fig. 5. But the refractive bodies are not found in the epithelial cells of mucuous exudates or of skin nodules in every case. I have found them only in the early development of the nodule and the diphtheretic exudate, and have never found the mature coecidium in the nodules of the skin.

When the exudate on the mucuous surface or the crust of the nodule of the skin is torn off the raw surface bleeds rather freely and a fresh mount of this blood contains a short oval bacillus, numerous round bodies (see fig. 7.) usually said to be nuclei of leucocytes; and a few polynuclear leucocytes. Repeated inoculations in the comb, wattles, skin and conjunctiva and oral mucuosa of healthy chickens of various ages, with this blood, fresh from under a nodule or a diphtheritic exudate, has failed to produce positive infective results. I have also tested it on pigeons with like negative results.

The exudates on the mucuous membrane of the throat mouth or larynx appear to be very much alike in all forms of the disease.

The CLINICAL SYMPTOMS of sore head are quite clearly described in the quotation from Friedberger and Frohner on page 23 of this bulletin. The crust-like nodules on the skin of the head, comb, wattles, and eye lids are quite common. The mucuous membrane (conjunctiva) of the eye may be involved and a large amount of tears or serum

and organized exudate fill the conjunctival sac or the cavity formed by the closure of the eye-lids. The cornea of the eye ball may become ulcerated and destroyed by pressure of the exudate and extension of the inflammation to the cornea. In some cases the entire eye ball may be destroyed by pressure of the exudate and inflammatory processes.

There may be croupy diphtheretic membranes in the mouth, pharynx, larynx, trachea and oesophogus; also in the nasal passages and air cells or cavities connected with these passages. When the larynx or trachea are affected there may be difficult breathing, as wheezing or rattling in the throat. When the nasal mucosa is involved, a nasal mucous discharge will appear; and when the lower orbital sinus becomes filled with semi-solid mass of pus, etc., a prominent swelling will appear under and around the eye; that half of the hard palate in the roof of the mouth becomes twice its usual width and bulges into the mouth cavity. At the first appearance of this enlargement, pressure on it may produce a discharge from the nostrils. At first this enlargement under and around the eye may be soft and if then opened will be found to contain quite a thick, pus-like liquid: but later the enlargement becomes hard, and if then opened is found to contain a mass of white or yellowish granular or flaky pus, more or less dry.

If the inflamed process has been progressing for some time about the mouth, throat; etc., the infection may extend to the intestinal mucosa and there diphtheritic infiltration may appear attended by diarrhoea with watery, bad smelling feces, sometimes the feces becomes mucilaginous, or bloody. This usually causes stupor, dullness, depression and death. If the head only is involved, the affected chicken may retain its good appetite and general health and make a nice recovery in 10 to 20 days. In some badly affected cases of the nasal form (roup) the appetite will remain good, but the affected bird becomes gradually more and more emaciated.

The PERIOD OF INCUBATION is said to vary all the way from 2 to 20 days. In December I placed a newly-purchased barred Plymouth rock cock (18 mos. old) in a yard with my chickens, many of which were recovering from sore-head, and in 24 hours this cock developed a good case of sore-head on the wattles, comb and eye-lids. There were mosquitoes in the roosting house. The period of incubation varies with mode of transmission, virulency of the virus, the weather (rapid in damp warm weather and slower in cool and dry weather,) and the age and condition of the chicken or pigeon. Chicks from broiling size up to 7 or 8 months old seem to be most susceptible. Chickens with large combs seem to be more susceptible than birds with small combs and wattles.

Affected birds may recover in 2 to 8 weeks.

The mortality is said to vary from 50 to 70 per cent. of the affected birds. I judge this a low per cent. of losses if birds are left to themselves without proper care or treatment. But if individual treatment is patiently and regularly applied the mortality can be cut down to less than 20 per cent. If only the skin of the head, and the comb and the wattles are involved, one should lose less than 10 per cent. If the mouth and pharynx are also involved, less than ten per cent. should die. But if the nasal passages and infra-orbital sinus is filled with pus, or the larynx and trachea are involved, or the intestines become involved,—good care and treatment may save 50 to 80 per cent.

Immunity.—It is possible that one attack of sore head makes the bird insusceptible to a second attack. I have noticed that old chickens that have passed, at least two summers, are rarely affected and I have been unable to infect chickens that have had one attack of any form of the disease, except in a few cases.

Treatment.—Iodoform, creolin, lysol, creosote, carbolic acid, permanganate of potash, corrosive sub limate, chlorate of potash, chloride of lime, nitrate of silver, boric

acid, tincture of iodine, sulphate of copper, sulphate of iron, zinc sulphate, solicylic acid, and many other drugs have been recommended. It is possible that a number of the above drugs may be useful if properly applied. Friedberger and Frohner advise "the application by brush of a solution of corrosive sublimate (1 or 2 parts in 1,000 of water), or one of creolin (1 to 2 in 100 of water)." This they say is especially effective when the disease is localized.

I have found nothing better or more effective than iodoform by itself; or iodoform 1 part and tannic acid 1 part; or iodoform 1 part, boric acid 1 part and tannic acid one part. It is best to wash the head, wipe out the mouth and throat with a weak solution of creolin (1 or 2 to 100), using a boiled cotton or medicated absorbent cotton swab. Next remove the crust on the skin, comb, wattles and eye-lids and the exudate from the eyes, the mouth and throat. Then with sterilized or boiled or absorbent cotton wipe away the blood on the raw surfaces until they cease to bleed; then with cotton swab cover the raw places with iodoform or either of the iodoform powders above mentioned. Do not be afraid to put iodoform into the eye or the conjunctival sac. The next day or the same day a few hours later, apply freely vaseline or fresh lard all over these places. In some cases it may be necessary to apply the iodoform or iodoform powders once a day for two or three days, and thereafter apply freely only lard or vaseline every day. In other cases one application of the iodoform and daily applications of lard and vaseline are all that is required. In bad cases, especially where they do not improve as rapidly as they should, give internally, as much as a teaspoonful of vaseline, containing a few drops of creosote, or 10 to 30 grains of Epsom Salts in 1 tablespoonful of water. This may be given once per day or once every other day; it usually prevents intestinal infection or complications.

In cases where "roup" predominates, or where the sub-orbital sinus becomes filled with pus and the eye is greatly dis-

tended, there are several lines of treatment that may be followed. In the early stages apply sweet oil or olive oil to the nostrils and if possible inject some of this oil into the nasal passages by using a small nozzle and syringe. After injecting or applying the oil, apply pressure over the distended parts and thus expel as much of the pus as possible. This may be repeated twice per day. Also in the early stages of roup, the diseased birds may be placed in a moderately tight room and there steamed in this way: Fill a large bucket or a kettle a little more than one-half full of hot water; now put into the bucket 1 tablespoonful of creolin and the same quantity of turpentine; then drop into the bucket a red hot iron, weighing 5 to 10 pounds. Let the affected chickens breathe this steam for 10 to 20 minutes. If the room is too small or too close, you might scald or suffocate the chickens; this can be prevented by regulating the entrance of fresh air at the door or windows. This may be repeated once per day, for a week or longer if it improves the condition of the birds.

When the distension is hard or firm, there is no way to remove the dry pus from the sub-orbital sinus except by opening the sinus. This can be done by cutting into it below the lower eye-lid and parallel to the border of the lid; remove the pus: wash out with weak creolin or other disinfectant and stitch it up.

Chickens with affected eyes must be fed by hand.

Prevention.—No doubt, it can be introduced into a flock of birds by bringing in an affected bird, and this should always be avoided. But I have seen it appear on farms and in yards where no new birds had been introduced for 6 months or more. However, in such cases, pigeons or other wide ranging birds may have introduced it. Sore-head has occurred in Alabama, so widely extended as to embrace nearly every county, every year for the past 15 years. The cause or virus may live over from year to year or it may pass the winter in a second host. Isolation of sick from well birds

is advisable and wide ranges, dry, well ventilated and clean roosting houses will materially aid in checking the extension of the disease. The conditions that favor the propagation of mites, ticks, lice, mosquitoes and roaches are favorable to the extension and excessive virulency of sore-head in all its forms. Hence, old and filthy nests, damp, hot and filthy roosting houses; filthy and close brooding coops; poorly drained and small, unclean yards; dirty water and filthy water and feed vessels; sour fermenting, rotten, musty, or spoiled feed of any kind—should all be avoided; not only as means of preventing sore-head in all its forms, but also to help keep out all other infections and maintain the vigor and health of the flock. Cleaning, white-washing, spraying with disinfectants, should be practiced at least once per month during outbreaks of sore-head, and once every two or three months as wise and profitable sanitary and preventive measures.

Some of the Cases Treated.

1. Plymouth rock cockerel, 5 months old. Had several scabs on head. Removed the crusts once and applied vaseline every day. Recovered in two weeks.
2. Plymouth rock grade, 4 months old. Several crusts on head. Removed crusts once and applied vaseline and 5 per cent creolin. Recovered in 2 weeks.
3. White Leghorn hen, 2 years old: had sore-head crusts all over comb and large yellow exudate in eye. From the eye almost pure culture of *psedomonas pyocyanae* was obtained. Removed crusts from comb and exudate from eye: applied equal parts of iodoform and tannic acid to comb and put into eye. Repeated every day for three days; then used vaseline every day. Recovered in 18 days.
4. Rhode Island Red cock, 1 year old. Had sorehead and eyes were distended from a collection of dry pus in sub-orbital cavities. In other words this cock had sore-head and roup. Applied vaseline to crusts on head and gave

vaseline per mouth, and tried to work it into nostrils. This cock recovered from skin sores on head and at times appeared to improve in the roup conditions in nasal sinuses. He never lost his appetite but was continually poor or thin in flesh. He died or was killed one night by some animal.

5. Common hen with distended eyes from pus in one nasal sinus. Opened below eye and removed pus; washed with 3 per cent. creolin; stitched up; recovered in 10 days.
6. Light Bramah hen, 2 years old; head one mass of crusts; both eyes filled with exudate and closed. First removed crust from skin of head and exudate from eyes. Applied iodoform and tannic acid to the head and eyes, once per day for three days: then applied daily vaseline. Recovered in 18 days. Had to feed this hen by hand for several days until she could see to eat.
7. Common hen with crusts on head and diphtheritic exudate in mouth and throat. Removed the crusts from the head and exudates from the mouth and throat. This always leaves raw bleeding surfaces. Applied iodoform and tannic acid to raw surfaces. Repeated this for 4 days; then applied vaseline once each day, some days gave one-half teaspoonful of vaseline and a little 3 per cent creolin internally. This is done to destroy and eliminate germs or parasites that may pass into the alimentary canal when the throat and mouth are at first involved. This hen recovered in 15 days.
8. In flock of 75 White Bramahs and White Leghorns, a large number of the young chickens 2 to 8 months old and many of the old hens contracted "sore-head." The disease appeared in June and cases appeared among these chickens from that time until the last of August. Many of the chickens were very badly involved. The disease was confined usually to the skin of the head, to the eyes, the comb and wattles. A few cases had the mucosa involved and there diphtheritic exudates appeared. Quite a

number of cases developed nasal discharge. These cases were treated with vaseline. The crusts were removed and vaseline applied. Thereafter vaseline was applied once per day for 3 or 4 days and then every other day. The exudate in the eyes mouth and throat was forcibly removed and vaseline applied freely. Ninety per cent. recovered.

9. In a brood of 9 chicks, hatched in October, when three weeks old, 6 of them developed sore-head and sore mouth. The eye-lids and the eyes (conjunctival sac) and the mouth and throat were involved. In this case the chicks had what is usually called sore-head with sore mouth or diphtheria of mouth and throat. This combination is not uncommon. In fact nearly every case of chicken pox or sore-head has sore-mouth in some form and also some discharge from the nasal openings indicating the presence of "roup." These chicks were treated with iodoform and tannic acid once per day for 3 days and then pure fresh lard was applied daily. All but one recovered in three weeks.
10. In large number of White Leghorns sore-head and distended eyes from roup exudate in nasal passages appeared. Nearly all died where the dried exudate collected in nasal passages but large per cent. of the cases of sore-head recovered by removing the crusts and applying fresh lard.
11. One man reports trying "Mercurial Ointment" on sore-head chickens and that it failed to cure them.

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EXPLANATION OF PLATES.

- Fig. 1.*—Sore-head crusts on comb, eyelids and skin.
- Fig. 2.*—Head of hen that recovered from bad case of sore-head. The bare places on the skin around the eye give some idea of the extent of the crusts. This case was treated with creolin and vaseline.
- Fig. 3.*—A case of sore-head with eyes badly involved and a large diphtheritic ulcer with prominent exudate on roof of mouth or hard palate.
- Fig. 4.*—Same case as fig. 3 with mouth opened to show the exudate on hard palate.
- Fig. 5.*—(By Johne in Birch-Hirschfeld's Pathological Anatomy). It represents the stages in the life history of coccidia. See description on page 27.
- Fig. 6.*—Shows epithelial cells of the skin from sore-head case. The coccidia are supposed to enter the epithelial cell and destroy its contents or take the place of the body of the epithelial cells.
- Fig. 7.*—Illustrates the cells found in blood taken from immediately under a sore-head crust. rbc. are nucleated red blood cells. wbc. are white blood cells or leucocytes. sf. are the nuclei of white blood cells or are free "sporozoites" or a free spore-like stage of coccidia.
- Fig. 8.*—Section of the mucous membrane of pharynx of chicken. d. is the diphtheritic exudate (early stage) containing coccidia. m. is the mucous membrane. mg. are mucuous glands.



Fig. 1.



Fig. 2.



Fig. 3.

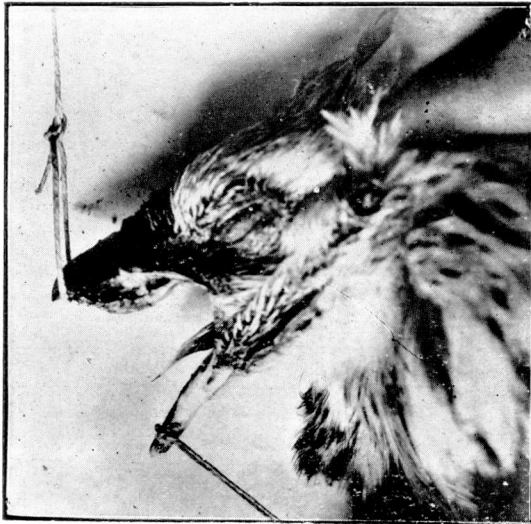
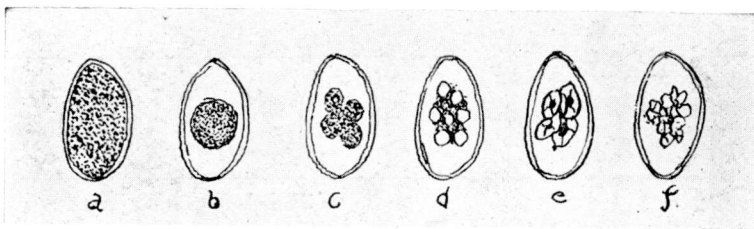


Fig. 4.



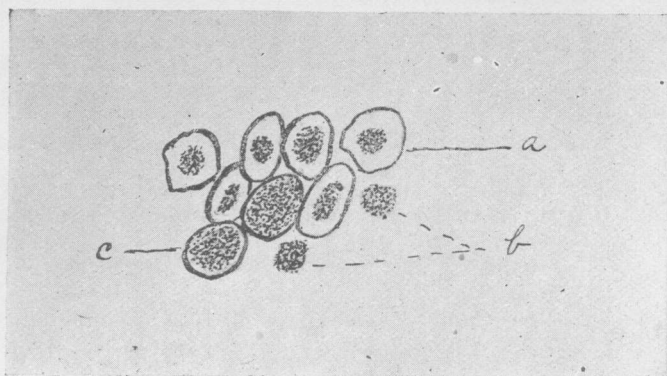


Fig. 6.

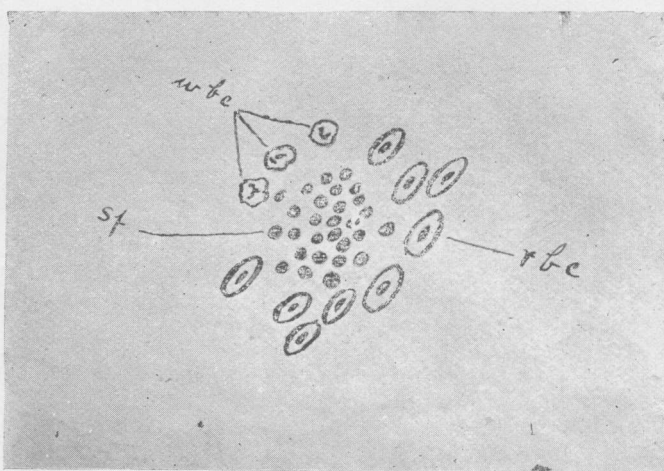
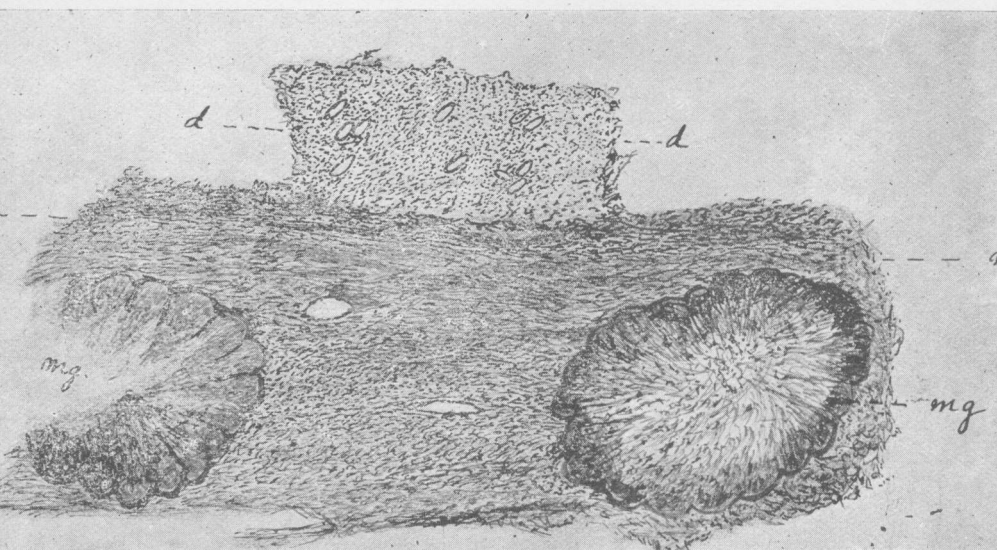


Fig. 7.



APPENDIX.

A few words on sanitary conditions in the poultry business may help some poultrymen out of difficulties.

The *water supply* for poultry should be the very best. Fresh water in clean, uncontaminated vessels should be kept constantly within reach of the chickens, or all kinds of poultry, especially during the hot weather. Good well water is preferable to running surface water. Protected earthen-ware vessels, or any form of water vessel, should be so constructed that it can be cleaned. In fact it should be cleaned daily with boiling hot water.

The *Feed* is responsible for the health, growth and flesh of poultry. Young chicks are often over-fed and usually fed in filthy places or in unclean troughs or vessels. More young chicks die from over-feeding, and sour, fermenting, discomposing feed than from any other cause. Especially is this true where mashes or liquid or moist feed is used. Some poultrymen use milk with bread or coarse meal in it. Milk is a good food; but if given to chickens it must be fresh or it should be boiled or cooked with the bread or meal in it and fed as soon as sufficiently cooled. Always feed it in clean vessels, not in too large quantities and never leave the excess to sour. In feeding milk and all forms of moist feeds to chickens be sure to thoroughly clean and boil or scald out the feeding vessels once or twice per day during hot weather. Look well to the chick feeds. Many of them are made of refuse corn, wheat sorghum and other grains. As a rule it is best to make your own mixed grain feeds and then you will know the quality of each grain ingredient and will not be compelled to pay grain prices for the heavy grit that is so plentiful in the average mixed chicken feed. It is cheapest and safest and best for the health and growth of the chickens or other fowls to buy the separate grains and the grit and do your own mixing.

The chicken houses should be separated from all other

buildings and all the sides should be of lattice work or quite open during the summer; the north, east and west may be closed during late fall and winter. The floors, roosts and nests should be so arranged as to be readily removed, cleaned and disinfected. Portable or movable chicken houses are useful if so built that they will not come to pieces when moved. In case of infection with disease germs or of infestation with mites, intestinal parasites, lice, etc., it makes the work of disinfection and eradication of parasites more easily and quickly and permanently done, if the house can be quickly moved to a new uninfected locality.

Most chicken coops are too close, too heavy and too inconvenient to clean. Some one should invent a "knock-down" brooding coop that can be cleaned readily and one that will not easily break and retain firmness and solidity when set up.

The yards and runs are usually too small and insufficient in number. Poultrymen can greatly lessen their work by having large runs or yards and many of them.

The placing of 20 to 40 chickens in a small yard (say 50 x 100 feet) and keeping them there 8 to 12 months in a year is one of the means of intensifying the propagation of intestinal parasites of all kinds. The degree of infestation of a yard or run or poultry house depends upon the size the number of poultry kept in them; the length of time poultry are kept in them; and, to some extent, on weather conditions. A large area, as a yard or pen, will not become alarmingly infested with intestinal or other parasites as quickly as a small area. Likewise, the fewer the birds and the shorter the time the birds are kept in a given place, the less, in degree, the infestation. This often explains why a man with very few chickens having good feed and wide range, can raise fine, healthy birds. But when this same man attempts to raise a large number on a small range, yard or run, he fails and his chickens are less vigorous or

healthy and consequently less profitable. The number of houses, coops, yards and runs should always be in excess of the immediate demands. Suppose a man has yards, runs, houses and coops for 3 different lots of chickens. He should at least have 3 extra yards and runs into which he could shift the disinfected houses coops and birds as soon as the the other yards or runs became infested. It would be best to have yards and runs sufficient in number to enable the poultryman to make three or four shifts before coming around or back to the first. This may seem extravagant but it is the only means by which you can breed healthy, vigorous birds without an immense outlay in cleaning and disinfecting yards or runs. Immediately after vacating a yard or run, plow it up and seed it down to wheat, rye, oats, barley, cowpeas, sorghum or anything that will make a growth upon which the chickens can graze when brought back to this yard or run. Young chicks should not be allowed to range over ground where old chickens run; if it be possible, have the young chicks in a run or yard where no old chickens have been for 6 or 8 months. This will prevent young chicks from becoming infested with round worms and tape worms.

In purchasing a new chicken, or a new lot of chickens, have them confined in some place remote from the flock for one to four weeks. During this time you will determine the presence or absence of such an infectious disease as fowl cholera. This precaution may save your flock and the difficulty of disinfecting houses and yards.

Chicken mites are the most common pests in nests and houses. Cleanliness is the best means of preventing their multiplication. They developed best in filthy nests and in cracks and under boards in chicken house. Clean the house (move if portable) and then spray the house with kerosene oil emulsion. If possible apply tar in the cracks and under roosting boards and this will catch many which escape the spray. Clean and spray the infested houses and coops

once per week and dip the infested chickens in weak kerosene oil emulsion, or a 2 to 4 per cent creolin solution. Never dip chickens in a poorly mixed kerosene solution. It will blister the skin, if the kerosene is not thoroughly emulsified. The copper sulphate solution if applied hot will kill mites. It should not be applied on the chickens.

Every farmer or poultryman in Alabama should take one or more good poultry journals, and get all the bulletins on poultry from the department of agriculture at Washington, D. C. and the bulletins on poultry published by the state experiment station and also secure Salmon's book on Poultry Diseases. Please report to me all the outbreaks of poultry or other infectious animal diseases that may occur in your vicinity or on your farm. Make these reports, at least once every year.

Kerosene oil emulsion is made as follows:

Dissolve 1-2 pound of hard soap in one gallon of hot water; add 2 gallons of kerosene and stir or churn until a milky mixture (or emulsion) is formed: now add 8 to 10 gallons of water; stir or mix with a spray pump, or keep the first emulsion of soap, water and kerosene and use as much of it as you desire after diluting with 8 to 10 parts of water.

Copper Sulphate Solution.—Dissolve 4 to 6 pounds of copper sulphate (blue stone) in 20 to 50 gallons of water. Spray this over dusted or cleaned boards, walls, nests or other places. When dry, or the next day, whitewash with spray or brush. If applied hot this copper sulphate solution will kill mites.

Government White Wash.—“Half a bushel of unslaked lime, slaked with warm water. Cover it during the process to keep the steam. Strain the liquid through a fine siene or strainer. Add a peck of salt previously well dissolved in warm water, three pounds of ground rice boiled to a thin paste and stir in boiling hot a half pound of powdered Spanish whiting (Plaster of Paris) and a pound of glue

which has been previously dissolved over a slow fire, and add five gallons of hot water to the mixture. Stir well and let it stand for a few days. Cover up from dirt. It should be put on hot. One pint of the mixture will cover a square yard if properly applied. Small brushes are best. There is nothing that compares with it for outside or inside work and it retains its brilliancy for many years. Coloring may be put into it and made of any shade, Spanish brown, yellow or common clay."

This is good for chicken houses, etc., to fill up small cracks and make a smooth surface. To it may be added two pints of carbolic acid, which will make it a disinfectant.

List of a few drugs and their uses for the poultryman:

For Intestinal Worms:

1. Isolate infested birds and destroy or disinfect their droppings while being treated.
2. Put one to 2 drams of copper sulphate in each gallon of drinking water, for one week: or
3. Powdered Pomgranate root bark (for tape worms) followed by 2 or 3 tablespoonfuls of castor oil: or
4. Oil of turpentine, 1 to 2 teaspoonfuls, followed in 4 to 6 hours with castor oil.
5. Powdered santonin in 5 to 8 grain doses is especially good for round worms.
6. Chopped-up pumpkin seed for tape worms.

For worms in the air passages:

1. Turpentine introduced by stripped feather, into the windpipe.
2. Steaming with creolin and turpentine in the hot water.
3. Feeding garlic in the food.

For Diarrhoea:

1. Subcarbonate of Bismuth. 1 to 4 grains. 2 to 3 times per day; or
2. Pulv. cinchona bark. 1 to 2 grains 3 times per day and
3. Quinine 1-8 to 1-2 grain 2 times a day.
4. Dry feed or cooked and slightly moist feed.

Constipation:

1. Epsom Salts.—20 to 30 grains in 1 tablespoonful of water; or
2. Castor oil, 1 to 2 teaspoonfuls; or
3. Calomel, 1 to 2 grains; and
4. Soft feed.

For Lice:

1. Lard, or vaseline over head, under wings and around anus.
2. Dipping in 15 per cent. kerosene oil emulsion; or
3. Dipping in 2 to 5 per cent creolin solution.
4. Pyrethrum powder dusted among the feathers.
5. Clean nests yards and houses.

For intestinal disinfectant:

1. One-half to 2 drams of copper sulphate in one gallon of drinking water; or
2. One-half to 2 drams of iron sulphate in 1 gallon of drinking water; or
3. Salol 1-2 to 1 grain, once or twice daily.
4. Naphthol 1-2 to 1 grain, once per day after eating.
5. Resorcin 1-4 to 1-2 grain once per day after eating
6. Hyposulphite soda, 4 to 10 grains in one tablespoonful of water

FOR CHICKEN MITES.

1. Lard or vaseline on legs, feet and head applied once or twice per week. Wash off scales.
2. Kerosene Emulsion sprayed on walls, roosts, floors and nests once per week for what is commonly called chicken mites or chicken ticks.
3. Two to 5 per cent creolin solution sprayed on same places as (2).
4. Formalin 1 part to 200 parts of water sprayed as (2).
5. Corrosive sublimate (very poisonous) 1 part to 1000 parts of water sprayed as (2).
6. Boiling hot water freely applied by pouring over walls, roosts, nests and floor.
7. Clean Chicken house every day until mites are gone.