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## KANSAS STATE AGRICULTURAL COLLEGE

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DEPARTMENT OF BACTERIOLOGY

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### POULTRY DISEASES

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#### INTRODUCTION

The purpose of this circular is to aid poultrymen in preventing and controlling disease in their flocks. It is hoped that it will be of value not only to the specialist in poultry raising but also to the general farmer whose birds are a side issue and yet often are an important asset in his business. For poultry gives many a farmer a financial lift when he needs it most, and more regular attention to many neglected farm flocks would bring certain and large returns to the owners.

The term disease in its broadest sense is any deviation from the normal. Consequently, any factor that interferes with the fullest performance of the normal functions of growth, development, or egg production is to be regarded as causing disease. Underfeeding or overfeeding, excess of heat or cold, lack of water, or annoyances by lice, mites, worms or other parasites, are all capable of disturbing the normal state of health and must therefore be considered as causing disease. The accumulation of animal filth caused by neglect or overcrowding is the most common cause of disease, especially in small farm flocks. Cleanliness and proper sanitation are the preventives, and their application is the first concern of the successful poultry raiser.

#### VALUE OF CLEANLINESS

To determine more accurately the effect of cleanliness test pens were maintained under farm conditions. One was given a minimum of care which meant very little more than feed and water. Another was given a maximum of care which meant sufficient to maintain thoroughly clean and sanitary quarters.

Table I shows the result. It will be noted that a death loss of 42 percent in the insanitary pen could have been reduced to 7 percent by simple clean-up methods.

TABLE I.—EFFECTS OF CLEANLINESS ON DEATH RATE<sup>1</sup>

	Losses per hundred birds												
	Jan.....	Feb.....	Mar.....	Apr.....	May.....	June.....	July.....	Aug.....	Sept.....	Oct.....	Nov.....	Dec.....	Total for the Year.....
Minimum of care.....	1	3	6	10	8	5	3	2	1	1	1	1	42
Maximum of care.....	0	0	0	1	2	2	1	1	0	0	0	0	7

The same results are shown diagrammatically by figure 1.

Sanitation can be maintained only by having a regular schedule for cleaning and disinfecting. No matter how small the flock the weekly cleaning should not be omitted.

### THE CLEANING PROCESS

The object of cleaning is not so much the removal of all visible dirt and filth collections as the destruction of those invisible forms of life, the disease producing bacteria. Most people would consider the intestinal excreta, the manure, as so much lifeless and inert refuse, but the bacteriologist knows that this is not true. In a state of health the bowel discharge from all animals contains an enormous number of organisms which are so small that their form and movements can be observed only by using the highest powers of the microscope. The amount of feces that would adhere to the point of a pin would contain an uncountable number of bacteria. The diarrheal discharges from sick birds may also contain disease producing organisms and thus become a very serious menace to the health of all other members of the flock. Other birds, unless removed at once, will carry the infectious material on their feet to the feed and water pans. The contaminated grain and water will be consumed and soon the entire flock will be suffering from the same trouble. Besides the harmful bacteria in the bowel excreta there are many other dangerous organisms. Of

<sup>1</sup>The data upon which this table is based were obtained in part from actual test pens maintained under Kansas conditions, and in part from statistics derived from correspondence pertaining to poultry diseases. Naturally the results are to a certain extent only approximations.

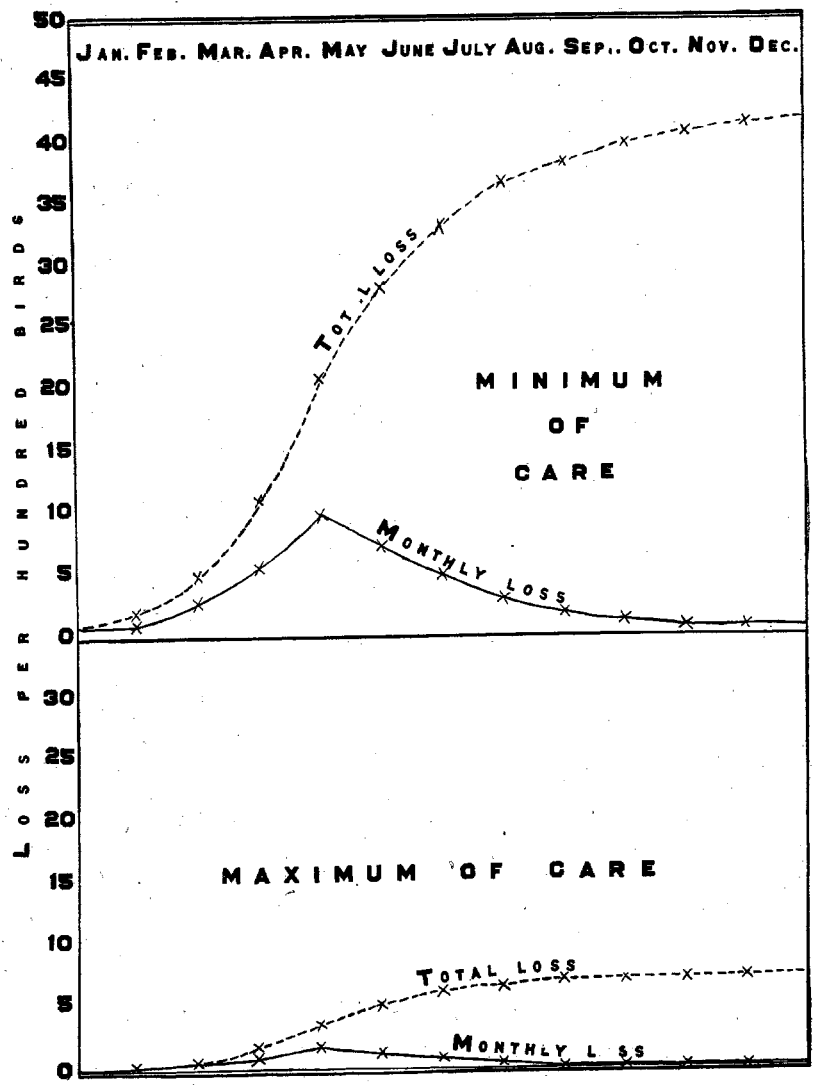


Fig. 1.—Graphs showing the effect of cleanliness—sanitation—on disease losses

these the intestinal tapeworm and roundworm deserve mention. These worms at times become so numerous as to cause the death of the bird. Their eggs, which are always produced in large numbers, are continuously passed off with the droppings, and as in the case of the bacteria, may find their way into the intestinal tract of a healthy bird.

But while control of the so-called internal parasites is chief in point of importance, control of the external (skin) parasites—the lice, mites, and others—is also important.<sup>1</sup> Large numbers of external parasites will so lower the vitality of a bird that it is thereby rendered an easy prey to bacterial infection. In order to hold in check the disease producing bacteria, it is necessary to control also these external skin pests. The cleaning process therefore should consist in (1) the removal of the manure and refuse, (2) the use of insecticides to destroy lice and mites, and (3) the use of disinfectants to destroy bacteria.

Fortunately, in practice, this scheme can be simplified, since most of the agents that will destroy bacteria are equally destructive to lice, mites, and all other parasites. This is not always true of the insecticides, which are not, as a rule, good disinfectants. Kerosene, for example, is excellent for killing mites, but has little effect upon bacteria.

The apparatus for disinfecting need not be expensive. For a small coop a hand atomizer is desirable; for a large building a bucket spray pump or “knapsack” sprayer is more desirable. By using some form of pump, disinfectants can be forcibly injected into cracks and crevices that application by broom or brush would fail to reach. The important point is to soak every nook and corner with the disinfectant. The means of application is of less importance.

#### DISINFECTANTS AND INSECTICIDES

Many farmers keep on hand so-called stock dips which are coal tar preparations. These products are, as a rule, very thorough and satisfactory germ destroyers. A safe rule to follow in their use is to use too much rather than too little. Common, but good disinfectants are carbolic acid, used in a 5 percent solution, and lysol in a 3 percent solution. Potassium permanganate in about a 1 percent solution is somewhat unde-

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<sup>1</sup> Bishopp, F. C., and Wood, H. P. Mites and lice on poultry. U. S. Dept. of Agr. Farmers' Bul. 801: 1-26. Figs. 1-14. 1917.

sirable because of the dark red stains that result when it comes in contact with the skin or clothing. Formalin in an 8 percent solution is very good but is irritating to the nose and eyes of the worker. Bichloride of mercury (corrosive sublimate) in a 1 to 1,000 solution is effective but is very poisonous and corrodes metal so that it could not be used in a metal pump. In some cases dry quicklime, or chloride of lime, sprinkled over a foul or decomposing mass is more convenient and effective than a fluid disinfectant. One of the very best disinfecting agents is the direct rays of the sun. However, its penetrating power is limited to a thin surface layer and consequently thick clumps of filth are not completely sterilized. Several hours action should be allowed even for thin layers.

At this laboratory many of the trade-preparation disinfectants have been tested and usually the coefficient (value compared with carbolic acid) as given by the manufacturers is not far from correct. A disinfectant with a coefficient of 4 is four times as strong as carbolic acid and so could be diluted with four times as much water as is used in diluting carbolic acid and still be as effective. When two disinfectants have the same price the one with the highest coefficient is the most economical because it can be diluted more and, therefore, will go further.

A spraying mixture long used with success at this laboratory, for cleaning and disinfecting, consists of ordinary whitewash to which has been added enough crude carbolic acid, sheep dip, or cresol to make a 5 percent solution.<sup>1</sup>

The disinfectant is aided directly by the lime and is both an insecticide and a germicide. The whitewash also aids mechanically by filling the small cracks and crevices, thus preventing mites getting into or out of the building. Crude petroleum (preferably thinned with 1 part kerosene to 4 or 5 parts crude oil) is a good insecticide. Repeat application after three or four weeks. Pure kerosene will destroy mites. Several applications are necessary since the eggs are not always killed by one application. Remember that kerosene has very little effect upon bacteria.

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<sup>1</sup> Ordinary whitewash is prepared as follows: To 10 pounds of quicklime in a bucket, add 2 gallons of water; cover with a cloth, and allow it to stand for one hour. Add more water until the consistency of the wash will permit ready spraying by a brush or pump.

### ISOLATION FACILITIES

In case of an outbreak of disease, confine sick birds in an isolation building. Remember that sick birds need the best of care. Clean and disinfect all buildings daily. If isolation is impossible, in many cases it is advisable to kill and burn sick birds at once. Clean and disinfect the premises and usually losses will cease.

### POULTRY HOUSING AND MANAGEMENT

It must be borne in mind that proper cleanliness and sanitation are made possible from the point of view of financial success only by proper poultry house construction and proper feeding and care of the flock.

### HEALTH-FEEDING

It is not the purpose of this circular to give detailed information regarding feeding.<sup>1</sup> It is necessary, however, to give a few suggestions regarding health-feeding. They are as follows: (1) Do not overfeed. An excessively fat bird is far more susceptible to disease than one not so fat. (2) Feed more than once a day. Birds will do better if fed oftener and in smaller amounts. A chicken is not equipped to store large amounts of food. (3) Do not feed moldy grains. (4) Chickens are more prone to develop colds, especially in the winter, if fed warm or hot food. (5) If spoiled or decomposing table garbage is to be fed it should be cooked for one-half hour and cooled before feeding. (6) Do not feed uncooked, carcasses of dead animals, or offal from wild animals or game birds that are being dressed for the table. Wild animals often harbor infectious organisms against which they are immune. This material should be cooked and cooled before feeding. (7) Commercial meat scraps may at times be a source of danger. Usually this product is perfectly safe. When wet, however, it soon undergoes bacterial decomposition, especially in warm weather. Buy only good products and keep them in a clean and dry place.

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<sup>1</sup> For detailed information regarding this or any other phase of poultry production write to the Agricultural Experiment Station, Manhattan, Kan.

CURATIVE MEASURES

When disease appears in a flock of birds the important question to the owner is: Can anything be done? In general, poultrymen are agreed that it does not pay to give individual treatment as the low unit value of the bird does not justify the expenditure of much time or money. However, in the case of especially valuable birds, and in case the treatment is very simple, individual treatment might be allowable, although even here there are certain objections as the recovered cases show inferior stamina, vigor, and resistance to disease. Further it is possible that the recovered bird may be a source of danger to other birds on the premises. It might still be a "carrier" of the disease even though immune itself. In man this possibility has been established beyond doubt in several diseases where it is known that occasional individuals that have recovered, still carry the infectious organism and are a danger to their fellow citizens. It is believed that many cases of annual or periodic outbreaks of chicken cholera on a farm may be due to recovered cases which are carriers. The only valid excuse for curing a bird is to fatten it as soon as possible for an early market.

The first step in the treatment of a disease is to make a diagnosis. Unless the correct disease or group of diseases are recognized, measures which are ineffective, or even harmful, may be taken. A diagnosis depends upon the symptoms as shown before death and the appearance of the body and internal organs after death. The following group of symptoms, and abnormal changes encountered in the internal organs after death, is intended to aid in arriving at a correct diagnosis.

SCHEME FOR RECOGNIZING A DISEASE BY SYMPTOMS

<i>Symptom</i>	<i>Disease</i>
Abdomen, tender and swollen.....	Enteritis, white diarrhea, or egg bound
Breathing, very rapid .....	Pneumonia, enteritis, gapes, or diphtheria
Breathing, very slow .....	Leucemia, white diarrhea, cholera, or diphtheria
Comb, pale .....	Leucemia, tuberculosis, enteritis, white diarrhea, chickenpox, worms, or lice
Comb, dark red .....	Cholera, blackhead, pneumonia, or enteritis
Comb, powdery scale .....	Favus, or pox (roup)

<i>Symptom</i>	<i>Disease</i>
Crop, very large and hard.....	Crop-bound
Convulsions .....	Poisoning, heat prostration, apoplexy, or vertigo
Diarrhea .....	Enteritis, white diarrhea, poisoning, leucemia, blackhead, tuberculosis, roup, cholera, or worms
Droppings, green, light, very fluid..	Cholera
Nostrils, watery discharge from....	Roup, or catarrh
Eyes, foaming or glued shut and swollen	Roup
Face, swollen .....	Roup
Feathers, falling out .....	Depluming scabies (feather pulling)
Fever .....	Roup, enteritis, leucemia, aspergillosis, or cholera
Going light .....	Tuberculosis, leucemia, mites, or worms
Lame .....	Rheumatism, scaly leg, injuries, or tuberculosis
Legs rough .....	Scaly leg
Limber neck .....	Roup, poisoning, or worms
Liver, white spots .....	Tuberculosis, or blackhead
Liver, large and pale.....	Leucemia
Mouth, with patches in.....	Diphtheria (roup)
Neck, bent under body and backward	Poisoning, roup, heat stroke, or limberneck
Skin, scaly .....	Mites, lice, mange, or favus
Staggering .....	Heat stroke, tuberculosis, or leucemia (Weakness common to many diseases)
Thin, body wasted .....	Tuberculosis, leucemia, lice, or intestinal worms
Thirst (excessive) .....	Aspergillosis, roup, worms, or enteritis
Tumors, on head .....	Roup (pox)
Vent, inflamed and protruding.....	Prolapse of oviduct, or inflammation of cloaca
Wings, drooping .....	Lice, mites, white diarrhea, or cholera



DISEASES AND THEIR CONTROL

ROUP

Roup is also called contagious catarrh, contagious epithelioma, sorehead, chickenpox, swellhead, ocular roup, diphtheria, and canker. Much confusion has existed in the past regarding this disease in fowls. The consensus of opinion now seems to be that what were formerly described as a number of separate diseases are really different stages of the same disease.

**Symptoms.**—Roup makes its appearance by a slight watery discharge from the nostrils and eyes. The eye discharge is generally characterized as “foaming.” This stage is the contagious catarrhal stage. If recovery does not occur the next stage soon appears. The discharge from the nose dries and closes the nostrils. The eye discharge becomes sticky. The lids adhere and the exudate beneath the lids causes the eye to swell. The swelling may attain the size of a hickory nut. When the lids are pulled apart a tough yellow cheesy mass protrudes. This stage is called swellhead and ocular roup. Often with this stage there develop ulcers in the mouth or throat commonly called cankers. This is the diphtheritic stage. The infection may attack the external skin at the same time that the other stages are developing, or the skin from may develop independently. This form is the sorehead or chickenpox type of the disease. In this section of the country the pox form is not so common as it is in the states farther south. Cases of pox often recover in a few days or a week. The process, however, may continue to grow worse until the entire comb and wattles are one mass of small wartlike sores which may later involve the eye and mouth, producing the canker and other changes already described. Roup generally follows exposures such as those giving rise to colds or catarrhs in the human subject. The treatment of this disease is long and tedious.

**Treatment and Control.**—Healthy birds should be supplied with plenty of fresh water once or twice a day to which has been added enough potassium permanganate to give the water a deep wine color. The container for such water should be a crock or wooden vessel rather than metal. The feeding pans or troughs should be frequently scrubbed out with soap and hot water and thoroughly dried in the sun. Give the following physic: Epsom salts, 1 tablespoonful per bird. Mix with about

as much dry cornmeal as one bird will readily consume. Slightly moisten with water before feeding. If a large number of birds are to be treated, compute the amount of epsom salts and feed necessary, mix and place small amounts upon boards or shallow dishes so that each bird may receive its respective share. Give preferably after 12 hours of fasting.

In addition to the above general treatment the heads of the sick birds may be massaged in a solution of potassium permanganate and the discharge removed from the nostrils and eyes with a small wooden probe and permanganate solution. Apply a 2 percent solution of silver nitrate to any ulcers or diphtheritic membranes in the throat. Recovered cases should be given special attention and feed, and sold to the packer as soon as possible after recovery.

#### CHOLERA

Cholera, which is due to a special organism in the blood, is a rapidly fatal infection of poultry. A bird may appear well in the morning and be dead in the evening. At most the course of the disease seldom runs over 24 to 48 hours, but many occasionally run over several weeks.

**Symptoms.**—The characteristic symptom is the light greenish fluid droppings. (The feathers about the anus become soiled and stick together.) The bird is usually found dead beneath the roosts in the morning except in the slower and more chronic form of the disease. In these cases the bird stands with the wings drooping and apparently is scarcely able to walk. This is spoken of by some as "leg weakness."

**Treatment and Control.**—Carefully carry out the cleaning and isolation methods previously described. A bacterin protective inoculation has been tried with very satisfactory results for this disease.<sup>1</sup> The bacterin will check the spread of the disease but will not cure a bird that is already sick. The problem is now under investigation by the Department of Bacteriology at this station.

#### ENTERITIS

Enteritis is very similar to dysentery, and is a more severe type of disease than the simple diarrhea due to incorrect feeding. From the latter the birds appear to suffer but little ill

<sup>1</sup>Mack, Winfred B., and Records, Edward. The use of bacterins in the control of fowl cholera. Nev. Agr. Expt. Sta. Bul. 85:1-29. 1916.

effect. Typical enteritis is an inflammation of the digestive tract and cannot be accurately diagnosed during life.

**Symptoms.**—In many cases this disease is probably only a symptom of cholera or one of several other diseases that are localized in the intestinal tract. The trouble may be due to eating some poisonous substance as paint, lye, unslaked lime, or spraying mixtures, or to an acute bacterial infection of the digestive tract. The affected bird appears inactive. The comb becomes pale and may later become dark and purplish. The discharge from the vent may be greenish, or in severe cases bloody. The bird may appear very hungry or refuse food. If the disease is of long duration the bird loses weight. A post-mortem examination shows the liver enlarged or shrunken according to the duration of the disease. If long continued the liver is usually shrunken. The spleen is usually enlarged. The intestines are inflamed and full of mucus.

**Treatment and Control.**—The most important step is to ascertain and remove the cause of the trouble. It is of no use to spend time treating such birds if the source of the trouble still exists. Clean and disinfect the premises. Use special care concerning drinking pans and food troughs. Isolate and care for the sick birds.

After attending to all the above measures a physic of epsom salts should be given. Care should be taken not to overfeed. Mixing powdered charcoal with the food is often of value.

#### WHITE DIARRHEA

White diarrhea is a rapidly fatal disease in young chicks a few hours to a few days after they are hatched. The diarrhea develops due to the action of a specific bacterium which soon devitalizes the young bird. The death rate is very high.

**Symptoms.**—The chicks appear stupid and remain under the hover or hen most of the time. They remain much by themselves and many of them peep continually, or will utter a sharp cry apparently of pain, when attempting to void the excrement. Their feathers become rough and the wings droop. They eat little and appear unable to pick up food. The characteristic whitish discharge from the vent soon makes its appearance. The discharged matter may be creamy or mixed with brown. In many cases this clings to the down in sufficient quantity to plug up the vent. This condition is known as “pasting up behind.”

The chicks often become "big bellied" and bunch out behind. In some cases they die without warning and show few symptoms. In other cases they will live for a long time and show all the above symptoms

**Treatment and Control.**—For several years the following method has been used with success in combating this disease in young chicks. As soon as the chicks are hatched, take them away from the incubator and place them in a freshly scrubbed and disinfected box or brooder. Give no food for 36 to 48 hours. Then furnish a generous supply of sour milk or buttermilk. Allow the chicks to partake of this as freely as they will. It will serve as both a food and a drink for the first two or three days. The box, of course, should be disinfected and dried in the sun at least once a day or preferably have a second box to which the chicks may be transferred while one is being cleaned. It is well to sprinkle a layer of fine ashes over the floor for the chicks to scratch in. At the end of three days some dry cornbread or cornmeal may be mixed with the sour milk. Continue this diet in the usual manner for three weeks, after which time the chicks are safe from danger of this disease. Keep everything scrupulously clean.

This treatment has been used with entire satisfaction by many chick raisers. Lack of success can undoubtedly be attributed to insufficient care and attention to small details concerning disinfection of the brooder and the like.

In some cases the organism causing white diarrhea is present in the adult bird and may be transmitted to the young chick through the egg. Rettger and Stoneburn make the following statement in regard to the control of white diarrhea:<sup>1</sup>

If the disease makes its appearance among the flocks of chicks every effort should be made to ascertain the source of the infection. This may be (a) breeding stock upon the place, (b) eggs for hatching secured from other breeders, or (c) newly hatched chicks purchased from others.

If the breeding stock proves infected there are two courses open; (a) market the entire flock or refrain from using their eggs for hatching, or (b) install trap nests in the breeding pens and by means of accurate pedigree records ascertain which individual hens are producing infected chicks, and remove such hens from the breeding flock.

Since infection may be brought upon the place through purchased eggs or stock, such purchases should be made from farms where bacillary white diarrhea is not common.

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<sup>1</sup> Rettger, L. F., and Stoneburn, F. H. Bacillary white diarrhea of young chicks. Storrs (Conn.) Agr. Expt. Sta. Bul. 60:56. 1909.

In the case of infected breeding stock the marketing of the entire flock, followed by proper methods of cleaning and disinfection, and then starting with non-infected birds, is probably the best way to get rid of the disease.

In flocks of high-grade stock which have been selected for some special purpose, a satisfactory method is to determine which birds are "carriers" of the infection by careful pedigree records or by sending sample of blood to this laboratory for agglutination tests. By these methods it is possible to eliminate the infected birds. The latter is a much more rapid method. It is, however, considerable trouble to collect the samples of blood and there is a small charge to cover cost of material and postage. Any one desiring such tests should write to the laboratory for instructions.

**BLACKHEAD (INFECTIOUS ENTEROHEPATITIS)**

Blackhead is more or less prevalent in Kansas. It is seen especially in turkeys, but reports have come that other fowls also may contract the disease.

**Symptoms.**—There are no special external symptoms of this disease except in the advanced state. The young bird loses flesh and remains apart from the other members of the flock. The trouble is thought by most authorities to be due to a specific microorganism. The examination of the dead birds shows a greatly enlarged liver with yellowish-white spots the size of a pea. These contain the organisms in large numbers. The head of the bird becomes very dark red to black in color; hence the name blackhead.

**Treatment and Control.**—Remove the birds to new quarters by all means. Boil all the drinking vessels. Provide only freshly boiled and cooled water or freshly pumped water to which has been added a tablespoonful of hydrochloric acid to every quart. Give nothing for food but sour milk or butter-milk to which has been added a little cornmeal or shorts. Continue this diet for ten days to two weeks. Clean up the premises carefully.<sup>1</sup>

Dr. Philip B. Hadley, makes the following suggestions concerning the control of this disease.

<sup>1</sup> For a more detailed treatment of this disease the reader is referred to Bul. 17 by C. H. Higgins. Dominion of Canada, Dept. of Agr., Health of Animals Branch. 1917.

<sup>2</sup> Hadley, Philip B. Blackhead in turkeys: A new conception of the nature of the disease and suggestions for new methods in prophylactic feeding. Jour. Amer. Assoc. of Instructors and Investigators in Poultry Husbandry. 2: 57-61. May, 1916.

1. After collection from the nests, hatch the turkey eggs in incubators, in the meantime having ordinary hens set on china eggs in nest boxes or brooders on the permanent range.
2. Remove the poults from the incubator about 24 hours after hatching, and distribute at night among the hens, giving from 12 to 14 to each hen. Be sure that the hen accepts them before they are left.
3. Give no feed before the poults are two days old. Each family may then receive 2 teaspoonfuls of egg chopped fine with some green food such as nettles, dandelion, onion tops or lettuce. A little cracker may be added to take up surplus moisture so that the mixture will not be pasty.
4. This ration may be repeated for the remainder of the feedings upon this day, or bread soaked up in sweet milk may be substituted for one meal.
5. During the first three or four days of feeding the poults receive four meals each day, at about 8 o'clock, 11, 2, and 5 o'clock; after this but three meals are given.
6. On the second day of feeding about the same rations are given, but one of the meals may be of chick grain, and some rolled oats may be added to the chopped egg mixture.
7. The third day of feeding is like the second. The poults are allowed to run in their enclosure.
8. On the fourth or fifth day of feeding, the number of meals may be reduced to three, at 8 o'clock, 12, and 4:30, respectively. The amounts are slightly increased and a little grit may be added.
9. When the poults are about a week old they may be allowed to run free with the old hen on the range on pleasant days when the grass is dry. Chopped egg in the ration is reduced and omitted by the seventh day of feeding.
10. On the sixth day of feeding the feeding is put on a time basis. Several spoonfuls of food are put on a tray and well distributed, but the poults are not allowed to eat for more than about three minutes at any one meal.
11. By the end of the second week, the time limit is reduced to two and one-half minutes, since the poults are now obtaining more food on the range in the form of insects.
12. About the same time sour milk is introduced. It is placed, whey and curd well mixed, in shallow pans or in troughs, scattered about the range. It is at first given each morning and night at the rate of about 1 quart to 40 poults, and is gradually increased in amount until by the beginning of the fourth month 1 quart may be given for each 20 birds, each morning and night.
13. During the second month, which is the critical period for the young birds, the feeding is continued about as in the latter part of the first month. But, after the age of about 6 weeks the number of meals per day may be reduced to two. Green food in the form of chopped carrot tops, onion tops, or lettuce should be given in abundance; it should comprise at least one-half of the ration for each meal. The time limit remains at about two and one-half minutes.
14. When the poults are about 6 weeks old the nest or brooder coop should be replaced by a larger house made of laths and covered partly

with roofing paper. This house may be about 3 by 5 feet, and 3 feet high at the apex. Such a house may suffice until the poults are about 3 or 4 months old. Family houses should then be given up and all the poults with their mothers, be brought together in a single roosting shed.

15. The feeding for the third month is like that of the second except that the amount of sour milk is gradually increased and that a grain mixture of equal parts or cracked corn and wheat may be gradually substituted for the chick grain.

16. As the autumn months advance and insect life disappears, the time limit may be lengthened to three or three and one-half minutes.. It is rainy weather the noon-day meal may be added and a four-minute period allowed. Rolled oats may be omitted and the ration made to consist of the grain mixture with an occasional feed of rolled oats or bread and milk. A mash may now be added containing some beef scrap.

17. Before Thanksgiving the breeders for the coming season should be selected and marked. Their feeding for the winter may consist of the following grain mixture fed at the rate of 1 quart for six or seven turkeys each night and morning:

Cracked corn .....	3 parts
Barley .....	2 parts
Wheat .....	2 parts
Oats .....	1 part

TUBERCULOSIS

Tuberculosis is generally called "going light" by the poultryman.

**Symptoms.**—The bird becomes thin, the comb and wattles are pale. Finally the bird becomes so weak that it is unable to move about. After death, when the body is opened, small white spots the size of a pin head are usually visible in the dark reddish-brown pulp of the liver. Healthy birds may contract the disease from eating the diseased carcass of dead birds. The organisms of this disease may also be spread in the droppings.

**Treatment and Control.**—All sick birds should be killed and if a number of birds have already died, the best plan is to kill and burn all the remaining fowls since the spread of this disease is so rapid that probably all will die in time. Clean and disinfect according to directions given. Keep no birds on the premises for six months to a year after an epidemic. Medical treatment is of no value in controlling this disease.

PNEUNONIA

Pneumonia is occasionally seen in adult birds but oftener in young chicks (brooder pneumonia).

**Symptoms.**—The lung tissue is dark red and solid; small pieces of the tissue, when snipped off and dropped into water



will sink. This disease has been encountered on several occasions in experimental birds and on two occasions the same condition has been seen in what was believed to be a pneumonic form of roup. The bird breathes rapidly and the comb becomes dark red or purple. Coughing is said to be a symptom but this has never been observed in this laboratory. The disease is often associated with diarrhea.

**Treatment and Control.**—Treatment is largely a matter of care and nursing. Keep the bird in a warm well-ventilated room. Give a little raw milk at frequent intervals. A drop of tincture of aconite in the milk every two hours is valuable in relieving the elevated temperature and easing the rapid breathing. Apply the “clean-up” measures to all buildings used by the sick birds as pneumonia is highly contagious.

#### RHEUMATISM

**Symptoms.**—Enlarged joints that are hot and painful are considered diagnostic evidence of rheumatism. The disease is probably due indirectly to exposure. When a number of birds are affected at the same time it signifies that probably something is radically wrong with the feed or housing.

**Treatment.**—Keep the birds in dry warm well-ventilated houses. Give an epsom salts physic as directed for roup. Keep birds on a rather light diet. Furnish an abundance of green succulent food with very little meat or milk. Recovery is likely to occur even without medical aid.

#### ASPERGILLOSIS

Aspergillosis is a highly fatal disease of the lungs caused by a mold. No cure is known. Clean up as previously directed. Do not feed moldy grain. An accurate diagnosis can be made only with the microscope.

#### FAVUS (WHITE COMB)

Favus is caused by a fungus that attacks especially the wattle and comb, but may spread to other portions of the body. When the crusts are removed the skin appears irritated and somewhat raw. If the feathered portions become affected the feathers become dry, erect, and brittle and finally break off or fall out, leaving a disk-shaped scale with a depression at the bottom where the feather was located. The affected parts ap-



pear white, as though covered with powder. The disease often spreads rapidly.

**Treatment.**—After removing as much of the scales as possible with warm water or glycerine and gently scraping with some blunt instrument, apply tincture of iodine. Early stages of the disease often respond favorably to an application of lard, or oil, or to a salve made by mixing about equal parts of lard and sulphur. This latter should be worked into a smooth salve before using. Keep the birds apart during treatment. Follow with the usual “clean-up” methods.

#### LICE

Lice will not trouble the poultryman who carries out the “clean-up” program previously given.

**Treatment and Control.**—When these parasites are present dust the birds with one of the following louse killers: (1) Persian insect powder, (2) flowers of sulphur, or (3) sodium fluoride. These products are on sale at most drug stores.

Hold the bird by the legs, work the powder well into the feathers under the wings and around the vent. Sitting hens should be given a dusting 10 days before hatching time as it is easier to rid the hen than the chicks of lice.

Bishopp and Wood recommend dipping the birds in a solution of sodium fluoride for getting rid of lice. The dip is made in a tub in the proportion of 1 ounce of the commercial or  $\frac{2}{3}$  ounce of chemically pure sodium fluoride to each gallon of water. The bird is held by the wings and submerged in the solution; the other hand is used to ruffle the feathers and wet the body. Finally, duck the head of the bird a few times, drain for a few seconds, and release.

Another good louse remedy consists of 3 parts gasoline and 1 part of crude carbolic acid. Add to this mixture enough plaster of paris to take up all moisture. (About 4 quarts of plaster are necessary to absorb 1 quart of liquid.) This powder should be dried for a few hours before use. It is relatively inexpensive and yet is very good. Care must be used in applying this powder to young birds as carbolic acid is sometimes absorbed in sufficient amount to cause poisoning and death. Half-grown chicks have been observed to die in a few minutes after its use.

WORMS

**Symptoms.**—Birds with worms appear weak, droop their wings and may have diarrhea. Young birds often die quickly and in badly infected flocks even the mature birds may succumb. Some poultrymen prefer to kill off all the stock on hand and begin anew when worms are present in large numbers. To diagnose an infection a dead bird is opened, the intestines are laid out and opened with a small knife or scissors. The presence of the round or flat (tape) worms is considered conclusive proof. The worms vary from the size of a small pin to a small nail depending upon the species of worm.

**Treatment and Control.**—Keep the birds off feed for 12 to 48 hours. Give a physic of epsom salts as directed for roup. In more severe cases, oil of turpentine may be given. This is best mixed with an equal amount of any other bland oil such as olive or cottonseed oil. Give each bird ¼ to ½ teaspoonful of the mixture. Follow this in a few hours with a tablespoonful of castor oil or the epsom salts physic. Other remedies are thymol, 1 grain, or santonin, 7 to 8 grains per bird, made into a pill with bread and butter. This should be followed with a physic. For tapeworms powdered areca nut, 30 to 40 grains, is particularly effective. Follow with a physic.

Dr. James E. Ackert, parasitologist, Kansas Agricultural Experiment Station, recommends the following remedy for fowl tapeworms:

- Wheat ..... 1 pint
- Oats ..... 1 pint
- Concentrated lye ..... 1 teaspoonful
- Water ..... Enough to cover

Cook this mixture for two hours and allow to cool. Chickens that are suspected of having tapeworms should be put in an enclosure and fasted for from 16 to 18 hours, then fed all of the mixture they will eat, giving them plenty of water to drink. They should not be fed again for 24 hours, when they should be given a second dose.

This is a perfectly safe method. All of the flock can be treated without harm. As chickens may become reinfested, it is a good plan to give this treatment every two months from May until December. This is especially advisable in the case of a young flock.

Any worm medicine should be preceded by a 12-hour to 18-hour fast so that the intestinal tract is comparatively free from food. The “clean-up” measures are absolutely imperative if permanent results are expected.

GAPES

Gapes is observed in chicks chiefly, but in badly infested ground some older birds may die or the entire flock may be lost. A small reddish-colored worm attaches itself to the inner wall of the windpipe, sucks blood, and causes asphyxia if the numbers are large. Overcrowding and insanitary surroundings are the indirect causes.

**Symptoms.**—The chick gapes, sneezes, and becomes pale and weak. The worm is called the forked worm because the male and the female are firmly grown together, giving the appearance of a two-headed worm. The presence of the worms in the trachea of a living chick may be demonstrated by passing a gapeworm extractor—a loop of horse hair or fine wire—carefully down the trachea for some distance, turning it round to loosen the worms and drawing it out. If worms are present they will be removed with the extractor.

**Treatment and Control.**—Stripping a feather of all its web except a small tuft on the end, moistening this in kerosene and inserting it into the windpipe where the worms are attached, will often cause them to loosen their hold. They can then be withdrawn or coughed up. Reliance must be placed in prevention. In badly infected pens kill off and burn all stock, clean buildings, runs, and premises. Allow the ground to rest for six months. Under conditions where land is not available the following methods of treating the soil have been advised: (1) Treat ground with air-slaked lime and spade. (2) Sprinkle with a 2 percent solution of sulphuric acid, with a solution of copperas—2 ounces of copperas dissolved in 2½ gallons of water—or with a potassium permanganate solution—1/2 ounce of crystals dissolved in 50 gallons of water. The lime and acid treatments are the most frequently recommended.

POISONING

Many cases of sudden outbreaks of poisoning are due to carelessness on part of workmen leaving paints or various spraying poisons sitting about uncovered. Common salt in too large amounts will poison fowls. They may be poisoned by eating decomposed food, such as garbage and spoiled meat, and material of this sort should not be fed. Fowls seldom become poisoned from eating poisonous plants growing in the field. Treatment in a case of poisoning is usually of little value. Confine

the birds for a few days inclean quarters. Clean up the premises and buildings and carefully remove anything which might be poisonous.

#### INFECTIOUS LEUKEMIA

Infectious leukemia was first described by Moore<sup>1</sup> according to Pearl, Surface, and Curtis.<sup>2</sup> It is also called fowl typhoid. The disease is recognized with certainty only by means of the microscope and laboratory facilities. The bird usually appears weak and poor in flesh. The wattles and comb turn pale. In two cases encountered at this station a great enlargement of the liver was noticeable. This has not been observed in other cases. Treatment is useless. Sanitation as outlined may prevent the disease. It is not considered highly infectious.

#### SCALY LEG

A very small mite causes this condition by burrowing into the skin. An exudate oozes from the small injury. This dries and causes the leg to become thick and appear scaly. The disease generally appears between the toes and gradually involves the entire unfeathered portion of the leg. In bad cases the leg may appear several times the normal thickness, greatly misshapen and very rough.

**Treatment.**—Combine the “clean-up” measures with local applications of an ointment consisting of oil of caraway, 1 part and vaseline, 5 parts. Kerosene diluted with olive oil and rubbed in is also very good. Apply on several successive days. Local applications without general cleaning is of no avail because the mites often leave the affected bird and attack other birds if not destroyed.

#### DEPLUMING SCABIES

Depluming scabies is known as feather pulling. This condition is sometimes thought to be a vice or habit of the bird like eating eggs. It is most likely that this is never the case but rather that it is due to a very small mite that attacks the base of the feathers. The irritation caused by the mite may cause the bird to pull the feather or the feather to drop out. The disease may progress until all except the large feathers in the tail and wings are gone.

<sup>1</sup> Moore, Veranus A. A bacterial disease frequently mistaken for fowl cholera. U. S. Dept. Agr., Bur. Anim. Indus. Ann. Rpts. 12-13: 185-205. Pls. 14. 1895-1896.

<sup>2</sup> Pearl, Raymond, Surface, F. M., and Curtis, M. R. Poultry diseases and their treatment. 216 pp. Me. Agr. Expt. Sta. Orono, Me. February, 1911.

**Treatment.**—Apply to the affected skin an ointment of 1 part flowers of sulphur with 4 parts vaseline. Carbolated vaseline (1 part carbolic acid and 50 parts vaseline) is also very good.

The “clean-up” measures should follow the individual treatment. Finally a louse powder may be applied to all birds.

#### CROP-BOUND

Birds become crop-bound by overeating, at times by poisoning, as the result of certain other diseases, or by swallowing indigestible substances. The material can sometimes be massaged out by holding the bird in an inverted position. In severe cases it may be necessary to open the crop with a sharp knife and remove the contents. The opening can be stitched together with white silk thread. The external skin and crop wall should be stitched separately. Feed very lightly for several days on milk and eggs.

#### HEAT STROKE

The bird affected by heat stroke falls over, or walks with a staggering gait. Place the animal in cool, comfortable quarters. Recovery generally occurs. The condition is usually due to overheating but other causes such as indigestion may make the bird more susceptible than it is normally.

#### REQUESTS FOR ADDITIONAL INFORMATION

Whenever a thorough trial has been given of any measure outlined herein, and losses still continue, it is suggested that several of the sick birds, showing different stages of the disease, be sent by express to the Department of Bacteriology of this station for further examination.

Birds so received will always receive prompt and careful attention. By making observations of the birds before death and finally by making a postmortem examination of the birds after death it may be possible to correct a mistaken diagnosis. Proper advice for control or treatment will always be offered when this is possible,

The crate in which the birds are to be shipped should be supplied with a tin can container for water. This may be nailed or wired in place. Never send dead birds to the laboratory for bacteriological examination, as they usually are received too badly decomposed to be of value.