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University of Arizona
College of Agriculture
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**POULTRY DISEASES IN
ARIZONA**

By
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College of Agriculture, Agricultural Extension Service

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TABLE OF CONTENTS

	PAGE
I. Introduction	3
II. Sanitation	3
A. Securing and maintaining healthy stock	3
B. Relation of soil and drainage to health	4
C. Location and construction of poultry houses	4
D. Yards	5
E. Cleaning and disinfecting buildings	5
F. Cleanliness of food and drinking water	6
G. Isolation and quarantine	8
III. Anatomy	8
IV. Examination of diseased birds	8
A. External examination	8
B. Killing the bird	11
C. Examination of internal organs	11
D. Chart to assist in poultry disease diagnosis	12
V. Parasites	16
A. External parasites	16
1. Body lice	16
2. Red mites	17
3. Scaly leg mites	19
4. Blue bugs or fowl ticks	19
5. Bed bugs	22
6. Feather mites	23
7. Stick-tight fleas	24
B. Internal parasites	24
1. Roundworm	24
2. Ceca worm	25
3. Gizzard worm	25
4. Gapeworm	27
5. Tapeworm	27
6. Coccidiosis	29
7. Blackhead	31
VI. Diseases of the digestive tract	32
A. Impaction of crop (crop-bound)	32
B. Impaction of intestines	33
C. Enlarged crop (pendulous crop)	33
D. Ulcerated gizzard	34
E. Dropsy	35
F. Abdominal yolk masses	35
G. Cloacitis (vent gleet)	36
H. Constipation	36
I. Simple diarrhea	37
J. Enteritis (inflammation of the intestinal tract)	37
K. Mycosis	37
VII. Diseases of the respiratory system	38
A. Colds	38
B. Catarrh (nasal roup)	38
C. Chicken pox and diphtheria	39
D. Ophthalmia (eye roup)	40
E. Laryngotracheitis (infectious bronchitis)	41
F. Pneumonia	42

	PAGE
VIII. Diseases of the liver.....	42
IX. Diseases of the kidneys.....	43
A. Nephritis	43
X. Abnormal conditions of the ovary and oviduct.....	43
A. Egg-bound	43
B. Rupture	43
C. Prolapse of the oviduct.....	44
D. Abnormal eggs.....	44
E. Blood clots in eggs.....	45
F. Bloody whites	45
XI. Diseases of the brain and nerves.....	45
A. Fowl paralysis	45
XII. Fowl poisoning.....	46
XIII. Limber-neck (botulism).....	47
XIV. Diseases due to bacteria.....	47
A. Infectious blood diseases.....	47
1. Fowl cholera	47
2. Fowl typhoid (infectious leukemia).....	48
3. Pullorum disease (bacillary white diarrhea)	49
4. Septicemia	51
B. Chronic infectious diseases.....	51
1. Tuberculosis	51
2. Aspergillosis (brooder pneumonia).....	52
XV. General diseases	53
A. Bumblefoot	53
B. Subcutaneous emphysema	53
XVI. Tumors	53
XVII. Diseases due to deficient diets.....	54
A. Nutritional roup (Avitaminosis A).....	54
B. Beriberi or polyneuritis (Avitaminosis B).....	55
C. Scurvy (Avitaminosis C).....	55
D. Rickets (Avitaminosis D).....	55
E. Sterility (Avitaminosis E).....	57
F. Sources of important vitamins.....	57
G. Pellagra (Avitaminosis G).....	58
XVIII. Vicious habits	58
A. Egg eating	58
B. Feather pulling and eating.....	58
C. Cannibalism	58
XIX. Appendix	60
A. Table for preparing solutions.....	60
B. Approximate equivalents.....	60
C. Corrective solutions.....	60
D. Purgatives	60
E. Disinfectants and antiseptics.....	61
F. A disinfectant whitewash.....	62
G. Medicated vaseline	62
H. Formula for chlorinated water.....	62
I. Formula for bronchial spray.....	62
J. Dosage table for adult fowls.....	62
K. When writing regarding poultry diseases.....	63

POULTRY DISEASES IN ARIZONA

BY H. EMBLETON, H. B. HINDS, AND C. F. ROWE

I. INTRODUCTION

A survey of fifty-one farms in Pima county, Arizona, showed a yearly mortality of 25 per cent amongst old birds. That this condition is representative of the mortality in most of the poultry flocks in Arizona is beyond question. When the value of this 25 per cent of the mature poultry population is taken into consideration along with the potential egg production lost through this high death rate, and considering the value of the losses in young stock, the seriousness of the situation can readily be understood. The monetary loss would be well up into the thousands of dollars. Any recommendations or suggestions which would tend to reduce these losses will be of untold value to the poultry industry of Arizona.

II. SANITATION

The maxim, "An ounce of prevention is worth a pound of cure," should be taken literally in regard to poultry diseases. The value of an individual fowl is so small that one cannot afford to expend too much effort and expense to cure it. The "axe and spade" method is more economical and sensible. Too many persons, however, instead of informing themselves concerning sanitary measures, wait until their flocks become diseased and then try to combat the disease. A surer and less expensive method is to surround the flock with healthful conditions which will go far toward preventing disease. The poultryman should regard his function the same as that of the Chinese physician who is primarily concerned in keeping the patient from becoming ill rather than in giving specific treatment after he becomes ill.

A. SECURING AND MAINTAINING HEALTHY STOCK

In the early days of poultry raising the small farm flock was the backbone of the industry. The addition of new blood to a flock was done on a localized basis. In most instances cross-breeding was resorted to, resulting in a more resistant fowl.

Since the great development of the industry on a commercial scale, stock is shipped from one end of the continent to the other. With this practice, poultry diseases have spread tremendously. An especial effort should be made to see that nothing but absolutely healthy stock is introduced into the flock.

With the development of purebred birds and their increased production, resistance to diseases seems to have decreased. Birds running on the same ground, especially where the runs were restricted, increased the possibility of disease from contamination. The lengthening of the hatching period beyond the natural season brought about a weaker chick from the later hatches.

The weak individuals of the flock are usually the disease-carriers. Every precaution should be taken, therefore, to remove them from the flock by continuous culling throughout the year. Do not nurse along a weak chicken. Kill it, for such a bird may be the means of causing the loss of many other fowls. Too often energy is expended in trying to cure sick birds rather than in trying to keep healthy birds well. It is just as natural for chickens to need exercise, as it is for human beings, in order that the proper assimilation of feed and other body functions can be performed normally. A means of compelling exercise is very necessary.

B. RELATION OF SOIL AND DRAINAGE TO HEALTH

A sloping land surface, providing good air and water drainage, makes an ideal location for poultry. Sandy soils are preferable since they assure good drainage and hence a dry surface the maximum portion of the time. Damp, wet ground forms a favorable medium for the development of diseases in poultry. Too little consideration is given this very important matter of properly locating a poultry farm.

C. LOCATION AND CONSTRUCTION OF POULTRY HOUSES

The ground surrounding the poultry house should slope away from it in all directions, in order that no water is left standing near the house. The house should stand on a good foundation sufficiently high to prevent any flood water from entering it.

Sunshine and dryness are two of the greatest enemies of disease. Drafts are a chief aid to disease. These factors should, therefore, be kept in mind in designing buildings to house poultry.

An open-front house is ideal for the prevention of disease since it allows the sunshine to penetrate all parts, and increases dryness. An open front on the south lets the maximum amount of sunshine into a house. However, too much sunshine makes an extremely warm house—in fact, too warm for economical egg-production in the warmer sections of Arizona. The open front, therefore, should be limited and should face east rather than

south. In the cooler parts of the State, the opening can be larger and should face south to allow the maximum amount of sunshine to enter.

A house with a dirt floor is harder to keep clean than is one with a concrete floor. Droppings left in holes in a dirt floor are possible sources of infection, for many diseases are spread through contact with the droppings. Dirt floors are usually damp. Concrete floors, however, are satisfactory in these respects.

Precaution should be taken to keep the birds from the droppings by lining the roost supports with wire netting in such a manner as to allow the roosts and wire to be lifted out together when cleaning.

Cracks are a menace to proper sanitation. Insect pests breed in them. To prevent this, when building a house, all joints should be painted with a coal tar preparation such as wood preservatives, or similar products. This will repay many times the expense of application in preventing losses from pests and diseases.

D. YARDS

More failures in poultry keeping can be traced to soil contamination than to any other one factor. The droppings collected in the yards and worked into the soil are a chief source of contamination. Providing for a rotation of yards, either two, three, or preferably four yards is the most effective way out of this difficulty. With a system of this kind, fowls use the same ground only one year in every two, three, or four years, as the case may be. The remaining yards in the meantime should be cleaned and left idle.

Dusting holes should be kept filled with soil since they afford a place for the collection of filth. Water holes should be eliminated for they are also a very important source of contamination (Figure 1). Where fowls are not confined to a yard, the danger of contamination is lessened but not entirely done away with since the poultry house is still the central congregation point. The ground around the house should, therefore, be kept thoroughly clean.

E. CLEANING AND DISINFECTING BUILDINGS

The watch word in this procedure is thoroughness. All movable equipment should be carried to the outside, cleaned, scraped, and sprayed with a good disinfectant and then exposed to the sun. All litter should be removed and disposed of in such a manner that the birds will not have access to it. The floor should be scraped and swept with a broom. All dust is to be removed from the side walls, braces, and curtains, as dust provides a hibernating place for germs. The floor should be scrubbed with a hot lye solution of one tablespoonful of lye to a gallon of



Figure 1.—Showing screened-in tree hole at University of Arizona poultry plant.

water. Following this, the entire building is to be sprayed with a good disinfectant applied with a pressure spray pump so that the solution can be forced into the cracks. The cracks are a natural hiding place for germs and parasites. The house and nests are then ready for new litter. This cleaning process should be done frequently. A 3 per cent solution of any of the approved disinfectants, or any of the homemade disinfectants appearing in the appendix, can be used for this purpose.

F. CLEANLINESS OF FOOD AND DRINKING WATER

The definite knowledge that many diseases are transmitted through contact with the droppings indicates the absolute importance of so constructing all feed hoppers so as to preclude the possibility of filth entering the feed receptacle. The reel top hopper was designed to serve this purpose (Figure 2).

The ease of thorough cleaning should be considered in the

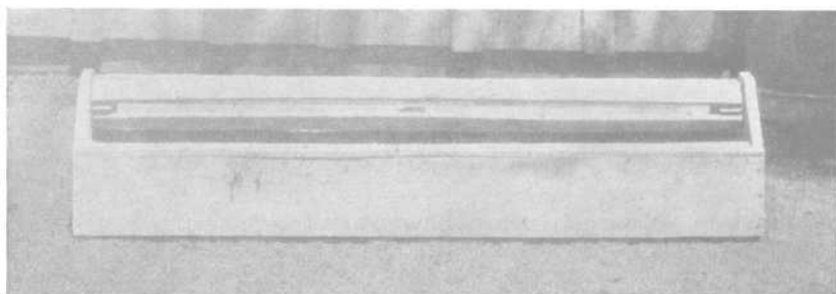


Figure 2.—A desirable, sanitary, and non-wasting reel feed hopper.

construction of all hoppers, for a collection of moldy feed or filth in a feed container is one of the surest ways to bring on trouble with diseases.

Clean, fresh water is essential to the health of poultry. Guards should be provided so that the possibility of filth from the feet of the chickens getting into the drinking water is prevented (Figure 3). The general use of automatic floats in connection

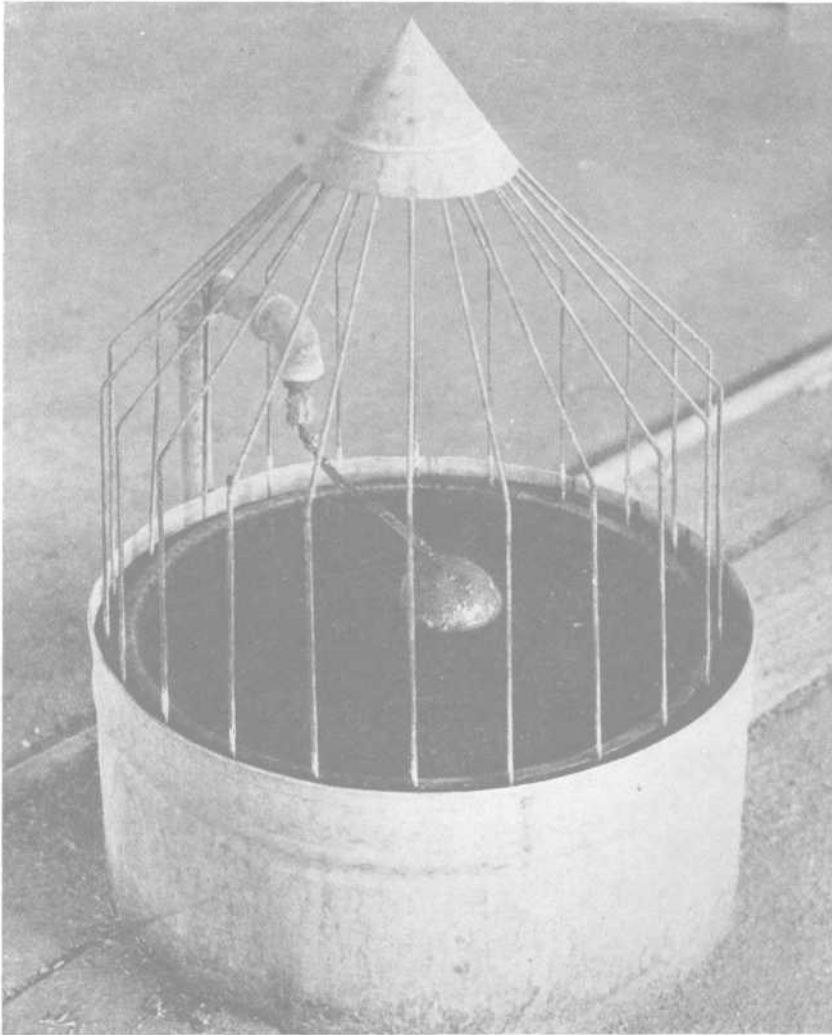


Figure 3.—A watering system using an automatic float, sanitary earthen crock, and wire guard. Crock sets in metal frame which provides for overflow water being carried off through drain in floor.

with the water supply makes it imperative that a means of leading off overflow water into a waste drain be provided. Where it is possible to do so a wire screen over a gravel pit makes a good arrangement for the proper disposal of overflow water. Water utensils should be cleaned and scrubbed daily. The use of a 3 per cent solution of an approved disinfectant in the rinsing water is a wise precaution.

The habitual use of medicines in drinking water is not advisable. It is much safer and less expensive practice to provide proper sanitary conditions through daily cleaning. The use of medicines and disinfectants should be restricted to specific epidemics and then only for the duration of the trouble.

G. ISOLATION AND QUARANTINE

All cleaning and disinfecting will be of little value unless the poultryman is constantly on the lookout for individual birds which are sick or out of condition. One sick bird may contaminate the entire flock. At the first sign of ill health a bird should be isolated and quarantined. All sick birds should be killed without spilling blood on the ground and burned. Figure 4 illustrates a homemade incinerator in use at the University of Arizona poultry plant. Where it is not possible to burn dead carcasses, they should be buried deep enough to prevent their being dug up by cats, dogs, or other animals.

III. ANATOMY

A knowledge of the digestive, reproductive, and respiratory systems is necessary for a proper understanding of the discussion of some of the diseases affecting poultry (Figure 5).

IV. EXAMINATION OF DISEASED BIRDS

Birds that do not appear to be normal, active, and eager for their food, should be examined. An external examination may assist in making a diagnosis, though in most cases an absolute diagnosis is not possible by symptoms alone. However, in attempting to identify diseases all leads are to be followed and symptoms carefully noted. Although a post-mortem, or internal examination, may be sufficient, certain diseases can be diagnosed only by laboratory examination. This should not, however, discourage the attempt to find out why any bird dies. The low unit value of a bird makes investigation within the reach of all and future losses may be materially reduced if the poultryman familiarizes himself with some of the common ailments.

A. EXTERNAL EXAMINATION

The first step is to examine carefully the exterior of the carcass for lesions of disease. Parasites or tumors may show on the

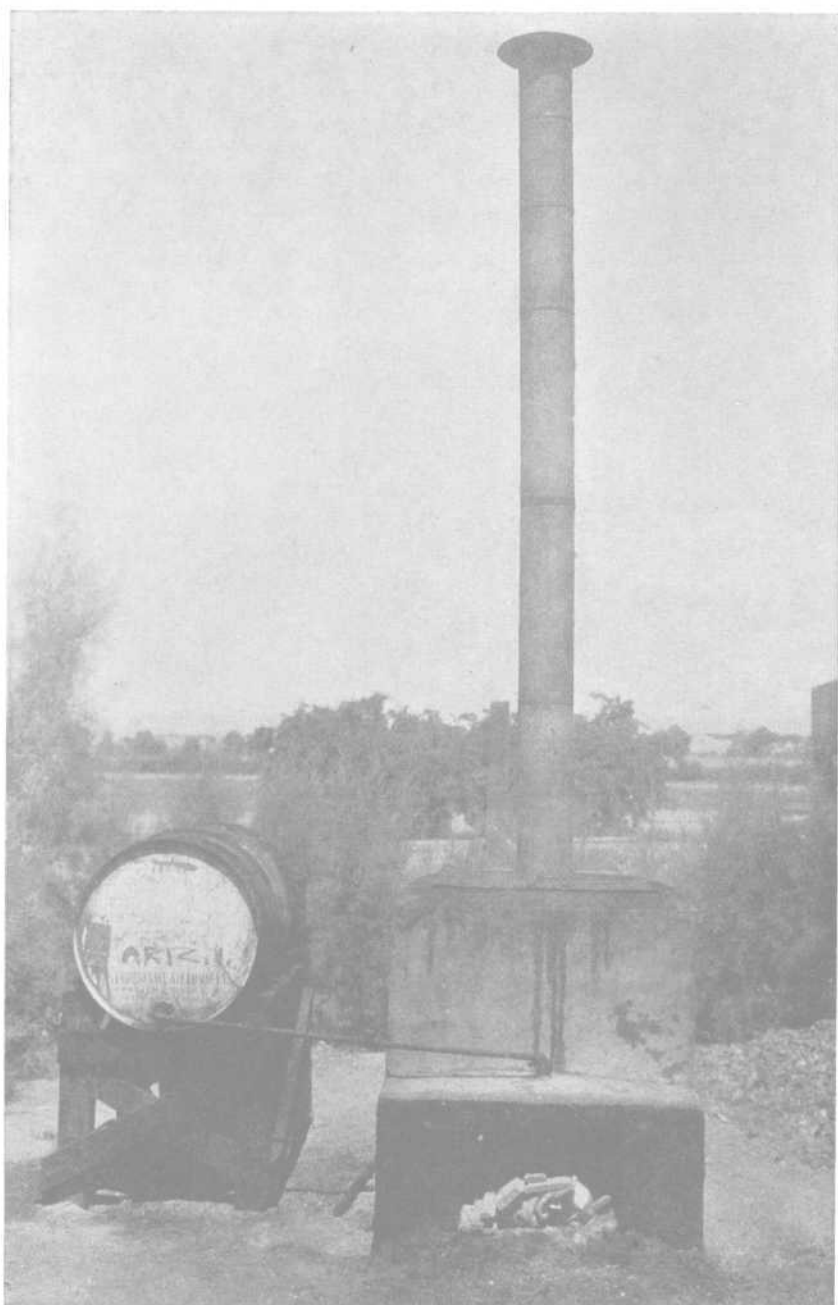
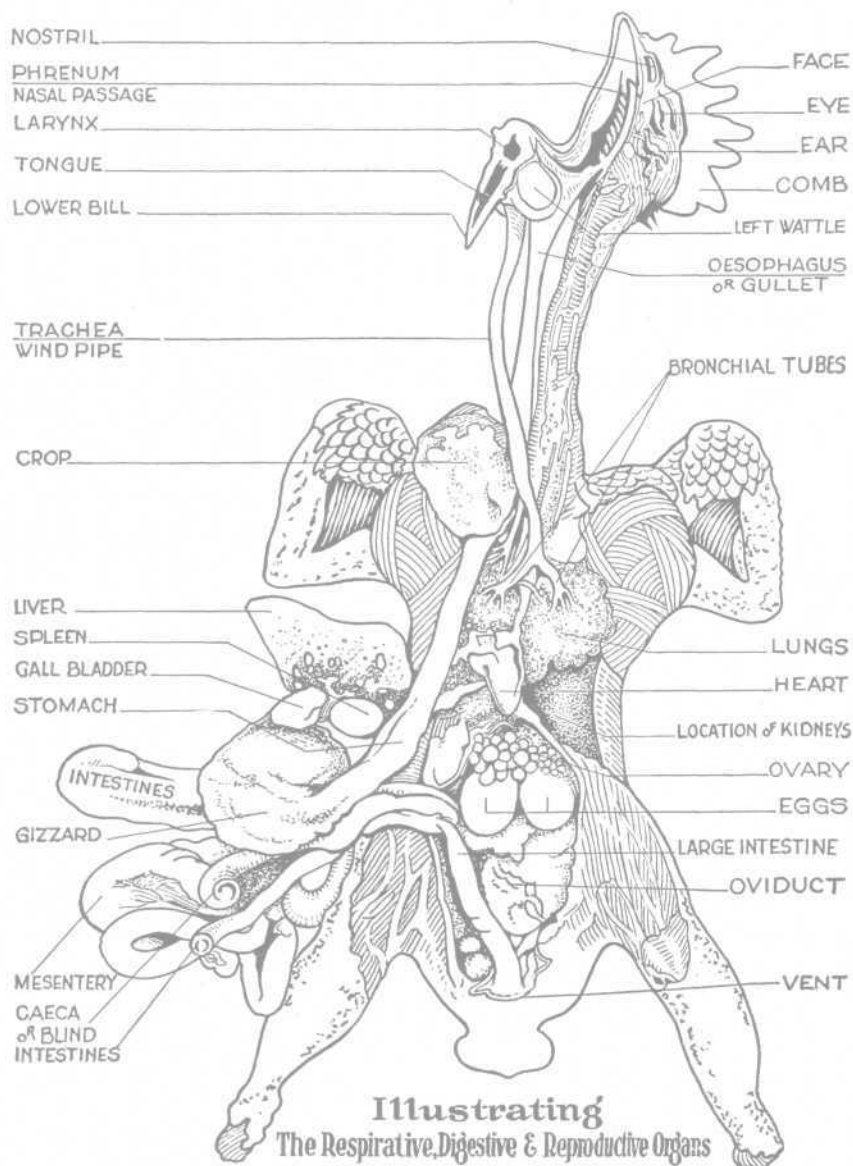


Figure 4.—A homemade concrete incinerator used at the University of Arizona poultry plant. For plans write the University of Arizona.



Courtesy, G. E. Conkey Company.

Figure 5.—Anatomical chart.

skin. Chicken pox or swelling due to roup may be present on the head. A pale appearance of the head is indicative of tuberculosis, fowl typhoid, coccidiosis or leukemia. A congested or darkened appearance would suggest cholera, enteritis or pneumonia. The joints of the leg or wings may reveal the presence of tuberculosis or gout. Nodules in the throat often accompany a nutritional disease, while exudates of diphtheria may be found in the mouth. Diarrhea will be evidenced on the feathers surrounding the vent.

B. KILLING THE BIRD

Always break the neck by dislocation. This precludes the possibility of contaminating the premises and spreading disease. A simple procedure is to grasp the legs in the left hand and place the head in the right hand in such a way that the base of the skull is over the thumb. Care should be taken to discontinue pressure as soon as the vertebrae are pulled apart. In this way the blood collects under the skin at the base of the skull (Figure 6).



Figure 6.—Showing a method of dislocating neck without loss of blood.

C. EXAMINATION OF INTERNAL ORGANS

After the bird has been killed, the feathers should be wet preparatory to opening. This aids in preventing contamination from dust and feathers. The skin is cut between the legs which are pulled away from the body until they are thrown out of joint. The skin is pulled forward until the entire underside of the body is exposed. A cut is then made just back of the

point of the breastbone and through the ribs on each side in the direction of the wing joints. The breast is removed by cutting through the bones at the shoulder girdle at the entrance to the chest. Care should be taken not to injure any internal organs in the process. Before removing any of the organs, a general survey should be taken. The organs should then be carefully examined. To do this, it is suggested that they be removed and separated. The gizzard and intestines are to be cut open and carefully washed out. Each organ is to be carefully inspected for abnormalities and reference made to the diagnostic chart. The trachea and bronchi are split open for examination. All post-mortem work should be done in a good light so that small deviations from the normal may be easily observed.

In order to become familiar with the appearance of normal organs, it is suggested that a perfectly healthy bird be autopsied. After the examination the bird can be eaten.

D. CHART TO ASSIST IN POULTRY DISEASE DIAGNOSIS

EXTERNAL SYMPTOMS

Organ	Condition	Disease	Page Reference
Head & adjuncts	Comb	Anaemic (pale)	Tuberculosis 51
			Parasites (intestinal) 24
			Typhoid 48
			Avitaminosis A (nutritional disease) 54
			Leukemia 48
			Lice, mites, bugs..... 16
	Congested	{ Botulism 47 Cholera 47	
	Tumors	{ Fowl pox 39 Nonspecific 53	
	Wattles	{ Swollen 35 Frozen	
	Eyes & nostrils	exudate in	Colds 38
			Ophthalmia (ocular roup) 40
			Avitaminosis A 54
			Coccidiosis 29
	Mouth & throat	{ Ulcers, cankers 39 and nodules 54 Avitaminosis A..... 54	
	Neck	Limber-neck	Cholera 47
			Botulism 47
		Wry neck	Poisoning 46
			Worms 24
			Polyneuritis 55

Organ	Condition	Disease	Page Reference
Body	Wings	Drooping	{ Heavy infestation of parasites (intestinal)..... 24
			{ Heavy infestation of parasites (external)..... 16
			{ Bacillary white diarrhea..... 49
			{ Coccidiosis 29
			{ All acute diseases
	Feathers	Loss of feathers	{ Botulism 47
			{ Depluming mites 23
			{ Cannibalism or vicious habits 58
			{
	Vent	Inflamed & protruding	{ Worms 24
			{ Lice 16
			{ Tracheitis (flu) & colds 38
			{ Nutritional disease 54
Other manifestations	Legs & feet	Lameness	{ Prolapse 44
			{ Vent gleet 36
			{ Inflammation of cloaca..... 36
			{
			{
		Paralysis	{ Scaly leg 19
			{ Bumblefoot 53
			{ Tuberculosis 51
			{ Sod disease
			{ Rheumatism
	Joints swollen	Injury	{ Gout
			{ Avitaminosis B (polyneuritis) 55
			{
			{
			{
Other manifestations	Emaciation (loss of flesh)		{ Coccidiosis 29
			{ Tapeworms 27
			{ Avitaminosis D (rickets)..... 55
			{ Tumors 53
			{ Range paralysis 45
	Bloody		{ Unbalanced ration (slipped tendon)
			{
			{
			{
			{
Other manifestations	Emaciation (loss of flesh)		{ Tuberculosis 51
			{ Rickets 55
			{ Gout
			{ Rheumatism
			{ Injury
	Bloody		{ Tuberculosis 51
			{ Air sac mites..... 27
			{ Intestinal parasites 24
			{ Cholera (chronic) 47
			{ Coccidiosis 29
Other manifestations	Emaciation (loss of flesh)		{ Blackhead 31
			{
			{
			{
			{
	Bloody		{ Coccidiosis 29
			{ Cholera 47
			{
			{
			{

Organ		Condition	Disease	Page Reference
Other manifes- tations	Diarrhea	White	Tuberculosis	51
			Worms	24
			Bacillary white diarrhea	49
			Botulism	47
			Coccidiosis	29
			Cholera	47
		Green	Fowl typhoid ..	48
			Salt poisoning ..	46
		Yellow	Cholera	47
	Blackhead		31	
	Temper- ature	Elevated	Cholera	47
			Typhoid	48
			Bacillary white diarrhea.....	49
			Tuberculosis (late stages)	51
			Subnormal	Botulism
Avitaminosis A	54			
Respira- tion	Difficult	Bronchitis	41	
		Gapes		
		Pneumonia	42	
		Aspergillosis	52	
		Avian diphtheria	39	

INTERNAL SYMPTOMS

Organ	Condition	Disease	Page Reference
Liver	Enlarged	{ Leukemia 48	48
		{ Blackhead 31	31
		{ Fowl typhoid 48	48
		{ Apoplectiform septicemia 51	51
	Spotted	{ Coccidiosis 29	29
		{ Tuberculosis 51	51
		{ Fowl typhoid 48	48
		{ Blackhead 31	31
	Yellow	{ Chilling	
		{ Overheating	
		{ Sand scours	
Heart	{ Small hemorrhages	Cholera 47	47
	{ White spots	Fowl typhoid 48	48
Lungs	{ Heavily congested	Cholera 47	47
	{ Dark gray and firm, filled with pus	{ Aspergillosis 52	52
		{ Pneumonia 42	42

<i>Organ</i>	<i>Condition</i>	<i>Disease</i>	<i>Page Reference</i>
Spleen	Enlarged	Acute toxemia	
	Mottled	Passive congestion	
		Tuberculosis	51
Intestines	Congested	Cholera	47
		Worms	24
		Coccidiosis	29
		Poisoning	46
		Apoplectiform septicemia.....	51
	Ulcers	Worms	24
		Coccidiosis	29
		Tuberculosis	51
		Blackhead	31
	Nodular	Tapeworms	27
		Tuberculosis	51
Ceca or blind intestines	Filled with blood		
	Worms	Coccidiosis	29
Gall bladder	Enlarged	Suspended digestion in intestines	
Kidneys	Enlarged	Fowl typhoid	48
		Cholera	47
	Inflammation	Nephritis	43
	Ureters filled with urates	Avitaminosis A	54
Ovaries	Dark, greenish, angular, hard or shrunk, congested	Bacillary white diarrhea.....	49
		Fowl typhoid	48
Trachea and bronchi	Congestion		
	Bloody	Tracheitis (flu).....	38
	Pus	Pneumonia	42
Crop	Worms	Gapes	27
	Distended (food), (Feathers, straw, etc.)	Crop-bound	32
		Depraved appetite	
	Putrid odor	Botulism	47
		Mycosis	37
		Crop-bound	32

<i>Organ</i>	<i>Condition</i>	<i>Disease</i>	<i>Page Reference</i>
Proventriculis or stomach	Tumors.....		53
	Mycosis.....		37
Gizzard	Sloughing of membrane wall	Poisoning	46
	Worms	Gizzard worm	25
	Ulcers	Ulcers	34
Body cavity	Inflammation of membrane lining abdominal cavity	Peritonitis	
	Accumulation of straw-colored liquid in abdominal cavity	{ Abdominal dropsy	35
		{ Septicemia	51

V. PARASITES

A parasite is an organism, either animal or vegetable, that lives with or upon another organism, either animal or vegetable. Bacteria are vegetable organisms that live upon animal organisms (Kaupp¹).

Parasites are divided into external and internal groups. External parasitism may be permanent or transitory. The permanent external parasites, such as lice, live upon the skin surface of a bird, the full life cycle being carried out on the bird. Those parasites, which are parasitic only for temporary periods, visit the host when in need of food; mites and mosquitos are representative of this class (Kaupp¹).

A. EXTERNAL PARASITES

1. BODY LICE

Distribution: This group is by far the most important of any of the numerous species found in Arizona. It is found in every section of the State.

Life History: The name (body louse) is derived from the fact that this parasite spends most of its time on the body of the bird, living by eating the skin of its host. Numerous cases

¹ *Poultry Diseases.*

have been found where it has caused such irritation and discomfort, as to result in the death of the bird. The eggs, or nits, are attached to the barbs of the feathers near the vent, or under the wing, and hatch in five to seven days. The young louse reaches maturity in seventeen to twenty days (Figure 7).

Control: Many effective treatments have been discovered for this insect, the most important of which is nicotine sulphate (Black Leaf 40). This liquid, which is a tobacco by-product, is applied to the top of roost poles just before the birds go on them at night. The fumes kill the lice. In order to make the treatment most effective, care must be used to see that all birds roost on the treated perches and that dropping boards are tight enough to prevent fumes from escaping below. While one treatment, if properly applied, is sufficient to exterminate all lice on the birds, it must be borne in mind that the eggs, or nits, will hatch in five to seven days, thereby reinfesting the flock. A second treatment should be administered in seven to ten days.

Sodium fluoride has long been recognized as a standard treatment for lice, and may be applied as a dust or in a bath or dip. The former, known as the pinch method, consists of placing the powder on the skin of the bird just below the vent, under the wings, and on the breast and back. Six or eight pinches of the dust should be used and care taken to see that it is rubbed well onto the skin. Dipping is recommended only during warm, sunny, days. A dip is made by placing 8 gallons of warm water in a tub and dissolving in this 8 ounces of the sodium fluoride. The bird is submerged to the head and the feathers ruffled with the fingers. A second treatment is advised in seven to ten days.

Blue ointment is recommended as a treatment for lice when properly applied. Three bits, the size of a pea, are rubbed on—one under the vent and one under each wing. Be sure it is not left in a dab, as it is very poisonous to the bird. A second treatment is not generally advised.

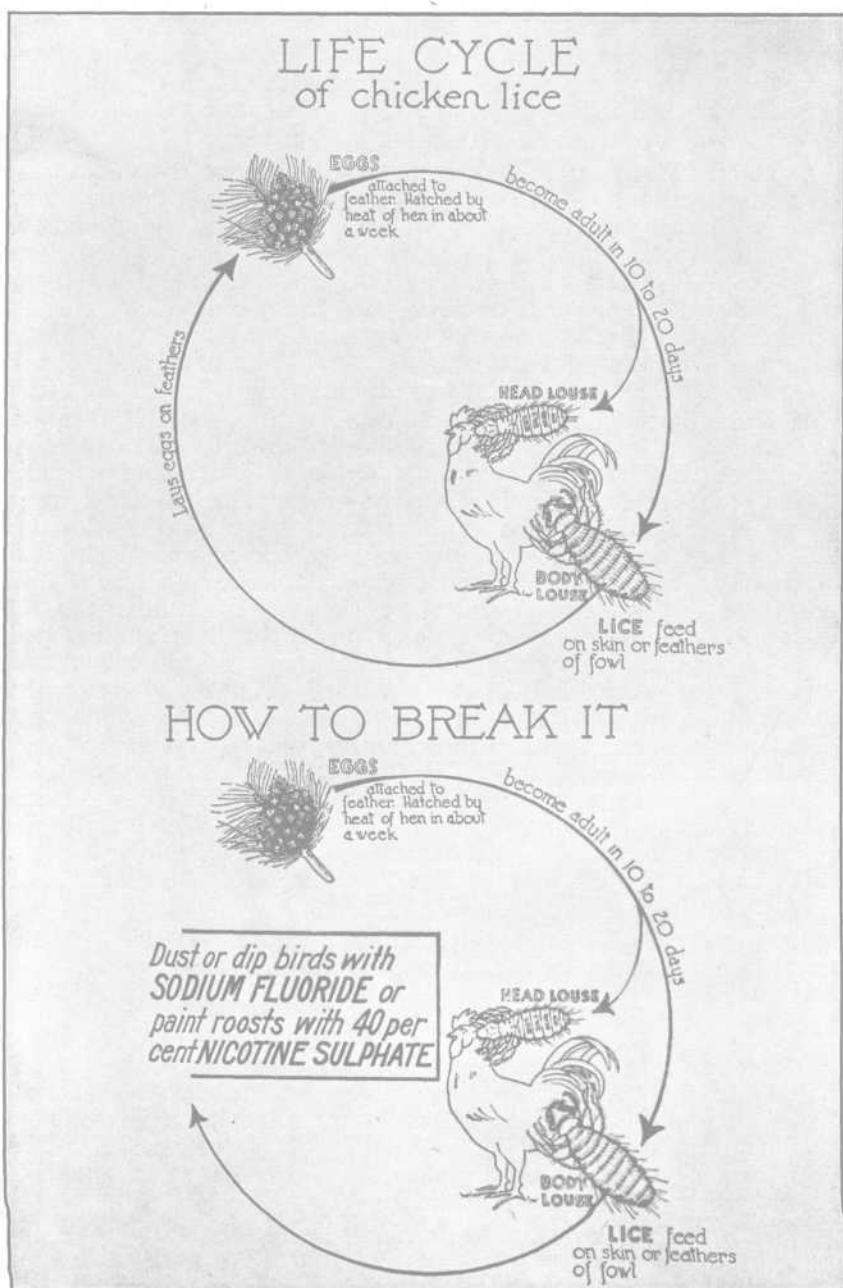
Precautions: Nicotine sulphate is a poisonous product and must be kept away from children or irresponsible persons.

2. RED MITES

There are a great number of parasites affecting poultry which belong to the mite group, but it has been observed that only three or four of these are of particular importance in Arizona, namely: red mite (*Dermanyssus gallinae*), harvest mite, or chigger (*Trombidium*), and scaly leg mite (*Sarcoptes mutans*). The latter will be discussed separately.

Distribution: The red mite is found in all sections of Arizona.

Life History: This insect spends most of its time in the cracks, crevices, and rubbish of the house. It usually can be found in abundance under the roosting poles and about the dropping boards. When mature, the females deposit their eggs in the cracks and rubbish, where they hatch in two to four days, de-



Courtesy, U. S. Department of Agriculture.

Figure 7.—Lice are easily controlled by dusting or dipping the birds individually with sodium fluoride or by painting roosts with nicotine sulphate.

pending somewhat on the temperature. The nymph reaches maturity in two to four days, completing the life cycle in about a week (Figure 8).

Control: The mite is successfully controlled by a large number of spray materials when properly applied. Wood preservatives, dips, oils, and carbolic sprays give good results. All boxes, nests, hoppers, etc., should be treated and the entire house sprayed thoroughly, using one of the above sprays applied with a compressed air sprayer. A driving type nozzle should be used. A second application within a week is advisable and is usually sufficient.

3. SCALY LEG MITES

This is one of our most troublesome insects and is the cause of far greater loss than it is usually credited with. It is found in all sections of Arizona.

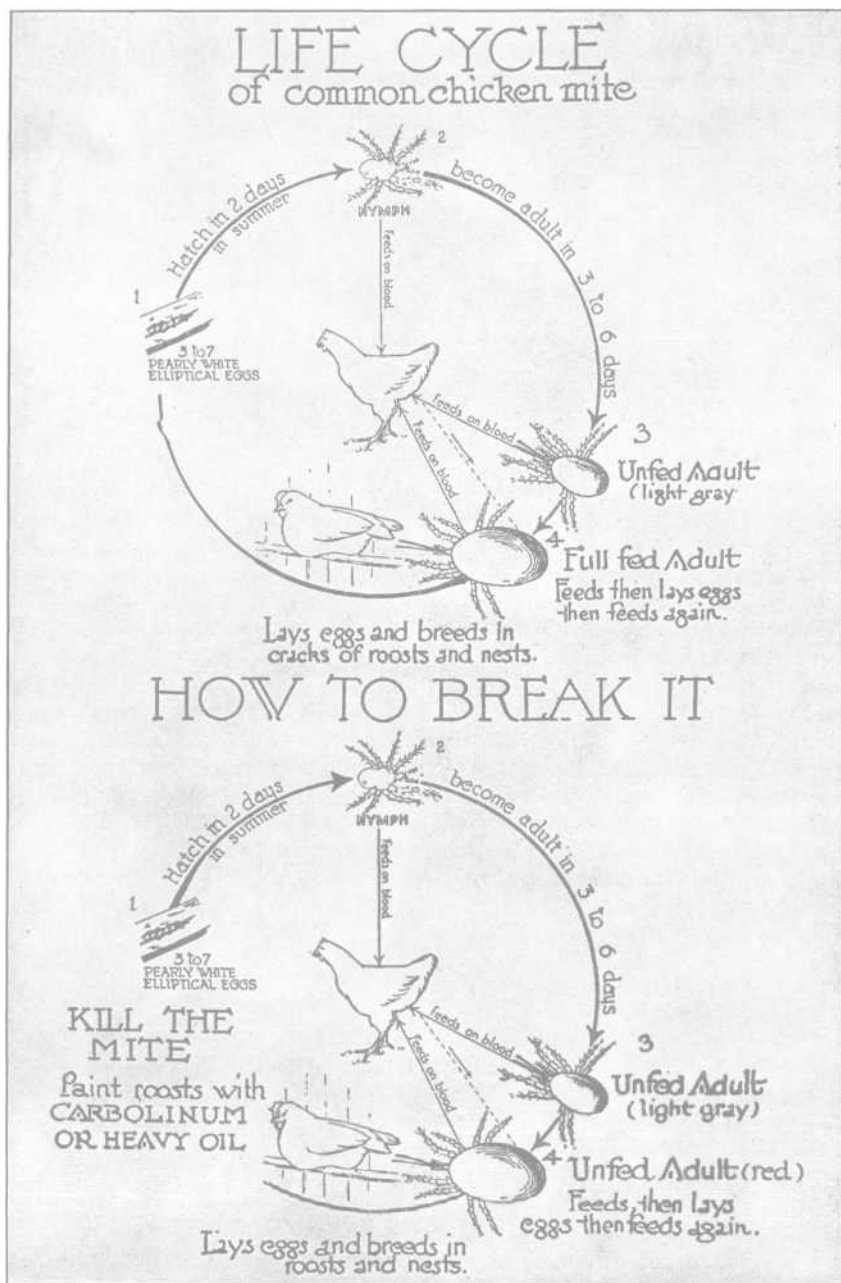
Life History: The scaly leg mite derives its name from its habit of burrowing under the scales of the legs, causing an exudate which pushes the scales out, making an unsightly appearance and causing intense irritation and discomfort to the bird. The mature mites deposit their eggs under the scales, where they hatch in about ten days. The nymph passes through a series of molts, and upon reaching maturity develops sexual organs, thus completing the cycle. Its spread is affected by scales being dislodged from the birds' legs.

Control: The first step in control is to see that the premises are kept clean. Rubbish and droppings should not be allowed to accumulate. Since the insect is protected by the scales and skin of the bird, ordinary treatments or sprays are not very effective. Complete control may be had by soaking the birds' legs in warm, soapy water, after which they are brushed with a stiff bristle and greased with a penetrating oil, such as one part caraway oil and four parts white lard. Kerosene may also be used effectively. A second or third treatment is advised in seven to ten days.

4. BLUE BUGS OR FOWL TICKS

Distribution: This insect is found in practically every section of the State, yet it is not considered very troublesome in the colder sections.

Life History: The blue bug spends the greater part of its life secluded in the cracks and crevices of the house and roost. At night it crawls onto the bird and in a few minutes gorges itself with blood and returns to its hiding place. When it reaches maturity, the females deposit large numbers of eggs in the cracks, crevices, and rubbish of the house, where they hatch in ten to fifteen days. The young, or seed tick, crawls about until it finds a host and attaches itself for a period of three to five days



Courtesy, U. S. Department of Agriculture.

Figure 8.—Painting the roosts and filling the cracks and crevices about the dropping boards and nests control mites if done properly and at the right time.

(Figure 9). Following this period, during which it is constantly attached to its host, it returns for feed only at night. These insects are the most hardy of all insects affecting chickens. They have been known to live thirty months without food. Unlike most other insects, the females do not die following the depositing of eggs.



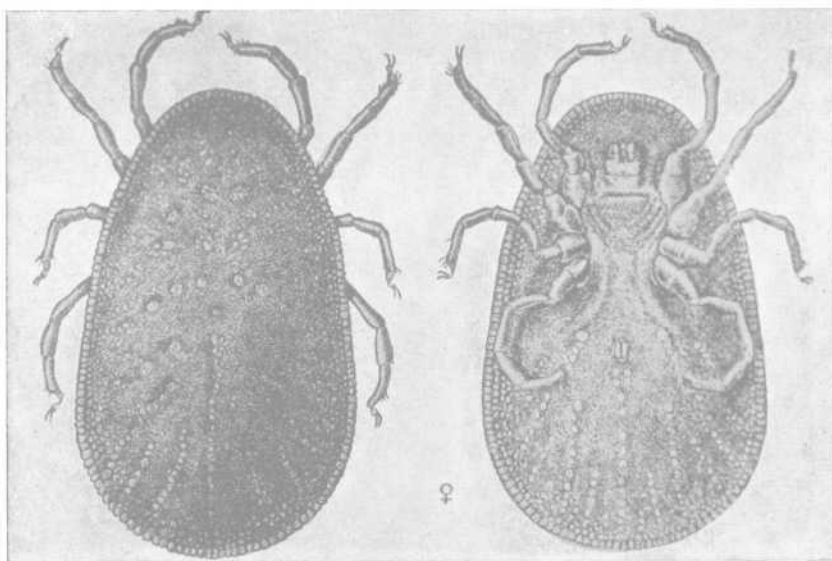
Courtesy, U. S. Department of Agriculture.

Figure 9.—The fowl tick: mass of seed ticks, more or less filled with blood, attached to skin of chicken. About natural size.

Treatment: These ticks being most hardy and protected by a tough leathery skin (Figure 10) are not killed by ordinary disinfecting sprays. Wood preservatives and various oil sprays have been found effective when properly applied. Gasoline or similar torches are very effective where fire hazards are not too great.

The first step in the control of this insect is the removal of as many of its hiding places as possible. Adobe houses should be plastered, shingled roofs should be extremely well treated, and all building materials should be smooth and free of cracks. Sprays should be applied with a power or compressed sprayer and with the driving type of nozzle. Every part of the house and roost must be thoroughly covered: roof, walls, floor, roosts, dropping boards, nests, etc. Birds should not be allowed to roost in trees, which, when infested, become a most desirable harbor for these pests.

These insects frequently cause a severe weakness or lameness in birds, and all birds showing such symptoms should be carefully inspected for the seed ticks, which will be found attached to the



Courtesy, U. S. Department of Agriculture.

Figure 10.—The fowl tick: adult female, upper and lower sides. Greatly enlarged.

bird on the loosely feathered parts of its body. They are probably best removed either with the finger nails or by swabbing with a 3 to 5 per cent solution of some creosote preparation. An excellent policy is that of never letting these bugs get a good start on the place.

Attention is called to the discussion on page 5 relative to the treating of all lumber with wood preservatives while the poultry house is under construction. This is one of the most effective ways to prevent an infestation of blue bugs.

5. BED BUGS

The so-called bed bugs associated with chickens are in reality the chicken bug. The chicken bug is so closely allied to the bed bug that a microscopic study is necessary to differentiate them. It is more prevalent in the north-central part of Arizona in the wooded sections of higher altitude.

Life History: The female deposits one hundred to two hundred eggs in the cracks and crevices of the perch poles and building, and in the filth of the floor and dropping boards, where they soon hatch if the weather is warm, and rapidly develop to adult size. The eggs are oval and pearly white. The young escapes from the egg by lifting the end cap or operculum. The hatching under favorable conditions occurs in one week, the nymphal stage in six weeks, and the entire time from the egg to the age of reproduction is from seven to eight weeks (Kaupp²).

² *Poultry Diseases.*

Symptoms: The chicken bug hides itself in the cracks and crevices of the poultry house, coming out at night and swarming over the fowl's body. It sucks the blood, causing an irritation similar to that caused by the blue bug. It usually leaves a trail behind it by marking the eggs and housing equipment with its excrement. The effect on the hen is similar to that of the blue bug.

Treatment: Inasmuch as the chicken bug lives in filth and in the cracks and crevices of the building, the same treatment as in the case of blue bugs is advised. It is also suggested that all lumber used in the construction of the poultry house or equipment be of dressed lumber, so that less hiding places will be available and the hiding places can be more easily reached with the proper spraying solution.

6. FEATHER MITES

The feather mite is prevalent in some parts of Arizona. The damaged feathers due to this pest should not be confused with the broken feathers of the back due to mating or mechanical injuries.

Life History: The eggs of this microscopic mite are laid in the quill follicles of the feather and soon after hatching arrive at the reproductive stage. Infestation takes place by a bird brushing against another, or by contact with house equipment or loose feathers, infested with them.

Symptoms: The parasites are found at the base of the feather and in the quill follicle of the skin. The feathers either shed entirely or break off close to the skin. The mites may be observed on the stumps of the broken quills with the aid of a low-powered magnifying glass. The irritation set up by the mites and the scab formation at the root of the feathers often causes the bird to pluck its feathers, or even set up the habit of pulling the feathers of other birds. These mites are blood suckers and cause severe irritation and rapid loss of flesh. Production and growth of the birds are naturally very seriously impaired.

Treatment: The following treatments have been recommended for this trouble:

(1) Dipping the bird in either of the following solutions, using a washtub:

- a. 20 ounces sulphur
10 ounces soap
10 gallons water
- b. 3 per cent solution of any good "dip."

(2) Repeated applications of mineral oil, in which there has been dissolved one teaspoonful of sulphur to the pint of oil (Kaupp^a).

^a *Ibid.*

(3) The nicotine sulphate (Black Leaf 40) treatment used for body lice is also recommended. Complete eradication in all cases is not obtained but generally the results are satisfactory.

7. STICK-TIGHT FLEAS

This is a very small, dark brown or black insect which derives its common name from its habit of attaching itself about the unfeathered part of the bird's head. In cases of severe infestation they collect in groups, giving the appearance of large brown patches. It is distributed over the entire State but usually does not cause serious damage except where there are sandy soils.

Life History: The greater part of its life is spent on the bird, where it feeds by sucking blood; however, it breeds in the dust about the place. The adult female deposits eggs in the dust or on the bird. If they are deposited on the bird, the eggs fall to the ground where they hatch. The young go through several changes before reaching maturity.

Control: The most satisfactory control consists in destroying the breeding places by flooding with water, or spraying the land thoroughly with a 3 to 5 per cent solution of a coal-tar preparation. Affected birds should be greased with lard or vaseline to which has been added 1 per cent flowers of sulphur. A small amount of kerosene may be used with success. Several applications may be necessary.

B. INTERNAL PARASITES

Those parasites which live within the body of the bird are known as internal parasites. The intestinal tract, liver, trachea, lungs, and air sacs may all be affected.

Those in the intestinal tract are quite common and are known as worms. Most birds are infected to a certain degree. Birds so affected are generally unprofitable and steps should be taken to remove these parasites.

1. ROUNDWORM

As a class, roundworms include four important species of internal parasites: the large roundworm, the small roundworm found in the ceca, the gizzard worm, and the gapeworm.

The large roundworm (*Ascaridia lineta*) is very common and is found in the entire intestinal tract. It is a white worm attaining a length of 1 to 4 inches and varies in numbers from a few to a number sufficient to block the intestine.

Symptoms: By consuming food which has been taken into the fowl's body, these parasites rob the bird of nutrients. Frequently a few worms cause no noticeable effect on the bird but large numbers make their presence known by unthriftiness, drooping wings, paleness, and emaciation. Young birds are more often infected and especially so if kept in crowded, damp quarters. A

post-mortem examination will reveal the presence and prevalence of worms in the intestines.

Treatment: A 2 per cent tobacco dust (1.5 to 2.5 per cent nicotine)* should be mixed with the dry mash. This is to be fed for a three weeks' period. Discontinue for three weeks and repeat for a similar period. At the end of each weekly period give Epsom salts at the rate of 1 pound per one hundred mature birds. Several poultry supply houses manufacture a nicotine sulphate pill which is satisfactory. Certain forms of iodine are used very effectively.

Dropping boards and yards should be thoroughly cleaned within twenty-four hours after giving the salts (Figure 11).

2. CECA WORM (*HETERAKIS PAPILLOSA*)

A small, round, white worm about $\frac{1}{4}$ to $\frac{1}{2}$ inch in length is found in the ceca (Figure 11).

Symptoms: When present in large numbers, considerable irritation results. This causes an unthrifty condition, loss in egg production, and possibly emaciation. Small numbers, however, do not seriously interfere with the bird.

Treatment: The Bureau of Animal Industry, United States Department of Agriculture, recommends oil of chenopodium and olive oil injected into the ceca, via the rectum. It is recommended that one teaspoonful of oil of chenopodium to 6 fluid ounces of olive oil be given at the rate of $\frac{1}{3}$ ounce to a bird weighing 3 pounds. Dosages are regulated according to the weight of the birds. Injection is made with a small hard rubber syringe by following the lower wall of the cloaca to the rectum where the liquid is slowly released. Cottonseed oil and turpentine are also used. Equal parts of these materials are given the bird by way of the mouth. The dosage for a mature bird is 4 cc. Best results are obtained when given before the morning feeding.

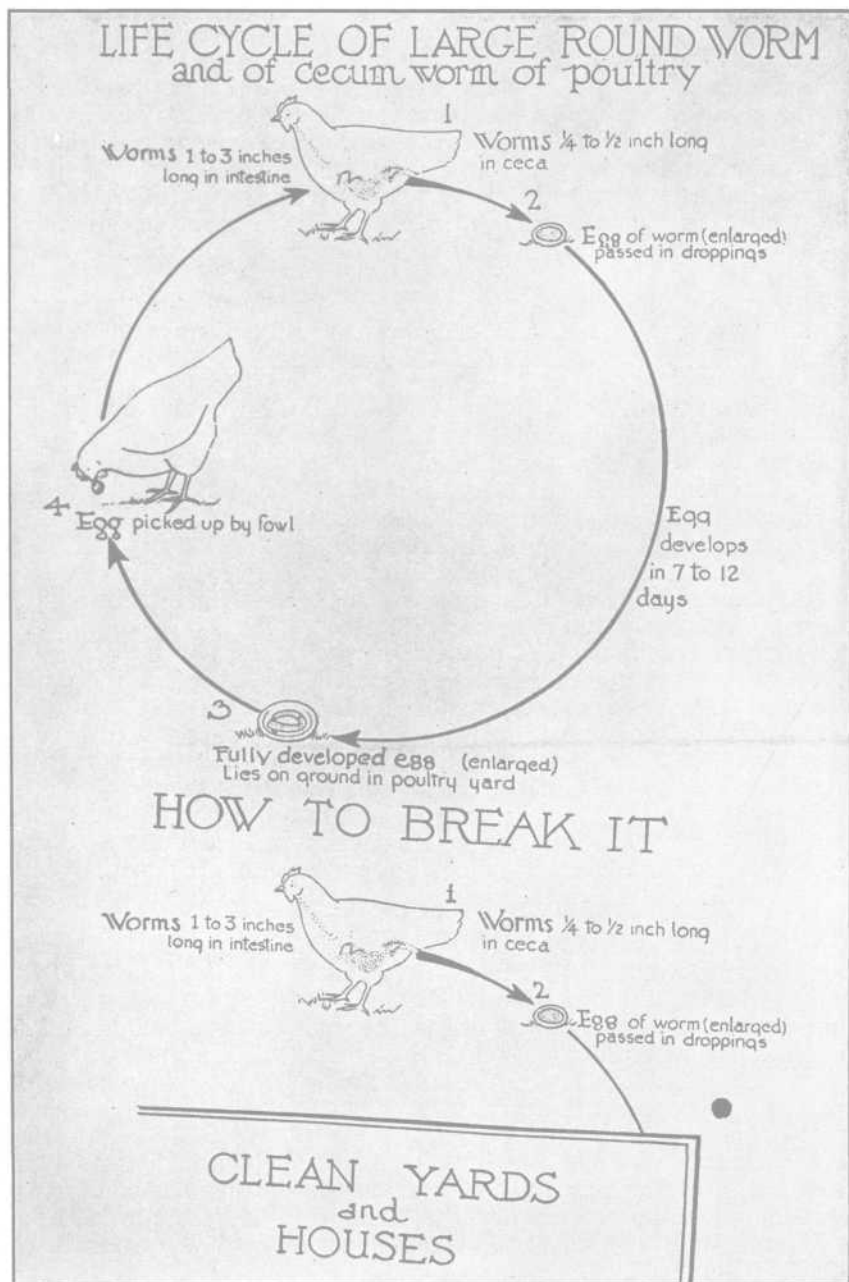
3. GIZZARD WORM (*SPIROTERA HAMULOSA*)

This is a small, round worm $\frac{1}{2}$ to $\frac{3}{4}$ inch in length that is embedded in the mucous lining of the gizzard.

Symptoms: Loss in weight, stunted growth in growing stock, and decreased egg production, together with a ravenous appetite are indications of this parasite. Post-mortem examination, however, is needed for a definite diagnosis. Even then a careful peeling of the gizzard lining is necessary or the worms will be overlooked.

Treatment: Due to the location of the worms, treatment is difficult. Inasmuch as the intermediate hosts mentioned in connection with tapeworms are the same in this case, preventive measures such as those used for tapeworms are suggested as a means of control.

*Tobacco dust loses its nicotine content when exposed to the air so it should be held in air-tight containers. It is estimated that 14 per cent of the nicotine is lost per month on exposure. Mix it in small amounts of mash frequently rather than in larger quantities.



Courtesy, U. S. Department of Agriculture.

Figure 11.—Roundworms and ceca worms of poultry can be controlled by treating with 2 per cent tobacco dust (1.5 to 2.5 per cent nicotine) mixed in mash and later thoroughly cleaning houses and yards.

4. GAPEWORM (*SYNGAMUS TRACHEALIS*)

This is a small, reddish worm which attaches itself to the trachea, or windpipe. The male and female are attached giving the impression of a forked worm with two heads.

Symptoms: This parasite causes injury to chicks and young pullets and usually does not affect mature birds. Chicks heavily infected with gapeworms cough, gasp for breath, and expulse frothy saliva from the mouth. Dullness, loss of appetite, rapid emaciation, shaking of the head, and finally asphyxiation are the results unless treatment is given.

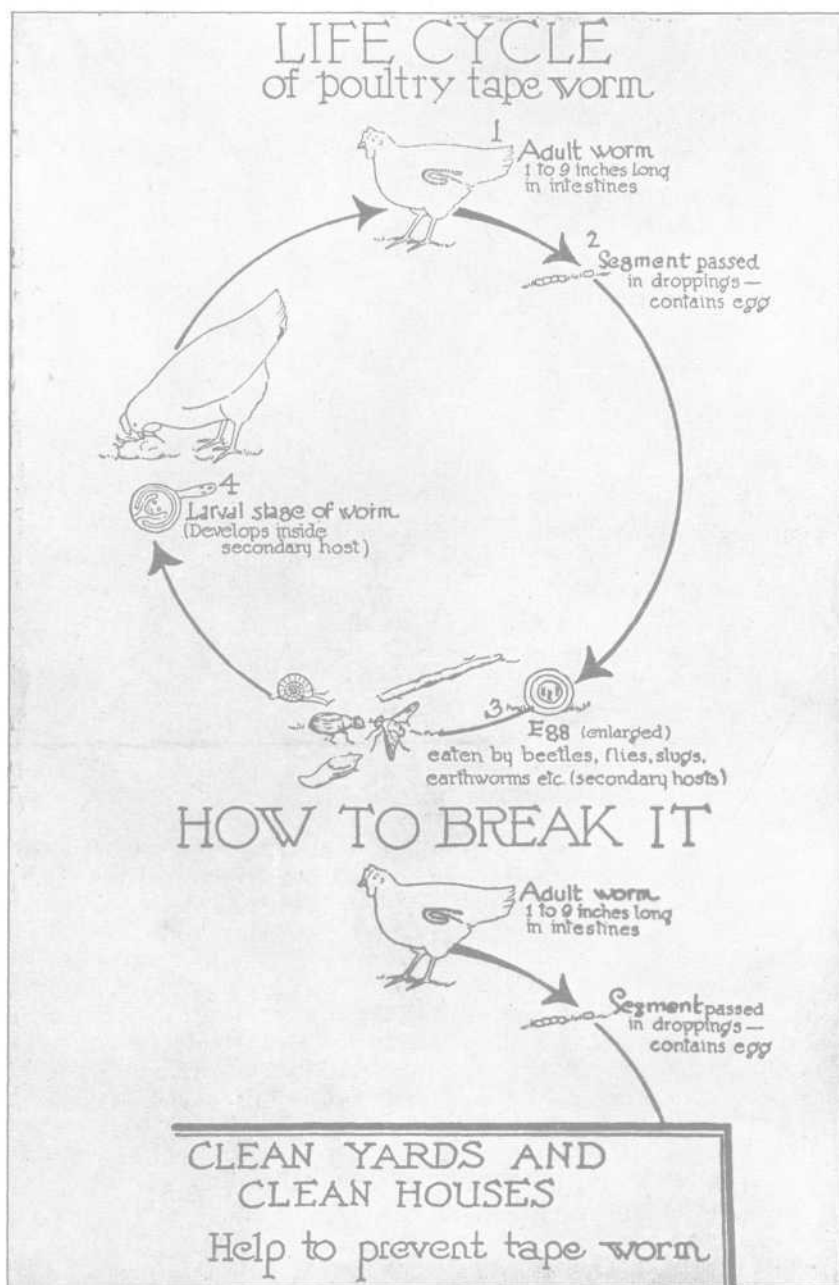
Treatment: Prevention is the first consideration. Inasmuch as turkeys may harbor these worms, do not allow young chicks to run with or on the same ground that is used by turkeys. Keep chicks off wet grass or away from wet ground. Individual treatment consists of stripping a feather of all barbs except those on the extreme tip, moistening this with kerosene and inserting it into the windpipe where the worms are attached. This causes the worms to loosen their hold and they are coughed up by the chick. In badly infested pens, remove the treated chicks and leave the ground idle for six months. Houses should be cleaned and disinfected thoroughly.

5. TAPEWORM

Tapeworms are flat and segmented and inhabit the intestines of all species of poultry. They are often called "chain worms" from their resemblance to a chain. More than thirty different kinds of tapeworms have been found in birds. This worm differs from the roundworm in many respects, including treatment. Probably the most important difference is that of requiring an intermediate host for development (Figure 12). When the segments of the worm containing the eggs pass out of the birds with the droppings, the hosts such as flies, earthworms, snails, or grasshoppers devour them. When the host is, in turn, eaten by the chicken a young larva is liberated and attaches itself to the lining of the intestine and soon reaches the adult stage.

Symptoms: Birds with slight infestations may not show any symptoms. When heavily infested, however, the bird is robbed of much food and becomes unthrifty, emaciated, stunted in growth, and if an adult, shows a falling off in egg production. It is thought by some to be the cause of leg weakness. Death may be directly caused by this parasite. Young birds are more active than older ones and consequently often show greater infestation.

Treatment: Since a tapeworm may live throughout the entire life of the fowl, some means of removing it is necessary. Due to the method of attachment and means of securing food, this parasite is difficult to control without injuring the bird and suffering a loss of egg production. Individual treatment, consisting of a 15-grain tablet of Kamala for a mature bird, is recommended. This treatment is usually accompanied by a drop



Courtesy, U. S. Department of Agriculture.

Figure 12.—Sanitation is an important factor in controlling tapeworms.

in egg production, while some birds, if weak or heavily infected, may die. Iodine in some forms has been used very effectively as a treatment. With layers the egg production has not been interrupted. A flock treatment using concentrated lye is used quite extensively by farmers. It is prepared as follows: dissolve one teaspoonful of concentrated lye in one pint of water, which is a sufficient dose for twenty-five adult birds. This is used to make a crumbly, wet mash. Food is withheld from the birds from 4:00 P. M. until the following morning when the treated mash is fed. Two hours later a dose of Epsom salts is given at the rate of $\frac{3}{4}$ pound per one hundred birds. The smaller dosage of Epsom salts is used due to the fact that the lye is caustic and somewhat laxative. This treatment is given once a month. Some poultrymen feed the treated mash in the afternoon in order to have most of the worms passed on the dropping boards at night. Dropping boards should be cleaned in the morning. Others use the morning system and confine their birds to the house, which is cleaned after the treatment is over. Have plenty of water available for the birds during the treatment.

6. COCCIDIOSIS

Prevalence of the Disease: Coccidiosis is widely spread amongst poultry flocks of Arizona. Severe outbreaks have been reported from almost every community where poultry is being kept on anything like a commercial scale. A general lack of understanding of the various types of coccidia, their life cycle, mode of spread, and their effect on poultry flocks has been responsible for the disease gaining such headway in the State.

Kinds of Coccidia: There are six types of coccidia, which are generally known to exist among poultry flocks; they are:

(1) *E. tenella*, one of the first types to be recognized, is found primarily in the ceca and frequently causes severe hemorrhages, resulting in the passage of a considerable quantity of blood in the droppings. This type of coccidia is usually quite fatal to young birds.

(2) *E. acervulina* is usually found in the upper part of the small intestine and is detected by small grayish spots along the inner lining of the duodenal loop.

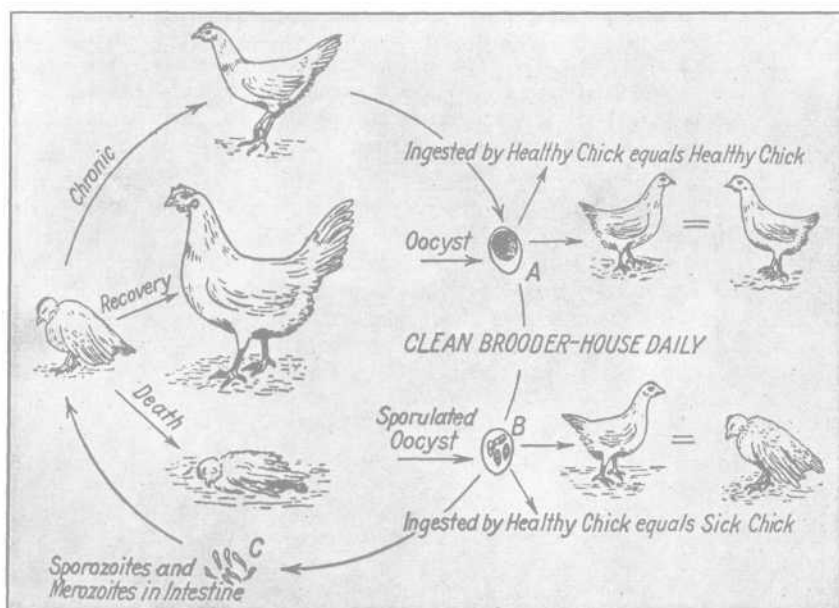
(3) *E. maxima* is found in the middle or lower part of the small intestine and frequently causes a hemorrhagic condition which is recognized by small blood spots along the lining of the intestinal tract.

(4) *E. necatrix* is also found in the small intestines and frequently causes small pin-point and severe hemorrhages.

(5) and (6) *E. mitis* and *E. praecox* are found in the intestinal tract but are usually not very pathogenic in effect.

Life Cycle: Coccidia, when eaten by a bird, develop in large numbers in the intestinal tract by a process of multiplication known as schizogony. This mode of reproduction is limited, however, in that the organism must spend a part of its life cycle

outside of the bird's body where it goes through an incubation period before it again becomes infective. This part of the reproduction cycle enables the poultryman to break in and prevent its development (Figure 13).



Courtesy, University of California.

Figure 13.—The life cycle of the coccidiosis parasite.

Symptoms: It is quite difficult to definitely diagnose an outbreak of coccidiosis by symptoms exhibited by the bird. The use of a microscope in an examination of the droppings or intestinal content enables one to locate the organism and make definite diagnosis. Those forms of coccidia causing hemorrhages can frequently be diagnosed by bloody droppings. However, unless the infestation is quite severe, these conditions are likely to pass unnoticed. By the time bloody droppings are observed, the trouble has been in the flock several days. Generally, the bird affected with coccidia will appear somewhat listless, droopy, and will over a period of time show considerable loss of weight. Those birds which recover, however, may continue to harbor the organism and serve as a source of reinfestation of the buildings and premises.

Post-Mortem Findings: Upon opening a bird infested with coccidia, various symptoms are usually exhibited. If an infestation of *E. tenella* is present, the ceca will show a somewhat diseased condition and frequently are filled with a hard, cheesy mass, showing various amounts of blood. In the case of other

types, grayish spots or hemorrhagic spots along the lining of the intestinal tract will be noted. Rather large amounts of mucus slough off the inner lining of the intestinal tract.

Method of Spread: No definite control measures can be given until one has a thorough understanding of the mode of spread. As previously stated, the organism must spend a part of its life cycle outside of the bird's body (Figure 13). It must also have proper conditions of heat and moisture before it can complete this incubation period and become infective. It is known that the organism is carried from one farm to another by an exchange of infected birds, on the feet of caretakers, on feed sacks, egg crates, and various other pieces of equipment; also by dogs, cats, birds, and other animals as well as by running water and possibly wind storms.

Control: Control of the spread of coccidia is about the only means available to the poultrymen in combating this organism. Keeping the poultry house and runs in a dry condition minimizes the possibility of the organism completing its life cycle. Careful sanitary measures will protect the birds from coming in contact with the droppings. Since the organism is protected by an extremely resistant coat or shell, spray materials, which are used, must be very strong and penetrating. Thorough spraying of the litter, dropping boards, watering fountains, feeding equipment, etc., every day (or every other day in cold weather) will be found very effective as a means of preventing the spread of the disease. In any event, litter should be removed every third day. The use of fire-guns on the houses, runs, and equipment is also of great benefit in that the organism is easily destroyed by extreme heat.

Treatment: No treatment of the individual bird has been found that will give complete success except where carried on in connection with a rigid control program. The use of a 40 per cent dried buttermilk or skim milk mash has given excellent results as a treatment of the *E. tenella* type.

Where conditions are favorable, the building up of a resistance in the bird against this disease is probably the most important means toward its control. This is accomplished by allowing the birds to contract a slight infection and in this manner build a resistance against the disease. This may be the ultimate recommendation as a preventative, but at the present time is still in an experimental stage. The difficulty of this procedure is that it is usually not possible for the average poultryman to gauge the amount of infestation. Careful feeding and management practices, which build vitality in the poultry flock, will be of great importance in controlling the severity of an outbreak of coccidiosis.

7. BLACKHEAD

Cause: The organism responsible for blackhead in fowls is a small parasite or protozoa known as *Histomonas meleagridis*. It

is primarily a disease of the liver and intestines. The organism is responsible for extremely heavy losses in turkeys, although in Arizona the losses are not so heavy as elsewhere. Chickens are susceptible to the disease but it is usually not highly fatal.

Spread of Disease: The organism responsible for blackhead is usually spread by an exchange of infected birds among poultrymen and by carrying the organism on feed sacks, brooders and other equipment, as well as on the feet of caretakers, by predatory animals, water and the like. Recently the ceca worm has been found to play an important part in the spread of this disease. These worms inhabit the ceca, or blind intestines, thereby making it possible for the organism to gain entrance into the body. Birds, which recover from blackhead, frequently become chronic carriers and keep the premises infected by passing out millions of organisms in the droppings.

Symptoms: The disease may appear at any time in the life of a turkey, however, it is most apparent in young poults. The first condition noticed will be that certain members of the flock seem to lag behind and do not travel well. They show somewhat of a droopiness, loss of appetite and frequently sulphur-colored droppings. Death may be sudden or the bird may linger for several days. A few may recover.

Post-Mortem Findings: Upon opening a bird, that is infected with blackhead, it will be noted that the liver is more or less covered with yellowish, irregular, sunken, necrotic (deadened) spots. The ceca are usually enlarged and filled with a purulent substance. The inner linings of these organs will show necrotic areas.

Prevention: Prevention of this disease consists primarily in changing the birds to noninfected ground, the removal and destruction of all birds showing any symptoms, and to the complete control of the ceca worm. This worm can usually be controlled by feeding $1\frac{1}{2}$ to 2 per cent of a high-nicotine content tobacco dust in the mash. This tobacco dust may be fed from the beginning without any interference with the growth and vitality of the birds.

Treatment: No definite treatment has been found which can be recommended as a cure for this disease. The entire effort of the poultrymen should be directed toward control measures.

VI. DISEASES OF THE DIGESTIVE TRACT

A. IMPACTION OF CROP (CROP-BOUND)

This is due to an obstruction between the crop and stomach which prevents the normal passage of food material. This obstruction may be due to fibrous food material, to feathers which have been eaten, or some similar material, such as Bermuda grass or tamarisk needles.

Treatment: Water should be injected into the crop with the aid of a rubber tube and the crop then massaged, holding the head of the bird downward so that the food material can be forced out of the mouth. A mild solution of potassium permanganate, or some other mild disinfectant, should be passed into the crop to overcome the ill effects of the fermentation which invariably takes place in cases of this kind.

If the crop content cannot be passed out through the mouth an operation will be necessary. A 2-inch incision is made through the skin and crop at the top of the crop, after feathers have been removed in the area of the incision. The impounded material is removed with the aid of a finger, making sure no obstruction is left between the crop and stomach. The crop is then thoroughly washed with a solution of some mild antiseptic and the incision sewed up with white thread which has previously been treated with iodine, placing the stitches $\frac{1}{4}$ inch apart. The crop wall and the skin are sewed together with the same stitch.

After the operation the bird should be placed in a clean coop or cage and fed nothing but bread slightly moistened for three days, after which a light feed of soft material and water can be given.

B. IMPACTION OF INTESTINES

By impaction of intestines is meant any obstruction which may prevent the normal passage of food into or through the intestines and the normal voiding of the excrement. This may come about through an excessive worm infestation clogging the intestines, the matting together of fibrous material in the gizzard blocking the opening into the intestines, tumors in the intestinal walls, or the accumulation of excreta on the fluff of baby chicks blocking the anus.

Symptoms: Continual straining without much voiding is the most characteristic symptom along with loss of appetite and general listlessness. Death may result from mortification of the wall of the intestines at the point of obstruction, or from exhaustion.

Treatment: Give to adult fowls a cathartic such as castor oil in one teaspoonful doses, or Epsom salts at the rate of 1 pound to one hundred fowls, or 1 ounce for one hundred baby chicks, or proportional amounts for ages between these limits.

C. ENLARGED CROP (PENDULOUS CROP)

This is a fermentation of food stuffs causing the crop wall to become paralyzed, thereby preventing contraction of the wall. The crop hangs down like a pendulum.

Treatment: The only correction is to operate by taking out a piece of the crop wall. The operation is similar to that of a crop-bound bird. Inasmuch as this condition causes very little inconvenience to the bird, an operation is hardly worth while, except in the case of turkeys where it is advisable.

D. ULCERATED GIZZARD

Ulceration of the gizzard has appeared in several flocks in the State. Examination of this organ reveals a peculiar type of ulcer which may be found in any part of the gizzard but always having its beginning in the lower part of the folds of the lining (Figures 14 and 15).

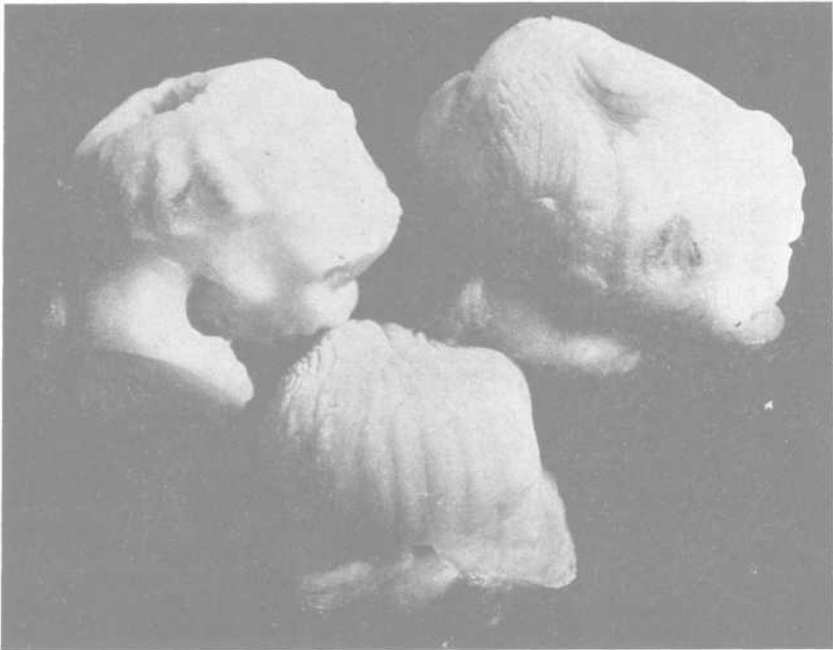


Figure 14.—Gizzard ulcers in early stage.

In work at this Station it was possible to artificially reproduce this trouble in approximately 100 per cent of the cases. Infection may be obtained by inducing fungus that was secured from the ulcers of naturally infected birds into the crop, the gizzard, the mouth, or by feeding inoculated grain. This fungus seems to fall in the *Aspergillus* group. Work at the University of Arizona has not, however, thrown much light on how infection takes place.

Symptoms: Emaciation, ruffled feathers, listlessness and unwillingness to move are noticeable. Post-mortem shows all organs normal except the ulcers in the gizzard. Young pullets before coming into production seem to be most susceptible. All breeds are affected and losses may be heavy. With the coming of cold weather, losses are materially reduced indicating that weather conditions may have something to do with its development.

Treatment: No treatment outside of strict sanitation is recommended. Work now in progress will be reported later and it is hoped that some method of control can be given.

E. DROPSY

This is an accumulation of fluid in the abdomen caused from a filtration of blood serum through the serous membranes. This

trouble may be confused with excessive abdominal fat or with drooping abdomen.

Symptoms: Except in severe cases no external manifestations are noted. However, when large amounts of liquid are present, the abdomen is distended and the liquid can be felt.

Treatment: Some temporary relief can be obtained by puncturing the abdominal wall. This will not be lasting and will reoccur unless the cause is corrected.

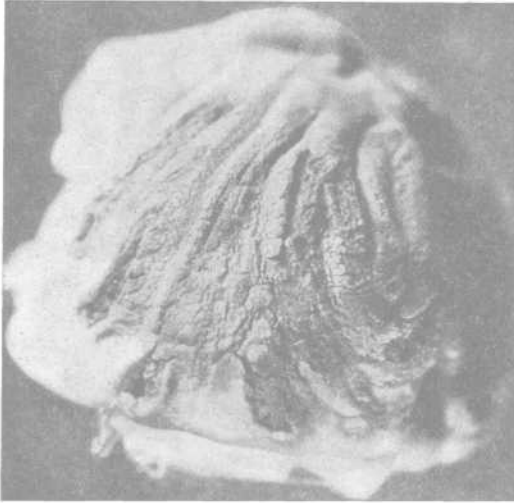


Figure 15.—Gizzard ulcers in advanced stage.

F. ABDOMINAL YOLK MASSES

Ruptured yolk is the term generally given to abdominal yolk masses. There is some dispute among investigators in the classifying of ruptured yolk. Some investigators regard ruptured yolk as a condition produced in poultry, particularly pullets, by the use of stimulating foods during heavy egg production. Other investigators have demonstrated that infections play a major role in producing abdominal yolk masses. The organisms most frequently producing this condition are of the fowl cholera and fowl typhoid groups.

Symptoms: The symptoms of poultry suffering from abdominal yolk masses are general droopiness, yellowish green diarrhea, sticky mucous discharge from nostrils, dark discoloration of comb, and death within twenty-four hours. Many times the condition is very acute and birds are found dead on the roosts and in the nests. It usually affects poultry in heavy production.

Post-Mortem: The post-mortem lesions are usually well defined. The liver is large and soft, many times being covered with small white spots. The intestines usually show inflammation and

are always covered externally with either fresh yolk material or a cheesy mass of organized yolk material. The fat around the heart shows small hemorrhages.

Treatment: The treatment of abdominal egg masses consists of a change of diet and strict sanitation. Considerable bran should be added to the ration. This can be fed at intervals twice daily moistened with hot water or mixed with the mash in the dry form. A laxative of Epsom salts should be given at the beginning of the treatment. In addition to this treatment, careful attention should be given to sanitation. All sick or dead birds should be removed immediately. The houses and utensils should be thoroughly cleaned and disinfected. The birds should be kept off of all moist ground and preferably kept off the ground. The feeding and watering utensils should be cleaned daily. Potassium permanganate, or a chlorine preparation should be added to all drinking water. Any outbreak of this nature should be reported to a laboratory and sick or dead birds should be sent for a diagnosis.

G. CLOACITIS (VENT GLEET)

Cloacitis is an inflammation of the cloaca and vent. The trouble can be transmitted by contact.

Symptoms: The anus and cloaca become inflamed and ulcerated and later may protrude. This condition is accompanied by a very offensive odor. The inflammation may extend into the oviduct.

Treatment: Although the affected parts may be swabbed with iodine every third day, and an antiseptic injected daily, the probability of a complete cure is so uncertain and the chance of transmission so great, the treatment is not worth the time and effort expended. It is wiser to kill the affected bird.

H. CONSTIPATION

Constipation is an ailment of fowls brought about by a lack of exercise, an insufficient amount of green feed, or improper feeds, or feeding of too much grain without grit.

Symptoms: There will be a straining on the part of the bird with little or no voiding. The droppings are not moist as in the case of normal droppings.

Treatment: Epsom salts dissolved in water from which a wet mash is made may be used effectively, using enough water to properly moisten the mash. Epsom salts are used at the rate of 1 pound to every one hundred mature fowls, or one ounce for an equal number of baby chicks. Proportional amounts can be used for birds between these ages. Withhold all morning feed and in its place give the wet mash containing the dissolved Epsom salts. Epsom salts can also be administered through the drink-

ing water, using the same proportions as above. This method is more distasteful to the fowl and there may be difficulty in getting the fowls to consume this treated water.

I. SIMPLE DIARRHEA

This trouble is apparent by the soiled condition of a bird in the rear. It is chronic in some individuals, but may result from improper feeds or feeding, exposure to severe weather, or from any other condition which may cause the digestive system to cease functioning properly.

Treatment: Give a laxative, such as mentioned above. Follow with intestinal antiseptics, such as sulphocarbolates, used in the drinking water.

J. ENTERITIS (INFLAMMATION OF THE INTESTINAL TRACT)

Enteritis is a more severe form of diarrhea.

Symptoms: As in all forms of diarrhea, the feathers are soiled in the rear. The droppings are watery, sometimes being accompanied by a mucous and bloody discharge. The bloody discharge is usually associated with dysentery of the large intestine.

Causes: A variety of causes are responsible for this more serious form of diarrhea. A bacterial form comes from filthy surroundings, contaminated drinking water, and putrid feed. A toxic form may result from an overdose of salts, and any poison, such as arsenic, copper, paint skins, etc. Various intestinal parasites may have the same effect.

Treatment: An attempt should first be made to ascertain the source of the trouble which, if located, should be corrected. It may be a sick bird which has not been removed, or the house and premises need a thorough cleaning and disinfecting.

The specific treatment is the same as in the case of all forms of diarrhea, some intestinal antiseptic in the drinking water such as trisulphocarbolates.

The Connecticut Agricultural Experiment Station reports considerable success with the following treatment, mix:

- 8 ounces powdered catechu
- 2 ounces powdered sodium phenolsulphonate
- 2 ounces powdered calcium phenolsulphonate
- 4 ounces powdered sulphate of zinc

One heaping tablespoonful of powder to 1 gallon of drinking water. Use for one week, discontinue for one day and give Epsom salts at the rate of 1 pound for each 400 pounds of birds. Continue powder for one week longer.

K. MYCOSIS

Turkeys appear to be more susceptible to this disease than do chickens. This is probably due to the fact that turkeys are

foragers. Many forage plants, including sorghums, harbor the fungus which causes mycosis. In wet seasons, or where irrigation has been practiced, the condition becomes more prevalent. The infection is taken in by way of the mouth and gains access to the walls of the crop, the esophagus, or the stomach by means of abrasions caused by rough feed.

Symptoms: The bird becomes weak and emaciated. It generally refuses food but drinks large quantities of water. Post-mortem examination will reveal wart-like growths in the tissues. The size will vary from very small to $\frac{1}{2}$ inch in diameter, and $\frac{1}{8}$ to $\frac{1}{4}$ inch in height. They may be quite numerous and are of a yellow color. Tissue immediately surrounding will be red, due to inflammation. In advanced cases the obstruction becomes so large as to close the opening of the stomach, causing crop-bound and starvation. This should not be confused with Vitamin A deficiency which is explained later.

Treatment: Since the disease is not contagious, treatment will consist of removing the cause. Individuals cannot be successfully treated, and flocks in which losses are occurring should be marketed and not held for breeders.

VII. DISEASES OF THE RESPIRATORY SYSTEM

A. COLDS

Colds are common in poultry flocks of Arizona during the fall, winter, and early spring months. In the warmer sections of the State, colds are quite common during the summer months.

Causes: While colds are thought to be caused by a bacterium, there are a number of conditions which are far more important from a practical control standpoint. Exposure to drafts, faulty ventilation, an insufficient amount of Vitamin A, crowding, internal and external parasites, and overworking of the flock are some of these contributing factors.

Treatment: Colds are best treated by removing the contributing causes. If birds are thin, they should be induced to eat heavily of grain and green feeds. Adjust the house so as to give plenty of ventilation without drafts. Allow the full recommended roosting space for each bird. (Place a few birds in a small crate and treat for worms. If they are found to be wormy, treat the entire flock.) Individual birds which are badly affected should be isolated and treated by washing the nostrils with soda water (one teaspoonful to one cup of water) and submerging the head in a 3 per cent compound creosote for two or three seconds. In extreme cases, it is best to kill and destroy the bird.

B. CATARRH (NASAL ROUP)

Catarrh, or nasal roup, is very closely related to colds. From a practical standpoint the two diseases should be treated in the same manner.

C. CHICKEN POX AND DIPHTHERIA

Chicken pox and diphtheria are so closely related that they are frequently referred to as one and the same disease, making its appearance in a different form.

Symptoms: The chicken pox form is usually characterized by wart-like growths on the unfeathered parts of the head (Figure 16). These should not be confused with scabs caused by

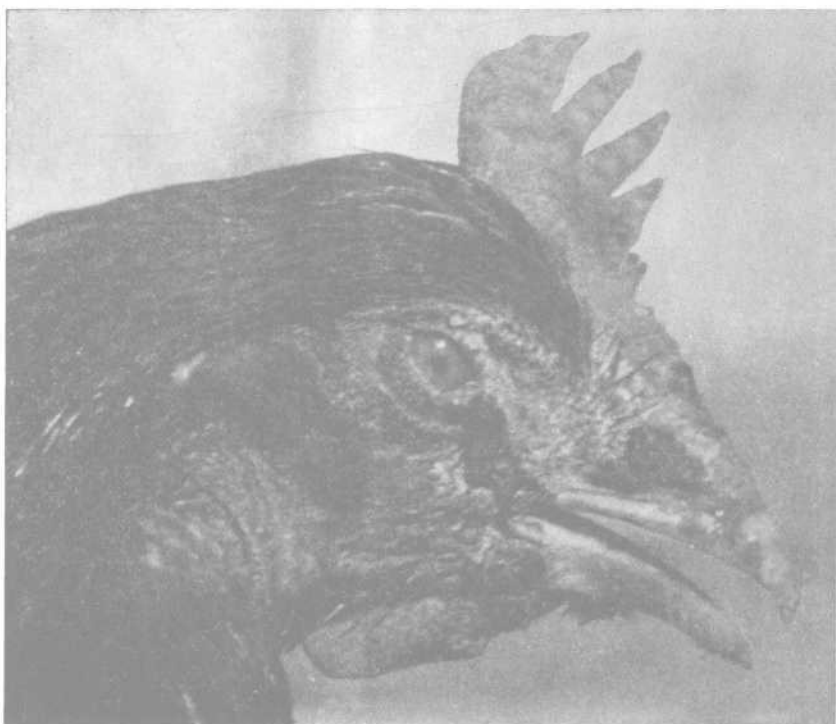


Figure 16.—A typical case of chicken pox. Note prominent nodules around mouth and on wattles, also nodules in early stages on comb.

abrasions. The pox nodule, or scab, is raised whereas abrasions are not. The diphtheritic form is characterized by canker or patches which form in the eye, mouth, and throat. This condition is usually associated with an offensive odor. Breathing is difficult and the bird appears depressed, listless, and unthrifty.

Treatment: This disease, regardless of the form it takes, does not respond readily to treatment. Contributing causes, such as drafty, damp houses, improper feeding, parasites, etc., should be given immediate attention. Such birds should be isolated and the house and runs given a thorough cleaning and disinfecting. The entire flock should be given a purgative and their heads dipped in a 3 per cent solution of compound creosote. By

holding the mouth open while the head is being dipped, the inside of the mouth, as well as the nasal passages, are reached by the disinfectant. Pox lesions may be painted with tincture of iodine.

Vaccinating for Control: The most advisable practice for the prevention of this disease is the use of vaccines. There are two kinds of vaccines available: chicken pox and pigeon pox. Chicken pox vaccine, being more potent, will build a more lasting immunity, but the reaction subsequent to its use is more severe and the flock must be in good physical condition. It should be used purely as a preventative.

The pigeon pox vaccine, being less potent than the chicken pox type, does not build as lasting an immunity and should be used to carry birds through a short period of danger only. Laying birds are not seriously affected by the use of pigeon pox virus, and flocks which are slightly out of condition may be safely vaccinated.

How Used: Chicken pox virus is used by the stick method, and the pigeon pox virus by the feather follicle method.

Cautions: Live viruses are dangerous and should be used only by licensed veterinarians, or others equally competent. Vaccinate only birds that are in good physical condition and free from parasites. Yearly vaccination of additions to the flock is necessitated. The best age for vaccination is two to three months.

D. OPHTHALMIA (EYE ROUP)

Ophthalmia is another form of roup affecting the eye and sinuses. The disease is quite common in all sections of the State and is usually associated with other diseases.



Figure 17.—An inflamed eye in early stage of cold or roup.

Symptoms: Ophthalmia is readily recognized in the later stages by the swelling and filling of the eyes and sinuses with a cheesy, yellowish substance (Figure 17). In the early stages of the disease there may be a watery discharge from the nose and a foamy condition in the eyes. The condition in turkeys is frequently referred to as swell head (Figure 17).

Treatment: Keeping the flock in a good, thrifty condition is of paramount importance in preventing this disease. Precautions mentioned in other cold diseases should be followed. Of these the feeding of large amounts of green feed and the complete control of intestinal parasites are most important. Individuals should be isolated and the eyes and sinuses opened and cleaned of the cheesy mass and washed with a disinfectant. If the sinuses are filled with a solid cheesy mass, it is advisable to lance them and remove the mass. Swab with a 15 per cent solution of argyrol. Disinfectants in the drinking water and a good purgative should be given.

E. LARYNGOTRACHEITIS (INFECTIOUS BRONCHITIS)

Infectious bronchitis is a disease of the respiratory system and is quite common in the poultry flocks throughout the State, especially in the lower altitudes during the spring, summer, and early fall months. The symptoms resemble other respiratory diseases and it is sometimes difficult for the layman to make a definite diagnosis.

Causes: The disease is caused by a filterable virus which is usually introduced on the poultry farm through the addition of infected birds, on various pieces of equipment, feed sacks, on the feet of visitors, and by predatory animals. Not infrequently it is introduced on the place through the purchase of baby chicks from infected hatcheries.

Symptoms: The bird appears quite depressed with the feathers somewhat ruffled and unkempt. It also shows considerable difficulty in breathing. It will be noted that the bird sits or mopes around, frequently stretching its neck and gasping for breath. While this latter symptom is quite characteristic of infectious bronchitis, it is not a definite diagnosis due to the fact that almost any condition, which would have a tendency to plug the respiratory passage, would cause the bird to breathe through the mouth with some difficulty. Swellings in the eye, sinuses, and about the head are not common symptoms of infectious bronchitis. The rapid manner in which it spreads through the flock is diagnostic of the disease.

Post-Mortem: Post-mortem lesions of infectious bronchitis are quite well defined. In the trachea and bronchial tubes there is a hemorrhagic condition and the tubes are more or less filled with blood-stained mucus. Death frequently occurs when the trachea becomes plugged with this mucus. Infectious bronchitis is sometimes referred to as tracheitis due to this hemorrhagic condition in the trachea.

Treatment: There is no effective cure for infectious bronchitis. Frequently vapor or bronchial sprays are used—not as a cure but as a means of giving temporary relief. Irritating sprays, though frequently used, are of no curative value and tend to aggravate the condition.

The poultryman should direct his efforts toward preventative measures rather than a cure. Infectious bronchitis is far more severe and more prevalent in flocks low in vitality due to intestinal parasites, lice, and especially those which are fed a ration that is low in Vitamin A. Liberal quantities of green succulent feed are most desirable in building vitality in the flock. In recent years a vaccine has been perfected which if properly used will build an immunity against this disease. In view of the fact that heat and exposure are highly destructive to this vaccine, and in view of the fact that it is administered with considerable difficulty and danger by the layman, its use is not recommended except by, or under the supervision of one who is trained.

F. PNEUMONIA

Pneumonia is common among fowls in Arizona, but it usually occurs in birds which have had their vitality sapped by other diseases, such as colds, roup, bronchitis, aspergillosis, and the like.

Symptoms: Birds affected by pneumonia show a very depressed condition, difficulty in breathing, a high temperature, and a tendency to drink large quantities of water.

Post-Mortem: An examination of the lungs of a bird affected with pneumonia reveals a highly congested condition with the lobes filled with an exudate.

Treatment: Treatment consists of giving the bird warm, dry, well-ventilated quarters and inducing it to eat by giving soft, moist, highly nutritious foods.

VIII. DISEASES OF THE LIVER

The liver is the organ which most poultrymen blame for a variety of troubles. It is the most prominent organ seen at post-mortem. The many functions of the liver in digestion and in the formation and destruction of blood cells causes it to have many lesions. Some of the various conditions are described briefly:

1. Chronic venous congestion is due to interference with the normal return of blood to the heart caused usually by lesions in the heart.

2. Atrophy, or wasting away of the liver, is due to toxemias and general wasting diseases, such as tuberculosis.

3. Fatty degeneration and infiltration is usually not only an exaggerated physiological process, but also occurs in a pathological form in chronic infectious diseases.

4. Abscess of the liver occurs in general pus conditions. The septic material is carried to the liver, forming abscesses.

5. Chronic inflammation of the liver is caused by toxins circulating in the blood stream or irritants in the bile passages.

6. Tumors are also common in liver tissue, usually in connection with tumors in the alimentary system.

7. Specific diseases, such as tuberculosis, leukemia, and black-head cause definite lesions on the liver. The liver is affected by most infectious diseases and these are described separately under the discussion of the disease.

IX. DISEASES OF THE KIDNEYS

A. NEPHRITIS

An inflammation of the kidneys is often seen in fowls and chicks. Improper diet, exposure to cold rains, and improperly heated hovers are the principal causes.

Symptoms: Nephritis causes loss of coordination, emaciation, and death. On post-mortem examination the kidneys are increased in size. The color has changed to a gray or grayish-yellow. Upon sectioning a soft gray mass is found. Treatment consists of removing the cause.

X. ABNORMAL CONDITIONS OF THE OVARY AND OVIDUCT

A. EGG-BOUND

There are many causes for eggs becoming obstructed in their passage through the oviduct. An infection from the digestive tract may so weaken the structure along the oviduct that it ceases to function. Abnormal eggs or weakened structure due to overwork may bring about the condition. This trouble is most apparent in the heaviest layers. Rough handling also may cause the trouble.

Symptoms: Birds suffering from this condition may go to the nest but are unable to lay.

Treatment: In some few cases it is possible to lubricate the index finger and insert it through the vent into the cloaca and up into the oviduct to the point of obstruction, and in this manner dislodge the obstruction. Great care must be exercised as the wall of the oviduct is very tender and easily injured. In the majority of cases it is impossible to render any aid, and it is more practical to destroy the bird.

B. RUPTURE

A ruptured oviduct is one which is torn. It becomes apparent through the hen going to the nest but failing to lay. The abdomen becomes enlarged through the accumulation of eggs and feels like a hard mass. It is frequently referred to as "internal laying."

Treatment: Nothing can be done to assist once the trouble is apparent, and sooner or later the bird will die from complications. It is better to destroy the bird.

C. PROLAPSE OF THE OVIDUCT

The inverting of the oviduct is apparent by its protrusion through the cloaca. It is usually associated with heavy egg production, and is more evident in pullets than hens. If the bird is not treated in a short time, the exposed tissue becomes infected, inflamed, and necrotic. It is also exposed to the attacks of other birds in the flock that are attracted by the sight of the blood-red tissue. Constipation is usually associated with this condition.

Treatment: Inasmuch as the majority of cases are found in heavily producing flocks of pullets, the first step to overcome the difficulty is to reduce the consumption of stimulating feeds, such as egg mashers. Individual birds may be assisted by cleaning and disinfecting the protruding part and replacing it with the finger, which has first been greased. Following this treatment, the bird should be placed on a low-protein feed for several days to purposely retard production until the parts again become normal. Some laxative should be given to relieve constipation.

D. ABNORMAL EGGS

Abnormal eggs are more a matter of interest than of economic importance for the numbers produced are relatively small, and it is impossible to prevent their formation.

Small Eggs are caused by small particles of tissue or masses of albumin, blood, or similar material, getting into the oviduct and in its passage through this channel setting up enough friction to cause a small secretion of albumin or white. This is surrounded by a membrane and shell with a complete small egg minus a yolk being formed and laid.

Large Eggs are formed by an abnormally large yolk, or two yolks, entering the oviduct at the same time. Due to the friction of the larger mass, a greater amount of albumin is secreted, all of which is surrounded with a normal membrane and shell, the result being the formation of a large egg. Most of the large eggs are double yolked.

Freak Eggs are of many shapes and formation. The dumbbell-shaped egg comes about through a contraction of the oviduct wall, through fright or similar reactions, while the egg is being formed and the shell hardening in this manner. Eggs with a long tail of shell material are produced during the course of the passage of the egg through the shell-forming portion of the oviduct, and the egg passing more rapidly than usual at this point with the result that a tail-like structure is formed. Eggs with two and three shells, one enclosed within the other, are due to an egg going through the process of formation but before being laid it is again forced back through the oviduct through fright or other nervous reactions, and in the return passage again lays on more albumin, membrane, and shell.

E. BLOOD CLOTS

Blood clots are caused by a small hemorrhage in the membrane surrounding the yolk. The blood forms in a little ball on the side of the yolk and becomes surrounded with the albumin. When the egg is broken open the clot is seen. Although this is unsightly, it does not injure the egg from an edible standpoint.

F. BLOODY WHITES

The presence of blood in the white of an egg is due to a hemorrhage occurring in the oviduct during the formation of the egg and the blood mixing with the white. This trouble is unavoidable, but fortunately does not occur frequently.

XI. DISEASES OF THE BRAIN AND NERVES

A. FOWL PARALYSIS

Fowl or range paralysis as it is commonly known is widespread throughout Arizona and is probably one of the most destructive diseases. The name "range paralysis" is given the disease because birds seldom show a paralytic condition until they are three to four months of age at which time they are usually on range. The exact cause of range paralysis is not known. It is thought to be the result of a filterable virus which gains admission either through the egg or is picked up from infected houses and runs. Definite diagnosis is not possible except by trained laboratory technicians.

Symptoms: Range paralysis may exhibit three types of symptoms, namely: paralysis of the leg (Figure 18), paralysis of the wing, and discoloration of the eye, resulting in blindness. In



Figure 18.—A typical case of paralysis of the leg.

the first case, birds will begin to show an unsteady gait with a tendency for the toes to double under the feet. In such cases the birds prefer to sit around on their hocks and move only

when disturbed or when securing food and water. As the disease progresses, the bird becomes completely paralyzed, usually lying on its side with one leg stretched forward and the other backward. The bird apparently is otherwise healthy and readily eats its supply of food.

In the second type, the first condition observed will be the inability of the bird to hold its wing firmly to its sides. In a few days the wing hangs limply as though it were broken, with the bird stumbling over the flight feathers.

In the third type, the eyes become gradually discolored, turning to a cloudy white until the bird eventually becomes completely blinded.

In all three cases the disease usually strikes about the time the birds are ready to come into lay. Most frequently the more advanced birds are first affected. The disease progresses through the flock until the birds are about fifteen to eighteen months old, after which time only a few losses occur.

Post-Mortem: Upon opening a bird that has range paralysis, no symptoms of a diagnostic nature are observed except an enlargement of the nerves leading to the wings or legs.

Treatment: Treatment for fowl paralysis is of no avail. Control lies in strict sanitation and the elimination of breeding flocks which have been infected. Several research workers, who have given considerable time to a study of this disease, state that it is of an inherited nature, coming either directly through the egg, or the offspring inheriting a weakness for the disease. This disease should not be confused with troubles caused by parasitism or deficiency diseases.

XII. FOWL POISONING

Poisoning in poultry is many times caused by the careless use of commercial sprays, rat poisons, salt or brine, disinfectants, and liquid milk products when used in metal containers. Some plants are also toxic to poultry.

Symptoms: The sudden death of several birds in the pen and several sick birds with discolored combs is usually suggestive of poisoning. The commercial sprays containing various amounts of arsenic; rat poisoning, containing arsenic or phosphorus; and salt generally show similar symptoms. Arsenic, phosphorus, and salt are corrosive and burn the mouth and intestinal tract. Nicotine sulphate (Black Leaf 40) is used frequently around poultry to kill lice and also as a vermifuge. The proper amounts are very beneficial but over-amounts cause sudden deaths in poultry. Care should be used in handling nicotine sulphate. Liquid milk in galvanized containers produces chemical compounds which are poisonous. Whorled milkweed and death comas cause nervous symptoms in poultry. The birds have difficulty in walking and twist their heads to the side.

Treatment: When poisoning is suspected, it is necessary to find the product that is causing the trouble before a definite

diagnosis can be made. Many infectious diseases resemble poisoning so post-mortem lesions alone are not sufficient to diagnose the trouble. The treatment consists of finding and removing the cause. The treatment of individual sick birds is usually unsuccessful. Lard and milk can be given along with a laxative of castor oil.

XIII. LIMBER-NECK (BOTULISM)

Limber-neck is due to a toxin which affects the nervous system, causing the muscles of the neck to become useless so that the head and neck are limp, hence the name. This toxin is produced by spore-forming organisms in spoiled foods, and causes a breaking down of the nervous system with the subsequent loss of the use of the muscles.

Symptoms and Post-Mortem Findings: The symptoms and post-mortem findings are the same as in the cases of poisons previously discussed with the additional symptom of feathers pulling out easily in the case of limber-neck due to the breaking down of the nervous system.

Treatment: As in the case of poisons, treatments are generally ineffective. The source of the toxin should be located and removed. Birds should be removed to a cool, shady place and given one teaspoonful of castor oil.

XIV. DISEASES DUE TO BACTERIA

A. INFECTIOUS BLOOD DISEASES

1. FOWL CHOLERA

Fowl cholera is common in domesticated fowls and is one of the most dreaded diseases of poultry. It is usually sudden in its appearance in a flock and before a definite diagnosis can be made a large number of birds have died.

Symptoms: Usually the first symptoms noticed by the poultryman is the finding of dead birds under the roost. A close examination of the dropping board may reveal that some of the birds have a yellowish-green diarrhea. In acute outbreaks no other symptoms may be observed. In chronic outbreaks, birds appear drowsy, standing around in darkened corners with head and tail drooped and feathers ruffled. The comb withers and turns a dark purple. The bird shows great thirst and carries a high temperature (110° to 112°). The bird may live for several days.

Post-Mortem: Upon opening a bird affected with fowl cholera, a general congestion is found throughout. Reddened areas may be seen on the flesh of the breast. The heart fat is usually studded with pin-point hemorrhages. Reddened areas may be observed on the heart. Frequently the mouth and throat are filled with a thick mucus.

Treatment: Treatment consists in isolating birds which are not affected. Should birds be cured of this disease, they might become carriers and serve as a source of other outbreaks. Move all well birds to a new location. Kill and burn all diseased birds, and thoroughly clean and disinfect the house, runs, and all equipment. A second or third cleaning and disinfecting should be given before birds are returned. Homemade chlorine solutions in the drinking water for a week or ten days are advised. The only certain way to detect this disease is to have a laboratory examination made.

2. FOWL TYPHOID (INFECTIOUS LEUKEMIA)

Prevalence of Disease: Fowl typhoid is one of the most troublesome of our infections poultry diseases in the irrigated sections of Arizona. Outbreaks have been reported from numerous districts operating under dry land conditions, however, the disease has not become widespread in such communities and the outbreaks usually occur after heavy rains.

Cause: Fowl typhoid in poultry is caused by a microscopic organism known as *Salmonella gallinarum*. It so closely resembles the fowl cholera and pullorum (bacillary white diarrhea) organisms that it is difficult for the layman to make a very definite diagnosis without the assistance of a trained laboratory technician.

Mode of Spread: The disease is usually introduced on the poultry farm through the purchase of diseased birds, hatching of infected eggs, unsterilized feed sacks and equipment, the feet of the caretaker, and more commonly by irrigation water which has run across infected soil. In some of the irrigated sections of the State an outbreak of fowl typhoid is almost certain to occur following an irrigation unless proper precautions are used in preventing the birds from coming in contact with such water or soil.

The relation between the organism responsible for fowl typhoid and pullorum make it possible to eliminate fowl typhoid carriers from the breeding flock by the blood test commonly employed to determine pullorum-infected birds. It has been definitely proven that fowl typhoid is transmittable to a chicken through the egg from which it is hatched. Hatcherymen should be extremely careful that all breeding flocks are tested and reacting birds are removed.

Symptoms: Birds infected with fowl typhoid organisms may exhibit various symptoms, depending somewhat upon the progress and the severity of the infection. Birds of any age may contract the disease. Numerous cases have been cited in chickens only a few days old.

In the more acute cases the birds may die before any definite symptoms are noticed. In the less acute, or lingering outbreaks, the bird shows a general wasting away with some paleness of comb and wattles, is inclined towards listlessness, stands around

in a drooped condition and usually has a green-yellowish diarrhea. So many different diseases will cause a bird to exhibit such symptoms that a post-mortem or laboratory examination is usually necessary for a definite diagnosis.

Post-Mortem Findings: Upon opening a bird that has an advanced case of fowl typhoid, it will be noted that the liver, spleen, and kidneys are somewhat enlarged and seem to be engorged with blood. On cutting through these organs, blood oozes from the cut surface. In the more advanced stages the liver will exhibit grayish or yellowish tumor-like spots varying in size. The kidneys have a more or less grayish appearance. Generally in advanced cases of this disease the intestinal tract will show an anemic condition with slight hemorrhages along the inner lining of the duodenal loop. The heart sometimes appears pale with grayish spots on the surface.

Control: Control of fowl typhoid is not a difficult matter if birds can be forced to consume only clean feeds and water. Since no treatment is available for this disease, all birds showing any symptoms whatever should be removed from the flock and destroyed. If allowed to run on the farm, those which recover will very likely become carriers of the disease and keep the premises infected.

A very thorough spraying of the houses and all equipment and sweeping the runs will greatly lessen the chances of the organism surviving. The use of chlorinated drinking water has been found most effective in preventing the spread of the disease. Ordinary homemade chlorinated water should be used for three or four days following each rain or irrigation (page 62). Blood testing all breeding flocks and rigid sanitation of incubators are also necessary control measures.

Treatment: No treatment has been found which is worthy of the effort involved in its administration. The most satisfactory results have been obtained by a rigid application of control measures.

3. PULLORUM DISEASE (BACILLARY WHITE DIARRHEA)

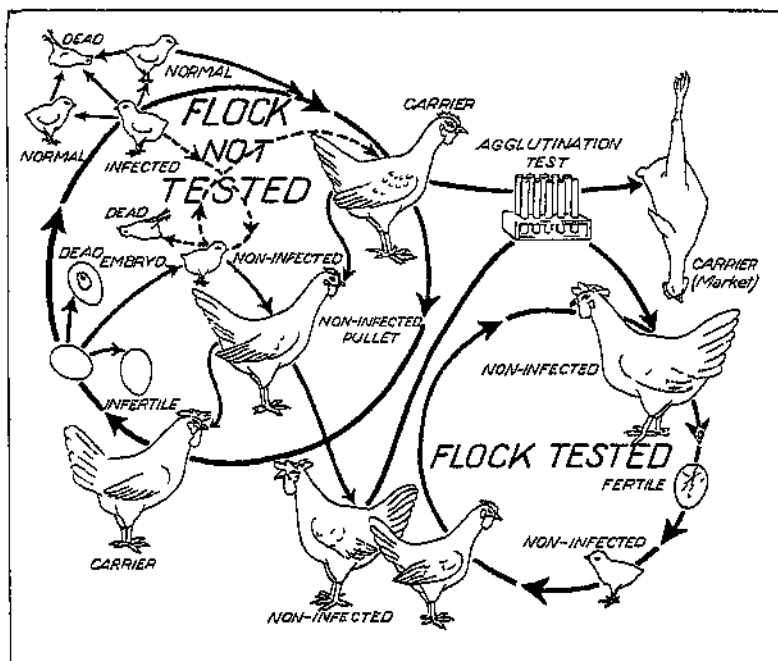
Pullorum disease is caused by the organism *Salmonella pullora* and is found in all sections where poultry is raised. Present day knowledge of this disease is very comprehensive and its application is doing much to lessen the losses occasioned by this disease. Many states have adopted an eradication program and poultrymen are becoming accustomed to buying pullorum-free chicks.

Symptoms: Affected chicks show very pronounced weakness and rapid death. Mortality is very high and reaches its peak from the eighth to the fourteenth day. In mature birds the disease shows no well-defined external symptoms. Production may be irregular or cease entirely, depending on the severity of the infection. Post-mortem examination will often show a deformed

blighted condition of the ovules. A few birds will die but the losses usually do not reach an epidemic form.

Treatment: No satisfactory treatment has been devised. Feeding the chicks good, clean, well-balanced feeds is recommended, in that it has a tendency to build up the vitality and make the chick more highly resistant. Dryness, sanitation, and proper temperatures are extremely important. Disinfectants in drink-water are not recommended.

Chicks affected with this disease will in all probability not be of value even if they survive, since they would become carriers and be a constant menace to the rest of the flock. The elimination of reactor birds from the flock offers the best means of combating pullorum disease (Figure 19). Fortunately, the methods of detecting reactors have been simplified to such an extent that they are within the reach of every poultryman.



Courtesy, Kansas State Agricultural College

Figure 19.—The life cycle of pullorum disease (bacillary white diarrhea), showing stage where the blood test breaks cycle.

An elimination program consists of detecting and removing the reactors and fumigating the incubators. Either the agglutination (laboratory tube) or the whole blood (field) tests are used. In Arizona the whole blood method has been adopted and used since 1930. The Agricultural Extension Service and the Poultry and Veterinary departments of the University have supervised this work. Records kept by poultrymen during 1933 showed the

losses in chicks from tested stock to be 4.9 per cent and from non-tested parentage to be 24.5 per cent up to six weeks of age.

The fumigation of incubators should also be used in conjunction with blood testing. Two methods of fumigating force draft incubators at the time of hatch have come into common usage. One is known as the formalized cheese cloth method, and the other the formaldehyde potassium permanganate method. Each of these methods, when properly carried out, has proved effective in controlling the spread of pullorum in forced draft incubators and exerts no detrimental effects on the chicks. Hatcherymen are advised to write to the University of Arizona for detailed information on fumigating incubators.

A Pullorum Elimination Program: (1) Test all breeding flocks and remove reactors from premises; (2) fumigate force draft incubators at time of hatch; (3) grow chicks on clean ground with clean equipment. The elimination of any one of these three steps will defeat the program.

4. SEPTICEMIA

Without a laboratory diagnosis, poultrymen will have difficulty in differentiating between a number of diseases belonging to the septicemia group. From a practical standpoint this differentiation is not necessary as control in all cases is very much the same. Fowl typhoid, fowl cholera, leukemia, blackhead, and apoplectic form are not to be treated but prevented by strict sanitation and the use of intestinal antiseptics, such as homemade chlorine solutions.

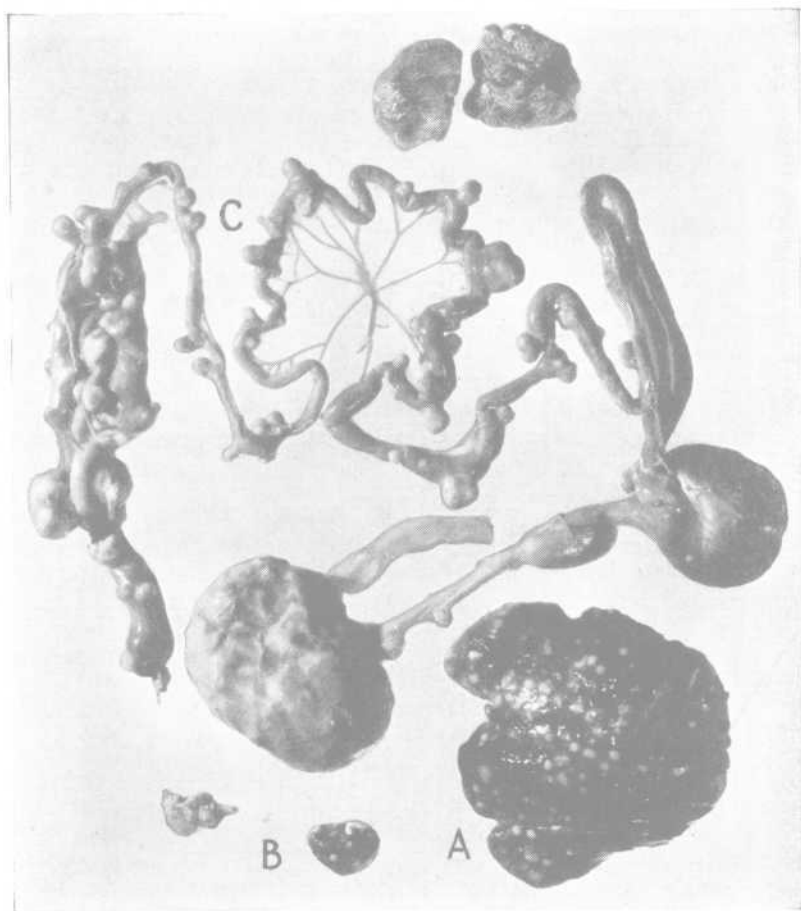
B. CHRONIC INFECTIOUS DISEASES

1. TUBERCULOSIS

Tuberculosis is caused by a microorganism (*Mycobacterium tuberculosis*) similar to that which causes the same disease in man. Poultrymen describe the disease as "going light." Filthy, damp, overcrowded houses and yards hasten the spread of the disease through a flock when infection is present, but are never responsible for the start of the disease. Very few cases have been found in the State.

Symptoms: Infected birds show symptoms of infection only in advanced stages. Emaciation, paleness of comb and shanks, together with great weakness are diagnostic. The fact that young birds do not show symptoms is probably due to the time necessary for the development of serious lesions. Post-mortem examination shows the mesentery, the ovary, the spleen, the liver, the kidneys, and the intestines studded with calcified nodules of varying sizes (Figure 20).

Treatment: Treatment of an infected bird is useless. In case of a general infestation, the complete disposal of the flock is recommended after which the yards and equipment should be cleaned and disinfected, then allowed to remain idle for a period of at least one year. Another method of control is to sell or kill



Courtesy, Kansas State Agricultural College.

Figure 20.—Viscera of a tubercular bird. A. Liver, B. spleen, and C. intestines.

all birds over one year of age. A third method is to test all birds by means of the tuberculin test. This consists of injecting tuberculin between the layers of the skin of one wattle. If tuberculosis is present, the wattle will swell. This should be administered by veterinarians and is practical only in the case of birds valuable as breeders. All birds killed or dying from this disease should be burned.

2. ASPERGILLOSIS (BROODER PNEUMONIA)

Brooder pneumonia is a disease of the pulmonary organs due to fungi infection. These fungi are nearly always of the *Aspergillus* group and are widely distributed in nature. Most often they are observed on moldy, damp litter and on grain. When birds scratch in such material they inhale the spores. All species

of birds are susceptible. Chicks are most likely to succumb to the disease while adults are quite resistant.

Symptoms: Those associated with pneumonia are accelerated breathing, rattling sound in the throat, diarrhea, sleepiness, and suffocation. Birds show signs of pain when handled. In older birds the disease generally occurs at intervals unless the exposure is great. Death usually follows in two to eight weeks. In brooder chicks the disease runs a very rapid course with a fatal termination in two to seven days.

Treatment: It is difficult to cure and its widespread distribution makes prevention essential. Use care in selecting grain and litter, and keep them dry. Do not overcrowd the house. Locate the source of infection immediately upon noticing symptoms. Filling the brooder room with a vapor made by placing a tablespoonful of turpentine in a pint of hot water and vaporizing by pouring on hot coals is sometimes recommended as a temporary relief.

XV. GENERAL DISEASES

A. BUMBLEFOOT

This name is given to abscesses on the feet of birds. These abscesses occur on the pad of the claws or in the interdigital spaces. They are filled with firm, cheesy pus showing many bacteria. *Staphylococcus aureus* is isolated in pure culture from the pus.

Symptoms: Bumblefoot usually follows injury to the foot caused by birds jumping off high perches onto hard surfaces or running on rocky ranges. The infection localizes in the feet and sometimes infects the joints and tendon sheaths of the legs.

Treatment: Bumblefoot is treated by opening the abscess and draining out the pus or removing it if it is hard. Following the removal of the pus, the wound should be treated with an antiseptic solution and then painted with iodine.

B. SUBCUTANEOUS EMPHYSEMA

The accumulation of a large amount of air under the skin is known as subcutaneous emphysema. This is caused by either a wound or rupture of an air sac.

Symptoms: The air confined beneath the skin produces distention, which in severe cases gives the bird the appearance of a ball.

Treatment: Temporary relief may be obtained by slitting the skin to release the air. There is no way of removing the cause.

XVI. TUMORS

Tumors are common in fowl, although they do not constitute an economic problem. They are most often encountered in birds

over two years of age. Treatment is generally of little value for external tumors and impossible for those occurring inside the bird since their presence is not generally known until after death (Figure 21).



Figure 21.—A case of tumor on the wattle. Tumors may appear on any part of the body.

XVII. DISEASES DUE TO DEFICIENT DIETS

A. NUTRITIONAL ROUP (AVITAMINOSIS A)

Nutritional roup is one of the common disease conditions found among poultry flocks in Arizona. In the high altitudes, where it is necessary to confine birds in adverse weather during the winter months, the disease is more prevalent. In the desert sections the disease is more prevalent during the summer months when a lack of moisture prevents the growing of green feed.

Symptoms: The disease in its early stages is not readily recognized. Later there is a loss of appetite, a gradual loss of flesh, a shrinking of the comb and a general ruffled condition of the feathers. As the disease advances, an excess of urates will be noted in the droppings and generally a swelling of the eyes which fills with a whitish, cheesy mass that is easily squeezed out by pressing against the side of the mass with the thumb. No odor is present at this stage of development.

Post-Mortem Findings: Upon opening a bird suffering from nutritional roup, an anemic condition will be observed. The

kidneys are enlarged and are filled with urates. The throat is generally studded with small white nodules (Figure 22).

Treatment: No treatment is prescribed for this disease except large quantities of Vitamin A. This vitamin is found in liberal quantities in green, tender feeds, certain cod-liver oils, yellow carrots, yellow corn, and bright green alfalfa products.

B. POLYNEURITIS (AVITAMINOSIS B)

Polyneuritis is a disease of the nervous system and is caused by a lack of Vitamin B. It is not prevalent in Arizona although cases are sometimes observed.

Symptoms: Birds affected by polyneuritis show a very nervous condition, sometimes ending in complete paralysis. Frequently the nerves of the neck or head are affected, causing the bird to lose control of the head. A bird will frequently get its head between its legs or over on its back and be unable to regain its normal posture.

Treatment: Treatment for polyneuritis consists in placing the birds on a diet rich in Vitamin B. This vitamin is found in yeast, wheat, and corn germ meal, as well as in the outer covering of most grains.

C. SCURVY (AVITAMINOSIS C)

Poultry authorities are not agreed as to the necessity of Vitamin C in the poultry ration. It is thought that poultry can synthesize Vitamin C.

D. RICKETS (AVITAMINOSIS D)

Rickets is not a common disease in poultry flocks in Arizona due to the fact that in most sections of the State it is possible to have the birds in the sunshine a large part of the time. It is sometimes found in flocks of baby chicks which are fed a ration low in Vitamin D and where the birds must be kept in the house over a long period of time.

Symptoms: The most characteristic symptom exhibited by a chicken suffering from rickets is leg weakness. The birds will appear weak in their legs and spend a good part of the time sitting around. When they are forced to move they do so with some difficulty, frequently balancing themselves with the tips of their wings. Upon examination, the bone of the leg will be found comparatively soft and easily bent or broken; otherwise the bird appears quite normal. No definite post-mortem symptoms are exhibited except in the bone structure.

Treatment: The safest treatment is the feeding of proper minerals and 1 to 2 per cent cod-liver oil which has been biologically tested for Vitamin D. This cod-liver oil may be mixed in the mash but it is more readily mixed in the grain on the average farm. Where birds have access to direct sunlight, little fear need be had of rickets.



Courtesy, Burt Heywang, U. S. Poultry Experiment Station, Glendale, Arizona.

Figure 22.—Characteristic nodular lesions as seen in Avitaminosis A.

E. STERILITY (AVITAMINOSIS E)

Vitamin E is frequently referred to as the antisterility vitamin because its absence in a ration of mammals causes sterility. It is thought by some that this vitamin is essential in rations of breeding flocks. This vitamin is found in green feeds, wheat middlings, and grain germs.

F. SOURCES OF VITAMINS* (Waite)

Material	A	B	C†	D	E	Remarks
Cod-liver oil (good grade).....	xxx	0	0	xxx	Low	Quality varies with source
Cod-liver oil (exposed to air).....		0	0	xx	0	
Direct sunlight.....				xxx		
Ultra-violet light.....				xxx		
Salmon oil.....	xx			xx		From cannery refuse con- taining viscera
Corn (yellow).....	xx	xxx	0		In germ	
Corn (white).....	Low	xxx	0			
Corn germs.....	0	xx	0		xx	
Cereal grains.....	x	xxx	0		In germs	
Wheat bran.....	x	xx	0		x	
Wheat middlings.....		xx	0		xx	
Wheat germs.....	xx	xxx	0		xxx	
Sprouted oats (green).....	x	xx	xx	x		
Germinated oats.....		xx				
Leafy parts of plants.....	xxx	xxx	xxx	x	xx	
Legume hays.....	xx	xx		x	xx	Clover, alfalfa, and soybean hay properly cured
Alfalfa-leaf meal.....	xx	xx	x	x	x	
Cabbage, fresh.....	xx	xxx	xxx			
Mangel.....	0	Trace	Trace			
Whole milk.....	xxx	xx	x	x	x	
Skim milk.....	x	xx	x	Low	Low	
Dried milk (skim).....	x	xx	x			
Buttermilk.....	x	xx	Low			
Butter.....	xxx	0	0	x	x	
Egg yolk.....	xxx	xx		xx	x	
Whole egg.....	xx	xx		xx	x	
Yeast.....	Low	xxx		x		
Orange juice.....	xx	xx	xxx	0	x	
Tomatoes.....	xx	xx	xxx			
Meat scrap.....	0	0	0	0		
Fish scrap.....	0	0	0	0		

*Information gathered by author from scattered sources with many helpful suggestions from Sybil L. Smith, U. S. Department of Agriculture.

†Vitamin C is not required by chickens.

Note.—A quickly deteriorates by oxidation on exposure to air. B is not easily injured by oxidation. E is not injured by acids or alkalis or refining processes.

G. PELLAGRA (AVITAMINOSIS G)

Vitamin G frequently is referred to as the antipellagrous vitamin. It is thought to be a part or one of the two divisions of Vitamin B. Vitamin G is present in dried milk, yeast, and green feeds.

XVIII. VICIOUS HABITS

A. EGG EATING

The habit of egg eating comes about through eggs being broken and left available to the fowls. When the habit once becomes established, some hens will deliberately break eggs in order to eat them. Eggs become broken due to a lack of nesting material, nests that are too small, failure to properly dispose of broody hens, breaking an egg and thoughtlessly throwing it to the birds, infrequent gathering, and similar causes.

Treatment: The remedy is very apparent, correct the causes and dispose of birds which have developed the habit.

B. FEATHER PULLING AND EATING

This vicious habit is most evident among fowls in confinement, both old and young. Very little trouble is experienced with birds having access to range. Evidently birds in restricted quarters have a tendency to be nervous, and lacking activity, take to feather pulling as a diversion.

Treatment: Once the practice becomes established, clip the upper beak of the offending fowl. The edge of the upper beak is cut in about $\frac{1}{8}$ inch about $\frac{1}{8}$ to $\frac{3}{16}$ inch from the tip. The tip is then pulled off, not cut off. This will leave the quick exposed. The fowl can still eat mash effectively but will find it painful to pull feathers. Certain mechanical devices available on the market are very satisfactory in eliminating this difficulty.

C. CANNIBALISM

Toe, tail, and body picking is referred to as cannibalism. It is more apparent where a large number of fowls are confined in a very limited space. Although young stock are more frequently troubled in this respect, the older fowls also take up this habit. Good management does not seem to prevent, or eliminate this trouble, for it creeps into a flock fed recommended rations, in properly designed houses, where sanitary conditions are of the best. Idleness, close contact and large numbers in one unit seem to be predominating reasons why chickens take the notion to "pick on each other."

Treatment: Any practice, which will tend to keep chickens busy, will, to a certain extent, eliminate cannibalism, especially where they are confined in large units. This might be a sequence

of practices, such as the feeding of green alfalfa hung around in convenient positions in the house, the feeding of semisolid butter-milk placed around the side walls near the floor, the scattering of pieces of red cloth in the pens where there will be competition for their possession, the placing of light litter on the floor and scattering grain in it, or similar ideas.

If the birds are confined and cannibalism breaks out, the best move would be to get the stock out on a green range, where they will have a wider territory to range over with green feed and bugs to keep them occupied.

Darkening of the room and the eliminating of any light streaks, which might focus attention, have proved helpful. The painting of windows and curtains a red color in order to throw a red hue over the interior of the brooder room has been used with some success. The use of red light-bulbs in a darkened brooder room has been recommended.

XIX. APPENDIX

A. TABLE FOR PREPARING SOLUTIONS (CLINE³)**If liquids are used:**

To make 1 % solution use 2½ tablespoonfuls to one (1) gallon of water
 To make 2 % solution use 5 tablespoonfuls to one (1) gallon of water
 To make 2½ % solution use 6¼ tablespoonfuls to one (1) gallon of water
 To make 5 % solution use 12½ tablespoonfuls to one (1) gallon of water

If dry chemicals are used:

To make a 1% solution use 2½ drams to one (1) quart of water
 To make a 2% solution use 5 drams to one (1) quart of water

B. APPROXIMATE EQUIVALENTS (BUSHNELL AND BRANDLY⁶)

1 level teaspoonful of potassium permanganate	equals	11	grams
1 level teaspoonful of crude catechu	equals	3	grams
1 level teaspoonful of copperas	equals	8	grams
1 level teaspoonful of nux vomica	equals	2.5	grams
1 level teaspoonful of copper sulphate	equals	9	grams
1 level teaspoonful of Epsom salts	equals	8	grams
1 gram of potassium permanganate	equals	amount that will stay on a five-cent piece.	

C. CORRECTIVE SOLUTION (CLINE⁵)

Limewater: Useful for correcting digestive trouble, diarrhea, etc. Limewater can be made by slacking 1 gallon of quick lime by pouring water over it slowly, until it is thoroughly slaked, finally covering the slaked lime with 5 gallons of water. Stir vigorously and let settle. When the water is clear, pour off and discard, being careful not to stir the residue. Add 10 gallons of fresh water, stir vigorously several times and let settle. This water may be used as limewater for drinking purposes when further diluted with an equal amount of clear water. As long as any undissolved lime is left, more water can be added, stirred several times and used as before.

D. PURGATIVES

Epsom Salts (Magnesium Sulphate), Glaubers Salts (Sodium Sulphate): Five level tablespoonfuls to each twenty-five adult fowls. For flock treatment, use 1 pound to 4 or 5 gallons of water or milk, or 1 pound mixed in sufficient ground feed for one hundred adult fowls. Smaller birds will consume the salts in proportion to their size.

Castor Oil: A cathartic indicated in constipation, diarrhea, or indigestion. One tablespoonful for each four adult fowls given in a wet mash. Smaller birds should be dosed in proportion to size.

⁵ *Turkey Production* by L. E. Cline.

⁶ *Kansas Bulletin* No. 247 by Bushnell and Brandly.

Calomel: A cathartic to be given at the rate of 3 grains for one adult fowl; 1 ounce for 160 fowls given in wet or dry mash.

E. DISINFECTANTS AND ANTISEPTICS (CLINE)

Lysol: To be used in about 2 per cent solution on mucous membranes or skin, or four to six tablespoonfuls to the gallon of water. Lysol should be used in stronger solutions for equipment. Soft water is preferred.

Cresol: To be used the same as Lysol.

Creolin: To be used the same as Lysol.

Mercuric Chloride (Corrosive Sublimate): Use one part to six thousand parts of water for drinking, or one part to five thousand parts of water for equipment.

Formaldehyde: May be used in about the same strength as Lysol.

Potassium Permanganate: Disinfects by oxidation. May be used to purify drinking water. In solution it soon gives up its oxygen, and thus no longer has disinfecting properties. For internal use, one part to twelve hundred parts of water, or one teaspoonful to 2 gallons of water. For disinfecting equipment, one tablespoonful to 1 gallon of water.

Sodium Hypochlorite: Sold in different strengths under many trade names. This is one of the most convenient and effective disinfectants. It mixes readily with water and leaves no stain. Sodium hypochlorite should be used at the rate of not more than $\frac{1}{2}$ of 1 per cent in drinking water, but two or three times as strong for disinfecting equipment.

Mercurochrome: A very effective, nonirritating disinfectant for use in 2 to 5 per cent solution for treating wounds, roup, sinus trouble, etc.

Argyrol: Efficient, penetrating and antiseptic and nonirritating. Use in 10 per cent solution. Useful in treating open wounds and can be put directly into the eye or nostril of fowls in treating roup or sinus trouble.

Sulphocarbolate Compound: Composed of calcium, zinc, sodium, and copper; an efficient intestinal antiseptic for treating diarrhea or indigestion. It is used at the rate of 30 grains to 1 gallon of drinking water and should not be placed in metal containers.

Boric Acid: A mild, nonirritating antiseptic, which can be used in strength up to saturated solutions for open wounds in the eyes and nostrils for individual treatment of colds, roup, or swellhead.

Carbolic Acid: A common antiseptic, which should be used in 5 per cent solution, or ten tablespoonfuls to the gallon of water.

Tincture of Iodine: Made by dissolving 70 grams of crystalline iodine and 50 grams of potassium iodide in sufficient alcohol to make 1,000 cubic centimeters. A very efficient and penetrating antiseptic. May be used in full strength in treating roup, swellhead, bruises, and cuts, but should not be repeated because of its caustic effect.

F. A DISINFECTANT WHITEWASH (BUSHNELL AND BRANDLY⁷)

The following formula is one that is recommended for preparing a whitewash that has a disinfectant value in addition to its other properties:

Hydrated lime	1½ pecks
Salt	2 pounds
Commercial lime-sulphur dip	4 gallons
Water	40 gallons

Equivalent amounts for a small quantity of the above whitewash are approximately as follows:

Hydrated lime	1 heaping quart
Salt	3 tablespoonfuls
Commercial lime-sulphur dip	1½ quarts
Water	4 gallons

G. MEDICATED VASELINE (BUSHNELL AND BRANDLY)

Vaseline	2 ounces
Crude carbolic acid	1 teaspoonful

H. FORMULA FOR SODIUM HYPOCHLORITE (CHLORINATED WATER)⁸

12 ounces chloride of lime
½ pound salt
1 gallon of water

I. FORMULA FOR BRONCHIAL SPRAY

1 pint of pine tar
4 ounces of beechwood creosote
4 ounces of eucalyptus oil
2 ounces of menthol crystals
2 gallons of kerosene oil

J. DOSAGE TABLE FOR ADULT FOWLS (BUSHNELL AND BRANDLY)

Drug	Therapeutic dose	Nontoxic dose	Toxic dose
Ammonium carbonate.....	10 to 15 gr.	20 gr.	
Areca nut (powdered).....	3 to 4 gr.	5 to 10 gr.	
Arecoline hydrobromide.....	0.1 gr.		
Calomel.....	5.0 gr.	30 gr.	
Capsicum.....	1 to 4 gr.	5 gr.	
Carbolic acid.....	0.5 gr.	2 gr. in sol.	5 gr. in sol.
Calcium phosphate ppt.....	15 gr.	30 gr.	1.25 dr.
Castor oil.....	1 dr.	6½ gr.	
Charcoal.....	5 gr.	10 gr.	
Chenopodium (oil of).....	5 minims		

⁷ *Poultry Diseases, Their Prevention and Control* (Kansas State Agricultural College).

⁸ A brown glass bottle should be used for this preparation and it should be kept away from sunlight. Do not hold stock solution longer than ten days.

Drug	Therapeutic dose	Nontoxic dose	Toxic dose
Cod-liver oil.....	1% of ration	5% of ration	
Cottonseed oil.....	1 dr.	144 cc. of 1 to 500 sol.	
Catecha (powdered).....	2 to 5 gr.		
Catecha (tincture of).....	2 to 5 minims		
Copper sulphate.....	1 to 2 gr.	3 to 10 gr.	15 gr.
Copperas.....	10 to 20 gr.	30 gr.	
Digitalis (fluid extract).....	10 to 20 minims	20 minims	
Epsom salts.....	1 dr.		
Gentian.....	10 gr.	2 dr.	1 ounce
Ginger.....	15 gr.	5 dr.	
Ipecac (powdered).....	.5 dr.	.75 dr.	1 dr.
Ipecac (fluid extract).....	.5 dr.	.75 dr.	1 dr.
Linseed oil (raw).....	1 dr.		
Mustard.....	5 to 7 gr.	10 gr.	
Nux vomica (powdered).....	10 to 15 gr.	2 dr.	1 ounce
Potassium permanganate.....	2 to 6 gr.	15 gr.	30 gr.
Quinine sulphate.....	2 to 3 gr.		
Salicylic acid.....	1 to 5 gr.	5 to 15 gr.	30 gr.
Santonin.....	.5 to 2 gr.	5 to 15 gr.	
Sodium chloride (common salt).....	5 gr.	1 1/4 to 1 3/4 dr.	2 1/2 dr.
Strychnine sulphate.....	.25 to .5 gr.	2 gr.	3 gr.
Sulphocarbonate of calcium.....	1/4 to 1/2 gr.		
Sulphocarbonate of sodium.....	1/4 to 1/2 gr.		
Sulphocarbonate of zinc.....	1/4 to 1/2 gr.		
Turpentine.....	.5 dr.	2 1/2 dr.	
Thymol.....	1 gr.	3 gr.	

K. QUESTIONNAIRE ON INFORMATION DESIRED WHEN WRITING REGARDING POULTRY DISEASES

Because of the vagueness of the description generally received by the Poultry Department of the University of Arizona, in reporting diseases of poultry, the following questionnaire was prepared. Answering the questions in detail will greatly assist us in diagnosing the disease.

1. How many chickens have you in your flock? How many are affected? How many have died?
2. At what age are the chickens affected?
3. When was the disease first noticed?
4. What are the outward symptoms?
5. Do the birds have lice? Mites?
6. When you autopsied a bird, did you find anything abnormal?
7. Were there any worms in the intestinal tract?
8. Are the chickens getting plenty of green feed?
9. Have you thrown any spoiled food into the chicken yard?
10. Do they have access to dish water? Paints?
11. Are there any dead carcasses on the premises?
12. Do the chickens use metal drinking fountains?
13. Are the houses dry, well-ventilated, and free from drafts?
14. Have the houses been cleaned and disinfected since the disease started?
15. What disposition is being made of the dead birds?

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