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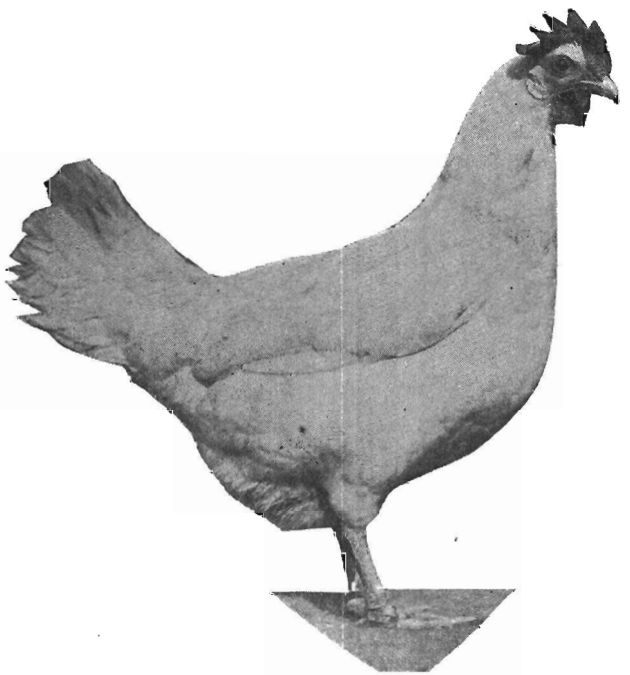
Pullorum Disease
(Contagious White Diarrhea)
of Poultry



Figue 1. Carriers of pullorum disease germs are normal in external appearance.

Agricultural Experiment Station
Oregon State Agricultural College
CORVALLIS

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Pullorum Disease (Contagious White Diarrhea) of Poultry

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PULLORUM disease has been commonly referred to as white diarrhea, B.W.D., contagious white diarrhea, etc. Since these names tend toward misunderstanding, the name bacillary diarrhea was adopted at this laboratory about six years ago. More recently a group of eastern laboratory workers voted to adopt the name pullorum disease and since that name is coming into general use, it is here accepted.

The disease is of outstanding economic importance to the poultry industry. It has therefore been given a prominent place in this state in the control of diseases of the chicken during the past eight years.

The present publication is not an attempt to cover the subject completely but should answer many of the more important questions being raised.

LOSSES

The greatest losses from the disease comprise chick deaths, decreased egg production, death of mature fowls, and lower hatchability. The loss of chicks sometimes results in another loss—namely, eventual unbalancing of the proportion of laying fowls to equipment and labor.

NATURE OF THE DISEASE

Germ disease. The cause of pullorum disease is a germ which can be seen and distinguished from others when proper methods are employed in the laboratory. Chilling, overheating, improper feeding, etc., can not produce the disease. Neither are these conditions necessary for the disease to develop.

Infection in laying fowls and chicks. Infected laying fowls commonly harbor the germ in the ovary or organ which produces the yolk of the egg. As a consequence, the germ is contained in some of the yolks. Most of these yolks appear normal. The percentage of eggs from infected females which carry the germ is highly variable. Infected fowls sometimes lay eggs for weeks at a time which are free of the germ and then may lay two or three eggs a month in which the germ is found. In the case of some infected fowls, most of the eggs may carry the germ. It should be apparent that this variation is one important factor in causing variation in the appearance of the disease.

Chicks hatched from eggs which contain the germ develop the disease. Infected chicks expose others in the same incubator and brooder. Chicks are most susceptible during the first few days of their lives. When a few days of age, they appear to resist infection to some extent. This probably

accounts for the fact that a group of healthy chicks, hatched separately, may show slight or no loss from pullorum disease when placed with infected chicks several days after hatching.

The death loss occurs chiefly during the first three weeks after hatching and is most prominent during the second week. Occasionally death occurs considerably beyond this period. Other infected chicks develop to maturity and customarily present the external appearance of normal fowls. These then carry the germ to the next generation, if kept as breeders.

Several days are required from the time infection of the chicks takes place until symptoms develop. As a consequence, it is common for chicks infected just after hatching to appear to be in good health for several days thereafter.

Infection in mature males. Mature males show a much lower percentage infection than mature females from the same stock. Apparently the germ does not find as favorable a place to live for extended periods in the male as it does in the female.

TRANSMISSION OF INFECTION OTHER THAN THROUGH EGG

The most serious transmission of infection occurs from chick to chick rather than egg to chick. Infection may also take place in mature fowls, but does not commonly occur to any considerable degree. A detailed consideration of some conditions will serve to explain transmission of infection other than directly through the hatching egg.

In incubator. Chicks harboring infection when hatched may convey large numbers of germs to others through droppings and material released from the chick down. The material from the down is particularly dangerous when vigorously circulated throughout the machine. This occurs to the greatest extent with the lower degrees of moisture content in the incubator. The germs may be blown about the incubator in the dust from the droppings of infected chicks. Droppings may act as a source of infection when eaten. This occurs more in an undarkened incubator.

A system which involves continuous operation with simultaneous incubation and hatching in the same compartment increases considerably the seriousness of the disease. This would not be a factor if the eggs were from stock absolutely free of infection. The difficulty may also be lessened by incubating in one compartment and hatching in another which is completely separated, or incubating in one machine and hatching in another. This does not, however, prevent the germ being distributed among the chicks of any given hatch. It merely prevents transmission from one hatch to the next, if disinfection of the hatching compartment is carried out between hatches, or exposes fewer chicks if the eggs are separated into smaller lots for hatching in separate units. In brief, the serious distribution of infection in the incubator is during hatching and subsequently.

Among chicks outside of incubator. Perhaps the most common means of distribution outside of the incubator is through droppings from infected chicks eaten by those which are healthy when hatched. This is less likely to occur if the chicks are kept in a dark place until fed. The droppings from infected chicks also contaminate the chick boxes and provide a means of

infecting subsequent hatches if the boxes are used again soon. The brooder-house and equipment may also be contaminated through droppings and be responsible for infection of chicks brooded in these quarters a few weeks later.

Eggs fed to chicks, especially infertile eggs from the incubators, if not heated in boiling water for one-half to one hour when cooked in quantity, may cause infection. The same applies to the feeding of egg-shells.

Among mature fowls. While infection commonly develops in chicks during the first few days after hatching through association with affected ones, mature stock under average conditions does not readily develop it. It has been demonstrated, however, that infection does develop in mature fowls. Very heavy infection of mature stock has been reported following the feeding of uncooked, infertile eggs from the incubator. Other possible sources of infection for mature fowls are eggs eaten in the laying-house coming from infected fowls, as well as droppings from such fowls and soil contaminated by them.

SYMPTOMS AND POSTMORTEM FINDINGS

Mature fowls. Affected mature fowls exhibit external evidence of the disease so seldom that for practical purposes they can be regarded as normal in this respect. Even when external evidence exists, the symptoms are similar to those occurring with other common diseases. The rather general belief that a soiled vent fluff is a symptom is without foundation.

Since infection in the male is comparatively uncommon and the evidence found in affected internal organs of such fowls is not especially characteristic, a study of the symptoms and postmortem findings in this sex is of slight value when made other than at a laboratory.

In contrast to the males, the females of laying age commonly show characteristic conditions. The appearance of the ovary, the organ which produces the yolk, is so characteristic in affected fowls that one can often recognize the disease by this means alone at postmortem. Recognition through this means is often of distinct practical importance to the flock owner in approximating the prevalence of the disease in a given flock. Such examination may be made of the fowls which die from miscellaneous causes.

The ovary of an affected molting hen, completely off production, presents the most readily recognized postmortem evidence, as at such a time there should be no yolks attached to the ovary to confuse one. The abnormal developing yolks attached to the ovary vary widely as to size and number. Such yolks, when typical, have elongated attachments, are angular, darkened, usually brownish, with a pasty content associated with a small amount of a distinctly oily liquid similar to linseed-oil in color. A knowledge of these characteristics is as a rule all that is necessary for the average postmortem diagnosis. Figures 2 (A) and 3 (A) illustrate infected ovaries. Figures 2 (B) and 3 (C, D, E, F) illustrate normal ones.

If an absolute diagnosis is desired, the germ may be obtained from affected ovaries by bacteriological methods at a laboratory.

Occasionally, abnormal ovaries not affected with pullorum disease may be mistaken for this type. For this reason, one not particularly trained in

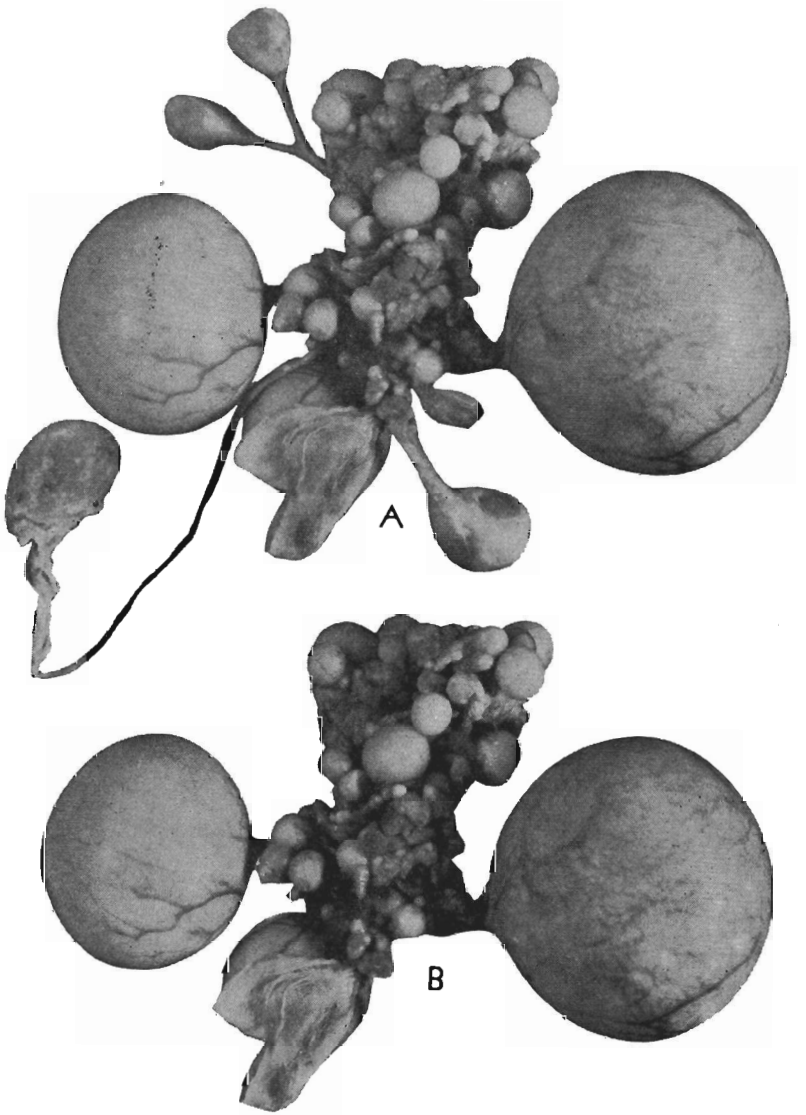

Figure 2. A. Pullorum disease ovary or yolk-producing organ of a laying fowl.
B. The same as Fig. 2, A, except all the "yolks" typical of pullorum disease have been removed, leaving only the normal appearing ones.

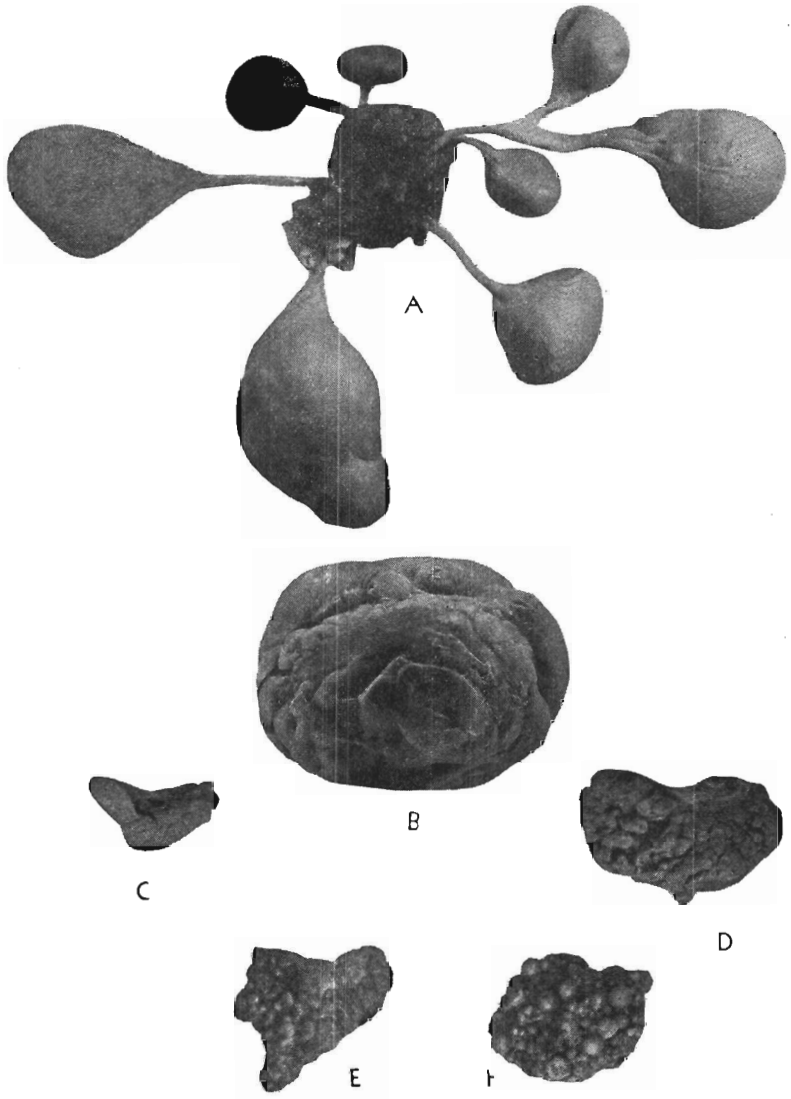

Figure 3. A. Ovary of a fowl of *laying age* but *not laying*. All the developing yolks are typical of pullorum disease.
B. A frequently noted abnormal, developing yolk but *not* due to infection.
C. Ovary of a pullet before coming into lay. The ovaries in fowls of this age appear the same whether infected or not.
D, E, and F. Healthy ovaries of fowls of *laying age* but *not laying*—all having developed yolks in the past.

diagnosis may be misled and should base judgment only upon finding the typical condition described above. Figure 3 (B) illustrates a common non-infectious type of yolk that is sometimes mistaken for that of pullorum disease.

Sometimes the disease causes the developing yolks to adhere to various abdominal organs. Egg production is mechanically impossible in some of these cases.

It is not uncommon to find infection of the heart, particularly in infected males. Where this occurs, there is usually a collection of whitish or yellowish, cheese-like material in the sac surrounding the heart. This condition, however, is also produced with other diseases.

Chicks. Losses during the brooding period should not average more than five per cent if the chicks are healthy and properly fed and cared for. Excessive losses during the first two or three weeks should cause one to suspect this infection. Obviously, other causes are also responsible for losses during this period, but pullorum disease is undoubtedly an outstanding one. It is always possible to attribute pullorum disease losses to other causes and this has been a common unnecessary error. Why guess when pullorum disease can be definitely determined?

Very definite symptoms are shown by affected chicks, but it is not possible to diagnose by this means alone. The same symptoms occur with other diseases. Postmortem examination of infected chicks often reveals definite lesions, particularly of the ceca (blind guts) and lungs. These lesions provide reasonable evidence to the experienced individual that some flock infection exists. This is not an accurate means of determining the percentage of infection. The most accurate diagnosis depends on bacteriological examination. This is the customary procedure when laboratory examination is made.

Lung infection occurs in the incubator at the time of hatching or shortly thereafter. This is especially true if the moisture is low or if the chicks are left in the incubator until considerably dried. This form of the disease is accompanied by the formation of yellowish, cheese-like areas in the lungs of chicks several days after hatching. Figure 4 (B) illustrates these lesions. Although similar formations may occur with other diseases (very uncommon in Oregon), this condition may be considered of practical value in determining the presence of pullorum disease.

Infection of the ceca is sometimes accompanied by collections of grayish, whitish, or yellowish material in these organs, such as is illustrated by Figure 4 (A). The literature indicates that many have mistaken such material produced as a result of pullorum disease to be due to coccidiosis. When this condition is found in chicks up to two weeks of age, one can reasonably consider that coccidiosis was not responsible, especially if there have been no pure blood droppings.

EFFECT OF MANAGEMENT AND FEEDING FACTORS

The belief exists that subjecting pullorum-infected flocks of chicks to mismanagement or improper feeding increases the loss from this disease. Although this appears to be a logical consequence, it remains a supposition, so far as the writers know, and not an established fact. That the infection is primarily responsible should not be lost sight of. Heavy losses

from pullorum disease in flocks brooded under excellent feeding and management conditions by poultry raisers of unquestioned ability and experience, have been noted often enough to be particularly significant. Also, the high percentage livability of chicks coming from stock free of pullorum disease, even when subjected to conditions of feeding and management generally conceded to be undesirable, is notable. There is but one deduction: efforts should be directed primarily toward producing pullorum-free chicks.

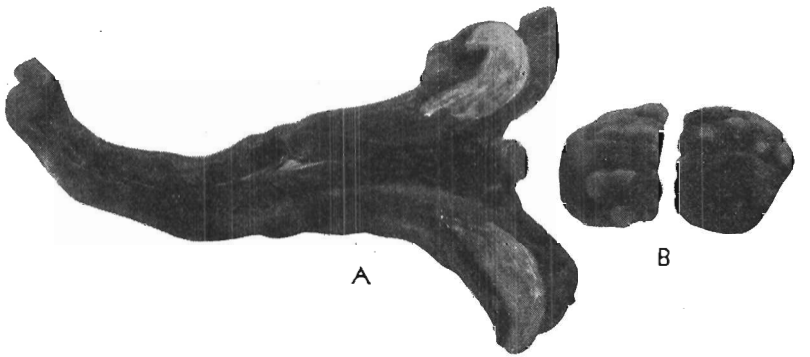

Figure 4. A. Ceca or "blind guts" of a six-day-old chick affected with pullorum disease. The ceca have been cut open at the blind ends, exposing the pale, firm, cheese-like cores frequently accompanying the disease.
B. Lungs or "lights" of a six day-old chick affected with pullorum disease. The pale areas represent cheese-like material caused by the infection.

BREED A FACTOR

Heavy breeds average a distinctly higher percentage of infection than light breeds. The prevalence of infection in heavy breeds makes the purchase of chicks from such stock particularly hazardous if the stock is not known to be reasonably free. This should not be taken as a blanket criticism of heavy breeds but as emphasizing the need for greater discrimination when buying this class of stock. There are flocks of heavy breeds in this state which are absolutely free of the infection. The free flocks should become more numerous and will as the buying public becomes more appreciative of the superior value of such stock.

INHERITED RESISTANCE

It has been established that some fowls are resistant to the disease through inheritance. Further investigations and reproduction of such stock are necessary before control through this means may be considered a satisfactory, large-scale control method.

SENDING CHICKS TO LABORATORY FOR DIAGNOSIS

If one suspects serious losses from pullorum disease, chicks may be sent to Oregon State Agricultural College, Department of Veterinary Medicine, Poultry Pathology, Corvallis, Oregon, for bacteriological diagnosis. Owing to the fact that no charge is made for this service and that

considerable work is involved, chicks should not be sent unless the losses are serious.

At least six live chicks showing droopiness should be selected. Dead chicks from under the hover should not be selected as they are often decomposed at the time shipped. Shipment should be made by parcel post. It is preferable that the chicks arrive before Saturday as otherwise they may be held in the post-office over Sunday. A report should not be expected short of approximately a week from the time chicks are shipped.

CONTROL

Extensive application of the agglutination test and accompanying control measures should result in a tremendous saving by eliminating unnecessary losses. Progress in this direction will be made directly as prejudice and personal opinion give way to established facts. It is encouraging to note that this is now rapidly taking place, and coordination of effort among the various branches of the industry to control the disease is apparent.

TREATMENT

No satisfactory treatment has been established. However, very satisfactory results may be obtained by prevention.

PREVENTION

The basis of prevention is the application of highly reliable tests to determine which fowls in infected breeding flocks harbor infection, removing them, and locating breeding flocks which are free of infection. Intelligent use of testing eventually eradicates the disease from infected flocks. The nominal testing cost makes this economical.

Several methods of testing are available, but the serum-agglutination methods are recognized by authorities as the most reliable yet developed. In view of the inquiries received, a brief description of these and other methods is considered of value.

TESTING METHODS

Serum-agglutination methods. Two distinct tests come under this head. In both instances it is necessary to have a sample of blood from each fowl in the flock. This is readily obtained from the wing vein without any effect on the general health of the fowl. One bleeder with sufficient help should satisfactorily bleed about 100 or more fowls per hour. The blood samples are sent to the laboratory. There the serum from the blood is used for conducting a test which designates with a high degree of accuracy whether the fowl supplying the blood has the disease. Fowls affected are known as positives or reactors. Non-infected ones are known as negatives or non-reactors. Approximately three-fourths of a million serum-agglutination tests have been conducted at the Oregon Agricultural Experiment Station the past eight years.

Unless otherwise stated, the term "testing" is used in this publication to designate serum-agglutination testing.

Whole-blood-agglutination methods. Three tests may be conducted in this manner. In one a drop of whole blood is mixed with an uncolored suspension of the pullorum disease germ. The test is conducted in the poultry-house. This test was widely heralded by commercial interests before sufficient investigations had been conducted to establish its value. The investigational work which has been done with this method has shown its use as a practical control method to be unjustifiable because of its failure to detect a sufficient percentage of infected fowls. This test has been practically abandoned.

More recently a modification of this test has been developed. The test is conducted as described except that a preservative is used and a colored suspension of the germ is employed. This gives promise of being more accurate in the hands of *trained workers* than the test just described, but not as accurate as the serum-agglutination tests. Further experimental work is necessary to establish its accuracy under a wide variety of conditions such as are encountered in routine testing.

The third test by the whole-blood-agglutination method is the same as the second, except that the drop of blood is dried on a small piece of glass and sent to the laboratory for testing. This is also open to objection regarding accuracy.

Pullorin method. This is commonly spoken of as the "wattle test" and consists in using a hypodermic needle to inject into the skin of the wattle a small amount of material known as pullorin, which contains the product produced by the germ. Each fowl must then be handled again to examine for a reaction.

In the hands of almost all investigators throughout the world who have compared the tests, this test has not proved as accurate as the serum-agglutination tests. It has frequently been found decidedly inferior to the serum-agglutination methods. It has therefore not been advocated for control work in Oregon. When applied by untrained individuals, undoubtedly many fowls have been reported as reactors when they were not infected and many infected fowls have been missed. Poultry raisers for whom this type of testing has been done would do well to have the results checked by the application of an authentic serum-agglutination test before disposing of many reactors.

TESTING PLANS

A number of testing plans are available. The one to be chosen depends on the circumstances surrounding the flocks to be tested. Such factors as size of flock, percentage infection, breed, economic value, percentage losses in the chicks, and customer demands should govern the testing plan used. Regardless of the plan followed, the goal of the flock owner should be eventually to have stock *absolutely free* of the disease.

Some of the plans being used are:

1. Testing annually all the fowls of laying age and males to which they are mated, until free of infection.
2. Testing annually only the hens and males to which they are mated, until free, and using only these fowls to produce replacement stock on that farm.

3. Testing all fowls of laying age and males to which they are mated, each month or six weeks until passing two successive tests without reactors.
4. Testing all fowls of laying age and males to which they are mated, every other year after the stock has been established as free of infection.

The first plan is the most common one employed in this state. A preferable plan at present for the average breeding flock would be to test the hens and males to which they are mated twice each year, or until passing two tests free, with an interval of a month or six weeks between tests, and then use only this stock for producing chicks which are later to be used for breeding. Absolute freedom from infection is not as important in the case of commercial egg stock as where breeding stock is involved.

Where pullets are tested, it is thought best to wait until they have been producing thirty to fifty per cent for about two months.

ADDITIONAL GUIDES FOR ADOPTING A TESTING PLAN

Universal application of the agglutination test is neither necessary nor advisable. Breeders who have flocks of minor breeding value should replace them with stock from tested flocks of as good or better breeding, particularly stock *free* of the infection.

The infected flock. Generally speaking, it is not advisable to attempt eradication of the disease from flocks which show approximately twenty per cent or more reactors. Such stock should not be used for breeding. It is preferable in such instances to obtain stock from a source free of the infection and discard the infected stock. If for various reasons it is desirable to retain flocks showing twenty per cent or more reactors, it is particularly important that a retest of the negatives to the first test be made before taking hatching eggs. There should be an interval of at least a month or six weeks between these tests.

During the first stages of a testing program, low-percentage reacting breeding flocks of merit must of necessity be recognized as acceptable to quite a large extent as a necessary evil. As elimination of the disease proceeds, this point of view becomes less justifiable.

The free flock. In the beginning of a pullorum-disease control program a small percentage of the flocks will be found to show no reactors to a first test. Such flocks can not be safely regarded as absolutely free of the disease. If no reactors are found by a second test in about one to six months following the first, and both tests include all the fowls on the farm, one can reasonably regard them as free. It is then acceptable to test no oftener than once every two or more years as long as they remain free.

The reacting non-infected fowl. Testing results occasionally in a fowl being pronounced a reactor when not infected—for example, one or two fowls in a flock of 500 to 1,000. In view of this fact, it is sometimes important to establish the diagnosis by making a postmortem examination of such cases to observe the ovary. Bacteriological examination is necessary for the most complete diagnosis if one desires to establish a free flock.

THOSE ELIGIBLE TO BLEED FOWLS FOR TESTING

The services of the Oregon Agricultural Experiment Station poultry disease laboratory, which conducts the official agglutination test for pullorum disease in this state, are available to any one in the state. Poultry raisers may bleed their own fowls or not, as they see fit. The test at the laboratory is the same and is always considered as official, regardless of the arrangements made for bleeding. If, however, one desires the *bleeding* recognized as official, the bleeder must be deputized as an official bleeder by the State Department of Agriculture, Division of Animal Industry, Salem. The regulatory part of the testing program comes under the jurisdiction of that office.

TIME OF YEAR TO TEST

The test may be applied any time of the year. Less care is necessary to prevent spoilage of the blood samples during the fall and winter, however, and most of the testing is done then. In addition to the season, the age of stock to be tested also determines the time of the year to test.

Pullets. It is not generally considered advisable to test pullets until they have been in thirty to fifty per cent egg production for about two months. Testing pullets on this basis almost without exception permits of fall and winter testing, in this state.

Hens. The molting period, or fall and winter, affords an ideal time to test hens. At that time they can be tested with the least possible interference with egg production.

THE TEST CHARGE

The present laboratory charge is three cents per test or blood sample. This covers supplying the tubes, corked and labeled, the test, and mailing the test report. The flock owner pays the shipping charges on the tubes from and to the laboratory.

It is conservatively estimated that a breeding female in one season will produce twenty-five saleable chicks. On this basis it would take forty females to produce one thousand day-old chicks during a season. The laboratory charge for one test of forty fowls, at 3¢ per test, would be $1.20, or slightly more than $\frac{1}{8}$¢ per chick. This expense, together with minor additions incurred through testing males and expressing the blood samples, in many instances constitutes the only monetary outlay by the flock owner. It is not the intention to imply that this constitutes the entire expense of testing. Such cost factors as are incurred through bleeding, banding, removal of reactors, and similar activities are highly variable. These may result in no cash outlay for testing, as the flock owner may do all this work and the fowls may already have been banded for trap-nest records.

It should not be lost sight of that after a flock has been established as free of the disease the *per chick* cost of testing materially decreases.

PRESUMED ERRATIC RESULTS FROM TESTING

It is customary for flocks to show a decided drop in percentage reactors to subsequent tests. Occasionally an increase in the percentage results. In these instances there is a tendency to lose faith in the value of

the test. It should be distinctly kept in mind that such increases, though not necessarily, are often due to carelessness or lack of information on the part of the flock owner. Discussion of a few common causes for this situation should serve to clarify it and should also serve to emphasize that eradication of the disease and maintenance of a free flock are of more concern than merely the application of the test.

Hatching eggs from various farms. This practice, including custom hatching, is the most fertile source of introducing infection and increasing the percentage of reactors. This is especially true where eggs from heavy breeds are hatched and large machines with one compartment are used for incubating and hatching or for hatching only, and the chicks in the same compartment are from several farms, including infected flocks for part of them.

Flock owners frequently sell eggs to hatcheries operating as just described and have their own chicks hatched by these hatcheries. They may thus bring back a higher percentage of infected fowls than exists in the parent stock. This statement should not be interpreted to signify that obtaining eggs from several farms and hatching them in one incubator is unjustified. It is entirely justifiable when the conditions are right. If assurance can not be given that the foregoing hazard will be avoided, such flock owners, especially those having free flocks, should make other arrangement. This is not only beneficial to the owner of the breeding flock and the purchasers of the chicks, but also should be to the hatchery owner. The gain to the hatchery owner results in part from the opportunity to obtain eggs from flocks with less infection.

Introduction of new stock. Special precautions are advisable when introducing new stock into a flock which is free of pullorum disease. If possible, the new stock should come from a free flock. In any case the stock to be introduced should be tested before being placed in the flock. New blood may be introduced with greater safety, so far as pullorum disease is concerned, by obtaining males only for this purpose.

Percentage testing. Sometimes a percentage of a breeding flock is tested and is followed the next year by an increase in the percentage of reactors instead of a decrease. This may be expected. This method is of no value in eradicating the disease.

Insanitary premises. If the premises are insanitary, less satisfactory results are likely to follow testing of infected flocks. Flocks which are free may continue so even though the sanitation is not correct, but this should not be taken to signify that sanitation is not a factor if the flock is infected.

Disposal of reactors. Reacting fowls should be removed from the flock as soon as possible. The longer they are kept in the flock the greater the danger of others contracting the disease from them.

Since infected fowls frequently return a profit when used for production of commercial eggs, it is sometimes profitable to segregate them and keep them for this purpose. This depends largely on the number that are infected, the price of eggs, the accommodations, and whether one has flocks on the place which are absolutely free and which might be jeopardized.

MISCELLANEOUS PREVENTIVE MEASURES

Disinfection. This has a place as an aid in control, but its value is sometimes overestimated. The method used depends on what is to be disinfected. As a first essential in proper disinfection, everything to be disinfected should be thoroughly cleaned.

Incubator disinfection, when no eggs or chicks are present, has been successfully and conveniently carried out through the use of formaldehyde, as this permits of confining the gas. This may be done by mixing 1.5 cubic centimeters (approximately one-third teaspoonful) of formalin and 1.0 gram (approximately one-fifth teaspoonful) of potassium permanganate for each cubic foot of air space in the incubator and then tightly closing it. The container in which the chemicals are mixed should be non-metallic, tall enough to prevent boiling over, preferably with a rounded bottom, and should be placed in a small pan of water or on sand. The incubator is kept closed for at least one-half hour, preferably overnight.

Disinfection of the incubator, when eggs or hatching chicks are in a compartment being disinfected or in a communicating compartment, constitutes a risk. This is especially true during the first few days of incubation. One should follow carefully the instructions of the manufacturer, if any are available, when disinfecting under these conditions. Disinfection of separate incubators, or separate hatching compartments may be carried out safely and effectively. This is done between hatches and is particularly desirable as a routine practice if trouble with pullorum disease has developed in chicks hatched in such machines. Disinfection may be made more effective by maintaining a high humidity.

Incubator moisture. A low moisture content in the incubator increases the danger of spreading infection. For this reason it is considered best to operate the incubator at as high a moisture content as is consistent with good hatching. Removing the chicks, while still moist, from the incubator to shipping boxes in a *warm* room should also aid in pullorum-disease control.

Chick culling. Culling and killing all weak chicks just after hatching should assist in reducing the spread of infection. This is especially indicated for those which evidence vent fluff soiled with droppings.

Early chick feeding. Feeding chicks twenty-four hours after hatching, a practice more common in recent years, may be responsible for increased losses. It is thought that at that age chicks are more susceptible to infection than at sixty or more hours after hatching. This fact should be particularly taken into consideration if there is much prospect of infection.

THE DISEASE IN TURKEYS

The turkey industry has suffered comparatively slight loss from pullorum disease. It is becoming increasingly important through the advent of large-scale artificial incubation of turkey eggs and the rather common practice of *hatching* chicken and turkey eggs in the same machine at the same time. If the turkey producers of today use incubators free of pullorum disease germs and do not hatch turkey and chicken eggs in the same incubator, considerable loss may be avoided in the future. If the same

incubator is used for hatching turkey and chicken eggs, but at different times, the incubator should be disinfected before the turkey eggs are placed in it. This is a good practice between hatches, regardless of the kind of eggs set.

Comparatively little is known regarding pullorum disease in turkeys. There is therefore need for more investigational work before several important questions can be answered. In the meantime, direct comparison of the disease in chickens to that of turkeys should be considered with caution.

TESTING FOR ADVERTISING PURPOSES

Testing for advertising advantage solely is fundamentally unsound. The basis of testing should be *reduction* and *eradication* of the disease. Where this principle is adhered to, increased livability of the chicks results and repeat orders for chicks automatically follow.

The expression "tested stock" may have no real significance. A number of questions may be raised in establishing whether such a statement signifies what it should. Has a reliable test been used? If so, is a test report available to substantiate it? Have all the fowls been tested? Are the flocks free of infection? If not free, what percentage are reactors? Have the reactors actually been removed? Are the testing results being nullified by hatching eggs from infected stock with those from free stock?

Those having testing done at the Oregon Agricultural Experiment Station laboratory are provided with a test report. These reports include the name of the flock owner, the date of testing, number of fowls tested, percentage of reactors, as well as other information. Three copies of each test report are made, one of which is kept on file by the State Department of Agriculture, Division of Animal Industry, Salem. Those desiring testing information should obtain this from the flock owner, as this is held in confidence so far as the laboratory is concerned.

SUGGESTIONS TO PURCHASERS OF STOCK

The safest plan is to purchase eggs, chicks, or other stock from a source determined by proper testing to be free of infection. Infected flocks which have been consistently tested and the reactors eliminated should provide stock with a comparatively low percentage infection. The loss of chicks from tested stock which is not absolutely free averages less than if this stock is not tested. Stock from untested sources should not be purchased unless reliable information is available that chicks from such sources are *consistently* showing good livability in the hands of a number of purchasers. An occasional low percentage loss in chicks is not sufficient, as this sometimes occurs even though the parent stock shows a rather high percentage infection.

ARRANGEMENTS FOR TESTING

Those desiring to have their flocks tested by the serum-agglutination method will be mailed special instructions pertaining to bleeding procedure, costs, etc., upon request.

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