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Questions and Answers  
Concerning  
Pullorum Disease

By H. Van Roekel

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The purpose of **this bulletin is to make available for the Massachusetts poultry industry information which will aid the poultrymen to improve their methods of establishing and maintaining pullorum disease-free flocks.**

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MASSACHUSETTS STATE COLLEGE  
AMHERST, MASS.

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## QUESTIONS AND ANSWERS CONCERNING PULLORUM DISEASE

By H. Van Roekel,<sup>1</sup> Chief of Laboratory  
Poultry Disease Control

### Introduction

Since numerous inquiries concerning pullorum disease have come to the attention of the laboratory, it has been deemed advisable to present this information in the form of questions and answers which should serve the needs of the Massachusetts poultry industry. In preparing this bulletin an effort has been made to present the information in such a manner that poultrymen will be able to understand the nature, eradication, and prevention of the disease.

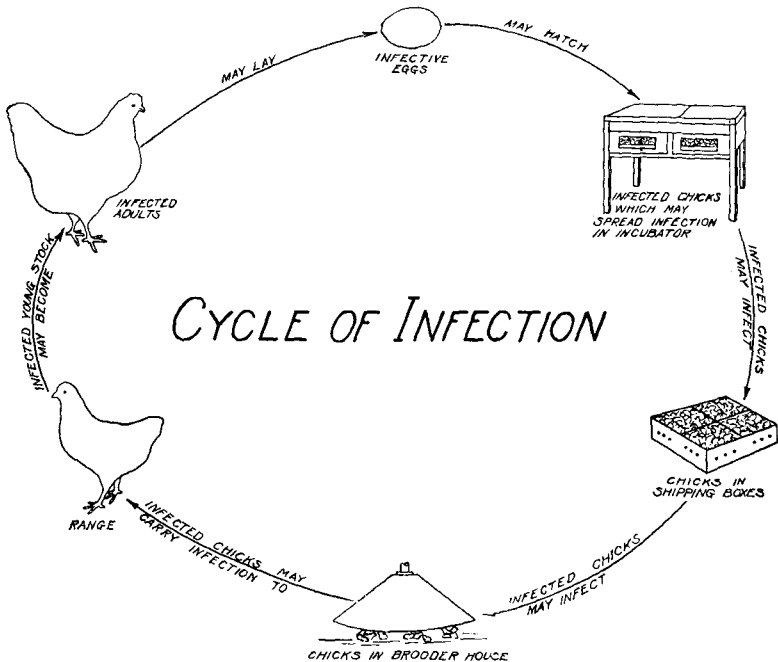


Figure 1.—Pullorum Disease Infection in a Flock May Follow This Cycle.

The disease can be eradicated either by breaking the cycle of infection through eliminating the infected birds by means of the macroscopic agglutination test, or by disposing of the entire infected flock and replacing it with pullorum disease-free stock.

<sup>1</sup>Assisted by K. L. Bullis, O. S. Flint, and Miriam K. Clarke. Appreciation is extended to Dr. John B. Lentz, Head of the Department of Veterinary Science, for the suggestions made concerning this bulletin.

### History and Distribution of the Disease

1.—When was pullorum disease discovered? This disease was first reported late in the nineteenth century. In 1899, Rettger isolated the causative organism from infected chicks. The organism was first named *Bacterium pullorum* and the disease was designated bacillary white diarrhea. In 1925, the name of the organism was changed to *Salmonella pullorum*. In 1928, the name bacillary white diarrhea was changed to pullorum disease.

2.—What is the geographical distribution of the disease? Reports of the disease have come to our attention from England, continental Europe, Asia, Africa, Australia, Canada, and approximately every state in the United States.

### Nature and Dissemination of the Disease

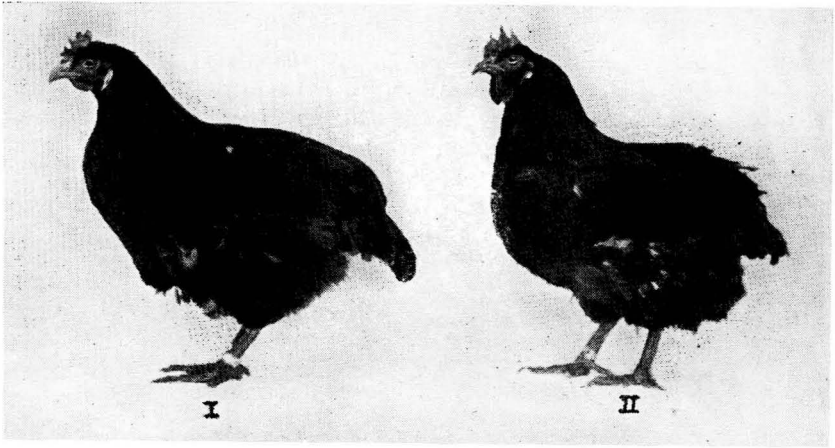
3.—What is the cause of pullorum disease? The cause is an infectious agent, a microscopic organism known as *Salmonella pullorum*.



Photograph 1.—*Salmonella pullorum*, the Causative Organism of Pullorum Disease.

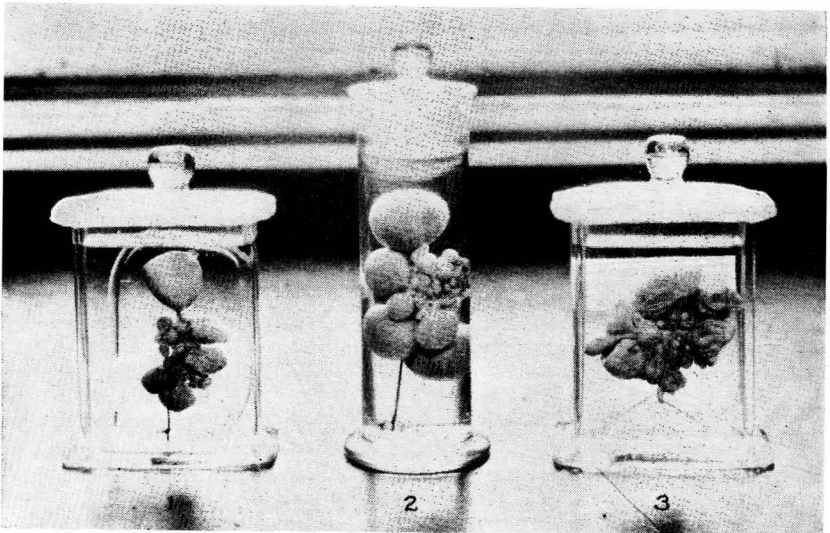
The cells were taken from a 24-hour plain agar culture. Magnified 1200 x. Refer to question 3. (The author wishes to acknowledge his indebtedness to Dr. Theodore Soller, Amherst College, for taking this photomicrograph.)

4.—How does the disease affect adult birds? The disease usually manifests itself in adults in a chronic form. Infected birds as a rule cannot be differentiated from the non-infected by physical examination. While the organism may localize in various parts of the body, it is most frequently found in the ovary. Focal infections of this organism have been observed in the pericardial sac, lungs, remnant yolk stalk, spleen, testicles, ovary, abdominal cysts, and digital cushion of the foot. Frequently these focal infections break down, liberate the organism into the blood stream, and cause death of the bird. This seems to occur particularly when some debilitating process is present. Occasionally sporadic outbreaks of an acute form are observed in flocks and the disease pursues a definite course, accompanied by a high mortality.



Photograph 2.—Bird No. I—Non-infected Hen; Bird No. II—Infected Hen.

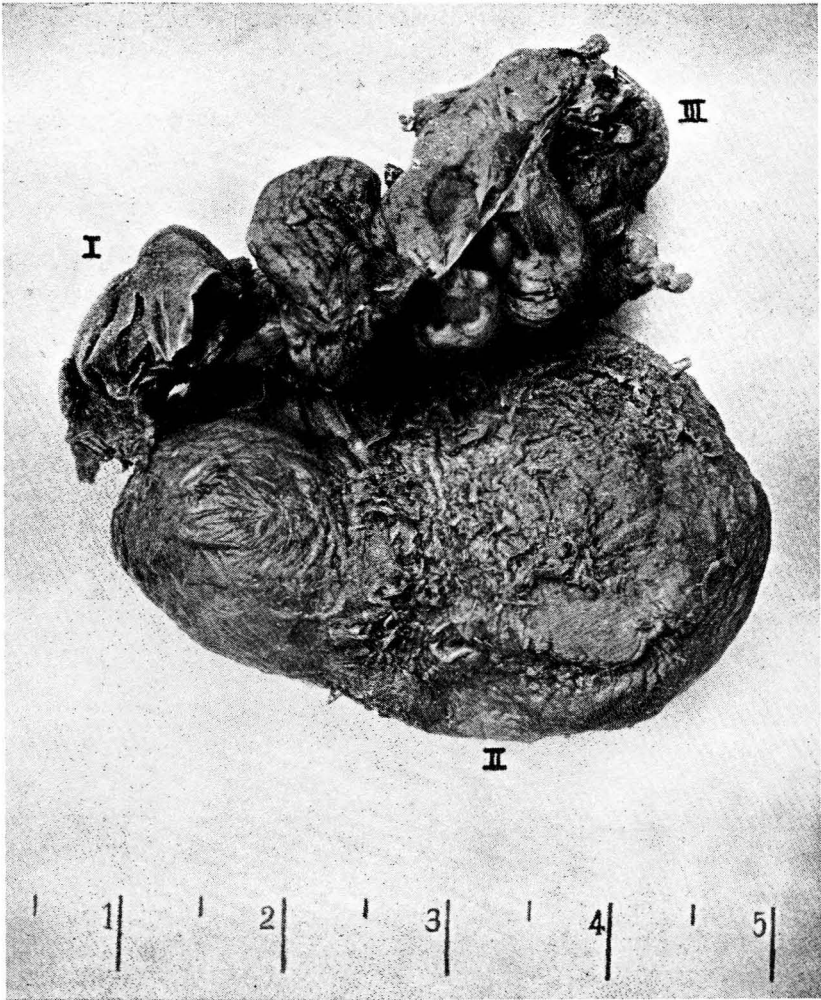
Pullorum diseased birds as a rule cannot be differentiated from the non-infected by physical examination. Apparently normal, well-developed birds may be affected with the disease. Infection in such birds can be detected either by the agglutination test or by bacteriological examination. Refer to questions 4 and 33.



Photograph 3—Ovaries Removed from Hens.

Specimens I and III, showing irregular shaped, discolored and pedunculated ova, are affected with pullorum disease. Specimen II, showing normal ova, is not affected. Refer to question 4.

5.—Can the disease spread among adult birds? Yes. Non-infected adults may contract the disease when placed in contact with infected birds. The rate of spread is influenced by the condition of the flock and type of management, but generally speaking it appears to be slow.

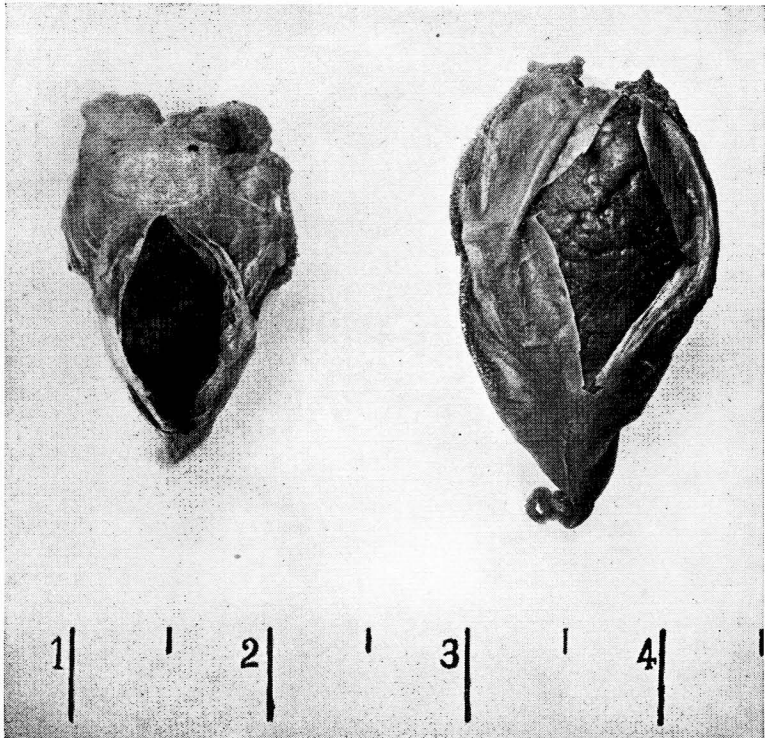


**Photograph 4—Oviduct Removed from an Infected Hen.**

Parts I and II are the funnel and albumen secreting portions of the oviduct, respectively. The funnel or fimbriated portion shows an enlarged and thickened wall. The albumen secreting portion (anterior end) is impacted with hard, dried egg material. The exterior surface of the impacted region is roughened due to inflammatory conditions. Such changes may be found occasionally as a result of inflammation of the oviduct and other abdominal organs. Part III is the shell gland portion. Refer to question 4.

6.—**Are male birds affected?** Yes. Males may contract the disease. The percentage of reactors among tested males appears to be less than among tested females. It is probable that the sex difference is not the only factor responsible for the difference in the percentages of reactors.

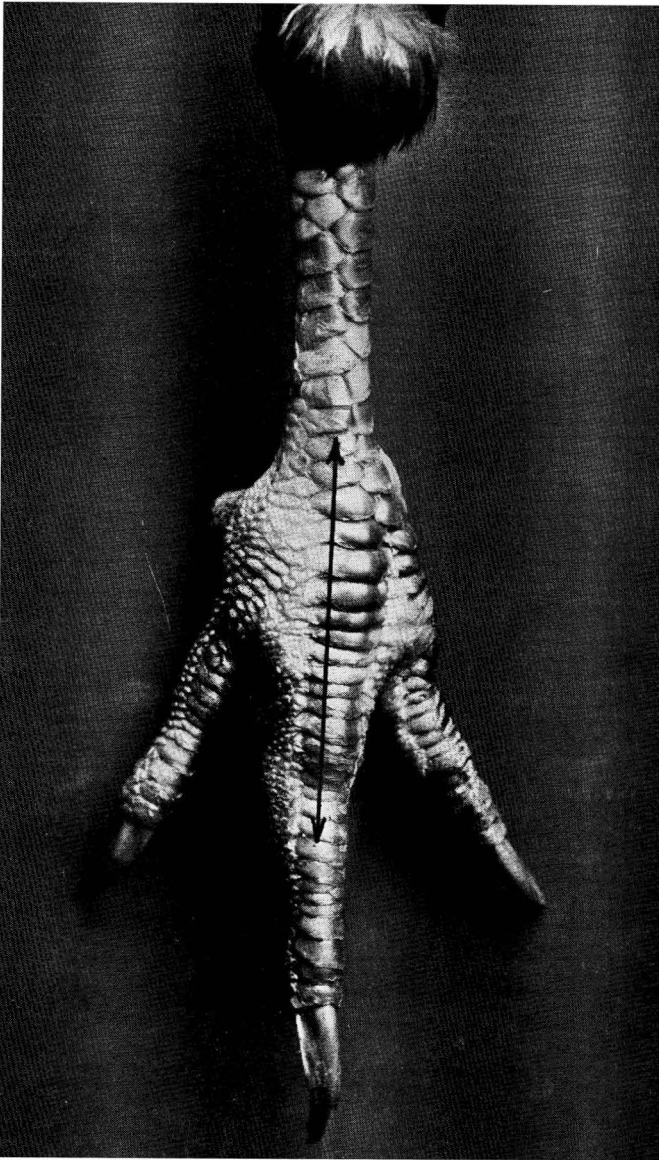
7.—**Do males play a role in dissemination?** Conclusive evidence is not available to show that males spread the disease. Focal infections have been observed in the testicles. Also, one might assume that the infected male could eliminate the organism in the droppings, as occurs in diseased females. Furthermore, males might act as mechanical carriers in transmitting the organism from the cloaca of an infected female to the cloaca of a non-infected female.



Photograph 5.—The heart on the left is apparently normal and was removed from a non-infected hen. The heart on the right shows enlargement, thickening of the heart sac, and roughened heart surface. *S. pullorum* was isolated from the pericardial fluid. Refer to question 4.

8.—**What is a pullorum disease “carrier”?** A “carrier” is an infected bird that has not succumbed to the disease during chickhood or has become infected before or during maturity.

9.—**How is the organism eliminated by adult birds?** The organism may be eliminated by means of the droppings (secretions and excretions from the digestive, urinary, and reproductive tracts), by eggs, abrasions in the skin,

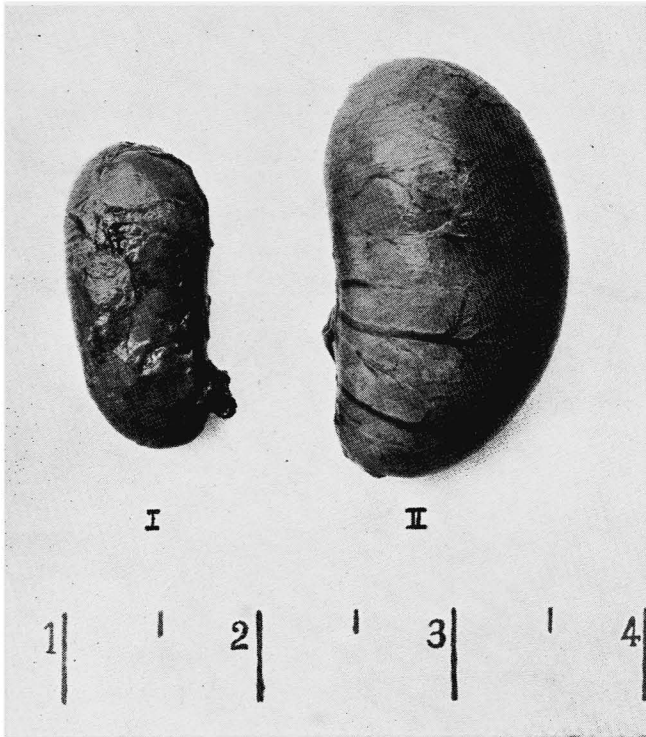


**Photograph 6.—Lower Portion of a Leg of a Pullorum Disease Reactor.**

**Note the enlargement of the foot in the region of the arrow. The pad of the foot had an abrasion in the skin which was covered with a scab. *S. pullorum* was isolated from pus in the region of the digital cushion. Refer to question 4.**

and possibly from the mouth, nostrils, and eyes. The organism has been isolated from an abscess in the foot, which at one time appeared to have communicated with the exterior. The organism has also been found in the respiratory system. According to investigations, the presence of the organism has been observed in eggs and droppings.

**10.—Through what avenues may birds become infected?** Birds have been infected by way of the digestive and respiratory tracts, eyes, abrasions in the skin, and cloaca.



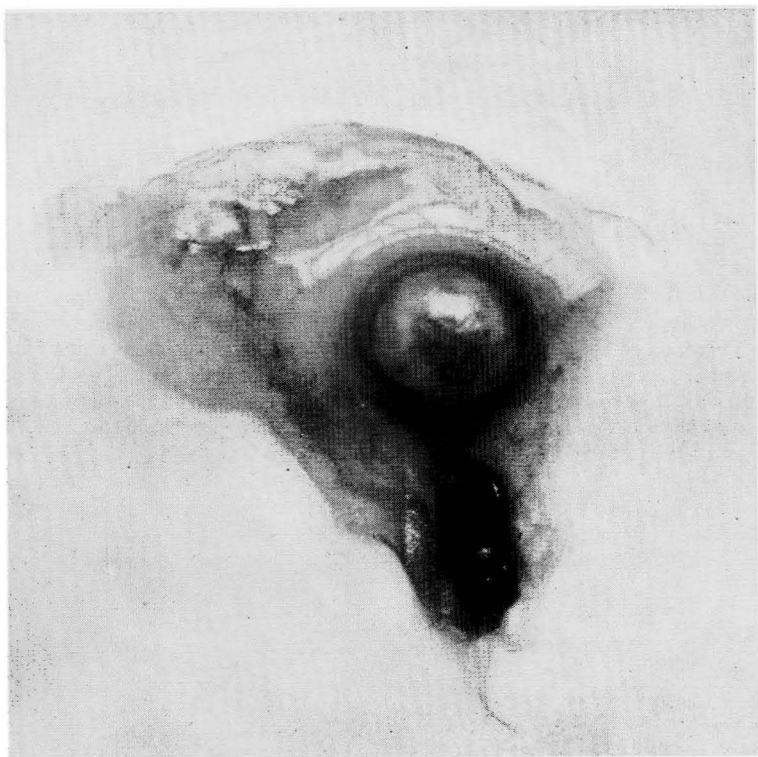
**Photograph 7.—Testicles Removed from a Reacting Adult Male.**

Testicle No. I appeared to be functioning even though its structure was firm and its size greatly reduced. *S. pullorum* was isolated from this testicle. Testicle No. II appeared to be normal in size and texture. *S. pullorum* was not isolated from this organ. Refer to question 7.

**11.—How may infection be introduced into an adult flock?** The disease may be introduced into an adult flock through buying infected stock, returning birds from shows or contests, using equipment (bird and egg crates, feed sacks, etc.) that may have been contaminated elsewhere; feeding infective eggs; and feeding garbage which might contain infective eggs or offal of infected birds.



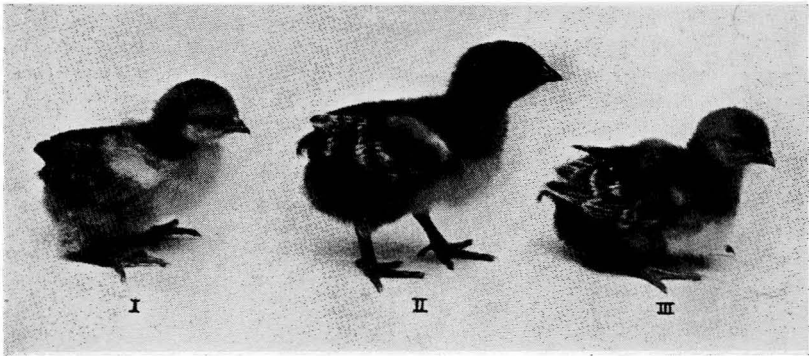
12.—May adult birds contract the disease by eating fresh eggs laid by infected hens? Yes. Investigations have shown that birds may contract the disease by eating infective fresh eggs. In some flocks one frequently observes birds that have formed a habit of egg-eating. This habit may have been acquired as a result of birds laying the eggs on the floor or dropping board. At present the most important means of spread among adult flocks appears to be through eating infective fresh eggs.



Photograph 8.—An ovum (abnormal in color, size, and shape) was found in an infertile egg which contained an apparently normal yolk. Note the dark peduncle which was its means of attachment to the ovary. *S. pullorum* was isolated from the amber colored, caseated contents of this ovum. Enlarged 2x. Refer to question 9.

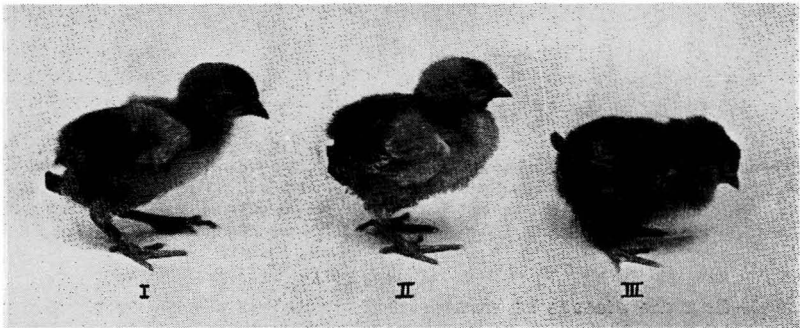
13.—Can the disease be transmitted through the egg? Yes. Infective eggs used for hatching purposes transmit the disease to the chicks. Feeding of infective eggs to chicks will infect them.

14.—How does the disease affect young chicks? The disease may manifest itself within a few days after hatching. The following symptoms may be observed: depressed vigor, loss of appetite, a tendency to remain under the hover, frequent cheeping, droopy wings, shortened bodies, pasting of the vent



**Photograph 9.—Nine-day-old Chicks Free of Pullorum Disease.**  
**Chicks I and II are males and III is a female. Refer to question 14.**

with white chalky excreta, marked depression and exhaustion followed by death. These symptoms are neither characteristic nor specific for pullorum disease alone, since they may be observed in other health disturbances of chicks. The mortality rate may vary from low to as high as 100 per cent. Losses may be observed within two or three days after hatching and may continue until the chicks are three weeks of age or older. The greatest losses usually occur during the second week of chickhood. The onset and severity of the disease depend upon the amount of infection in the body, the ability of the organism to produce the disease, the resistance of the chick, and the care given by the poultryman. In some cases diseased chicks show little or no evidence of infection, while in other cases all the possible manifestations of the disease are found.



**Photograph 10.—Nine-day-old, Naturally Infected Pullorum Diseased Chicks.**  
**Shortened bodies, pasting of the vents with excreta, droopiness and drowsiness are symptoms manifested by these chicks. Chick III died two days after it was photographed. *S. pullorum* was isolated from chicks II and III. Chicks I and II are males and III is a female. Refer to question 14.**

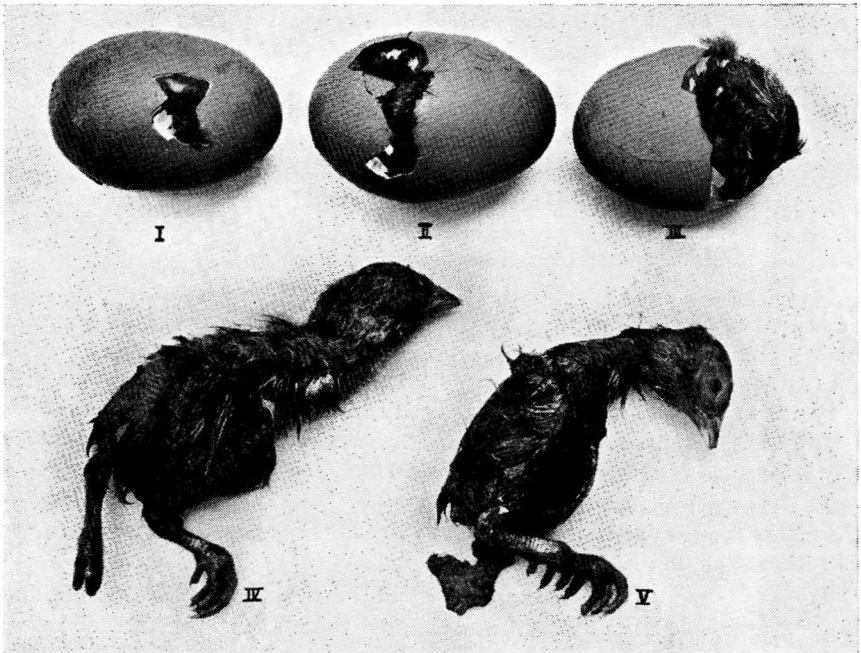
### Losses Due to Pullorum Disease

27.—Do adult flocks suffer a mortality from this disease? Yes. Occasionally a high mortality may be experienced when the disease develops into an acute form. Carriers in general do not possess the disease resistance of normal birds; therefore, a higher mortality is observed among carriers than among healthy individuals.

28.—Is egg production affected? Yes. Investigations have shown that infected birds do not lay as well as non-infected birds. This may be accounted for by the diseased ovary, underdevelopment, and low disease resistance of the bird.

29.—Are fertility and hatchability affected? Yes. The percentages of fertility and hatchability are markedly reduced.

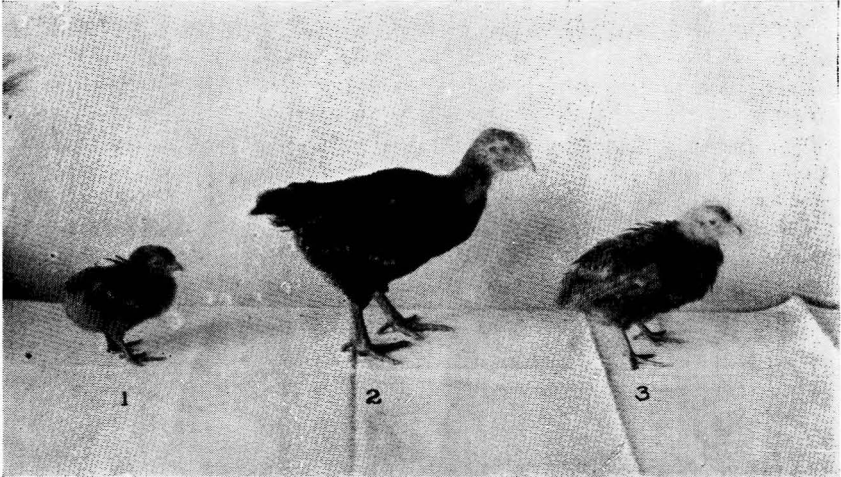
30.—Do chicks suffer a mortality? Frequently high mortalities, sometimes as high as 100 per cent, are observed among infected chicks and infrequently little if any mortality is observed. Overheating, chilling, overcrowding, and insanitary conditions markedly influence the mortality rates.



Photograph 11.—Dead Embryos.

Pullorum disease affects hatchability. At the end of the incubation period, embryos may either be dead in the shell or be too weak to emerge from the shell. Embryos IV and V were removed from the shell on the twenty-first day of incubation. *S. pullorum* was isolated from embryos III, IV, and V. Pullorum disease should not, however, be regarded as the only cause responsible for low hatchability. Refer to question 29.

**31.—Do infected chicks mature normally?** In severe outbreaks the normal development is markedly affected, as shown by a lack of uniformity of growth and underdevelopment of birds.



**Photograph 12.—Six-weeks-old Chicks Exposed to Pullorum Infection When 72 Hours Old**  
**Weights: No. 1, 115 grams; No. 2, 488 grams; No. 3, 193 grams.**  
 Pullorum disease has an influence on the rate, uniformity, and amount of growth. Refer to question 31.

**32.—Does the presence of the disease affect the salability of eggs and stock?** Yes. The public has been and is being educated to buy only pullorum disease-free stock. A buyer who has had the unfortunate experience of buying and losing infected chicks will avoid repeating that experience if at all possible. A poultryman who has spent several years in developing a pullorum disease-free flock of good breeding, and then unthinkingly or unknowingly introduces infection, will suffer a great loss not only through the cost of eradicating the disease, but also from reduced sales.

#### Control and Eradication of the Disease

**33.—Can the disease be eliminated by culling birds that lack vigor and vitality?** No. "Carriers" of the disease are not always the poorest individuals in the flock. Apparently normal, well-developed birds may be infected with the disease.

**34.—Is incubator disinfection effective in eradicating the disease?** Incubator disinfection, while partially effective in decreasing the spread of the disease in the incubator, should not be encouraged as a means of controlling or eradicating the disease because it is unable to destroy the organisms in the live chick. Infected live chicks are spreaders of the disease, and complete control or eradication requires the elimination of the spreader. Therefore, poultrymen who have outlined an incubator disinfecting program with the intention of eradicating this disease, can expect but one result, which is failure in eradication.

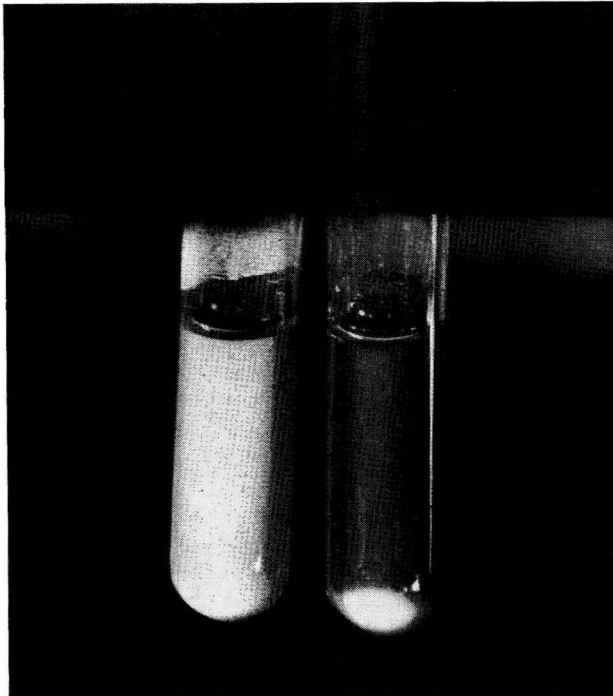
Incubator disinfection should be regarded as part of the general sanitary program and not as a disease eradication measure in itself.

**35.—How may carriers of this disease be detected?** Infected birds may be detected by the following tests: Intradermal test; macroscopic agglutination test; rapid serum agglutination test; and whole blood agglutination test.

**36.—What is the intradermal, pullorin, or “wattle” test?** This test consists of injecting a biological preparation into the skin of the wattle. If a swelling appears at the point of injection within a certain limit of time, the bird is regarded as infected.

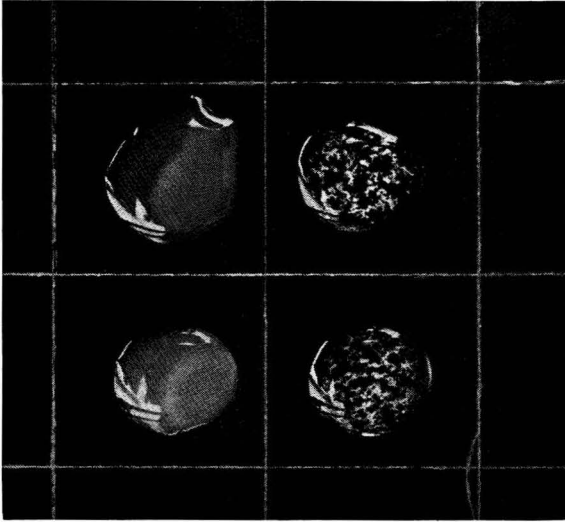
**37.—Is the intradermal test reliable in eradicating infection from a flock?** Leading investigators are of the opinion that the test in its present state is not as reliable as other tests which are employed for eradication of the disease.

**38.—What is the macroscopic tube agglutination test?** In general this test consists of the following steps: all birds are legbanded; a small amount of blood is taken from the bird and the sample labelled with the legband number; a small portion of serum is removed from the blood sample to a tube containing



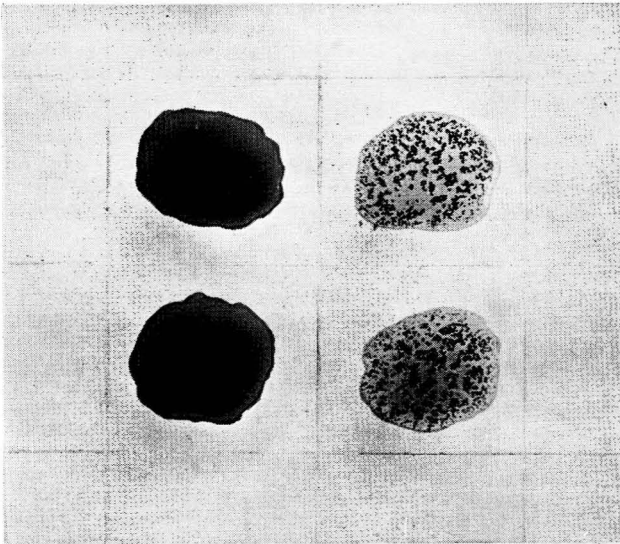
**Photograph 13.—Macroscopic Tube Agglutination Test.**

The tube on the left shows a negative reaction, and the tube on the right shows a positive reaction. Refer to question 38.



**Photograph 14.—The Rapid Serum Agglutination Test.**

The mixtures in the squares on the left show a negative reaction, and the mixtures in the squares on the right show a positive reaction. Refer to question 39.



**Photograph 15.—The Whole Blood Agglutination Test.**

The mixture in the squares on the left shows a negative reaction, and mixtures on the right show a positive reaction. Refer to question 40.

turbid test fluid; the serum and test fluid are thoroughly mixed, the mixture is incubated for 24 hours or longer at body temperature; and the results are recorded at the end of the incubation period. A test is regarded as positive when a deposit has formed in the bottom of the tube with the test fluid partially or completely clear, and upon shaking of the tube the deposit breaks up into fine clumps. In a negative test the turbidity of the mixture is not changed. All birds whose samples react positively are reported as reactors or "carriers." These birds are removed from the flock and slaughtered for meat.

**39.—What is the rapid serum agglutination test?** This test is a modification of the tube agglutination test. A small amount of serum taken from the blood sample is placed on a glass plate. To this serum is added a small amount of test fluid whose turbidity is far greater than that of the test fluid used for the tube method. The serum and test fluid are mixed by stirring and after a few minutes the result of the test is recorded. A test is positive when definite white clumps form in the serum-test fluid mixture. In a negative test the serum-test fluid mixture remains uniformly turbid.

**40.—What is the whole blood agglutination test?** The whole blood agglutination test consists of mixing whole fresh blood or whole dry blood with a stained test fluid which is quite similar to that employed for the rapid serum method. The results are recorded within a few minutes after the blood and test fluid are mixed. A positive test is indicated by definite clumps floating in the mixture. A negative test shows no clumping. This test is used on the premises, usually in the poultry house, and tested birds are retained in trapnests or improvised retention coops until the results of the test are recorded. This makes it possible to remove positive birds from the flock immediately.

**41.—Have any of these tests been adopted as standard?** At the present time, the macroscopic tube agglutination test is regarded as the standard test for detecting pullorum disease carriers. This standard test is subject to modification or change when a more effective, inexpensive and efficient method or test is discovered for pullorum disease eradication.

**42.—Has a test been developed which has proved practical and reliable in the hands of poultrymen?** At the present time, no test for pullorum disease eradication is recognized as reliable and effective when placed in the hands of poultrymen or persons not properly trained. The different tests are of such a nature that they require thorough knowledge in the fields of biological sciences in order to obtain most expeditious and successful results in eradication of the disease. The results of a test must be judged by the quality of the operator and the methods employed.

**43.—What is a reactor?** A reactor is a bird whose serum gives a doubtful or positive reaction in the serum-test fluid dilution of 1-25 after 24 hours' incubation at body temperature. If only doubtful birds are found, they are subjected to further examination. Postmortem examinations are often helpful in making a diagnosis.

**44.—Do infected birds always show a positive agglutination test?** Occasionally infected birds are discovered at necropsy that did not react positively to the agglutination test. The serum dilution (proportion of serum to test fluid) is an important factor in detecting such birds. The lower the dilution the more infected birds will react. Infrequently, some birds may react at one test and not at the next. Due to this fluctuation in reactions they are called intermittent reactors.

**45.—Are non-reacting infected birds considered as spreaders?** Investigators have found the causative organism in eggs laid by such birds. The organism has also been isolated from the ovary and other organs on necropsy. Fortunately such birds are rare, as shown in flocks which are tested annually.

**46.—Are all reactors infected with the organism?** Reacting birds are observed in which no gross signs of the disease can be found. Few such birds are found infected on bacteriological examination. A plausible explanation for failure to isolate the organism from some reacting birds is that such birds either have been infected recently or the organism has been eliminated recently. However, it must also be recognized that the methods of examination have their limitations.

**47.—Do all reactors lay infective eggs?** No. If the infection is localized in those parts of the body which have no direct relation or communication with the oviduct, the organism is not eliminated through the egg. Furthermore, not all eggs laid by an infected bird contain the organism.

**48.—Should fresh eggs from infected or untested flocks be fed to non-infected stock?** No. Investigations have shown that birds may be infected when fresh eggs laid by infected birds are fed.

**49.—Why do negatively reacting birds suddenly become positive reactors?** Non-reacting birds that suddenly react positively, in all probability have been infected recently. Artificial infection has shown that birds may first react between the fourth and seventh day after the first exposure. The avenue of infection, the size of dose, the ability of the organism to infect the bird, the resistance of the bird, and the ability of the bird to produce antibodies are factors that determine the reaction of the bird.

**50.—Should the flock be tested annually?** Yes. Poultrymen who use part or all of their flocks for breeding purposes should test all birds on the premises each year. The test is a means of detecting infected birds. It does not assure the owner that once his flock is free of infection it will remain free. Flocks do become re-infected, and through annual testing the infection is detected and eliminated before it has an opportunity to cause great losses. Therefore, annual testing is necessary to determine, from year to year, the status of the flock in regard to this disease.

**51.—At what age may birds be tested?** Reactors have been detected among chicks seven days of age or older. However, infected chicks do not all react at this age period. Birds tested between four and twelve weeks of age will show a larger percentage of reactors than if tested at a younger age. On the other hand, some young birds detected as reactors may become negative towards maturity. Since this disease will be disseminated as long as infected birds are present, the purpose should be to eliminate the majority if not all of the infected birds at the earliest practical age. Birds three to four months of age may be tested successfully.

**52.—Should birds attain egg production before they are tested?** Since the majority of infected birds can be detected before they attain egg production, it is advisable from an eradication point of view to eliminate the infected birds before they attain egg production in order to prevent the spread of the disease through the eating of infective eggs laid by diseased birds. Furthermore, elimination of infected birds at an early age will also prevent dissemination by other means common in a diseased flock.



**53.—Can birds be tested on range?** Birds may be successfully tested on range provided suitable facilities are available. Range testing is recommended for infected flocks so that the bulk of the infection will not be moved into the laying quarters where the birds are more congested and there is greater opportunity for spread of the disease.

**54.—Is it necessary to test all birds on the premises?** To determine the exact disease status of the entire flock it is necessary to test all the birds on the premises.

**55.—Is it safe to retain a few untested culls on the premises for a short time after the test?** Untested culls should always be regarded as dangerous to the tested flock even under the best of quarantine conditions. The safest procedure is either to cull and dispose of the undesirable birds before the test or to test all the birds on the premises.

**56.—Is it safe to retain untested birds in separate houses for egg and meat production?** No. The practice of keeping untested birds on the premises for egg and meat production is one of the causes for failure to establish or maintain a pullorum disease-free flock. Most poultry plants are so organized and managed that no quarantine measures could be successfully executed on the two types of flocks.

**57.—Why should the entire flock be tested at one visit?** Testing of the entire flock at one visit permits the flock owner and the blood collector to check more accurately whether all the birds have been tested. It prevents untested birds from mixing with tested birds. It assures more economical and satisfactory routing of the blood collector.

**58.—How should tested birds be marked?** All tested birds should be banded with an official sealed band in order that their future identification can be accurately associated with their testing history.

**59.—Is retesting advisable in infected flocks?** In retesting infected flocks one should consider the value of the stock, the amount of infection, and the arrangement and the mode of operation of the plant. The value of the stock is probably the primary consideration. If the value does not warrant the expenditure for retesting, then the inferior infected flock should be sold and replaced with pullorum disease-free stock. In the majority of cases when the flock is heavily infected, retesting is not advisable because the size of the flock will be reduced to such an extent that a profitable breeding program cannot be followed. Furthermore, the eradication of infection often appears to be more difficult in such cases than where the amount of infection is small. Sometimes the arrangement and operation of the plant are such that a retesting program cannot be applied effectively. If the nature of the flock and condition of the plant do not warrant or permit effective retesting, then the flock should be replaced with pullorum disease-free stock.

**60.—How many tests are necessary to eradicate the disease from a flock?** The number of tests required to eradicate the disease is influenced by the condition of the birds, the amount of infection, the conditions and the management of the plant and the quality of the test. In Massachusetts five retests within one season have been the maximum number necessary to eliminate the infection from a flock. In some flocks only two retests were necessary.

**61.—Should infected or reacting birds be culled as soon as detected?** Yes. Infected or reacting birds should always be regarded as spreaders of the disease. Therefore, immediate culling and disposal of such birds is recommended.

**62.—Why should reactors not be retained for egg production?** Reactors retained for egg production are a constant source of danger to the non-infected birds on the premises. The possibility of the reactors coming in contact directly or indirectly with the non-infected birds always exists. Eradication of the disease from the premises cannot be accomplished as long as reactors or infected birds are retained on the premises.

**63.—What disposition should be made of reactors?** Reactors should be sold only for slaughter. Offal and waste should be properly handled to prevent the spread of the disease.

**64.—In case of a few reactors, is home slaughter objectionable?** Home slaughter may be practiced if the reactors are slaughtered immediately after being detected and if proper disposal is made of the waste and offal. However, the safest procedure is to sell the reactors to a slaughtering plant.

**65.—Is feeding offal from dressed birds to animals a dangerous procedure?** Feeding offal from dressed birds to animals is an unsound procedure because they may either become infected or act as mechanical carriers and in that manner disseminate the disease.

**66.—What disposition should be made of dead adult birds, waste, and offal, infertile and unhatched eggs, and dead chicks?** Such materials should be burned which will destroy all forms of life. An incinerator of some sort should be considered a necessary fixture on each poultry plant. Burying is not recommended unless the materials are placed at such a depth that they will not be disturbed and lead to further dissemination of the disease.

**67.—Is it necessary to clean and disinfect premises after reactors are removed?** Thorough cleaning and disinfection of the houses following the removal of the reactors is a very important and necessary step in an effective eradication program. The sanitary aspect of a poultry plant should not be neglected, as is very often the case.

**68.—What disinfectant should be used?** Any of the "permitted" disinfectants approved by the United States Department of Agriculture are applicable for general disinfection of poultry houses and equipment. Poultrymen have access to the list of "permitted" disinfectants through their local county agents.

**69.—Should owners of pullorum disease-free flocks practice custom hatching?** The owner of a pullorum disease-free flock should strive to prevent the introduction of disease into his flock. This may be accomplished with the greatest degree of certainty by eliminating all possible disease hazards. If the owner is not certain that his customers are supplying non-infective eggs, custom hatching is a disease hazard to his flock.

**70.—Should owners of infected or untested flocks practice custom hatching?** Investigators have shown that infection may spread in the incubator, and in order to prevent the dissemination of the disease, the practice of custom hatching eggs from infected or untested flocks must be condemned. The first consideration for such owners should be to establish a pullorum disease-free flock, which will be for the good of the industry as well as for their benefit.

**71.—What dangers are associated with the practice of having eggs hatched away from the premises?** The owner who follows this practice subjects his flock to the same hazards as the owner who does custom hatching. In fact it may be a more dangerous practice because he has no control over customers supplying eggs to the same hatchery. A thorough investigation of the pullorum disease standing of the flocks and the business integrity of the customers should be made to assure the maximum elimination of hazards. However, even with the utmost care, one may introduce infection through this practice.

**72.—If new stock is desired, what kind should be selected?** In selecting new stock, the first consideration is health. Adults, chicks, and eggs should be selected that are free of infection. Such stock may be obtained from recognized pullorum disease-free flocks.

**73.—What is generally regarded as a pullorum disease-free flock?** A pullorum disease-free flock is a flock in which no reactors were detected by the macroscopic tube agglutination test on two successive tests not less than six months nor more than a year apart.

**74.—Who should be consulted in the purchase of pullorum disease-free stock?** Whoever is in the position to give reliable and official testing information regarding the flock, aside from the owner. No flock owner should resent having his statements checked. In Massachusetts, testing information may be obtained from the local county agent.

**75.—Why should buyers check advertisements?** Frequently claims in advertisements are incomplete, misleading, and false. The purchase of stock should not be based upon the claims in the advertisement without investigation.

**76.—Do terms such as “tested stock”; “100 per cent clean”; “state tested”; “accredited”; “certified” mean freedom from pullorum disease?** Such terms are indefinite and misleading in regard to the pullorum disease standing of a flock. The terms “tested stock” and “state tested” do not inform the reader about the particular disease and the results of the test. The term “100 per cent clean” does not state the disease in question. In certain states the term “accredited” has been given to flocks designated as “certified” in other states. Considerable confusion has resulted from this. The terms alone do not have any meaning unless one is familiar with the regulations that define these terms and the thoroughness of the execution of the regulations. Therefore, one should investigate carefully the significance of such indefinite terms.

**77.—Who can assist in determining the validity of the advertisement?** In Massachusetts, the county agent is able to assist in checking the validity of claims in advertisements. In other states, either the control or the testing agency should be consulted.

**78.—Are the tested flocks in Massachusetts classified according to their pullorum disease status?** Flocks that have qualified for certain breeding and testing requirements are eligible for certification. Flocks are certified for one year only. Copies of testing results of all tested flocks are submitted to the certifying agency by the testing laboratory. The certifying agency operates independently of the testing agency. County agents are provided with testing summaries of flocks in their local counties.

**79.—Where may information concerning certification be obtained?** Inquiries concerning certification should be submitted to the Massachusetts Department of Agriculture, State House, Boston, Mass.

**80.—How should tested flocks be classified as to their pullorum disease status?** Tested flocks in reality are either infected or pullorum disease-free. However, in a disease of this nature, it is not always safe to declare a flock free of the disease when only one negative test has been obtained. Therefore, two successive negative tests not less than six months nor more than a year apart appear to be a safer index in determining the true status of a flock. Nevertheless, a flock which has passed one negative test should be given more recognition than a tested flock which has revealed reactors. The latter flock should be regarded as infected and unsafe for breeding purposes.

**81.—Are other measures aside from the agglutination test important for successful eradication?** Yes. The agglutination test is only in an eradication program. Prompt removal of reactors and sanitary ventive measures must be observed in establishing and maintaining a disease-free flock.

**82.—What is necessary for successful eradication?** Successful eradication is based upon the adoption of sound, effective, and uniform methods and skillfully executed. A sound eradication program for the flock or for the poultry industry as a whole should include measures to prevent the spread of the disease (through various channels as discussed in the bulletin) and permit effective eradication of the disease. The adoption of the best methods is no more important than their proper execution. Control and poultrymen should not expect to attain their goal in eradication if the measures are not justly put into practice. Too frequently either delay or failure in eradication is due to faulty execution of recommended measures. The measures should be observed in establishing and maintaining a pullorum free flock:

- a. All birds on the premises should be tested each year.
- b. If infection is present, the entire flock should be retested every four to six weeks until a negative report is obtained, provided the health of the birds justifies the expenditure for testing.
- c. Every reactor, regardless of its value, should be removed from the premises and sold for slaughter immediately upon receipt of the report.
- d. Offal from all birds dressed for market or home consumption as well as dead birds that are not fit for consumption should be destroyed.
- e. The poultry houses, runs, and equipment, should be thoroughly cleaned and disinfected immediately after removal of reactors. Provide an empty pen to each house to facilitate cleaning and disinfecting during the winter months. Use disinfectants approved by the United States Department of Agriculture.
- f. Birds removed from the premises to egg-laying contests, exhibitions, etc., should be held in quarantine and determined free of disease before they are re-admitted into the flock.
- g. Purchase of stock in the form of adults, chicks, and eggs should be made only from known pullorum disease-free flocks.
- h. Eggs should not be saved for hatching until after a flock has been tested and all the infected birds removed. Early pullet testing will insure early hatching.

*i.* Fresh and infertile eggs from unknown or infected sources should not be fed to chickens or exposed to other animals that may carry or spread the infection.

*j.* Poultrymen should not custom hatch for untested or infected flocks.

*k.* Owners of pullorum disease-free flocks should not have hatching done where infected eggs or stock may be found.

*l.* Poultrymen should not buy feed in bags that have been used or exposed to infection. (Such bags if properly disinfected will be safe for further use.)

*m.* Poultrymen should not use equipment that has been exposed to or contaminated with infective material.

**83.—Why are sound, effective, and uniform methods of control and eradication necessary?** Such methods are necessary to create faith and confidence in the eradication results upon which a profitable poultry industry rests.

**84.—Can reliable and uniform methods of eradication be instituted if poultrymen test their own flocks?** No. At the present time, no simplified test has been discovered which can be placed in the hands of poultrymen and yet give reliable results. Uniformity of technique and interpretation of results would be sacrificed. The results of a test are no better than the ability and integrity of the person conducting the test.

**85.—When should new stock be tested and retained in quarantine before being admitted into the flock?** In respect to pullorum disease, new stock received from doubtful sources should be retained in quarantine and pass two negative tests at least four weeks apart before being admitted to the flock. Frequently poultrymen fail to observe this measure and as a result introduce infection into their flocks. The purchase of new stock from doubtful sources is not recommended as a sound practice in poultry husbandry.

**86.—Should birds employed for exhibition and contest purposes be returned to the premises?** From the aspect of disease prevention, it is not advisable to return such birds to the flock. However, if for breeding purposes their return is really necessary, then they should be retained in quarantine and pass two negative tests at least four weeks apart before being admitted to the flock. Poultrymen attach too little significance to the introduction of disease through this channel.

**87.—Are any losses associated with testing due to bleeding and handling of birds?** Very seldom birds die as a result of loss of blood. A decrease in egg production has been observed in some flocks. However, losses associated with the collecting of blood samples should be negligible if the flock is healthy and properly handled.

**88.—Why is the flock owner requested to report the condition of his flock prior to the arrival of the blood collector?** The flock owner is requested to report the condition of his flock in order to prevent the unnecessary exposure of the blood collector to disease outbreaks. Furthermore, the most important reason is to prevent the disturbance of diseased flocks, which is beneficial to the diseased and healthy birds. Delayed notification of the flock condition causes great inconvenience in routing the blood collector and consequently increases the cost of testing.

**89.—Is there danger of the blood collectors spreading the disease?**

Blood collectors are given instructions designed to prevent the spread of the disease from plant to plant. The field operations of the blood collector are checked from time to time by a laboratory representative. Flock owners are requested to report to the laboratory when blood collectors do not observe precautions.

**90.—What is the resistance of the causative organism to various environmental conditions?** Investigators have reported that the organism may remain alive in artificially inoculated soil for approximately fourteen months and in carcasses for at least thirty days. On dry cloth, retained at room temperature, it has remained alive for at least 26 weeks. In chick feces it remained alive for approximately 101 days. When subjected to the ordinary disinfectants, it is easily destroyed. Its resistance to heating or exposure to sunlight is very slight.

**91.—Can medicines or drugs eradicate pullorum disease?** No satisfactory medicine or drug has been found to be effective in eradicating or controlling the disease. Elimination of infected birds and proper follow-up measures must be resorted to in order to establish pullorum disease-free flocks.

**92.—Is Massachusetts making progress in eradication of pullorum disease?** In 1919 under the Poultry Disease Law, an organized testing program was started and since then the following testing results have been obtained.

Year	Flocks	Total Tests	Positive Tests Per cent	Non-Reacting Flocks
1920-21	108	24,718	12.50	25
1921-22	110	29,875	12.65	27
1922-23	121	33,602	7.60	29
1923-24	139	59,635	6.53	38
1924-25	156	66,503	2.94	79
1925-26	201	67,919	2.31	124
1926-27	249	127,327	4.03	114
1927-28	321	232,091	6.52*	138
1928-29	413	304,092	4.25*	228
1929-30	460	386,098	2.17	309
1930-31	447	402,983	1.47	328
1931-32	455	420,861	0.90	355

\*Based on total birds tested: 1927-28, 190,658 birds; 1928-29, 254,512 birds.

The success in pullorum disease eradication in Massachusetts depends to a great extent upon the cooperation of the poultrymen. If Massachusetts poultrymen expect to improve the standing of their flocks in respect to pullorum disease, they must adopt and conscientiously follow sound eradication and preventive methods.

**93.—Where may Massachusetts poultrymen obtain information regarding pullorum disease and testing service?** Requests concerning pullorum disease and testing service should be forwarded to the Department of Veterinary Science, Massachusetts State College, Amherst, Mass.