ROUP IN FOWLS

COLUMBIA, MISSOURI
SEPTEMBER, 1922
ROUP CAN BE PREVENTED

Roup is a contagious or infectious disease affecting all classes of fowls. The microbe or germ that causes this disease is unknown. There are three forms of the disease—one with swelling around the eyeball, and enlargement of the bird's head. Another is the diphtheretic form showing canker-like sores in the mouth and throat. The third form of roup is the so-called "chicken-pox" in which sores or scabs form on the comb, wattles and bare parts of the head.

Proper management in feeding and housing the flock are the most important measures in the control of roup. Medicinal treatment is not advisable unless the birds are of special value. Bad cases of the disease should be killed and burned.

Success in treatment depends largely on treating it early.

Fig. 1. Roup in which the swelling around the eyeball has destroyed the eye
ROUP IN FOWLS

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Roup is a contagious or infectious disease affecting all classes of fowls, particularly chickens and turkeys. It may attack birds of any age, and is usually more prevalent during the fall, winter and spring months.

The microbe or germ that causes this disease is unknown. Many different germs are associated with roup. Though these invade the tissues during the progress of the disease they are not regarded as primary causes, but merely as accidental or secondary invading microbes, which apart from the true cause would probably not be harmful.

SYMPTOMS

Roup usually starts with a watery discharge from the nasal passages and the eyes. There is a rise in temperature, the bird's feathers become ruffled, and the wings may droop. There is a loss of appetite, the breathing becomes difficult, the bird makes a wheezing sound and often sneezes. These symptoms are especially noticeable on entering the poultry house at night when the birds are on the roosts. After a time the odor of the discharge from the nasal passages becomes very offensive, and usually the nasal passages become so obstructed that the bird is compelled to breathe through its mouth. The space around the eyeball fills rapidly with a cheesy deposit, and often causes an enlargement of the bird's head to twice its normal size*. Collection of this material in the nasal passages may press down the roof of the mouth to such an extent that the bird is unable to close its mouth.

In many cases roup may take another form. Minute white specks may appear on the mucous membrane or inner surface of the mouth and throat; these minute white specks increase rapidly in size and run together, forming larger spots until the entire surface may become covered with a diphtheritic membrane. In the advanced stages this membrane is usually of a yellowish color; it is sometimes so extensive that the bird is unable to close its mouth, and in some cases the membrane obstructs the windpipe and causes death of the bird from asphyxia. The lungs may become involved. A portion or an entire lobe may become solidified with a cheesy deposit and at times coagulated exudates are found in the body cavity.

Another more mild affection which is classed with roup, is the so-called "chicken-pox".† It is first noticed by the appearance of small white spots on the comb and wattles. The spots increase in size until they run together, forming large somewhat superficial sores filled with bacteria and swollen epithelial cells. These skin lesions may spread until the eyes are closed. But if this form of the disease is not complicated by the diphtheritic throat lesions it generally runs a mild course. The nodules or sores slough off and the bird regains its normal health in a few days.

*See Fig. 1, on opposite page.
†See Fig. 2, Page 11.
PREVENTION AND CONTROL

Preventive measures are the most important in the control of roup. Do not allow poultry, other animals, or persons to go directly from infected yards to a healthy flock. Recently purchased birds, and birds that have been exhibited at poultry shows should be isolated for a period of fifteen days or until the health of the bird is assured.

The most important control measures consist in proper management and proper housing of the flock. Damp, unsanitary, poorly ventilated, overcrowded, drafty quarters are conducive to the spread of roup. And a poultryman cannot expect his flock to escape the disease when he allows such conditions to exist.

The birds should be fed at regular intervals; and a liberal, well balanced ration is important. A balanced ration is one in which all of the food elements required by the birds are supplied in proper proportions. The reader is referred to other circulars for information on poultry feedings.*

To maintain resistance against roup, routine treatment for lice and mites is also important and should not be neglected during the summer months as well as at the time the flock goes into winter quarters. During cold, damp weather the birds should be properly housed. The dropping boards should be cleaned daily, and the litter should be cleaned out and renewed whenever it becomes unclean with the droppings of the birds.

When the disease appears in the flock, isolate the diseased individuals at once, and use disinfectants freely in the poultry house and yards.

One of the best disinfectants for the floor, roosts, and inside of a poultry house is compound cresol (liquor cresolis compositus). A little less than a tablespoonful should be used with every gallon of water. The disinfectant is best applied with a foot bucket-pump, fitted with 5 to 7 feet of hose and the nozzle attached to a small pole 5 feet long. This pole enables one to direct the spray into all parts of the building. It is important that the disinfectant should come in contact with all surfaces that may be infected with the germs of the disease.

To disinfect the yards and runs, freshly slaked lime may be spread over the ground in a fairly thick layer. To apply this properly unslaked barrel rock lime may be dumped here and there in small piles over the yard and enough water added to make it crumble into powder. This should then be spread immediately over the grounds by means of a hoe or rake, thus mixing it with the surface layer of the soil.

Where new cases of roup are appearing in a flock, a good preventive method is to dip the heads of the healthy fowls into a mixture of two parts of cottonseed oil to one part kerosene oil every five or six days during an outbreak. This simple household mixture is a mild antiseptic emollient which prevents and aids in curing the initial sores about the head and mouth.

To detect the disease in the early stages, the poultryman should visit the fowls while at roost. Passing with the lantern along the line of roosts, the head of every bird should be examined for the beginning stages of roup.

*1918. Townsley, T. S. Circular 59, Agricultural Extension Service, University of Missouri, College of Agriculture.
TREATMENT

The medical treatment of roup in most cases gives fairly good results, though it requires a great deal of time and care; and unless the birds are of special value they should be killed and burned.

As soon as a bird shows evidence of the disease it should be put in a dry, warm, well ventilated place, sufficiently isolated from the healthy birds. Fresh water should be supplied. Wet mashes and green feed should go given. The amount of dry grain should be limited. Dip the head of the bird twice a day in a solution of 1-1,000 bichloride of mercury. This solution is prepared by placing one of the bichloride of mercury tablets (containing 7.3 grains) in a pint of water. A solution of permanganate of potash may be used. (Add the permanganate crystals to water until it shows a dark purple color.) The bird's head should be immersed in the solution until the bird struggles. In cases where swelling appears around the eyeball, the whole side of the head should be painted over with tincture of iodine, being careful to apply the medicine thoroughly to the swollen parts.

The large swelling beneath the eyes should be opened with a sharp knife, and the cheesy contents removed. The open wound should then be packed with a small piece of absorbent cotton soaked in iodine. This packing should be removed and a fresh pack put in at the end of 24 hours.

The diphtheritic membranes occurring in the mouth and throat should be removed with tweezers, and the raw surfaces should be painted with Lugol's solution of iodine and then swabbed with oil.

Where fowls are affected with the so-called "chicken-pox" form of roup, the affected comb, wattles and bare parts of the head should be painted over with iodine. In a day or two the scabs may be scraped off and the parts painted again with iodine.

Birds affected with roup should be given about 40 grains (one teaspoonful) of Epsom salts, or one teaspoonful of castor oil and 15 or 20 drops of turpentine. The turpentine may be administered in No. 000 gelatine capsules, which are easily passed down the throat of the bird. Most of the birds when given prompt treatment in the early stages of the disease will recover completely in a week or ten days.

Another remedy for local application to the head, which many poultrymen have found good, is a mixture of 8 ounces of olive oil, 1 ounce gum camphor, and 1 ounce of carbolic acid. To prepare the mixture heat the olive oil; then add the gum camphor and when it has completely dissolved add the carbolic acid and mix thoroughly. Apply some of this mixture to the affected parts of the head, comb, wattles, around the eye, and angles of mouth; and in severe cases, hold the mouth open between the fingers and inject a small amount of the mixture into the slit in the roof of the mouth, by means of a syringe or curved medicine dropper. By applying this remedy early in the outbreak, the disease as a rule will be cut short.

In case of doubt as to the diagnosis, two live birds showing some evidence of disease may be shipped, by prepaid express, to the Veterinary Department, Missouri Agricultural Experiment Station for examination.
VACCINATION

Efforts to prevent roup by vaccination have been made in many parts of the country, but in the opinion of the writer the experimental evidence and practical results do not justify the general use of vaccines for roup, as an immunizing measure, by the poultry raisers of Missouri. Such a procedure would prove disappointing; for the reason that the specific virus has not yet been isolated with sufficient definiteness, and its pathogenic action, apart from secondary infections, has not been definitely established; and for the reason that the primary disease in most outbreaks is probably complicated by various, and varying secondary infections. Reliance in protecting the flocks must therefore depend mainly upon good poultry husbandry, which insures hygienic conditions that favor the maintenance of vigor in the fowls.

In the experimental work carried out by this Station, the department has had, in a number of instances, what appeared to be good results from the use of a vaccine prepared from the scabs, diphtheritic membranes, and cheesy collections in the swollen sinuses of the head. But in other instances the results were not so good. And, whether the good results in certain instances were merely coincidental and due to better care, or whether they were due to specific preventive substances, or on the other hand, to a great increase of leucocytes in the blood, induced by the injection of foreign protein substances occurring in the crude vaccine—are questions which cannot at present be decided by the data available.

Since October, 1914, the Veterinary Laboratory has vaccinated approximately 4,000 fowls, of which about half the birds were affected with roup, while the other half were still healthy.

Case 1.—In one flock, which consisted of 52 birds, about 40 birds showed evidences of the chicken-pox form of roup (*contagious epithelioma*). Two hens showing well marked lesions were brought to the laboratory. In both cases the head was covered with scab-like nodules, and the eyes were closed by similar scabs or sores. The scabs and superficial parts of the sores were removed carefully and made into a vaccine. The two birds which supplied the materials were vaccinated with a small quantity of the vaccine. They made rapid improvement, and in five days showed no evidence of the disease except the healed scars where the chicken-pox sores had been. Another injection of the vaccine was given and the hens were returned to the owner. The other birds of the flock were vaccinated on the premises of the owner, and all recovered except one, which was apparently affected with some concurrent ailment. Fourteen of the birds that showed no visible signs of the disease at the time they were vaccinated did not develop any symptoms of chicken-pox or roup.

Case 2.—One lot of vaccine which was made up from the infected lung tissue of a large rooster, suffering from the bronchial form of roup was apparently useful in preventing and curing the disease in an affected flock.

Case 3.—In a flock of 3,000 birds among which roup had appeared, about 500 pullets and cockerels were vaccinated. The owner reported no improvement; and in one bunch of cockerels, that were apparently healthy at the time of injection, a virulent and fatal form of the disease developed soon
after the vaccination. In this case no immunity was given the exposed birds and apparently the toxic products in the vaccine lowered their resistance.

**Case 4.**—Six hens were brought to the laboratory. All showed roup in varying degree. They were placed in the hospital and vaccinated. At the end of five days the injection was repeated. All birds made a complete recovery and were returned to the owner the second week after they were received for treatment. The more comfortable quarters in the hospital may have been a favorable factor.

**Case 5.**—A flock of 150 White Leghorn pullets included about 25 which showed evidences of roup. The flock was vaccinated twice at an interval of five days. The owner reported no improvement. These birds were heavily infested with round worms (*Heterakis papillosa*) and were poorly kept.

**PREPARATION OF THE VACCINE**

The vaccine as used in the foregoing cases was prepared as follows: The cheesy exudates occurring in the sinuses under the eye, as well as the scales and sores from the comb and bare parts of the head, and the diphtheritic membranes which occur in the mouth and throat were collected in a cleanly manner. The materials were put into a mortar and ground thoroughly by means of a pestle; just enough normal salt solution was added to facilitate grinding the materials into a paste of soft consistency. Physiological salt solution was then added in sufficient amount to make a fairly cloudy opaque suspension—definite weights and measures not being employed, but a density being attained comparable to that of stock bacterial vaccines. The material was filtered through several layers of sterile gauze, to remove the coarser particles. The filtered solution was then shaken in a bottle for five or ten minutes, and heated for one hour at 55° Centigrade. Carbolic acid to the amount of one-half per cent was added as a preservative. (See Literature—Manteufel et al. p. 8.)

The dosage, as a preventive in healthy birds that were exposed, was 1 cubic centimeter. A second injection was made in five or six days. In the case of affected birds the same dosage was employed but the injections were repeated at intervals usually of five or six days until a marked change for better or worse appeared.

The vaccine is injected hypodermically on the side of the thorax in the bare region under the butt of the wing. A 5- or 10-cubic centimeter syringe, with an 18-gauge needle, is a convenient size for making the injections. After passing the needle through the skin the point should be shoved along under the skin for some distance before expelling the vaccine. This will prevent the vaccine from running out when the needle is withdrawn. The skin where the injection is to be made is usually quite clean, and disinfection is rarely necessary, but care should be taken that the syringe and the vessel into which the vaccine is poured are clean and sterile.

Further work on the disease or diseases included under the term "Roup" will be carried on as opportunities occur; and the matter of preventive inoculation will receive special attention. But for the present the writer wishes to impress upon the Missouri poultry raisers the fact that while the question of the practical value of vaccination against roup and chicken-pox
is still in doubt, the disease can be controlled and serious losses prevented by the rigid application of hygienic measures, and simple remedies.

REVIEW OF LITERATURE

The literature relating to experimental work on roup or chicken-pox is meager. The poultry raiser or the student who is interested in the subject is referred to the original articles which have come to the attention of the writer. A list of these is given below with a few of the important data, and brief comments on same.

1910 Manteufel. Arbeit. Kaiserl, Gesundh. 33 p. 305.—This author appears to be the first investigator to attempt immunization and treatment of chicken-pox (or roup) by vaccination. He prepared a vaccine from the disease products; namely the scabs and nodules occurring on the comb and other parts of the head; and, in addition, the diphtheritic or canker-like accretions in the mouth, and the cheesy collections in the protuberant swellings about the eye. These materials were ground and mixed with normal salt solution, filtered, and heated at 55 degrees Centigrade for an hour, and administered hypodermically. The author claimed good results not only as a preventive but also as a curative measure.—The vaccine as used in the foregoing tests at this Experiment Station was prepared according to this method.

1913 Hadlev and Beach. Proc. Amer. Vet. Med. Association, (1913) p. 704.—These authors reported that the chicken-pox vaccine as prepared by Manteufel’s method gave good results in tests carried out by them in 1912-13. Their experiments apparently confirmed the claims of Manteufel that the procedure was of value both as a prophylactic and as a therapeutic measure. In a lot of sixty affected birds, forty were given treatment and the remainder left untreated. The disease ran a milder course in the treated birds than in the untreated. They also reported that among healthy fowls that were exposed the vaccination prevented the development of the disease in 98 per cent of the birds.

1915 Mack and Records. Bul. 82 Nevada Agr. Expt. Sta. June, 1915; and Bul. 84, same Station, April, 1916.—“Contagious Epithelioma in Chickens (Chicken Pox, Swelled Head). Its Control by Vaccination.” The authors had an opportunity to study the ailment under discussion, in seven flocks, comprising a total of more than 4,500 birds. In each flock they found birds affected with one or more of the lesions described by clinical writers under the several terms:—Roup, Chicken-pox, Canker Mouth, Contagious Epithelioma, Swelled Head or Chicken Diphtheria. They were unable to determine whether they were dealing with a single specific infection which showed various manifestations, (and perhaps secondary complications), or whether two distinct specific contagions were present at the same time in these flocks; namely, a skin affection, “Contagious Epithelioma”, and an influenzal ailment “Roup”.

The seven flocks were treated with vaccine prepared by the Manteufel method. Morbid products from all the head lesions were included in the vaccine.

The results in five of the seven flocks were quite satisfactory, but in two flocks the results were not so good; in the case of one flock the authors state that “apparently the treatment was seriously detrimental to this flock.” And in another a sudden illness developed, after the second injection of vaccine, which resulted in the death of several fowls. The cause of the illness in the latter case was not determined. But in the other case it was believed to be due to “serious septic and toxic processes which were apparently caused by the vaccination.” Concerning the other five flocks the authors report that of the 4,524 birds treated, 1,761 or nearly 39 per cent showed visible lesions at
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the time of vaccination or soon thereafter and that the spread of the infection among the healthy vaccinated birds that were exposed was negligible. The deaths numbered 373; that is a little more than 21 per cent of 1,761 visibly affected birds, or a little more than 8 per cent of the entire number vaccinated (excluding the two flocks in which unfavorable complications arose). Except for the untoward mishaps in the case of two flocks, the results make an apparently good showing both for prevention and treatment.

The authors conclude that: "Apparently we have in this method a fairly efficient means for promptly checking outbreaks of Contagious Epithelioma, and a therapeutic agent of considerable value." On the other hand they say: "The methods employed for the preparation and standardization of the vaccine are not altogether satisfactory as some trouble followed its use in two flocks." ** Our experience indicates the necessity for improvement in the preparation of the vaccine, and we hope ultimately to overcome the difficulty and be able to produce a more refined product."

1920 Beach, J. R. Jour. Amer. Vet. Med. Assoc., Vol. 58, No. 3 (Dec., 1920). Title:-"The Diagnosis, Therapeutics and Prophylaxis of Chicken-pox (Contagious Epithelioma) of Fowls." - -

In the more recent reference the author presents the view that the scab-like nodular lesions occurring in the comb, wattles, bare parts of the head and margins of eyelids are due to a specific contagion or virus that is different from that which is responsible for the influenzal symptoms that precede and accompany the formation of the cheesy collections in the facial sinuses, and result in the enlargement of the head. He would apply the term "chicken-pox" or "contagious epithelioma" to the first set of lesions. And perhaps restrict the term roup to the second named conditions. He believes, however, that the "cankers" or diphtheritic products occurring in the mouth and throat may be produced both by the chicken-pox virus, and by the infection or infections that produce "roup." Moreover he regards faulty nutritional conditions as being responsible at times for symptoms which may be confused with roup.

These considerations, as well as the mishaps which sometimes follow the use of chicken-pox or roup vaccine when prepared from all the head lesions found in affected birds, probably led Beach to the "modification" of the Manteufel method which he now uses in preparing the chicken-pox vaccine, as he excludes all morbid material except that occurring in the scabs and tumors on the combs of the affected fowls. And in propagating the chicken-pox virus he still further guards against contaminations of a septic character by inoculating in an aseptic manner the combs of healthy fowls with the chicken-pox material obtained in as cleanly a manner as possible from the combs of other fowls showing the typical comb-lesions, without the development of other doubtful lesions. He does not depend upon the natural outbreaks as a supply for the virus. The natural source is uncertain, and the danger of contamination with secondary infections is greater.

In other respects the preparation of the vaccine differs but little from the original method of Manteufel. The desiccated scabs are pulverized and thoroughly mixed with normal salt solution in the proportion of 1 gram of the powder to each mil. (or cubic centimeter) of the salt solution, and then filtered, heated and preserved in the usual manner.

Beach makes no claims of perfection in this vaccine; on the contrary, he states that the virus of chicken-pox is quite variable, and that the vaccine is correspondingly so; moreover, that all attempts to standardize it have failed. He states that the potency may last for a month, or in other lots of vaccines not longer than two weeks. The vaccine
should therefore be used as soon as possible after it has been prepared.

He states also that while complete protection against severe artificial infection is not conferred in the majority of cases, the vaccine does confer considerable resistance, and probably sufficient to protect against natural infection; which he regards as less severe than the experimental infections he has made in testing the degree of potency. He does not recommend it for general immunizing purposes but for use only in flocks already infected.

The following experiment was made to test its protective value in healthy exposed fowls. Nine hundred healthy birds were vaccinated and exposed to 272 birds which had contracted chicken-pox from natural infection. With these, 126 healthy birds were placed, which had not been vaccinated. The results were as follows: 99 birds or 11 per cent of the 900 vaccinated lot contracted the disease from the naturally affected birds; and 108 or 86 per cent of the 126 healthy birds, that were not vaccinated, contracted the disease. The number of deaths among the different lots was not given.

To test its curative value 536 diseased fowls were used. They were divided into two lots of 268 birds each. One lot was vaccinated with 1 mil. each of chicken-pox vaccine in addition to receiving local treatment. The results were as follows:—the percentage of deaths in the vaccinated lot was only 19.6 per cent, while in the other lot the percentage of deaths was 38.9. The report also states that the results were so satisfactory that the vaccine was recommended to the commercial poultrymen of California and that he has distributed to them during the past year, over 300,000 doses of the vaccine. Whether the “chicken-pox” type of the disease is the more prevalent type in California, and but little of the “roup” type of the disease occurs in that state is a question that is not answered.

The author does not recommend the vaccine for the apparently infectious influenzal ailment commonly called roup, nor for the conditions simulating roup which he regards as being due to faulty nutrition. It would be of interest to know the percentage of loss in the flocks of California from these other causes. Our observation of Missouri conditions convinces us that the “roup form” is the more prevalent in this state. The winter climate of a large portion of California differing as it does so greatly from this region may be a favorable factor in reducing the fatalities from chicken-pox and roup in that state. Moreover, the work of later investigators at least raises the question as to whether too much credit has been given to the vaccine for the results in controlling chicken-pox in California.


These authors give the details of tests made by them with the roup or chicken-pox vaccine prepared according to the Manteufel method, and that prepared according to Beach’s modification. The conclusions of these investigators are not in accord with those of the previous investigators concerning the prophylactic and curative value of the vaccines mentioned. The data show the result in vaccinated groups to be quite as good as those reported by others; but since in their experiments the difference between the vaccinated groups and the control groups was so slight, and in some cases more favorable to the control group, their conclusions are that satisfactory proof of the value of chicken-pox or roup vaccine is as yet lacking.

The first test carried out by Boerner and Stubbs was with vaccine prepared at the state laboratory according to the Manteufel method. One affected flock used in the experiment contained 952 fowls, which were housed in four separate poultry houses, and distributed
in ten pens. In each pen at the time of vaccination there were both healthy and affected birds. One pen of fowls in each of three houses was left unvaccinated for purposes of comparison; all the birds in the adjoining pens were vaccinated. An analysis of the data given shows that among the 608 vaccinated birds, 282, or 46.38 per cent, showed visible lesions at the time of vaccination; and that 130, or 21.54 per cent, succumbed to the disease. While in the control group of 281

birds 90, or 32 per cent, were affected; and 49 birds, or 17.43 per cent, succumbed to the disease.

The authors state that the results of the test on this flock "allow but one conclusion, and that is that the vaccine was not demonstrated to be of any value."

A second experiment with the Manteuil preparation was carried out on another flock comprising 3,446 fowls, distributed in eight houses. The number of birds vaccinated was 954, distributed in three houses; while 2,492 birds in five houses were not vaccinated. There were affected and healthy birds in each of the eight poultry houses. And in house (No. 1), in which no vaccinating was done, and which contained 373 fowls, 72 birds, or over 16 per cent had already died during the three weeks preceding. But during the next three weeks, and without vaccination, the mortality was greatly diminished; only 25 birds or 6.97 per cent of those remaining succumbed to the disease. In comparison with this lot, another lot in house No. 6 which were vaccinated should be considered. At the time the vaccination was done there were 335 birds in this house, and during the three weeks prior to the vaccination the losses had amounted to 75 birds, or 18.29 per cent of the original number, and during the next three weeks, following the vaccination, 34 birds died or 10.15 per cent of those remaining; that is, a larger per cent of the vaccinated birds died than in the untreated flock. The remaining ten vaccinated flocks and the other four unvaccinated flocks are not so comparable, since the number and per-

Fig. 2.—Chicken Pox (contagious Epitheloma). The head is covered with the sores or diseased spots. Mild form of roup.
percentage of deaths in the ten vaccinated flocks were considerably greater, during the three weeks prior to the vaccination than in the untreated flocks; and it might be assumed that the infection in these vaccinated flocks was the more virulent, or that other conditions contributed to the increased mortality. On the other hand it was demonstrated that the losses were comparatively light during the last three weeks of the attack in both groups, and far lighter in the flocks that were not vaccinated. Possibly better hygienic conditions account for the almost negligible loss in three lots of fowls, among the five lots that were not vaccinated.

If the 2,492 fowls included in this group which were not vaccinated had been vaccinated, and the results had been the same as reported, or even not quite so good, the owner would have regarded the vaccination treatment as highly successful; which would have been a faulty interpretation. And it is not improbable that faulty interpretations of the value of the chicken-pox vaccine are often made on many poultry farms where the entire flock is vaccinated at the beginning of an outbreak, or even at later stages, and where coincidentally the caretaker is stimulated to improve the hygienic conditions of the flock.

In order to test the value of the chicken-pox vaccine as prepared by Beach's modifications, Boerner and Stubbs secured active chicken-pox virus from the University of California and prepared the vaccine according to the method recommended by Beach. The results of the test of same are as follows: The disease appeared in a flock of 379 fowls; of which 186 were vaccinated and 193 were left as controls. There were 72 "affected" birds (38.7 per cent) in the vaccinated group, and 78 in the control group (40.4 per cent).

The data showed that more cases developed among the vaccinated fowls during the two weeks following the treatment than in the controls. The mortality, however, was low in both groups; 11 of the vaccinated birds died while only 7 of the controls died.

Another test was made in which 672 fowls were used; of which 364 were vaccinated, 126 of them showed visible lesions of chicken-pox (34.60 per cent). The number of controls not vaccinated was 308, of which 107 were affected (34.7 per cent).

In the opinion of the authors it is questionable if any of the improvement that was observed was due to the vaccination. "If so it was not sufficient to be of practical value, as neither the egg production nor the mortality was favorably influenced. In the experiment but two birds died, one of which had been vaccinated and the other had not."

Further investigations will no doubt yield definite knowledge concerning the true cause or causes which give rise to the symptoms and lesions we now include under the terms "roup" or "chicken-pox". And even if the vaccination measures just discussed prove inadequate, there is hope that measures may yet be developed, whereby a definite differential diagnosis may be made, and specific immunization against this and other poultry ailments may be effected. Such results, however, are not likely to lessen the need for careful daily attention to proper hygienic conditions. Attention to these matters will in large measure obviate the need of vaccination and medicinal treatment.

The foregoing review of the literature showing the status of some of the attempts at immunization and vaccine treatment, and its present doubtful condition, should not therefore discourage the poultry raisers, for good poultry husbandry, including the health measures recommended in the first several pages of this bulletin, will prevent serious loss from roup and its complications.