THE KOCH TREATMENT AND THE USE OF IT ON DAIRY CATTLE IN THE CHILLIWACK DISTRICT

BY
W. BRUCE RICHARDSON

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INTRODUCTION

It has been my pleasure and good fortune to have been afforded an opportunity to observe and study the use of the Koch "Glyoxylide" Treatment as used for the correction of various diseases of animals in the Province of British Columbia since October 1944. At that time, the late Minister of Agriculture, the Honorable Dr. K. C. MacDonald, appointed a Committee, of which I was a member, to study and appraise the product under actual field usage in the treatment of mastitis and sterility. After one year of study, the Committee approved by a unanimous decision "that the product had established curative merit" and recommended its further use by the veterinarians in the treatment of animal diseases.

During the intervening years, the Koch "Glyoxylide" Treatment has been extensively used by veterinarians in British Columbia at the request of many owners or managers of large dairy herds in the Province. At the same time opposition to the use of the Treatment both in Canada and the United States, together with legal action taken by the United States Federal Court against the originator and manufacturer of the product, has served only to stimulate interest and enquiry regarding the use of the Treatment in British Columbia from people all over North America. As a consequence, students in Animal Husbandry at the University of British Columbia have been stimulated to undertake studies pertaining to the use of the Koch "Glyoxylide" Treatment in animal disease work. This essay is the first such study made by a senior student and submitted in partial fulfillment of the requirements for the degree of Bachelor of Science in Agriculture.

Since this essay was completed it is of interest to note that the Chemistry of Dr. Koch's "Glyoxylide" and other compounds as used by him have been established. Noted chemistry experts declared Dr. Koch's Chemistry "pure nonsense" and structurally "incomprehensible," but recently, positive proof of the chemistry has been determined by chemists of the Dow Chemical Company of Midland, Michigan. With regard to their investigation of the Koch Chemistry, Dr. James Sheridan of that organization states, "Needless to say the Dow chemists leaned over backwards in their proofs in order that we might protect the good name of Dow from such a vigorous assault"—referring to the assaults that have been made upon the name of Dr. Koch." Continuing Sheridan reports, "The complete evidence of the Dow chemists is now available to anyone interested. As a general conclusion I can say that in every single case where an experiment was possible the results were consistent with the views expounded by Dr. W. F. Koch. We have not as yet secured any results inconsistent with those views."

The same statement may be applied with regard to the use of the "Glyoxylide" Treatment as used for animal diseases in British Columbia. We have not as yet secured any results inconsistent with the views and claims made for the product by Dr. W. F. Koch of Detroit, Michigan, and Dr. D. H. Arnott of London, Ontario. Dr. Arnott has been chiefly responsible for the product being tried and used successfully in the treatment of mastitis and sterility of cattle. Studies with regard to its use in the treatment of other diseases are continuing in British Columbia.

S. N. WOOD, D.V.M.,
Professor of Animal Husbandry

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PURPOSE OF THE STUDY

The first objective of this study is to outline the principles of immunity and present the Theory of Natural Immunity outlined by Dr. Koch.

The second objective, perhaps the most interesting from the viewpoint of the animal husbandman, is to review the use of the Koch Treatment Therapy on livestock.

The material presented will include:

(1) The method of treatment;
(2) Recorded information resulting from the use of the Treatment;
(3) Supplementary information obtained from farmers in the Chilliwack area of the Fraser Valley.

IMMUNITY

Immunity has been defined by Bryan (1) as the ability of the individual to resist or overcome infection caused by living microorganisms. This state of resistance is indicated either by the failure of the individual to develop the disease upon exposure or, in some cases, by the demonstration of specific immune bodies or bactericidal substances in the blood, which are considered effective against the invading organism.

Immunity may be natural or acquired. The individual acquires immunity during its lifetime following infection with a certain microorganism; in response to which antibodies are developed which remain in the bloodstream for various periods of time. This type of immunity is opposed to natural immunity, for in this case, the individual becomes immune only after he has had an attack of a disease, or has been rendered immune by the injection of bacteria or bactericidal products.

This acquired immunity may be of two types:

Active Immunity:
In this case, the antibodies are developed within the individual as a result of having the disease, or following a course of immunization with attenuated organisms, dead bacteria, bacterial toxins, bacterial filtrates, toxoids or attenuated or killed virus.

Passive Immunity:
This immunity is usually of short duration and differs from active immunity in that the antibodies, instead of being formed by the individual, have been produced in another animal whose blood serum is injected into the individual to be immunized.

The mechanisms of acquired immunity are well understood and are made use of extensively in prevention, treatment, and diagnosis of disease. For example, calfhood vaccination for protection against Bang's Disease is being widely used, and, from a diagnostic point of view, the agglutination test for the same disease is standard procedure.

Natural immunity to a specific disease is inherited, and the degree of immunity varies considerably in different individuals. Eichhorn (2) uses the following example: when a herd of swine has been exposed to hog cholera, a few animals commonly die within 48 to 72 hours after the symptoms develop; others—probably the majority—are sick for 4 to 10 days before dying; some recover after being slightly sick; some after being very sick; and a few may show no indications of illness. The last group would be considered naturally immune.

Most individuals of a species are immune or resistant to certain specific diseases. For example, horses and cattle may be exposed to hog cholera but they never contract this disease. Such natural resistance is known as species immunity.

There are other factors that operate in resistance to disease. The severity of exposure and the virulence of the germs or virus causing the disease may be a factor in breaking down the natural immunity. It would be unwise to dismiss the subject of disease resistance without indicating the role of nutrition. In a general sense, poor nutrition tends to weaken the natural barriers of the animal body to disease-producing invaders. How this is accomplished is a very complex question. Complete knowledge as to the interaction and interdependence of the proteins, the energy source, the essential minerals, and the vitamins, is lacking at present. Much of the experimental work has been conducted on laboratory animals, such as the guinea pig and rat. Due to the species differences in the need for vitamin factors, results obtained in the laboratory are not necessarily applicable to larger animals.

During recent years, much attention has been directed towards the vitamins. Ellis (3) suggests that the underlying cause for the increased susceptibility of Vitamin A deficient animals resides in the changes produced in the epithelial tissues (those of the skin and lining membranes) through the substitution of keratinized or horny tissue for normal tissue. If this is true, the change in epithelial tissues brought about by lack of Vitamin A, increases the susceptibility to invasion by disease-producing organisms, but there is not necessarily a decrease of immunity in the strictly medical sense.

The general picture regarding nutrition and disease resistance indicates that nutritive well-being is essential for the animal body to combat disease.

In contrast to acquired immunity, natural immunity is made little use of as a means of animal disease control. The mechanisms involved in natural immunity are poorly understood. It is within this field that Dr. Koch has made an endeavor to ascertain the nature and functions of these mechanisms. As a result of studies and research, he has formulated a Theory of Natural Immunity.

The possible applications and the limits to this Theory as yet have not been fully determined.

DR. KOCH'S THEORY OF NATURAL IMMUNITY

In an attempt to explain the underlying mechanisms involved in natural immunity, Koch (4) has not only studied conditions existing when disease is present, but also the characteristics of

normal healthy tissues. He suggests that normal healthy animal tissues contain substances that prevent and abolish its basic pathology.

These substances, called metabolites, are described as being diffusible bodies of small molecular weight held in adsorption by the lecithin cephalin fractions of the tissue extracts, from which they can be removed by dialysis, and exist in exceedingly small quantities.

Resulting from the hypodermic administration of these metabolites to human patients suffering from malignancy, various infections and allergic states commonly met with, Koch (4) has arrived at the following conclusions:

(1) Natural immunity is a general property of the tissues, depending upon the presence of metabolites concerned in the oxidation process ordinarily belonging to the production of energy for function. The metabolites seem to serve as photo-chemic sensitizers or catalysts.

(2) The normal biological reactions, resulting from a sufficient supply of these tissue metabolites, constitute the resistance to disease and prevents malfunction in general.

(3) Deficiency in these materials eventuates in an interruption in the progress of oxidation and function. Consequently, susceptibility to infection with symptoms and structural changes of disease being produced.

(4) Deficiency in these substances may result from exhaustive muscular effort, the exhaustion from too severe exposure to cold, from lytic action of poisons upon tissue colloids that raises the surface tension and causes a washing out or leaking away of the important metabolites, and finally from the action of toxic molecules that inhibits or paralyzes the action of the metabolites.

In supporting the views of Koch, Arnott (5) points out that the most potent forces affording us protection from disease are natural within our bodies. The potency of these protective forces depends to a large degree upon the normal oxidation of food materials into living energy. Arnott believes that the last step in the transition of energy contained in the food consumed for nourishment into that of living energy, takes place through the catalytic action of certain carbon compounds (described as metabolites, by Koch) which are natural to the body; and that a chronic deficiency of oxidation results when the supply of these essential compounds becomes depleted. A defect in the continuous efficiency of this fundamental biochemical reaction constitutes the origin of the predisposition to disease or various types of pathological states.

The supposition is, therefore, that renewing the supply of these essential carbon compounds, by hypodermic injection, will re-establish a vigorous resistance to disease and a natural recovery process may be instituted through which good health may be restored.

PREPARATION OF THE THERAPEUTIC REAGENTS

The first method used in producing the metabolites employed the use of certain animal tissues as the starting point. Certain tissues were thought to provide the richest source, because of their

greater survival against starvation as compared with other body tissues. But it is to be pointed out that this first method of producing the Reagents was expensive and very often unsuccessful.

To get around these difficulties, a synthetic procedure for producing the compounds in a suitable form was developed. Several methods were tried. The end product is described as being the internal anhydride of glyoxylic acid, and is given the structural formula O=C==C=O. The term "Glyoxylide" is used as a short form when referring to this compound.

METHOD OF TREATMENT FOR ANIMALS

The Reagents are contained in small glass ampoules. A full 5 c.c.'s constitutes one treatment for an animal corresponding to the size of a mature dairy cow. The dosage is decreased for smaller animals; for example, a dairy heifer under one year of age is given a 2.5 c.c.'s dose, while for the average size dog a 1 c.c.'s dose is satisfactory. The material is injected with a special hypodermic syringe using a large-bore needle. The injection is made intramuscularly, usually in the neck region.

Recommendations regarding the diet of the treated animals include decreasing the amount of protein in the ration, and, in the case of dairy cattle, silage should be eliminated as well.

When treating mastitis cases, it is recommended that for the acute type, the Treatment should be made without delay and with the chronic type, the change of ration should be in effect for a few days prior to Treatment. Another method used in treating chronic mastitis is to administer the Treatment during the dry period, and retreat if signs of the disease recur after freshening.

In British Columbia, the Treatments are distributed by a representative of the Dr. W. F. Koch Laboratories and are available for use to all veterinarians.

REPORTED USE OF THE KOCH TREATMENT

The use of the Koch Treatment Therapy on livestock has been recorded in two provinces of the Dominion; namely, British Columbia and Ontario.

The most extensive investigation yet carried out in an effort to determine the therapeutic value of the Koch Treatment was conducted by a committee named by the British Columbia Minister of Agriculture in October of 1944. Prior to this date, much interest and enthusiasm had been created by a few dairymen who had obtained favorable response from the use of this Treatment on their cattle. The Minister, wishing to form an opinion based on accurate investigation, named a committee to carry out the investigational work. Represented on the committee were the British Columbia Veterinary Association, the University of British Columbia, the Provincial Department of Agriculture, the breed associations, and the Dr. W. F. Koch Laboratories.

"Province of British Columbia, Reprints from Department of Agriculture Reports for 1944 and 1945, Koch Treatment Investigation."

NO. OF CASES	LACTATION PERIOD	RECOVERY		RECURRENCE, MONTHS AFTER TREATMENT						DOUBTFUL	NUMBER GIVEN SECOND DOSE	UNSATIS-FACTORY	FRESHENED WITH NO RECURRENCE	QUARTERS DRY OR LOST
				1	2	3	4	5	6					
7	1-12 days	5	71.4%	1	-	-	1	1	-	1	2	1	-	2
45	1-8 months	26	57.7%	2	3	2	1	3	2	10	10	9	-	5
19	Dry to freshen	8	42.1%	1	-	-	-	-	2	2	8	9	8	-
71		39								13	20	19	8	7
Per cent		54.93%								18.3%	28.1%	26.76%	42.1%	3.38%

The purpose of the investigation carried out by this committee was not to ascertain the cause of the disease, but solely to determine the value of the Treatment. Data taken from the Department of Agriculture Reports (6) indicates the findings of the investigational committee.

The procedure used with the mastitis cases was as follows: milk specimens were taken from each quarter of the udder of the affected animal by the veterinarian, at the time each animal was injected. Milk samples were taken again in one week and at following monthly intervals. Duplicate samples were sent to two different laboratories for bacteriological examination. A physical examination of the udder was made and noted each time the milk samples were taken.

General Observations Included:

1. During the first week after giving the Treatment there was a decided drop in the bacteria, leukocyte, and chloride content of the milk, as revealed by the bacteriological examinations.

2. A consistent result was a definite softening of the udder after Treatment. The disappearance of fibrous tissue was noticed in a considerable number of cases.

3. Out of a total of 207 affected quarters, only 7 were lost to production.

4. It also appeared that the Treatment had a beneficial effect on digestion, also on the skin and coat.

The detailed results of the mastitis cases are given in the following chart:

In addition to the mastitis cases observed, similar investigational work was carried out with dairy cattle suffering from sterility and infertility.

Prior to giving the Treatment, a physical examination of each animal was made by the veterinarian. All abnormal conditions were left precisely as found. No attempt was made to correct the abnormalities by manipulation or other treatment. The owners were advised not to breed the animal on the appearance of the first estrual period following injection, but to wait for the second appearance to be sure of a normal twenty-one, day return.

The following findings were recorded:

Total number of cases treated	29
Number of cases showing favorable response (certified in calf)	21, or 72.4%
Average time sterile before injection	5.7 months
Average number of times bred before injection	4.9 times
Average time sterile after injection	1.7 months

It is of interest to note the various conditions that existed prior to treatment. Of the twenty-one cases that responded to the Treatment, the conditions present were:

Cysts of the ovaries	2 cases
Cysts of the ovaries and vaginitis	3 cases
Retained corpus luteum	3 cases
Retained corpus luteum and vaginitis	4 cases
Vaginitis	8 cases
Fibrous ovaries	1 case

Of the eight cases that did not respond, the conditions present were:

Nymphomaniacs	2 cases
Cysts of the ovaries	3 cases
Cysts of the ovaries and vaginitis	2 cases
Retained corpus luteum and vaginitis	1 case

The results obtained with the sterility cases prompted the committee in expressing the opinion that the Treatment has considerable merit in constitutional derangements and unbalance, as found in sterility and infertility; and that the intelligent use of this material combined with known manipulative treatment would possibly give more satisfactory results than either treatment alone.

At the preliminary meeting, prior to the investigation, the veterinarians present expressed themselves as being very skeptical about the value of the Koch Treatment. Since that time, however, a change of opinion on the part of the veterinary profession in British Columbia is indicated, by the passing of a resolution at the regular meeting of the British Columbia Veterinary Association in January, 1946, to the effect that the official results of the Koch Treatment in veterinary practice were reasonable grounds to warrant continuing its use.

Additional information concerning the treatment of dairy cattle is being compiled as time goes on. Wood (7) has gathered the following data obtained from dairy herds in the Lower Fraser Valley.

FARM A

Acute Mastitis Cases Treated with "Glyoxylide"

Cows taken out of production due to acute mastitis	22 head

Cows returned to production following Treatment	22 head—100%
Number of quarters of udders definitely infected	40 quarters
Number of quarters of udders returned to production	33 quarters—82.5%
Number of quarters showing subsequent infection	1 quarter—2.5%
Number of quarters lost due to teat injury plus mastitis	4 quarters—10%
Number of quarters lost due to mastitis only	2 quarters—5%
Total number of Treatments administered	36 Treatments
Average number of Treatments per cow	1.63 Treatments
Cows that have milked 12 months or more since Treatment	16 cows
Cows that have shown no recurrence of mastitis after milking for 12 months or more since Treatment	13 cows—81.2%

Chronic Mastitis Cases Treated With "Glyoxylide"

Cows out of production due to chronic mastitis	15 head
Cows returned to production	15 head—100%
Number of quarters definitely infected	39 quarters
Number of quarters completely cured	33 quarters—84.62%
Number of quarters lost due to mastitis only	5 quarters—12.82%
Number of quarters lost due to teat injury plus mastitis	1 quarter—2.56%
Total number of Treatments given 15 cows	24 Treatments
Average number of Treatments per cow	1.60 Treatments
Cows that have milked 12 months or more since Treatment	8 cows
Cows that have milked 12 months showing no recurrence of mastitis	7 cows—87.5%

General Cases Including Sterility and Systemic Conditions Treated With "Glyoxylide"

Number of cases treated	17
Number of complete recoveries	13—82.3%
Number of doubtful recoveries	2—11.8%
Number of failures	1— 5.9%
Number of Treatments administered to 17 cows	20 Treatments
Average number of Treatments administered per cow	1.18

FARM B

Sterility Cases Treated With "Glyoxylide"

Number of cases treated for sterility	24 head
Number of cases recovered and in calf	19 head—79.1%
Number of clinical recoveries, but conception doubtful	2 head— 8.3%
Number of cases failed to recover; open	2 head—12.5%
Breeding time lost previous to Treatment in 10 cited cases	33.9 weeks
Breeding time lost between Treatment and time of conception	7.1 weeks

FARMS C AND D

Sterility and Systemic Cases Treated With "Glyoxylide"

Number of cases treated for sterility	9 cases
Number of recoveries	5 cases—55%
Number of cases treated for systemic conditions	15 cases
Number of recoveries	9 cases—60%

The foregoing summaries give additional evidence relative to the merit of the Treatment. It is difficult to determine to what degree the variation in the percentage of successful cases in separate herds was influenced by environmental conditions, management procedures, and the severity of the pathological state.

In Ontario, an attempt was made to secure the aid and cooperation of the provincial Department of Agriculture concerning the use of the Koch Treatment. No agreement was reached. The information on the use of the Koch Treatment in Ontario is, therefore, limited to reports by a representative of the Dr. W. F. Koch Laboratories and one practicing veterinarian.

Arnott (8) reports that the Treatment has been used in fifty different herds on approximately three hundred cows. Considerable fieldwork was carried out in Middlesex County on mastitis cases. Sixty-six animals presenting the disease in acute and chronic states were treated and observed. The dairymen made the observations.

In twenty-seven cases, using one Treatment, all signs of the disease were eliminated. The same result was had in twenty-seven additional cases using two Treatments; while in another twelve instances, the result fell short of complete success, or no noticeable benefit was derived.

The indication is that the Treatment was successful in eighty percent of the cases. However, the standards set for a successful treatment are not indicated. The differences in the opinions of the dairymen may also have an influence on the percentage of the so-called successful Treatments.

It is suggested that the Koch Treatment can be used to control Bang's Disease in cattle. The Treatment is used with three objectives; first, to establish the normal reproduction of healthy living calves; secondly, to prevent the spread of the disease in an infected herd; and thirdly, to change positive blood tests for Bang's Disease to negative readings.

Arnott and Campbell (9) report that in three herds where serious losses due to Bang's Disease were encountered, fifty-five animals were given one Treatment. Two of these animals were sold and were lost track of, but with the remaining fifty-three animals no further losses occurred. The results may be very misleading. It is quite possible that the value of the Treatment is being judged at a time when the disease has run its course and is becoming chronic. At this stage, abortions can be expected to decrease as a result of acquired immunity and a large percentage of cows produce apparently normal calves.

The same workers present the following findings when using the Treatment in an attempt to change positive blood agglutination tests from positive to negative. Two animals in one herd

were blood tested on April 13th, giving a positive reading. The Koch Treatment was administered on April 28th, May 7th, and May 15th. On June 26th, another blood sample was taken from each animal, and both were found to be negative. The blood samples were drawn by a veterinarian and were tested at the Ontario Veterinary College. Also, in the case of another ten cows, which were shown to be positive by the agglutination test, following the administration of the Koch Treatment, the blood picture improved in nine instances with five negative readings. These results are encouraging but cannot be regarded as highly significant considering the number of cases involved.

Another interesting use of the Treatment is reported by Arnott and Campbell (9). An outbreak of Johne's Disease occurred in a dairy herd. Post-mortem examination of one of the animals confirmed the presence of the disease. Under supervision of the staff of the Ontario Veterinary College, tests were made which revealed the presence of the disease in eight other cows in the herd. The owner was advised to dispose of all the infected animals, to protect the rest of the herd. However, he decided to try the Koch Treatment. The eight positive animals were treated three times at weekly intervals. Six weeks after the first Treatment, the entire herd was given the clinical test for Johne's Disease. Another animal was found positive to the test, but among the eight found positive at the first test and subsequently treated, four were found to be negative. These four animals improved in condition and returned to normal milk production.

The number of cases cited is very limited, but there is an indication that some degree of immunity was established following the Treatment. The possibilities suggested are worth consideration because Johne's Disease is very widespread and has been observed in practically every country where cattle are raised on a large scale. Up to the present time, however, no satisfactory method of treating cattle affected with Johne's Disease has been found.

Specific remedies for each disease constitute the normal approach to disease eradication and control. An important feature of this new method of combating disease is the use of the same Treatment on a wide range of pathological states. Some critics may consider this sufficient reason to class the Koch Treatment as a "cure-all." If, however, by using the Reagents, the natural immunity mechanisms of the body are strengthened, it is logical to believe that many diseases can be brought under control.

All the available data concerning the use of the Treatment are taken from information gathered by workers in the field. There has been no well-controlled experimental work conducted. The basis for evaluating the merit of the Treatment must therefore be confined to results obtained in the field. This leaves open many possibilities for error in judgment, due, for the most part, to the variations in environment. These variations include different management practices, the wide range in level of nutrition, the nature of sanitation measures, and many other factors influencing the health of animals.

SURVEY OF DAIRY HERDS IN THE CHILLIWACK AREA

In order to supplement the foregoing information and to give some indications relative to the present status of the Koch Treatment, a limited survey of a few dairy herds in the Chilliwack area of the Fraser Valley was conducted. The Treatment was first used in this area early in 1944.

These initial experiences stimulated the interest of the veterinarians and the dairymen. The use of the Treatment continued, and soon became more widespread. At the present time, the local veterinarians are using the Treatment to combat various diseases and physiological disturbances commonly met with in dairy cattle.

An attempt was made to obtain a representative sample of the herds and not to include only those where the most desirable results were obtained. A local veterinarian, who administered the largest percentage of the Treatments in the area, chose the herds that were visited. In all instances the opinion of the dairyman was solicited and the environmental conditions were noted. The farms were visited during the winter months when the cattle were confined to the barn. The physical appearance of the animals and the accommodation provided, afforded a fairly reliable guide as to the efficiency of the management procedures. No attempt was made to analyze the rations and the possible influence of nutrition.

At the outset it was intended to secure case histories of the treated animals, but it was soon realized that the lack of accurate records constituted a severe handicap to obtaining suitable information. The nature and extent of the records varied greatly between herds. In some herds it was possible to obtain fairly reliable case histories, but with the majority, where the owner's memory constituted the main source of information, the findings are limited to not more than a general observation.

CASE HISTORIES
FARM Cl

1. GLENGARRY ANN—Tattoo EF-23U. Born December 24, 1940—Acute Mastitis.
March 9, 1944—Calved as a three-year-old, with her second calf. Normal milk flow increased up to 45 pounds per day.
March 30, 1944—Acute mastitis developed with a high temperature and refusal of feed. The udder was inflamed and swollen, particularly in the right hindquarter. The milk was discarded.
March 31, 1944—Treated with Glyoxylide.
April 6, 1944-By this date the inflammation and the swelling in the udder had reduced. The milking machine was used again, and marketable milk was produced from all quarters. Milk production increased up to 40 pounds per day.
There has been no reappearance of this condition; the cow has produced and reproduced normally. She calved again on March 9, 1945, and March 7, 1946.
December 28, 1946—Due to calve again on March 23, 1947. The udder was examined; it appeared to be normal in every respect.

2. GLENGARRY DAISY—Tattoo EF-7T. Born May 23, 19:39. Acute Mastitis.
December 25, 1945—The cow calved normally. Acute mastitis developed in the right front and right rear quarters. There was no fever, but feed was refused. The milk was discarded from the infected quarters.
January 11, 1946—Treated with Glyoxylide. The condition improved immediately and the milk from all quarters appeared normal to the Geneva blotter test.
January 30, 1946—Return of the previous condition.
January 31, 1946—Treated with Glyoxylide.

February 7. 1946—Milk secretion from all quarters had returned to normal, giving a normal reaction to the blotter test.
December 28, 1946 — Normal production continued throughout the lactation period. Examination of the udder revealed the physical texture to be good. There was a small amount of fibrous tissue evident in the previously affected quarters.

3. GLENGARRY NANCY —Tattoo EF-20U. Born November 11, 1940. Acute Mastitis.
This animal was taken to the Chilliwack Fair on September 9, 1945.
September 10, 1945—Acute mastitis developed. The udder was swollen and inflamed; the infection was localized in the right front quarters. The temperature reading was 106 degrees.
September 11, 1945—Treated with Glyoxylide. An immediate response was noted by the reduction of swelling and inflammation.
September 15, 1945—All quarters were producing saleable milk. Blotter test reaction normal on all quarters.
February 6,1946—Calved again with no recurrence of mastitis.
December 28. 1946—Still producing normally; physical condition of the udder good.

4. MAPLE SPRINGS DAISY—Tattoo AKR-5X. Born September 7, 1943. Acute Mastitis.
July 25, 1946—Cow calved. Two weeks following calving, acute mastitis developed in the left rear quarter and spread immediately to the right front quarter. Udder hard and swollen. High temperature—106 degrees approximately for three days.
August 17, 1946—Treated with Glyoxylide. The udder softened gradually and the milk from all quarters returned to normal quality.
December 28, 1946—Normal milk produced from all quarters. Volume of milk secreted from the affected quarters approximately one-third that from the corresponding unaffected quarters. The physical texture of the two affected quarters was soft and pliable with no evidence of fibrosis.

5. MALE SPRINGS CHRISTMAS — Born December 18, 1942. Acute Mastitis.
November 19, 1944 — Cow calved with mastitis in right rear quarter.
November 20, 1944—Treated with Glyoxylide.
November 24, 1944—Milk from the infected quarter showed normal to the blotter test. There was no recurrence of mastitis during the balance of the lactation period.
March 2, 1946—Calved again; no recurrence of mastitis.
December 28, 1946—Normal production continues. Udder appears to be in a normal, healthy condition.

6. CHARITY—Born April 21, 1944. — Sterility and Acute Mastitis.
This virgin heifer was bred four times and remained sterile for a period of 4 months prior to Treatment.
January 3, 1946—Treated with Glyoxylide.
February 19, 1946—Bred again to the same sire. Conceived to this service.
This heifer was taken to the Chilliwack Fair in September 1946. Two days prior to showing, acute mastitis developed in the left rear quarter. This was a non-functioning udder at this time. The udder was swollen and hard; feed was refused.
September 11, 1946—Treated with Glyoxylide at the exhibition grounds. The response was immediate. Appetite restored. The recovery was such that this animal was awarded the female

reserve Grand Championship of the show.
November 19, 1946—Heifer calved; sound on all quarters.
December 28, 1946 — Milk production 48-50 pounds per day. Udder appears to be in excellent condition.

7. BEAUTY—Born September 7, 1944. Sterility.
Virgin heifer, bred 5 times, and remained sterile for 4 months prior to Treatment.
January 3, 1946—Treated with Glyoxylide.
February 20, 1946—Bred again to the same sire. Conceived to this service, calving on December 7, 1946.

8. GERTRUDE—Born July 24, 1944. Sterility.
Virgin heifer, bred 5 times, and remained sterile for 4.5 months prior to Treatment.
January 3, 1946—Treated with Glyoxylide.
February 19, 1946—Bred again to the same sire. Conceived to this service, calving on December 17, 1946.

9. KILLILANA HOPE—Ear Tag M392. Born February 8, 1936. Sterility.
This cow was a chronic buller exhibiting continual estrum for a period of 4 months prior to Treatment.
March 15, 1945—Treated with Glyoxylide.
March 21, 1945—Estrual cycle controlled.
April 11, 1945—Bred; conceived to this service.
January 24. 1946—Cow calved. No recurrence of the previous condition. Bred for the first time following calving on April 24,1946.
December 28, 1946 — Certified to be in calf to the April 24 breeding.

10. DENTONIA MAMIE—Tattoo OE-8N. Born December 23, 1935. Sterility.
March 11, 1945—Calved. This cow failed to come in season. Allowing 8 weeks for the appearance of the first estrual period following parturition, estrum was suppressed for 34 days prior to Treatment.
July 15, 1945—Treated with Glyoxylide.
August 2. 1945—The first heat period following parturition occurred. The cow was bred and conceived to this breeding.
May 15, 1946—Calved. The same condition which existed the previous year returned. Again allowing 8 weeks for the appearance of the first estrual period following parturition estrum was suppressed for 109 days before Treatment.
November 1, 1946—Treated with Glyoxylide.
November 30, 1946—The second heat period following parturition occurred. The cow was bred and she conceived to this service.
March 15, 1947—The cow was certified to be in calf.

11. MAPLE SPRINGS DEHLIA—Tattoo AKR-3X. Born June 1, 1943. Sterility and Acetonemia.
Virgin heifer bred 6 times and remained sterile for 5 months prior to Treatment.
January 20, 1945—Treated with Glyoxylide.

March 5, 1945—Second heat period following Treatment; bred and conceived to this service.
December 16, 1945—Calved. Produced 38 pounds of milk per day before calving.
December 28, 1945 — Acetonemia developed and despite treatment with sucrose and molasses, the condition became more pronounced. Feed was refused and a severe nervous condition was evident.
January 3, 1946—Treated with Glyoxylide. There was an immediate response. Some feed was taken 2 hours after the administration of the Treatment. The condition continued to improve steadily until the recovery was complete.
June 3, 1946—In season and bred.
December 28, 1946 — Certified to be in calf. Due to calve on March 11, 1947.

12. BRINDLE—Born December 10, 1940. Acetonemia.
December 5, 1944. — Calved. Acetonemia developed 3 weeks after calving. This cow was treated for four days with hydrochloric acid, with no apparent response. Appetite poor.
January 5, 1945—Treated with Glyoxylide. Normal appetite was restored 36 hours after Treatment. A satisfactory recovery resulted with an improvement in general condition.
December 28, 1946—This cow has calved twice since December 1944, with no recurrence of Acetonemia.

13. WILLOWS BLOSSOM—Born August 27, 1938. Acetonemia.
December 6, 1945—Calved.
Acetonemia developed 3 weeks following parturition. Feed was refused and the cow was unable to stand.
January 3, 1946—Treated with Glyoxylide.
January 5, 1946—The cow was on feed again but still remained weak on her legs.
January 12, 1946—Appetite back to normal; able to stand normally; recovery appeared to be complete.
March 22, 1946—In season; bred and conceived to this service.
December 28, 1946—This cow is in excellent physical condition; immediately prior to calving.

14. KILLILANA BLOSSOM—Born January 6, 1942. Summer Snuffles or Rhinitis.
This cow had difficulty in breathing and showed nasal discharge while on pasture during the spring and summer months of 1946. She was treated with Glyoxylide in May, June and July. A definite improvement was noted following the first Treatment, but the recovery was not complete—the disease still persisted.
December 28, 1944—The cow still remains in the herd. A small amount of nasal discharge was evident and the breathing was almost normal. This condition can be expected because the difficult breathing is more pronounced during the warm months, and the disease tends to subside, or becomes more or less dormant, during the cool season.

Environmental Conditions—Excellent.
The animals in this herd receive excellent care. The milking herd is kept in a lounging shed, except for the length of time-required daily for feeding and milking.

Owner's Opinion: The owner states that he is well satisfied with the results obtained from this method of Treatment. He also feels that in order to derive the maximum benefits, it is necessary

to administer the Glyoxylide as soon as possible when needed, and to eliminate silage and high protein feeds from the ration immediately after Treatment.

FARM C2

1. BUTTERCUP—Tattoo P-1957, 2-year-old. Acute Mastitis.
Two days prior to calving, acute mastitis developed in the left front quarter, which was swollen and hard. The excretion from this quarter was thin and serum-like.
March 11, 1945—Treated with Glyoxylide.
March 12, 1945—Calved with normal milk secretion from three unaffected quarters.
March 21, 1945—Normal saleable milk was produced from all four quarters. The swelling and hardness in the entire udder was greatly reduced. During the remainder of this lactation period the volume of milk secreted from the affected quarter was two-thirds that of the other fore-quarter.
April 6, 1946—Calved again with no recurrence of mastitis.
December 29, 1946—Still producing normally from all quarters. The physical condition of the udder is normal—no fibrosis evident.

2. RITA—3-year-old —Acute Mastitis.
December 4. 1946—Calved with second calf.
January 4, 1947—One month after calving, acute mastitis developed in the left front quarter with swelling and hardness. The milk from this quarter was discarded.
January 6, 1947—Treated with Glyoxylide. The condition remained the same—no response. Two injections of penicillin were given directly into the quarter.
March 3, 1947—The affected quarter is atrophied and is almost dry. The limited secretion was clear and serum-like.

3. JOSIE—Tattoo P1284, 2-year-old—Chronic Mastitis.
June 18, 1944—Calved with first calf. The udder remained extremely tender following parturition after the normal swelling and inflammation had subsided. Difficulty was encountered when using the milking machine on this heifer. The milk secreted appeared normal—no clotting or stringiness evident.
July 12, 1944—Treated with Glyoxylide. Forty-eight hours after Treatment, the tenderness had disappeared sufficiently to allow normal use of the milking machine.
December 26, 1946—This cow had calved twice since the previous trouble was encountered and has remained normal and healthy in every respect.

4. BETTY—Mature cow—Sterility and Chronic Mastitis.
This cow was purchased in April 1944, and was supposedly in calf. A subsequent examination by the veterinarian revealed that she was still open. After the examination, she came in heat normally, but failed to conceive with continuous return to the bull. She was treated with Glyoxylide in November 1944, and January 1945.
March 7, 1945—In season; bred and conceived to this service.
December 12, 1945—Calved. Failed to come in season following parturition. Allowing 8 weeks for the appearance of the first estrual period following calving, estrum was suppressed for 49 days prior to Treatment.

March 31, 1946—Treated with Glyoxylide.
April 2, 1946—First heat period following Treatment; bred and conceived to this service.
November 1946—A chronic mastitic condition developed during the drying-up procedure. All four quarters were affected.
November 18, 1946—Treated with Glyoxylide.
January 9, 1947—Calved normally with no appearance of mastitis.
March 3, 1947—Producing 50 pounds of milk daily; all quarters normal.

ENVIRONMENTAL CONDITIONS-Good.

OWNER'S OPINION— The owner expressed himself as being satisfied with the results of the Treatment.

FARM C3

1. FAIR ACRES MYRTLE—Acute Mastitis.
January 23, 1947—Calved.
Acute mastitis developed in the left rear and right front quarters following parturition. The milk produced from these quarters was not saleable.
February 2, 1947—The affected quarters were treated with an injection of penicillin; no response.
February 11, 1947—Treated with Glyoxylide; no response.
March 1, 1947—The secretion from the two affected quarters remains unsaleable and is diminishing steadily. The secretion had a serum-like appearance containing some clotted material. The udder presented a definite unbalanced condition. The affected quarters were hard and unpliable.

2. MURIEL—Acute Mastitis. January 19, 1947—Calved.
Two weeks following parturition, acute mastitis developed in the right rear quarter.
February 11, 1947—Treated with Glyoxylide.
The infection spread to the right forequarter following the Treatment.
March 1, 1947—The secretion from the right half of the udder still remains abnormal; the fluid produced was serum-like, containing some clotted material. There was considerable fibrosis evident in the affected quarters.

3. DORA—Chronic Mastitis.
This cow had an attack of acute mastitis in the right forequarter during the previous lactation period. The condition seemed to clear up but evidenced itself again during the drying-up period.
December 20, 1946—Treated with Glyoxylide just prior to calving.
December 23, 1946—The cow calved normally and produced marketable milk on all four quarters.
March 1, 1946—Daily milk production—40 pounds per day; normal on all quarters. The udder was soft and pliable and in excellent physical condition.

4. PRAIRIE VIEW PANSY—Chronic Mastitis
During the previous lactation period, an acute flare-up of mastitis occurred in the left rear

quarter. One intra-mammary injection of penicillin was given. The infection apparently cleared up, as normal milk was produced from this quarter during the remainder of the lactation period. The udder remained normal until just prior to calving again (Feb 1947) when an abnormal amount of swelling and inflammation occurred.
February 11, 1947—Treated with Glyoxylide.
February 14, 1947—Calved.
March 1, 1947—Normal milk produced from all quarters—daily milk production 35 pounds per day. The physical texture of the udder was normal.

ENVIRONMENTAL CONDITIONS—Good.

OWNER'S OPINION— The owner was disappointed and dissatisfied with the results obtained.

FARM C4

1. OLIVE VALE—Ear Tag 47563 —Acute Mastitis.
October 25, 1946—This heifer calved for the first time as a late 2-year-old. Normal milk production followed and increased to 65 pounds per day.
January 5, 1947—Acute mastitis developed in the left forequarter, which was swollen and hard. The secretion from this quarter was very thick and white in appearance. Treated with Glyoxylide.
January 8, 1947—A marked improvement was evident three days after Treatment. The quarter became softer and the milk improved gradually in physical appearance.
March 1, 1947—A complete recovery has been made. The milk production at this date was 60 pounds per day. It was impossible to tell from a physical examination of the udder which quarter had been previously affected.

2. FERN VALE—Ear Tag 47567—Chronic Acetonemia with Scours.
October 23, 1946—This heifer calved as a late 2-year-old with her first calf. Normal milk production increased up to 60 pounds per day following parturition.
November 25, 1946—Milk production began to decrease and continued until only 15 pounds were produced daily. This condition was accompanied by scouring. The veterinarian diagnosed the condition as Acetonemia. Both sucrose and chloral hydrate treatments were used, but the condition remained the same.
December 28, 1946—Treated with Glyoxylide. A steady improvement was noted following the Treatment with Glyoxylide. The scouring cleared up, the acetone body content of the urine reduced steadily, and milk production increased.
March 1, 1947—The cow appeared to be in excellent health. The milk production recorded on the previous day was 52 pounds.

ENVIRONMENTAL CONDITIONS—Good.

OWNER'S OPINION— The owner was well satisfied with the manner in which his cows reacted to the Glyoxylide.

FARM CS

1. SAUCY SUE—4-year-old—Acute Mastitis.
November 2, 1945—Cow calved.
November 15, 1945—Acute mastitis developed affecting all four quarters. All the milk produced was unsaleable.
November 18, 1945—Treated with Glyoxylide. Within two weeks after giving the Treatment, marketable milk was produced from all quarters. There was no reappearance of mastitis during the remainder of the lactation period.
December 20, 1946—The cow calved again with no recurrence of mastitis.
March 3, 1947—The cow was in excellent health, producing 40 pounds per day and sound on all four quarters.

2. PANSY-4-year-old—Chronic Mastitis.
During the summer of 1946, this cow was subject to intermittent flare-ups of mastitis in the right rear quarter. She was treated with Glyoxylide in November 1946, prior to drying-up.
February 28, 1947—Cow calved; normal milk secretion from all quarters.
March 3, 1947—The daily milk production was 50 pounds per day; sound on all four quarters.

3. TULIP—4-year-old—Rheumatism.
This cow suffered from a rheumatic condition affecting the hind quarters. This condition, which existed for approximately two years prior to Treatment, was aggravated by the confinement during the winter months. The cow appeared to be stiff and sore on the hind legs.
November 1945—Treated with Glyoxylide. There was no appreciable response to the Treatment.
March 3, 1947—The condition was growing steadily worse, and the owner expects to dispose of the cow.

ENVIRONMENTAL CONDITIONS—Fair.

OWNER'S OPINION— The owner believes that the Treatment has some value, but he considers the cost to be too high.

FARM C6

1. RUBY—5-year-old—Acute Mastitis.
March 10, 1944—Calved. Acute mastitis developed in both rear quarters.
March 23, 1944—Treated with Glyoxylide, no response.
April 3, 1944—Treated with Glyoxylide. The condition cleared up gradually until both affected quarters were producing normal milk. The recorded production for this lactation period is 477 pounds of butterfat.
March 26, 1945—Calved again with no recurrence of mastitis. The recorded production for this lactation period is 543 pounds of butterfat.
January 2, 1947—This cow still remains healthy in every respect.

2. PAMELA—5-year-old—Acute Mastitis.
August 4, 1944—Calved. Three weeks following parturition, mastitis developed in the two forequarters. The quarters were hard and swollen and produced a straw-colored fluid.
September 1, 1944—Treated with Glyoxylide. There was an immediate softening of the udder

and marketable milk was produced from both quarters within one week following the Treatment. Recorded milk production for this lactation period is 428 pounds of butterfat.
December 10, 1945—Calved; no return of mastitis.
January 2, 1947—This cow still remains in good health and is producing normally.

3. MAE WEST—6-year-old—Chronic Mastitis.
May 17, 1944—Calved. Intermittent attacks of mastitis occurred during the summer months of 1944. Stringy milk was produced from both rear quarters at different intervals. One Treatment of Glyoxylide was given in the late summer. The condition cleared up completely.
January 2, 1947—There has been no return of mastitis during two subsequent lactations.

4. PEGGY—5-year-old—Chronic Mastitis.
January 1945—Stringy material and a water fluid was produced when attempting to dry-up the cow.
January 10, 1945—Treated with Glyoxylide. Milking was continued throughout the normal dry period. The infection was effectively controlled.
March 5, 1946—Calved. By this date normal milk secretion was obtained from all quarters. Recorded milk production during the lactation period is 492 pounds of butterfat.
January 2, 1947—Milk production was still normal on all quarters.

5. LILLIUMS—13-year-old—Chronic Mastitis.
This old cow suffered from chronic mastitis in both rear quarters. The condition was present for one year prior to Treatment.
April 19, 1944—Treated with Glyoxylide. There was little, if no improvement noticed, and the cow was sold to the butcher.

6. WILLA—2-year-old—Chronic Mastitis.
December 8, 1945—Calved for the first time. Two weeks after calving, stringy milk was produced intermittently from all four quarters. The udder was slightly hardened and tender.
December 29, 1945—Treated with Glyoxylide. There was a marked improvement within a few days, followed by a complete recovery.
January 2, 1947—The cow was just drying up after completing a 365-day record of 720 pounds of butterfat. This has since been reported as the highest 2-year-old record registered under Cow Testing Association Supervision in British Columbia. General health and condition of the udder were good.

There has been considerable trouble encountered in this herd in getting virgin heifers in calf. All the heifers are bred for the first time so that they will calve when they are approximately 2 years old. The following table indicates the results that have been obtained from using the Koch Treatment as a remedy for this situation:

Number of cases treated	10 cases
Number successful	8 cases—80%
Number of failures	2 cases—20%
Time sterile from first breeding to time of Treatment	5.6 months
Time sterile after Treatment	1.3 months
Number of Treatments given to ten heifers	13 Treatments

Average number of Treatments per heifer 1.3 Treatments

Each individual heifer that responded to the Treatment was bred to the same bull that had been used initially.

ENVIRONMENTAL CONDITIONS—Fair.

OWNER'S OPINION— The owner states that he is well pleased with the results obtained from using the Treatment. He considers that it is effective in keeping an important percentage of the animals in production that would otherwise have to be replaced.

SUMMARY OF CASES CITED:

ACUTE MASTITIS:

Number of animals out of production that were treated	14
Number of animals returned to production following Treatment	12—85.7%
Number of quarters infected	22
Number of quarters returned to production	18—81.8%
Number of quarters lost	4—18.2%
Number of cows that have milked for 12 months or more following Treatment	9
Number of cows that have been milked for 12 months following Treatment with no recurrence of mastitis—	88%
Total number of Treatments given	15
Average number of Treatments per animal	1.07

CHRONIC MASTITIS:

Number of animals out of production that were treated	9
Number of animals returned to production following Treatment	8 —38%
Number of quarters infected	23
Number of quarters returned to production	20—86.9%
Number of quarters lost	3—13.1%
Number of animals that have milked for 12 months or more following Treatment	5
Number of animals that have milked for 12 months following Treatment with no recurrence of mastitis	4—80%
Total number of Treatments given	9
Average number of Treatments per animal	1

STERILITY:

Number of animals treated	18
Number of complete recoveries	13—72.2%
Number of doubtful recoveries	3—16.6%
Number of failures	2—11.2%
Length of time sterile before Treatment	4.6 months
Length of time sterile after Treatment	1.4 months
Total number of Treatments given	23

Average number of Treatments per animal	1.28

SYSTEMIC CONDITIONS:

Number of animals treated	6
Number of successful recoveries	3—50%
Number of failures	2—33.3%
Number of doubtful recoveries	1—16.6%
Total number of Treatments given	8
Average number of Treatments per animal	1.33

The summary of the cases cited gives a somewhat false impression of the overall effectiveness of the Treatment. Generally speaking, the data were taken from herds with the more desirable management practices and environmental conditions. It was not possible to collect and incorporate any specific data from herds with deficient records. It is the writer's opinion that the percentage of favorable results would be considerably lower if this information had been available.

Some of the herd owners have recently seen fit to institute a policy of herd Treatment. The plan is to give an injection to all the milking animals during the dry period to serve in a prophylactic capacity. As an inducement to the herd owners, a considerable reduction in the price per Treatment is made to those who adopt this policy. The following summary shows the general trends relative to the Koch Treatment in the Chilliwack area:—

Total number of herd owners consulted	14
Number of owners who are satisfied with the Treatment and are continuing to use it	10
Number of owners who are not satisfied with the Treatment and are not continuing to use it	4
Number of owners who voluntarily expressed the opinion that the cost per Treatment is too high	5
Number of owners who have adopted the policy of herd Treatment	6

The following table serves as a comparison between the previously reported results and the data collected by the writer. In each instance, the number of cases cited varies considerably and the methods used in compiling the information were by no means uniform. However, there does seem to be a general agreement as to the apparent effectiveness of the Treatment.

A COMPARISON OF REPORTED RESULTS AND DATA COLLECTED BY THE WRITER

CONDITION	Data Collected by the Writer	Results Obtained by the B. C. Dept. of Agriculture	Unpublished Material' Reported by Dr. S. N. Wood (Univ. of B.C.)	Results Obtained In Ontario Reported by D. H. Arnott
Mastitis				
Number of cases cited	23	71	37	66
Percentage of recoveries	86.9%	54.9%	83.5%	80%
Total number of infected quarters	42	207	79	——
Number of quarters lost	7	7	12	——
Average number of treatments used per animal	1.04	1.28	1.62	1.22
Sterility				
Number of cases cited	18	29	33	——
Percentage of recoveries	72.2%	72.4%	75%	——
Months sterile before treatment	4.6	5.7	8.5	——
Months sterile after treatment	1.4	1.7	1.8	——
Average number of treatments used per animal	1.28	1	——	——
Systemic Conditions				
Number of cases cited	6	——	32	21
Percentage of recoveries	50%	——	68.7%	52.3%
Average number of treatments used per animal	1.33	——	1.18	1.95

CONCLUSIONS

Heredity and environment are the two broad factors, which determine and influence the ultimate performance of animals. The existence of an inherited resistance or susceptibility to disease is by no means a new concept. The experimental evidence, with animals to substantiate this idea, is relatively new and limited. Nevertheless, during recent years there has been a growing interest in the natural resistance to disease shown by some individual animals. Interest has been stimulated

primarily by advances in genetic knowledge, particularly in relation to physiological characteristics. During recent years, the plant breeder has made remarkable progress in this field by developing disease resistant strains. The question then arises whether or not the animal breeder could make similar progress. Self-fertilization is a natural process for many crop plants, and this makes it possible to retain genetic purity in succeeding generations. Such is not the case with the animal breeder. At the best, he can employ a much less intense system of inbreeding in an attempt to fix any heredity for disease resistance that may now exist in a diluted form in animal populations.

It is the writer's opinion that accurate records of disease incidence should be kept and that these records be given due consideration when future selection of breeding stock is made. It is also well to keep in mind that selection, carried out in the absence of disease, may lead to the development of lines that have no specific disease resistance.

In the past, in the case of animal diseases, nearly all the attention has been focused on the disease organisms themselves, the tissue changes brought about by their presence in the host, and therapeutic measures of control. Such studies have been very fruitful and have made the major contribution to the present measures used to control disease. For example, the development and extensive use of biologics, such as vaccines, to avoid disease indicates the importance of this work. The Koch Treatment used in an attempt to maintain or institute the normal physiological functioning of the body, thus increasing the natural resistance or immunity to disease, represents a new approach to disease control.

To appreciate fully the suggested possibilities of this new therapeutic measure, it is necessary not only to study the results obtained with livestock but also to consider the many applications that have been made in human medicine. Conclusive experimental evidence is lacking at present, and in order to determine accurately the true worth of the Koch Treatment, much more accurate information must be gathered. Only time will tell what position it will attain in future endeavors to maintain the health of animals and humans.

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