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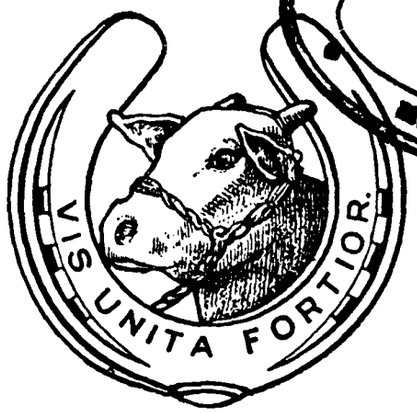

DEVOTED TO THE CAUSE OF THE VETERINARY PROFESSION.

(ESTD. 1924)

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The Indian Veterinary Journal

(The Journal of the All-India Veterinary Association)

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1950-51

Sitting left to right—S. N. Luktuke, Dr. S. S. Prabhu, Dr. P. Bhattacharya o-in-c (*A.G.S.*), Dr. S. C. Datta (*Director*) Dr. N. D. Kehar, o-in-c (*A.N.S.*), Shri S. G. Iyer, o-in-c (*P.R.S.*), Dr. D. P. Mukerji.

Standing left to right—Shri K. R. Gulati, (*Student-Punjab*) Shri K. D. Bhaya, Sardar Sundar Singh.
Shri J. D. Bisht, (*Student, U.P.*) Shri M. P. Johari, Shri S. S. Misra, (*Student, Bihar*)
Shri S. N. Chaterji, Shri S. K. Day, Shri U. D. Sharma.

PAKISTAN ANIMAL HUSBANDRY RESEARCH INSTITUTE,
SUB-STATION, COMILLA.

Group photo taken on the eve of retirement of Mr. S. R. Hassan.

Sitting left to right—M/s. E. H. Siddiqi, R.A. (*P & B*); *Capt.* Ch. M. Hasan, A. R. O. (*Prst.*); M. A. A. Quresbi, A.R.O. (*P & B*); M. A. Quadir, R. A. (*B. P.*); M. Israil, (*O. C.*), M. H. Rahman, R. A. (*Prst.*); S. R. Hassan, (*Retiring O. C.*)

THE

Indian Veterinary Journal

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General Articles

TUBERCULOSIS AND TUBERCULIN WITH SPECIAL REFERENCE TO P. P. D. TUBERCULIN*

A Review

By

B. N. Sahoo,

Superintendent, Orissa Serum Institute, Cuttack.

In view of the increasing attention paid to the study of the human tuberculosis and the well known relationship of bovine and human tuberculosis, tuberculosis of animals has been a subject of intensive study. The opinion has generally been expressed that Indian cattle are rarely victims of tuberculosis, if not relatively refractory, in comparison with the cattle of western countries. It is true that, under average conditions, where Indian cattle are kept out of doors, little tuberculosis exists and the risk of spread through a herd are slight as compared with the cattle of western countries where conditions are particularly favourable for the dissemination of infection. That tuberculosis, however, is not infrequent among Indian cattle maintained under the relatively ideal system of an open air life and that it is a disease to be seriously reckoned with in housed and stall-fed cattle of the cities is a fact of increasing recognition and importance. Data concerning the incidence of tuberculosis in cattle in urban areas reveal a disquieting position and, while mammary tuberculosis may not have assumed the proportion and the significance that it has in cows in Western countries, the fact must not be overlooked that, apart from any disease of the udder, an infected cow may excrete tubercle bacilli in the milk.

*This article was prepared during the author's stay at the Indian Veterinary Research Institute, Mukteswar, on deputation for training on Biological products.

The incidence of tuberculosis in cattle has largely been determined from abattoir figures and, although it is not judicious to accept such figures as being representative of the average general incidence, they are sufficiently alarming to make us revise our opinion of the susceptibility of Indian cattle to the disease. As the results of carefully controlled tuberculin tests on closed herds, it has been found that the disease exists to a degree which warrants a very intensive investigation and, during the last two decades, some very valuable data concerning the incidence and types of the disease have been collected from all the States of India.

Bovine tuberculosis must have existed in this country for a long time but the earliest record traced so far dates facts only to 1898, while experience of early workers indicated that the disease was very rare among Indian cattle and the lesions were invariably minute in extent, localised in particular tissues and retrogressive in their appearence. Slaughter house statistics collected in 1927 revealed an incidence of 16.28% and the figures of 1931 showed 21.38% cows, 23.6% buffaloes and 31.6% bullocks as affected with gross lesions. The disease is no longer restricted to urban areas or to any part of the country and numerous cases have now been detected among animals of all species.

The first experimental investigation upon Bovine tuberculosis in India may be said to have started with the researches of Glen Liston and Soparkar in 1917. The work was directed to obtain an explanation for the alleged rarity of the condition and while they attributed it to a natural resistance to the disease possessed by Indian cattle, the later experiments of Sheather appeared to show a relatively low degree of virulence of the casual organisms isolated locally but this finding of Sheather was challenged by Soparkar. The subject was next discussed at a meeting of Veterinary Officers held in Calcutta in February 1923 and by the Board of Agriculture at its meeting at Pusa in 1925. The latter body passed a resolution recommending certain steps to be taken for the prosecution of researches in Bovine tuberculosis and, in the meantime, the Indian Research Fund Association had been persuaded to supply funds and to depute an officer for carrying out at the Indian Veterinary Research Institute, Mukteswar, a Bovine tuberculosis enquiry for a period of five years from 1923-28.

The experiments undertaken in this enquiry showed that, while some of the indigenous cattle displayed a high resistance to the organisms, others succumbed as quickly as European animals would have done under the same conditions and it was found that, generally speaking, indigenous breeds did not possess more resistance to the disease than animals possessing admixture of European blood. The organisms obtained from natural Bovine lesions appeared to be as virulent as those in other countries. The above enquiry added some valuable informations to our knowledge.

Evidence collected from different dairy farms and remount depots and zoological gardens showed that, after introduction of infection, a high incidence of clinical tuberculosis may develop in a herd maintained under certain conditions of housing. In studies that have been carried out more or less throughout the country, a high incidence of generalised tuberculosis among the conservancy bullocks has been noted. Record exists of a number of cases of tuberculous mastitis in buffaloes and cows in this country and occasional samples of milk from such animals have shown the presence of the specific bacilli.

The available results of bacteriological work carried out upon lesions of tuberculosis in animals in India show that the bovine type of organism is commonly associated with bovine lesions and the human type with the disease of pigs. The avian type of organism has also been recorded from bullocks and pigs and the bovine type from a pig, goat, several Mamas and buffaloes. The human type is usually believed to be responsible for the disease in man in this country. Cases of naturally acquired tuberculosis in cows caused by human bacilli have, however, been recorded and similarly cases of human tuberculosis of bovine origin have been detected.

Having regard to the great public health and agricultural significance of the problem, it is of utmost importance that researches should be pressed upon and intensive campaign must be carried out to diagnose the disease for its control and subsequent eradication.

The only diagnostic agent that we possess now for diagnosing this disease during life before the manifestation of clinical symptoms is Tuberculin, and in this paper I will deal with this product only. But before I do so I believe it will be better to give a short review of the chemistry of the protein of organisms which are acid-fast.

The protein components of bacteria are in most cases of great biological significance and an understanding of their chemical composition and properties is one of the pressing problems in bacteriological chemistry. There is reason to believe that such knowledge is of great value in throwing light on the organisms themselves and also on the biological reactions they elicit.

Among the proteins of the acid-fast bacilli, none has received as much study as that of human type tubercle bacillus. Most of these studies have been the result of a search for the specific active principle of tuberculin. The conclusion that this active substance is protein has been supported by comprehensive and convincing evidence and the apparently divergent views that it was associated with muco-protein, nucleo-protein proteose etc., are explained by the existence of a complex inter-relationship between the protein, nucleic acid and poly-saccharide molecules in tuberculin. Recently, physico-chemical techniques have demonstrated a fact

frequently suspected, namely, that tuberculin proteins of various molecular sizes (8000 to 32,000) are potent. Thus the disagreement in the literature as to whether or not the active material is dialyzable has been due to the fact that different investigators were working with potent molecules of different sizes.

Apparently biological potency must be inherent in some small relatively stable part of the protein molecule and many changes can be effected in the molecule as a whole before there is recognisable loss in the biologic activity. Tuberculin in its original form as produced by the tubercle bacillus may, therefore, be considered a reversibly dissociable component system which consists of active protein, polysaccharide and nucleic acid. The relative proportion of these various components and properties (potency, specificity, toxicity and antigenicity) in any fractions would depend upon the degree of dilution and the reagents used for isolating the fractions. With this knowledge it is apparently possible to isolate molecularly homogeneous substances which would repay careful study along the following lines:

(*a*) Their precise amino-acid composition;

(*b*) Their reactions to specific and highly purified enzymes;

(*c*) Their specific chemical groups responsible for the biological properties which have made tuberculin an interesting and important biological product.

Hitherto analysis of this character has been of doubtful significance because of the impurity and hetrogeneity of the products studied.

From the practical stand point the chemical studies have led to the isolation of a purified and highly potent protein in large quantity for use as a new official standard for tuberculins. This product has been designated as "purified protein derivative tuberculin."

The proteins of several acid-fast bacilli have been studied by similar methods and have been shown mainly by immunological methods to differ from the proteins of the human type tubercle bacilli. Recent work indicates that a serological group specificity exists in the polysaccharides while a type specificity is due to the proteins of these bacilli.

It is now well over half a century since Koch first prepared a product capable of eliciting allergic reactions in tuberculous subjects. Koch's original tuberculin was made by growing the tubercule bacillus in glycerinated meat broth for about six weeks, boiling to kill the organisms, evaporating to 1/10th of the original volume and filtering through a diatomaceous candle. This gave a viscid brownish fluid free from bacterial cells but containing residual constituents of the medium, metabolic product during

growth of bacilli and sufficient glycerine (about 40%) to act as preservative. Koch also prepared other tuberculins in various ways by grinding and extracting the bacilli but the term O. T. refers to products prepared by evaporation procedure. This was termed as Koch's old tuberculin and was used mainly for opthalmic and intradermal use. Apart from this a subcutaneous form of tuberculin was also prepared by carbolising the product to a strength of ½% for preservation without concentrating by heat.

Researches were directed to finding out a more suitable medium for the growth of organism in the preparation of tuberculin, the main object being to eliminate the possibility of non-specific reaction due to non-essential substances derived from the broth medium. One of the chief objection to Old tuberculin is its complexity, for it contains protein derivatives and other non-specific substances from the medium and products of bacterial growth other than the active principle. It has been estimated that only one percent of the product is specific tuberculin. These disadvantages have been met by cultivating the tubercle bacterium on a synthetic media. It is generally agreed that the active principle of tuberculin is protein in nature and, therefore, by preparing tuberculin in a protein free media, the isolation and purification of the active princple is considerably simplified. Long and Sibert (1926) were the first to show that the tubercle bacillus would grow on such a media. Synthetic media consists of a mixture of inorganic salts, asparagine and ammonium salts as the sole source of nitrogen, glucose and glycerol as sources of carbon.

The full constituents of synthetic media, as adopted by the bureau of animal industries U. S. A., are:—

0.18% dipotassium hydrogen phosphate (C. P. quality K2HP04, 3H20); 0.09% Sodium Citrate; 0.15% Magnesium Sulphate (Crystals); 0.03% Ferric Citrate Scales; 1.4% Asparagine; 1.0% Glucose; and 10% by weight of Glycerine. Each of the salts is dissolved separately in distilled water in the order given, stirred into the hot Asparagine solution made up in half the total final volume. The glucose and glycerine are then added and the final volume adjusted with distilled water. The solution is clear and no filteration is required. The pH value is 7.0 and no adjustment is necessary (if required adjust with Liq. Ammonia.) 100 c.c. of media is put inside 300 c.c. flasks and autoclaved at 10 pounds pressure for 25 minutes and incubated for 3 days before inoculation. The cotton plugs are covered in tin foil to reduce evaporation during the subsequent prolonged period of growth after inoculation.

The seeding flake grows as a thin film over the surface of liquid media in the course of about 10 days and then thickens until in about 8 weeks the medium is exhausted. The most active growing period is about the fifth week at which time there is marked condensation of moisture on the

upper parts of the flasks. Final growth corresponds to about 2 gms. of bacterial dry weight per 100 c. c. of medium. If any of the thickening films sink, growth ceases and yield is lower. The final reaction is well above pH7.

After rejection of possibly contaminated cultures, the pure ones are subjected to flowing steam for 3 hours to kill the organisms. After cooling over night the contents of the flasks are strained through 60 mesh copper gauze. Each flask is finally rinsed with 10 c. c. of distilled water and the combined rinsings poured through the collected pressed mass of bacterial debris. To the entire strain liquid 1.5% glycerine is added and the product evaporated to 1/5th of its volume on a steam bath in corrosion proof pans (Porcelain basin.) The concentrated product is then cooled in a suitable flask and diluted with an equal quantity of 1% phenol. The phenolised product is stored at 47° C for a fortnight to ensure permanent limpidity of the finished product and passed through a Sharples high speed bowl-type centrifuge 2 or 3 times to ensure subsequent ease of passage through sterile filters into sterilized containers.

At this stage phenol content is checked and an 'acetic acid test' applied to indicate the content of active principle in the finished product. In this test 15 drops of Glacial Acetic Acid are added to 20 c.c. of tuberculin in a graduated tube. After standing for 48 hours the precipitate should show a volume of about 5 c. c.

Batches are tested for safety and potency on normal and sensitized guinea-pigs and bottling is conducted under aseptic precautions. A tentative expiry date of one year is assigned on the labels. Sample bottles are checked for absence of micro-organisms by cultural tests and microscopic examination.

Although this method of preparation involving concentration by heat precludes the presence of animal protein the tuberculin still contains the concentrated decomposition residues of the synthetic media and unwanted metabolic by-products of bacterial growth besides the active principle itself.

To obviate this, the active principle of tuberculin is separated from the steamed and filtered culture by saturating the filterate with Ammonium Sulphate. The precipitate is collected and redissolved in 20% glycerine to make the final volume 1/10th of the original volume. The final product is filtered through a bacterial candle and preserved with Merthiolate or 0.1% formaline.

But the purest form of tuberculin yet available is known as P.P.D. tuberculin.

As early as 1891 Koch believed that the substance responsible for eliciting the specific effect in diseased animal was of protein nature and the literature on 'The Chemistry of the proteins of the Acid fast bacilli' over the ensuing half century was reviewed by Florence Seibert. Seibert

herself has done much to elucidate the nature of active fractions of tuberculin and the term P. P. D. (Purified Protein Derivative) was coined by her about 1934 to replace one of her earlier T. P. T. products (Trichloracetic Precipitated Tuberculin). As early as 1926 she isolated a crystalline protein with tuberculin activity though this constituted only a portion of the total active proteins. In 1932 she prepared a trichloracetic precipitated tuberculin protein suitable for the preparation of a standard tuberculin having already shown that similar products could be obtained by a variety of precipitation procedures. Her earlier preparations were generally made from H. C. S. M. (Heat Concentrated Synthetic Medium) tuberculin by ultra filteration through collodion impregnated alundum candles, 'washing in solution' to remove dialysable material and precipitating the residual solution (containing the protein, some polysaccharide and nucleic acid) with Trichloracetic acid. The precipitate after washing with anhydrous ether, yielded a dry powder stable for years and suitable for making up solutions on a precise quantitative basis. This product still contained considerable quantities of nucleic acid (upto 9%) and polysaccharide (5% or more) and gave all specific reactions of tuberculin. Tuberculin freed from protein did not give the required specific reaction. At a later date she reverted to the use of saturated Ammonium Sulphate (buffered at pH 7·0 with disodium phosphate) in order to reduce the nucleic acid content of the powder and in 1941 published her later methods of preparation and analysis of a large quantity of P.P.D. for use as standard. The method retained the somewhat cumbersome collodion ultra-filteration and final drying was effected from the frozen state instead of by ether. The product contained much less nucleic acid but about the same amount of polysaccharide as before.

Seibert's 'Reserve standard P.P.D.' has been extensively used in the United States on the human subject and since it probably has almost maximum obtainable potency as well as experimental priority it might well become a provisional "International Standard" for P.P.D.s prepared from human strain of M. tuberculosis. Complications arising when 'comparative testing' is carried out with mammalian and avian strains need not be discussed at this juncture.

Whilst Seibert's work was going on in America, satisfactory P. P. D.s were also made in other countries by similar technique by Doig *et al* in England in 1938, by Jensen in Denmark in 1938, by Wong and Chu in China in 1938, by Vasarhelyi and Gozsy in Hungary in 1939 and by Leyva in the Philippines in 1940.

The Veterinary Laboratory of agriculture at Weybridge also interested itself in the question in 1938 and prepared a few specimens of P. P. D. by Seibert's original technique from its own H. C. S. M. tuberculin, made along the lines of B. A. I. tuberculin since 1935. But it soon became apparent that a much simplified technique could be adopted for routine

manufacture of P.P.D. tuberculin for veterinary use and, after large scale testing on cattle throughout the country, P.P.D. tuberculin of both mammalian and avian origin were adopted for official use early in 1942. When studying the earlier preparations it was noted that the cumbersome collodion ultra-filteration (selected by Seibert in her first work on crystallisation of tuberculin protein and adhered to in her later work) could be dispensed with and that direct precipitation with trichloracetic acid, followed by centrifugal washing to remove media constituents and soluble metabolic products, could be substituted. P. P. D.s made by the ultra-filteration and centrigugal washing technique gave identical potency values when tested on sensitised guinea pigs. Resolution in phosphate buffer and second precipitation for further purification made no material difference. Collodion filtrates from H. C. S. M. tuberculin gave no precipitate with trichloracetic acid and, in the high dilutions used for guinea pig testing, gave no skin reaction. When P. P. D.s made by the prevailing Seibert technique and by direct precipitation and centrifugal washings followed by anhydrous ether drying were compared with the H. C. S. M. tuberculin from which they were made in solution of equivalent protein content (as determined by chemical analysis) results on guinea pigs were apparently identical in all the three cases. Since these observations fitted theoretical expectation, the traditional ultra-filtration washing was omitted in later work which at this stage was of desultory character.

The following year a study of chemical changes occuring during the growth of acid-fast organisms was made and losses of protein during heat concentration of tuberculin were determined. It became apparent that much larger yields of P. P. D. could be obtained by direct precipitation of steamed bacterial filterates.

Manufacture of Weybridge P.P.D. tuberculins.—The method adopted here follows that described above for B.A.I. tuberculin upto the point at which the culture flasks are steamed. After steaming the cultures, straining through copper gauze and discarding the rinsed bacterial debris, the liquid is sucked through a ½" pad of pressed filter on a Buchner funnel to remove residual cellular material and to provide a perfectly clear filterate. The filterate is transferred to a litre-measuring cylinder and 1/9th of its volume of 40% trichloracetic acid solution is added to bring the whole to 4% concentration. Total protein is precipitated, allowed to sediment over night in the cold store and the supernatant solution (containing unwanted residues of the medium and soluble by-products of bacterial growth) is syphoned or sucked off. The sedimented sludge is rinsed into 250 c.c. centrifuge tubes with dilute trichlor-acetic acid (1%) and centrifuged for 10 minutes to remove residual supernatant. The compact protein centrifuge is then re-suspended in 200 c.c. dilute trichloracetic acid to wash out media residue, centrifuged for 15 minutes, the supernatant again discarded and the precipitate re-suspended in 200 c.c. of 0.3% KH_2PO_4 solution (*i.e.*, lightly buffered water) to wash out trichloracetic acid. Centrifugation at this washing takes half an hour at 2,000 R.P.M. before a clear supernatant is obtained. After discarding this, the washed purified protein derivative may be taken to the dry state after washing with acetone and ether but better dry preparations are obtained by the modified technique described below and for practical issues of tuberculin the wet precipitate is simply dissolved up in M/15 Na_2HPO_4 solution to provide a concentrate suitable for preservation in cold store until required for further dilution to issue strength. Because of the buffering effect of the trichloracetic precipitated protein, the reaction of the redissolved "Crude P.P.D." is too acid and sufficient M/15 NaOH is added to bring to about pH 6·8. A solution of 50% Glycerol, 2·5% Phenol, and 2·5% Sodium Chloride is then added in amount sufficient to bring the final concentration at about 1/10th of the original cultural filterate volume, to 10% Glycerol, 0·5% Phenol, and 0·5% Nacl. The pH is finally adjusted electrometrically to 7·0.

The neutral concentrated solution contains the true P.P.D. of low molecular weight but also contains 5 to 10% of its total nitrogen in the form of higher molecular weight material of lower potency, which clogs the final Seitz filteration prior to bottling. The latter is, therefore, removed by passing three times through an air driven Sharples super centrifuge running at 35,000 R.P.M. and delivering about 5 litres per hour. The unwanted debris adheres to the rotating bowl and is removed after the first run, although not necessarily between the second and third runs.

The protein nitrogen of the centrifuged concentrate is determined by Kjeldael's method and this multiplied by 7 (or whatever factor is given by the reserve dry P.P.D. used for final biological standardisation) is taken as representing ' The P.P.D. content '. The concentrate averages about 1% protein and being stable more or less indefinitely in cold store, is kept until required for dilution to issue strength of 1·5 mg. per c.c. The diluting fluid is a solution of 0·5% Phenol, 0·5% Nacl and 10% Glycerol in M/15 phosphate buffer adjusted to pH 7. The finished P.P.D. tuberculin is then passed through 20 x 20 C.M. ford Sterilmats (G. S. grade) in a filter press under a few pounds air pressure into sterile containers and bottled under aseptic conditions in 1 c.c., 3 c.c., and 5 c.c. phials. In making the final dilution a small allowance is made for absorption of protein in filteration (which amounts to about 2% of the total when 50 litres go through four Sterilmats), such that the bottled material shows the accurate figure of 1·5 mg. P.P.D. per c.c. The Phenol concentration of 0·5% is also determined by the folin colour reaction as an additional check.

The usual sterility test for freedom from bacterial contamination and biological test on sensitized guinea pigs and cattle are carried out before final issue.

Preparation of dry P.P.D. powder:—This is best prepared from the concentrate after removing the alien material by the Sharples super centrifuge, re-precipitating with trichloracetic acid, washing once or twice with water, prolonged centrifuging at 2000 R.P.M. twice with small quantities of anhydrous acetone to remove water, and then with anhydrous ether as often as required to bring the stirred material to the fine, flakey state, which, on removal of ether and drying in a vaccum dessicator, crumbles to a soft, light, nearly white powder. This, specially, if stored over phosphorous pentoxide to keep quite dry, retains its potency and specificity for an indefinite number of years.

For larger quantities freeze drying is probably preferable. A powder prepared in this way still contains about 7% of nucleic acid and 5% of polysaccharide and is, therefore, only 88% of true protein. But both of the alien constituents are regarded as inert from the point of view of the intradermal reaction and it has not been considered necessary to purify ordinary P.P.D. any further.

It is of interest to record, however, that of about 40 different products prepared from acid-fast organisms, one human strain of highly purified P.P.D. prepared by re-precipitation with metaphosphoric acid to free from polysaccharide and then salted out with ammonium sulphate at pH 7·2 to remove nucleic acid and finally brought back to original form by reprecipitation with trichloracetic acid, washing and ether drying showed only 1% each of nucleic acid and polysacchride. This product of 98% true protein content is from the chemical point of view probably the purest ever prepared anywhere. Its potency, and specificity, as tested on 8 guinea pigs sensitised to human strain and 8 sensitised to avian strain, did not differ significantly from the less pure reserve standard P.P.D. from which it is derived.

Avian P.P.D. tuberculin:—The procedure is the same as for mammalian tuberculin except that the final issue strength is 0·4 mg. per c.c.

Bovine P.P.D.:—The method of preparation is practically the same except that bovine strains are less tolerant of glycerine than human strains and are, therefore, grown on the modified Sauton medium of Watson and Reid which has the following composition:—Asparagine 0·5% Glucose 1%, Glycerol 6%, Mg So_4 0·1%, KH_2Po_4, 0·2%, Ammonium Citrate 0·2%, Nacl 0·2%, Ferric Amonium Citrate 0·0075%, the whole being brought to about pH 7·2 with ammonia.

The yield of P.P.D. under these conditions is only 1/5th of that obtained from human strains and this appears to be one of the reasons why human strains have been continued for the so called 'mammalian tuberculin' used in cattle testing. [N. B. In Weybridge Laboratory, bovine strain has beep educated to grow on higher concentration of glycerine, the growth being free and fairly luxurient. The yield of P. P. D. under these conditions rises to above that of human strain.]

Other P.P.D. preparations:—P.P.Ds. have also been prepared from other acid-fast organisms for experimental purpose including B. C. G., M. para-tuberculosis and the non-pathogenic M. phlei.

Nature of P.P.D:—Although it has been conclusively demonstrated that the active principles are protein in character and that these are of small molecular size, it can be shown by physico-chemical means that any given P.P.D. is a mixture of several proteins with similar biological properties. Attempts to separate these by salting out procedures or by ultra-centrifuge techniques may yield products of different molecular size but when tested for potency, and specificity on a gravimetric basis, all show the same properties as allergens in the intradermal reaction. All the evidence points to the existence of a primary biological unit of molecular weight in the region of 8000. Two of these units linked loosely together or physically aggregated give a molecular size of 16,000 and four, a size of 32,000. Any product reduced below the smallest unit by enzymic action lose their biologic activity. Any larger molecules give tuberculin reaction although those of medium small size are not antigenic, in the sense they do not sensitise the skin of a non-reactor to the allergic reaction they are capable of eliciting in a naturally infected animal. They can, therefore, be used in re-testing an animal.

It may be mentioned that a high concentration of P.P.D. is used in veterinary practice as compared with medical practice (0·15 mg. per dose as against 0·00002 mg. to 0·005 mg. per dose).

Tuberculin testing is carried out intra-dermally and it is of great importance to us as a profession. To appreciate the tuberculin test one must know how it works.

When the tubercle bacillus invades the body, certain products result from the growth and break-down of the bacilli. The body response is to produce agents or anti-bodies to neutralise these products. These anti-bodies probably get into the circulation but there is no definite evidence that this is so. They may be present in such a state of dilution or the methods of detection are so clumsy that so far they have not been effectively demonstrated. Sooner or later these antibodies appear to become fixed to the tissue cells, which tissue cells is a matter of speculation at the moment, but it is believed that the lymphocyte with its globulin attachment may be involved. The body is now in the hypersensitive state and the tuberculin type of reaction appears on the introduction of tuberculin. The tuberculin is not itself capable of sensitizing the body

and is not, therefore, in the strictest sense of the term an antigen. It may however be regarded as an antigen in that it provokes the desired reaction and also in that it can be used without difficulty to desensitize the body and lead to the disappeareance of the reaction.

When tuberculin is injected into a sensitized animal, a reaction occurs between the tuberculin and the antibodies as a result of which toxic products are formed e.g. histamine-like substances, and it is the effects of these toxic substances in the body which lead to the development of the so called tuberculin type reaction.

In the case of intradermal type of reaction there is capillary dilatation at the site of injection and an out-pouring of fluid and cells, leucocytes, mainly polymorphonuclear leucocytes, collect at the site in the very early stages but in the later stage mono-nuclear leucocytes predominate. In the early stages the reaction may not be visible microscopically, but it gradually increases and reaches a maximum perhaps at 72 hours. The swelling when it reaches its peak is firm and tense and as resolution commences it takes on the diffuse character.

The tuberculin test is a biological test and as such is subject to certain limitations inspite of the various improvements in its preparation. The various system of tuberculin testing such as 'The subcutaneous test' 'The double intradermal test' are quite common and need not be described, except the newly introduced 'single intradermal test' and the "Stormont test".

Single intradermal test.—It is difficult to understand as to why in the case of 'Double intradermal test' the first dose was called the sensitizing dose and the second one the reacting dose or test dose. The first criticism is that so far none has succeeded in sensitizing an animal to any other antigen in such a short period as 48 hours. The second point is that if the antigen-antibody theory is correct, a second injection serves no useful purpose. The use of the second injection has been discontinued and it has been shown that a single intradermal injection is equally as effective as the double test and the single intradermal comparative test is now coming into use as the official test.

The Stormont test.—A site in the middle of the neck is prepared and clipped in the usual way. 0.1 c.c. of mammalian P.P.D. tuberculin of the 1.5 mg. per c.c. potency is injected. Seven days later the site of injection is measured, re-injected and 24 hours later it is re-measured. If there is an increase in measurement of 5 m.m. or more it is considered as a positive result.

Standardisation.—Although there is an international standard for tuberculin for human use, there is neither a national nor international

standard for tuberculin for veterinary use. The standard for human tuberculin has been widely accepted but so far as veterinary tuberculin is concerned each laboratory appears to have its own method of standardisation.

The usual procedure is first of all to estimate the reaction produced in the tuberculous guinea pigs, an animal which is particularly sensitive to tuberculin. This is known as standardisation test. Tuberculous guinea pigs are injected subcutaneously with varying amounts of tuberculin in order to determine the minimum amount which will cause death. This furnishes an approximate indication of the toxic power of tuberculin. Its value as a diagnostic agent is determined by the 'Potency test' and it is desirable that this should be performed in the species of animal for which the tuberculin is destined to be used. In the case of bovine tuberculin, for intradermal use, the method followed is to inject intra-dermally varying dilutions of the tuberculin under test and tuberculin of known potency side by side on the neck of a tuberculous animal and a known healthy animal. In this way a comparison of the degree of reaction can be made. Tuberculin for subcutaneous use should be tested by the subcutaneous method but in this case only one injection can be made in each animal at particular time. Further tests can be applied until the period of tolerance has passed.

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RANIKHET (NEWCASTLE) DISEASE

Review of work done with special reference to vaccination, at the Indian Veterinary Research Institute, Mukteswar-Kumaun, U.P.

By

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Prior to the second world war, poultry industry in India was in its infancy. During the war, because of a great concentration and traffic in troops, a large number of poultry farms were started throughout the country both by the civil veterinary departments and military organisations. With the termination of war, these farms have become the nucleii for the

quick expansion of poultry farming in India. Besides these farms, there has been a drive in the country to produce food of high nutritive value to combat the acute food shortage and in consquence poultry industry has been much encouraged. The position to-day in this country is that poultry keeping has gained much popularity.

The major problem experienced in practising extensive poultry farming in India, as in many other countries, has been the frequent occurrence of Ranikhet (Newcastle) disease. Though this disease was first observed in 1927, it was not until 1945 that a reliable and cheap prophylactic was evolved at the Indian Veterinary Research Institute, Mukteswar.

History of the spread of the disease

This disease was first noticed in 1927 in a poultry flock of freshly imported birds at Ranikhet, a hill station in the Kumaon Hills, Uttar Pradesh. Simultaneously a similar disease was said to have occured in Tanjore district in South India. Soon the disease spread throughout the Uttar Pradesh and the Southern Peninsula. Early in 1928 the disease spread to the adjoining provinces and states and in the course of a couple of years the disease was noticed to occur throughout the country. It was soon shown (Cooper, 1931) that the disease was identical clinically and immunologically to a condition observed in England (Doyle, 1927). At the same time a similar disease was found to occur in Dutch East Indies (Picard, 1928), Phillipines (Rodies, 1928), Korea (Kouno, et al, 1929), Ceylon (Crawford, 1930), Japan (Nakumara et al, 1933) etc. During the recent years this disease has been noticed in some of the Western Countries, and in America several outbreaks of fowl plague were reported as early as 1925 with symptoms identical with Ranikhet disease. The discovery of this new disease evoked a great interest and has been a favourite subject of extensive study by various workers throughout the world.

Occurrence

The disease occurs in India in all seasons of the year. Generally fowls are affected and, under field conditions in actual outbreaks, ducks, geese, guinea fowls, pigeons are found to be resistant. The experience gained in this country shows that the disease manifests itself in different forms—out.breaks with a very high and a very low mortality rate being observed.

Dissemination of the virus

It has been observed that traffic in live birds is the main source of dissemination. Village poultry markets, meat stalls, where there is a collection of birds from different places, are the centres of spread of infection. During the war when poultry farms were started in fairly isolated places, outbreaks occurred even where there was no definite history

of new birds having been introduced. In such instances we had always to suspect the dissemination of the virus by such mechanical carriers as crows, vultures, sparrows and other free flying birds. As early as 1931 Cooper had observed that in an infected locality crows were also found to have died. From this observation, it is not unlikely that wild birds act as mechanical carriers.

Work done in this Institute indicates that crows, pigeons, sparrows and parrots can be infected artificially. Komorov (1940) and Idnani and Seetharaman (1947) failed to transmit the disease by transferring to a healty bird lice and ticks from an infected bird. Some experiments were conducted (Idnani and Seetharaman, 1947) to investigate the possible spread of the disease through inhalation of virus infected air. The results indicated that a susceptible bird could contract the disease when exposed for three hours or more to an infected bird kept at a distance of not more than two feet under conditions suitable for the play of air currents. This observation elucidates the statement that infection is possible through the respiratory tract (Stover, 1942).

Control Measures

Prior to the introduction of prophylactic vaccination against the disease in this country, much work was done on its chemotherapy. A variety of drugs was tried without success. The control measures then adopted in actual outbreaks consisted in splitting the flock into small batches and distributing them as far as possible (Haddow, 1937). Strict veterinary police measures and the policy of slaughtering all the birds in the infected premises as practised in foreign countries were not applicable to Indian conditions, and much attention was paid to evolve a suitable vaccine.

Vaccination

A. Chemical means. Various types of vaccines involving the use of different chemicals in their preparation have been tried on analogy with those available for other virus diseases; but they have all been failures, (Picard, 1930), (Cooper 1931), (Kylasamier, 1931), (Naik, 1936), (Shirlaw, 1937), (Nakamura *et al*, 1937), (Iyer, 1943). Haddow and Idnani (1941, 1946) however obtained useful results with alumina-gel adsorbed vaccine. It was observed that though such a vaccine was safe for general use, it did not produce strong immunity and that it had poor keeping quality which limited its use under ordinary field conditions. Formalinised virus was tried with varying results (Kylasamier, 1931), (Iyer, 1943,) (Brandly *et al*, 1946) but the immunity produced was very limited and necessitated re-vaccination every three to six months or administration of live virus following vaccination.

B. Biological means. The use of serum from recovered birds to evolve a serum *cum* virus method was attempted (Cooper, 1931) and

(Shirlaw, 1937) without much success. So on analogy with the evolution of goat virus for rinderpest (Edwards, 1927) much attention was paid to adapt the fowl virus to heterogenous species.

(i) *Duckling-passaged virus* :—The susceptibility of different species of birds to Ranikhet disease has been studied by different workers (Doyle, 1927), (Picard 1928), (Farinas, 1930), (Crawford, 1930), (Cooper, 1931) (Mannings, 1936), (Iyer, 1939), (Komorov, 1946), (Asplin, 1947). From the observations made by the different workers it seemed evident that the age of the bird is one of the main contributory factors for susceptibility to the disease. Keeping this in view, Haddow and Idnani (1946) attempted to adapt the virus to ducklings. They observed that ducklings 1—10 day old could easily be infected by intramuscular or subcutaneous routes. They found that, though such ducklings reacted, not all of them died. In order to maintainthe virus of fowls in ducklings it was necessary to destroy them as soon as they showed symptoms of illness. They used three different strains in their attempts to adapt them to the system of duckling and found that, at the fifth duckling passage, the virus had become markedly attenuated for fowls and that such a strain propagated slowly when cultvated in embryonating eggs. After a few further passages in hen's eggs the embroys were found to die by 48 hours indicating that the virus had got fixed. This virus was tested on a large number of birds in the field with encouraging results. It was, however, found to produce a little more reaction than desired. A satisfactory attenuated strain of Newcastle disease virus was evolved by Komorov and Goldsmith (1946) in Palestine. The method adopted by these workers differed from the method of the Indian workers in that the former passaged the virus in ducklings intracerebrally

(ii) *Pigeon-passaged virus*:—A review of the literature indicates that attempts have been made from time to time to passage virulent fowl virus in pigeons apparently with a view to attenuate it. Doyle (1927, 1935) failed to set up natural infection in pigeons with fowl virus but reported that young pigeons were more susceptible to artificial inoculation than the older ones. Picard (1930) could not maintain fowl virus in pigeons for more than three passages. Manninger (1936), however, observed that in pigeons the virus died out at the thirteenth passage. Komorov (1946) attempted to passage fowl virus serially in pigeons by intracerebral inoculation with a view to attenuate it but after the ninth passage no modification in its character was observed. Haddow and Idnani (1946), however, succeeded in fixing the fowl virus in pigeons and in carrying serial passages by the subcutaneous route. This strain of virus was tested in fowls from time to time (Haddow and Idnani, 1946) with varying results. This strain is now being maintained at the Indian Veterinary Research Institute and is now at its 390th passage. A recent test conducted on fowls indicated that

though the virus is definitely attenuated, it is not yet safe to be used as a vaccine. The utility of this virus on further passages will, it is hoped, open up a new approach in the control of Ranikhet disease.

(iii) *Duck-egg-passaged virus*:—Haddow and Idnani (1946) succeeded in infecting the duck embryos by inoculation on the chlorio-allantoic membrane and in maintaining the virus by serial passages. Such a strain was maintained for fifty serial passages. They observed that whereas even at the tenth passage the virus was slightly attenuated for fowls no further noticeable attenuation was observed at the fiftieth passage. Komorov and Goldsmith (1947) reported good results in immunising fowls using a Haifa strain of Newcastle disease virus passaged serially in duck eggs. The variations in the degree of attenuation by serial passages in duck eggs by research workers in India and elsewhere appear to be mainly due to the variations in the character of the strains of viruses.

(iv) *Hen-egg-passaged virus*:—Iyer and Dobson (1940) and Iyer (1941) working with an English strain of Newcastle (Ranikhet) disease virulent virus obtained an attenuated strain of the virus by serial passages through developing fowl embryos. They observed satisfactory attenuation at the 33rd passage in one and 14th passage in another. Further experiments on the same line carried out by Iyer and Hashmi (1945) using Indian field strains indicated that attenuation was not uniformly achieved in all the strains used. It was observed that field strains of Ranikhet disease virus from different outbreaks varied in their amenability to attenuation by serial passages in eggs. Further work was undertaken by Haddow and Idnani (1946) on these lines. These authors continued the passage in egg of a particular Indian field strain which Iyer had observed to produce 45 per cent of casuality rate at its ninety-second passage and found satisfactory attenuation at about the one hundred and fifteenth passage. With the egg virus of 115-126th passage field trials were initiated and uniformly good results were obtained. It was also observed that an immunising dose was contained in a 1×10^{-4} dilution of the amniotic fluid from the vaccine-virus infected eggs. This strain of virus is now being maintained at the Indian Veterinary Research Institute. The 190th passage was tested in fowls and found to be as good as the 115th or 126th passages. At the present moment one cannot say whether in further passages this attenuated strain would maintain its antigenic properties in as high a dilution as 10^{-6}.

The advantages of this vaccine are (1) it is cheap, (2) it is innocuous and does not produce 'carrier' infections which would spread the disease, (3) immunity is established in 48 hours after vaccination, (4) the duration of immunity is perhaps life long (3 years so far tested) (5) though it is not a curative it can be used with impunity in actual outbreaks to control the disease. The Mukteswar strain of virus has been used in the control of this disease in Ceylon, Burma, Malaya, China, Palestine and Egypt.

With all the advantages mentioned about the vaccine, it has its limitations as well. It is a fragile one and is easily susceptible to fluctuations in the external atmospheric conditions and so has to be transported on ice by reliable couriers or by air wherever possible. Attempts are now being made at the Institute to freeze-dry the vaccine. Preliminary experiments have shown encouraging results.

India is mainly an agricultural country the main population of which live in villages. More than eighty per cent of the poultry population estimated at about 200 millions are in the rural areas. In order to make vaccine available to the farmers different sub-stations in the country to manufacture the vaccine have been started.

Beyond doubt this vaccine has gone a long way to protect poultry from the dreadful Ranikhet (Newcastle) disease and every bird protected against this disease has added to the national prosperity not only in India but also in other countries where it is in use.

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COMMON POULTRY DISEASES IN INDIA

By

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Introduction.—In our country, poultry industry has mainly been in the hands of the poorer class of people. The enhanced prices of eggs and table poultry during the last world war gave impetus to many zealous breeders to organise poultry units on commercial basis. They worked satisfactorily for some time, but as soon as some disease appeared, the economic balance was disturbed to such an extent that the work had to be discontinued altogether. Most people are ignorant about the nature of the various poultry diseases prevailing in this country. It is, no doubt, difficult to diagnose ailments which affect this species of livestock, but, if the syndrome is properly studied and one is conversant with the pathognomonic symptoms, in most cases, the disease can be correctly labelled. The present article is a short resume of the nature of the various poultry diseases and the control measures which can be effectively employed.

The following are the most common poultry diseases occurring in this country:—

1. *Ranikhet disease* :—This is the most dreaded malady. It occurs throughout the country and in almost all seasons. Widespread outbreaks are, however, noticed during the hatching season. The causal factor is a filterable virus. It spreads rapidly and causes enormous economic losses. It continues unabated for weeks together, till only a few fowls are left behind in the affected locality. Death rate in most cases ranges between 95 to 100%.

The symptoms are ushered in with loss of appetite, dullness and crouching attitude, followed by characteristic respiratory distress. The bird stretches out its neck, usually whistles through the half-opened beak with strands of thick mucous hanging from it. A frothy exudate is also seen oosing out of the nostrils. Simultaneously diarrhoea sets in and cyanosis of comb and wattles is observed. At this stage partial paralysis of legs and wing develops and the bird ultimately dies of exhaustion.

Post-mortem examination usually does not show any significant lesions in the lungs. Haemorrhages are generally seen on the heart muscle and in the mucous lining of the glandular stomach. Intestines may show patchy enteritis and there may be red-flag appearance of the cloaca.

There is no known treatment for this disease. As a matter of fact, treatment in contagious diseases of poultry is scientifically and economically unsound as it only serves to perpetuate the infection.

Vaccination consists in dilution of 1 c.c. of the vaccine with 500 parts of chilled distilled water and inoculation of 0·5 c.c. of the resultant mixture subcutaneously irrespective of the age and size of the bird. A mild yet a decisive reaction follows from the fourth to the sixth day and the bird is rendered immune. It has been estimated that only less than 1% birds die of reaction.

2. *Fowl-pox.*—It is a highly contagious disease characterised by wart-like eruptions on the comb, wattles, and eye-lids and by yellowish cheesy deposits in the mouth and pharynx with muco-purulent discharge from the nose and eyes. The cause is a filterable virus which is present in the local lesions. The common method of infection is through the wounds, scratches and mosquitoes. Domestic chickens are highly susceptible to fowl-pox but the disease also affects turkeys and to a less extent ducks and geese.

Symptoms.—The disease occurs in four forms :—

(1) Cutaneous form (2) Buccal form
(3) Catarrhal form (4) Ocular form.

The disease may occur in any one form or a combination of these forms. In the cutaneous form small vesicles appear on the comb, wattles and eye-lids which soon become brown, wart-like nodules. These nodules coalesce and form large masses. Similar lesions, though extremely rare, may also be found on the legs, feet, about the vent and under the wings. Later, these nodules dry up and are shed as crusts. In the buccal form there is formation of yellowish membranous patches or masses of cheesy exudate in the mouth and pharynx. As the disease progresses the patches become very thick and extensive so that the affected fowl cannot close its mouth. In the catarrhal form there is nasal catarrh, with its accompanying symptoms. The ocular form is characterised by watery discharge from the eyes followed by the formation of yellow pus-like material causing the eyelids to be glued together. Death rate is low in cutaneous form, but high in other forms. Egg production is much diminished.

Treatment.—In the cutaneous form emolient dressings work satisfactorily. In the buccal form the removal of the lesions will be helpful. These lesions should be removed and the raw areas resulting from their removal should be dressed antiseptically. In the ocular form, antiseptic dressings are known to reduce mortality considerably.

Vaccination.—Pigeon-pox virus is being used as a vaccine. From experimentally infected pigeons the crusts are collected to constitute the vaccine. The crusts contain live pigeon-pox virus. These are ground to a powder and made into 1% suspension in 50% glycerine. The vaccine can be applied by a stiff brush on the thigh after plucking the feathers. A strong immunity is produced lasting for about six months.

3. *Coccidosis.*—Coccidiosis also causes heavy losses especially among chicks. Important species of coccidia which cause this disease are, *Eimeria tenella* and *Eimeria necatri*. Coccidiosis in young chicks is very serious. The disease occurs usually in an acute form. The symptoms begin with dullness, depression, ruffled feathers, drooping wings and half closed eyes. Diarrhoea is commonly present which may be whitish or yellow and is blood-stained. The faeces contain mature coccidia which become infective after sporulation. There is great emaciation, comb and wattles become pale and death follows. Mortality is very high. In older birds the disease is usually chronic and develops slowly. There is chronic enteritis; the affected birds lose condition and their combe and wattles become anaemic. Later, weakness increases and the birds cannot stand on their legs. Diarrhoea may or may not be present. The disease can easily be diagnosed by microscopic examination of the faeces. The infected birds show the presence of oocysts in their faeces.

Treatment.—Various sulpha-drugs including Sulphaguanidine have been tried. Of all the drugs Sulphamezathine (a product of the Imperial Chemical Industries) is found to be of much value and has a definite curative effect. Sulphamezathine sodium solution 16% is used. 2 fluid ounces of this solution are added to each gallon of drinking water for five days to young chicks and may be continued for seven days in adult birds. The medicated drinking water should be prepared fresh everyday, and all the birds in the infected runs should be treated at the same time as it is impossible to tell which bird will develop the disease next.

Prevention.—Since the oocysts become infective only after sporulation, faeces should be removed daily and thorough disinfection of the place conducted so that the spread of the disease is checked. The rearing of chicks on wire-netting floors is very successful as the faeces fall through the holes on the ground.

4. *Spirochaetosis.*—It is an acute or sub-acute septicaemic disease of poultry causing high mortality and is produced by a long screw-like protozoon parasite, *Borrelia gallinarum*. The disease is transmitted through the agency of ticks, usually *Argas persicus*. The spirochaetes are present in the blood of infected fowls, and therefore diagnosis of the disease is very easy.

Symptoms.—There is high rise of temperature accompanied by loss of appetite, sleepiness, diarrhoea and ruffled feathers. There is great loss of condition and anaemia; later, paralysis of the wings and legs may occur resulting in death.

Treatment.—Various arsenicals have been tried. Good results are obtained by Soamin and Sulfarsenol. Sulfarsenol is the better of the two, being less toxic, the dose being one C.gm., per killogramme body weight. The injection is made intramuscularly in the pectoral muscles.

Control.—Since the disease is spread through the agency of ticks, further spread can be checked by their eradication. The adult ticks usually remain

in the crevices of poultry houses during the day time and attack only during the night. The *kutcha* poultry houses should be burnt and new ones constructed. If the poultry houses are made of bricks with cemented walls, it would not then be desirable to burn and demolish them. Gammexane P 520 spray may be used. 12 ounces of Gammexane P 520 water-miscible powder should be added to one gallon of water. It should be stirred thoroughly and sprayed throughout the inside of fowl-houses. The larval ticks which stay on the birds day and night can be got rid of by applying Gammexane D 025 powder. Gammexane is a product of the Imperial Chemical Industries and has a lethal action on the ticks.

Protective inoculation.—0·2 c.c. of virulent blood taken from a fowl suffering from Spirochaetosis is injected into each healthy bird. The temperature rises after 36 to 48 hours and the spirochaetes appear in peripheral circulation. At this stage Sulfarsenol one C. gm per killogramme body-weight is injected intramuscularly. Temperature falls by lysis and the bird becomes immune for about 8 months.

5. *Avian leucosis complex.*—This disease is gaining much importance during the recent years as heavy losses are said to be caused by it especially among young birds within one year of age.

Avian leucosis complex is a disease complex of poultry especially of young chicks characterised by symptoms of paralysis, blindness, formation of tumour-like masses in the internal organs, deformity of bones and marked changes in the blood.

The disease is believed to be caused by a filterable virus and is spread by contact. Egg transmission is also possible. The symptoms are not seen before 3 to 5 months of age as the disease is slow in development. The following types are recognised :

1. Neural type (Neural lymphomatosis)
2. Ocular type (Ocular lymphomatoiss.)
3. Visceral type (Visceral lymphomatosis)
4. Bone type (Osteopetrosis)
5. Blood type (Leucosis)

Two or more types may coexist.

The neural type is the most common. Lameness or slight drooping of wings is first noticed and, as the disease advances, lameness increases and is followed by paralysis of wings and legs. When the muscles of the neck are affected, 'wry neck' is produced. Breathing becomes difficult when the nerves controlling the respiration are affected. The appetite usually remains normal. Post mortem shows enlargement of the nerves supplying the affected parts. The enlargement is caused by the infiltration of lymphocytes in the nerve tissue,

The ocular type is recognised by loss of pigment from the iris which becomes grey. The pupil is usually contracted. Due to infiltration of lymphocytes in the retina total or partial blindness results.

In the visceral type there is formation of greyish tumours like masses in the internal organs especially in liver, spleen, kidneys, ovaries, testes, intestines, lungs, heart etc. Similar masses may be formed in the muscles and skin. This type is rarely diagnosed during life, when the lesions are in the internal organs, except that, in old standing cases, wasting occurs. These masses result from heavy infiltration of lymphocytes, polymorpho and plasma cells in these organs.

In the bone type which occurs very rarely there is enlargement and thickening of long bones especially of legs and wings.

The blood type is usually recognised by anaemia, emaciation and hydraemic condition of the blood. Postmortem shows enlargement of the liver and spleen with greyish spots on their surfaces.

The death rate is high reaching sixty percent. Affected birds rarely recover completely.

Treatment.—No chemotherapeutic agent is known to affect a cure. The only alternative at present is the prevention and control by adopting the following measures :

(*a*) *Sanitation.*—Preventing the contamination of food, water and utensils by faeces.

(*b*) *Isolation of the young stock.*—The incidence of the disease is much reduced if the young stock is reared seperately from the adults.

(*c*) *Breeding from the resistant strains.*—It is known that there are strains of birds which are resistant to this disease and that this character is transmitted to the progeny.

(*d*) *Salmonellosis.*—This disease is not of much importance in India as only a few cases have been recorded so far.

STUDIES ON MYIASIS AND ITS TREATMENT

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There are a few species of flies whose larvae invade animal and human tissues and live in them producing a condition which is generally termed as myiasis. The condition is of both medical and veterinary importance as some species produce myiasis in both man and animal. Some are specific to animals

and others to human beings. Myiasis in man was believed to be restricted to unhygenic local conditions till Dove (1937) proved that in stock-raising countries if myiasis cases due to the species common to human beings be neglected, human myiasis would necessarily develop into a public health problem. Lindquist (1937) studied 37 myiasis cases in wild animals caused by the species common to man and domestic animal and concluded that affected wild animals served as potential reservoirs of the disease. The predisposing causes of the 37 cases were rabbit bots, gun shot wounds, boils, disease, birth of young, injury to predators, fighting and brush and wire cuts.

In nature the members of the family Calliphoridae play an important role in the disposal of dead bodies of animals which are not buried as their larvae live on decaying animal matter. This aspect of the bionomics of these flies has been profitably utilised in modern human surgery in treating chronic, non-healing and discharging wounds. The procedure comprises in rearing sterile maggots of the flies and using them in such wounds, the larvae acting as scavengers of diseased tissues. Many of these flies besides causing myiasis in man and animal get inside human dwellings and oviposit on food materials.

The important myiasis producing flies mostly come under the families Calliphoridae and Sarcophagidae (though Senior-White *et al* (1940) include both under the family Calliphoridae). The maggots cause considerable pain and misery to the host. Besides, they cause considerable damage to wool, meat and hides and skin. In case of sheep the adults oviposit in soiled wool about the hind quarters and the larvae attack the flesh. In sheep rearing countries such as Australia, South Africa, etc., myiasis is a serious problem and with the development of sheep rearing in India the country will, in the near future, have to face similar situation. In India quite a large number of species have been incriminated as producing myiasis in live stock. But the common ones may be mentioned as *Calliphora erythrocephala* Macq., *Lucilia cuprina* (Wied.), *Chrysomyia bezziana* Vill. and *Sarcophaga ruficornis* (Fabr.). Females of the family Calliphoridae lay from 450 to 500 eggs at a time. They occasionally oviposit on open sores and wounds of man and animals particularly on the skins of sickly or newly calved animals and may cause severe myiasis resulting even in death of the host. Females of the family Sarcophagidae are larviparous.

The literature on myiasis producing flies in general is very voluminous, particularly on the work on sheep blow flies in Australia and Great Britain, etc. However, the work done in India is decidedly meagre and consists of a few importantant reports by Patton, Sinton, Senior-White, etc. Patton and Cragg (1913) in their text book of medical entomology give an account of Indian blow flies. Patton (1920–22) in a series of articles described a few species of the family Calliphoridae, studied their binomics and their myiasis producing and beneficial effects. His papers also contain a large number of case reports from various parts of India. Sinton (1921) also gave an extensive account of the

cases of myiasis in India and Persia with a description of the larvae causing the lesion. Senior-White *et al* (1940) published their volume on Calliphoridae in the Fauna of British India series.

Incidence

That myiasis is not a very uncommon disease in India is well known but the number of cases which have been recorded in detail seem to be few while those in which the actual species of fly causing the lesion has been identified seem very few indeed. The more common species appear to belong to one of the following genera: Sarcophaga, Lucilia, Calliphora or Chrysomyia (Sinton 1921). Patton and Cragg (1913) state that in Gujrat it is not uncommon to see large sores full of larvae of Sarcophaga. Castellani and Chalmers (1919) say that Sarcophaga larvae are not uncommon in the ulcers in the tropics. The case reports received from the various States show that no State in India is free from myiasis.

Hepburn (1943) and Monnig and Cilliers (1944) working in the Union of South Africa came to the conclusion that a comparatively heavy rainfall and high atmospheric relative humidity were favourable to high incidence of blow flies of sheep. Later on, McLeod (1947) working in Hertfordshire showed that oviposition of sheep blow flies has close correlation with air temperature, the lower critical limit being 56-58°F.

In our series of observations recorded at Izatnagar during 1948-49 and 1949–50, all types of animals available in the area were examined for myiasis. Our observations on the incidence of myiasis cases with reference to the local rainfall, atmospheric humidity and temperature showed that the atmospheric conditions had some influence (though not very significant) over incidence (vide Table I). Out of 448 and 473 animals of the Institute estate examined during the years 1948–'49 and 1949–'50, 33 and 23 respectively were found having fly strike. The maximum number of cases was recorded during the months of October and November. From the table it is seen that the myiasis producing flies are present throughout the year except the hot summer months of May and June. The details of incidence are presented in Table I.

During the period 60 calliphorid flies were collected from the cow, buffalo, horse and sheep. They were found frequenting the animals with stale open wounds. Their eggs and larvae were often found in the wounds. The larval stages of these flies have so far been isolated from sores on the body of sheep, cow, bullock and buffalo. The flies developed from larvae collected from the sores belonged to two genera viz., Calliphora and Lucilia. The common species were *Calliphora erythrocephala* Macq. and *Lucilia cuprina* (Wied.). A few sarcophaga were collected from the buffalo and horse while hovering about stale wounds.

As the animals in the estate are better looked after and kept under hygienic conditions it was expected that the incidence of myiasis would naturally be

TABLE I

Showing the incidence of myiasis at I.V.R.I., Izatnagar, from July 1948 to June 1950

HOST	July '48	July '49	Aug. '48	Aug. '49	Sept. '48	Sept. '49	Oct. '48	Oct. '49	Nov. '48	Nov. '49	Dec. '48	Dec. '49	Jan. '49	Jan. '50	Feb. '49	Feb. '50	March '49	March '50	April '49	April '50	May '49	May '50	June '49	June '50	Total
Cow ...	2	1	1	4	—	3	2	—	3	2	1	1	—	1	2	—	2	—	1	1	—	—	—	—	27
Buffalo ...	2	—	1	—	1	1	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	—	—	—	11
Horse ...	—	1	—	—	1	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—	4
Goat ...	—	—	1	—	—	—	—	1	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	4
Sheep ...	—	—	1	—	1	—	—	—	2	1	—	1	2	—	—	—	1	1	—	—	—	—	—	—	10
Total ...	6		8		7		5		10		4		4		3		6		3		—		—		56

Meteorological data for the period July 1948 to June 1949.

Temperature varying between (°F)	104–73	93–75	96–71	93–59	87–48	82–42	81–43	85–46	101–52	105–64	109–70	111–74
* Relative humidity (%) ...	99–27	100–61	100–47	95–27	80–20	94–36	94–32	95–20	75–14	68–15	84–9	71–11
Total rainfall inches ...	11·02	35·02	13·83	—	—	—	—	3·64	—	0·70	1·0	1·0

* Showing variations of 8 a.m. and 5 p.m. readings.

TABLE II

Showing myiasis cases recorded in the civil veterinary hospital, Bareilly, from July 1948 to June 1950.

HOST	July '48	July '49	Aug. '48	Aug. '49	Sept. '48	Sept. '49	Oct. '48	Oct. '49	Nov. '48	Nov. '49	Dec. '48	Dec. '49	Jan. '49	Jan. 50'	Feb. '49	Feb. '50	March '49	March '50	April '49	April '50	May '49	May 50'	June '49	June '50	Total
Cow ...	11	14	32	6	26	5	9	19	10	6	8	7	58	47	69	49	70	102	60	43	40	9	30	11	741
Buffalo ..	2	4	7	1	11	4	13	4	2	2	—	—	16	11	19	10	9	22	5	8	6	4	3	10	173
Horse ...	1	—	5	1	2	—	3	1	1	—	—	—	8	—	—	—	4	—	1	—	—	—	—	—	27
Goat ...	—	1	1	2	3	1	2	2	1	—	1	1	2	1	—	1	1	—	—	1	1	—	—	—	22
Sheep ...	—	—	—	—	—	—	—	—	—	—	—	—	—	8	—	—	—	—	1	2	—	3	—	2	16
Dog ...	—	1	—	1	—	—	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	4
Total ...	34		56		52		54		22		17		152		148		208		121		63		56		983

less than that under village conditions. In order to ascertain the exact position the record of myiasis cases treated in the local civil veterinary hospital was obtained and analysed. It was found that a very large number of domestic animals was annually infested with maggots, the infection being prevalent throughout the year. Further, from the figures it was found that in May, June and July cases were generally fewer in number but in the rest of the year the incidence remained fairly high. The animals usually affected were the cow, buffalo, horse, goat, sheep and dog. The details of these figures are presented in Table II.

Treatment

From the above statements it appears that myiasis in man and animal is not uncommon and some sort of treatment had been in practice from very old days. But with the gradual development of different antiseptic, insecticidal chemicals and plant products the treatment of myiasis has been evolved. In general practice in India phenyl, turpentine, chloroform and a mixture of the last two are in common use. But from the literature it is seen that upto 1937 Benzol alone, or in combination, was considered effective for treating wounds infested with maggots [Bishop *et al* (1923 and 1926), Parman (1925), Dove (1935), Bruce and Sheely (1936) and McGovran (1937)]. Monnig (1943) recommended a preparation containing 43 per cent alcohol, 43 per cent creosote oil, 11·25 per cent liquid paraffin, 2·5 per cent cresol and 0·25 per cent sulphuric acid which gave excellent result in field conditions both against sheep blow flies and *Chrysomyia bezziana* on cattle. Shanahan (1946) suggested that Benzene hexachloride might be suitable for jetting the breeches of ewes and applying to ram's head for prevention of fly strike. Loeffler and Hoskins (1946) found that several halogenated compounds (DDT etc.) were highly toxic to the larvae of *Lucilia cuprina*. Waterhouse (1947) described tests with various essential oils and other materials to assess their efficiency in preventing oviposition. Graham and Eddy (1948) tested six chemicals on the larvae of various blow flies and found Toxhaphene to be the most promising.

But with the preparation of a few important insecticides like DDT, BHC, etc., attempts were made to ascertain their efficacy against maggots of myiasis-producing flies and a series of experiments were conducted at the Institute with the following results: Dichloro-Diphenyl-Trichloroethane (DDT), Benzene hexachloride (BHC), Derris root powder and a mixture of chloroform and turpentine (one in four) were tested on maggot infested wounds on a number of cows and buffaloes. Four were treated with DDT, three with BHC, three with Derris root powder and two with chloroform and turpentine mixture. The powders were dusted inside the wounds and plugged with dry cotton wool. The mixture of turpentine and chloroform was soaked in cotton wool and plugged inside the wound. The details of these treatments are given in Table III.

TABLE III

Result of treatment of myiasis cases with DDT, BHC, Derries and a mixture of turpentine and chloroform.

Serial No.	Animal.	Drug used.	Result of treatment.	No. of maggots collected.	No. pupated.	No. hatched out.
1.	Buffalo	DDT	After 24 hrs. 10 small maggots were found dead After 48 hrs. 2 small dead After 72 hrs. none found	10 first stage	4	2
2.	Cow	Do	24 hrs. none dead 48 hrs. 2 small dead 72 hrs. a few alive 96 hrs. none found	9 fourth stage	8	5
3.	Buffalo	Do	Upto 72 hrs. none dead 96 hrs. none found	6 fourth stage	6	4
4.	Bullock	Do	Do	4 fourth stage	4	2
5.	Sheep	BHC	24 hrs. 12 small dead 48 hrs. 3 small dead 72 hrs. none found	10 first stage	5	3
6.	Buffalo	Do	Upto 48 hrs. none dead 72 hrs. none found	6 fourth stage	5	4
7.	Cow	Do	Do	5 fourth stage	4	3
8.	Buffalo	Derris	48 hrs. 2 small dead 72 hrs. none found	4 fourth stage	nil	nil
9.	Buffalo	Do	Do	4 fourth stage	nil	nil
10.	Buffalo	Do	48 hrs. 2 small dead None found alive on the third day	4 first stage	2	nil
11.	Buffalo	Chloroform-turpentine	24 hrs. all dead	4 first stage	3	1
12.	Cow	Do	within 48 hrs. all dead both big and small	6 fourth stage	5	2

It may be seen from the table that DDT, BHC and Derris root powder had definite lethal action on the immature larvae but had little or no effect on mature larvae. But a mixture of chloroform and turpentine was found effective against all stages of the larvae which were found dead within 24 to 48 hours It may be mentioned here that for satisfactory result the medicine should reach well inside the wound. It was also noticed that the population of maggots did not increase in the treated wounds.

In order to study the effect of DDT, BHC and Derris on the fourth stage larvae, two laboratory tests were conducted as described below.

Thirty mature larvae, ten in a batch, were kept in three petri dishes. One was dusted with DDT, the other with BHC and the third with Derris root powder. After 24 hours the maggots in all the batches were found to be alive and they all pupated between the second and third day. It was noticed that the untreated maggots from the same lot kept as control did not pupate so early as the treated ones and the time taken by them was between six and eight days.

The time taken by the pupae from these different batches to develop into the adult fly was found nearly equal in all the cases, i.e., seven to ten days. One interesting point observed was that in many of the treated cases the adults failed to emerge completely out of their pupal cases and only the neck portion was found protruding out. A few, however, emerged out as normal adult flies. It may be observed here that the developmental phases inside the pupal case were complete in all and that while emerging out some of the flies must have come in contact with the insecticides and then died before coming out fully. From the above it is also clear that in adverse circumstances fully developed maggots try to pupate much quicker than in ordinary circumstances. The results of these tests are shown in Table IV.

TABLE IV

Showing the effect of DDT, BHC and Derries on fourth stage larvae of Sarcophaga.

Drug used.	Date of test.	No. of maggots used.	Result after 24 hours.	Date of pupation.	Date of hatching.	
FIRST TEST.						
DDT	11-7-49	10	None dead	13—7—49	20— 7—49	21— 7—49
BHC	Do	10	Do	13—7—49	19— 7—49	20— 7—49
Derris	Do	10	Do	13—7—49		
				14—7—49	21— 7—49	
Control	Do	10	Do	17—7—49		
				19—7—49	24— 7—49	27— 7—49
SECOND TEST.						
DDT	24-9-49	10	No move-ment	26—9—49	2—10—49	
BHC	Do	10	None dead	26—9—49		
				27—9—49	2—10—49	3—10—49
Derris	Do	10	No move-ment	26—9—49		
				27—9—49	2—10—49	5—10—49
Control	Do	10	Alive	30—9—49		
				1—10—49	6—10—49	7—10—49

Tests on similar lines were conducted with thirty first-stage larvae which were all found dead on the day following the treatment. The results of this test are tabulated in Table V.

TABLE V

Showing the effect of DDT, BHC and Derris on first stage larvae of Sarcophaga.

Drug used.	Date of test.	No. of maggots used.	Result after 24 hours	Date of pupation	Date of hatching.	
DDT	24-9-49	10	All dead	...	...	
BHC	Do	10	Do	...	...	
Derris	Do	10	Do	...	...	
Control	Do	10	All alive	31— 9—49	...	
				2—10—49	8—10—49	10—10—49

Summary

The incidence of myiasis cases at the Indian Veterinary Research Institute, Izatnagar, was studied for a period of two years, 1948-'49 and 1949-'50. The number of cases recorded was 56.

The incidence for the same period at the local civil veterinary hospital was analysed and 983 cases were reported on different animals viz., cow, buffalo horse, goat, sheep and dog.

From the recorded cases in various reports it is seen that myiasis is not uncommon in India and from our observations it is found that the rainfall, atmospheric temperature and humidity have some influence, though not very significant, on the incidence of myasis cases.

The common genera responsible for myiasis in India are Calliphora, Chrysomyia, Lucilia and Sarcophaga.

A series of myiasis cases were treated with DDT, BHC, Derris root powder and a mixture of turpentine and chloroform. The last named mixture proved to be the best.

DDT, BHC and Derris have definite lethal effect on first stage larvae but they have no action on the fourth stage larvae; on the other hand pupation is hastened.

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SOME ASPECTS OF IMMUNITY IN RINDERPEST

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Introduction

Towards the end of the ninteenth century, research workers in different laboratories tried in several ways to find out the means of inactivating the rinderpest virus and using the same as an immunizing agent. In 1897, when Robert Koch visited India to report upon Human Plague, he was also consulted upon rinderpest. He advocated the use of bile-inactivated-virus as an immunizing agent and this was reported in the Veterinary Journal (1). Since then, several workers tried with the Bile Method, as advocated by Koch, and also went ahead with their researches for finding out other forms of inactivated vaccines. Trials on alternate host adaptation were also undertaken simultaneously. Thus, among the earlier workers, Kakizaki (2) began his work in 1904 with glycerinated vaccine and finally reported on this in 1918. Schein in French Indo-China made some observations on the effect of serial passages in goats in 1917 (3) and his subsequent experiences were published in 1926 (4). Topacio (5) in the Phillipines also worked on similer lines and published his findings in 1926. In India, Edwards (6) investigated into the possibilities of adaptation of the virus to species other than cattle, and at first attempted to transmit the rinderpest virus into rabbits in 1922 and was soon successful in his attempts, but, owing to an outbreak of Pasteurellosis among the rabbits, his strain was lost. He then tried with goats and met with success in November, 1926, (7). After necessary laboratory trials, this goat-passaged inactivated virus was pushed into the field, at first on a restricted scale, in 1928. But, before its use could be extended to a much wider area and results observed, he had to leave India in April, 1929. Since then, commendable progress has been made towards perfection of the caprinized strain, and also of the lapinized strain, and the results are incorporated in the Annual reports of the I. V. R. I. The recent work of Haddow and Idnani (8), published in 1947, on the problem of vaccination of highly susceptible animals against rinderpest deserves special mention. At the present moment, we have in our possession an effective and valuable weapon in the form of goat-spleen-tissue containing inactivated rinderpest virus which can be used with little cost and lesser risk on plains cattle (Bos indicus type.)

Antigenicity of the Goat-tissue-vaccine

The degree and duration of the immunity conferred on vaccinated animals depend on several factors, of which the following may be mentioned. The nature of the strain used in infecting goats; the breed, age and condition of the goats intended for use as spleen donors; the type of reaction in such goats; the number of passages of the strain in goats, i.e., whether moderately caprinized or

highly caprinized ; the dose and dilution of the spleen suspension used for vaccination ; the route of inoculation ; the breed, age and condition of the vaccinated animals ; the post-vaccination management, which includes the quality of food offered during the period of immunization, the nature of the shelter provided for the vaccinated animals, particularly in the day time, during the period of immunization, the amount of work taken from the vaccinated animals during the same period, and lastly, the most important consideration is the climatic condition (air temperature and relative humidity of the air) prevailing at the time and few days after immunization. The type of reaction in the vaccinated animals has got no direct relation to the degree of immunity conferred by vaccination. Even 'symptomless' reaction is often followed by solid immunity, provided the virus used was potent. Most of these factors have been thoroughly dealt with in the author's thesis entitled 'Influence of Solar radiation on immunity' (9).

All major experiments on rinderpest have been carried out at Mukteswar on Hill Bulls, which are highly susceptible to rinderpest. Mukteswar, being situated at an altitude of 7,500 feet above sea-level, is cold throughout the year, and snow falls during winter months are common features. Animals living in this cool environment normally secrete more amount of adrenalin, pituitrin and thyroxine. The role of these endocrinal secretions in this formation of antibodies has been discussed by the author in his thesis referred to above. As expected, the duration of immunity conferred on hill cattle at Mukteswar by a single dose of Goat-tissue-vaccine alone is found to be much longer than that in plains cattle vaccinated with the same method. Thus, Seetharaman (10) reports that, under experimental conditions at Mukteswar, the immunity has been proved to endure for some ten years. Srinivasan (11) reports that immunity conferred by the same method of vaccination in Hill Cattle at Mukteswar has been found to last for about eight years. In contrast with these observations made on animals adapted under cool environment, the immunity conferred by the same method in plains cattle and buffaloes adapted under hotter environment lasts for a much shorter duration, which is, on an average, between three to five years, as reported by several Veterinary Investigation Officers in their Annual reports, and also by D'Costa and Singh (12), Naik (13), and a few others. Until a more suitable immunizing agent is discovered in the laboratory and is put into the hands of the field-workers, Goat-tissue-vaccine will continue to hold the ground. All-round efforts should, therefore, be made to improve its antigenicity, so that it may play a more effective part in the campaign of total eradication of rinderpest from India.

New approach to the problem

As we have got to deal with a vast country like India having wide topographical and climatic variations, and a vast cattle population having a varying degree of susceptibility, a new approach to the research problem is

essential. The term Indian Cattle does not represent one homogeneous type of cattle, but includes a number of immunologically heterogeneous animals. Moreover, buffaloes constitute another group of highly susceptible animals. Hill Bulls, which so long constituted the chief laboratory animals in the researches on rinderpest, are not the representative types of animals inhabiting the plains of India. Therefore, it is imperative that plains-cattle should be used under local conditions in the future experiments on rinderpest, and then only the real problems will be understood and tackled effectively.

It is well known that strains of rinderpest virus recovered from the natural outbreaks are not always of the same virulence. There are strains recovered from the mild natural outbreaks that are actually milder in their effects upon cattle than are some moderately caprinized strains of the virus. There are, again, strains recovered from more virulent natural outbreaks that have devastating effects in the inoculated animals. Not only the same strain of the virus undergoes different degrees of variation in virulence under different conditions, but it is highly probable that there exist more than one strain of the virus which are immunologically different. Thus, Edwards (14), while engaged in the problem of eradication of rinderpest from Egypt during August-April of 1946, observed that the Mukteswar strain which was used in the campaign 'presented one undesirable feature, in that there was not complete antigenic overlapping between it and the local bovine virulent strain, two out of the twelve calves which had exhibited distinct mild reactions after it (Mukteswar strain) had been inoculated into them, succumbing afterwards, on challenge, to the local virulent strain showing typical severe rinderpest lesions.' Again, it is the author's experience that a highly virulent strain recovered from a natural outbreak of rinderpest among Hill Cattle in the village Kapura, about three miles down Mukteswar towards Almora side, in the year 1939, when inoculated into a Hill Bull discontinued after rinderpest work at Mukteswar Institute, produced distinct reactions. Observations like these point towards probable existence of multiple strains of rinderpest virus immunologically different from one another. This possibility should be properly investigated at an early date.

Goat-tissue-vaccine prepared in one State may not be antigenically similar to the goat-tissue-vaccine prepared in another State. The probable factors involved are the type of strain used for passaging, the breed, age and condition of the goats used, the stage of passaging at which the spleen is removed and used as vaccine, and the resistance-level of the animals vaccinated. Edwards (*loc. cit*) observed. "Several workers have now reported that the rinderpest virus becomes 'fixed' after about 80 passages in goats ; some have not been able to observe change after much longer passage ; Koch in 1897, and Stirling in 1932, besides Topacio, reported change after a few passages only ; while, for the Zebu cattle of West Africa, which are much more susceptible than those of East Africa, a strain had been found 'Safe' for the latter by about 300 further goat passages. Much would seem, from a perusal of the literature, to depend

upon the goats that are available for passing, and, perhaps, on the plasticity of the virus strain selected for passaging." Discussing the effects of continuous serial passaging in goats on the Virus strain, the same author observed that "under stresses inflicted upon it, a highly caprinized strain readily loses its residual bovine moiety, the main caprine moiety proving to be immunogenically different"* *" It is not, therefore, that in the course of caprinization, the bovine virus suffers a total decline in pathogenic status for the bovine, but that it becomes modified in its immunogenic components." In order to preserve its bovine affinities, the strain has to be periodically 'out passaged' before it gets highly caprinized. Necessary investigations have, therefore, to be carried out at different vaccine producing centres in order to find out the correct stage of caprinization at which the spleen tissue will have the best antigenic value for the particular types of animals intended for vaccination.

Attempts should be made to step up the immunity conferred by goat-tissue-vaccine. The author's research work on 'Influence of Solar radiation on immunity', mentioned above, reveals that the degree and duration of immunity conferred by a single dose of goat-tissue-vaccine can be increased if the vaccinated animals are kept away from the heating effects of the sun during the period of immunization. Winter months are, therefore, considered favourably for undertaking immunization. In summer months, when vaccinations are undertaken, the vaccinated animals should not be exposed to the direct sun for a considerable time, nor they should be overworked. A dose of adrenal cortical extract, together with goat-tissue-vaccine, may, perhaps, help in augmenting antibody formation. Food, rich in proteins of high biological value, should be given to the vaccinated animals during the period of antibody formation. The dose and dilution of the vaccine and route of inoculation are matters of considerable importance. It is claimed that the higher the dilution and the greater the dose, the better is the response to the antibody formation. From a physiologist's point of view, and also from the view-point of an Immunologist, sub-cutaneous route for introducing the antigen into the body is most effective, particularly so in rinderpest, because of the great affinity of the virus towards the monocyte cell system. The scarification method advocated by Siddiqui (15), and now in use in some parts of India, has been condemned by Edwards (*loc. cit*), as the results observed by him were very unfavourable. He observed "that this method (scarification) was dangerous. The reactions were somewhat delayed as compared with those observed after subcutaneous inoculation, but about 60% of the animals died, while none died after the subcutaneous inoculation. That result accorded well with our own experience at Pirbright, which showed that next to direct inoculation into a superficial lymphatic gland, intra-dermal inoculation was the most severe route of inoculation. This relative severity can be explained in the light of Henderson's findings, also at Pirbright, relating to the intimate connection between the skin and the neighbouring lymph nodes through the connecting lymphatic vessels, so that an intra-dermal inoculation is virtually an intra-glandular one; and, as is now well known, the rinderpest virus has a

selective affinity for the monocyte cell system." Evidently, the experiment was conducted on highly susceptible animals. At any rate, further experiments on different types of susceptible animals are desirable before this method is finally adopted. The immunity is likely to be stepped up and prolonged if the animal is at first sensitized to a small dose of the vaccine and is then inoculated with the reinforcing or immunizing dose of the same on the 6th day after receiving the sensitized dose. Presumably, a combination of the methods, indicated above, is likely to produce a more solid immunity in the vaccinated animals.

The author believes that the problems connected with the Epidemiology should have to be tackled on the 'Zonal basis.' The problems of one zone may be different from those of the other, and unless these problems are known, they cannot be solved.

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SHEEP AND GOAT HUSBANDRY AND ITS DEVELOPMENT IN TEHRI-GARHWAL

BY

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Introduction:—In a five years' plan for the development of Animal Husbandry activities in Tehri Garhwal State drawn up by me, I have mentioned about sheep-breeding and sheep-farms and I feel the following note will give a clear and brief picture of the position of sheep and goats in this State. In dealing with sheep and goats, I should not be understood to under-value the worth of the cow which is 'our mother of prosperity'; but the forests in the Himalayas, in which this district is situated, cannot be utilised for cattle, and therefore, we have to use these areas for the betterment of other animals. As mentioned in 'Cow in India', Himalayan forests are practically unused and the great belt of the Himalayan forests in Bengal, Bihar and the

Uttar Pradesh along the foothills are also far too out of the reach of the cultivators.

Situation:—This is a newly added district (50th District) of the Uttar Pradesh. It is a hilly country with a wide variation in climate, soil and rainfall. It is situated between latitude 30°·3′ and 31°·18′ and longitudes 77°·42′ and 79°·24′ and has a total area of 4,500 square miles. Its boundaries are formed by Tibet in north-east, Himachal Pradesh north-west, Dehra Dun District south-west and by brother Garhwal south-east.

It is drained by two main rivers viz. Bhagirathi (its main tributaries are Bhilangna and Alak Nanda) and Yamuna (which is fed by Tons and Paber) in the South and the North respectively. Extremes in climate vary from snow-covered parts all the year round to extremely dry parts where water, rain and fodder are rather scarce and the temperature reaches to about 100°F in summer. Rainfall varies from 30″ to over 125″. Such varied conditions naturally affect sheep and goat industry.

Pastures:—While the rest of India is feeling the scarcity of pastures, this district is possessing surplus pastures. The total areas which are available for summer and winter grazing are as given below :—

Summer grazing	Acres	Winter grazing	Acres
1. Alpine grassy area.	3,28,644	1. Low level kukat forests.	55,314
2. Silver fir and spruce forests.	53,802	2. Chir forests.	2,42,156
3. Blanks and gaps in fir forests.	14,149	3. Blanks and gaps in No. 2	64,636
4. Oak forests.	4,38,094	4. Unmeasured land.	76,800
5. Blanks and gaps in 4.	59,664		
Total.	8,94,353	Total.	4,38,906

Taking for granted that sheep and goat require 1 acre, a cow or bullock 2 acres and a buffaloe 4 acres for grazing per annum, the pasturage required, annually by existing livestock is given below :—

		Heads.	Acres.
1.	Bulls and bullocks ...	92,812	185,624
2.	Cows ...	91,819	183,638
3.	He-buffaloes ...	4,240	16,960
4.	She-buffaloes ...	67,913	271,652
5.	Sheep and goats ...	210,938	210,938

(Statistics from Indian Forester, November 1947, Vol. 73, No. 11 Industrial Survey report of Tehri Garhwal State by P.D.Raturi).

From the above data it will be clear that, even if all the animals in the district were to be at pasture, we have got surplus pastures to the extent of nearly of 4,64,447 acres. If, in addition, the fodders like stalks of cereals, common legumes and grasses that grow in the cultivated lands were to be taken into consideration, then our surplus of pastures and fodders is really enormous. This is highly significant when one remembers that, according to the statistics available, the average forest grazing in India is only 5%

Mode of transport in hills :—This mountainous district is full of valleys and peaks, where construction of roads and bridle paths has been difficult. Consquently, sheep and goats play an important role in transport where other means of conveyances are impracticable. Cereals, potatoes, fruits, salts etc which are the necessaries of life, are being transported by animals. The trade between Tibet and India is through this district and there is an already well established trade between the two countries in wool, salt, cereals, animal products, herbs and drugs of Himalayas, etc. The two countries are inter connected by Jelo-Khega Pass.

Climate :—The extreme cold climate all the year round prevailing in major parts of the district gives great importance to the romantic wool—a 'product' of the sheep and goats. Woollen cloths are a necessity for the inhabitants of this region as is common in western countries and northern hemisphere.

Diet :—Excessive cold and snowfall being the greatest obstacle for cultivating cereals economically, meat is the main diet of the people here.

Religion and custom allow killing of sheep and goats in thousands every year for performance of ceremonials and worshipping. Goat's milk is freely used to supplement the diet.

In view of the above climatic conditions and resources, this new district has got great potentialities for Sheep and Goat husbandry and I am confident that, if this is properly exploited, it will revolutionise the whole woollen industry of this province. It is worthwhile remembering here that the value of the livestock products greatly exceeds that of crops.

Present conditions

Sheep and goat husbandry, as practised here, can safely be divided into three different areas from geographical, cultural, breeding and rearing aspects.

1. *Thathikathoor Bhilang :*—Where farmers keep, rear and breed Gaddi—a black variety of sheep as commonly met in brother Garhwal, whose wool is coarser than those undermentioned.

2. *Rawaine.*—Where local farmers keep a good number of sheep whose wool is generally of brown colour (Bandriya), though a few black-white and inter-mixed ones may be found. The wool of this zone is better than the above but coarse in comparison to the Taknori. Animals are kept and reared by Budera peasant shepherds.

3. *Taknori*.—This sheep is the best breed and it is reputed for its better quality of wool, when compared with other hill districts of the State. The trade is in the hands of a special class of residents known as *Jadhs* who do this trade from times unknown and their love and attachment to these animals is as old as human civilization is in this hilly country. These animals are their mainstay.

The *Jadhs* are very highly specialized in this industry. Their wealth is their livestock viz. sheep, goat, yak cattle and Pahari pony. These animals give them fine fleece wool (in some goat), cow's milk, packing and riding facilities in hills. Situated as they are in Taknor which touches the boundary of Jelo-khaga pass of Tibet, the chief route for Tibet from this district, they carry on various trades.

N. B. The expression 'coarse wool' has been used in comparison to Taknori wool, but it is superior and better than the wool from other hill districts and indigenous sheep of India.

Transport.—The *Jadhs* use sheep and goats for loading with the exception of pregnant ones, but peasant shepherds (Budera and Gaddi) use only males for packs. These animals under the existing road facilities are as important as pack animals like mules and other vehicles.

Rearing of lambs and kids and milking.—Milking of ewes is abhorent even to think of here, and, therefore, a lamb enjoys in full the nature's gift from its mother; there is, however, no doubt, that goats' last strippings of milk are taken by the owners to supplement their diet.

Feeding and pasturing.—Grazing is the only system. The winter grazing is confined to 4 months in lower regions, whereas summer grazing is for 6 months in Alpine grass areas. The shepherds start at the end of October from their homes and return back in the following February.

Mutton and flesh value.—This is good but not so delicious as of the black goat commonly found in the lower region.

Disposal of males.—Animals below standard are either killed for mutton or sold to farmers in the lower regions where they are interested in keeping one or two animals to get wool for spare time spinning.

Housing.—Housing of herds is unknown; open grounds under the sky are the only shelter all the year round. Small tents are used for shepherds in migration.

Shearing.—This is done in February, June and October by all. Necessary care is taken in collecting the wool.

Common enemies of sheep and goat.—The common enemies are the wild animals, contagious diseases, heavy rains and snow. Kura (a thorny grass found in low regions) robs the sheep's wool during migration.

Friends.—The shepherds' indispensable companions are horses and dogs, the latter being renowned for their brilliant handling of flocks.

From the above sketch it is clear that this section of our livestock has got an importance of its own in this area and that there is a vast potentiality for its development on scientific lines.

Experiment in cross-breeding.—There is a huge controversy in respect of cross breeding with Merino strain of sheep and its introduction in India; but we have solved this controversy by practical trials here. One Australian Merino ram was very kindly brought by H. H. Sir Narendra Saha Bahadur with his Jersey cattle and the ram with 11 Takhori sheep was supplied to a local shepherd in 1941 with the aim of feeding a new Uttara Kashi weaving school and to experiment the effects of this cross breeding on woollen industry.

The ram survived well, and its crosses too, but the local shepherds rejected both in the beginning till *Acha Dogla* (i.e. progeny of half-brother and sister) could be got.

The causes of rejection were:—

1. Being high-pedigreed, they were easily susceptible to diseases.
2. Being flabby, they were unfit for pack work.
3. Progeny, unlike our sheep, were born naked and required extra care which was difficult during marching and inconvenient at other times.
4. They were poor in mutton.
5. In accidental deaths (not due to any specific diseases) the carcase changed its natural colour, unlike the carcase of local sheep, into an ugly dark red appearance and hence was not utilised as 'shepherd's perquisite.'
6. Not habituated to local conditions, they fell an easy prey to wild animals and steep roads; did not understand signs of the shepherd unlike the local sheep which were highly developed in this respect.
7. They became easily tired during migration.
8. They did not make friends with their mates.

The off-spring was a bit better but possessed all the above defects predominently. The *Acha Dogla* was supposed to be a very good cross and it was said that it was seven-eighths like the sire in stamina and intelligent like the locals.

The lengthy process in the evolution of this strain, the impatience and ignorance of the shepherd and the lack of Government interest in the direction—all led to deterioration before *Acha Dogla* was evolved. Even this fine evolution was nipped in the bud by change of shepherds entrusted with this task. At present there are about 25 Merino strain animals found with the flocks here and there.

Points of Acha Dogla :—The shepherd who kept this flock up to 1947, on enquiry, told me that it is a medium-sized animal with fine white wool, compact body, fine head, Roman nose, prominent eyes, horns coiled in males and rudimentary in females and tail short ; wool yield was about 6 lbs.

Common points of Takhori sheep :—These animals are generally white, are hardy, possess short legs, strong bones, wool of June shearing is about 2·5″ to 3″ staple, is fairly distributed, Roman nosed, horns turned downwards in males, rudimentary in ewes and tail short. Wool yield 3 to 5 lbs.

Common points of goats kept by the Jadhs :—1. *Glacier goat:*—It is of black colour over head, neck and fore-quarter and pure white on rest of the body. It has long hairs on its.

2. *Other goats* :—They are white, have long hairs, thin ears and twisted horn inclining at their extremities to the rear, short small bones and heavy coat.

N.B.—Fleece is found on goat's body.

Improvements suggested under existing conditions :—

The following are the brief suggestions for effecting improvement.—

1. In primary schools' curriculum, enough literature, in brief, be included on sections of livestock and free propaganda with slides etc. be arranged, particularly dealing with these animals and their products.
2. Higher training in this subject is of immense value to personnel of Veterinary departments interested in these animals.
3. Veterinary aid to be within reach of the shepherds.
4. Castration by Burdizzo Castrator to be popularised and progeny deviated from the desired type to be disposed off.
5. Selection—best animals to be selected from the existing ones.
6. Suitable breed—a thorough study in this respect is necessary to evolve a suitable breed of sheep and goats to fit the local areas.
7. Stud goat and ram—these animals to be selected and supplied by Government as is done elsewhere.
8. Association—Co-operative associations of sheep owners to be formed to safeguard their interests.
9. Shearing and weaving.—Those engaged in its development to be modernised. Government should encourage the present cottage woollen industry by distributing prizes for best exhibits and rectify imperfections in these.
10. Fairs—Sheep and goat fairs to be frequently arranged in these areas and they must include the other animals which are companions of shepherds there.
11. Exchange—Males supplied to be exchanged periodically to avoid in-breeding in the grading process.
12. Gun licences to be issued free to shepherds.
13. Diseases—Prevalent diseases to be studied and eradicated.
14. Hides—Elementary knowledge of skinning and tanning to be imparted to the people and establishing tannery in this district.
15. Stockmen—Candidates to be selected from amongst shepherds and trained as stockman.
16. Roads—Construction of roads to exploit all other resources in these areas.
17. Government should purchase surplus stocks and products and dispose of them.
18. Legislation—Contagious disease acts to be adopted by legislation and enforced as in other countries to prevent spreading of contagious and infectious diseases.
19. Wastages in the use of horns, bones, intestines etc. should be minimised and these portions of dead animals should be put to good use.

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Editorial

A HISTORIC EVENT

The celebration of the Diamond Jubilee of the Indian Veterinary Research Institute, Mukteswar, on the 11th March 1951, is a great land-mark in the progress of the Veterinary Profession in India. Starting from very small beginnings, the Institute, during the last sixty years of its existence, has achieved the distinction of being claimed as the premier institution without an equal of its kind in the East. Its contributions to the problems of the livestock industry in the tropical and sub-tropical countries have been so outstanding that the veterinary profession instinctively looks up to this Institute for help and guidance in solving its varied and multifarious difficulties. Can there be a greater recognition than this ?

Unlike Western countries which are highly industrialised and mechanised, our country has been, and continues to be, a primarily agricultural land with animal power as the main motive power behind the plough and the cart. Lord Linlithgow, a former Viceroy of India, did not use any exaggerated language when he said that the bullock and the cow bear on their patient backs the entire economy of this country. The efficiency and well-being of the bullock and the cow reflects in a true and correct manner the prosperity of the peasant and the country. To keep the livestock in a state of maximum efficiency has, therefore, been the chief aim and object of the Veterinary Profession and, in this task, the researches of the Indian Veterinary Research

Institute would be remembered by a grateful profession, and an equally grateful country, with pride and affection for a long time to come.

A recount of all that has been achieved by this Institute during the past sixty years since it was established would be an elaborate process. Even a brief resume of these activities will show how this Institute has helped the development of Animal Husbandry work in our country.

By far the greatest impediment to the building up of a good herd of cattle and sheep in this country has been the incidence of contagious and infectious diseases. Among these, what may be described as veritable scourges, are the well-known and dreaded diseases like Rinderpest, Anthrax, Black-quarter and Hæmorrhagic Septicaemia. These diseases levied a heavy toll year after year on the livestock wealth of the country and caused enormous losses which, particularly, in the cases of small owners, ruined them financially. It is one of the earliest remarkable achievements of the Indian Veterinary Research Institute that it worked out and put out for field-use prophylactic remedies for each and every one of these diseases and saved crores and crores of rupees worth of livestock. The preventive remedies have been very easy to use, caused the minimum dislocation of work and, what is most important, conferred absolute protection to the vaccinated animals. It has been an amazing experience to the ryots to see his protected animals moving about non-chalantly in the midst of disease-infected localities where unprotected animals were dying in numbers. Such an ocular demonstration of the simplicity and, at the same time, efficacy of these prophylactic vaccines have made them really popular amongst the people. The diseases have become absolutely preventable. It speaks volumes for the efficiency of these products that they are in great demand even in countries adjoining the Indian Union. Pakistan, Afghanistan, Iran, Iraq, Egypt, Ceylon, Siam, Malaya and China—all these countries also obtain their supplies from this Institute and benefit by them.

While these prophylactics of earlier years have stood their ground well, those of later years have been equally successful. Among these later researches of this Institute, is the highly popular

and effective vaccine against Ranikhet disease, a disease dreaded alike for its suddenness of its onset and its quickness in the wiping out of the flocks. The mortality in practically every outbreak is nearly cent per cent and the disease neither gives a chance for treatment nor is amenable to it. Consequently, poultry breeders and lovers have been loathe to expand their activities and the poultry industry in the country was not in a position to develop and expand. But thanks to a vaccine evolved at the Indian Veterinary Research Institute it has now become possible to give absolute protection to the birds and snap our fingeres, as it were, at the dreaded disease. The savings to the poultry world on this account are colossal and it cannot be too grateful to the research work of this Institute.

The activities of this institute are not confined only to research work on the eradication of contagious diseases. They embrace also the other aspects of Animal Husbandry. Diseases of nutritional origin, genetic causes, environmental factors, and also those caused by parasites and protozoons have claimed the close attention of the Institute. Our country has been the home of some of the finest breeds of livestock and it has been the pride of our Maharajahs, Princes and Zamindars that they possessed exceedingly valuable specimens of horses, cattle, sheep and fowls under their personal care and supervision. Latterly, however, these valuable livestock have deteriorated in their qualities mainly due to absence of care in management and breeding and they are now the poorest stock in the whole world. If we are now to recover our lost ground and build up our livestock to a level of excellence, the research work at the Institute is bound to be of incalculable help and guidance to all Animal Husbandry workers.

In addition to research work, the Institute is also concerned with a good deal of Advisory work and Teaching. It advises the different States in the tackling of the various local veterinary problems and examines a large number of pathological specimens for the elucidation of obscure diseases. The team-spirit that is thus fostered between the field and laboratory workers is an illustration of the 'combined effort'—to use an

expression of Dr. J. T. Edwards, a well-known former Director of the Institute—so essential for progress in science.

Above all, the Institute has earned a reputation for imparting Post-graduate study in Veterinary Science. The scarcity of trained personnel for advanced Veterinary work has been a great stumbling block for the advancement of the Veterinary Profession and it has been keenly felt by each and every State in the Indian Union. Within its limited resources, the Institute has been meeting the steadily increasing demand in this respect and a course of Post-Graduate study at the Indian Veterinary Research Institute has been a hall mark of advanced and up-to-date Veterinary training in this land. With the advent of our Freedom, the responsibilities of the Institute have increased enormously and it is to be hoped that the proposals of the present energetic and enthusiastic Director, Dr. S. Datta—incidentally he is the first Indian to be appointed to the post—would be sympathetically considered by the Central Government and adequate finances placed at his disposal for expanding the Institute to meet the requirements of the modern days.

It is very gratifiying that, on such an occasion like this, the All-India Veterinary Association gave expression to the high esteem in which this Institute is held by the profession by presenting a Silver Shield as a token of appreciation of the services rendered by the Institute in the cause of Veterinary Science for the past sixty years. The presentation was made to the Director of the Institute by the Hon'ble K. M. Munshi, the Minister for Food and Agriculture at the request of Rao Sahib T. Vinayaka Mudaliar who attended the celebrations as the representative of the Association.

May the Institute continue to prosper and reach higher heights to build up the livestock wealth of the country—this should be the prayer of every one of us.

THE INDIAN VETERINARY RESEARCH INSTITUTE, MUKTESWAR

By

Rao Sahib T. Vinayaka Mudaliar,

Retired Livestock Development Officer, Madras.

At a time when the world is at cross-roads and is indulging in the soliloquy 'To be or Not to be', the Diamond Jubilee of a scientific institution is not likely to receive the attention it deserves. Even so, these distressing days will soon pass away and the poor old world will yet live to see happier and brighter times. In that not distant future, the enduring work of the Indian Veterinary Research Institute, Mukteswar, will continue to shine quite un-tarnished and compel people to take cognisance of its real worth. Every Indian, be he a Veterinarian or not, may well feel proud of this great institution, which has earned a status and a reputation all its own, in the international sphere of scientific men.

In the cloistered seclusion of the Himalayan heights, the Indian Veterinay Research Institute has been turning out work of the first magnitude quite unostentatiously in the cause of Veterinary Science in our country. Its very seclusion has deprived it of much wider publicity amongst the ordinary men, in whose interest it has been toiling so hard for the last sixty years. The great Himalayas is looked upon as an abode of mystery and it is that abode that has given shelter to this unique institution to unravel many of the mysteries which the animal flesh is heir to.

How successfully the Institute has carried out the pioneer work in our land, is now a matter of history recorded in the several blue books of the Government. For obvious reasons, it is not possible to enter into the details of her achievements in the course of an article of this nature. Suffice it to say, that the Institute has successfully tackled almost all the major problems of diseases of cattle, sheep, goats and poultry, which once claimed such a high percentage of mortality in our land.

The high level of work turned out by the Pathology, the Bacteriology and the Parasitology sections has led to many a discovery. It is remarkable how well the Biological section has been able to keep pace with new discoveries and advances made. Indeed, the history of this Institute is a magnificient story of collaboration of heads and hands devoted solely to the cause of science, with no better recompense than the stern delight of accomplished efforts.

Who can ever tell the monetary value of cattle so far saved from Rinderpest alone, ever since the first Anti-Rinderpest Serum was prepared and issued from this Institute in 1899? That value alone will run into astronomical figures. What then is the national savings from the other diseases like Haemorrhagic Septicaemia, Black-quarter, Anthrax, Fowl-pox, Fowl Cholera, Fowl-pest, etc., which have all been tackled successfully by evolving suitable vaccines that are in daily use all over the country to-day. Further work to produce better and cheaper vaccine is always on the anvil and the lion-hearted workers refuse to rest on what has been achieved so far.

Not satisfied with the control and prevention of diseases alone, the Institute has taken upon itself the more positive side of Animal Husbandry work by opening the Animal Nutrition section and the Animal Genetics Section. I visualise a day when the two sections will revolutionise the Animal Husbandry work in this land. All the available Indian feeds and fodder for livestock have been analysed, their nutritive values determined and published as a guide for the field workers. Research into new and cheaper feeds is going on silently but steadily. Deficiency diseases are also receiving the attention they so well deserve.

In the field of Genetics, the adoption of Artificial Insemination on a fairly large scale all over the country to-day has had its beginning at this Institute. Fundamental research into the mode of inheritance of certain genetic characters in Indian livestock has been going on. A study on hormones and the preparation of certain hormonic products to rectify several breeding errors and defects ordinarily encountered in the field is also in progress.

The Poultry section of this Institute is too widely known to need any specific mention. The strain of indigenous bird of poultry evolved at this Institute, yields on an average about 116 eggs a year as against 50 in rural areas. A close study of poultry in health and disease is kept up and the phenomenal success of the vaccine against Ranikhet disease has earned for the Institute a lasting reputation. It has virtually saved the poultry industry from complete extinction in our land. Work on several branches of poultry technology also is said to be under study and it may not be long before we hear that the Institute undertakes to teach the technique of frozen eggs, drying of eggs, canning of poultrymeat, etc.

On the teaching side, she has been the parent Research Institute ever since 1890 and has been training the necessary personnel for similar work in other States. If today every State could boast of a small Research Unit, it is no exaggeration to state that it had the necessary inspiration and guidance from the Indian Veterinary Research Institute, Mukteswar. It has also been running several Post-Graduate Courses in special subjects and is a recognised Institute to work for the M.Sc., Ph.D., and D.Sc., degrees of the several Universities.

Such is the glorious record of work of the Indian Veterinary Research Institute, Mukteswar, which celebrated its Diamond Jubilee on the 11th March 1951 at Izatnagar. Given more funds and facilities, its contribution is bound to be many-fold. One feels nervous to indicate anything in way of expansion or improvement of its work. Who can undertake to perfect perfection itself? We know they have been thinking of regional institutes for Animal Nutrition work and also of a Cattle Breeding station for work on breeding research. Both are of immediate necessity and of utmost importance. Let us hope the Central Government, in spite of its financial stress, will see its way to help this great Institution, which occupies such a key position in the National economy of our country. To neglect it is to court national disaster.

I feel sure the good wishes of all our countrymen will go to that Institute for continued success in the service of our motherland and in the wider field of science.

EMERITUS PROFESSOR JOHN SHARE JONES

The news of the death of Emeritus Professor John Share Jones on the 2nd of December 1950 has been received with deep regret all over the Veterinary world. In him, the profession has lost a towering personality of noble purpose and high achievements.

The late Professor is familiarly known to the profession as the author of the famous publication 'Surgical Anatomy of the horse' which is a master piece of descriptive anatomy displaying alike his grasp of the essentials of the subject and his capacity for precise presentation. In addition to the pursuit of scientific studies, the late Professor was a staunch and powerful advocate of our profession continuously pleading for its proper status. He was one of the earliest to plead for an University status for the Veterinary Science and, as the Professor of Anatomy at the University of Liverpool, he did yeoman service for raising the dignity of the profession.

May his soul rest in peace!

THE DIAMOND JUBILEE OF THE INDIAN VETERINARY RESEARCH INSTITUTE

Amidst scenes of unforgettable joy and splendour the Diamond Jubilee of the Indian Veterinary Research Institute, Mukteswar, was celebrated at Izatnagar on 11th March 1951, under the presidency of the Hon'ble Minister for Food and Agriculture, Shri K. M. Munshi of the Government of India.

A gigantic shamiana was specially put up for the occasion. Flags and festoons waved all over the area and the entire route from the main gate to the shamiana was spanned at suitable intervals by specially erected decorative gate-ways, each one bearing the name of a past Director of the Institute. Thus, there were Lingard, Rogers, Holmes, Sheather, Edwards, Ware and Minnett gates. The paintings on those gate-ways indicated the particular line of contribution of each Director to the cause of Veterinary Science. As one passed through these gates, one could not

help a feeling of solemnity and reverance creeping on him in memory of those soldiers of science. This was a form of homage which was quite dynamic and exceedingly appropriate.

The cream of the Veterinary profession in India was gathered there. There were Directors and Deputy Directors, Principals and Professors, Research workers and Field Investigation officers and the entire *elite* of the town. After a group photograph was taken, the gathering adjourned to the shamiana, where Dr. S. Datta delivered his welcome address. His statement that 'in the thoughts of the staff of the Institute, the future far outweighs the past' was greeted by all. What a prospect! We look forward to the day when that promise of the Director would materialise and make the Institute even still more famous.

Sir Dattar Singh then welcomed the delegates for the Animal Husbandry Wing meeting. The Hon'ble Shri K. M. Munshi in his presidential address paid a glowing tribute to the work of the Institute and came out with a practical proposal to commemorate the occasion. He asked the authorities concerned to start immediately a Diamond Jubilee Key Village scheme, close to the Indian Veterinary Research Institute at Izatnagar, for the improvement of livestock in that area. This was applauded by all.

Next came a very pleasing function which added lustre and colour to the entire proceedings. It was the presentation of a Silver Shield to the Indian Veterinary Research Institute by the All-India Veterinary Association in grateful appreciation of the services rendered by the Institute to the cause of Veterinary Science during the last 60 years. In requesting the Hon'ble Minister to present the shield to the Institute, Rao Sahib T. Vinayaka Mudaliar, the representative of the All-India Veterinary Association, spoke as follows:—

Ladies and Gentlemen,

I beg leave to associate myself with all the handsome tributes so eloquently paid by the Hon'ble Minister to the Indian Veterinary Research Institute for the services rendered during the last 60 years. Sixty years, whether in the life of an individual or an Institution, is indeed a land-mark and is considered as such all the world over, whether in the East or the West. It is that land-mark in the life of the indian Veterinary Research Institute that we have all gathered to celebrate to-day. No man with vision will fail to realise the historic importance of this occasion in the march of science in our land.

On this solemn occasion, for it is nothing less, our hearts go out in prayer to that Supreme Power, which has enabled that great Institution to render so much of service in so short a time, in the cause of science in general. Next in order comes to us the memory of that long list of illustrious men, down to the present day, who have toiled hard to make

that Institute what it is to-day. They have built that edifice brick by brick with utmost caution and diligence. It is a labour, epic in nature, that cannot be easily forgotten by a grateful posterity.

Whatever may be the reasons, scientific or otherwise, which had prompted the originators to shift that Institute from Poona to Mukteswar, there is an appropriateness in the way it has retired to the cloistered seclusion of the Himalayan heights in search of truth. Like all seekers after truth, the Indian Veterinary Research Institute, judging from its achievements, has equally found the Himalayas, that abode of mystery, quite congenial for its work. Man seems to become highly conscious of the purpose of life in the midst of the prevailing greatness of Nature there and the purity of its atmosphere. It is this perhaps that has helped the workers, both past and present, to achieve so much.

I do not know if students of economics amongst you will agree with me when I say that prevention of losses is as much a gain as profits made. It is even more so in a sense. Judging from that standard the direct contribution of the Indian Veterinary Research Institute to the national economy of the land is something colossal in way of prevention of losses of the livestock wealth. A stage has now been reached when the Institute could undertake the more positive side of the Animal Husbandry Work by trying to multiply, and multiply quickly, and stock this land with better and superior cattle, sheep and goats, a work which has already been started in its Animal Genetics and Animal Nutrition sections.

On this day of its Diamond Jubilee, the profession as a whole stands in salute to the Indian Veterinary Research Institute and, as a humble spokesman of that great organisation, the All-India Veterinary Association, I wish to convey its grateful thanks for the splendid record of work which the Institute could boast of.

As a humble token of its appreciation, the All-India Veterinary Association has sent this Silver Shield and I request the Hon'ble Minister to present it to the Institute.

The Hon'ble Minister then handed over the Shield to Dr. S. Datta amidst a deafening round of applause. With this, the inaugural session of the Diamond Jubilee Celebrations was over.

There was a Tea-party in the evening on a lavish scale. Over 500 invitees sat at tables on the beautiful lawns of the Institute. There was quite a good sprinkling of ladies with colourful sarees, who added much to the mirth and splendour of this memorable party.

Thus ended a historic event of great importance in our land. It is a land-mark that will beckon future generations of Veterinary Surgeons " to strive, to seek, to find and not to yield."

T. Vinayaka Mudaliar.

Notes and News

The General Secretary of the All-India Veterinary Association writes to say that, for the first time, the Association was invited by the Indian Council of Agricultural Research to send a representative to attend the Conference of Veterinary Investigation Officers and Veterinary Research workers held at Izatnagar during the 2nd week of March 1951 and that the Council of the Association deputed Rao Sahib T. Vinayaka Mudaliar as its representative. On a further reference to the Indian Council of Agricultural Research, the representative of the Association attended also the ninth meeting of the Animal Husbandry Wing held in the same place as a visitor. Rao Sahib T. Vinayaka Mudaliar in addition to attending the abovesaid two meetings participated in the Diamond Jubilee Celebrations of the Indian Veterinary Research Institute also as a representative of the Association and handed over a Silver Shield on its behalf to the Hon. Sri K. M. Munshi for presentation to the Director of the Institute as a token of appreciation of the services rendered by the Institute to the cause of Veterinary Science during the last sixty years.

We are very glad to note the beginning of a close liaison between the Association as the representative of the Veterinary profession and the Government—a thing for which the Association has been working ever since its inception thirty years ago—and we only hope that this relationship will strengthen as years go by to their mutual advantage and to the country's benefit.

* * *

Preservation of Cattle

When Parliament resumed its session on 26-2-51, consideration of Pandit Thakurdas Bhargavas' non-official Bill to provide for the preservation of useful cattle in the Centrally Administered Areas was taken up.

Mr. Satish Chandra (U. P.) wanted the House to approach the question from an economic and not a religious point of view. There were to-day 18 crores of cattle in this country, but it was possible that, by improved breeding, ten crores of them would give more milk and more service than these 18 crores. As the sentiment of the people would not permit cow slaughter on a large scale, it would be advisable to concentrate useless cattle in forests and other areas where they would not be a liability and to castrate all useless bulls. That would solve the problem to a certain extent. He hoped Government would bring forward the comprehensive measure for cattle development they had promised in the last session. While the annual income from cattle was estimated at Rs. 2,500 crores or 16 per cent of the national income, the amount spent out of the public exchequer on their development was only ·08 per cent. He had no doubt that Government could get large amounts for cattle development from non-official sources if they made an effort.

Seth Govind Das (Madhya Pradesh) said that the demand for protecting the cow was not communal. When Pakistan also was to have legislation on this matter, it was a misfortune that the demand for cow protection in India was alleged to be prompted by communal considerations. The Grow more food campaign could never be successful until the problem of bullocks for cultivation and cows for milk supply was properly handled.

Mr. Frank Anthony said India had the largest cattle population relatively to human population and the output of milk per head here was lowest in the world. The problem of destruction of useless cattle was more urgent than that of preservation of useful cattle. Increase of useless cattle was an unnecessary burden on the strained fodder resources of the country. He was afraid the present Bill would be a weapon for banning cow slaughter. If ban on cow slaughter was to be a concession to the susceptibilities of the majority community, it should be stated so specifically in the legislation. The Bill should also provide for destruction of useless cattle.

Mr. Munishwar Datt Upadhyaya(U.P) and Mr. B Munavalli (Bombay) were of the opinion that small holdings in the country would not allow any large scale use of mechanical appliances. Bullocks were necessary for agricultural operations and therefore preservation of cattle was important for the country's economy.

Mr. K. M. Munshi, Food and Agriculture Minister, intervening in the debate, announced that a Bill on the question of development of animal husbandry on scientiffic lines was before the Cabinet. He, therefore, requested the mover, Pandit Thakurdas Bhargava, to postpone his Bill till the Government measure came before the House or withdraw it. That would save considerable time of the House, he said.

Mr. Munshi said he had no quarrel with the fundamental principles underlying Pandit Thakurdas's Bill. His only fear was that it did not provide the solution that was intended by the Bill itself because it was partial. It did not view the problem as a whole. It would, therefore, be much better that the House should solve the problen in all its aspects when the Government Bill on the question was brought forward and which would be very soon.

Mr. Munshi said the nation as a whole had already accepted the principle of preservation and improvement of breeds of cattle as stipulated in Article 48 of the Constitution. Any isolated solution would complicate the matter further.

He said the question of prohibiting slaughter was inter-dependent with the idea of establishing *gosadans*. The Bill, which will be brought before the House, would be a complete enactment providing for inter-dependent things. It was not possible for placing a ban on slaughter without providing for segregation of useless cattle.

Mr. Munshi said that it was not correct to say that the Government did not devote attention to compost. During 1949-50, twelve lakh tons of urban and 44 lakhs tons of rural compost was prepared. This year the figure would be 137 lakh tons.

As regards the efficacy of ammonium sulphate, he said, one ton of that artificial manure would give an additional produce of 56 maunds while one ton of compost would give only one maund.

The Government had evolved a 'key village scheme' to promote good breeds of cattle by keeping stud bulls in villages. But there was the financial difficulty. The Cattle Protection Committee had suggested that a cess should be levied to make such schemes successful. In his opinion it would be a most productive cess.

Pandit Thakurdas Bhargava alleged that the Government did not devote sufficient attention to running *goshalas*. He wanted to know what share of the 'grow more food' campaign funds was directed for improving cattle.

Mr. Munshi said that animal husbandry did not come under the purview of the 'grow more food' rules. He would examine the question of making alterations in them to make them applicable to cattle improvement.

At this stage Mr. Raj Bahadur suggested that the Bill be postponed till such time as the Government Bill came before the House. Pandit Thakurdas said it was no use postponing the Bill as to-day the time was not sufficient to pass it. But he would like to have an assurance from the Minister that the Government Bill would be passed during the current session.

Mr. Munshi said the programme of the House depended on the convenience of the House itself. Ultimately the motion was adjourned.

* * *

Inaugurating the 34th meeting of the Advisory Board of the Indian Council of Agricultural Research in New Delhi in the first week of January 1951, Sardar Datar Singh disclosed that the International Conference on Cattle Breeding held at Lucknow in February 1950 under the auspices of the F.A.O. made as many as 32 recommendations of far-reaching importance to the development of livestock and that these were now receiving the attention of the Government of India. He also added that the Indian Council of Agricultural Research had already sanctioned six pilot Key Village Schemes and that arrangements were in progress for the establishment of an Artificial Insemination Centre under the Delhi Villages Development Schemes. He further said that 140 reports and programmes of work relating to Agricultural and Animal Husbandry activities of the State Governments were obtained this year and considered by the Scientific Committees of the Indian Council of Agricultural Research at the meetings held in November 1950.

Due to the uncertainty of racing in Western India after 1952, the 110 lots brought for auction from the twelve breeding centres in the country showed a marked decrease since pre-war years, but the fear did not deter the buyers.

Again, the princely patrons of the Turf, the Maharajas of Kashmir, Gwalior, Morvi and Idar monopolised the ring. Morvi was prominent among the buyers, paying Rs. 1,76,000 for ten two-year-olds. The Maharaja of Kashmir made the highest bid for a chestnut filly by Mas d'Antibes out of the Lady Devon for Rs. 47,000.

Bellrue stock from the Yerwada Stud was in demand following the victory of Gold Street (sired by Bellrue) in the Indian Derby. Two of the Bellrue colts together fetched Rs. 70,000 after keen bidding. The Bhopal stud, through their five colts, got the maximum amount for a breeding centre—Rs. 1,42,500.

The famous Renala and Montgomery Studs from Pakistan were absent at the auction due to the ban imposed on them by the Bombay Government, treating them as 'foreign'.

Out of the 110 lots, 25 were withdrawn. The remaining 85 lots were sold at an average of Rs. 9,904 which was the second best since pre-war years. Last year's average of Rs. 9,944 was the best.—***The Hindu.***

* * *

PERSONAL

Dr. V. Mahadevan, M.A., D.Sc. (Paris), A.R.I.C. (Lond.)

Sri V. Mahadevan who went abroad for higher studies on deputation by the Government of Madras has returned to his duties at the Madras Veterinary College with acquisitions which have been described as 'meritorious'. During his period of training from 1948 to 1950 in France and Great Britain, Sri V. Mahadevan underwent special training in Animal Nutrition. His efforts have secured him the award of the Doctorate Degree in Animal Nutrition (Science) of the Paris University, with the additional mark of distinction 'Mention tres honourable' (Very honourable credit). His two theses were entitled as (1) Studies on the influence of amino-acids and Iodo-Casein on the growth and composition of wool and fur in Animals and (2) Recent researches in vitamins of B-group—the latter being a subject proposed by the Faculty. He has also been admitted as an Associate of the Royal Institute of Chemistry (London) for proficiency in Applied Nutrition and Bio-Chemistry. And, recently, on the 19th February 1951, he has been elected as a member of the Nutrition Society, London, by the Council of the Society.

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P. S. SUNDARAM, G.B.V.C.
Asst. Director of Veterinary Services, C. P., Amraoti who has recently retired from service.

[To face page 378]

A. K. VERMA, G.B.V.C.
who has gone to U. K. for higher studies as a Bihar State scholar.

[To face page 377]

Maqsood M. BUTT
who has gone abroad from Pakistan for Postgraduate studies.

[To face page 377]

Dr. V. MAHADEVAN, M.A., D.Sc. (Paris)
Lecturer in Animal Nutrition, Madras Veterinary College who has returned from abroad after Postgraduate studies.

[To face page 376]

Plate No. 28

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A case of generalised tuberculosis in a monkey

Fig. 1

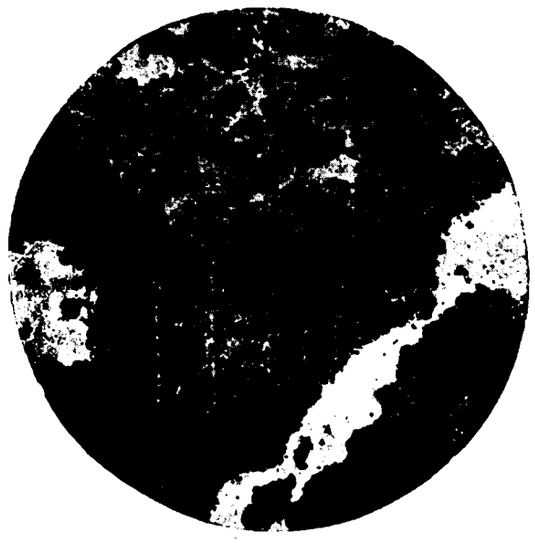

Fig. 3

Fig. 2

Illustrating the article by K. P. Chandrasekharan.

Dr. Mahadevan has thus come back equipped very highly and it is to be earnestly hoped that the authorities would give him all the necessary facilities to enable him to carry on his researches and utilise his knowledge for the improvement of the nutrition of the livestock and the wool and fur industry of the country.

A. K. Verma

Sri A. K. Verma, (General Secretary of the Bihar Veterinary Association and Member of the Council of the All-India Veterinary Association) who was on the staff of the Bihar Veterinary College has sailed for U. K. on the 22nd February 1951, for higher studies as a Government of Bihar scholar. He has been accepted by the London School of Hygiene and Tropical Medicine as a Research student in the Department of Parasitology under Prof. J. J. C. Buckley for a period of two years.

M. Narayana Menon

Another Veterinary Graduate who has gone for higher studies in the U. K. is Sri M. Narayana Menon, Lecturer in Surgery at the Madras Veterinary College. He has joined the Royal (Dick) Veterinary College, Edinburgh and he is expected to stay abroad for over two years taking courses in higher veterinary science.

Maqsood M. Butt

Information has been received that Mr. Maqsood M. Butt of Pakistan, a research worker at the University of Cambridge, England, will be presenting one of his research papers at the 18th International Physiology Congress, Copenhagen, Denmark. During his study period in U.S.A., and the United Kingdom, he has already distinguished himself with his research papers at the American Dairy Science Conference, Minnesota, U.S.A., Birmingham Conference of the Society for Experimental Biology, England and the 5th International Zootechnic Conference, Paris. He also attended the Steroids and Hormones Conference, Madison, Wisconsin; American Animal Production Conference, Chicago; 13th International Veterinary Congress, London, 1st International Biochemistry Congress, Cambridge, etc.

Mr. Maqsood is the first Pakistani to be elected as a member of the Society for Endocrinology and is Secretary of the Reproductive Physiology Association, Cambridge.

We had two stampedes within 24 hours of each other in a Yeomanry regiment in Palestine. The first occurred on the march when the regiment was halted and both men and horses were having their mid-day meal. I warned the O. C. to be careful that night as horses are liable to stampede a second time; he took every precaution, doubling line guards and putting an extra picketing pegs. In the middle of the night, for no apparent reason, the horses suddenly became restive—those that were lying down got up, and all stood for a short time with ears pricked staring into the night; then, suddenly, the whole lot pulled up their picketing lines and went off in a cloud of dust'.

Vet. Rec. No. 40, Vol. 62.

* * *

Rights and Duties of a Chief District Veterinarian in U.S.S.R.

His duties include the organisation of veterinary service for the socialised animal husbandry of the collective farms that do not have their own veterinary service, and also for the privately owned animals of the farm workers. He must plan disease control measures and see that they are carried out on all farms of the district. He is responsible for the enforcement of all veterinary-sanitary regulations, and for the prevention of diseases transmissible from animals to man. He must organise sanitary supervision for all places where meat and animal products are manufactured or stored, where animals are slaughtered, and where animals, meat, or animal products are marketed. He is also responsible for animals trailed or transporated, and for the transport of animal products. He provides control over the culling of animals on the collective farms to see that this is done according to regulations.

The Chief District Veterinarian directs and inspects the work of the veterinary establishments of the Ministry of Agriculture and supervises the veterinary service on farms belonging to other jurisdictions in the territory. He recruits candidates for appoinment to positions in the veterinary service of the district and presents them for approval to the district chief of the agricultural administration. He devises measures for the improvement of the qualifications of the veterinary workers and carries on veterinary-sanitary extension work among the population.

He must take part in the planning of buildings for the veterinary establishments of the Ministry of Agriculture, and must be available for consulation on construction of animal shelters on the farms. Together with the head zootechnician of the region, he must prepare estimates of expenditure for the maintenance of veterinary establishments. He also controls the expenditure of funds for veterinary activities.

He is required to keep a journal on epizootics and to report at suitable intervals (on the prescribed forms) to higher veterinary authority.

He has the right to inspect livestock and poultry farms and their buildings, plants for the processing and storage of meat and other animal products, and the market place for poultry, meat and industrial raw materials of animal origin. He may give advice on veterinary sanitation to managers of farms of all jurisdictions except the military.

The Chief District Veterinarian may prevent the movement to and from farm of animals that have not been certified free from disease by a veterinarian. He may also prohibit the working of sick, exhausted, or pregnant animals.

He has the authority to organise and direct all necessary measures to localise and eradicate infectious diseases until a quarantine is declared by the proper administration. He also has the authority to fix the responsibility for violations of the veterinary regulations of the U.S.S.R., and to assess fines up to 200 rubles with the approval of the district chief of the agricultural administration.

The directives of the Chief District Veterinarian, based on the veterinary regulations of the U.S.S.R. and instructions of the Ministry of Agriculture, and pertaining to the care, housing, feeding, and exploitation of animals, and the prevention and treatment of disease, are obligatory for all farms, plants and individual citizens. Such directives may be revoked only by decision of Executive Committee of the District Soviet of Workers' Representatives, or by higher veterinary authority.

[*Veterinaria, 27 (March, 1950): 61-62. J.A.V.M.A. Jany. 1951.*]

Clinical Articles

A CASE OF GENERALISED TUBERCULOSIS IN A MONKEY (MACACA Sp.)*

By

K. P. CHANDRASEKHARAN and D. KRISHNAMURTHI,
Madras Veterinary College.

Although tuberculosis in warm blood animals living in a wild state is unknown, the disease is frequently met with in those kept in captivity. It is one of the main causes of mortality in wild animals in captivity and this could be expected from the conditions in which they are often kept in most of Zoological gardens and other institutions. The restricted quarters

* Paper presented to the Medical and Veterinary Section of the 37th Indian Science Congress, 1950, at Poona.

allotted to them, lack of sufficient excercise and the artificial nature of their diet, all have a cumulative effect, telling upon their health and predispose to tuberculous infection.

In India very stray reports are available of tuberculosis in wild animals. Liston and Soporkar (1924) have recorded an occurrence of a small outbreak of tuberculosis among animals at Bombay Zoological gardens. The infection in this case was traced to a Mamas imported from Germany. Primates are susceptible to both human and bovine types of Myco. tuberculosis. The human type was found to predominate in most of the cases of spontaneous tuberculosis studied by Griffith (1928), where, out of twenty-eight cases of tuberculosis in monkeys, he found eight affected with the bovine type and the rest twenty with the human type. In India, Iyer (1940) recorded two cases of spontaneous tuberculosis in Abyssinian baboons, where the type of the bacillus affecting one of them was ascertained as the bovine type, while in the other it was deduced, from the history, to be of a similar nature. No other records are available in India of tuberculosis in primates under captivity.

History.—The animal under report was a female monkey, (Macaca nemestrina (?), aged about 1½ years. The monkey belonged to an army officer, who, it was reported, captured it from the jungles of Burma, about six months prior to its admission for treatment at the Madras Veterinary College Hospital. The animal was brought for treatment of wounds on the body and for anorexia on 19-6-46. It had two open sinus wounds one on the right forearm and the other, just above the right carpus, both on the external aspect. The wounds were discharging thick creamy pus and was refractory to the usual treatment. The animal was progressively going down in condition, but no other obvious symptoms were noticed. The body temperature during the period of treatment (19-6-'46 to 28-10-'46) did not at any time go above 102.4° F. The animal died on 29-10-'46 and on autopsy the following lesions were noticed.

Autopsy finding.—The carcase was emaciated and visible mucous membranes were very pale. There was plenty of frothy discharge from the nostrils. The persistant sinus wounds mentioned above were present, the one on the forearm being linear and about an inch in length, and about an inch in depth, while the other on the carpus, was about half its size. On removal of the skin over the affected limb, numerous caseating tuberculous nodules were seen in the musculature at the region of the shoulders, forearm, and elbow joint [Plate 28, Fig. 1], The size of the nodule varied from that of a pea to a small grape and they were filled with cheesy, caseated material. Patchy fibrous attachment was noticed between the pericardium and epicardium and a small pea-sized tuberculous lesion was noticed at the area of attachment. On the surface and in the substance of the lungs, a number of pin-head sized greyish-white miliary

nodules were seen. Bronchial and mediastinal lymph glands were swollen and congested. The sternal lymph gland was swollen and completely caseating. On the left half of the diaphragm, three grape-sized, caseating tuberculous nodules were present. Numerous tubercles, varying in size from that of a pea to a ply-marble, containing caseo-purulent material were present on the surface and parenchyma of the liver. The associated lymph glands also showed extensive caseation. On the parietal surface of the spleen, a single pea-sized tuberculous nodule was noticed. While the left kidney was normal, nearly a third of the right kidney was replaced by caseating material. A large number grape-sized caseating tuberculous nodules were present on the mesentry close to its attachment to the intestines [Plate 28, Fig. 2]. Mesentric lymph nodules were swollen and partly caseating. The intestinal mucosa was remarkably free from any lesion. Of the superficial lymph nodes, the sub-maxillary on both sides and the right prescapular, showed tuberculous lesions.

Microscopical examination of the smears from lesions in different organs revealed numerous acid-fast bacteria, morphologically indistinguishable from Myco. tuberculosis. The organisms were very slender and highly beaded. It was interesting to find large numbers of acid-fast bacteria in the smears made from the open sinus wounds and from the discharges from the nostrils.

Bacteriological Examinations

Biological test.—The material from the liver was used for biological tests. Two guinea-pigs and two rabbits were inoculated. One guinea-pig died after about 12 weeks and, on post-mortem, showed lesions in inguinal, iliac and precrural lymph glands and caseating nodules in peritoneum and mesentery. The hock and fetlock joints showed induration with foci of suppuration. Smears examined from various lesions showed numerous acid-fast organisms. The other guinea-pig became progressively emaciated and died after 18 weeks. There was a local abscess at the site of injection which after about 6 weeks ruptured discharging thick creamy pus, rich in acid-fast bacteria. Autopsy of this animal revealed tuberculous lesions in spleen, liver and regional lymph gland.

The rabbits showed local abscesses at the site of inoculation which ruptured by about the 10th week. The regional lymph gland was also swollen and partly caseating. The animals were later killed after about 8 months from the date of inoculation and on autopsy none of the internal organs showed any tubercles.

Material collected from the first guinea-pig was again used for biological tests in guinea-pig and rabbit to confirm the above findings. While progressive disease with involvement of liver and spleen and

several lymph nodes was noticed in the guinea-pig, only localised reaction involving the site of inoculation and the regional lymph gland was seen in the rabbit.

Cultural Examination.—Cultures made directly on suitable media from the caseating material from liver did not prove useful due to secondary bacterial contamination. Later cultures were obtained from materials from guinea-pig, after treatment with 4% potassium hydroxide. The organisms grew fairly well on Dorset's egg with glycerine, showing discrete yellowish colonies after incubation at 37°C for about 3 weeks, while the initial growth on unglycerininated egg medium was decidedly very poor.

Thus from a biological and cultural examinations, the strain was considered to be one of Myco-bacterium tuberculosis *var* hominis.

Histo-pathology.—Histo-pathological examination of sections of affected portions of liver, kidney and muscles showed extensive caseation-necrosis, with plenty of chromation granular material in the caseated mass [Plate 28, Fig. 3]. Around the caseated portion numerous epitheliod cells were seen. Section of affected muscles showed central necrosis with a zone of epitheliod cells around and a few small round-cells scattered in between them. While the muscle fibres at the centre of the lesions have completely disappeared, those adjoining them were replaced by fibroblastic tissue, and the muscle fibres still further showed degenerative changes, with loss of striation. There were no giant cells, nor any evidence of calcification in all the lesions examined microscopically.

Discussion.—It is interesting to note that this animal, although suffering from an acute form of open tuberculosis, showed no symptoms associated with the disease and it would also indicate how such animals which are kept for fondness, may harbour and disseminate the disease. The entire absence of lesions in the alimentary tract (excepting the mesentery and the mesenteric glands), the presence of miliary lesions in lungs and other internal organs, indicate that the route of infection is neither alimentary nor respiratory. The presence of persistent sinus wound, discharging numerous acid-fast organisms, with extensive lesions in the adjoining musculature together with the miliary lesions in the internal organs, suggest that the portal of infection was the sinus wound. The entire absence of giant-cells or calcification indicates that the disease has run an acute course in this animal. This is because that the wild animals, not being exposed to infection any time previous to their capture, possess very little resistence to this disease, and that when once the infection sets in, they succumb to an acute form of the disease.

Summary.—In this paper a case of generalised open tuberculous in a monkey (Macaca emestrina (?)) has been described, including the clinical history, autopsy finding, bacteriological and histo-pathological examination. Cultural and biological tests showed that the type involved in all probability was one of human. The organism was found in large numbers in the open sinus wounds and in the nasal discharge. From the nature and disposition of the lesions, it was considered that the route of infection was the ulcerating open wound.

Acknowledgment

We wish to thank Sri S. V. Mudaliar, Principal, Madras Veterinary College for permitting us to record this case.

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SOME OBSERVATIONS ON THE TREATMENT OF COMPLICATED FRACTURES WITH THE AID OF GOOD SURGICAL TECHNIQUE, MODERN ANTIBIOTICS AND UNPADDED PLASTER CAST

BY

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Director of Animal Husbandary and Veterinary Services, Orissa, Cuttack.

My profound belief in the capacity of animals to fight disease stimulated the work on the treatment of complicated fractures in all domesticated animals in preference to amputation. Until Truetta and his co-workers working during the Spanish War developed thet echnique to a great fineness, the same was the fate of human beings, specially with War injuries. During last Great War, Truetta and his co-workers reduced the percentage of amputations to bare minimum following good and early surgical interference and unpadded plaster cast technique.

After reading his book, I decided to try the technique on those cases in domesticated animals which could be plastered. From a perusal of the cases given below it will be seen that my colleagues and I have met with fair amount of success at the Cuttack Hospital where we have worked for a period of two years now. The technique is very simple but must be followed rigidly if success is to be achieved.

1. Prompt surgical interference.
2. Thorough cleaning of wound.
3. Excision.
4. Provision of drainage.
5. Immobilisation in a plaster cast.

This programme has been laid down by Truetta and we have tried to follow it as rigidly as possible, with our limited resources and type of subject with which we have to deal with.

Although No. (1) is very important from the point of end result most of our cases were brought to us when all treatment by the local men had failed. Still as soon as an animal is received, after taking down the clinical history, we treat the apparent symptoms both locally and generally. The wounds are given first aid cleaning and temporary bandaging. The general stimulants in the form of Glucose and Saline are given and Toxæmia or Septicæmia encountered by Sulpha and Penicillin. The part is shaved and thoroughly scrubbed with hot water, soap and nail brush. The process is carried out with a religious zeal. Then the dead skin, fascia, muscle and tissue are cut out. No dead tissue or discoloured tissue is left. Where there are sinus tracts they are completely destroyed. Broken pieces of bone if not discoloured are rearranged. The wound is thoroughly flushed with hot sterile saline. This is carried out till the wound starts looking red and starts oozing out. Then the wound is either insufflated with Penicillin or Sulfanilamide powder depending upon the pocket of the client. Finally it is covered with sterile fine mesh gauze under which are laid rubber tubing strips to drain from most dependent part.

With the help of the assistant, the fractures are reduced and the portion immobilised in plaster cast. The technique followed in this is exactly the same as in an unpadded plaster cast on simple fracture. No windows are left.

Daily temperatures are taken and the patient watched. No notice is taken of the slight rise in temperatures if the patient eats and looks normal. If there is an abnormal rise of temperature or the animal goes off feed and looks ill, the cast is cut, wound cleaned again and replastered. In our limited experience of 16 cases we have not met this eventuality. The bandage usually gets soaked with pus from underneath in about 3 weeks, when the cast is cut, parts cleaned and replastered. Most obstinate cases will completely heal up in three casts i.e. 9 weeks' time.

I believe that in bovines, and ovines, the method can be adopted upto hock behind and knee in front. In dogs upto stifle behind and elbow in front. Birds entire legs and wings.

This article is being written in the hope to stimulate interest in brother veterinarians in this country to save many an animal from the horrors of amputation. No originality is claimed for the method.

My thanks are due to Messrs. M. S. Rao and D. Kohoro, Veterinary Assistant Surgeons, for the assistance rendered in all the recorded cases.

REFERENCE

The principles and practice of War Surgery by J. Truetta M.D.

CAESARIAN SECTION IN A GOAT

By

G. B. SINGH, B.A., M.R.C.V.S.,

Director of Animal Husbandary and Veterinary Services, Orissa, Cuttack.

Subject.—A Black Bengal Goat 3 years old.

History.—It was served on 11-9-49 by a Beetal Buck stationed at the Veterinary Hospital, Cuttack. On 26-4-50 the goat was brought to the hospital with the complaint of bleeding from the vagina. After examination it was found that the blood actually came from uterus and there was constant straining in an effort to expell something. But the os was only partially dilated. Stillboestrol dipropionate 50 mgm. intramuscularly was tried by the Veterinary Assistant Surgeon with the consent of the owner. The straining increased in intensity without any further dilatation of os. The Veterinary Assistant Surgeon repeated the injection on 28-4-50 without any results but the bleeding stopped. On 6-5-50 I examined and advised caesarian section.

Condition of the goat.—Weak and very anaemic. The owner was warned that the goat may not stand the operation.

Operation.—

(i) *Preparation of the patient and site.*—On 7-5-50 the site was shaved and thoroughly scrubbed with hot water and soap, painted with Acriflavin lotion in spirit and bandaged with a pad soaked in Acriflavine-in-Spirit.

(ii) *Anaesthesia.*—Epidural 2% Procaine Hydro Chloride 10 c.c. with 1 minum of Adrenalin Hydro Chloride 1.1000 added to each c.c. of Procaine Solution into the lumbo-sacral space. Three minutes prior to this, Adrenalin hydro chloride solution 2 c.c. was injected intramuscularly.

(iii) *Site.*—Right flank—An incision 8" long was made. The muscles were seperated in the usual way. Blood vessels ligated. The uterus when exposed was found completely adherent to the abdominal viscera, peritoneum etc. and therefore instead of lying on the floor of the abdomen was stuck to its roof. The abdominal cavity was packed with sterile towels soaked in hot normal saline. A 6" long longitudinal incision was made through the uterine wall over the mass. As soon as the opening was made, a semi-solid greenish mass gritty to touch, was encountered which gave the feeling more of the ruminal contents than uterine. After a little exploration some decomposed pieces of bones, hairs, skin could be recovered. It was then realised that the foetus had liquified. Thereupon, sterile towels soaked in saline were draped round the uterus and complete evacuation of the uterus done followed by thorough wash with hot normal

saline. Due to the liquifaction of foetus the walls of the uterus were also thinned down which made suturing very difficult. After a lot of labour, the uterus was sutured with three layers of lembert using No. 00·20 days old Chromic Catgut. Peritoneum was sutured with continuous sutures using No. 1 Chromic Catgut and the muscle with two layers of No. 2 Chromic Catgut; finally the skin with silk. The line of sutures was painted with Tincture of Iodine, covered with a sterile pad and bandaged with many tailed bandage. The operation took one hour and thirty minutes and the animal at the end showed considerable weakness. Stimulants were administered but it died after 6 hours.

Postmortem findings.—The uterus and intestines were completely adherent. There were also adhesions with rumen which on opening contained two ribs of the foetus. Further, two ribs of the foetus were also found in a portion of the small intestine which were rigidly adherent to the gravid uterine cornua.

Observation.—Although it is an ordinary case of Caesarian Section in a goat, the abnormal condition of the uterus found on opening the abdomen, during the operation and at postmortem, has led me to record this case.

Acknowledgments

My grateful thanks are due to Sri M. K. Patra, M.Sc., B.V.Sc., M.R.C.V.S., Sri M. S. Rao, and Sri L. N. Das for assistance during the operation.

A CASE OF HAEMORRHAGIC SEPTICAEMIA TREATED SUCCESSFULLY WITH SULPHAPYRIDINE (M&B 693) TABLETS

BY

B. K. SALUNKE, G.B.V.C.,

Veterinary Assistant Surgeon, Shrigonda, Bombay State

An outbreak of Haemorrhagic Septicaemia was reported to me on 12-7-50 by the village office of Adhalgoan which is over five miles from the dispensary headquarters.

On enquiry, two buffaloes, two bullocks and two cow-calves had already died in the course of 7 days prior to the date of my visit and one buffalo which was actually affected with Haemorrhagic Septicaemia was produced before me on 12-7-50 for examination and treatment.

Symptoms:—Animal dull and depressed, off-feed and rumination, lachrymation and salivation, temperature 106·2° F, shivering, breathing hurried and difficult being almost oral, swelling at the region of the throat with oedema extending to about the middle of the neck along the dewlap.

The case was diagnosed provisionally as one of Haemorrhagic Septicaemia. Blood smears from the tip of the ear were taken and sent for microscopic examination to the Principal, Bombay Veterinary College. The result, as reported later on, was positive for Haemorrhagic Septicaemia.

Treatment:—20 tablets of M&B 693 were administered immediately on the morning of 12-7-50 and 20 were supplied to the owner to be administered in the evening. The case was isolated and the place got disinfected. Milk and kanjee were advised as diet. Creosote inhalations were given as a respiratory antiseptic. Next morning the temperature came down to 104° F., and the animal whose condition was serious on 12th morning looked slightly better. The dose was repeated both morning and evening. On the third day, the temperature was 102·4° F. and the animal being more lively showed a tendency to eat though it was physically unable to do so due to its swollen tongue. Kanjee and milk were however continued.

15 tablets in the morning and 15 in the evening were administered on the third day. On the 4th day, the animal started eating lucerne grass much to the rejoice of the owner and myself. On the 7th day, when the owner happened to see me at my dispensary, he reported that the swelling with all the other pathological symptoms had disappeared completely and the animal was taking its normal ration and started giving milk as well.

The outbreak was further controlled by vaccinating all the healthy stock of the village with H. S. vaccine.

BRUCELLOSIS IN BULLS

BY

K. V. DIVEKAR,

Assistant Artificial Insemination Officer, Poona.

Subject and History:—A Gir bull, aged 5 years, was admitted to the Veterinary Hospital, Nasik, on 9-9-48 with a history of swollen joints and testicles and inability to get up and lie down for the previous fortnight.

Symptoms:—All the joints including knee, hock and fetlock and the right testicle were found inflammed. The animal had difficulty in getting up during morning time and required support. Once the animal was made to stand and the legs were well massaged, it was alright throughout the day. There was a slight rise in temperature and loss of appetite.

Diagnosis:—Rheumatic arthritis?

Treatment:—Prescribed Salicylates and Iodides internally and massage and fomentation to the affected regions externally. The animal responded to the treatment and was discharged.

After 1½ months, the animal was brought back for the same ailment. The same treatment was adopted. The swellings except that on the right testicle subsided. Absorbent ointments were used externally but they too were of no use. Then *Shilaras* was pasted over the affected testicle and tobacco leaves were wrapped and a suspensory bandage was used to keep the tobacco leaves in position. In a week's time the swelling subsided but the general condition of the animal was not satisfactory.

['Shilaras' is otherwise known as liquid amber orientilies (with properties similar to Balsam of Peru and Tolutanus) and is thick in consistancy.]

At this time, cases of abortion in cows were recorded on the farm where this bull was used.

On the advice of Shri. L. Sahai, M.Sc., M.R.C.V.S., Director of Animal Husbandry and Veterinary Science, Bombay State, Poona, who was then on tour and suspected the case as one of Brucellosis, blood serum was sent to the Bacteriologist, Bombay, for agglutination test. It proved positive. The animal was, thereupon, castrated by Burdizzo's method but ultimately it died in about a month's time.

Case No. 2.—A second case in a Gir Bull from the same Institution suffered from Brucellosis in November, 1949, showing similar symptoms. Blood-serum was sent to the Bacteriologist, Bombay, for Agglutination test who confirmed it as positive for Brucellosis. It was observed that only the testicle was affected in both the cases. The affected gland was found sensitive to pressure.

This case was castrated by the open method with a view to study the pathological conditions of the testicle.

On exposing the affected testis, it was noticed to contain abscesses. These were of chronic type and firmly enacapsulated. The dense fibrous envelope of the testicle had become thickened and distended with an enormus volume of pus and glandular tissue.

The idea of recording these two cases is to bring to the notice of the profession that, while examining cases of orchitis, synovitis, hygroma and swelling of the various joints etc., it is necessary to keep in mind the possibility of Brucellosis infection and the need for sending samples of blood sera from such animals for agglutination test to confirm the diagnosis.

My thanks are due to Sri L. Sahai, Director of Animal Husbandary and Veterinary Science, Bombay State, Poona and Shri. C. R. Sane Special Officer i/c, Artificial Insemination Section, Bombay State, Poona for help rendered.

HOMEOPATHY IN CANINE DISTEMPER

By

CAPT. G. VENKATA NARUSU, G.M.V.C., P.G. (MUKT.),
Veterinary Officer, Gwalior, M. B.

Distemper in dogs, as is well known, is only a name which bears no relation to the actual condition of the disease. It manifests itself in many and varied forms. The efficacy of the treatment depends upon the recognition of the various stages of the disease from commencement to the end. I have found the treatment given below based on homeopathy to be most successful in puppies from 2 to 8 months, and, if it is carefully followed, I am sure there will be very little difficulty in treating and curing cases of distemper in canines, provided the case had not been badly treated earlier.

(I) *The first stage* :—The symptoms are as follows :—The dog does not eat well; is dull in his general demeanour, accompanied by signs of anxiety and restlessness.; cutaneous exanthema may be present or absent; a dry cough originating in the throat; tonsils may be inflammed; there may be vomition; eyes may become blood shot; temperature 101° F to 104° F; watery discharge from the eyes and nose.

Treatment :—Aconitum Napellus, 30 or 300 potency thrice a day will clear up this condition.

(II) *Second stage* :—If no homoepathic treatment is given during the first stage, the infection proceeds on to the second stage, in which there is an aggravation of the watery eyes which become inflammed and sensitive to light (photophobia). Pupils get dilated. There is purulent discharge with which the eyelids get glued together. There is difficulty in deglutition, the mouth and the skin feel hot and dry.

Treatment and dosage :—Belladona 30 to 200 potency, three drops thrice a day.

An intermediate stage between No. I and II is often observed wherein there is an aggravation of dullness accompanied by definite drowsiness with torpidity in general. The discharges from the eyes and nose continue accompanied by sneezing, as if the animal is suffering from severe coryza and presents a weak and trembling appearance.

Treatment :—Arsenicum Alba, 30 potency, thrice in three drop doses will clear up this condition. If the patient is not treated up to this time, the disease progresses rapidly and can take any of the undermentioned forms :—

Ist form :—A combination of the stages (i) and (ii) where there is pronounced thirst; Ferrum Phos 30 or 200 potency is an excellent remedy.

IInd form or the pulmonary form :—The whole of the respiratory tract is involved and the animal shows painful and oppressed breathing. There is a dry

cough ; pleurisy and pneumonia may set in. There is marked constipation and increased thirst.

IIIrd form :—This is the gastro-enteric form in which the animal presents a pitiful appearance. Wasting and emaciation are prominent. Prostration is severe. The animal sips little cold water. There is watery diarrhoea of a shooting nature. All the discharges from the nose, eyes and bowels are very offensive.

Treatment :—Arsenicum 30 to 200 will assist the animal towards recovery.

IVth form :—In this form of the disease, all the mucous membranes are involved. Thick yellowish purulent material exudes from the nose and eyes and gets dried up on these organs. There will be haemorrhage from the gums, and offensive saliva dribbles from the mouth. The cutaneous glands around the lower jaw and throat are inflammed. The cough simulates chronic bronchitis. The stools are slimy and offensive. All these symptoms are worst at night.

Treatment :—Mercuris Solubitis 30 or 200 potency is a very useful remedy.

Vth form :—In this form, there is extreme emaciation. The skin is dry and tight. There is subnormal temperature ranging from 95°F to 98° F. The dog lies on its side with all the limbs outstretched, cyanosed, eyes closed and tongue hanging out. Breathing is shallow. There is loose putrid diarrhoea. The heart beats are violent and strong ; but the pulse is very feeble and may not be perceptible.

Treatment :—The only remedy when the dog presents this picture is Pyrogenium 30 or 200.

VIth form :—The nervous form. In this form of the disease, allopathy fails to assist the animal and declares the case as incurable. Homeopathy however, achieves success. If the first and second stages of the disease are suppressed by allopathic drugs, the disease finds expression in new set of symptoms. That is, the entire motor, sensory, and sympathetic nerves are quickly involved and there may be manifestation of (i) Chorea, which first makes its appearance as a twitch in any part of the body, head or limb, (ii) Paraplegia and (3) Meningitis.

Treatment :—In all these nervous forms, I have had good results with the following preparations :—

(*a*) Zincum metalbicum
(*b*) Rhustex
(*c*) Cuprum metallicum
(*d*) Phosphorus

The drugs suggested are in their order of sequence for the respective nervous complications. These may be administered either in 30 or 200 potency. When the dog recovers from these nervous forms, sulphur and Nuxvomica in 30 or 200 potency may be given to tone up the system and bring the patient back to normal health.

Correspondence

[*The views and opinions expressed in Correspondence are those of the writers themselves. Ed. I.V.J.*]

Slaughter Houses

Sir,

The Government of Bombay have done very well in appointing a Committee under the Chairmanship of Mr. R. P. Masani (once a Municipal Commissioner of the Bombay City) to report on the slaughter houses in the State and to make recommendations for their improvement on modern sanitary lines within a period of three months.

In this connection it may be necessary to make a few observations, particularly in connection with the City's slaughter house at Bandra, which has been in existence for nearly 80 years or over, and has now become quite obsolete according to modern standards.

It is over 30 years or so that the Bombay Municipal Corporation had the scheme of removing the slaughter house from Bandra and the various trades connected therewith (viz gut making, gut casing, tanneries, etc.) which are operating at Dharavi and Mahim. A vast area had been earmarked at Deonar, near Chembur in Greater Bombay for their removal. But these proposals could not be given effect to all these years by the Municipal Corporation on account of financial stringency in the time of my predecessor, Capt. C. M. Flanders, the then Superintendent of Markets.

When I succeeded Capt. Flanders in 1936, I immediately took up the question of immprovement of the slaughter house and remodelling the refrigeration plant at the Arthur Crawford Market, fully knowing well the opposition which the meat traders of the market and slaughter house at Bandra would have against the shifting of the slaughter house to Deonar. I had put up two alternate proposals during the time of Mr. M. D. Bhat, I C.S., the then Municipal Commissioner (now Chief Secretary to Bombay Government) viz.

(1) for shifting the slaughter house to Deonar (original proposal) and constructing a most modern one on uptodate sanitary lines with modern appliances and provisions, etc at the estimated cost of Rs. 29,49,735,

(2) for remodelling the present slaughter house on the most modern and sanitary lines and fitted with uptodate equipment at an estimated cost of Rs. 8,49,030.

In both these proposals, provisions were made for rooms for the preliminary processes of carrying out the cleaning and scraping of guts, cleaning and storing of hides and skins, storing of heads, horns, bones, hoof, offals, etc.

until their final disposal, and also for the most important one of the boiling of blood by pumping it directly from the slaughtering chambers into the Double Jacketted Steam Boilers for the manufacture of blood manure which is very much in demand in Ceylon etc for coffee and other plantations. The above process of boiling prevents not only the loss of nutritive elements as is the case with the crude method of boiling, which is prevalent at the Bandra slaughter house, but would obviate the stench that persists and which is now perceived when travelling over the Bandra Creek from Bombay City.

But before these proposals could finally be put up before the Bombay Municipal Corporation, the Second World War broke out and, therefore, they had to be kept in abeyance. However, before my retirement on the 29th July, 1944, I had discussed these proposals at a Conference with Shri Minoo R. Masani, the then Mayor of Bombay so as to give this question and others pertaining to the Bombay Municipal Markets a priority in the Post-war Construction Schemes. So far, the Refrigeration plant at the Crawford Market has been recently remodelled.

But with regard to the slaughter house at Bandra it is now proposed to shift the same to far distant Thana in the Bombay Suburbs and not to Deonar as originally proposed. This step has been taken in the master plan for the development of the Greater Bombay. Besides the objections from the Aviation Department to the nuisance caused or likely to be caused by the presence of vultures at and near the slaughter houses which interfere or are likely to interfere with the aircraft and possible danger of accidents arising therefrom, it is recommended that the slaughter house should be shifted outside the radius of nine miles from the aerodromes at the Santa Cruz Airport and at Juhu close by. This will entail considerable cost in view of the long distance for the conveyance of meat from distant Thana and the high and rising cost of materials, appliances, etc. in the construction of a new slaughter house for the needs of the Greater Bombay with all the amenities provided thereat.

Now a word about the Double Jacketted Steam Boilers. When Mr. D. Symmington, I.C.S., was the Acting Municipal Commissioner during the interim period about 1937-38 or so when Sir Ivon Taunton, I.C.S., left and Mr. M. D. Bhat, I.C.S, took charge of the portfolio, I had put up this proposal to him for being implemented at the Bandra Slaughter House, Messrs. Anderson Dawn and Co being the contractors to whom the right of collecting and boiling blood in the slaughter house premises was farmed out. Mr. Symmington appreciated this proposal very much but it had been kept in cold storage on account of the financial stringency and the difficulty of obtaining the plant and the equipment. Apart from its use as manure, the boiled and dried blood could be processed as Blood meal, which is very much prized for fattening cattle. Besides, during the War, blood was used for the manufacture of ' Blood Foam ' to prevent the spread of fires from incendiary bombs.

During the war period fresh livers from the Bandra slaughter house also were in great demand by the Cipla and other pharmaceutical laboratories for the manufacture of liver extracts. Medicinal use could also be made of the Pituitary and other glands of the slaughtered animals for the manufacture of extracts. So also other by-products from the materials available at the slaughter houses even for commercial use.

With reference to the prevention of slaughter of useful cattle, which is the cardinal question of the day, it may be stated that under G. R. No 9257/24 dated the 12th June 1944—Defence of India Rules, Government of Bombay had already taken measures that no person shall acquire for purpose of consumption or slaughter or cause to be slaughtered any of the following categories of cattle, namely :—

(1) Bulls and bullocks physically fit and below the age of ten years and suitable for work.

(2) Cows in milk and cows in calf.

(3) Young stock of the above suitable for breeding purposes. Provided that this order shall not apply to the acquisition and slaughter of such animals for bona-fide religious purpose.

If any person contravenes the provision of this order any court trying the offence may order any animal in respect of which the Court is satisfied that the offence has been committed, shall be forfeited to His Majesty. Further, under G. R. No. 9257/24 (a) dated 12th June 1944, Government of Bombay under the Defence of India Rules, promulgated the following restriction :—

In exercise of the powers conferred by the Sub-rule 81, of the Defence of India Rules, Government is pleased to sanction that with effect from the 1st July, 1944, the number of buffaloes slaughtered during any week beginning from Sunday and ending with Saturday following at any of the slaughter houses at the place mentioned in column 1 of the Schedule hereto annexed shall not exceed the number specified in column 2 of the said Schedule.

Schedule

Place and District	Number
(1)	(2)
Bandra—B.S.D.	... 180
Kurla do	... 166
Ahmedabad—Ahmedabad Dist	... 155
Ma-legaon—Nasik Dist.	... 90

Consequent on these G. Rs., the Government enforced the inspection of cattle entering the slaughter house at the outer gate and in the yards and pens therein for implementing the above mentioned regulations by detailing

the Government Veterinary staff, while the Municipal Veterinary inspection by the Bombay Municipal Corporation was confined to the sanitary condition of the animals at the inner gate of the slaughter house for *ante* and *post mortem* examinations.

With regard to the scientific running of the slaughter houses, it will not be out of place to state here that about the year 1937-38 or so, during the time Sir Ivon Taunton I.C.S. was the Municipal Commissioner of the Bombay Municipal Corporation, a copy of draft of the Model Rules and Regulations were sent to us by the Council of Agriculture Research, Government of India, for our opinion. When studying them I had recommended about 8 to 9 additional suggestions, which were embodied when these Rules and Regulations were finally passed and confirmed by the Government of India.

Bombay,
29th January, 1951

D. S. LAUD, G.B.V.C., F.R.H.S., F.Z.S.,
Superintendent of Markets,
Bombay Municipal Corporation (Retired)

Chemotherapy in Anthrax

Sir,

By way of introduction it should be made clear at the very beginning that the object of this note is not to strike anything wonderful in chemo-therapy of Anthrax as much it is to have a discussion on the subject. It is just an attempt to place some view points for consideration of veterinarians recommending a trial in actual field of practice of the suggested treatment and to judge and draw their own conclusions.

Veterinarians both at home and abroad and literatures on the disease all agree on one point that Anthrax is practically not amenable to chemo-therapy with consequent very high mortality almost cent per cent. Resisting power of Anthrax bacilli in an animal's system depending upon their capability of forming a refractory thick protective capsule, their very rapid multiplication and acute virulence constitute the main barriers against effective chemo-therapy so much so that experience of veterinarians in actual field of practice is such that a cure is considered as a far-fetched idea. Besides this, difficulty in early and timely diagnosis of the disease due to its clinical confusion, at any rate in the early stage of the disease, with other diseases such as Haemorrhagic Septicaemia and Black quarter, its sudden onset and equally sudden termination and its very brief duration all combined confront the clinicians in their attempts for a timely diagnosis and proper treatment in good time. A prompt and accurate diagnosis at the early stage of the disease, proper selection and timely administration of a chemical reagent which may cause direct and destructive action on Anthrax organism or effectively stimulate the functional activities of the natural defensive powers in the animal's system to liquidate the organisms are essential in successful chemo-therapy of Anthrax.

That leucocytes are potential source of natural bactericidal substance found in the body fluid of animal needs hardly a recital. So if the leucocytes can be stimulated to greater and additional activities, before the causative organism of Anthrax has been able to culminate in its unhindered propagation by multiplication, an arrest, or at least an inhibition, in the sharp progress of the disease should be the first result. Irrespective of the final result this, if it can be secured, will give veterinarians at least a breathing time to try treatment in such a quickly fatal disease.

As already stated above an early and timely diagnosis constitute the most important and basic requirement for any line of curative treatment of Anthrax. Microscopical diagnosis by demonstration of the specific organism removes all ambiguities. Unfortunately, however, this to be of any practical value for a fruitful chemotherapy, is outside the scope of practical utility in Anthrax as the causative organism cannot be demonstrated in peripheral circulation at a stage of the disease before it is too late for treatment. This difficulty at any rate one has to encounter in early cases and before the outbreak is microscopically confirmed which is again not available handy in rural seats of outbreak of the disease. So in the matter of chemotherapy of Anthrax, clinicians in the field have mainly to depend on their practical experience of clinical symptoms despite the handicap of close confusion of clinical symptoms of Anthrax with those of other diseases mentioned above. Under such difficulties a veterinarian has to proceed with chemotherapy of Anthrax.

Occurrence of Anthrax with high mortality is well known all over India. Death amongst cattle is the highest and it is no less amongst the equine. Cases are also known from time to time amongst elephants, sheep and goats with equally fatal results. It is a peculiarity that healthy and well-nourished animals are more predisposed to Anthrax. It is held that excess of calcium salt accelerates the rapidity of multiplication of Anthrax organisms. It may therefore be assumed that a full or over-balance of calcium salt in the system of well-nourished animals may be a predisposing contributory factor. Anthrax has a bearing on public health too. Cases of this fatal disease do occur in man from animal source. This adds to the responsibility of veterinarians for an effective control of the disease.

It is interesting that different chemical reagents which will kill Anthrax organisms *in vitro* are ineffective *in vivo*. Thus different chemicals which kill the Anthrax organisms outside the animal's system are practically of no avail in chemotherapy of Anthrax. How a lethal dose will behave does not come within the perview of a clinician nor to the rescue of the patient. Intravenous injection of arsenic once found some favour but it did not stand subsequent test. Initiative perhaps came from the line of treatment of Anthrax in man with Salvarsan which is said to have an inhibitory action on multiplication of Anthrax bacilli. Sulpha drugs and Penicillin were tried on the assumption that they are effective against Gram positive organisms but with no promising

results in Anthrax. Camphor gives noteworthy results. This drug when administered in four drachm doses for adult animals and in frequency of every four hours to begin with, in the shape of electuary with molasses responds satisfactorily. The treatment must be given from the early stage of the disease and the time table strictly adhered to. When there is extensive swelling of the throat and deglutination is difficult with harrassing breathing the drug is given subcutaneously. For this one drachm of Camphor is dissolved in 20 c.c. of olive oil in a hot-water-bath and injected subcutaneously at body heat at a frequency of every two hours. Better still is if the drug is administered by both the routes *i.e.* by mouth and subcutaneously alternately at an interval of two hours. The dose of the drug and frequency of its administration are to be modified according to severity of the disease, condition of the patient and the progress it makes under the treatment. In favourable cases the progress of the disease is generally arrested after the second dose and the crisis is over after the third or fourth course of such doses. High temperature comes down, swelling commences to subside, breathing becomes less difficult, gradually there is an improvement in the general disposition and look of the patient which is following by nibbling of grass. The dose and frequency at this stage must be definitely reduced to two drachms or even less given in the shape of electuary twice daily. Two days should be sufficient for a cure and in some cases treatment may be necessay on the third day.

Anthrax bacilli gaining entrance into blood very quickly multiply resisting and over-powering the normal opposition of natural defensive proteins as is evident from the very high rate of mortality and the very rapid termination of the disease. Any treatment must, therefore, be as quick and effective to check multiplication of organisms, render them inert and ultimately to destroy them to be helpful. As already stated, leucocytes exert bactericidal action. So if the leucocytes can be actively stimulated to increase their activities, at any rate by far in excess of what they normally do, then with their re-inforced activities they can reasonably be expected to get the better of their opponent in the fight. Leucocytes on stimulation give up anthracocide substance. Blood plates under stimulation also exercise germicidal action. Lysin given up by leucocytes on augmented stimulation are in excess of what they do under their normal functional activities. The lysin helps in dissolving the resistant capsule of the Anthrax organism thereby exposing the organic protoplasm of the bacilli to easy bactericidal action. Phagocytosis is also accelerated by extra stimulation. When the protective capsule of the organism is thus dissolved the appropriate chemical reagent can also be expected to readily exert its baneful effect on the Anthrax bacilli denuded of their protective capsule and disintegrate them. It is therefore reasonable to suppose that all these factors combined effect a cure.

Camphor stimulates the blood circulation both directly and reflexly and with it the leucocytes and blood plates are stimulated to increased activities.

As already stated leucocytes are endowed with bactericidal and bacteriolytic properties and blood platelets exercise germicidal action. It is quite logical to suppose that these natural defensive proteins being stimulated by Camphor to greater activities exercise their specific action by dissolving the protective capsule of Anthrax organisms and once this protective capsule is dissolved disintegration of the bacilli is easily followed. A disease of so short a duration and so quick in termination calls for the action of a drug which besides possessing its specific action should be equally or more quick in absorption in the animal's system to exercise a prompt action. And Camphor, which is a highly volatile and dispersible drug, has got these properties.

Lastly the author of this note will be glad if the above discussion is found helpful and will receive with thanks any communication on the result of Camphor treatment in Anthrax, if and when a trial is given by veterinarians in actual field of practice i.e. in natural outbreaks of Anthrax. The Civil Veterinary Department, Assam, claims efficacy of this treatment.

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Assistant Lecturer, Assam Veterinary College, Gauhati

Stilboestrol Dipropionate (M & B) in the increase of Lactation in Milch Cattle

Sir,

Stilboestrol Dipropionate, an oestrogenic hormone, as is well-known, plays an important part in the regulation of the oestrus cycle, and the changes of pregnancy, parturition and lactation. Being in charge of a dairy herd, where the problem is to get more and more milk, I wanted to use Stilboestrol to the best advantage and thus undertook trials with the product in the farm.

I have used Stilboestrol Dipropionate (M & B) 10 c.c. solution (1 mgm. per c.c.) for over a year now for increasing milk yeild in cows. The dose I have always used is 1 c.c. (1 mgm.), every day, subcutaneously for 10 days in the 1st instances and subsequently another course of six injections. As high doses result in bringing the *animals to heat*, it is important to maintain the small doses uniformly. The drug has been tried by me in all seasons, i.e., when green fodder was available and when not available, and also at various stages of lactation as the enclosed chart indicates.

On the average, I find that the drug has produced an overall increase of about 18% in the milk-yield of cows. This increase has also been maintained for a period of 3 months and over in most of the cows, where the drug has been used.

Thus, I should say, without any hesitation, that the drug is a great boon to the dairy industries and should be tried on a wider scale by all concerned. It will be no small contribution to the 'Grow More Food' campaign' of the Government of India.

My thanks are due to Dr. K. S. Krishnappa of May & Baker (India) Ltd., Madras, for giving me suggestion in this regard.

[It would be a very good thing if the author would keep a close record of the breeding efficiency of these animals and report on them in due course—Ed. *I.V.J.*]

Group.	Date.	No. of cows.	No. of days after calving when treatment was started.	No. of injections 1 mgm. I. C. C.	Average milk yield for a week before injection given in Lbs.	Average milk yield for a week after injections were over (in Lb.)	Increase in Lb.
A.	15-12-50.	1	12th	10	12½	15	2½
	"	2	20th	10	13	15	2
		3	32nd	10	9	11	2
B.	11-2-50.	1	14th	6	14	15½	1½
C.	16-3-50.	2	19th	6	17	21	4
		1	6th	6	17	20½	3½
D.	6-6-50.	2	21st	6	12	15	3
		1	19th	6	9	11½	2½
		2	11th	6	12	14	2
		3	14th	6	14	15½	1½
		4	21st	6	12	13	1
		5	24th	6	16	19	3
E.	9-7-50.	1	14th	6	7	10	3
		2	9th	6	11	12½	1½
		3	45th	6	13	14	1
					188½	222½	34

1 Lb = = 16 oz.

A.B.C.D. E. or 5 batches.

Average increase about 18%

Coimbatore
3—1—50

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Abstract

Effects of Hypo- and Mild Hyper-thyroidism on Fleece-Growth in Sheep. [Received through the courtesy of the British Information Services, Madras.]

A review of the available literature on the subject of wool biology shows that practically no systematic work has been done so far on the role of various hormones on wool growth. Since the thyroid hormone regulates about 40 per cent of the energy metabolism in sheep and the growth of wool is influenced by the plane of nutrition[1], as well as by other factors, an investigation was undertaken of the effects of varying levels of thyroidal stimulation or inhibition on wool growth in the growing sheep.

Eight Suffolk male lambs about 4–4½ months old were used in the present experiments, and they were divided with regard to age and body-

1 Marston, H. R., *Aust. J. Sci. Res.*, 1, 362 (1948).

weight into three groups. The lambs in group No. 1 were given daily 'Protamone' (thyro-active iodinated casein) in the ration, within the physiological range, and the lambs in group No. 2 were either given daily sufficient doses of a goitrogen (for example, thiouracil) or thyroidectomized while group No. 3 was kept as control. All the animals were kept under the same environmental and feeding conditions. After 5½ months of treatment, wool samples were taken from each ram every month for four consecutive months, the animals being kept on the same treatments throughout the experimental period. All the animals were weighed and their rectal temperatures recorded weekly during the first half, and fortnightly during the second half, of the experimental period. The animals in a mild hyperthyroid condition showed greater gain in body-weight than the controls; but their rectal temperatures did not differ significantly from those of the controls[2].

Examination of the wool samples showed that mild hyperthyroidism resulted in an increase, while hypothyroidism resulted in a decrease, in the fibrelength when compared with the control group. In both the hypo- and hyperthyroid sheep the fibre diameter was not affected. The fleece in one of the hypothyroid sheep was comparatively easily pluckable and the crimps were less distinct when compared with the control.

Thyroidectomy performed in the young merino sheep does not show any effect on the wool fibre diameter[3].

How thyroidal stimulation influences wool growth in the growing sheep needs further investigation; but it may be that the thyroid hormone, by increasing the body metabolism with anabolic effects, stimulates wool growth. In the hypothyroid sheep, the marked decrease in the basal metabolic rate might have interfered with the normal fleece growth. These results will be described in detail elsewhere.

I am indebted to Dr. J. Hammond and Dr. Arthur Walton for providing facilities in their laboratories, to Dr. Sven Skarman, Wool Loboratory, Waid, Sweden, for sectioning the wool samples, and to Dr. A. B. Wildman, Wool Industries Research Association, Leeds, for valuable suggestions.

School of Agriculture,
University of Cambridge,
April 25.

M. MAQSOOD.

2 Maqsood, M., *Vet, Med.*, **45**, 339, (1950).

3 Marston, H. R., and Peirce, A. W., *Aust. J. Exp. Biol. and Med.*, **10**, 203 (1932).

Review

Textbook of Meat Inspection.—By HORACE THORNTON, B.V.Sc., M.R.C.V.S., D.V.H., F.R.S.I. Pp. viii—656 with 4 coloured plates and 257 other illustrations. Price 50s. *Baillire, Tindall & Cox, London.*

This is a new publication on inspection of meat including rabbits, poultry and fish by an English author who had studied the conditions of abattoirs and procedures of meat inspection obtaining in a number of countries on the continent of Europe. It is a very comprehensive book, very well illustrated, covering practically all aspects of meat inspection.

There are 14 chapters in the book each of which deal with a particular aspect of the subject including the more recent advances. The arrangement of these chapters is very good and on a textbook pattern. Commencing with food animals and their ante-mortem examination we are taken to the construction of abattoirs and the methods of slaughter. Post-mortem inspection and the comparative anatomy of tissue and organs are then dealt with clearly. From there we are taken to the general pathology of food animals and special pathology of specific parts. These are followed by consideration of bacterial and parasitic disease with a special chapter on bacteriology of meat in which the contamination of meat is dealt with in a detailed and clear manner. Disposal of by-products and fats and preservation of food conclude the main portion of the book. The remaining last 3 chapters deal with rabbits, poultry and fish.

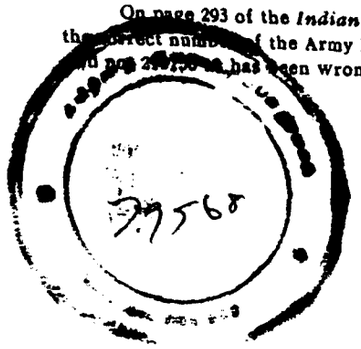
The above mentioned arrangement appears to us as very methodical and systematic and we are sure it will appeal to students and veterinary public health officers alike—to the former as a textbook, to the latter as a frequent reference book.

The book has been got up very well and would be welcomed by the profession.

ERRATA

Recruitment of Veterinary Officers

On page 293 of the *Indian Veterinary Journal* Vol. XXVII, No. 4, January 1951, the correct number of the Army Instruction should read as 219/50. (*i.e.* No. 219 of 1950) which has been wrongly printed.



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