Madras Veterinary Journal.
V 3. Nos. July ~~September~~ 1926.

Vol. III. No. 5.

THE MADRAS VETERINARY JOURNAL

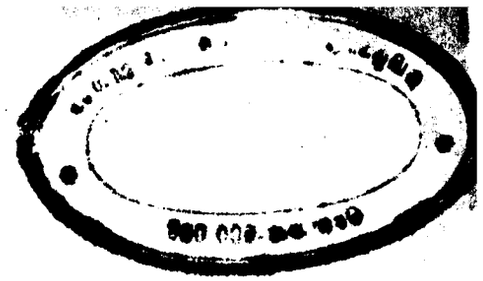
CONTENTS

EDITOR

THE OFFICER IN CHARGE IV CIRCLE, CIVIL VETERINARY DEPARTMENT, CHEPAUK, MADRAS.

Published under the Supervision of the Chief Superintendent, Civil Veterinary Department, Madras.

Subscription Rs. 2 per annum or price per copy As. 6 only.



EDITORIAL

We regret very much having to refer again to the lack of support which this Journal has been receiving of late. As a result, Vol. 3 has already been spread over nearly 2 years, but we hope to be able to complete this Volume by the end of the present year. The existence of another Journal in the field is no doubt partly responsible for the small number of articles recently received by us, but the total number of professional articles published in both the Journals in the last 2 years does not do credit to the Veterinary profession of this Presidency, which is growing in numbers every year. The aims of this Journal are well known. It is intended almost entirely for the dissemination and discussion of professional topics, and it would be a great pity if after going so long, it had to be abandoned. This however is a point for the rank and file to decide. We should be glad to have from our readers any suggestion they can make for the improvement of this Journal along the lines on which it has already been run, but failing the receipt of any such suggestions or an increased number of literary contributions, we shall be forced to the conclusion that this Journal is no longer required and it will therefore cease issue with the next number.

In this nnmber we are publishing an article on Necrobacillosis of the tail contributed by Mr. Naik who refers to some remarks made in a previous editorial on an article by Mr. Suryanarayanamurthi on the same condition. It appears that in this country we have at least two conditions of the tail about neither of which very much is known. One is a Necrosis of the tail of cattle, the exact cause of which does not yet appear to have been confirmed, and the other is a disease of the hairs of the horse's tail. This second condition has been named *Trichorrhexis Nodosa* after a similar disease of man first described in 1849, and was recorded by Messrs. Dawson and Gaiger in the Journal of Tropical Veterinary Science, Vol. 4, 1909. Some investigation was carried out, but unfortunately it was on a case which had already been treated, and the results obtained were therefore not conclusive. We should be glad to hear of cases of either of these conditions from which fresh specimens can be obtained.

NECROBACILLOSIS.

BY

R. N. Naik. G. B. V. C. Post Graduate (I.B.L.) Veterinary Assistant Surgeon, Veterinary Dispensary, Kunta.

Introduction. Adverting to the interesting article on "Necrosis of tail in a she-buffalo" by Mr. C. Suryanarayanamurthi in the *Madras Veterinary Journal* (Vol. III, No. 2 and 3) this paper is written with an object that it will be of some interest to those who responding to the suggestion made in the Editorial comments are intending to undertake the investigation of the disease.

The symptoms narrated by Mr. Suryanarayanamurthi in his article were due to *Necrobacillosis of Tail* or *Necrotic lesion of Tail* caused by *B. Necrophorus*. This disease bears no relation with *Trichorrhexis nodosa* nor is resulted from it. *Trichorrhexis nodosa* is a separate disease of hair alone characterised by curious concretion on the shaft of the hair without affecting the cutaneous tissue to which the hairs are attached. During my practice I have found a certain number of animals suffering from *Necrobacillosis of Tail*, out of which one is cited below. Besides, the disease in its entirety is briefly reviewed.

Case Record No. 322.

History. A buffalo-bullock eight years of age-in poor condition-was admitted in the Veterinary Dispensary-Kunta-on July 23, 1923 with a complaint of progressive rottenness of the tail since two months.

Symptoms. The lower extremity of the tail 12 c.m. long was rotten. The superior border of the lesion was sharply circumscribed with an uneven border. The external surfaces of the lesion was greenish white, homogeneous, structureless and dry and contained tissue debris of soft and cheesy consistency and was devoid of hair. It had a peculiar offensive smell that can be compared to a "Compound of the odour of old cheese and glue." The part from the tip of the tail to 28 c.m. above showed no pain nor was there bleeding when pricked with a pin. It appeared as if it was dried up being thinner than the healthier portion above. The external surface of the necrosed part above the actual lesion was rough and cold to the touch.

Infection. The owner did not know how his animal contracted the disease. My own conception was that *B. necrophorus* gained

entrance through a break in the continuity of the skin near the tip of the tail. This break did not appear necessarily to have occurred by any external injuries. For, during my practice I examined the tails of many buffaloes and observed that a certain number of cases that were kept unclean showed one or two vertical or oblique breaks either fresh or healed up, the biggest being 1·5 c.m. on the last quarter. Due to uncleanliness the tuft of the tail gives ample room for the dirt to be accumulated and imprisoned within the hairs. The surface of the tail therefore becomes very rough and hard and at the time of using the tail actively and forcibly as a whip to ward off flies etc., breaks on the skin must be occurring in some dry season. These are subsequently exposed to infection which is very widely distributed in nature.

Treatment. In the necrotic lesion of the tail as a certain portion above the actual lesion becomes necrosed without showing much recognisable change externally it is indeed very difficult to ascertain the exact extent of necrosis. In the present case therefore, after rigid examination a point *A* was marked as the proximal extremity of necrosis. And, still—to err on safer side by removing a portion of the healthy tissue rather than leaving a part of necrosed area—another point *B* was marked two joints above *A*. After tying a tape tightly above the mark *B* tail was amputated on the joint at that mark under aseptic precautions. The wound so exposed was dressed with Tr. Iodine and bandaged. The tape was removed on the third day. From the second day onwards the wound was painted with Tr. Iodine, dusted with Boro-Iodoform and bandaged. It completely healed up within eight days. There was no recurrence of the lesion ever since.

Now I have given below a review of the disease studied from various sources referred to in the Bibliography.

Necrobacillosis

Definition. Necrobacillosis is a specific inoculable disease of all domesticated animals caused by *Bacillus necrophorus* It is a Gram negative anaerobe occurring in the form of wavy filaments—80 μ to 100 μ long and ·75 to 1·5 μ thick. The filaments are irregularly segmented—intricately interwoven and found often grouped into bundles. These organisms are found in large numbers towards the periphery of the lesion.

Susceptibility, Under natural conditions cattle—sheep—goats antelopes—reindeer—red deer—roe deer—horses—asses—kangaroos,

rabits—dogs—chickens—kites and guinea pigs and experimentally mice and pigeons (*Mohler and Morse*) are affected. Young calves are most susceptible and easy transmissibility of the disease among them is fully established by Dammann.

Pathological characters, Broadly speaking it may be stated that it is a coagulation necrosis with subsequent caseation. It presents three important characters viz.—

A. Progressive advance into the surrounding (especially deep) tissues.

B. Invasion of distant parts of the body by embolic metastasis.

C. And finally general intoxication.

Pathological Anatomy, Symptoms presented vary considerably according to the seat of affection and presence or absence of other organism—but the most common outstanding one is *necrosis*. In the lesion primary or secondary the line of demarcation between the living tissue and the dead mass, is a narrow hyperaemic zone.

Special Pathology, When once the *B. necrophorus* secures a lodgement in the tissue it develops a deadly, volatile toxin which rapidly spreads to the tissues which come in contact with it and as a result these tissues fall an easy prey to the necrosing action. Necrobacillosis of the skin and other superficial tissue is not very harmful to the life and general condition of the animal but the extensive affection of mucous membranes and of the internal organs is most dangerous and generally causes death.

Diseases caused by B. necrophorus

1. Necrosis of the skin.
2. Necrotic dermatitis in horse (Frohner and Davis)
3. Necrotic dermatitis in hog (Jensen)
4. Necrotic scratches.
5. Necrotic lesion of tail.
6. Necrotic lesion of mouth and nose.
7. Necrotic pox (Gangrenous pox. Bang)
8. Necrobacillosis of hoof.
9. Necrobacillosis of digestive tract (Bang, Jemsen and Olt).
10. Necrotic stomatitis.

11. Necrotic vaginitis (Ellinger)
12. Necrotic metritis.
13. Foot rot of cattle and sheep.
14. Necrotic Omphalophlebitis (McFadyean—Jensen and Olt).
15. Joint ill.
16. Poll evil.
17. Fistulous withers.
18. Quittor.
19. Cracked heels.
20. Calf diptheria.
21. Panaritium,
22. Multiple necrosis in liver, lungs and other viscera.

(Jenser—McFadyean and Georgevilsch).

Diseases numbered from 15 to 18 above are also caused by Streptococci.

Mode of infection. Necrobacillosis is an inoculable disease. Under natural condition the bacillus gains entrance through an impaired tissue. Particularly in the necrosis of the skin and other superficial tissue breaks in the continuity of the skin is the channel of infection.

Natural infection. The B. Necrophorus is very widely distributed in nature. Faeces of herbivorous animals often contain it. It being anaerobe is very resistant and tenacious and remains alive for a long time on the dirty floors of damp shed—in musty food and straw etc. From these the bacillus gains entrance into the buccal cavity or in the wounds on the body surface.

Treatment. When the affections are in the internal organs, especially in the thorax and abdomen they are very difficult to diagnose and treat. When any part of the external body is affected the necrosed tissue should be removed completely by curette, knife or hot iron. The wound so exposed should be treated as a common wound by washing it thoroughly with antiseptic solutions especially Lugol's solution or 5 per cent. carbolic acid which according to Mohler and Morse are said to possess a greater germicidal effect on the bacillus. It is not very easy to ascertain the extent of invasion of the bacillus in the adjacent tissue as there is no marked or recognisable change in all forms of necrotic lesions particularly in old standing fistulae.

Summary and conclusion. Necrobacillosis is a disease of the livestock of much academic and economic importance. It takes a variety of forms according to the seat of affection but *necrosis* is always a common symptom. The causative organism--*B. necrophorus* is most widly distributed in nature and gains entrance in the body through the channel of breaks or wounds in the cutaneous or mucous surface. Treatment in the cases of necrosis of the internal organs is of no avail but that of necrois of superficial body surface, is ordinarily successful.

BIBLIOGRAPHY.

1. Banham G. A. Table of Veterinary Posology—page 148.

2. Cuille, Diseases due to Bacillary Necrosis—Journ. Comp. Path. and Ther. Vol. XIV.

3. Hutyra and Marek. special pathology and Therapeutics of the diseases of domesticated animals.

4. McFadyean.

   (*a*) Multiple necrosis of liver, Journ Comp. Path. and Ther. Vol, V.

   (*b*) Metastatic lesions in *Bacillary Necrosis*, Journ. Comp-Path. and Ther. Vol. XIII.

5. Mohler and Morse. Bacillus necrophorus and its economic importance

6. Quain's Dictionary of Medicine 1902.

7. Wallis Hoare system of Veterinary Medicine Vol, I.

IMPACTION IN A BUFFALO.

BY

K. V. Raghavachari, G.M.V.C., Veterinary Assistant Surgeon, Negapalam.

Subject. A buffalo-bullock aged about 8 years and of a fairly good condition was brought for treatment on 14-11-24.

History. The animal did not pass motion or urine for the past ten days and the owner had given country medicines to no purpose.

Symptoms. On the day on which the animal was brought to the dispensary, he showed the following symptoms. Stomache bloated with gas and contained food material. Breathing difficult and laboured. Salivation, running from the nose, general appearance dull, and the animal was having an anxious expression, was off feed and not ruminating. It was unable to walk freely and would do so only with very great difficulty. Temperature 104° F.

Treatment. 14-11-24. The animal was given 1 lb. of Ol. arachis with Ol. Crotonis—1 drachm Ol. Terebinthinae 3 ounces—Ammonii, carb.—half an ounce and Pulv Nux vomica 2 drams. A warm soap water enema was also given.

15-11-24. No motion or urine was passed, but the bloating disappeared, Temperature was 98° F, Gave spts, aetheris Nitrosi 3i, spts, Rectificatus 3ii, and Tr Nux vomica half an ounce in a pint of water aud advised the owner to give 2 drams (about 8 oz.) of country arrack in a gallon of rice kanjee,

16-11-24. No motion, but the animal had passed a small quantity of urine the previous evening. Temperature was 98. 4° F. Gave Ammonii Carb. 3iv Pulv. Nux vomica 3ii and spts, Rectificatus 3ii in an emulsion with mucilage and ordered continuance of arrack with kanjee.

17-11-24. No motion. Passed urine twice the previous day. Temperature was 59° F. Repeated previous day's treatment.

18-11-24. No motion, passing urine normal, temperature 100° F. Repeated the medicine of 16-11-24 with 4 ounces of Mag-Sulphas.

19-11-24. No motion. Temperature 100° F. Repeated previous day's treatment.

20-11-24. No motion. Temperature 100° F. Repeated medicine of 16-11-24 Substituting Ol. arachis 4 oz. for Mag-Sulphas and discontinuing spts, Rectificatus.

21-11-24. No motion. Temperature 101° F. Repeated previous day's treatment.

22-11-24. No motion. Temperature 100° F. Repeated the treatment.

23-11-24. Animal had one broad and liquid motion the previous night and began to drink a little kanjee of its own accord.

Temperature 100° F. Gave Tonic powder half oz. with Liq. Aresenicalis 2 drams.

24-11-24. Had nō motion again the previous day but the animal looked a little lively and was weak in the loins and was staggering behind, Repeated the previous day's medicine with Sodii Sulphas 2 oz. and Sodii Salicylas 4 drams.

25-11-24. The animal had two or three motions and was eating a little, but he was not brought to the dispensary as he could not walk and was not even able to stand for some time on account of pain over the region of the loins. Repeated previous day's treatment.

26-11-24. The animal began to pass motion and urine normally and also began to eat slowly some food. Repeated treatment.

27-11-24. The loins got a little improved and the animal was able to walk better. Temperature normal and the animal looked bright. Repeated treatment. Since then the animal discontinued and I subsequently got information that he had completely recovered and was doing his usual work.

Remarks. The interesting point in the case is the animal not passing motion for about 18 or 19 days and finally recovering after prolonged treatment.

TRAUMATIC PERICARDITIS IN A BUFFALO DUE TO AN UNUSUAL FOREIGN BODY.

BY

R. G. Sathe G.B.V.C. Vety. Inspector Imperial Bacteriological Laboratory, Muktesar.

Althought it would appear to be probable that buffaloes are exposed to the same risks from ingestion of foreign bodies as cattle are, it is believed that few cases of traumatic pericarditis in these animals have hitherto been recorded.

A Plains buffalo-bull, used for the production of anti-anthrax serum at the Imperial Bacteriolgical Laboratory, Muktesar, fell victim to this malady which was of course detected only on post-mortem examination, where an advanced diseased condition of the pericardium was found, and which could be fully accounted for by

the presence of an ordinary curved suturing needle which measured four and a quarter centimetres long, situated wholly in the pericardium without damaging the heart.

Though the tract of this needle from the reticulum to the pericardium was clearly marked, yet, with the exception of a local abscess, of the size of a pea on the pleural surface of the diaphragm the important lesions were confined to the pericardium and the cavity. No oedema was present. The pericardium was uniformly thickened and measured 28 x 21 centimetres due to the presence of a solid white fibrinous deposit. A similar deposit of half a centimetre in thickness was firmly adherent to the whole surface of epicardium, while the pericardial cavity was distended with about a litre of milky white semitransparent fiuid.

ASCARIASIS.

BY

M. Velu Pillai, G.B.V.C., Assistant Veterinary Surgeon, Penang Municipality.

Ascariasis of the dog is a very common disease especially among puppies of 1 to 3 months old and caused by Ascaris Marginata, commonly called round worms. They affect chiefly the small intestines. As such cases are frequently brought to my notice in the infirmary, I give a short description of the experiences I gained in diagnosing and treating them. The infection among puppies generally occurs through food and water contaminated with ova, which, when developed produce irritation of the mucous membrane of the intestines by their movement and result in inflammation and digestive disturbances.

In all cases admitted here for treatment I observed the appetite variable, bowels irregular, animals emaciated, the visible mucous membranes pale, abdomen pendulous and sometimes the animals vomit when worms migrate into the stomach.

The following lines of treatment are adopted here to eradicate the worms. Detect the worms or their ova in the faeces under microscope and the best method for this is by means of "sugar floatation Technique" the full description of which can be seen from the "Journal of Comparative Pathology and Therapeutics 1923 December Vol. 36, No. 4 Paras. 266—275.

After detecting the ova or worms, the puppy should be starved for 24 hours and in the early morning a small dose of oil of Chenapodium 3 to 5 ms., in a gelatine capsule should be very carefully administered followed by ½ to 1 ounce of castor oil after half an hour. The animal will have a good motion within 5 hours and if the stools are examined macroscopically, any number of worms, dead and living, can be seen. The general condition of the patient will be rapidly improved after this treatment without any sort of tonics. The most important points to be remembered in this method are.—

(1) Chenapodium Capsule should be well inserted in the throat, so that the patient may not bite or break.

(2) The intestines should be well cleared out by a purgative to avoid absorption of the oil.

The efficiency of Chenapodium in removing Ascarids in small animals is in my opinion far superior to Carbon Tetra Chloride.

A CASE OF TUBERCULOSIS IN AN ELEPHANT.

BY

R. S. Narayanan G.B.V.C., (Lately Vety. Inspector. I.B.L.)
Veterinary Inspector, State Filkhana.

Since the reported discovery of tuberculosis in an elephant by Dammann and Stedefer in 1908 (Elephants and their diseases by G. H. Evans, 1910 Edition) no record of this disease has appeared in the Veterinary literature. It may therefore be of some interest to record here the few observations of a case, in which the disease was in all probability contracted from a human origin. The disease could not be conclusively diagnosed during life but the chances of transmission from man to the elephant are many due to the great prevalence of the malady here.

Subject.—Female elephant "Gomati" aged about 70 years belonging to the State Filkhana, Rampur State (U.P.) It was noticed about the early days of March 1923 that the animal was gradually losing in condition and with altered expression. The appetite was found to be not quite constant. Urine cloudy and urination was frequent but small in quantity at a time. Faeces not of normal firm consistency but passed in small quantities and frequently, and was often mucus coated. Temperature of the body was varying from 99°F. to 101·8°F. Sometimes she had sudden accessions of temperature.

A month prior to fatal termination, temperature occassionally was sub-normal. Considerable wasting, foetid diarrhoea, dung frequently blood coated, great prostration and exhaustion. Greyish foetid discharge from the mouth, oedema of the cheeks, intermaxillary space and abdomen. Animal fell down and died on 23rd March 1924.

Post-mortem.

Abdominal Cavity.—On opening the abdominal cavity of the Cadaver, about 2 gallons of clear straw coloured fluid escaped.

Liver—Enlarged.

Spleen—Enlarged.

Stomach and intestines contained fluid ingesta. mucous membrane of the large intestines slightly thickened and dark red in colour. On the walls of the large intestines three separate raised lesions to the size of a human fist were noticed and they contained dirty white matter inside.

Lungs.—Both were extensively affected but the right was more in comparision to the left. The bronchules and alveoli were found engorged with the gritty and caseated matter. The mediastinal lymphatic glands did not show any considerable change.

Sections of the lungs, liver, spleen and intestinal lesions were forwarded to Prof. J. T. Edwards, Director of the Imperial Bacteriological Laboratory. Muktesar and the following are the extracts from his report of the examination of the preserved materials.

"The examination has proved that the lesions were of very exceptional interest, in as much as conclusive proof was obtained that the elephant was suffering from tuberculosis.

Briefly, the changes revealed in the tissues were as follows :—

The lungs on histological examination showed very numerous areas of necrosis and caseation, with nests and disseminated aggregations of "epithelloid" cells, and the affected areas were often encapsuled with delicate strands of young fibrous tissue. The lesion presented some resemblance to that of equine pulmonary tuberculosis, but necrosis and fibrosis were more pronounced than is ordinarily observed in this type of affection. On staining sections for acid-fast organisms, numerous distinctly bacillary forms, somewhat granular in texture. were seen, quite indistinguishable from well-developed tubercle bacilli as seen in other animals. In some fields examined

(with 1/12" oil immersion lens) up to 50 bacilli could be detected. The pleura was affected with extensive fibrous thickening and fibrinous exudation.

The liver showed very marked passive congestion due to regurgitation of blood in the portal system caused by the stasis of circulation in the tuberculous lungs.

The spleen showed marked passive congestion also, with apparently fibrous thickening of the trabeculae.

The intestinal lesion examined would appear to be a long standing centre of disease due to worm invasion. From the descriptions given it would appear also that the clinical manifestations are undoubtedly intensified by verminous infection."

In this connection, I may add that the presence of Murshida Falcifera (as identified by F. Ware Esq. of the Research Institute in animal Pathology, Royal Veterinary College, London.) is noted in over 35% of the elephants here.

Prof. J. T. Edwards further adds—"Although tuberculosis in cattle in India appears to be very rare, laboratory examination of specimens at this institution (I.B.L.) shows that the disease is not uncommon among horses, as it might transpire that elephants kept in captivity are also by no means rarely affected."

The discovery of the tuberculosis in an elephant, (the discovery being one of historical importance) is entirely due to the labours of Prof. J. T. Edwards.

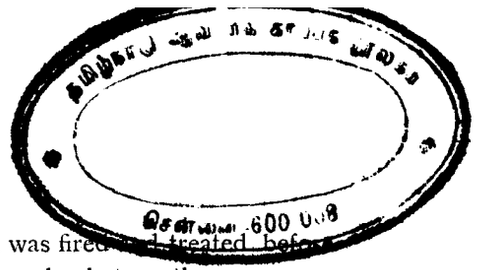
A CASE OF FISTULA OF RUMEN IN A SHE-BUFFALOE.

BY

Syed Mohammad, G.B.V.C., Veterinary Assistant Surgeon in charge, Veterinary Hospital, Dhanbad.

A she buffaloe aged 4 years was brought into the hospital on 23rd March 1924, and was admitted into the hospital for treatment.

History of the case :—The buffaloe fell ill at her owner's house about a fortnight before, and she was brought in to the hospital having a swelling about the size of a cocoanut, with a small opening in the skin about 1/8th of an inch in diameter on the left side of the abdomen,



whence ingesta oozed out. The animal was fired [illegible] treated before her admission into the hospital by quacks but as there was no improvement she was brought here.

Symptoms observed :—The animal was emaciated, no rise of temperature, no difficulty in urination and defaecation, conjunctiva was pale. The animal was taking her daily ration all right.

Treatment :—The animal was chloroformed and was placed on her back, and an incision about 8 inches in length on the swelling was made parallel to the Linia Alba, under strict antiseptic precautions. After making the incision, semi-solid ingesta was found between the skin and abdominal tunics which was removed and the part was washed with normal saline solution. One third of the ingesta was removed from the rumen, and the edges of the ruptured portion of the rumen snipped. The abdominal muscles and the tunics were thoroughly washed with normal saline solution and the ruptured wall of the rumen as well as the abdominal muscles sutured with cat-gut. The skin was sutured with silk thread. After suturing the skin, the part was dressed with Iodoform and Collodion and a suspensary bandage was put around the abdomen for support. The animal was dull for a day but there was no temperature. No food was given her for a day. The sutures were removed after a week and the part was painted with Tr. Iodine.

I am glad to note here that the wound healed up without any trouble.

In this case of operation I am much indebted to the local touring Veterinary Assistant Surgeon Babu S. B. Lal, who helped me materially in the operation and took the trouble of sending the case to the hospital.

---

*"IMMUNITY AND THERAPEUTIC IMMUNIZATION."

BY

D. V. Subramanyan, Final Year Student, Madras Veterinary College.

Protection from disease is the problem of problems that has been engrossing the attention of humanity ever since disease was

*The essay the earned the silver medal amongst the papers read by the Students under the auspices of the Madras Veterinary College Medical Association.

known. Whether primitive races, the ordinary layman, medical men, legislators and even the subtle thinkers devoting their energies to the solution of the problem of immunity against poisoning and infections. Under these circumstances, I am afraid, I will be carrying coal to Newcastle, were I to expatiate on the paramount importance of a subject like 'Immunity and Therapeutic immunization' to an audience like this.

Owing to the rapid advancement of Bacteriology, due to the marvellous discoveries of earnest Bacterioligists, a certain stage has been reached wherein the phenomenon of immunity is being explained in a scientific way and the means of saving thousands of beings from succumbing to deadly diseases by rational methods have been understood. At a time, when the medical man's attempts in curing a patient suffering from a specific disease with the best of his therapeutic drugs are baffled, at a time when the resources of thinking men have been strained to the utmost to find means of checking their destructive processes, Sero-vaccine Therapy comes to their aid like an angel to help them in the hour of their need.

I have made an earnest attempt to understand the subject and I will be immensely glad to be corrected wherever necessary by my friends and the worthy President.

In this connection my very grateful thanks are due to the talented authors of the following books, which are the entire source of my information on the subject.

1. "Notes on Bacteriology" D. A. D. Aitchison, M.R.C.V.S., I.V.S., Principal of our College.
2. "Veterinary Hygiene" F. Smith, C.B., C.M.G.
3. "Green's Pathology."
4. "Immunity in infectious diseases." Metchnikoff. (Translation English).
5. "Sanitary hand book for India." MacNally.
6. "Notes to Horse owners" Captain Hayes.
7. "Veterinary Pathology" Freidberger and Fronher (Translation English).
8. "Clinical Bacteriology and Vaccine Therapy for Veterinary Surgeons" William Scott, F.R.C.V.S.

Contents of the Essay.

1. General introduction.
2. Immunity and its classification.
3. Active and passive immunity.
4. Older theories of immunity.
5. Two modern theories of immunity.
6. Differences between the two and the more probable one.
7. Wright's opsonic theory.
8. Phenomenon of Immunization.
9. How active immunity is acquired.
10. Brief illustrations of the above in certain diseases.
11. How passive immunity is bestowed.
12. Short historical sketch on immunity and conclusion.

Definition of immunity.—Immunity is the power of resistance possessed by an individual or a species against the attacks of the virus of a disease. Mac Nally says that immunity is that condition of body which renders it able to successfully ward off attacks of pathogenic microbes and to neutralise their toxins.

Immunity presents great variability. Sometimes it is very stable and durable, in other cases it is very feeble and transient. Thus immunity in general could be classified under two heads.

1. Natural Immunity.
2. Acquired Immunity.

Natural immunity could be sub-divided into,

a. Absolute or complete.

b. Relative or comparative.

Similarly acquired immunity is divided into,

a. Active acquired immunity.

b. Passive acquired immunity.

Immunity that is successfully transferred in a species from one generation to another continuously and possessed by animals at the time of their birth is known as natural immunity. It is the privelege of a whole species as the horse or the ox and hence known as racial.

For instance horse possesses racial immunity against the scarlet-fever of man and the pleuro-pneumonia of cattle. Men are immune to strangles of horses and rinderpest of ruminants. Cattle are immune to glanders of horses and typhoid of man. Dogs are immune to the dourine of horses, and cholera of man. Asses are immune to tuberculosis while fowls possess immunity against anthrax. All animals are immune to syphilis of man. I stop with these, though instances can be multiplied.

Natural immunity possessed by some breeds of a particular species is known as comparative immunity. As possessor of comparative immunity I may cite Algerian sheep against anthrax. British sheep against sheep-pox, Texas cattle against Texas fever and Negroes against yellow fever of white races. South Indian cattle and dogs may be said to have comparative immunity against Piroplasmosis. Possessors of comparative immunity are refractory only when inoculated in the usual way but prove susceptible to diseases when the dose of the virus is largely increased. Nature of lesions set up in tissue and the health of the animal body greatly affect comparative resistance.

Acquired immunity. Is the immunity that the animal now possesses, but which was absent when the animal was born (except those cases where the mother of the animals suffered from an attack of the disease carrying the animal in uterus.

Active acquired immunity. It is the result of an animal having successively come through a natural attack of a disease or as a result of its having been successfully vaccinated by one or the other of the artificial methods. Active immunity is due to alteration in the fluids cells and tissues of body. It derives its name 'active' from the animal body taking active part in the preparation of anti-bodies, to hold the disease in check. The condition is obtained by the individual himself and is accompanied by great pain and attended with grave result to animal.

Immunity acquired as a result of a natural attack of disease is known as Naturally acquired immunity. It is due to this fact, that we find among every species of animals individuals who are more or less refractory to the inroads of a disease to which their fellows show marked susceptibility. Thus man, horse, ox or dog which has had one attack respectively of small-pox, strangles, pleuro-pneumonia or distemper will have acquired immunity from a second attack. Cow recovered from rinderpest is said to be immune against a second attack. Old dogs and aged cattle are said to be respectively immune

to distemper and quarter-evil. There is no such possibility. The probablity is that an unnoticed mild attack of the disease has given those animals an immunity in their earlier times. This acquired immunity is never absolute. Active acquired immunity.—(Artificially).—Active immunity could be induced by injections of toxins or of bacillus either dead, attenuated or living in non-lethal doses. It cannot be transferred in the medium of serum. Immunity in this condition will be of sufficient duration (though not absolute) to be of the utmost value in protecting animals during epidemics, although it takes a long time to get it.

Passive acquired immunity.—Immunity that is conferred on an animal by injecting into it some blood serum from another animal whose blood has acquired the so called antitoxic properties, by repeated inoculation with virulent bacteria or toxic substances is called passive immunity. The blood of a horse that has been put through a course of subcutaneous or intravenous injection of filfered bouillon cultures of tetanus bacillus by and by furnish a serum which if injected into another horse will render the latter immune both against tetanus bacillus and tetanus toxin. This passive immunity is not met with in nature as a rule. It is an invention which human ingenuity has discovered to its credit. It is acquired instantaneously without any risk to the animal. Here no alteration takes place in the cells or fluids of body due to protective bodies or substances injected. Passive immunity helps in the segregation of animals and facilitates disinfection. Passive immunity may assist in the cure of a disease already existing, but does not last long enough to be of value as a prophylactive measure.

Phenomena of immunity.—Different people of various countries have endeavoured to explain the interesting practical phenomena of immunity. Numerous were the explanations put forward from time to time. So many theories sank under the weight of criticism. To-day, there are two modern theories—Cellular theory of Metchnikoff and the Humoral theory of Ehrlich which explain the phenomena of immunity.

Let me say a few words about the older theories of immunity before I come to the modern theories.

Acquired immunity.

Theory of exhaustion.—This theory supposed that susceptibility was due to presence of certain substances in the animal body

necessary for the growth and multiplication of invading bacteria. According to this view, as all available substances are used up in the first attack there is no second attack of disease. This theory is not a sound one in view of the fact animals immune to a moderate quantity of infected material nevertheless become infected when a larger quantity is injected.

Retention theory.—This theory supposed that immunity is due to the paralysing influence which the materials formed in the tissues by the disease germs has on the microbes. Something resembling this does certainly occur, for at times in artificial cultures, the organisms cease to grow long before the nutritive material in the medium has become used up. Bouchard has proved this in the cultivation of the bacillus of blue pus and Rawline in Aspergillus niger.

As a familiar example Cadeac cites the experiment of putting yeast in a solution of sugar, which mixture will produce carbon—dioxide and alcohol. After a certain time the fermentation will stop. If we add sugar to the liquid the yeast will recommence growing, but the fermentation will soon again stop and will not begin afresh, even if we add more sugar. If on the contrary, we add water the fermentation will commence again and will also do so if by heating the liquid we drive off the alcohol which has been formed.

In the first case the effect of water, was only to dilute the matters formed by the yeast of which alcohol was the principal. In the second case, the heat expelled the alcohol or considerably diminished it and the fermentation commenced anew. Here, the alcohol has a poisonous or paralysing effect on the yeast which produced it.

Anyhow, such injurious materials could not be retained in the body for a long time. Thus Captain Hayes remarks,—"That this theory serves to explain the fact that certain diseases like pleuro-pneumonia of cattle, and pink eye (Influenza) in horses run a definite course at the end of which if the animal has withstood the severity of the symptoms the disease disappears. He is further of opinion that the spinal cord of a rabid rabbit used by Pasteur in inoculation against rabies may act in the same way by checking the development of the microbe that is supposed to produce rabies.

Immunity may be also due to the tolerance of the animal to the invader due to constant invasion. Immunity possessed by opium and arsenic eaters for the ordinary lethal doses of those drugs is only to

be explained as a sort of tolerance. It is said guinea pigs could finally be brought to a stage by gradually injecting increasing quantities of Recin-active principle of castor seeds—to withstand 400 times the lethal dose.

Immunity of the South Indian cattle against Piroplasmosis and Trypanosomiasis deserves to be classified unde this group. This tolerance of those animals breaks down once their vitality is lowered by specific diseases or old age.

Cellular Theory of Metchnikoff or the theory of Phagocytosis.

Phagocytes are certain fixed or mobile cells (Leucocytes or white blood Corpuscles) found in all tissues of the body, which seize and ingest foreign bodies that may enter the system and absorb soluble (contents) substances. Fixed cells that react against invading particles are the endothelium of blood, and lymph capillaries, connective tissue cells and certain epithelial cells.

There are two kinds of phagocytes such as Mikrophages (mononuclear cells) and Makrophages (polynuclear cells). Mikrophages attack only those foreign bodies that are of animal origin. It is the function of makrophages to deal with all other forms of foreign things and to safeguard the health of the animal.

Phagocytes are guided towards the invading matter by what is known as Chemiotaxis. Chemiotaxis is the attractive influence of some chemical substance present in the disease germ towards leucocytes. This corresponds to a magnet attracting the iron. The term chemiotaxis, indicates positive chemio-taxis which is seen in immune animals. When the germs or chemical substances in germs have a repulsive effect on white cells or at least do not attract them, it is said to have a Negative Chemiotaxis. The presence of chemiotaxis need no longer be doubted for the presence (introduction) of a quantity of metallic copper in the anterior chamber of the eye (aqueous humour) bringing such an innumerable number of leucocytes to the seat of copper, has been found out by experiments.

In this connection Bordet's experiments on Guinea pigs are worthy of consideration. On injecting a culture of some streptococci he found some of them escaped the voracity of phagocytes. These were distinguished by the thickness of their protecting aureola. Leucocytes no longer digest Streptococci and generalisation of infection results. At this time, Bordet injected a definite quantity of a culture of Proteous Vulgaris. These bacilli in a short time became

the prey of phagocytes, which however still refuse to ingest Streptococci. This experiment domonstrated very clearly the difference between the positive susceptibility of the leucocytes (with respect to Proteous) and negative (with respect to Streptococci) Bordet accepted this sensitiveness as a chemiotaxis, this is to say a perception of the chemical composition of the surrounding medium. Substance which excites the negative chemiotaxis is contained in the aureola that surrounds streptococci.

We have seen that the phagocytes are directed towards disease germs by chemiotaxis, These cells seize microbes whilst they are still living and capable of exercising their noxious effect and bring them under the action of the cellular contents which are capable of killing and digesting the micro-organisms or of inhibiting their pathogenic action.

The theory of phagocytes seeks to establish the part played by these cells in the destruction of cells. It maintains that the vital manifestation of the phagocytes, irritability, mobility and voracity constitutes an essential factor in ridding the animal of micro-organisms, because the true bactericidal ferment is contained within the phagocytes except in cases of Phagolysis (which is the paralysis of the phagocytes as seen in Pleiffer's phenomenon.) The destruction of the micro-organisms follows the laws which govern the absorbtion of formed elements in general. This absorbtion finally is the work of two soluble digestive ferments, one of which (fixative) is readily excreted by phagocytes into the plasmas of the blood and exudations, while the other ferment known as Cystasis is contained within the bodies of the phagocytes from which it only escapes after the coagulation of blood.

Metchnikoff deals in order with the natural immunity of animals respectively against diseases, which have for their casual agent a bacillus cocci, and a spirulam. As all of them lead to the same conclusion, I cite here the immunity of animals against diseases in which a bacillus is the casual organism.

He demostrated that natural immunity of frogs, fowls and dogs against Anthrax was due to Phagacytosis. Introduction of a virulent culture of anthrax into every one of these animals subcutaneously produced a hard thickened mass at the seat of inoculation. It is due to the arrival of a host of leucocytes to hold anthrax bacillus at bay which devoured them alive and digested them. On examining the leucocytes at the seat of inoculation sometime afterwards, anthrax

bacillus was found within each of the leucocytes. If it was a little later the bacilli were in the shape of granules and after a long time nothing about the bacilli is noticeable. Spores are the last to disappear. Some time after inoculation leucocytes from the inoculated region were conveyed to an artificial medium favourable for the growth of anthrax bacillus. It was found after the elapse of a considerable time that anthrax bacillus was gradually (multiplying) developing. This substantiated beyond the possibility of a shadow of doubt that in immune animals the bacilli are first ingested and then gradually absorbed. It is said that the organism is thus prevented from secreting any of its poisonous products.

A few words of Metchnikoff with regard to immunity of fowls and dogs are worthy of great attention. "The phagacytosis in fowls inoculated with spores was very marked and preparation studied by Ziehl's method demonstrated most clearly the reality of this reaction phenomenon. In summing up the natural immunity of fowls against anthrax we are justified in concluding that it is due to phagocytes and not due to any bactericidal property of the "Humours."

Natural immunity of dogs from anthrax is a function of phagocytes. These elements under the stimulus of the bacillus and its products, exhibit a positive chemiotaxis of the most marked character. They approach the bacilli, ingest them by a physiological act and destory them by means of a substance which is not found in either the plasma or the blood serum but which can be demonstrated in an extract of the Mikrophages,

As it is impossible to pass in review all the cases of natural immunity against infective micro organisims we limit ourselves to several examples which may have an interesting bearing on the study of the problem as a whole.

A word of explanation is necessary to those, who think, that immunity of fowls against anthrax is due to the high temperature of (105° F) 41° C of their body. A strong argument in favour of this supposition is that the fowls fall a victim to anthrax, once they are made to remain in cold water for a long time. This susceptibility of the fowls to anthrax is not due to the decrease in temperature of blood of fowls but due to their lowered vitality. As a matter of fact anthrax bacillus grows well in an artificial medium at 42°C (107° F.) a temperature far greater than the temperature of fowls.

This susceptibility is noticeable in fowls when their vitality is lowered either by dipping them in cold water or by administering

refrigerents. Dogs from whom, the spleen an organ full of phagocytes has been removed becomes susceptible to anthrax and rabid animal succumbed to anthrax before the rabies has completed its evolution. All emphasise on the importance of phagocytes.

Even acquired immunity is only due to phagocytosis and chemiotaxis. The reason ascribed by the author of this theory for the once susceptible animal becoming immune for the disease after the first attack of the disease is due to the conversion of the former negative chemiotaxis into a positive one, after the first attack. This alteration in chemiotaxis is not clearly understood. Immunity in the second case may be due to the increased tolerance or resisting power of toxic products of the bacteria by the cells and due to the previous training in devouring microbes, which the leucocytes have undergone. Probably certain cells which had not the required capacity for destroying a particular bacillus perished in the first attack and then the body was crowded with descendants of a stronger band of white cells.

According to the Phagocytic Theory of Metchnikoff.—

1. Natural immunity is due to active positive chemiotaxis, the invading material being engulfed and digested.

2. Acquired immunity is due to training of cells in devouring microbes and due to conversion of negative into positive chemiotaxis.

3. Action of a preventive serum in the body is due to increased positive chemiotaxis, the result of the co-operation of two ferments in the serum. One of these 'fixateur' is contained in the liquid blood and acts on the bacteria for the phagocytes to deal with while the other ferment known as 'Cytasis' is contained within the bodies of the phagocytes from which it only escapes after the coagulation of the blood (Bactericidal serum).

Bactericidal immunity represents accordingly nothing else but an example of intracellular digestion.

4. Natural and acquired immunity against toxins are according to Metchnikoff due to some vital influence of certain cells which present the attack of the toxins on the susceptible cells.

Note.—In case of acquired immunity probably the Makrophages form the principal source of antitoxins and these in the living body act in a simllar way to the 'fixateur' in the case of bacteria.

Humoral Theory or Cell nutrition and Side-chain Theory of

Ethrlich.—According to this theory immunity and extinction of bacteria are ascribed to substances found dissolved in the blood or lymph or other liquids of the body. Germicidal or antidotal properties are attributed to the body fluids against bactericidal toxins. These antibodies present in blood unite with the bacteria and their toxin and rendering them inoffensive protect the protoplasm of the cell from destruction.

Animals recovering from a specific disease elaborate various substances in their economy inimical to growth of the specific bacteria and the secretion of their products. These antibodies are of two kinds.

1. *Non Specific antibodies.* Are substances produced as a result of tissue activities, which are always present in the body (i. e.) Complement.

2. *Specific antibodies.* Are agents produced due to the stimulus of an infection. These antibodies vary much in their character and action and nothing is definitely known as to how and where they are formed.

The chief antibodies according to this theory are respectively antitoxins, agglutinins, precipitins, and bacteriolysins. A few words regarding each of these antibodies with regard to their relation to immunity is necessary.

Antitoxins. As regards cell-nutrition, Ehrlich believes that the protoplasm is made up of many molecules showing an affinity for a large variety of food meterials. These molecules consist of a central portion surrounded by a group of atoms. These atoms unite with food molecules and thus bind them to the cell. Ehrlich calls atomic group as Side Chains or receptors which is responsible for the nutrition of the cell. A side-chain attached to a cell may unite with a particle of oxygen, fat, carbohydrate and similarly with a molecule of a poison or toxin.

A toxin molecule is said to consist of two groups.

1. Stable group known as 'Haptophore' which is capable of being attached to Unstable or lateral side chain of an animal cell.

2. Unstable group known as 'Toxophore' which unites with the stable central portion of cell and causes cell destruction.

We know that each molecule in a protoplasm consists of two groups.

1. A stable central group.
2. An Unstable lateral group known as receptors.

The toxin is attached to the cell through the medium of the side chain and if sufficiently virulent enough poisons the cell and produces the death of the cell itself. Otherwise death occurs only of the side chains, in which case the dead side chain is thrown off and a new one is formed in its stead. In fact, such an excess of compensation occurs that the superfluous side chains are left in the adjacent lymph and finally carried to the blood stream where it remains as receptors or antitoxins.

These antitoxins floating in the blood stream lay hold of toxin molecule and uniting with its haptophore before it can reach the cell, prevents it from attacking the cell substance thereby giving to the patient an immunity. A serum containing these free side chains or anti toxins when injected into another animal confer on the latter the same degree of immunity as possessed by the original animal, which explains the prophylactic and curative action of the anitoxin. Thus in this theory, the animal cell is likened to a side chain of atoms in organic chemistry.

Of the two Antibodies *Agglutinin and precipitin,* Agglutinin is believed to play some part in immunity. Allen is of opinion (that in an immunised auimal) the bacteria are got into clumps·····by agglutinin, so that they may be caught up in the various tissues, such as liver, the spleen, and lymphatics where the immunizing agents are generated about and their destruction thereby brought about.

Bacteriolysins. There exist in the animal system protective bodies that are capable of destroying bacteria by solution called 'Bacteriolysin' which process is known as bacteriolysis. Ehrlich explains the destructive action of a bactericidal serum-a serum got by hyperimmunising an animal by a particular bacteria—on the specific bacteria by his lateral chain theory. He assumes that due to repeated injections of bacteria the body cells cast off a receptor composing of two groups.

1. A cystophile group.
2. A complementophile group.

This two grouped receptor now called the 'Amboceptor' detached from cell links up with the bacteria in this way. The cystophile group joins on to the bacteria while the Complementophile group unites with the complemental substance, which is contantly present in the serum of normal animals and acts as a ferment for the destruction of the bacteria now linked to it. Thus the bacteria cannot reach the protoplasm and the immunity is known as passive. Thus amboceptor is the bacteriolysin.

Complement is a substance always present in all serums in living body which disappears in vitro either by heating up to 55° C, or on keeping at room temperature for 5 or 8 days. Unstable body capable of being destroyed found in all serums of living animals is termed 'Complement' while the stable body produced in the process of immunity is known as 'amboceptor.'

According to Humoral theory.

1. Natural immunity may be regarded as due to their being no appropriate receptors for the haptophore group of the toxin molecule and when those are absent no attack on cell-protoplasm is possible.

2. Active immunity is considered to be due to the co-operation of two substances (i.e.) Amboceptor and the Complement. Ehrlich calls a bactericidal serum complex which has these two substances present in it.

3. If a toxin and antitoxin be injected into the blood at the same time, the 'receptors' pass into chemical combination with 'haptophore' group of toxin molecule and a passive immunity is obtained which only lasts as long as the side chains are present in the circulation.

Passive immunity is due to receptors injected into the animal body.

4. Immunity against toxin is due to presence of 'receptors' and against bacillus due to that of 'amboceptors'

Hyperproduction of amboceptors according to Ehrlich is nothing but a normal function of the nutrition of the cells and the immunity it produces is therefore only one of its particular duties.

Difference between the two theories and the probable one in different forms of immunity.

While Metchnikoff asserts that the destruction of bacteria and neutralisation of toxins take place in the cells Ehrlich asserts that it is

in the body fluids especially in the blood. Metchnikoff is entirely vital while Ehrlich is mainly chemical.

The explanation offered by the humoral theory for natural immunity is far from being satisfactory. On the other hand passive immunity has been exhaustively explained by the side chain theory.

The humoral theory denies to the cell any role in defending the body against living organisms. On the other hand there is little or no evidence of extra cellular destruction of bacteria either in case of natural immunity or in the case of immunity following a natural attack of a disease, though it appears to be probable that in certain purely artificial degrees of immunity, bacteria may be destroyed in the cell free liquids of the body or at least without the agency of phagocytosis.

Germicidal property of serum is quoted in support of humoral theory. But now it is evident that such a property is absent in the blood plasma of the animal but is only possessed by the serum of the blood that is obtained after coagulation of blood in vitro.

Moreover there is practically no relationship between the possession of this germicidal property in blood serum or the strength of it to the degree of immunity possessed by the individual furnishing the serum. The blood serum is sometimes germicidal for animals that are remarkably susceptible and conversely the serum of an animal highly immuned may have no germicidal action. In evidence of the fact, when bacteria perish in the tissues of an immune animal, death is not due to any germicidal substance present in the liquid of the body.

A collodium capsule containing anthrax bacilli was introduced into the peritoneum of naturally immune animals against anthrax in such a way that the capsule was saturated with the juices of the part. It should be borne in mind. friends, that such a capsule permits the passage of fluids through its walls, but not of the animal cells. On removing the collodium after a reasonably long time it was discovered on examination that it contained an increase in the colony of anthrax bacillus. Thus the fluids of immune animals were not in any way deterimental to the development of bacilli. Thus the bacteria will grow quite well in the bodies of immune animals provided the leucocytes cannot get at them.

There are very many strong facts in support of cellular theory. It has been demonstrated that immunity or chances to recovery are roughly proportional to the activity of phagocytosis. When the

bacterium of fowl cholera is introduced subcutaneously into a pigeon which is highly susceptible for the said disease, there is very little migration of leucocytes and hardly any phagocytosis. The result is, the bacterium multiplies, invades the blood stream, disease assumes a virulent form aud animal rapidly dies.

When a similar experiment is conducted with the Guinea pig which has a considerable degree of immunity, the results are quite the opposite. There is a decided inflammatory reaction at the seat of inoculation in the form of a tumour. This reaction denotes an abundant migration of white cells and an active phagocytosis. A miniature battle is waged at the local lesions between the leucocytes and the bacteria in which the former come out victorious. Local lesion gradually diminishes in size and the Guinea pig makes a perfect recovery.

The predominance of phagocytosis observed in natural immunity is not absent in acquired immunity. Cadeae's experiments on two rabbits one susceptible to anthrax and another protected by vaccine confirm the above mentioned statement. Virus of anthrax was inoculated under the skin of both rabbits. In the unprotected rabbit, the seat of inocuation is flabby being poor in cells, is swollen which condition gradually extends to the neighbouring ganglion and the disease becomes generalised. In the protected rabbit, on the contrary is noticed a thickened mass full of leucocytes. Infection becomes localised, then bacilli disappear and animal gets cured.

The extent of local reaction in an artificially inoculated animal is proportional to the degree of immunity it confers against that particular organism. This every day experience is strongly in favour of phagocytic theory.

"Whilst the theory of phagocytosis has been consolidated by the demonstration,

1. That the phagocytes in cases of immunity ingest and destroy the living and virulent micro-organisms whithout the latter needing to be previously deprived of their toxin.

2. That the phagocytes absorb toxic substances.

3. That the phagocytes contain bactericidal cystases and produce fixatives, the humoral theory in spite of all the efforts made to defend them could never be developed as theories that were, in the slightest degree of general application.

The humoral theory based on the anti toxic and protective power of the body fluids can claim only a very restricted application

These properties are met with in acquired immunity only and even there not constant. Many cases of acquired immunity against micro-organisms are unaccompanied by any antitoxic power and in several examples of this immunity the body fluids do not exhibit any protective power.

There is only one constant element in immunity whether innate or acquired and that is phagocytosis. The extension and importance of this factor can no longer be denied. The absence of the antitoxic power in the fluids of the body taken in connection with a well marked phagocytic reaction in large number of cases of immunity natural and acquired has turned the scale in favour of the cellular theory."

Such was the opinion of Metchnikoff on the subject, and I could not resist the temptation of quoting his opinion on the subject for the simple reason that the statement is based entirely on facts. Any impartial man would have passed the same verdict were he to face facts and the remarks are not the less true to-day than when it was made years ago.

Thus natural immunity is explained by the cellular theory and acquired immunity by humoral theory of Ehrlich and by so many others. Thus immunity is the resultant of the efforts of the various parts of the body protecting in various ways. They are all right from their own point of view and for one who utilises these for practical use, all of them will have to be made use of.

Besides the phagocytes and the protective bodies, saliva, tears, gastric juice and bile are of great use, in destroying microbes by their antiseptic properties. But for the antiseptic properties of gastric juice and bile what amount of fermentation, decomposition and destruction would have occurred in the animal body.

The latest theory on immunity is

Wright's opsonic theory.—Opsonic theory is very much like the combination of the humoral and phagocytic theories. Wright has shown that the blood serum contains an anti body which possesses the power of sensitizing the bacteria and thus preparing them an easy prey to the voracity of phagocytes. This anti-body is known as 'Opsonin' or 'feast preparer.' It is said that the opsonic power which the serum has on a particular organism is specific, for, when an animal has a certain opsonic index during the course of a microbial disease, the further entrance of a different microbe does not alter the original opsonic index in one way or the other.

Wright maintains that in an animal recovered from an attack o a specific disease, the opsonic power to that bacterium is markedly developed in the serum of that animal that a second attack is checked due to the combined efforts of the increased opsonic power and phagocytosis. This discovery of Wright has been put to a practical use in preparations of vaccines in treatment of certain diseases. Wright's vaccine preparation against an ordinary troublesome boil is the best example. It is prepared of attenuated aud dead organisms and at first subcutaneously injected in small doses (50 m.m.). Soon after injection a certain opsonic index is present, during which the white blood corpuscles do not possess the same power of offence as they did before vaccination. But this is soon replaced in the course of 4 or 5 days, when they have a higher power of offence. Now a greater quantity 150 m.m. is given, when at first a similar fall and then a marked rise in opsonic index occurs. In this way, a course of vaccination furnishes the white blood corpuscles a very high power of offence against invading organism due to increased opsonic index and offending organisms are destroyed and immunity established.

We should have the following data before us in estimating the opsonic power and conferring immunity by vaccination.

1. Natural power of resistance or at what point opsonic index stands.

2. Efforts of Nature to overcome disease whether opsonic index rises or falls. These informations assist in fixing the proper dose and to observe how the animal responds to vaccine stimulus.

In estimating the opsonic index of blood we should have with us.

1. A tubule of patient's serum. 2. Control serum.

3. Washed emulsion of leucocytes 4. Emulsion of bacteria.

We have two pipettes with rubber teats in the first of which we have a mixture of serum of patient, leucocytes, emulsion of bacteria and a column of air. Now the end of pipette is sealed and is incubated at 37° C. for 15 minutes.

Similary we treat pipette No. 2, by replacing patient's serum with control serum and incubate.

After it has been incubated properly the closed end is scratched off. A few drops from each pipette is made into a film by a spreader on the convex surface of a clean grease-free slide. They are fixed by a saturated aqueous solution of mercury perchloride for $\frac{1}{2}$ to 1 minute and then washed in the tap, aired and stained.

...ture of 10-12 days standing which is fatal to both mice ...ing pigs and produces fever in rabbits is used for second vaccination.

(*To be continued.*)

DEPARTMENTAL NOTES AND NEWS

...regret to record the death of Veterinary Assistant ...geons C. Brown, N. Soundararajan and C. Subramaniam.

2. Veterinary Dispensaries were opened at Kallakurichi, Gobichettipalayam, Harpanahalli and Krishnagiri on 12th October 1924, 11th June 1925, 19th July 1925 and 28th August 1925 respectively.

3. Three touring billets have been created at Hosur, Namakkal and Chandragiri and the Touring Veterinary Assistant Surgeon at Hosur is also in charge of the Agricultural Livestock at the Hosur cattle farm.

4. M.R.Ry. M. R. Vasudeva Panikkar, M.R.C.V.S., B.Sc., (Edin) has been acting as Officer in charge I Circle, Civil Veterinary Department, Vizagapatam, vice Mr. T. J. Hurley on other duty at the Madras Veterinary College. He took charge of the Circle on 21st December 1924 fore-noon. M.R.Ry. M. Anantanarayana Rao was, on relief, reverted to his permanent appointment at the Madras Veterinary College.

5. Mr. D. A. D. Aitchison, Principal, Madras Veterinary College is on 6 months' leave from 17th July 1925.

6. Mr. F. Ware on return from leave resumed charge as Chief Superintendent, Civil Veterinary Department on 8th October 1925 and shortly afterwards has been appointed by Government as their Veterinary Adviser with control of the Madras Veterinary College until the return of Mr. D. A. D. Aitchison from leave.

6. Government have sanctioned the institution of a Refresher Course for 6 Veterinary Assistant Surgeons of this department for 6 months from 1st July 1925.

7. Fees for inoculation against Rinderpest by the 'Serum alone' method have been abolished with effect from 1st April 1925.

M.R.Ry C. Venkataratnam Chetty, Chief Superintendent of Cattle depots, Madras Corporation, was reverted to this Department, on 27th October 1925, his services not being required any further in the Corporation.

The film is examined under a low power of lens and it wil be seen many of the polynuclear leucocytes contained bacteria.

A count of leucocytes containing bacteria is made up to fifty with the aid of a paper and pencil near the microscope first from the slide from control serum and next from slide with the patient's serum. The ratio between the two gives the opsonic index.

Thus if 50 leucocytes of control serum had ingested 150 bacteria and 50 of the patient's ingested 80 bacteria the ratio $80 \div 150 = 0{\cdot}53$ is the opsonic power or index of patient. If the control animal were to be considered normal the patient's index is nearly 50% below normal.

Phenomena following active immunisation by vaccines.—

The injection of a suitable dose of vaccine is followed by a slight systemic disturbance of the animal. There is a rise of temperature, accelerated pulse, increased respiration and animal is weak and dull. If the vaccine has been used for a local lesion as Quittor, poll-evil, or fistulous withers, there is an increased discharge from lesion and animal evinces great pain. These consequences are due to a fall in the amount of opsonin present in the serum, as a result of the concentration of all available opsonin towards the bacteria introduced. This fall in the opsonic index is called the 'Negative phase' which usually lasts from 24 to 36 hours. It may last for a number of days or be completely absent depending on dose of vaccine used.

After the lapse of the said time, the above mentioned symptoms disappear, the condition of animal is good and appears brighter when it is said to have reached the 'Positive phase' This is due to increased output of opsonin due to the stimulus given by the vaccine. This opsonic index gradually rises for about two days when it reaches the maximum stage. This maximum increase of opsonic index is known as 'Phase of increased resistance'

Immunizer should aim at having the positive phase as long as possible and negative phase of the shortest duration, which is possible when a suitable vaccine of a proper dose is used.

The positive phase commences sooner or later according as the dose is smaller or larger. In acute diseases as pneumonia we give the minimum dose as we want the positive phase at the earliest possible time. Another larger dose may be given before the transient positive phase passes off. In chronic diseases, where there is no risk of high temperature we may give a full dose. A second dose should be given when the effects of the first are failing and this

time a larger dose may be given. On the contrary if there [illegible] response to a first vaccine, we can straightaway give a second and larger dose.

When the dose is too small we get a positive phase at once. If it is too large, a negative phase of long duration which in the hands of the immunizer should never occur. If vaccine treatment is to be carried out when there is a high rise of temperature a full dose of salicylic acid three or five hours before injection is advised.

Now we come to the various means of producing immunity. Active immunity could be conferred on animals by anyone of these following methods.

1. By injection of a pure virus (*i.e.*) sheep-pox, Bovine pleuro-pneumonia.

2. By injection of attenuated virus either by heating or drying (*i.e.*) Anthrax, Quarter evil, Rabies.

3. By injection of virus attenuated by methods of passage through another species (*i.e.*) Small-pox, Swine Erysepelas.

4. By attenuation from unknown causes of the virus occurring in the bodies of the sick or recovered animals (*i.e.*) Rinderpest bile, the blood of recovered cases of Texas fever.

5. By sero-virus inoculation either simultaneously or successively mixed (*i.e.*) Rinderpest, sheep-pox, Quarter evil.

In the following paragraphs, I briefly mention how active immunity in various diseases is conferred and I hope the method of description may be looked upon with a lenient view due to the fact that I have to make mention of a number of cases.

1. *Sheep-Pox.*—Clavelisation or ovination is the inoculation of the virus of sheep-pox, just as the variolisation of man was practised before the discovery of cow-pox.

Contagious Bovine pleuropneumonia.—The inoculation of the clear pulmonary fluid found in chest cavity or effusions from infiltrated lung of bovines dead of lung plague. Recently it has been filtered through Bedford-filters as the organism passes through them being the smallest organism known. This is more efficacious and is of unreproachable purity.

2. *Anthrax.*—Bouillon culture of bacillus anthracis at 42° 5°c of required standard is prepared.

A culture of 15-20 days standing which is fatal to mice and produces fever to Guinea pigs and rabbits is used for Pasteur's first vaccination.

Advertisement Rates

The Journal has a wide circulation among veterinarians and the general public interested in live-stock in the Madras Presidency and elsewhere. Such articles as are useful to touring officers as camp equipment, books, etc., also veterinary instruments, appliances and drugs, and other articles of trade, can be advertised with advantage through this medium.

The following is the schedule of rates:—

	Single insertion.	Per annum
For full page	Rs. 8	Rs. 25
Half page	Rs. 5	Rs. 15
Quarter Page	Rs. 3	Rs. 10

Short trade-advertisements of 6 lines and under are charged Re 1 each.

Preparation of blocks unless supplied by the advertiser charged extra and all charges are payable in advance.

All business and literary communications should be addressed to:—

THE EDITOR,

Madras Veterinary Journal,

CHEPAUK, MADRAS.

PRINTED AT THE N. M. S. PRESS, VEPERY, MADRAS—1925.