The tropical diseases of the horse

THE TROPICAL DISEASES

OF

THE HORSE

BY

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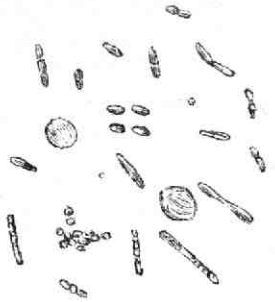
To

GEORGE FLEMING, C.B., D.C.L., LL.D., F.R.C.V.S.,

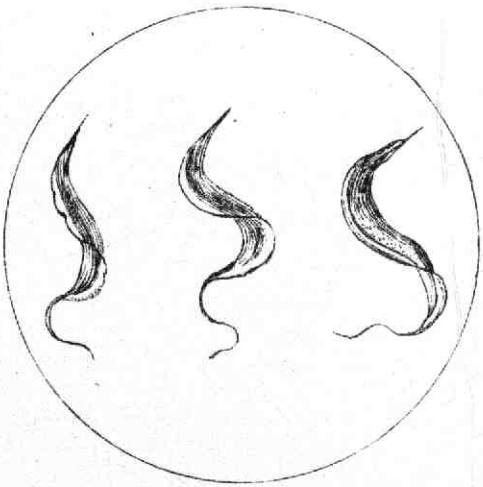
ETC. ETC.,

THIS WORK IS DEDICATED,

IN ACKNOWLEDGMENT OF THE MANY AND GREAT
ADVANCES HE HAS MADE IN OUR KNOWLEDGE
OF VETERINARY SCIENCE AND THE CARE
HE HAS BESTOWED IN IMPROVING
VETERINARY LITERATURE
FOR NEARLY THIRTY
YEARS.



Bacilli of Malignant Œdema.



The Surra Parasites.

PREFACE.

This work is intended as a guide for veterinary students and others proceeding to India. In the present edition several sections have been re-written, and I have added a new chapter each on Khujli, Kenchul, Pithkharish, Charak, Korhi, and Fungus-foot of India, which I trust will be found useful.

The original plan was to embody in it a description of *all* the diseases of the horse seen in India, but this is obviously a task which can only be accomplished by several larger treatises, and the present is only a manual dealing with diseases in a greater or less measure peculiar to India.

The many kind appreciative comments that have been made on it by the professional press, coupled with the suggestion of friends, have led me to bring out a second edition of my work in less than eighteen months after publication of the first, as the latter is now exhausted, with the exception of a few copies.

It has been my endeavour to give a clear and concise sketch of the leading facts relating to tropical diseases, without embarrassing the reader with minute details or minor points, and without entering into prolonged discussion or any other species of controversy. I am assured

that such a book, if properly executed, is much wanted, not only by the students at the several Colleges at home, and by young officers of the Veterinary Department serving in India, but also by the general reader, who may not find time for the perusal of larger treatises on General Surgery and Medicine.

In order that the volume might be compact, and fit for the pocket of the student, or the portmanteau of the young Indian officer (who always finds it difficult to carry large books about with him), I have tried to avoid the use of a single superfluous word. It is for others to decide whether I have succeeded in this endeavour.

Those who wish to peruse the subject, or any part of it, into more detail, will find an index to the best works in my footnotes, and in the notes at the end of each chapter.

I believe that I have simplified matters very materially in regard to the varieties and nomenclature of tropical diseases in our equine patients.

India still offers the best, the widest, the most fruitful field for pathological investigation; and in no other service than in that of the Veterinary Department has a young officer so fair a chance of advancing our knowledge of disease. As a necessary part of his education, and as one of the means of making himself competent to this full discharge of his duties, every young practitioner or army veterinarian, before going to the East, ought to make himself thoroughly acquainted with at least the main facts of tropical diseases.

If this little book prove of any benefit, if it encourage young men to go and follow the example of those before their time, its chief purpose will have been fulfilled.

I wish to take this opportunity of expressing my gra-

titude to all those members of the profession who have given their generous help and advice on every occasion of my attending and making inquiries into the pathology of disease among horses in India.

My temporary visits to Allahabad, Dinapore, Lucknow, and Meerut, have been of much advantage, more particularly in connection with the section dealing with the different forms of Anthrax in this book.

Referring to my report on the Meerut outbreak of 1886-7, and the subject of so-called "Influenza" in the horse being probably divisible into Intermittent and Remittent, as well as other forms of fever, we are much pleased to see a discussion quite recently carried on, on this subject, in England, by Mr. Briggs, whose account may be read in the June number of the *Veterinarian*. Also an article by Martin in the last number of the *Deutsche Zeitschrift für Thiermedicin und vergleichende Pathology*. Important and interesting results have also been made more especially as regards the essential nature of 'malaria' and the classification of organisms devloped in connection with malarial diseases. More recently Dr. Vandyke Carter, of Bombay, asserts that he has ascertained that in remittent fever of man the blood contains parasites, which in their morphologyand general features are indentical with the parasites of Surra in the lower animals.

Sufficient attention has not hitherto been given to this field of inquiry, which is capable of being greatly developed. The practical value of studying the several varieties of Influenza so far as they help the classification of fevers, has been to a great extent recognised, but no systematic measures have been taken to separate a long list of fevers which are described promiscuously along

with the ordinary "Influenza." Considering the importance of these fevers, *e. g.*, Intermittent, Remittent, and a host of others, the subject is worthy, I think, of being specially investigated.

I am also greatly indebted to many contributors for valuable information derived from their own experience of outbreaks of disease in many stations in India they have had opportunities of visiting. In this way some very useful information has been collected for comparison and record.

From Messrs. Gresswell, of Louth, I have received valuable assistance in explaining the pathology of Malignant Œdema; and as they have recorded their experience of this disease in England, corroborating my own as it is witnessed in this country, these experiences have resulted to our mutual advantage.

We are proud to know that veterinary surgeons who have served in India have lately made such rapid progress in the knowledge of Surra; but we must gratefully acknowledge the heroic self-sacrificing and successful labours of Dr. Griffith Evans and Mr. Steel chiefly and especially.

I wish also to acknowledge with many thanks the kind assistance rendered by Mr. Stanley Ismay, Deputy Commissioner, of Jubbulpore, in my inquiry into the geological nature of the soil of these districts as influencing the spread or otherwise of Barsáti. This inquiry, together with a study of the clinical and pathological characters, will, it is hoped, prove useful in facilitating the indentification of one of our most prevalent diseases in India.

Jubbulpore;
October, 1888.

R. W. BURKE.

CHAPTER I.

ANTHRAX.*

NUMEROUS articles have lately appeared on anthrax as it affects animals in India, but I do not think the subject has been advanced any farther than was already known regarding it many years ago. Without going into details, I may be permitted, in the short space at my disposal, to record the salient features of the disease, and the different clinical aspects it presents, from my own experience of it.

Although always the same disease, dependent on a common cause, its modes of manifestation vary considerably in different outbreaks and in different cases in the same outbreak. My experience leads me to recognise the following divisions, which may be made for convenience of description, *viz.*, the respiratory, gastro-intestinal, renal, hepatic, nervous, subcutaneous or carbuncular, cutaneous, and intermittent and remittent forms.

* See *Veterinary Journal*, Feb., 1887.

In some works on veterinary pathology the above are divided into internal and external forms of anthrax: this division has many supporters, inasmuch as the fatality varies so greatly in the internal and external forms of the disease, requiring separate description. There is no doubt, too, that frequently one type of the disease runs into the other, and sometimes one or more types co-exist; but according to my experience, the external form seldom leads to the internal, and, when not a complication, is generally less fatal than it.

THE RESPIRATORY form of anthrax shows itself as a specific pneumonia. This form of the disease has been very clearly sketched by Toussaint, and need not call for description here.

GASTRO-INTESTINAL form of anthrax presents all the symptoms of acute gastro-enteritis and *post-mortem* examination shows the effusions peculiar to anthrax, which do not appear in simple gastro-enteritis. Occasionally, the lesions of anthrax located in the alimentary canal are so marked, that symptoms of acute dysentery, with œdema, degeneration and sloughing of the mucous membrane in small patches, and even prolapsus recti, result. Death takes place usually in about seven hours, although it may be earlier in some, and later in other cases.

THE RENAL form of antrhax is ushered in with symptoms of acute nephritis, and rapid death, owing to inaction of the kidneys and uræmia. *Post-mortem* examination shows changes peculiar to anthrax located principally about the kidneys and in the renal structure. The presence of the *bacillus anthracis* may be detected on examining sections of the latter organ under the microscope, in the afferent and efferent vessels, in the glomer-

uli, and even in the parenchyma of the kidney outside the vessel walls, and in the uriniferous tubules. Consequently, the urine is a source of danger in outbreaks of anthrax, and the bedding of affected animals should be always burnt.

THE HEPATIC form, where, according to my experience, the symptoms of hepatitis follow in the course of the general symptoms peculiar to anthrax. It seldom appears as a primary symptom. Consequently I look on it as more a result, than a distinct variety of anthrax. Some observers, however, maintain that the symptoms of hepatitis are prominent from the first, and, therefore, believe the hepatic disease to be a distinct form of anthrax.

THE NERVOUS, or NEUROTIC forms.—I have met with three distinct varieties of this form of anthrax in India, which I may divide into the apoplectic, the furious, and the paralytic. An animal, without having shown any signs of illness, will suddenly fall to the ground, as if struck by lightening. In other cases the animal trembles, showing laboured breathing, a weak, small character of the pulse, and marked palpitation; is stupified, stumbles about and becomes very excitable and unmanageable towards the close, often tearing his own flesh with his teeth (furious anthrax.) Convulsions usually precede death. Sometimes paralysis sets in early in this disease, death taking place usually a few minutes after the animal has fallen to the ground.

THE APOPLECTIC form is the most common variety of anthrax met with among camels in India, while it is occasionally seen also in horses and in oxen. The furious and paralytic forms are chiefly seen in the horse. It is

well known to the Germans; for, I find Röll in his *Lehrbuch der Pathologie und Therapie der Thierarzte, 1885*, says, "that the common people in some parts of Germany speak of it as the Devil's shot, blood-plague," etc., and he regards it as a very frequent variety of anthrax in Germany. Horses usually drop to the ground suddenly, and expire without a struggle. Camels, in most cases, 'run wild' for about fifty paces or so, and suddenly drop to the ground as if shot, and usually die without a struggle. Dr. Röll believes death follows through paralysis of the lungs and heart's action. My observations of a great many cases lead me to confirm this view, while in other cases in which death was more rapid, or I may say instantaneous, it was caused by shock. *Post-mortem* examination shows no congestion of the brain, and hence some object to the use of the term 'apoplectic.' If so, we may speak of it as that form of anthrax in which death usually takes place by nervous shock, to avoid misapprehension.

Diagnosis: The furious and paralytic forms of anthrax are liable to be mistaken chiefly for rabies. When paralysis is the main symptom, the diseases with which it may be mistaken are rabies, kamri, beri-beri, remittent fever and other diseases of the blood attended with effusion on, or changes in the spine. Diagnosis will be rendered easy by (*a*) a microscopic examination of the blood and other tissues showing presence of the *bacillus anthracis* peculiar to anthrax; by (*b*) the history of the case, and the appearance of the disease in other forms in other animals; and (*c*) the course and symptoms of the disease.

CARBUNCLE.—Is the Ludhiana* form of anthrax, and occurs as a subcutaneous infiltration and enlargement which, in the horse in India, is seen chiefly under the jaws and region of the throat. Dieckerhoff, of Berlin, agrees with us in this opinion. (*Lehrbuch der Speciellen Pathologie und Therapie der Thierarzte, 1885.*) It leads to death usually from suffocation, owing to the mechanical obstruction that results from œdema of the larynx.

The swellings are diffuse or circumscribed, sometimes fluctuating, but usually tense, and there is no crackling sound communicated to the fingers on percussion.

Bollinger and Feser in Bavaria, and Arloing, Thomas and Cornevin in France have noted the presence of the bacillus anthracis in the blood and other tissues of animals affected with *emphysema iufectuosum* and have concluded that the presence of the organism confirmed the identity of *emphysema infectuosum* and anthrax beyond doubt. But it is also known that "anthrax very frequently makes its appearance at the same time as *emphysema infectuosum*" (Röll); and we have no evidence to show that the two diseases have not often coexisted in the same animal.

* We have sometimes wondered why, in these days of reformed spelling, grammarians, translators, and lexicographers as they are, cling to Lodiana as the proper spelling of this well known station. We have even suspected that their way must be right and the official "Ludhiana" wrong. But we learn from several recent references, that Ludhiana, pronounced Loodhiana, gives the sound as nearly as possible in English letters. When the British veterinarians went there in 1841 to investigate the disease which is named after the station, they found that some Civilians had invented an etymology for the name, as the abode of the Lodi, and were calling it Lodiana, so they did the same. And it has become more difficult each outbreak since, to change the widely known name of the "Lodiana Disease."

Hess* has now shown that milzbrand and 'rauschbrand' (*emphysema infectuosum*) are not the same disease. The fungus causing the latter has been carefully studied by several authors, but it is difficult to say whether the descriptions of Arloing, Feser, Ehler, or William Koch are the most correct regarding its chief characteristics. Feser and Arloing's observations show that the bacillus is constantly found in the body of animals affected with rauschbrand, and that the disease is inoculable. The fungus remains in a spore form in the body, and all the disease changes are dependent on this, which is, at present, a large fact in itself, although not a complete enough one.

Although this malady (charbon symptomatique of the French, rauschbrand of the Germans, and quarter-ill, black-leg, *etc.* of the English) has great resemblance to anthrax proper, it is clearly a disease of its own, having nothing in common with anthrax, for the following reasons:

(*a*) The fungus of *emphysema infectuosum* is, according to Arloing, quite distinct, both in its morphological characters and mode of growth, from the bacillus anthracis; (*b*) *Emphysema infectuosum* cannot be communicated to rabbits and young calves, and only in a mild form to horses, donkeys, and white rats, which take anthrax readily by inoculation; (*c*) A large quantity of fluid is requisite in order to transmit *emphysema infectuosum* from one animal to another, whereas a very

* *E. Hess, Bericht über die entschädigten Rauschbrand und Milzbrandfälle im Kanton Bern Während der Jahre 1884 und 1885, nebst einer Wissenschaftlichen Abhandlung über den Zusammenhang der atmosphärischen Einflusse mit dem Rauschbrand. Bern, 1886.*

small quantity suffices in the case of anthrax ; (*d*) Injection of a small quantity of virus protects against future attacks of *emphysema infectuosum*, but gives no immunity against anthrax ; (*e*) In anthrax the blood and the spleen generally show marked changes, but in this disease they remain unaltered ; (*f*) This disease is caused by bacilli, but is not set up if the bacilli are introduced into the circulating blood : in order to produce it the bacilli must act in the cellular tissue.

I have to mention in this connection a form of MALIGNANT SORE-THROAT in cattle which I was deputed to investigate* some time since at Allahabad. I was ordered there to inquire into an outbreak of disease reported as anthrax. My investigations led me to these conclusions, briefly : (*a*) Malignant sore-throat in cattle is caused by the *bacillus œdematis*, which is transmissible from oxen to oxen by inoculation ; (*b*) The fatality is low in cases in which early fomentation and blisters to the throat have been resorted to ; (*c*) The cause of death is purely accidental, and due to mechanical obstruction of the throat, and suffocation (*Veterinary Journal*, April, 1886.) It should be stated that, Messrs. Gresswell (*Ibid*, Nov., 1886) who have recently investigated this disease, have confirmed my observations relative to the nature of the germ which causes it, and have shown that it is a specific disease distinct from anthrax. It gives us great pleasure to find our observations corroborated by such able veterinarians. I trust that the cases I have reported may suffice to show that by early treatment of throat lesions, a class of cases

* See Reports Nos. 552 and 553, dated 18th January, 1886, to the Inspecting Veterinary Surgeon, 2nd Circle, Bengal.

hitherto found most intractable, and extremely fatal when left alone to chance, is capable of being very satisfactorily dealt with.

I have seen the same disease, lately, in the dog, in which it was characterised by the appearance of a large swelling of the throat and neck, the swelling being at first painful and tense, but rapidly becoming painless and crepitating. It was followed by sloughing of the throat, and was fatal. The same bacilli were found in the fluid punctured from the swelling, as I showed in the malignant œdema of cattle.

Kitt † shows the resemblance which exists between the bacillus of charbon symptomatique and that of malignant œdema, which is so frequently seen in the lower animals. In their clinical and pathological features the "two" diseases are identical. Kitt shows that the bacillus of malignant œdema is transformed into that of charbon symptomatique, which must be considered a common variety, presenting similar biological characters.

THE CUTANEOUS form of anthrax, in which the structures of the skin are primarily invaded, leading te eruptions, boils and abscesses. This is the least dangerous form of anthrax, because results due to changes in the skin are not at all comparable with those following changes in more important organs of the body, as the lungs, intestines, kidneys, etc. The functions of the skin can be taken up more easily by the lungs and kidneys, than those of the latter can by the skin, when labouring under disease or derangement. And this fact has often been overlooked, it has seemed to me, in considering the relation of external to internal anthrax.

† *Deuts. Zeits. für. Thiermed. u. Vergl. Pathologie, 13 Bd., 4 u. 5 Heft. 1887.*

INTERMITTENT ANTHRAX is that form of the disease where the animal revives after an attack, and some days after a relapse occurs, and the case is often entered as a fresh one. This form of the disease was first noticed, in cattle, by Bollinger; and in the last outbreak of anthrax in Government camels at Cawnpore, I recorded several such cases. (*Report on Anthrax in Camels*, dated Cawnpore, 1885-86.)

I have seen a few instances in which relapse was noted during the course of anthrax fever in horses, the term not being made use of unless there had been decided return of the symptoms of anthrax and of bacilli in the blood, accompanied by a temperature above the normal, the condition being remarked usually every fourth day, and in many cases lasting longer than 24 hours. Veterinary surgeon Hazelton (*Quarterly Journal of Veterinary Science in India*, April, 1888) who has lately investigated an outbreak of anthrax at St. Thomas' Mount, practically confirms these observations relative to the temperature variations seen in anthrax which I had shown in my *Report* dated Meerut, 1886-87.

Simple remittent fever in animals terminates not unfrequently in anthrax, the same as in typhoid fever seen in man; for remmittent fever is no bar to other specific diseases, especially anthrax in animals, and often coexists with the latter, as I have shown. The question arises, Is there a form of remittent anthrax distinct from simple remittent fever, or is the one a precursor of the other? I think we must acknowledge both views to be correct, for, judging from recent experience, we know that, whilst anthrax fever of a remittent type was prevalent in one part of the station, carrying off several

animals, in another part of the same station there were cases of simple intermittent and remittent fever without, in this instance, causing a single death. This I noted in an outbreak of disease in "waler" remounts arrived from Calcutta during January 1887, when anthrax among the horses of the 8th Hussars had all but ceased, in Meerut.

Besides the above-named varieties of anthrax, many cases are complicated with hæmorrhage from natural openings, as the nostrils, urethra, anus, etc. Death frequently results from hæmorrhage into the abdomen and thorax, due to rapid multiplication of the bacillus anthracis and plugging of the capillaries, producing rupture.

If I needed anything to confirm my faith in the different forms of anthrax I have described and seen in India, enough could be found in the literature of the subject, which has been lately described by French, German, and Swiss veterinarians. If it be asked to whom these observations are due, it becomes difficult to do justice to British veterinarians and to others at the same time. With regard to the features of anthrax mentioned, I can honestly say that most of the forms I have described I have met with myself; but I must add (1) that they are the same, or nearly the same as those described by a Committee of veterinary surgeons appointed by the Government of India to report on the disease many years ago; and (2) that they are the same, or nearly the same as those described by continental veterinarians. We, I believe, had long been anticipated by the latter, who got the start of English veterinarians in these matters, and who are, moreover,

now ahead of us. To Bollinger, Röll, Dieckerhoff, Friedberger and Fröhner, more than to any other, we owe our sense of indebtedness for all our knowledge, and who are the first authorities in Europe on this subject, and second to none in the world.

CONTAGION OF ANTHRAX.

The modes of conveyance of the germs have no special relation to the question of anthrax only: it is not settled by what channels, in each instance, the germs of specific diseases in general travel. Thus, cholera, typhoid fever, etc., have each its suspected sources, but no one source can be made to apply in each particular outbreak. It is possible the germs travel through various channels, some known and others unknown. Among some of the known channels may be mentioned the air (Tyndall); water; grass-roots obtained from burial grounds of anthrax affected animals, where earthworms (Darwin) act as the intermediate bearers; and direct contagion from animal to animal. From what I lately saw of an outbreak of anthrax in horses of the 17th Lancers and Native Cavalry Regiment at Lucknow, I have little faith in air as a medium of contagion in this disease, as the two batteries of Artillery close to the Native Cavalry Regiment escaped contagion, although not many yards' distant from the Cavalry lines. However, a volatile form of contagion in anthrax is recognised by many observers. Zundel (*Recueil de Med. Veterinaire, May and June, 1871*) recognises a fixed and a volatile contagion in anthrax; and Fleming also mentions it. Many so-called spontaneous outbreaks of the disease may be explained

on the possibility of air being a medium of contagion, the germs floating in the air, more during certain conditions than during others, alight on susceptible animals.

Though anthrax is almost always confined to horses without necessarily affecting the ponies that have to bring the grass, it is not always easy to trace a direct source of infection to the latter. The disease may be carried by flies, or by other agencies abovementioned, in different outbreaks; but often I have had reason to believe it was caused by the germs existing on the herbage. It has been too generally concluded that the bacillus anthracis is a parasite whose natural habitat is the animal tissues, and is only accidentally present on vegetation, instead of, as I believe, the exact reverse—that it is naturally present on the vegetation and only accidentally present in the animal body, which is probably also the case with other diseases caused by bacteria. Nowhere is anthrax so prevalent or so fatal, we have seen, as in grass-lands in India where cattle have not grazed before—a fact which many native breeders of horses, as well as cattle and sheep owners and others in India have learned to their cost. By successive or continuous occupation, and by drainage, such pasturage becomes healthy. These results speak for themselves, and I do not think there is any other method of treatment which will suppress such outbreaks, though there are many therapeutic agents which act beneficially in individual cases, but in an inferior degree.

Instances of anthrax communication by affected animals, I have reported in the case of this disease introduced among camels belonging to the Army Transport

at Cawnpore, on the arrival of affected animals from Allahabad ; and also in the case of slaughter cattle at Allahabad some years ago, through inter-communication of suspected cattle employed in carrying fodder for healthy ones. Such instances could be multiplied *ad infinitum*.

Among indirect means of contagion may be mentioned the excreta of animals affected with this disease, and, bedding, clothing, utensils, etc., used by them. Also flies, vultures, jackals, &c., all of which may be active agents in promoting the spread of anthrax. And, lastly, the bodies of affected animals in particular, which should be always cremated. If this were done in the case of village cattle also, and burial prohibited, we should hear less about grass-cutters' ponies introducing anthrax into cantonments than we now do.

The bacillus anthracis, by its excessive multiplication, has a mechanical effect, apart from all other considerations, in impeding the action of the heart, in blocking up the minute capillaries of important glands and preventing secretion and excretion, etc., as evidenced by the symptoms of this disease. In the heart the bacilli of anthrax abound within and around the vessels, and in the interspaces of the muscular fibres. In the liver they occur in the intralobular venule and its adjacent capillaries. In the kidneys they are found especially in the glomeruli near the surface of the organ, in the afferent and efferent small vessels, and in the uriniferous tabules and in the urine. They exist also in the milk. In the lungs they are found in great numbers around the alveoli, completely choking the minute capillaries, and leading, in other situations, to rupture,

ecchymosis, and effusions. When the effusion is excessive, and near important organs, as round the larynx, it is sometimes the immediate cause of death. It interferes with, or entirely suspends the function of important organs by its pressure. When the effusion occurs under the skin, it frequently constitutes well defined tumours.

The blood in anthrax shows an excess of white cells, with the presence of *bacilli anthracis*, is unusually dark, and does not readily coagulate.

The micro-organism of anthrax has certain distinctive characters, which will enable one to distinguish it in good specimens with a reasonable degree of certainty; but in many cases a doubt is left in our mind which can only be removed by the test of inoculation. The anthrax bacilli usually appear under the microscope as short, stiff, non-motile rods, and have their ends cut off somewhat abruptly, as it were; although this varies in some cases. They vary also in size in different animals (*Deutsche med. Wochens.*, 1881,) and sometimes in the same animal. (*Report on Anthrax* in Meerut, 1886-7.) The form and external appearance of a microscopical organism, is not sufficient to characterise it, and I repeat that the expert has no right to assert the existence of anthrax unless inoculation with the suspected liquid has given anthrax to animals used for experiments—guinea pigs or rabbits.

The bacillus anthracis was among the first organisms noted as being causative of disease, and the merit of its discovery rests with Délafond.* To determine its pre-

* *Traitè sur la Maladie du Sang des Betes bovines. Paris, 1843.*

sence the fluid and solid tissues should be simultaneously examined; it abounds more during some stages of the disease than during others, and hence hurried conclusions are apt to be formed when examining the blood only during certain stages.

COURSE.

ANTHRAX ACUTISSIMUS, ACUTUS, AND SUB-ACUTUS.

Regarding the course of the disease, a very important research, bearing on the conditions of infection of specific diseases, has been recently made in England. In this research it has been pointed out that the initial dose of virus is of great importance, and in many instances exercises a marked influence on the *course and virulence* of the disease. Various laws have now been made out—for example, the pathogenic dose of a virus varies inversely with the predisposition of the animals to the disease in question; in animals not very susceptible to a disease, the severity of the affection varies directly within certain limits with the amount of the virus introduced, etc. It is found that in some cases a small dose of a virus produces only a local effect, while a larger dose kills the animal, and the small dose often protects the animal from the fatal effect of a subsequent large dose. Although it is as yet impossible to measure predisposition, and thus to decide the dose for any animal, still the knowledge of the relation between these two factors is of great importance in throwing light on its spread in many outbreaks; while the fact that a considerable quantity of the virus is in many cases necessary for the production of a disease, explains many anomalies, and affords indications for preventive measures.

There are some animals which will take the disease in a very virulent type, and die rapidly, whilst in other animals the same micro-organisms will prove relatively inocuous, or produce only a very mild attack, characterised by a prolonged course. It is the same with other diseases: each animal has its own idiosyncracies for nourishing and for starving micro-organisms, since every nutrient soil is not equally adapted to the same microzoon. But not only is the difference of the same tissue in different animals the reason of a different behaviour of the same microzoon, the tissue itself, in one and the same animal, may change under different conditions. It is possible that changes may take place in the system of the animal, unknown perhaps to ourselves, but very important to the respective micro-organisms. I will only allude to 'vaccination' as a preventive of disease, which evidently changes the nutrient soil, so that the microzoa of that particular disease can no longer find nourishment, and the vaccinated animals remain unaltered by an injection which would have proved rapidly fatal if non-vaccinated. It is furrher ascertained, as a matter of observation, that certain micro-organisms cannot thrive well, or do so very imperfectly in one body under certain conditions, whereas they may be pernicious when certain other conditions are present. It is known that, not only in an animal's body, but cultivated in artificial media, bacteria may retain their properties unaltered, or they may undergo more or less modification.

If it is true that not every nutrient soil is equally well adapted to a certain microzoon, that microzoon developing better in one constitution than in another, it must consequently be true, that one microzoon may

be so changed that it may occasionally show some difference, according to its surrounding conditions, in its mode of growth and other peculiarities, to such an extent that its pathogenic activity night be lessened or strengthened according to those conditions. This idea is in accordance with what daily experience teaches with respect to plants and animals. Plants put in a convenient soil may grow extremely well, and may, to a certain extent, change their colour, smell and other qualities, but put in a bad soil, they will not thrive, or but imperfectly.

TREATMEMT.

Carbolic acid was first recommended by Dr. Fleming, and found very useful in many outbreaks, and in the *Vratch* several leading articles have recently appeared, lauding the therapeutic value of carbolic acid in the treatment of anthrax in man. Mr. Meyrick suggests that a convenient method of administering carbolic acid is that of employing carbolate of soda. Many years ago, Dr. Beale, in his work on Disease Germs, showed that the carbolate of soda is decomposed in the system, setting free the carbolic acid, and in this way a much larger amount of the acid can be administered without poisonous effects, than when given in the crude form. As a rule, cases do not come under the veterinarian's care till they are far advanced, or coming early under treatment, run a rapid course, and then, though the best remedies are administered, they have not the power left to imbibe the good which follows in the early stages and milder cases of this disease. Therefore conclusions that are arrived at without due consideration of these facts,

show no great exactness in stating the relation of percentages. Among the other agents which have been found useful, may be mentioned iodine and iron, especially the perchloride of iron recently mentioned by Steiger. Although these remedies have their uses, it must not be concluded that they are necessarily calculated to produce a certain cure in every case of anthrax; if such a success could be achieved, anthrax would no longer be the dread malady it has hitherto proved to be. Messrs. Gresswell, of Louth, have found the perchloride of mercury and sulphite of sodium of great efficacy in many outbreaks of anthrax fever in England. There is one thing which we are frequently cautioned against in the treatment of local anthrax and anthrax with pulmonary lesions, and that is, the application of warm poultices and hot water fomentations, as the use of warm nutritive moisture promotes in a high degree the growth of the bacillus anthracis; and the experience gained regarding the treatment of South African horse-pest, or "malarial" fever,* may not be without interest here.

The remedy I have found most useful in the dysenteric form of anthrax which is so common in camels in India, as well as in local anthrax in animals, is ipecacuanha given in large doses internally, and applied externally mixed with water. This treatment has sometimes been followed with the best results in cases that were not of unusual severity or already far advanced before the treatment was commenced.

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* See Mr. Nunn's Report on Horse Sickness in South Africa, *Veterinary Journal*, 1888.

PREVENTION.

The three essential points in the treatment of this disease are, it is obvious, change of air, change of water, and change of locality on the first appearance of suspicious cases. Such indications are not fulfilled by the ordinary plan in vogue of drugging animals. When a few cases of this disease occur in any regiment, the risks of an enzootic attack are considerably increased by keeping the animals in an anthrax contaminated locality week after week. Simple segregation of affected animals does not suffice to keep the disease in abeyance. The animals must leave, with the least possible delay (in order to avoid infection) the tainted ground. Extension of the disease is kept up for months by persistent occupation of tainted lines, until considerable loss has been experienced. In order to obtain a favourable result of our endeavours at prevention, it is necessary to undergo the cost of a new flooring, and have recourse to prompt and effectual removal of tainted earth. We must acknowledge that, whilst firmly convinced that dozens of animals may be easily saved by timely adoption of the abovementioned precautions, there are great difficulties and disappointments inseparable from the carrying out of proper segregation, which I believe to be the chief causes of these failures. One great cause of failure, I believe, is inequality of the measures adopted in different outbreaks, when the proper time for prevention had been allowed to pass by. The probability of an extension of this disease, depends less on the special nature of preventive treatment recommended than on inefficiency of such measures as are often employed.

The running at large of grasscutters' ponies during an outbreak of this disease is a frequent cause of diminished usefulness of preventive measures which are adopted. It is often forgotten that the most critical time for securing the movement of suspected animals is when the disease is absent in others. It is necessarily of greater importance to avoid contracting disease, than merely to attempt to suppress it among an already infected lot of animals. The extreme importance of preventing at every point the chances of entrance of the contagion into untainted lines cannot very well be exaggerated. A knowledge regarding the period of convalescence is of importance in preventing risk of infection by exposure of healthy animals to one which may have just recovered from an attack and be still convalescent. Anthrax may be communicated by the sick animal when the severity of the illness is past, and while recovery is being perfected, since every secretion and excretion of the body, in this disease, is a carrier of infection. Too great care cannot, therefore, be taken, so long as cases of this disease appear, in preventing a return of apparently recovered animals, which are at the time even more dangerous than when suffering from an acute attack and unable to move about. Undue alarm should be avoided, but we must insist on the importance of fresh air, fresh water, and change of locality above all, in the treatment of suspected animals. Recent observations show that a certain local and seasonable condition is essential to the spread of anthrax, these two factors being found in a porous material, the soil, penetrable by air and water, and soaked with organic substances (local predisposition), and in variations in the moisture

and temperature (seasonal predisposition.) The first essential condition of prophylaxis is immediate evacuation of the tainted ground, the checking of contagion by early isolation of the sick, and by observing the necessary precautions which stave off an attack among the healthy animals. Immunity is also obtained by guarding against exposure, want and debility in the case of grasscutters' ponies, this precaution being found necessary, since transmission of the disease, in these, is often dependent upon constitutional weakness, or upon degrees of predisposition and susceptibility. Acting upon our experience of former outbreaks of anthrax, we may formulate the following rules of prevention, namely :—(*a*) Not to return any animals as "fever-free" without having first ascertained, either by the use of the thermometer or other means, that such is the case; (*b*) To remove the conditions of soil favourable to the growth of the microbe, the infected standings must be renewed. The prophylactic treatment of tainted localities by enforcing rules of sanitation, and by avoiding the pollution or infection of the earth with anthrax material —*viz.* cadavers, the manure or offal of diseased animals, will always be the chief means of preventing an outbreak of the disease.

PROTECTIVE INOCULATION.

It is a great satisfaction to learn that the Government of India have under consideration the question of bacterioscopic laboratories being opened in many central stations in India; because there can be no question that such laboratories are necessary, where 'anthrax-vaccine'

can be prepared for distribution to the different mounted branches of the service, as well as in the agricultural districts throughout the country. Looking not only to the interests of the Army, but to the necessities of British India, the death-rate from anthrax in all classes of animals is a terrible calamity, and every Government should do its utmost to avert it. The entire tendency of modern inquiry is in favour of protective inoculation; enormous saving to the country may be effected by organising central laboratories in India for the purpose of sending 'vaccine' fluid into the agricultural districts, and it is difficult to see how postponement of such an evident means of saving to the country is possible. In some parts of Russia where anthrax is very frequent, carring off some thousands of animals of that country annually, preventive 'vaccination' has reduced the mortality from this disease to 2 per cent., as in every other country in Europe. It may therefore be considered as the most urgent necessity which the Government of India have now under consideration.

PROTECTIVE INOCULATION has been practised by virus enfeebled (*a*) by heat (*Toussaint, Pasteur, and Chauveau*); (*b*) by antiseptics (*Chamberlain and Roux*); and (*c*) by cold (*Gibier*); also (*d*) by Kitt's practical method, *i. e.*, inoculation of guinea pigs with Pasteur's attenuated virus; and (*e*) with the blood of rabbits which have succumbed to inoculation (*Pasteur, Chauveau, Perroncito, Kitt and others.*) Immunity from infection is also obtained by injection of chemical bodies, as the perchloride of mercury, etc., in which it is seen that after animals have taken a sufficient quantity of the drug, they are no longer liable to anthrax.

CHAPTER II.

"SURRA"; OR, PERNICIOUS ANÆMIA.

In a description which I gave in my 'Equine Diseases of India' in July 1887 on the subject of "surra", embracing a sketch of the clinical characters, post mortem lesions, rate of mortality, etc., I observed that it was becoming desirable to consider the question, "What is surra?" When there was one question chiefly occupying the attention of veterinary surgeons in India, and that with regard to the anatomical features of the parasite found in surra, there was seldom much importance attached to any other feature which may commend itself to the judgment of practitioners, veterinary as well as medical. I therefore suggested that we might still retain interest in the parasite followed by our predecessors, and endeavour to study the relations of surra with any other disease well known to science, which we will now consider.

It seems to me that some word is needed to define the condition of the system which ensues upon the action of the parasite found in the disease, so as to get a better explanation of both cause and effect, and thus improve its treatment. I venture to think that both the public

and the profession will better value and better understand our meaning if it be stated what the disease is, and if its place can be specially defined.

There can, I think, be no doubt that a revised nomenclature will be of service in connection with the theory of the subject of surra. This condition—which is attended by anæmia, pernicious and progressive; by a prolonged course, and more or less definite duration; by inordinate mortality; by paroxysms of increase of temperature, or so-called "anæmic fever"; and by leucocytosis, and other features essential to it—might, perhaps, be represented by pernicious anæmia, which shows the same features even in man.

If this need of adjustment of our nomenclature is ignored because it is either not recognised or not understood, it becomes an unrelieved want, which is apt to be misinterpreted by the practitioner who fails to see the true state of the case. When once surra ceases to be a "disease with which every one is familiar, but which nobody understands," the treatment will become more rational and more successful.

If the proper place of this disease were well understood, it would have a stronger tendency than anything else to the encouragement of progress in its pathology and treatment, especially upon points which have been under discussion for many years.

The most important fact to determine appears to me to be, not merely the presence of the parasites, and their morphological characters, but to show their precise significance and the part they play in the production of the disease. The study of the anatomical peculiarities of the parasite found in this disease has been elaborately

gone into by specialists in England and America, and by Dr. Crookshank(*Journ. Micr. Soc.*, Ser. 2, Vol. *vi*, 1886) and Prof. Wm. Olser (*Brit. Med. Journal*, 12th March, 1887) in particular. I do not think I need dilate therefore on this subject any farther, than to show that we have not yet considered the pathology of the disease called "surra," apart from the presence of the parasites described by Inspecting Veterinary Surgeon Dr. G. Evans many years ago. This seems strange, seeing that the disease has been known for many years on the continent of Europe, as the equine form of pernicious anæmia described by several authors.

Among continential veterinary surgeons there seems to be unanimity as to the proper place for this disease of the lower animals, the malady being recognised now to be pernicious anæmia. This unanimity does not appear to have made itself felt up to date in India. Many still seem to think that surra must always remain an obscure disease, known only by the presence or absence of the parasites. The clinical characters of the disease, however, contain many features of diagnostic value, and which afford correct classification. The disease has a pathological equivalent in pernicious anæmia of man—has a similarity of history and results, as may be seen by a comparison of these in the two classes of patients mentioned.

We may summarise our reasons for considering this disease to be pernicious anæmia, and not relapsing fever, thus :—

Duration and Course.—That in relapsing fever there is seldom more than two or more relapses noted, usually only one; whereas is surra there are usually an unlimited

number of "relapses," the average duration of the disease being probably not less than two months. The malady is usually progressive, seldom acute in character. The course is sometimes prolonged to several, usually six to eight weeks; the average duration of the human disease (pernicious anæmia) being also estimated at "two months." The average of twelve cases of surra noted by Mr. Steel (*Report on an Obscure and Fatal Disease among Transport Mules in British Burma*, 1884) was over sixty-six days; that of several cases observed by Dr. Evans (*Report on Surra Disease*, 1880) was two months. It is seen that weak animals succumb sooner, and in some outbreaks the ordinary duration of the disease does not exceed from one week to a fortnight, and, frequently, may be less in outbreaks in which reckoning was made *after* the date of admission on the sick report. A few cases have been seen to make slow progress in the disease for over a year. The most important feature of the disease is that there is no history of a definite onset, and that the condition is progressive.

FATALITY.—The fatality in relapsing fever is comparatively slight; whereas surra has been characterised as an "invariably fatal" disease. There is probably no disease in which the fatality is so high as in pernicious anæmia.

TEMPERATURE.—A great deal of importance appears to have been attached to the temperature in surra. This is all the more noteworthy, inasmuch as "periodicity," which is perhaps the most characteristic feature of this disease, is, after all, but an uncertain guide, as all febrile diseases and those due to micro-organisms in general, have more or less definite or regular periods of diminution

or exacerbation. That the course of the disease shows fluctuations throughout, the fever getting better for some and worse on other days, was conclusively shown many years ago by Dr. Evans, and must be familiar to every one acquainted with this disease; while the most recent investigations upon this point do but confirm, if they somewhat extend, the original experiences of Dr. Evans. It is desirable to correct the prevalent opinion that relapses are common to this disease only. Relapses may occur commonly during the course of rheumatism, as well as in other specific fevers, and constitute a very minor feature in the diagnosis of surra. No other feature of importance peculiar to relapsing fever, is common in surra. As we have shown before, the duration, course, fatality and other features, all speak against the relapsing fever theory, and we cannot overlook this in any consideration of surra which pretends to be a complete one. As to the significance of relapse in surra, this is a condition quite unexplained as yet, for it is no explanation to say that there is increased multiplication of the monads in the blood during the height of the fever, as the same increase in the number of micro-organisms is noticeable in other fevers.

There was a time when the statement that a fever showed "relapses" was held to be a sufficient explanation of its nature. It is not so now, but the word still conceals a considerable amount of ignorance, or at least an imperfection in our knowledge of the diseases that are included under it. We must not restrict the term, in practice, to relapsing or famine fever, for the etymology of the word indicates such maladies as are characterised by relapses, and is often applied to all affections

in which relapses in the fever are present. Thus, we have two classes of disease commonly called relapsing—a definite disease which has been described by Dr. Carter and is known as relapsing fever; and diseases in which relapses commonly characterise the fever, as in some forms of acute rheumatism,* in 'Weil's disease', in essential anæmia, *etc.* I have, moreover, seen a few instances in which relapse was noted during the course of anthrax fever in horses, the term not being made use of unless there had been decided return of the symptoms of anthrax and of bacilli in the blood, accompained by a temperature several degrees above the normal, the condition being remarked usually every fourth day. Veterinary surgeon Hazelton, who has lately investigated an outbreak of anthrax at St. Thomas' Mount, practically confirms my observations relative to the temperature variations peculiar to anthrax fever which I reported more than two years ago.

Principal veterinary surgeon Oliphant observes,—"I have always been anxious to discover from the charts, whether there is a periodicity in the temperature of anthrax fever. There is no doubt that the bacilli appear in crops, appearing and disappearing at varying intervals, and I believe they hold possession of the system, probably in the shape of spores, for very long intervals." The experience of Indian medical and veterinary officers will confirm this, for periodicity complicates nearly all disease in India.

* In 500 cases of acute rheumatism treated at St. Bartholomew's Hospital, 40 per cent. of these relapsed, the word not being made use of unless there had been decided return of joint pain accompanied by a temperature above the normal, the condition lasting longer than 24 hours. (*Lancet*, April 14th, 1888.)

There is great difference between a well-marked tertain and remittent or continued fever, but the steps by which the phenomena of one pass into those of the other, render the temperature chart alone an uncertain guide.

A point of interest we have noted in the case of surra in India, and other veterinary surgeons had done in that of pernicious anæmia seen in Europe, is the well-worn, but mysterious subject, the paroxysms of increase of temperature, the so-called "anæmic fever" of writers on pernicious anæmia in the human subject. Zschokke also, it is well known, has assigned a prominent place to this fever, which he found to be of an intermittent type in the horse (*Schweizer-Archiv für Thierheilkunde*, Bd. 25, 1883), and Fröhner has likewise noted a marked rise in temperature on the 4th day, which, with slight remissions, remained high till death. (*Archiv für Wissens. u. Praktische Thierheilkunde*, Bd. 12, 5 u. 6 Heft, 1886.)

Clinical History.—The clinical history of surra in general is that of pernicious anæmia. The marked anæmic conditions, observed both *ante* and *post* mortem, the leucocytosis, fatty degeneration of the muscles, liver, spleen and other organs, the general hæmorrhages, and the chronic state of fever, which end in death in so many cases, leave no doubt as to the nature of the disease.

Treatment.—I attached considerable importance to arsenic in the treatment of cases of surra, with the view of comparing or contrasting the results with those obtained through the use of this agent in pernicious anæmia, and in a recent number of the *Quarterly Journal of Veterinary Science in India*, Mr. Steel says that veterinary surgeon Butler has reported most interesting

results from treatment of cases of surra with "arsenic pushed as far as possible." The cases are "doing well, not losing condition, and the temperature keeping down." This observation is worth noting, when we remember that arsenic is the only remedy of any value in cases of pernicious anæmia in the human subject. In a recent paper by Professor Osler, in the *Therapeutic Gazette*, he states that in all cases of pernicious or essential anæmia there was no one case of recovery in which arsenic did not form the basis of treatment.

POST-MORTEM APPEARANCES.—Mr. Oliphant, principal veterinary surgeon in India, writes,—"In one outbreak of surra in the 18th Bengal Cavalry, in which 180 horses died, I made dozens of post mortem examinations, and the appearances in all were identical—extreme pallidity of the tissues, with perhaps a trifling serous effusion into the abdomen, etc. In fact, the animals looked as if they had been starved to death;" and Zschokke also states "that none of the principal organs show any, marked structural change" in pernicious anæmia in the horse.

Referring to post mortem appearances in surra, Dr. Evans, in his report dated December 1880, said—"I examined the kidneys, liver, spleen, heart, lungs and the mucous lining of the stomach and intestines throughout with great care in every case that I had the opportunity, and I am prepared to state positively that this disease is not characterised by any structural organic change; it is purely a disease of the blood. In some cases there were petechiæ of the mucous lining of the intestines. In one case the kidneys were pale and soddenlike, and in another the margin of one lobe of the lung was hepatised; but these cases being so exceptional can have had

no characteristic relation to the disease."

Veterinary surgeon J. Cooper, A. V. D., who has recently investigated an outbreak of this disease among ponies, says, in reference to the post mortem characteristics, "that the most striking feature is the anæmic condition of the tissues generally and the absence of recognisable lesion." (*Quarterly Journal of Veterinary Science in India, April*, 1888.)

Mr. Steel lays stress on the presence of gastric ulcers as characteristic of surra; and the relation of gastric ulceration to pernicious anæmia formed the subject of discussion lately at the Roy. Acc. of Medicine of Ireland. (See *Lancet* of March 10, 1888, page 474.)

Mr. Steel describes "mucous congestions continuous throughout the anterior two-thirds of the bowel, with the presence of several species of worms," although he attaches no importance to these as a probable factor in the etiology of surra. Dr. Evans had already alluded to the presence of petechiæ and yellow staining of the mucous lining of the small intestine, so that this fact is significant in the history of surra—the exact relations of mucous congestion to pernicious anæmia in man having been already ascertained. It is impossible to say whether this congestion of the intestinal mucous membrane is essentially connected with the presence of the worms seen in surra. It is a phenomenon of other specific fevers, and is generally ascribed to blood-vascular pluggings and minute extravasations of blood, but it may be due to direct irritant action of the worms, the same as in 'beri-beri,' or pernicious anæmia of human beings. The early symptoms of hepatitis present in surra, which is shown by jaundice of the visible mucous

membranes, may be due to congestion of the liver caused by irritation of the worms in the biliary capillaries, leading to their rupture, and consequent deposits in the gland-substance such as have been described by Dr. Evans in these cases. There is every reason to believe that when the liver has become so invaded, it is incapable not only of duly performing its own function of secreting bile which is essential to proper digestion and health, but that it is an abiding pathological source of general jaundice, which, if not removed, may result in the gravest evils—blood disorganisation, general anæmia, anasarca, etc. And in such cases the hepatic complication appears so marked that it is sometimes difficult to say what share in the disease should be assigned to it, and what to the action of the parasites on the blood.

In spite of a greedy appetite, debility appears progressive in character. It is scarcely necessary to remark on the importance of this symptom in diagnosis, as all who have written on the disease lay special stress on it. Professor Fröhner has noticed it in the German type of equine pernicious anæmia (*Ueber perniciöse Anämie beim Pferde, von* Prof. Dr. Eugen Fröhner, Berlin, 1886); and veterinary surgeon Cooper, who has only lately reported an outbreak of surra among ponies, in the Berars, says, that "the appetite is seldom quite lost, and sometimes an animal continues to feed up to the very last."

INFLUENCE OF SEASON.—It has been seen that surra occurs most commonly after the rainy season in India. There may be many local conditions—susceptibility of sex to climate, season, etc.—that may affect the greater

prevalence of disease in males or in females, in different outbreaks. Dr. Moore, at a recent meeting of the Royal Acc. of Medicine, Ireland, pointed out that season exercised a great influence on the occurrence of anæmia also in the human subject.

The short facts are that, if we compare the several features of pernicious anæmia with those of surra, the identity is very plainly apparent. When we include a broader horizon and consider all the clinical peculiarities, or those features by which we most readily recognise the disease, we find abundant evidence of identity between surra and pernicious anæmia.

As to the difference in the prevalence of pernicious anæmia in male and female animals, we have observed that the disease prevails irrespective of all sex, as it spares neither the male nor the female sex during an outbreak, and also attacks mules placed under similar conditions. While it is known "that the reason the human female was more subject to the disease was owing to the condition of the generative system—ovulation and menstruation—causing greater disturbance in the blood forming process in the female than in the male; at the some time anæmia was common not only to the female, when special calls were made on the vascular system in puberty, but to the male also." (*Brit. Med. Journ.*, March 31, 1888, page 700.)

From a comparative point of view, it is interesting to observe how the above manifestations of pernicious anæmia, correspond with those shown in man, in whom the fatality, duration and course, and other features peculiar to this disease in animals are represented by so closely allied characters. The marked anæmia noted in

surra, the paroxysms of increase of temperature, the duration and course, and the extreme fatality, together with the history of the parasites seen in the blood, form a group of coditions sufficiently diagnostic of pernicious anæmia. The leucocytosis which is a marked feature of pernicious anæmia, is also characteristic of surra, and which in typical cases is always present.

Now, with regard to the parasites in surra, to which I attach importance. The only point especially to note is that, besides the organism described by Dr. Evans and named after him as the *trichomomas, or hæmatomonas Evansi*, there is sometimes found another, a bacillus,* and which I believe to be more or less common, though not specially connected with the disease.

This bacillus was found associated with beri-beri in Burma ponies described by Dr. Wallace Taylor (*Report on Beri-Beri*, or *Kákke*, 1880), a disease marked by paralysis of the hind quarters and extremely fatal—symptoms which have been remarked also in pernicious anæmia of equine patients described by German veterinary surgeons. (*Archiv für Wiss. u. Praktische Thierheilkunde*, Bd. 12, 5 *u* 6 Heft, 1886.) Has the organism in question any connection with disease, or is it a special organism only associated with it and whose life-history is not yet determined , are questions which cannot be considered as settled. Many of these bacilli are probably of a septicæmic form accidentally present in certain cases. Dr. Pekelharing, of Atchin, has only recently demonstrated the presence of special diplococci in cases of beri-beri. (*Brit. Med. Journ.*, Nov. 26, 1887.)

* Monograph on "Surra," or Pernicious Anæmia in the Lower Animals, January, 1888.

Dr. Carter† has also very recently found bacillar forms associated with malarial fever in man.

It would appear as if, with the discovery of the surra producing organism, the pathology of the disease was satisfactorily settled. This, however, is hardly the case, for the following considerations, among others, render it evident that in surra cases other features in addition to the function of the parasites have to be explained. Thus, we find similar parasites present in healthy rats. Then again, we have the fact, on which I have not as yet dwelt, that, in order to produce disease changes in animals, various conditions, such as appear in surra, are essential. That these parasites are not of themselves able in many cases to set up the disease changes present in surra is evident also from the fact that they are frequently present in the blood of rats without producing surra. Thus Dr. Crookshank has shown that in rats apparently in perfect health, in London, the same parasites were present in the blood, without causing any lesions corresponding to those seen in surra. In fact, he says these rats appeared in perfect health, although more than 25 per cent. showed the parasites in their blood on examination. Dr. T. R. Lewis had demonstrated the same parasites in the blood of healthy rats in India.

In the case of successful inoculations with surra blood containing the parasites, it is not possible to draw a sharp line between the action of the parasites and that of the blood from surra cases, because a number of conditions are always combined in the same case. The

† NOTE on some Aspects and Relations of the Blood Organisms in Ague, 1888.

organisms have never been isolated apart from surra blood, and the disease then produced by inoculation; and this fact is of interest in connection with the blood of rats containing similar organisms, without giving rise to any apparent disease. To this we may add the observation of similar parasites by Dr. Evans in the blood of diseased as well as healthy camels(*Veterinary Journal*, 1881, p. 10), which require explanation. Little insight can be gathered from the observation of parasites in the blood of diseased as well as healthy animals, when the conditions of their growth remain as yet unexplained. Whether cases of surra occur in the horse, like those of pernicious anæmia in this animal described by continental veterinarians, as the result of the growth and action of parasites in the blood, we do not know; for the same parasites which seem to be the cause of surra are often present in the blood of other animals in considerable numbers without causing surra. It is easy, however, to understand that the parasites may become pathogenic under certain conditions; and these conditions may be found in surra. The mere presence of these monads in the blood would not appear to be sufficient of itself to lead to the production of this disease. This is very well seen in the case of the rats and camels we have described before. Here we have evidence that although the parasites exist in large numbers, the conditions are not always favourable for their growth and action as in other animals. We may consider the conditions which aid the action of these organisms, and the chief of these is what we may vaguely term general and local depression of vitality. A number of experiments show that when the vitality of a part has been lowered by

cutting off the blood-supply for a comparatively short time, organisms grow in that part much more readily and luxuriantly than if the blood-supply had not been interfered with. The trichomonas sanguinis attacks the weakened blood corpuscle, and assimilates the rich store of proteids contained within the highly organised but comparatively non-resistent cell. By the aid of this store of proteids it acquires increased energy to reproduce its like and to repeat the process of attack upon the blood-cells, producing a state of general disease.

In normal conditions the action of the trichomonas sanguinis is checked by the vital resistance of the tissue elements; but let this standard be to the least extent lowered, and the chances of an invasion at once become great. This is even more true of the hæmatozoa than of the hæmatophyta. Observe the readiness with which the ascaris lumbricoides and other abdominal worms attack children in preference to grown up people, because of the difference in the vital reaction of the tissues; for, in the case of the latter, the conditions of growth of the parasites would be absent in the healthy mucous membrane of the intestines but more frequently present in children. We also know that the same parasite attacks certain horses in preference to others placed under similar conditions; and these horses are said to be "subject to the worms." The great importance of these facts in explanation of the etiology of surra will be at once apparent.

One can hardly conceive that these organisms should exist in the blood, in any numbers, without affecting it prejudicially, though we know that they have been found in the blood of animals which were apparently healthy. Of course, it is difficult to define any absolute standard

of perfect health, and there may be a considerable amount of cachexia, even in animals appearing quite healthy. What the peculiar change in locality or action on the part of the monads may be that determines the diseased condition, is one of the points which needs elucidation.

We naturally ask if there be any analogy in the behaviour of other parasites in this respect? Dracunculus may cause little or no trouble in the earlier stages, but developing, changing place, and discharging its embryos, the gravest results follow; trichina in its earlier stages is comparatively unfelt, but may become the cause of fatal disease.

It is easy to understand that the active monads if directly removed from a case of surra and used along with surra blood, may produce the disease if entering the blood of an animal said to be free from it, when in fact the monad as well as the infecting agent were employed together in the same injections. We may therefore conclude from these facts that, in order to produce surra in animals, various conditions, such as affect the patient's system as well as influence the parasite in question, are essential; and that in the absence of these conditions, the same parasites may frequently be present in the blood without causing any disease. Were this not the case, we would expect to find the disease most readily contagious; whereas all experience proves this to be incorrect; for, to quote the words of Dr. Evans, "I find no evidence to show that the disease is either contagious or infectious in the ordinary sense."

Similarly, in regard to the relation of anchylostoma to the anæmia of Ceylon, it has been noticed that this parasite was so frequent in the post mortem examination

of cases that did not die of anæmia, that it is doubtful as to whether its presence invariably gives rise to anæmia with all its train of symptoms.—(*Brit. Med. Journ.*, June 30, 1888.)

Dr. Carter* has now demonstrated that malarial fever in man, is of the nature of hæmatozoic affections; and there is no doubt as to the presence of closely allied flagellated monads in the blood of horses suffering from surra; yet in some animals the same parasites seem to exercise no ill-effects whatever. A real difficulty lies in determining the relation of pathogenic and non-pathogenic hæmatozoa, and in tracing the distribution of those which play the *rôle* of general infectivity. But the fact of there being a difficulty to contend with in no way affects the question, 'What is the relation of hæmatozoa to infective diseases?' I believe many more of the fevers, which show a paroxysmal tendency and may be seen commonly attacking our animals, will be found to be of this nature.

From a simple consideration of the presence of flagellated monads in surra, it is at first sight difficult to say exactly how the clinical and pathological facts are to be explained, whether surra has any relation to ague in the horse, because allied organisms have been described as present in intermittent and remittent fever of man†; we know that similar parasites have been seen in other

* On the lately demonstrated Blood Contamination and Infective Disease of the Rat and Equines in India, 1888.

† The *Lancet* of June 16, 1888, says, that "they are the only organisms of this class of hæmatozoa that have yet been discovered in human blood."

animals (rat and camel) apparently in perfect health. Such a fact in itself is sufficient proof that infusorial organisms of more or less similar appearance exist under varying conditions—pathogenic and non-pathogenic—without implying any necessary connection between the conditions themselves. Hence Dr. Carter thinks that, as has been stated to be the case in other diseases, organisms morphologically identical may have varying pathogenic properties. I think, in order that we may understand the pathology of surra, it will be as well perhaps to examine into its clinical features, and see if they bear any relation to any well-known disease of man and animals. Such an examination seems to us to be distinctly indicated in the interest of our patients, and must always be of the deepest interest to to the practitioner.

Those who have appreciated the true nature of surra will not be surprised at the excessive mortality it causes in our animals. In the meantime, further investigations are needed, as it is fully admitted by Dr. Carter that the proof of the trichomonas being the cause of surra is incomplete. No matter what the fate of the monads, the classification of the clinical characters peculiar to surra is an object of the first importance, and the interest in the share taken by infusorial organisms in the production of this disease affords no exception to the rule. It is remarkable that, with all our attention and care shown in the past in the investigation of the characters of the monads seen in surra, the clinical features of the disease were not similarly considered. We find accordingly a variety of designations now in use, and we still rely for the most part on the interposition of side questions,

so that our facts are built up so far as they go on the suggestion of others, instead of being founded on facts encountered by us in actual practice.

There is a further aspect of this particular question which calls for attention. The above-mentioned monads are not the only organisms of this class of hæmatozoa that have been discovered in the blood of animals. Although they may undergo changes in their nature, in their passage from one host to another, yet there are different species, distinct from each other, which play a part in the dissemination of disease in animals.

The observation of parasites in intermittent fever of the horse (*Equine Diseases of India*, July, 1887, p. 4) resembling those described by Laveran in the blood of man during the ague paroxysms, receives confirmatory evidence from the pen of Dr. Carter, who found that in ninety-three instances of malarious disease in man (intermittent fever, simple remittent fever, and splenic cachexia) these organisms were present in nine. As to the influence of blood-parasites in causing disease, it is satisfactory to note that, in addition to the case of intermittent and remittent fever above described, there is the further fact of Dr. Kynsey's observation of the disease called 'beri-beri,' or anchylostomiasis in Ceylon being also due to a hæmatozoon, which afford interesting confirmation of the views already advanced by veterinarians on the continent of Europe, in which similar parasites have been shown to be the cause of fatal anæmia in horses.

Other animals, besides the horse, have been known to suffer from the disease. Megnin describes a symptomatic type of this disease seen in dogs and cats, which

was caused by an ankylostome producing anæmia, and which is, without doubt, similar disease to the symptomatic form of anæmia in man. Johne saw this disease in the dog as a secondary affection following a suppurative form of disease. Imminger has observed enzootic outbreaks of it in cattle. Fröhner describes having only recently seen cases of this disease in the horse, and Friedberger also saw an outbreak of it in the same animal.

We know how severely animals suffer from the presence in the blood of other minute organisms. The strongylus tetracanthus gives rise to epizootic outbreaks of emaciation in horses in many districts of England (Gresswell, *Manual of Equine Medicine*, 1885); the strongylus contortus has been known to produce a form of pernicious anæmia in the horse (*poikilocytose*) observed in the Buenos Ayres (Wernicke, *Deuts. Zeits. f. Thierm. u. vergl. Pathologie*, 13 Bd., 2 u. 3 Heft, 1887); the presence of the anchylostomum duodenalis and the trichocephalus dispar in the intestinal canal gives rise to anæmia, or beri-beri in man (Kynsey, *Report on Anæmia, or "Beri-Beri" of Ceylon*, 1887); and the same parasites have been found associated with pernicious anæmia in the lower animals described by Professor Fröhner (*Archiv f. Wiss. u. Prakt. Thierheilkunde*, Bd. xii, 5 u. 6 Heft, 1886) and other veterinary surgeons. Chlorosis in man owes its origin to the dochmius doudenalis (Leukhart); whilst not only anæmia but liver disease and a form of dysentery are produced by the same parasite (Fayrer.)

The organism I figured in the *Veterinary Journal* of May 1882, as causing an outbreak of "influenza" among

the horses at Woolwich, is a no less remarkable instance of an animal parasite in the blood, which closely resembles the filaria sanguinis of Lewis, setting up a specific fever in animals. The disease was characterised by relapses, the pyrexia being noticed to recede and recur with intervening periods of respite. There was present catarrhal symptoms and icterus, with an intermittent character of the pulse, and a tendency to cardiac thrombosis. The convalescence was protracted.

On the whole it must be confessed that while the fact of the presence of the trichomonas in surra is well established, the laws of its growth and action are by no means well understood.

Sources of Infection.—The surra parasites enter the body of their hosts with food or water, and probably pass by way of the bile-ducts into the blood. They can only infest animals which are kept on a similar diet and water. But even among these many possess an immunity against their action. In consequence of the dietetic relations, the access of these parasites can be prevented by timely adoption of the necessary precautions and by a change in the food and water-supply of the horses. The shallow pools or marshy places which are their natural habitat are very liable to dry up after the rainy season, and at this time of the year grass brought in from such places by the native grasscutters would contain the embryoes which, gaining entery into the system of horses, undergo development into the mature worms seen in this disease. Having gained entery into the alimentary track, whether by means of the drinking-water or along with the grass, they emigrate thence into the blood, which contains incredible numbers

of them. The reception of the trichomonas, or its embryoes, through sound skin is open to question.

The action of the surra parasite has been described as that of 'tearing,' 'dragging,' or 'tugging' at the blood-corpuscles. Is the action of the strongylus armatus any different on the mucous coat of the intestines and intima of the blood-vessels? The surra parasites are believed to possess suctorial organs, but they probably absorb their food by endosmosis through the body-wall without any mouth at all. They are transferred from one part of the body to another, along with the blood-current, by their wriggling movements which are aided by the flagella.

VARIETIES.—There is another variety of surra, which is never acute from the beginning, or scarcely even sub-acute. It is truly chronic, may last for months, and though in the end perhaps equally fatal, is more slowly so, and occasionally intermits during its course. Though such animals may be seen to be frequently on the sick-list for debility due to general loss of blood, indicated by anæmia of mucous membranes, a weak and readily excitable pulse, and swelling of the limbs, etc., they cannot be said at any time to suffer from more than chronic asthenia, and, to say the least of it, their appetite remains as good throughout the course of this disease as when they were in perfect health. Such cases occur sporadically, are not very uncommon, and I believe, a number of rejections by means of special casting committees to which every battery of artillery and regiment of cavalry is liable in India are due to this disease. In most, if not all of these cases it is exceedingly difficult to make any impression by the use of internal remedis.

They are liable to frequent intermittent attacks of debility, in many cases the animals falling away to a mere skeleton. In the treatment of such cases a most essential element is removal from the place where the disease was contracted.

In the acute form, as mentioned before, the disease is very fatal, but in the milder and more chronic form recovery is sometimes noted, although the malady being liable to recurrence it is difficult to say whether this really takes place.

Complications.—There is a tendency to the development of a watery condition of the blood, resulting in anæmia and degeneration of the cerebro-spinal centres, which gives rise to the paralysis sometimes seen in this disease. But though spinal, hepatic, splenic, or other complications, may intensify the severity of the disease and hasten the fatal termination, they are not essential concomitants, and appear to originate in the peculiar state of the blood and to be kept up by its progressively imperfect elaboration. I must leave the consideration of paralysis proper, or 'kamri' as it is called, to another chapter, but I may just say that there are more causes than one which are concerned in the production of this disease of horses.

The pathological changes that take place in the various organs and tissues of the body as a result of surra may be characterised, in a word, as degeneration due to imperfect nourishment. The blood itself is rendered unfitted for the purposes of proper nutrition, and degenerative changes of an adipose character, sometimes leading to disintegration of portions of the imperfectly nourished tissue, take place. When organs and parts so weakened

by starvation are distented with anæmic blood which they cannot utilise, sloughs result from gangrene of the imperfectly nourished tissues, as evidenced in the ulcerations of the stomach, etc., noted in this disease. The ulcer itself, once formed, suffers from nutritional defect, owing to the impoverished state of the blood which prevents the formation of resisting tissue around it, and often leads to perforations. The alimentary mucous membrane in general will be found to be in an anæmic condition, with petechiæ and ulcerated spots the result of disintegration and atrophy. Although the tissues present a blanched appearance, there is a large deposit of fat all over the body, but especially noticeable under the skin. This gives to the tissues a peculiar jaundiced appearance, which is shown to be due to deposition of fat globules seen under the microscope. It is easy to understand how a process of abstraction of blood, a fluid rich in oxygen, by the parasites, would lead to the conversion of albuminoid tissue into fat.

PATHOLOGY.—If we look through the list of post mortem changes special to surra, we shall see that they almost all amount to changes centred in the blood, and all other changes are subsequent to this. The blood itself becomes anæmic, and shows an accumulation of leucocytes owing to their not undergoing the natural transformation into the coloured corpuscles. The red corpuscles are much altered in appearance, being crenated or irregularly shrivelled, and sometimes assuming crescent shapes, although it is doubtful whether the latter may not be only another stage of the trichomonas. There are a number of small, colourless disks or blood-plaques in the serum. When examined fresh after

staining in sol. of methyl-violet, they appear as small, circular disks, which quickly alter in shape, and have hence been mistaken for fragments of white-cells. If the parasites destroy the red corpuscles leading to their decrease, what explanation can be given of the accumulation of leucocytes? The facts connected with the pathology of this disease strongly support the view that an increased number of leucocytes in the blood cannot be accounted for on the theory of parasitic action alone, as it is doubtless in some way related to changes associated with the lymphatic system of which we possess little or no knowledge as yet.

The lymph-follicles of the intestinal tract, especially those of the small intestine, are swollen and enlarged, and there is an accumulation of a sero-lymphoid fluid in the stomach and small intestine, and sometimes also in the abdominal cavity, in excess of that found in health.

The lymphatic glands throughout the body are generally more or less swollen and œdematous. There is often acute dropsy, with no other post mortem lesion save extreme anæmia and yellow-staining of the tissues due to fatty degeneration*.

As the lymphatic glands supply lymph-corpuscles to the blood, this may account for the excessive production of leucocytes, although how and in what way this extraordinary accumulation of leucocytes in the blood is produced in surra has not yet been clearly explained.

The effect of this disease on the system seems, in fact, to be the production of what is probably a weak tissue,

* The heart was found to be the seat of marked fatty changes in cases seen by Mr. Steel and those described by German authors.

and one unable to resist in any way the attacks of the parasites.

TREATMENT.—Surra in animals seems to have been somewhat frequent of late in many stations in India, and notwithstanding all that has been done in recent years to elucidate its pathology, its medical treatment does not seem to have advanced very much. Considering the frequency with which outbreaks of surra are met with, and the large number of deaths which have followed the attempts to effect a cure, I think that the treatment of this disease demands more serious attention than we have hitherto accorded it. The remedy above all others which has been spoken of by all veterinarians without exception, is arsenic, pushed as far as possible. This treatment has sometimes been followed by recovery in cases of pernicious anæmia in man, and continental veterinarians have noted recoveries from it in that disease seen in the horse. The cases which have recovered under this treatment prove, I think, as far as they go, that arsenic is a specific for the disease, in the sense that ipecacuanha is a specific for some forms of dysentery, and quinine for fever. We attached considerable importance to arsenic in the treatment of cases of surra, with the view of contrasting or comparing the results with those obtained through the use of this agent in pernicious anæmia; and veterinary surgeon Butler, in Burmah, has only lately reported most interesting results from treatment of cases of this disease with "arsenic pushed as far as possible." The cases are "doing well, not losing condition, and the temperature keeping down." There is little doubt that if the disease is treated early by arsenic, quinine, iron, and perhaps the vermifuges,

such as thymol, turpentine, santonin, *etc.*, and by removal from the contaminated area, or, if that be impracticable, by changing the water and making some variation in the location of the animals, great benefit, if not absolute removal of the disease, may be secured. To obtain the most satisfactory results, it should be treated early, before marked tissue changes have taken place. If the treatment be adopted at a later period, it may still be beneficial, though less so than in the early stage.

Chloride of ammonium should be given to relieve symptoms which are chiefly referable to congestion of the liver. The symptoms referable to hepatic congestion in surra are signs of the parasitic action—danger signals so to speak—and as such should be early averted, if possible. Calomel is said to be necessary to remove the profuse mucous secretion in the intestines which protects the worms. Since we recommemded the latter, veterinary surgeon Cooper has tried another preparation of mercury, the hydrarg. perchlor. in the treatment of surra. He found that the cases "improved greatly" under this treatment, and were "progressing towards recovery." Good results may here be anticipated by the use of this agent, due to its physiological action in increasing the normal activity and vital resistance of the cells, and enabling them successfully to resist the attacks of a parasite common in surra. *Atees* is much used in native practice, and there may be cases in which it might be expedient to use it; but it can in no way take the place of arsenic and other remedies above-mentioned. Hypodermic injection of quinine has a powerful effect in reducing temperature during the paroxysms. I know of nothing that has an antipyretic power as the

sulphate of quinine, for it decreases the temperature, retards tissue change, and prevents or modifies periodicity. When complications arise in the course of surra, as paralysis of the hinder quarters, *etc.*, they should be treated in accordance with the plan adopted in such cases.

Exercise should also be conjoined to the above methods of treatment, as there are many cases in which regular walking exercise will improve the nutrition of the muscular system and of the heart, and tend to the promotion of circulatory vigour, which may influence the amount and number of micro-parasites found in the blood and also their probable *modus operandi*.

Surra is a disease of debility, and it is very desirable to keep up the strength of the animal; and for this reason plenty of nourishment must be given, but it should be fluid or semi-fluid, and of the most bland and unirritating character—linseed tea, starch gruel, *etc.* All remedies of a sedative, or depressing nature should be avoided, as they are unnecessary and tend to establish that which it is our object to avert—debility. Change of locality and climate is most favourable to recovery in these cases.

The interesting series of facts now briefly recorded have led us on step by step through many difficulties and much obscurity in the past, in at length recognising the relation between surra and pernicious anæmia of man and the lower animals, and we have further shown its analogy to the 'South Wales disease' of ponies described by English veterinarians, a parasitic disease which prevails as an enzooty during certain seasons and carries off many scores of animals in that country.

Such facts as these deserve very thoughtful study, as evidences of the exceeding likeness of the features noted in man and the lower animals in what seems to us the same disease. Whether the comparison be made in the symptoms, or in the duration, course, fatality and other features, the evidence is of the same kind, and is convincing enough.

Beri-beri in man (*Lancet*, October 22, 1887) is probably the same disease as surra in the lower animals. It is described as occurring under two forms—one which is marked by paralytic symptoms, the other in which a dropsical condition predominates, the same as in surra seen in the lower animals. The *Lancet* recently published a full account of the malady which is known as beri-beri in many parts of this country, to which reference may be made for its peculiar characteristics, "the most constant and striking of which is the progressive anæmia." Medical practitioners in Ceylon have shown that the presence of the anchylostmum duodenale in the case of human beings caused pernicious anæmia or beri-beri, and sometimes no trouble; if, however, the anæmia was also present, the parasites were always present; although these parasites alone in large numbers are unable to produce beri-beri in the bodies of other men enjoying perfect health. (*Brit. Med. Journ.*, June 30, 1888.) What medical experience and research have indicated, veterinary investigation appears to confirm, as may be observed on an inquiry into the history of beri-beri and surra respectively. There is every reason to believe that, in a few years, important changes will be effected in the nomenclature of animal diseases which once seemed complicated or obscure. The importance of correct

nosology in disease, it would be difficult to overestimate, not only on account of its bearings on pathology, but because of the influence of treatment upon our animals, should the nature of the disease be not rightly understood.

We shall speak in future of one disease—pernicious anæmia: *surra, beri-beri, kàkke or Burma disease, panduwa or Ceylon disease, South Wales epizooty, etc.*, being merely synonyms.

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CHAPTER III

"KAMRI"; OR, PARAPLEGIA.

The Indian word *kamri* serves to describe in a general way the diseases of the loins, and especially paraplegia. A somewhat similar disease in man is called "ardhang", or more literally "adhangi," *adha* meaning half, and *ang* body, *i. e.* having the use of half the body, or affecting half the body only.

ETIOLOGY.

The causes of this disease may be divided into climatic, hygienic, dietetic, surgical and specific.

CLIMATIC CAUSES.—The atmospheric changes are a frequent cause of the disease in the horse in India. This is especially remarked during damp seasons, and is explained on the "chill theory", according to which the nervous system, in endeavouring to adapt itself to the needs of the body, exposed to the great and violent changes of temperature said to occur during certain seasons in India, breaks down and becomes disorganised; that is to say, kamri is essentially a disease of the nervous

system caused by exposure to climatic conditions. Chill is probably a wrong term to use, for the breakdown is nearly as often occasioned by exposure to excessive heat as to excessive cold. Fatal kamri is often caused by exposure to heat in some cases probably by cerebral hæmorrhage. These cases occur not only on exposure to the direct action of the sun's rays, as when the animals have been depressed or exhausted after a long march and are afterwards made to stand in an open camp without shelter, but also in the case of animals otherwise exposed to great heat in this country, especially in animals which are over-crowded, badly housed, and exposed to foul air at night, as in the case of grasscutters' ponies during the rains.

Fresh arrivals in India, especially Australian remounts, are more prone to suffer than other animals which are acclimatised and are native to the country. It is easy to understand that a country-bred animal will bear an amount of heat with impunity, which would prove fatal to a new arrival; although when the temperature rises above a certain standard, all animals succumb alike. Animals in regular exercise, and those acclimatised to the country, are able to withstand a very high temperature, beyond what such a temperature would exert on the bodies of other animals. If the atmosphere be pure and moderately dry, and if the health of the animals be not otherwise impaired and so long as the functions of perspiration, urination, and respiration are free, such animals will withstand a very great amount of heat. Ill-health from any cause operating from within, and malarious and ill-sanitary influence acting from without the body, predispose the animal to the disease.

Government horses are less likely to suffer because their general health is maintained by proper stabling and fresh air, whilst private and natives' horses succumb when placed in unhealthy surroundings. The effect of impure air on the brain which is supplied with contaminated blood is to depress and even to pervert its activity. It is a mistake to suppose that heat alone, especially dry heat, unaccompanied by any of the causes above enumerated, produces this disease. Even if we were to admit it possible that the animal was affected by a "stroke of the wind," or *loo* as the natives believe, we must admit that the effects of impure air would be still greater by poisoning the blood which would exert its action on the nerves and brain.

This most important subject of "wind-stroke" has been so much discussed, and is so well-worn, that to dwell on it at any length would be superfluous. It must be at once admitted that if the hot winds had any appreciable influence in exciting the disease known as kamri in India, the proportion of cases during the dry, hot months would be much greater than during any other season of the year. Considering the large number of cases witnessed during the rains, and even in the cold weather, this knowledge of its characteristic will impart a stimulus to future inquiry employed to throw light upon this subject. It is quite open to question whether the remaining few cases, seen in extreme hot weather, do not occur as a result of some of the conditions enumerated above, and which predispose the animals to the disease. Some of the most serious cases are those which come on under cover at night as well as by day, when the animals have in no way been exposed to the rays of the sun.

An atmosphere that is loaded with moisture particularly predisposes to the disease by preventing evaporation from the skin, and this is a much wider source of danger than actual rays of the sun. Hence it is that the dry atmosphere of the North-West Provinces and the Punjab, is much better tolerated than the damp atmosphere of Bengal; and the greater frequency of these cases towards the close of the rains as compared with those seen during dry weather, may be similarly explained.

Veterinary surgeon Spooner Hart, of Calcutta, has lately pointed out (*Veterinary Journal*, July, 1887) that, both kamri and roaring are the result, in many instances, of exalted body temperature, such as occurs in hunters and race-horses during training and galloping, and in the class of cases known as thermic fever (sunstroke.) From a large number of observations made in these cases, it has seemed, first, that the changes of temperature in certain seasons are sudden and violent; and, secondly, that the connection between these variations of temperature and perhaps the malarious character of localities in which they are often observed is such as to lead to the conclusion that if not in themselves the cause of the disease, they undoubtedly have a most intimate connection with it, and suggest precautionary measures in localities where kamri is most frequent. Much may, indeed, be done in all cases by avoiding exposure to the above-mentioned extreme variations of temperature, and by maintenance of "tone" in the nervous system.

DIETETIC CAUSES.—Besides climatic conditions, there are also certain dietetic causes in operation which produce kamri both in horses and in men, and which have been proved sufficient to induce this disease when

experimentally given to animals, or taken by human beings, as food. A variety of Indian pulse, which is found to be indentical with the *Lathyrus Sativus*, and known as the kusari, kasar, tiura, tiuri, and latri, is fraudulently mixed with grain sold in the bazaars in India, and is a frequent cause of paralysis in horses when eaten in sufficiently large quantity to have effect. It is grown as a cold weather crop, and on land which will raise no other kind of pulse—chiefly on clayey soils, and on land submerged in the rainy season, and which hardens during the cold weather almost to the consistency of stone, and splits up into long, deep fissures. It occasionally grows in rice-fields whilst the rice stubble is still standing. Chemically it is exceptionally rich in nitrogenous constituents, and this may account for its tendency to produce paralysis. Horses which have been fed on the plant for a considerable period drop while performing the lightest work in consequence of paralysis of the hinder extremities, and in many cases death follows from bilateral paralysis of the laryngeal recurrent nerves and consequent asphyxia.

It is true that animals fed on comparatively large quantities of the kasari dal have sometimes escaped all harm; and notwithstanding that it is so often present in the gram allowed even to regimental horses, only one in a hundred ever develops kamri; but the progress of the disease is slow, and although in small quantities taken at long intervals it may not be followed by any ill-results, the numberless cases in which a long-continued use of the kasari dal has been seen to produce kamri in our horses, should secure some attention. The experience of many former outbreaks of kamri will show what

time will accomplish in horses fed even in small quantities on this legume. It produces myelitis or hæmorrhage of the spinal cord, leading to secondary degeneration, although there may be no naked-eye indications of this spinal cord affection on making a post mortem examination even in cases far advanced in the disease.

SURGICAL CONDITIONS.—(*a*) *Reflex Kamri.*—Clinical observation teaches us that not merely motory impressions, but those also which cause sensations, may be reflected; so that the impression of one part is experienced by sensation in another. Impressions on the ultimate distribution of one nerve produce sensations in parts supplied by another nerve, or by another branch of the same nerve. Thus in shoulder lameness, and in lameness noted behind due to renal and cystic disease, calculi, etc., the sensations cannot be referred to direct nervous communication, but to an influence reflected, probably from the spinal centre only. In intestinal concretions, and in acute colic in the lower animals, we are familiar with lameness from pain reflected to the extremities. Experimental facts show that there are reflex inhibitory centres in the cord. We are acquainted with nerves whose action consists in the inhibition of the action of other nerves; and so pathologists have been induced to look upon reflex paralysis and reflex inhibition as very similar processes. (*b*) *Traumatic Kamri.*—Kamri is sometimes produced in its worst form from injury to the spine.

SPECIFIC CAUSES.—Symptoms resembling those of ordinary kamri may be seen accompanying the course of certain specific diseases, but especially that of anthrax, rabies, surra and others. We are familiar with a form of paralysis of the hinder quarters which occurs in

cases of rabies in the horse, but especially towards the latter stages of that malady; and this form of the disease simulates kamri in the horse when the history of the case is not known. Diagnosis is generally easy when we have the previous history of the case, and when other symptoms, absent in kamri, have been remarked in the case preceding the paralysis.

2. Similarly, one form of anthrax, attended with paralysis of the hinder quarters, may be mistaken for kamri, but is distinguishable from it by (*a*) the course of the disease; (*b*) the concomitant symptoms of anthrax, which are never witnessed in kamri; and (c) the presence of the *bacillus anthracis* in the blood and other tissues of the patient.

3. Dr. Wallace Taylor made the observation in 1880, that outbreaks of beri-beri in man were frequently associated with outbreaks of paralysis in animals—but especially in ponies and mules in Burma, China, Japan and adjoining countries—and that this disease of animals had a pathological relation to that seen in human beings, in that the blood of affected animals showed, on examination, the same organisms—*bacilli*—as Dr. Taylor had described in beri-beri of man. The subject of beri-beri has attracted considerable attention in India and elsewhere, and every day new and hitherto imperfectly understood diseases are coming under its nomenclature. Sir J. Fayrer even suggests that pernicious anæmia is probably the same disease in Europe. Cases of œdema of obscure origin, as well as other diseases so often met with in practice in India, might also be shown to be but different forms of beri-beri. One fact is noteworthy in Dr. Taylor's account, namely, change of situation and climate

always brings about an improvement in the cases; and this fact has been noted also in animals, as Dr. Taylor mentions both an acute and a chronic form of paralysis, and it is the latter cases which benefit mostly by a change of situation.

4. We have seen that paralysis of the hinder quarters sometimes characterised cases of surra in India, and Professor Fröhner has noted the same feature in Germany, where this symptom of paralysis was not infrequently present in pernicious anæmia in animals.

DIAGNOSIS.

I think the etiology of the disease shows that the subject of kamri in the horse—whether true or symptomatic kamri—is at once wide and interesting, and therefore worthy of our closest consideration. We must not, however, confound the simple forms of kamri with those due to specific causes, which are readily distinguishable by the course and concomitant symptoms, the presence of the specific organisms in the blood and other tissues, the influence of treatment, etc. The paraplegia accompanying the course of specific fevers—anthrax, rabies, surra, etc.—is not a *neurosis*, but is without doubt symptomatic, arising from reflex irritation of some remote disturbance, in this instance probably some blood-vascular derangement of congestive character. It is obvious that, the spinal cord being a complex organ, any reflex irritation arising from it would be more or less generally manifested, thus explaining the posterior paralysis sometimes noted in the course of these diseases. It is generally transient in character, of varying degrees of severity,

and usually passes off on the disappearance of the other symptoms common to the disease. The paralysis in kamri comes on quite independently of any febrile disturbance, and always runs a prolonged course, the symptoms lasting for many months or even years. In fact, general belief stamps the disease to be, as a rule, incurable through life: hence all animals affected with kamri, in the old stud days, were sold by public auction, as unfit for the service.

SYMPTOMS.

A horse affected with kamri stands in the stall with his hind legs under him, *i. e.* places them somewhat forward under the belly and parallel to each other, instead of one leg before the other as in health. He changes his position now and then, and again stands as aforementioned. In backing, he does so with difficulty, and drags his hind legs under him, and, if any force is used, even goes down sometimes on his haunches. In trotting, he has a rolling action behind, and the hind legs swing from side to side, especially in going up or down hill, which is noticeable from the hips downwards. In turning at a trot on the left, the animal swings the off hind leg outwards, and the near hind leg when turning on the right side. Some severe cases have a difficulty in rising in the stall, and, except in cases of kamri from injury, they evince no pain on pressure to the loins.

PROGNOSIS.

The prognosis is more hopeful in young than in very old animals, as in the latter it is less amenable to treatment even in the early stages, and in either chronic or

ordinary kamri serious symptoms are more likely to supervene in older horses than in young ones, in which it is under the control of appropriate treatment. I think that it may be stated generally that a person should not purchase a horse for at least twelve months after amelioration of the acute symptoms, and that he ought not to do so whilst any weakness in the animal's action is noticed, whatever time has elapsed since apparent recovery.

TREATMENT.

The treatment which is found most efficacious in practice is the internal administration of nux vomica, commencing with 20 grs. doses, and gradually increasiug the amount to two drachms each dose, given twice daily till improvement is noticed. In some cases the iodide of potassium will be found beneficial, with iron and other tonics. It is always well to administer a physic previous to commencing the treatment by more specific agents. When symptoms simulating those of kamri proper follow in the course of any specific fever, the same treatment will be indicated as is found beneficial in the management of that particular fever; we must, in fact, treat the disease, and not the symptom in this instance.

In the case of gram so obviously faulty as that aforementioned in which the presence of kasari dal is unduly heavy, a committee should, if occasionally con vened, act as an effectual check upon the culpable carelessness of contractors. The presence of a few of the kasari seeds in a relatively large bulk of gram is doubtless of no great moment, and it is not easily avoidable in some districts during certain seasons of the year; but we must contend for a reasonable degree of official

attention on behalf of the general health and food supply of the horses. It used to be said that animals fed on grain containing the kasari dal have frequently escaped all harm, and the view that it has any action in producing kamri in horses has quite recently been denounced as "theoretical." Nothing would be gained by substituting gram mixed with kasari dal for the pure gram in ninety-nine cases out of a hundred, and something would in every case be lost.

In those cases of kamri where heat is the primary cause of the disease, the object is to reduce temperature as speedily as possible, and before tissue changes have taken place. The bowels should be relieved at once and injections of quinine given hypodermically to reduce temperature and blood-pressure. Locally, the judicious application of cold by affusion, and counter-irritation by blisters over the spine are essential.

PATHOLOGY.

The symptoms of kamri consist in disordered innervation and general functional derangement, leading to secondary changes which may be found in varying degrees of severity in different cases. There is marked hyperæmia and extravasation of blood causing pressure on the cord, which is found to have undergone degenerative changes of the nerve cells; the latter are atrophied, shrunken, or eaten away, the connective tissue of the cord and membranes being hypertrophied. The cord itself is sometimes seen to be enormously thickened due to this hypertrophy of connective tissue.

The above changes are, doubtless, of secondary origin, the result of the disturbance of function, and afford no

indication of the morbid influence by which the function is disturbed. The one almost solitary fact which we have to guide us in seeking for the seat of the disease is the change in the irritability of the mortor nerves of the hinder quarters. This proves beyond a doubt that the nutrition of these nerves is changed. But such a change in the nerves suggests a similar change in the mortor nerve-cells of the spinal cord. Of these the mortor axis-cylinders are the processes, and share the changes in nutrition of the parent cell. Moreover, the loss of power, or paralysis itself, indicates that there is a morbid state of the grey matter, since we know that only nerve-cells can liberate the energy which causes motor power. We may feel sure, therefore, that the motor nerve cells of the cord and the fibres proceeding from them, are in a morbid state. But whether the morbid condition arises primarily in the cord, or descends from higher centres, we cannot tell, and opinions which may be given, that this or that part of the brain is the seat of the disease, would belong, in the present state of our knowledge, to the region of unsupported theory. We are not justified in going for the seat of the disease beyond the spinal axis, including the grey matter of the pons and medulla, in which a morbid state is undoubtedly indicated. The enduring alteration in function proves some change in their nutrition; but the fact that this change remains limited to weakened power, and frequently passes away entirely or becomes greatly improved under appropriate treatment, proves that it is comparatively slight in degree, and probably limited to such fine molecular changes as could not be recognised by any means of investigation at present at our disposal.

CHAPTER IV.

"BARSATI;" OR, ATROPHIC CARCINOMA.

From 1838 to 1879 numerous essays, papers, and other contributions were published on this subject of *barsàti*, especially those which came from the pens of army veterinarians serving at that time in India; and numerous theories were propounded as to its nature.

These observations refer to a few additional branches of inquiry set forth here, and I believe they may not be devoid of interest as supplying a continuation of the history of the disease; while, at the same time, it will be of some importance on account of its nomenclature and pathology, barsáti being confounded in India with many other diseases, some of which are sufficiently characteristic, while others may be said to possess only a casual resemblance to it. It is therefore necessary to have as clear a view of the disease under consideration as possible, which can only be obtained by comparing its characteristics as they occurred to various observers in separate localities, in different years and seasons, and under varied conditions of climate and treatment.

Since I first sketched my experience of barsáti in the *Veterinary Journal* in 1880, and especially since the publication of my Pamphlet on Barsáti or Equine Cancer in 1886, the leading idea of that experience has been largely recognised. Thus, it has lately been asked whether cancer is not more prevalent among our animals in certain districts of England than hitherto recognised; and the disease was already well-known to veterinarians especially on the continent of Europe, and, more recently, has been described in America also.

The conflicting ideas or dogmas urged as to the proper treatment of barsati prove that the true theory that can alone govern a rational scheme of treatment is not yet fairly recognised. Following the views of Mr. Collins and of some of the older practitioners, there are those who advocate the parasitic theory as constituting the whole explanation of barsáti, and who assume that the treatment of this disease consists in removing the parasites from the sore, if possible—when they are justified in leaving all else out of consideration, well satisfied if they can patch up their cases even for a few months. As regards the clinical features of the disease in their relation to human cancer, all that we can say is that there is a peculiar likeness in all its phases, not necessarily limited to the history of the parasites, which has an important bearing on the pathology of the disease. At the same time, the parasitic theory will not suffice to explain all the facts regarding cancer or barsáti in our animals, seeing that the disease is not produced by injection of the parasites into the circulation, unless some other determining cause, such as injury or previous attack, comes into play; and because also the disease not infrequently occurs when no

parasites can be demonstrated in the sores, save such as develop on the outside of the latter in specimens steeped in special solutions.

Cancer, as a disease in the lower animals, does not find a place in many of our best treatises on veterinary surgery, and the literature of the subject of malignant growths in general is so scant that, in the course of my reading, I have only met with but one or two classifications attempted in English, although it has been made the subject of repeated consideration by continental practitioners. The comparative claims of the diverse divisions of the subject of malignant growths it is at present unnecessary to discuss. It will be convenient in this place to regard the disease simply from its own aspect, and to show that sufficient importance is not assigned to it in the treatment of the malady. In accordance with this view, I have attempted to invite the attention of the members of the profession to the clinical features of which no satisfactory explanation has yet been given. In this chapter I have collected certain bits of evidence which may help to advance the inquiry a stage, even if my arguments should fail to convince the critical.

I propose to consider the subject under the following heads, in which we have to appreciate the experience and indications given by practitioners in human surgery, and in turn to compare our own with them. We have constantly searched for a kind of index to these facts; and from them, when accumulated in sufficient numbers, we may be enabled to deduce general conclusions:—

GEOGRAPHICAL DISTRIBUTION.

The geographical distribution of barsáti gives perhaps the best indications of its pathology. The indications have rather increased since the important researches of Sir James Paget, Mr. Haviland and others on the distribution of cancer in England. It is conclusively shown that in human beings cancer does not prevail to any extent, if at all, in certain rocky districts which afford much limestone, and suggests preventive means in other districts where it is more prevalent. Dr. Henry Butlin has already shown that "High and dry localities are unfavourable to the occurrence of cancer, and that the disease flourishes chiefly in low, flat parts of the country (England) which are covered by alluvium and watered by many streams that are subject to frequent floods." (*Brit. Med. Jour.*, July 11, 1885.)

A fact connected with this difference of distribution is that which I pointed out some years ago, *viz.* that the prevalence of barsàti was associated with the principal river systems of India. In examining the distribution of barsàti in India, we found that the highest precentage of admissions from this cause was noted in the Bengal studs, which were situated on the banks of the principal river systems in the country. The Government stud at Hájipur, near Patna, was abolished many years ago in consequence of this very prevalence of barsàti among the horses. Since my return to India recently I had shown the prevalence of barsàti to be greatest in stations situated on the banks of the river Ganges, and that in hilly districts which were located some distance away from the principal river-beds, there was to be found an

exceptional decrease in cases of this disease. Take, for example, Jubbulpore and Saugor Districts. Here there is an entire absence of barsàti, noted in animals often previously affected in other stations, as shown by the veterinary history sheets. Not only in this district, but in others further down the valley of the Narbada, the Bijàwar rocks afford limestones of various qualities* and one which the famous 'marble rocks' are particularly noteworthy, both for the beauty and purity of the material of which they are composed.

The Saugor rocks which contain a great proportion of limestone, are also seen to be free from barsàti. Since my connection with this station, now over two years, I have not known a single case of primary barsàti either in Government or in private animals.

Raipore District, in the Central Provinces, where limestone is so abundant throughout that it would be difficult to say where it is not found, I am told by many old residents that barsàti is practically unknown there; and veterinary surgeon Hazelton writes to say (Q. J. V. S., April, 1888) that "barsàti is practically unknown at St. Thomas' Mount", in Madras.

Spontaneous resolution of a barsàti sore sometimes takes place on arrival into a hilly station, and I have recently had examples of this in battery horses at Saugor, as shown by the veterinary history sheets; and I attributed the cure to the change of stations, where the animals showed rapid recovery under simple treatment. In one case the disease had recurred several times when in another station, which rapidly recovered on arrival at

* Geology of India, Part iii, by Ball.

Saugor, and has never since appeared. Principal veterinary surgeon Oliphant has drawn special attention to the fact, mentioned in my Pamphlet on Barsàti published in 1886, that taking horses, the subject of barsáti, to the hills, brings about a speedy improvement. I have recommended several horses suffering from this disease to be taken to the hills, with marked benefit in every case.

It will thus be seen that the disease prevails chiefly in low-lying, damp localities, and that in rocky stations it has been witnessed only as an exception, at long intervals.

The rocky nature of the soil here doubtless assists in reducing the number of admissions from this disease; but whether by its physical or its chemical characters, it is difficult to say. "The silurian and other rocks that assist in reducing the prevalence of cancer", says Dr. Haviland (*Lancet*, March 10, 1888), "do so more by their physical than their chemical characters." While Dr. William Stanwell advocates the treatment of cancer by lime salts, notably burned oyster shells, and says that cancer mortality is less in limestone districts in England. (*Lancet*, April 21, 1888.)

Barsàti flourishes in the low-lying parts of India where heat and moisture are combined. It is seldom or never heard of on the hills or in dry, elevated localities; and the Collective Investigation Committee in England, who were recently engaged in an inquiry into the prevalence of human cancer, bring forward evidence to show that that disease prevails under similar conditions. Dr. Lyford,* of America, writing on barsàti,

* *Veterinary Journal*, May, 1886.

says,—"It seems to be confined to the neighbourhood of Minneapolis and St. Paul, with the exception of a few cases which migrate each year." Minnesota, with its chief towns, St. Paul and Minneapolis, offer a climatic type precisely similar to that of India in the rains. The chief drawback to the above-mentioned districts is the trying and unhealthy period which accompanies the annual melting of the snow.

Geographical distribution has never yet been studied in relation to barsàti, as far as I am aware; but this undue prevalence of that disease in some stations and almost entire absence in others, require further investigation. Moreover, the remarkable difference in the prevalence of barsàti in dry and wet seasons, which I pointed out some years ago, is sufficient to warrant us in believing that there is something underlying in the causation of this disease which has yet to be revealed. Another fact connected with this difference in relation to locality, season, *etc.*, is that which I first pointed out in 1880 to the readers of the *Veterinary Journal*, namely, that in my inquiries into the characters of barsáti, I had noted that those who would best understand those local conditions which are coincident with an increase of this disease should study well the distribution of human cancer. "There is abundant evidence to show that cancer does not thrive in high, dry localities, where the soil is kept sweet by the absence of floods, and the nature of the rocks which either underlie it, or form its principal constituents; and that it does thrive and become very fatal where floods prevail, where their emanations are sheltered, where vegetation is killed, and where, after the floods have passed away, a rank herbage springs up,

composed of sour grass and bitter plants." (*Lancet*, March 10, 1888.)

CLINICAL CHARACTERISTICS.

The relation of barsáti to cancer of man has presented great interest since our first announcement on the subject, and if the identity was not before actually suspected, the clinical observations and experiments which appear in the past literature of the disease clearly point in this direction, and which establish the identity contended beyond cavil or dispute. There are included in the facts given, reasons which, not refuted by the parasitic theory, require separate and permanent recognition.

We must now examine the several clinical features of barsàti and human cancer, and see if we can find that any of them show marked and definite relations to each other. I give quotations of the disease as seen in the two different species, for it is necessary to form a judgment as to the relative characters of each and to have a wide overlook on experiences which have been in the past recorded. My opinion is, and it is founded on careful investigations of many years, during which time I have witnessed the disease in its most varied and pronounced aspects, that barsàti is a disease common to robust condition of body, and that, although appearing in all animals, it is most frequently seen in horses having reputed good condition of body, the health only suffering in proportion to the advance of the disease from local parts to the internal organs. I believe the recorded experience of other veterinary surgeons shows

this conclusively. And the experience of surgeons regarding cancer in man is that, "prior to, and for a long time after the appearance of a cancerous sore, the constitution is distinguished, in most cases, by its remarkably healthy characters, and by the absence of any appearances which would indicate disease."* The great question which is thus raised is as to the condition of patients previous to the appearance of this disease, and the general answer is, "Remarkably healthy." Mr. Smith† characterises the condition of horses subject to barsàti as "vigorous."

Most authors who have written on cancer state that simple wounds and ulcers sometimes become the seat of cancerous disease, and that the epithelial form of cancer does frequently arise in the chronic ulcers themselves. Now, what is the experience in regard to barsàti? I shall quote Mr. Hart,‡ who writes—"Simple sores and galls, if neglected, are very apt to assume barsátic action", which is the genaral experience of veterinary surgeons in India. Writers on cancer lay great stress on "induration of the sore" as specially distinguishing cancer, a fact emphasised by those who have seen anything of barsáti before writing upon it. I. V. S. Oliphant,¶ in charge of Hápur Stud, observes: "From rubbing or biting—for the sore is particularly itchy—the crown of the ulcer becomes violently detached, leaving a moist, irritable sore, *the base of which speedily becomes indurated.*" Mr. Hart, in his paper on barsáti, describes "an indurated base extending to a depth of half

* *On Cancer, Mitchell, 1879.*
† *Veterinary Journal, 1881.*
‡ *Veterinarian, 1873.*
¶ *Veterinary Journal, 1880.*

an inch or an inch." Another important feature of barsáti, is the presence in the sores of pain or irritation felt at different intervals. Mr. Hart writes, what must be the experience of every one, that, "barsáti sites, though healed, are liable at any time to become irritable and to be gnawed by the horse; this act showing beyond dispute that some irritative action is going on." This pain is certainly considered very characteristic also of human cancer, although it is not constant, or the patient could not live, but comes on at intervals only.

A fact of some importance in the clinical history of barsáti is, absence of inflammation characterising the sores. I. V. S. Meyrick, in a lecture delivered at the Aldershot Military Veterinary School in 1881, said, the disease was "non-inflammatory" in its character; and John Hunter, in 1828, wrote,—"True suppuration arises from inflammation, terminating in a disposition to heal, which is not the case with cancer." This estimate in relation to our observations on the character of the lesions in barsáti, is fully borne out by the history of human cancer, which goes in confirmation of our views. Dr. Mitchell observes, that "the absence of inflammation throughout the entire course of the disease (cancer) is the general rule, though inflammation may and occasionally does occur during its progress, but then as an exception only." (p. 84). The sore in barsáti in the early stage, is, moreover, usually single, as in cancer, rarely becoming multiple until a late stage, and seldom even then; while the sores in parasitic disease are mostly multiple. The points of junction of skin with mucous membrane, as well as parts exposed to friction, are most frequent sites of barsáti ulceration.

Hence the favourite seats of barsàti are seen to be the angles of the mouth and the lips, which are liable to irritation by the bit, &c.; the inner aspect of the fetlocks, more especially in horses given to habitual "brushing"; the prepuce; the lachrymal region, &c. The results of operation have likewise proved most unsatisfactory in the case of barsàti as in that of human cancer. I. V. S. Oliphant* writes,—"The state of the system existing in barsàti is not one that indicates the use of the knife;" and Dr. Walshe says,—"Cancers which have become quiescent have sometimes been cut out, and the operation been followed by rapid reproduction of the disease." Dr. Cooke writes,—"From 1851 to the end of 1863, we have had the opportunity of seeing at the Cancer Hospital 413 persons who had been operated on for cancer; and it will astonish the reader to be told that the average lapse of time before the disease returned in these cases was not more than *six and a half months*."† The experience of veterinary-surgeons in India shows that barsáti sores which, under appropriate treatment, generally subside about the end of September, re-develop their activity next March, April or May.

Not a few cases of barsáti become, after a shorter or longer time, arrested and retrogressive, and, ultimately, to all appearances, cured. These apparent cures are not always permanent, but after intervals of six months, a year, or more, a similar affection is started again, either in the same or in another part, or in both, when it contaminates the internal organs, or becomes again

* *Veterinary Journal, July, 1880, p. 18.*

† *On Cancer; Its allies and counterfeits, pp. 92-3.*

atrophic and is arrested: another striking resemblance between it and the form of human cancer known on the continent of Europe under the name *Atrophic Carcinoma*. Some pathologists call this *Recurrent** *Fibroid*, a vague term applied to many different species. For a tumour to be called fibroid it is not enough that it should contain fibrous tissue: it must also contain no other tissue. A fibrous matrix is common to nearly all tumours; and barsàti has a fibrous stroma which predominates in many parts of its structure, but it always contains in its meshwork cells; whereas true fibroids are composed solely of fibrous tissue. Moreover, although the distinctions of the various forms of cancer are useful and wise, and practical, and founded on natural laws, still there are cases in which these different forms pass into each other, and in which all these peculiarities may be seen affecting the same patient. "These cases of combination", says a recent writer on cancer, "are sufficiently rare to make the distinctions valuable in practice, but they at the same time show the common character of all these forms of disease." Various other names have been given to this form of cancer, as for example, *contracting cancer*, *cicatricial cancer*, *etc.*, each of which indicates some prominent feature of the disease. The cells, in this form of the disease appear to be very short-lived, for they are scarcely formed before they commence to decay (*Billroth*); but peripherally the slight cell-infiltration constantly extends, hence complete disappearance of the disease rarely, if ever, takes place. Some surgeons even object

* The term "recurrent" here is misleading, inasmuch as all malignant growths are recurrent.

to the term cancer being applied to epithelioma, but this objection is not valid, being founded on mere physical differences of no importance.

Mr. Hart writes—"After an *indefinite* period of immunity the disease (barsáti) reappears." We know the history of several cases in which the disease recurred after a cessation of three years, and in one case, recently treated, after a period of four years; whilst Hutchinson, Professors Billroth, Buchannna, and Dr. Whitehead give instances of immunity after operation and other modes of treatment for cancer, extending to three, five, and fifteen years in the case of man.* The tendency to fibroid development in excess of cell formation is one of the most potent agencies in giving respite, and, in some cases, towards arrest and apparent cure of the disease.

In England it has been seen that nearly twice as many females fall victims to cancer as males. In India this has not been noticed in the case of barsáti seen in animals. In Victoria the difference in the mortality between the two sexes is but slight; for instance, the Lancet says, "The mean annual death-rates to every 10,000 of each sex living during the years 1861-1884 were as follows: in England, males 3.78, females 6.92; in Victoria, males 4.28, females 4.52."

We have already shown that the presence of tubercle-like nodules in barsáti sores is diagnostic. And Dr. T. Weeden Cooke, on the subject of cancer in man, on page 33, writes: "In many cases the incisions made for the purpose of removing the diseased mass have scarcely healed before '*tubercles*' have appeared around the cicatrix,

*Med. Times and Gazette, 7 March, 1874, p. 256.

or the wound itself has taken on the diseased action." Dr. Green* says: "The cells may be so closely packed as ultimately to become hard and dry like those of nails and hair, and the globes are then of a brownish-yellow colour and of a firm consistence. These globes are often large enough to be readily visible to the naked-eye." Professor Billroth considers the presence of nodules in the skin, when numerous and well-characterised, diagnostic of one variety of cancer he has specially studied in Europe.

In their general history, clinical and post-mortem characteristics, course of development, and in the nature and extent of influence producible upon them by treatment, barsáti in the horse and cancer of man are identical. Excepting perhaps the lesser fatality in herbivorous animals noted by M. Leblanc, there is perhaps no feature of barsàti which may not be observed in cases of human cancer.

With regard to a question that has arisen regarding the fatality of this disease in the horse, it may be well to mention that melanosis is very little more fatal in the same animal, although it is so rapid in its effects in man; and yet melanotic sarcoma of the horse is only ordinary sarcoma, but otherwise just as usual.

While we cannot expect to find *exact* resemblances—no more than we find them in human and bovine tuberculosis, for example—I think much important data will be presented on a careful comparison of the leading characteristics of barsáti and cancer, pointing to their identity; while any apparent difference may be explained by the

* Green, Morbid Pathology, 1878.

difference in the conditions of species. The difference between man and the lower animals imparts to the tissues the alterations in their molecular disposition to the disease, which explains the difference in the virulence of the disease in these patients. Besides which silica is one of the substances which is found in the body, especially in the case of vegetable feeders; and silica and other salts assist in reducing the death rate from cancer even in man.

Professor Verneuil believes, and M. Reclus has collected statistics to prove, that cancer was all but unknown among persons whose food was exclusively vegetable. In regard to barsáti seen in our animals, may not a vegetable diet similarly influence its rate of mortality? We have noticed that horses fed on a starch diet (bran) exclusively, make more rapid progress than others receiving much gram during an attack of barsáti.

Sufficient attention has not hitherto been given to the question of food-supply as influencing the course of barsáti, which is capable of being greatly developed. The preventive value of starch so far as it affects the course of human cancer, has been to a great extent recognised, but no special measures have been undertaken to develop its significance, especially in the case of vegetable feeders.

It appears to me that in the study of malignant growths there yet remains some interesting work to be done in connection with those differences which depend upon the peculiarity of species, or of constitutions, and which influence the degree of malignancy in different animals. We have seen that almost all varieties of maglinant growths appearing in our animals run a

milder course than they do in man; and in the greater proportion of simple wounds, this difference has been also noted. Now, if this should be true in the case of simple wounds seen in the lower animals, why should it not be noticed in malignant growths? My observations lead me to believe that all malignant growths in animals, except those seen in dogs, run a much milder course, as a rule, than they do in man. It is quite easy to understand this when we recollect that the same distinction has been noted in the behaviour of simple wounds abovementioned. From these experiences we draw the conclusion that cancer in herbivorous animals is not generally so severe in its results as cancer in the carnivora.

When we characterise slowness of diffusion as a primary feature of barsáti, we are obviously referring not to all cases, but to the general behaviour of most of them, and to the peculiarities of this disease in the main. I would not omit to name in this connection, numerous other cases where the chief feature of the disease is seen in the severity of the lesions, and where there are no intermissions, but the malady rapidly generalises itself, often within a few months. These cases are happily in the minority, and, compared with the former class, comprise but a very small proportion of the cases treated by the veterinarian. In other cases in which diffusion is slow, ill-health is not remarkable until a very late stage, and I do not think that an absolutely normal temperature and fleshy condition in barsáti is any sign that the disease is not progressing. The progress of the disease from local parts to remote structures, or a *metastasis morbi* in barsáti, as experience

ence has shown, is generally very slow, and extensive disease of the lungs and other viscera is not incompatible with tolerable good health of the patient and capacity for regular ordinary work.

What is the nature or degree of malignancy of barsáti? Is it like the more virulent medullary form, or the local epithelial, or hard scirrhous cancer? Microscopic observation reveals some variety in the structure of this morbid growth, which generally shows a large proportion of fibrous stroma resembling hard cancer, and sometimes, though rarely, an excess of cells approaching more to the characters of epithelial cancer, some of the cells being arranged concentrically in places and thus forming the well-known "epidermal globes," or so-called *kanker* nodules of a barsáti sore. On the other hand, many intermediate examples may be seen in an examination of the sore during its different stages. It is clear that, any nomenclature of this disease which is founded on anatomical characters only, must necessarily be faulty, if not misleading, and I have therefore proposed that barsáti should receive the designation, *Atrophic Cancer*. We have found this designation, which is based on general characters of some importance in the clinical history of barsáti, the most comprehensive, and therefore the most correct one to employ.

CONDITION OF THE GLANDS.

The condition of the glands in barsáti has been a subject of much debate, and it seems to have been pretty generally accepted that the glands were always affected in cancer. Experience shows that the glands

are seldom enlarged in barsáti unless ulceration is pronounced, as in some cases we have lately recorded. (*The Veterinarian*, Jany., 1885.) Dr. Wilks agrees with us on this point in reference to cancer in the human subject. (*Pathological Anatomy*, 2nd Ed.) Dr. Campbell de Morgan says, that "the reason why the neighbouring lymphatic glands are so seldom implicated in the epithelial variety and oftener in the encephaloid, or soft cancer is explained by the difference in their histological constitution". (*Med. Times and Gazette*, 7 March, 1874.) Paget says, that "the lymphatics are upon the average not affected until the disease has passed through half its period of existence" which, in man, is computed at two years. (*Surgical Pathology.*) Dr. Bastian says, "the neighbouring glands become affected in cancer just as they do where simple inflammations exist". (*Brit. Med. Journal*, 7 Oct., 1871.) Dr. Mitchell considers "that the lymphatics should *not* be specially mentioned in defining cancer". (*Treatise on Cancer Life*, 1879, p. 79.) Mr. Hutchinson says, "the glands are seldom affected in Thiersch's cancer". (*Clinical Surgery.*)

RECURRING NATURE.

It is not at all unlikely that some of us have the opportunity of seeing this disease, in our equine patients, at an earlier stage than others generally see it; and sent as these patients are for treatment after repeated recurrences, we rarely have an opportunity of testing the precise value of many vaunted remedies during its different stages. Experience has shown that recurrence of

barsáti is not confined to the wet weather. It remains to be acknowledged, however, that though this is the case, yet, the disease having once established itself, its return *in loco* is rendered probably more certain during the rains than in any other season. The fact itself, we may observe, appears inexplicable to many who recognise it as such, but its causes are, notwithstanding, capable of explanation; for, as Dr. Moxon* has observed, moisture intervenes, together with the other unfavourable influences of accompanying heat, etc., during wet weather, which augment cell-growth in cancer structures. The effect of moisture in the atmosphere during the rains, therefore, is an increase of cell-activity and a general acceleration of all the worst accompaniments ef barsàti.

It has constantly been assumed that the term barsàti implies the occurrence of this disease is limited to wet weather, or that moisture favours its development. As a matter of fact, we know that moisture is a condition favourable in the extreme to the growth of human cancer; while the malignancy of the disease, when it is once developed, is greatly aggravated by moisture, as is easy to understand. For, "the malignancy of epithelioma† is greatly influenced by physical conditions, being more pronounced in proportion to the moisture, vascularity and amount of movement in the part." As regards its recurrence during the rains justifying the name of barsàti, we observe a great tendency of prevalence of all forms of skin disease during wet weather in India, the

* Moxon, "Trans. Path. Soc.," XX, 28. See Arnott "On Cancer," 1872, p. 70.

† Jones and Sieveking's Pathological Anatomy, 2nd Ed., p. 180.

frequency of which is simply the effect of normal activity of the skin. We further know that simple wounds are subject to the same law in India, in consequence of the peculiar state of the atmosphere, during the wet season, telling injuriously on diseased and injured tissues.

It is said that recession of the sores is peculiar to barsàti only, but I am not enabled to endorse this opinion. It is well known that alternate cessations and recurrences of the sores characterise human cancer quite as much as they do barsáti. Dr. Campbell de Morgan, F. R. S., writes*: "A remarkable and not very explicable phenomenon is the arrest of cancer growth and the gradual wasting of the diseased mass. The activity of the whole mass is arrested, new cells cease to be formed, and the tumour fades—*a widely spread mass becoming quiescent and then fading throughout its whole extent.* It shifts the difficulty back a stage or two to suggest that the recession of cancer takes place in obedience to the law under which local atrophy, independent of inflammation or disease, may occur; or that it may be due to some want of organising power inherent in it from the first, as *some cancers seem born to be atrophic.* It is, under any circumstances, a most important subject for investigation."

From the foregoing remarks it must not be concluded, however, that the period of respite due to atrophic change, is an invariable feature of barsáti. Not by any means has such been found to be the case in our experience of this disease; for, it is usually noticed in the milder cases only, where constitutional symptoms are

* Med. Times and Gazette, 7 March, 1874, p. 256.

also absent; whereas it is not at all uncommon to see sores existing before and persisting throughout the winter as well as during the summer. In many cases the disease runs its destructive course in a few months. Had our knowledge of cases ended when the disease first showed signs of local arrestation, we should have been compelled to adopt the prevalent theory of reported cures; but fortunately our cases have gone further, and in too many instances revealed the nature of our panaceas Nothing is more common than for a gradual breaking up of the constitution to be suddenly noticed when the disease has reached a certain stage.

NECROPSY.

Inasmuch as *'kankers'* are perhaps the most noticeable morbid change found in the internal organs, we may begin with a consideration of them, and describe the other changes afterwards.

(*a*) 'KANKERS.'—They are found in the lymphatic glands, in the lungs, liver, spleen and other organs. In the latter, they may be either deeply imbedded, or seated superficially on the surface and on fibrous and mucous coverings. They are both discrete and confluent, are of various sizes, shapes and forms, and of different consistency during different stages of development. Some of the youngest, seen on the surface of the lungs, appear slightly depressed in the centre, giving the surrounding pleura a peculiar puckered appearance. Those older in the stage of development, are harder to the feel, have an irregular outline and, when seated on the pleura, are slightly raised above the surface of the lungs and

surrounded by a zone of fibrous or cirrhotic tissue." Histo logically, these kankers differ in no respect from similar kankers found in the sores externally seated. In some places they produce, by confluence, characteristic "lumps" in the substance of organs, but particularly in that of the lungs. The irritant which produces barsáti nodules in remote structures is merely a tissue irritant derived from the external sore, and acts embolically; the caseation that sometimes follows is a mishap due to insufficient blood-supply; while the later change of calcification is due to infiltration of this structure with inorganic salts. Caseation of a barsáti nodule takes place generally as a result of complicity with other products and from insufficient nutriment, which accounts for the infrequency with which yellow nodules are here met with; and in this respect the disease differs in an important particular from tuberculosis. It is commoner, as experience shows, to meet with the grey formations, and those which have undergone that physical variation by transformation into a horny mass, called cornification, or by infiltration with inorganic salts into '*womb-stones*' or kankers.

(*b*) CONSOLIDATION.—Many protions of the lungs undergo consolidation, the result of catarrhal inflammation, and produce, what may be called, a peculiar cloudy degeneration, due to the air-vesicles being occluded with catarrhal products, in which may be seen numerous large, polygonal or hexagonal cells having ovoid nuclei and many nucleoli. The air septa are also the seat of a dense infiltration by numerous small cells. Auscultation over parts of the chest corresponding to such portions of the lungs shows loss of murmur of the normal sounds of the lungs, during life. The consolidation is frequently

a result of fibroid change in many advanced cases. Dulness is sometimes, but not always, detected, because frequently the surrounding lung is super-resonant from emphysema. Gradually the lungs become more and more extensively involved, and the signs, as well as the symptoms, are not to be distinguished from those of any other chronic lung affection.

(*c*) THE PLEURA.—Is the seat of important and marked changes in the advanced cases of this disease. It loses its normal transparency, becomes rough to the feel, and cloudy in appearance, and is thickened and adherent to the subjacent lung-tissue. In specimens steeped in alcohol, this is beautifully shown, the pleura being raised into distinct *rugæ*.

(*d*) FALSE BRONCHI.—Small cavities appear on section of the lungs resembling true bronchi, but which on inspection are found to be cavities emptied of kanker, and indicate the seat of kankers which have been dislodged in the act of sectioning. True dilatation of the bronchi may be seen in many long-standing cases of barsáti, due to cirrhosis : the cirrhotic tissue contracting, pulls the bronchi open on principles well recognised.

(*e*) EMPHYSEMA.—When any portion of the lungs is consolidated, the adjacent parts take on increased or excessive action, one of the results of which is emphysema, the amount of which will always be regulated by the amount of consolidation present in any given case.

(*f*) PHLEBECTASIS.—Or a dilated, corded condition of the blood-vessels of the lungs, generally of the subpleural vessels, also results in a few cases, from compensatory action.

No suppurative changes are usually noticed in any of

the internal organs in cases of barsáti.

MORPHOLOGY OF KANKER.

What is generally termed *'kanker'* in barsáti, is not kanker properly so-called, but is a product of disease, a cell-concretion in fact, either with or without calcareous deposition; for, there are two kinds of kanker, namely (*a*) soft, or fatty or caseous, and (*b*) hard, or calcareous kanker. When they are present in the sores they are considered characteristic; but they may be occasionally present only in small numbers, or be altogether absent in some cases. They may, and do occur also in the internal organs, during the latter stages of this disease. Billroth, of Vienna, in describing one form of human cancer he has specially studied, says, in respect to these concretions, that when they are numerous and well characterised, they are diagnostic. There is no doubt that, in hot climates in particular, their formation is expedited by the process of desiccation. We have noticed similar formations in the eruptions of horse-pox, which I described in the *Veterinarian* of 1884, and in other diseases mentioned in my work on Veterinary Surgical Pathology published lately.

The characteristic disposition of the cells in certain varieties of cancer, to settle themselves in concentric layers, makes an opportunity for the calcareous deposition taking place in them to convert them into conspicuous globular bodies—visible nodules. Beyond exhibiting the properties of a foreign body, however, kanker does not play the dire part of the cells not similarly circumscribed by calcareous deposition, but which, imbued with

the change peculiar to cancer, work hidden havoc by their pronounced tendency to infiltration of the adjacent tissues, and to constitutional invasion through the process of normal absorption carried on by the veins and lymphatics.

Microscopic examination of kankers reveals the fact that they consist of neither bone elements, as held by veterinary-surgeon Western; nor scrofula cells, as contended by veterinary-surgeon Hodgson; nor inspissated pus, as believed by veterinary-surgeon Phillips; for, we have no record of any microscopic examination in respect of either of the aforenamed theories, but merely a belief, amounting to hypothesis, has hitherto been expressed in regard thereto. A fourth view is held by Mr. Meyrick*, who found crystals of uric acid and oxalate of lime, and various other crystals have been described by different writers. Questions have been introduced during this controversy as to the occurrence of specifically shaped crystals in kanker. We do not think that "specificity" in the shape of crystals indicates aught else than that particular salts very constantly predominate in these kankers in consequence of their presence in the blood; but, then, we are also aware that the blood of different animals yields, in its natural state, various shaped crystals; and the occurrence, therefore, of crystals of this or that shape adds but little to the pathological information on the subject of which we are already possessed, it being a concomitant of health, or, in other words, a purely physiological product and unconnected with the process of disease. We must there-

* *Veterinary Journal, Nov., 1878, p. 320.*

fore conclude, that pigmentary matter and crystal forms met with in barsáti concretions, are simply the products of normal blood, and indicate prior extravasation.

To examine the above theories more in detail:

(*a*) Veterinary-surgeon Hodgson contended that kanker was made up of scrofula cells, and that during one or other of its stages of development it underwent fatty change. Undoubtedly right as this theory is in stating kanker to be subject to fatty change, it is as undoubtedly wrong in stating kanker to be made up of scrofula cells.

(*b*) Veterinary-surgeon Phillips, as surgeon and clinical observer, maintained that kankers were so many little pellets of inspissated pus. Mr. Phillips makes no mention of any microscopic examination, and we would remark that, once it was the general opinion that the nodules in tuberculosis were also simply masses of inspissated pus; but the development of histo-pathology has dissipated that view. And so we make no doubt that Mr. Phillips, imbued with this idea, readily fell into the belief that the kankers in barsáti sores were, in the same manner, simply masses of inspissated pus. But, masses of inspissated pus are discriminated from among their counterfeits through the circumstance of their possessing no distinct intercellular substance or fibrous matrix. Those who have examined a kanker nodule during its various stages of development know that, in addition to containing cellular elements, it is possessed of an abundant intercellular substance or fibrous matrix, among other things, depending on the stage of development during which the kanker is subjected to examination.

(*c*) Veterinary-surgeon Western maintained that these bodies were so many centres of independent osseous development. We are, however, unable to concur in this view, not having seen any such presentment under the microscope in our examinations into the nature of these disease-products. Mr. Western in coming to the above conclusion has chosen to adopt the *rôle* of a mere physicist. He has brought himself to the maintaining of this because of the fact that these bodies were hard to the feel, brittle, and chipping when struck by metal, &c.,—properties that very naturally engage the primary attention of physicists. We know that osseous change may, and does take place during certain morbid developments, but we cannot say we have found it do so in kanker in the examinations we have made of it; while the brittleness and hardness are demonstrably due to chemical changes occurring in it during its progressive stages of development.

DIAGNOSIS.

We will now direct our attention to the differences that exist between barsàti and those other morbid products which in some measure simulate it, and are not infrequently mistaken for it by those who are not skilled in the diagnosis of these diseases. The diseases with which barsàti may be confounded are rodent ulcer, Delhi-boil or lupus, keloid or *chakáwur*,* and ichthyosis. The important difference between barsàti and the latter is their limited diffusibility as compared with

* *The Veterinarian, March 1885.*

barsàti. They spread slowly and only continuously into the surrounding tissues, and their course is free from any generation of secondary disease in internal organs and distant tissues which characterises genuine barsàti. It is this restrictedness which marks the course of all these diseases, and makes their distinction from barsàti both possible and comparatively easy; while physical differences, together with a microscopical examination, should settle the decision in case of doubt. From lupus the disease is generally easily distinguishable. Lupus has seldom the hard base which always characterises a barsàti sore. It leaves a larger scar; does not contaminate the system; and while the centre of the sore may be showing signs of repair, the circumference still spreads on. In all these features it is quite distinct from barsàti. In keloid the induration is by no means so marked as in barsàti, neither is it of that inelastic character which indicates true barsàti. In keloid, connective tissue bands are deposited into wedges in the substance of the corium, and completely supplant it, which is not the case with barsàti. Keloid is found generally upon some part of the trunk. Ichthyosis has its seat always on the lips, and is characterised by special clinical features. The character of the scab is no less important. It is invariably thick in ichthyosis; in barsàti it is usually slight. The less extent of surface usually implicated, and the absence of any intervening constitutional disorder make it easy to distinguish ichthyosis from barsàti. There is a capacity for internal disease always present in barsàti that is absent in ichthyosis. In barsàti the local and constitutional morbid changes intensify *pari passu*. Doubtless analogies are presented by comparison with

the milder cases of barsàti in which no constitutional symptoms have been developed; but the comparison would appear erroneous beside typical cases of that most destructive disease, which never fails to involve the internal organs during its latter stages, as shown by numerous post mortem examinations we have made. For a more detailed description of these diseases, I must refer the reader to my work on Veterinary Surgical Pathology.

PATHOLOGY.

The analogy between the features of barsáti and those of human cancer naturally led to the supposition that some specific parasite may be the cause of the former as it has been lately suggested in the case of the latter. It would be rash to say that such a mode of causation is impossible, but at present no such parasite has been demonstrated in the case of human cancer, and little or no evidence has been given pointing to the probability of there being any connection between those parasites which have been noted and the growth of cancer itself. It is exactly one of those cases in which the difference between the presence of special and accidental parasites must be clearly understood, for it is highly probable that micro-parasites of various species may be present in cancer sores. Adherents of the parasitic theory point to barsáti being most frequent in parts to which water is often employed, and which they suppose is the medium of contagion. Water applied to the mouth, eyes, limbs, etc., may very probably have been noticed to cause the disease in horses owned by natives and others who use water for cleaning their animals, but under a good stable

system such a practice ought not to exist, and surely does not exist in regimental horses. Nor could such a cause be assigned for the prevalence of the disease in the case of horses belonging to the Government studs, where the use of water for cleaning purposes was strictly prohibited; and yet, barsáti was as prevalent in these as in other horses. As regards the second reason assigned for water proving a medium of contagion for the parasites we are not aware of any clear and conclusive evidence which shows that barsáti is inoculable, if parasites are to be looked upon as the active agents concerned in its development. Many attempts have been made during the last thirty years to produce the disease by inoculation in healthy animals, but the attempt has always been a failure. The most unsatisfactory part of the parasitic theory of barsáti is that which treats of parasites as the *cause* of this disease, when inoculations have no effect in producing any similar disease.

The main interest in this fact lies in the illustration it affords of the similarity shown between this disease and cancer occurring in man. This view of its causation corresponds exactly to the germ theory of the causation of cancer, though recent experiments in Berlin had confirmed the observation that it was impossible by the methods at present employed to cultivate any sort of organism from cancerous tumours. Further, at a recent meeting of the Pathological Society of London, the President, Sir James Paget, desired to state that the number of cases recorded of cancer propagated by contact was so small that it was almost coincidental. He had "never seen cancer of the tongue infect the cheek, nor cancer of the lower lip infect the upper, nor did cancer of the

lower eye-lid produce disease of the contiguous side of the next. These negative instances predominate so immensely over the few positive cases that we are driven to conclude", says Sir James, "that the latter were mere coincidences."

There is no doubt but that the action of many so-called pathogenic fungi, if present in barsáti sores, produces a kind of inflammatory change which in many cases aggravates the actual disease process, leading to suppuration, abscess and other results of acute inflammation, especially noticed in susceptible animals. But ample objections to the fungus, as a causative agent, may be gathered from its advocates. Mr. Smith, who has lately written on the subject, states: That he has noted the presence of a fungus described by Mr. Collins in barsáti sores, which he believes is a cause of the latter. This is nowhere proved. Next, as to the effects of inoculation: That in several attempts at inoculation the disease could not be produced, except in a single instance where the animal was doubtless already the subject of that disease before the inoculation was practised. Then, as to the species of fungus concerned: Various kinds of parasitic life have been described in barsáti sores, but no one kind has been shown to be universally present by any of the observers. Where so many different sorts of fungi exist to explain the causation of barsáti, it seems unnecessary to imagine a fungal origin of this disease. It is confessed further by all authorities, that all diseases, like barsáti, if due to a parasite, readily occur on inoculation, especially when every opportunity has been allowed to test the point in daily practice.

Drs. Lewis and Cunningham (*Report on 'Oriental*

Sore', or Lupus Endemicus, 1876), of Calcutta, have already shown how, similarly, the growth of fungi in Delhi-boil may occur as the result of the tissues being steeped in chromic acid and chromate of potash solutions. Quite recently Dr. Fenwick (*Lancet*, 1885), has found that in tissues hardened in a four per cent. solution of cocain, a peculair mould fungus always develops, whose presence is accidental and due entirely to the process of hardening the tissue. Parasitic organisms frequently develop also in specimens stained in carmine solutions.* Warden and Waddell ('*The Non-parasitic Nature of Arbus Poison*', Calcutta, 1884)have recently experimented with the arbus poison. Hypodermic injections were made, mainly on cats and fowls, in order to determine whether a general parasitic condition was necessarily associated with the toxic action of the seeds. From the general results of their experiments the authors conclude that the presence of organisms at the seat of injection is purely accidental, and that these develop from the air after the injection. Professor Ponfick (*Virchow's Archiv*, 1881) has demonstrated that organisms of various kinds are always present in tissues after the injection of turpentine and some other chemical irritants. The appearance of organisms in some cases may be ascribed to the possibly imperfect removal of them from the liquids used, or to the circumstance that, by their mechanical injury to the tissues, the power of resistance was lowered, which allowed the growth of the organisms.

It is remarkable that a series of inoculation experiments—scarifications and hypodermic and intravenous

* *Brit. Med. Journ., July 18, 1885.*

injections, conducted by myself as well as by other veterinary surgeons, should have been followed by no results, either local or constitutional. Indeed, judged by the verdict of common experience, the disease cannot be communicated, and is therefore not contagious.

If the analogy of parasitic action holds good between cancer of man and barsáti in the horse, we must assume that in every instance the disease has been "caught." But experience proves this to be correct in respect of neither. Thus, Dr. Wilks says,—"Cancer cannot be inoculated; it does not run a definite course; and, indeed, has no qualities which deserve it to be considered as foreign to the organism of the body;" and all attempts hitherto made to communicate barsáti to healthy animals have been attended by similar failures. Neither the human nor the equine form of the disease can be inoculated. I lay stress on this point, as I find observers on both sides pointing to exceptional cases of success attending their inoculation experiments. It is possible that there may exist an actual diseased state of system not yet developed, and where by local irritation in the attempt to inoculate with the discharge a nidus may be formed for the actual development of the disease, but then only as any other local irritant.

Allowing, therefore, for the sake of argument, that we have found a new method of injection, which produces barsáti growths in healthy animals, does this prove that the parasites which have been described are the cause of barsáti growths? Do we not know of connective tissue corpuscles, as altered in disease, producing degenerative changes in the tissues, and even leading in many cases to fatal results, as shown by Virchow, Dr. Tilbury

Fox, and many other good authorities? Do we not know of similar corpuscles detected by Dr. Flemming in Delhi-Boil, and which were also inoculable?

In the leading medical and veterinary periodicals the discussion on the infectiveness of cancer, and its dependence upon some specific organism—lately stated to be a bacillus—is more full of interest than ever, and helps only to explain the facts already known to us. Whatever may be the ultimate answer to the question of the origin of cancer, the important part played in its causation by the condition of the tissue of the part will remain unaffected.

The Lancet of Dec. 3, 1887, says,—"Should a cancer germ be demonstrated, its harmlessness, except in a suitable nidus very specially prepared for its growth, is undoubted; and the discovery will have but little influence on the views now held on the heredity of the disease and other similar points. Our columns have recently contained many letters on the question of the contagiousness of cancer, and no doubt the view that it is contagious will gain somewhat from the stress now laid upon its probable infective nature. Where its contagiousness proved, that would carry with it the fact of its being an infective disease. But we must say that the evidence in favour of its being contagious is far short of proof."

The Lancet of March 17, 1888, says,—"The arguments in favour of cancer being infectious were based upon the mode of its dissemination through the body, the occurrence of cases of acute miliary cancer, the supervention of cancer on chronic cutaneous irritation, and, less convincingly, upon the occasional occurrence of

'cancer by contact.' At the same time, the fact that the secondary growths reproduce the characters of the primary within tissues of wholly different nature formed a marked distinction from those infective tumours that are ascribed to the action of bacterial organisms. In tuberculosis and actinomycosis (we might add syphilis) the tumour is composed of indifferent cells, which are homologous with the elements (connective tissue) in which they occur. In fact, there is no instance known of a bacterium giving rise to heteroplastic growths—i. e. composed of cells dissimilar to those occurring at the seat of infection. The cancer microbe, if such there be, must then be intimately associated with the cancer cell or its nucleus, a relation which would therein differ from what is ordinarily believed to exist between the cell and the microbe. The problem is rendered more difficult from the fact that hitherto cancer has never been successfully inoculated upon the lower animals. We all know how the inoculability of tubercle was proved long before the bacillus tuberculosis was discovered; and the failure of such experiments with respect to cancer affords additional evidence of the difference between tubercle and cancer as regards their respective degrees of infectivity. As to Scheurlen's bacillus, Dr. Senger repeated the experiments upon which that discovery was made, making numerous cultures of portions of cancerous tumours upon various media without obtaining a micro-organism which could be recognised as specific; he proved satisfactorily that the bacillus of Scheurlen was due to the potato upon which the culture was made."

The question of the parasitic origin of barsàti must still be considered in an unproved state, the difficulties

in the way of investigation being great, owing to the fact that in diseased states of the external parts of the body which are exposed to the air, parasites of various kinds are found in abundance, and it is only by the isolation of these parasites and their cultivation in a pure state, that an attempt can be made to judge whether they are present as the cause of the disease, or only there, as doubtless most of them are, as a result of the diseased state, affording favourable conditions for their growth. It has been said that no fewer than half a dozen different specimens of parasites have been figured in the descriptions given of barsàti in the past, and several observers have laid claim to have discovered a 'barsàtic parasite.' Dr. Thin, of London, whose investigations may be considered reliable, and are published in the *Veterinary Journal* of Sept., 1879, found no parasites in kankers he examined from a case of barsáti. The parasites may be exonerated from being the cause of barsàti by the fact that they are often absent in this disease and frequently present in many simple wounds we have examined in India during the rains, and therefore may be regarded as accidental; and when inoculated on other animals, they do not produce a disease even resembling it. It seems, therefore, in this important respect, that barsàti, though showing the presence of parasites on external sores, does not follow the usual law of contagious diseases, of being contagious in the most susceptible animals. A large number of exprements have been made by me on horses, ponies and dogs, with fresh matter from barsáti growths, and no results were produced. The fact therefore is shown that though, like other sores, parasites are freely spread over a barsàti surface, yet this is

the result of some agency which favours parasitic development in external sores, so that the power of communicability which, accurately speaking, should be found is not found as a matter of experience.

Mr. Smith alone has succeeded,* after experiencing many failures,† in inoculating barsàti from one animal the subject of it to another that was not. And if we review the general experience in regard to experiments in this direction concerning both cancer of man and as it occurs in the horse, we find that the results of such experience differ in respect of neither. An experiment of Professor Langenbeck was supposed to have proved that the cancerous pulp containing the cancer cells is capable of propagating cancer in man and animals on being injected into the veins, but the attempt has been frequently made by others without any result. So in regard to barsàti; excepting the above instance, all other experiments by other veterinary surgeons have uniformly failed to produce the disease, although enough experiments have now been made in this direction.

The fact that the disease can be induced by inoculation, moreover, does not prove that the cause of the disease is derived from without the body, since the very cells of the body themselves, as changed in disease, can be transplanted from body to body and induce furunculoid and ulcerative mischief; in other words, there is nothing in the aspect of the disease itself, nor in the facts of the inoculated disease, to show that its cause is very likely to be parasitic. A direct transmission of barsàti has

* *Veterinary Journal*, 1384.

† *Ibid*, 1879, 1881.

been proved impossible; and it by no means follows that one or two exceptional successes which are recorded were entirely due to the inoculations, and were not developed in the ordinary course of things, seeing that simple wounds in India so often terminate in barsáti. I do not wish to say anything in discouragement of experiments, seeing that I have probably tried inoculations on as many animals myself; but individual results should include general results. It is also probable that constitutional predisposition, as from previous attacks of the disease, when present, may favour the success of an inoculation. We must at present explain differently the connection between such successes and the causation of the disease under consideration. We, at any rate, know that the accumulated experience of veterinarians of thirty odd years shows that experiment in this direction is by no means isolated, but is one of a series, many of which have been published in the pages of our professional journals. We may study Mr. Smith's success from two points of view, as showing the influence of constitutional tendency upon local disease processes, and the influence of local irritation upon general constitutional states. It is known that in a very large number of cases where simple wounds have been seen to be followed by barsáti sores, the constitution of the animal was at fault, as shown by the history of many cases.

Although the actually demonstrable lesions of this disease appear to travel from local to systemic centres, there is yet every reasonable probability that constitutional tendency, especially if favoured by climatic causes, may be the starting point of genuine barsáti. The local manifestations may be regarded as expressions of a

general dyscrasia; and an animal which from an injury or irritation gets indubitable barsáti may be held to be predisposed from causes latent in the system, which may appear healthy or even produce such results on the body as may be designated for the time "robust."

In contagious disease we think of a previous case of that disease from which it has been derived, with a certainty. In barsàti, we have never seen a case in which we felt this certainty.

Many observers agree in stating that barsáti sores are very liable to be immediately developed in the seats of abrasions, and that small sores take on in India a fungous or ulcerative character like barsàti sores. Mr. Hart speaks of this as occurring commonly during the rains in connection with the wounds and galls of the horse. Mr. Armstrong* notices the same thing. And we have only recently recorded several similar instances. The parts attacked are those most exposed to injuries or irritation: *example*, angles of the mouth, the lachrymal region, the prepuce, inner aspect of the fetlocks, &c. Thus, the continued irritation of tears over the lachrymal surface, or of secretions within the prepuce, or of the bit against the angles of the mouth of the horse, has been observed to be followed by the occurrence of barsáti in these parts in such a number of cases as to justify the inference that it has been the starting point of the disease.

We have seen that during the rains a barsàti sore generally becomes greatly aggravated and does not heal up under ordinary dressings. We recognise that wet

* Proceedings of Veterinary Medical Association, June, 26, 1838, p. 287.

weather favours the growth and increases the malignancy of a barsàti sore, but we know that the progress of a simple sore is influenced in likemanner during such weather. The opinion I venture to express is that this disturbing factor is dampness of the air, causing tissue metamorphosis and interference with the reparative process. Excess of moisture present in the air makes the protoplasm of the cell elements swell up, and ultimately become disintegraded. If this be so, we may infer that, where the influence of the healing process in simple wounds is upset by local causes, structural changes in a barsàti sore may be presumed to follow on the principle that the growth of an organic disease is similarly promoted by exposure to an atmosphere of opposed conditions. Thus it will be seen that so far as influence of season is concerned, aggravation of a barsáti sore in the rains may be viewed as a result of moisture that has led to very appreciable structural or organic alteration.

It appears to me incorrect, therefore, to refer this disease to parasitic action, as has hitherto been traditionally done. Any change in the nomenclature of disease which is made without due consideration of facts of clinical medicine and pathology must surely hinder accuracy in diagnosis, and is therefore to be deprecated. We must combine in our study of this disease experimental and clinical research to explain its pathology, and define the proper course to be adopted in its treatment. In this way may be added much to our knowledge of the disease. During recent years greater liberty is taken in the parasitic theory of barsàti but the characteristics of the disease itself have been entirely overlooked. No fact in modern veterinary literature is more

remarkable than the absence of all mention of the other departments in the history of disease. The present tendency is, perhaps, to exaggerate the influence of microbes, to take effects for causes, and ascribe to their agency almost every disease. The state of the tissue of the part itself is, unfortunately, not explained; but we may regard it as proved that a barsâti growth is made up of the elements of the part, having undergone changes in their character; and that the living animal is an aggregate of living particles or cells, each of which is liable to changes in its character depending upon changes occurring in the parent organism; and we may further assume that as the constitution of the parent organism is disturbed, it is shared by the tissues, and manifested under local irritation, forming imperfect states, and being thus converted from a healthy to a disease condition. This change we may fairly impute to irritation, especially when we consider that barsâti is remarkably common in parts liable to irritation. It causes unusual proliferation, with consequences dependent on greater or less perfection of the process of nutrition. Some of the cells of the body retain their natural characteristics; others, however, change their nature altogether, their structure and mode of growth alter, and they give origin to abnormal tissue—*e. g.* cancer, sarcoma, and other growths.

Uskoff, Ponfick, Drs. Burdon Sanderson, Beale, Bennett and others many years ago rejected an exclusively vegetable theory of morbid processes, which has not been controverted, and the idea of many normal cells capable of modification into the various forms of disease producing particles, commends itself at once as a view likely to reconcile many differences, and be acceptable to practical

as well as inductive physiologists, pathologists and clinicians.

The teachings of Huxley, Virchow, Uskoff and others show that the theory of susceptibility and phlogogenous action of cell upon cell is not all nonsense; it is only out of fashion, because many, at the present time, know of no "infective" process other than that by germs and fungi. Dr. Wilks writes, "It is now known that a variety of morbid growths may be produced in the tissues, and that between the one which is styled cancer and that which is identical with healthy material, all grades may exist. They are but modifications of normal tissues, show only altered nutrition, and can by no means be regarded as foreign to the system."

Dr. Beale writes, "When the germinal matter of the epithelial cells of certain mucous membranes, or that of other tissues of the body, or the germinal matter of the white corpuscles, lives faster than in health, in consequence of being supplied with an undue proportion of nutrient material, it grows and multiplies to an enormous extent. Many epithelial formations exhibit much the same changes in disease, and the gradual transition from the healthy and the morbid state is beautifully illustrated. Nay, we may almost conceive that it is by unremitting continuance of this very process, combined with irregularity in the rate of multiplication of contiguous particles, that the remarkable pathological formation—epithelial cancer—results."

Walshe, after giving his view of the enlargement of a cancerous tumour, says, "Microscopical examination has shown that some primary cells contain within them the nuclei of a second generation of bodies similar

to themselves, which are in their turn gifted with a similar procreative faculty. Colloid cancer exemplifies this condition of encasement. The mode of enlargement here is manifestly endogenous—a single cell may be regarded as the possible embryo of an entire tumour. In the endogenous system of growth the primary generation of cells appears to be all important, in fact to involve the subsequent and gradual production of a tumour, because they contain within them the elements of development *ad infinitum*. But there is another condition necessary, and this is the direct supply of blastema for the nourishment of the rapidly germinating cells. If this supply from the parent organism be cut off, germination must cease on the axiom, *ex nihilo nihil fit*. This is the capital fact lost sight of by those who style cancer a fungus endowed with independent life."

Professor Huxley says, "It is only in pathology that we find any approximation to true zenogenesis (the generation of something foreign). From such innocent productions as corns and warts there are all gradations to more serious tumours, and in the terrible structures known as cancers the new growth has acquired powers of reproduction and multiplication."

The anatomical elements of cancer are known to have no special and peculiar characteristics, and they are believed to be as easily derivable from pre-existing tissues as are other morbid growths.

There is one important group of diseases requiring careful inquiry in veterinary pathology, namely malignant growths. To study such conditions as cancer, sarcoma, etc., as they occur in animals, and compare

them with the corresponding diseases in man, and then demonstrate the identity by close observation, is the highest class of work in pathology, and the work of the future. Indeed, the careful observations of the comparative pathologist have shown up diseases of animals as a new and attractive field of research. Able authorities have repeatedly shown that the lower animal was liable to suffer from every form of malignant growth seen in man. The essential object of future investigators is to determine the importance of a comparative study of this disease in all its phases. With increased experience this line of inquiry will doubtless be encouraged; still it is satisfactory to learn from the writings of leading medical men a direct advocacy of the comparative study of disease.

TREATMENT.

Many observers exalt special remedies in the treatment of barsàti, and as usual, each produces a list of cures in favour of his favourite application. Further evidence of the difficulty of settling this point is afforded by general experience, which disproves the utility of these cures, and shows that their benefits have been overestimated. It is now proved that it is impossible to influence the course of barsàti by recourse to any number of acknowledged parasiticides which have been recommended; and I have myself tried, in numerous cases, local applications of caustic potash, nitrate of silver, chloride of zinc, chlorate of potash,* sulphate of copper, of iron

* *Berl. klin. Wochenschrift, No.* 6, 1873.

and zinc, salicylate of soda, salicylic,* nitric, sulphuric, acetic and carbolic acids, myrrh, aloes, camphor, alum, sulphur, &c., without effect. Iodine and sulphurous acid injections have been latterly tried by me in many private cases, with equally useless results. Mr. T. Marriott, A. V. D., speaks very highly of the results of treatment by iodoform. Very extensive barsàti growths on the fetlocks and lower lip and angles of the mouth have been gradually destroyed by caustics followed by iodoform dressings, and a healthy cicatrix has been obtained. How long an immunity from this disease has been secured, it would be difficult to say; but at any rate it is a considerable gain to have overcome, even for a time, the unsightly and ever-increasing out-growth, and to have thus early relieved the animal from pain, and returned him to duty. Calomel and biniodide of mercury were largely employed in the Government studs some years ago, but with no better results than any of the above-mentioned. Carbolic acid, when well diluted, has the effect of cleaning the surface; but when in strong solution, undoubtedly aggravates the growth in many cases. For the purpose of removing discharges from the surface, and keeping the sore free from smell, I never employ a stronger solution than 1 part in 20 parts of water, for the reasons above stated. Its efficacy, however, is no greater than that of most other agents in common employment. Mr. John Henry Steel, A. V. D., recommends the iodide of arsenic ointment (1-6) as a useful application, to cause a slough. The use of the actual cautery and of the knife is in every case contra-

* *Wien. Med. Wochenschrift, No.* 24, 1883.

indicated, as it generally increases the activity of the growth. Thus we have tried every remedy, and during every stage of this disease, with the same negative results. At the risk of appearing tautological I would add one other remark upon these operations by the knife, actual cautery and caustic agents. "Be quite sure that you remove all the induration, or you will do mischief instead of good." I might give a long list of "successful cases," such as are frequently recorded in the veterinary journals; but as I know from experience such cases have returned for treatment after they had been passed as "cured," I set no value on such temporary successes, and look upon them as mere compromises, which advancing knowledge will enable practitioners to discard, for a more radical and permanently successful treatment. So long as we continue to look upon barsáti as a mere local disease, so long shall we fail to effect more than a temporary recovery.

Where barsàti is indolent, it is wise not to attempt its removal by the knife or by any caustic applications. Such indolence or arrested growth in an external sore is sometimes coincident with its internal development. Inspecting veterinary-surgeon Oliphant says,—"The state of the system existing in barsàti is not such as indicates the use of the knife." Dr. Walshe, after condemning operation for the relief of human cancer, quotes Dr. Macfarlane, who "could adduce the case of several patients who had laboured under cancer for ten, fifteen, and twenty years, who were cut off in three or four months by an operation."

Pari Passu with the advance of the external sore I have noticed defects produced in the constitution of

the animal, which should be early supported by appropriate medicinal remedies. The results of this combined treatment will be generally found to be more satisfactory, although how long an immunity from this disease may thus be secured in all cases I am unable to say, but at any rate it is found to be a considerable improvement on the local treatment only, and affords better hope of restoring the patient to work and keeping him out of sick-lines long after others have been admitted with a locally recurrent disease of aggravated character. I know from early experience that it is no good "patching up" a case and returning to duty, which comes back in a few months with considerable constitutional disturbance. I know of no specific remedies that will avert the constitutional derangement, but would recommend the system to be supported on general principles by the administration of both vegetable and mineral tonics, but especially by iron and arsenic in large doses. Any of the preparations of phosphorus might also prove useful. The influence of phosphorus and arsenic on the general nutrition is analogous to their influence on the nutrition of the skin and subcutaneous tissues, which is seen in the case of many skin affections.

Our search for agents to neutralise and destroy this disease in its local aspects should lie in the direction of those which shut it up, or encase it, is it were, by hardening its cells. The subcutaneous injection of medicines promises the most likely means of doing this. The best agent which will effect this is chromic acid, which in the field of the microscope is seen, even in a solution as dilute as one part in a thousand of water, rapidly to define, as if dissecting out the delicate cells,

hardening and enclosing the nuclei, closing up their walls, and so preventing the diffusion of their contents. Professor Billroth's use of this agent as subcutaneous injection in lymphoma of the human subject, gives encouragement to the trial of the same in equine barsàti. Professor Trinchera,* of the Naples Veterinary School, believes he has cured cancer of the penis and scrotum in the carnivora, by early operation, the wound being dressed with chlorate of potash. Malthe recommends combining iodoform with nitrate of silver as a caustic and healing application in all chronic ulcers. The ulcerated surface is sprinkled with iodoform, on which the nitrate of silver is next applied, and on this again iodoform. A brisk effervescence of nitrous acid and insoluble iodine and chloride of silver results. This may be employed with much benefit in barsàti ulceration of not long duration, and where the subcutaneous tissues have not been deeply implicated.

The above remedies have been prescribed by me in many cases with good results, where constitutional disease was not already far advanced. No one remedy can be expected to produce a cure, and this alone illustrates the absurdity of the dogma, that any "specific" can eradicate a general disease by treating its local manifestations only.

I have given the above summary with the view of furnishing a general experience in regard to results of different modes of treatment in different cases. Most of the remedies mentioned have been tried by me as well

* *Giornale delle razze degli Animale utili e di Med. Veterinaria* 1875.

as other practitioners, in the treatment of this disease. I have, however, to say something further of certain preventives which have not been described before, and which come under the first category in the preceding summary. Those cases in which the sore has apparently been of short duration may be much benefited by a change of climate to the hills. Those in which the constitution is severely involved may derive temporary benefit by a similar change. But in some cases the result is disappointment: the local disease persists and grows in spite of all treatment, and sometimes fresh ulceration takes place in an already healed cicatrix, so that the treatment of barsáti must be considered only palliative in kind. When the disease has been suppressed by the abovenamed means a relapse is rendered less certain if the animal is kept on a strictly starchy diet. It would appear that high feeding and higher organization is, in a measure unfavourable to reparative work. We can quite conceive that the steady, regular processes upon which it depends are less likely to proceed in an orderly and uninterrupted manner under conditions of high excitability, where stimulus easily engenders disorder, than under lower functional activity and less susceptible circumstances. Herein, possibly—namely in the greater excitability of their tissues—may be found an explanation of the reasons why cancer changes should be as a rule more pronounced in highly-fed animals, as the carnivora, than in herbivorous animals, and of which it is practically important that we should take due account.

PROGNOSIS.

In giving a prognosis we labour under a very great

disadvantage, since we do not generally know when the disease commenced, because our patients cannot speak, and their owners frequently cannot assist us. This is singularly unfortunate, as it compels us to consider cases in relation to the possible local gravity measured merely from apparent symptoms, which is a much less satisfactory guide than the date of first attack, for the duration of cases is of the utmost importance in questions of prognosis.

I am in the habit of saying, if an animal is brought before me with a barsáti sore, and there be no history of recurrence, that the case will be relieved early; if there be the history of a single recurrence, less early; if of many, and presenting constitutional changes, never. This is not sufficiently insisted on by veterinary-surgeons in giving opinions on cases of barsáti; recovery usually takes place readily under good treatment, and the case is probably discharged "cured" in the books, but the veterinarian rarely has the opportunity of knowing how long or how short is the immunity from disease he has conferred on his patient. Having had the opportunity of watching the progress of several cases of this kind for two, and in some instances three years, I think I am justified in giving always a guarded opinion from the commencement of this disease, owing to the difficulty of foretelling the probable course of each case. Although re-appearance of barsáti is the rule, it does not follow that such is the invariable result, for we find in practice a number of cases in which the animals were free from the disease for two years, and in some for a longer term, without a single unfavourable symptom. Occasionally recurrence has been attributed to the animal biting an

old barsáti cicatrix. There is every reason to believe that recurrence is a pretty constant feature of the disease. Absorbed into the system the cancer elements become increasingly accumulated, and with the accumulations the proportionate liabilities to local recurrence. Their histories run parallel. And though the question of early and thorough removal of local disease to preserve the patient from recurrence is important, it is obvious that no proof of its utility can be given, since veterinarians rarely have an opportunity of witnessing many cases of this disease in its early stages, the majority of animals being brought for treatment in a recurrent state.

There is generally very little to be done in the way of curative treatment when once the animal has entered on this stage of chronic barsàti; but so long as he can be kept at work without suffering obvious pain, it is always worth while to persist in the use of both internal remedies and local applications; a rather free use of the remedies afore-named is advisable. I do not say that such cases will be "cured," with absolute immunity for the future, but the relief afforded may be sufficient to allow the animal to be worked for a much longer term, and with greater certainty than when left to chance without any treatment. Albeit, it is never safe to allow these remedies to be used in unskilled hands, because their too free use seems often to hasten the progress of the disease. As soon as local disease has subsided, one must still direct his attention to the removal of the disease from the system; for barsàti is not one of those diseases the elimination of which we can assist by local applications only. I have patched up many cases of barsàti, in the main by local applications. For instance,

in those subjects where the disease was of short duration, slow of growth, and where the general system was not affected. It is quite true that some cases require more energetic treatment than others, but there are very few horses whose condition does not begin to suffer, if they are not treated early in the local stage of this disease.

The causes of derangements of the wind from which horses so frequently suffer are so numerous that their owners pay no attention to them, and it may happen also that barsàti of the lungs shall attain a very advanced stage without any prominent symptoms to cause its presence to be suspected. There are, in fact, strong, "vigorous" horses, appearing to possess all the features of perfect health, and performing their daily amount of work,—whether in the saddle or in harness,—with apparent ease, in which barsàti has taken deep root, and in which tracts of the lungs are converted into mere fibroid tissue, and studded with numerous kankers, in which all power of respiration has ceased. We have seen several cases of this kind, and recorded some, of which examinations were made *post mortem*, in the Veterinarian.

In our prognosis we have clearly to consider, then, whether, in many cases, there has not been barsáti occurring at a period anterior to our examination, the history of which may or may not be forthcoming in every case. I cannot call to mind a single instance of extensive local disease without some evidence of the internal organs having been invaded as well. But the patient is very often restored to such a degree of apparent good health, and so far relieved from external disease for a time, that the owner is satisfied with the result, and neglects any further treatment, until a fresh

recurrence takes place. By these means we have not thoroughly cured the patient, but have only given temporary relief, and the disease may at any time return. We cannot always reckon upon such opportunities as were afforded in the case of stallions kept permanently in the studs, or in that of horses having history sheets, as in the service; and, in the absence of that knowledge, our prognosis must rest partly upon the history of the case furnished by the owner, but chiefly upon the results of our own examination of the patient.

We are not assured that barsáti is hereditary in its character. Colonel McDougal, Superintendent of central Government studs, tried to show from statistics that it was so. A safe practical conclusion to arrive at is, that all stallions which have suffered from this disease, although temporarily recovered from it, should be castrated, and brood mares similarly affected be disposed of by auction sale: they should not be retained for breeding purposes.

CHAPTER V.

"KHOOJLEE;" OR, TROPICAL PITYRIASIS.

In no department has veterinary progress been shown more conspicuously than in what is usually termed Cutaneous Pathology. This has undergone a complete revolution in England, on the continent especially, and in India to some extent, during the last few years. The experience of recent years has caused an entire change in the ideas regarding treatment which was formerly recommended in this class of cases. In the ages when mysticism in its varied forms prevailed, although we find glimpses of the knowledge that Nature herself was generally expected to do all that was necessary, no practitioners were bold enough to hazard their reputation by acting up to this belief, but almost invariably resorted to some application and favourite internal remedy to give it due effect. To the German practitioners in a great measure is due the credit of having broken through these bonds, and raising the study of skin diseases in animals, and paving the way for modern improvements in their treatment, on a level with the other branches of medicine.

From the earliest times the above disease has been described as an enzootic affection, and internal remedies were prescribed. Spinola and other writers considered the cause to be some constitutional defect. Haubner attributed it to digestive derangements, and others again thought it was due to the itch-scab. Recently Haselbach has observed it in ten per cent. of the whole of the Polish horses, and he regards it as a special affection of the hair, attended by an adhesive discharge. Formerly, a false and a true variety were described, which led to great confusion. "It is proved conclusively," say Professors Friedberger and Fröhner "to owe its origin simply to penetration of dirt, grit, lice, etc., into the hair-roots."

The disease, although long recognised in the human subject, has only recently attracted notice in the lower animals, and does not find a place in the new nomenclature of diseases issued for guidance of veterinary officers in India. Since my observations were published in my Annual Veterinary Report of 1883, and the *Veterinary Journal*, 1884, veterinary surgeons have described this affection as more or less prevalent throughout India, but especially during the hot weather, when the function of the skin is found to be normally active and in a manner predisposed to disease.

It has not, I think, been settled whether the term *khoojlee* is, or is not, properly defined; but we understand that there is no restriction here: it is used in a general sense, and applies to every form of skin disease which is attended with *itching*. If this is the case, it is a lamentable illustration of the urgent need for more precise definitions in this direction, and for the incorporation

tion in the new nomenclature of diseases of the lower animals of a stringent rule requiring that all our diseases of the skin shall be properly designated, and their characteristics clearly differentiated. It is not now desired to enter into a consideration of all the diseases of the skin in which khoojlee is a symptom : the disease under consideration goes by that name. In this chapter, we will invite our readers' attention to the subject of tropical pityriasis, or so-called "khoojlee" of the horse. In practice veterinary officers have sometimes to rely on the nomenclature suggested by *salootries* and others in India, but the natives are not accustomed to name diseases according to scientific principles, and are thus not quite at home with Europeans as instructors in native disease.

Some veterinarians appear to be stirred over the question of a proper name for this, the most prevalent form of skin disease affecting the horse in India. The necessity for such a name will be apparent; but some are exercised over the special designation, preferring the term "eczema" to pityriasis suggested by ourselves. I need not, therefore, re-state my reasons for considering this disease to be quite distinct from eczema, except that a prevalent use of this term "eczema" in England gives it special importance, where the occurrence of pityriasis appears to be infrequent, if not rare in the horse.

It is possible that India is a special habitat of the disease, and especially so in the hot weather, when the function of the skin is normally active, which sometimes causes the disease to assume an enzootic form. It is moreover important to note that this disease is chiefly

confined to the more hairy parts, or parts fairly covered by hair; for instance, it never spreads to the under surface of the tail, although it attacks every other portion of it supplied with long hair. The disease, moreover, originates in small papules, the cuticle covering which dies from insufficient nutriment and desquamates in small, bran-like scales, and is attended with heat and considerable itching. There is no discharge present in this disease, nor vesication as in eczema. Röll says,—"In this skin disease the epidermis peals off in small scales like those of bran. The disease attacks the horse principally on the head, on the sides of the neck, along the course of the mane and root of tail, but occasionally all over the body. In cattle it attacks the whole surface of the body, and leads to changes in the structure of the skin." From excessive rubbing, for the parts attacked are particularly itchy, the exudation of serum, or of pus-like fluid may take place on the surface of the skin, which, though not a special feature of the disease, is a frequent accompaniment of it, and is one reason why the disease has been so often mistaken for eczema. Pityriasis, moreover, selects for its attack the parts covered with longest hair, even in man (Tanner's *Practice of Medicine*, art. "Skin Disease"), which is what might be written in regard to the disease seen in the horse, and to which the common designation of 'mane-and-tail disease' has been given, owing to the mane and tail being the parts most commonly affected. Again, the exudation may cause the scales to adhere together, forming larger scales; hence the liability of the disease, in its latter stages, to be mistaken for psoriasis, from which it is distinct.

SYMPTOMS.

Small papules are noticed to develop themselves along the crest and about the root of the tail, on its dorsal aspect, and in due course free desquamation of the cuticle ensues about each papule, from which minute white scales are regularly shed; and we have thus eventually produced a surface of renewed desquamation, attended by fresh developments and increasing irritation, with its results: extension of the process into the corium and subcutaneous connective tissue, which are sometimes also implicated, owing to secondary inflammation. The latter is only a complication, however, and furnishes no clue to the solution of the true pathological change found set up, which is, in its inception, distinctly superficial in character and amenable to proper treatment. A prominent, and not the least troublesome feature of the disease is prurigo, which causes the subjects of it to rub themselves violently against adjacent articles, producing secondary symptoms of inflammation,—heat, pain, swelling, abscess, and sometimes also permanent induration of the skin. The crusts, which are at first small, scaly, and transparent, become, during the latter stages of the disease, larger, more opaque, and even adherent from admixture with inflammatory products. The hair also becoming involved and matted together, soon fall off, which is especially noticeable along the course of the mane and tail, in the latter situation producing the condition commonly known as 'rat's tail.' Owing to the presence of long hair about these parts, the disease frequently escapes detection in the early stages, it being seldom noticed until, through rubbing, changes in the

hair-papillæ and hair take place. The latter becomes at first thinner, curly looking, and, owing to its thinness and irregularity, allows more freely of the passage of dirt and filth of all kinds, which gives rise to inflammatory changes leading to depilation of the hair, and sclerosis, etc. Where the disease has become chronic, the hair generally assumes a coarse appearance.

RESULTS.

I have seen so many cases of this disease each summer for several years, that I feel warranted in giving a strong opinion that any treatment to be useful should be early applied, otherwise the disease tends to assume a chronic type, and will then prove rather troublesome: sclerosis of the skin and subjacent connective tissue may follow as a remote termination, and more particularly permanent induration of the crest, which is often produced as a result of certain heroic methods of treatment in vogue, and in a certain percentage of cases proves at least of diagnostic value and heralds an attack of the disorder in the following year. 2. One of the results of its action on the hair is evidenced in an undue coarseness of that appendage, which is specially characteristic of this disease. 3. Another remote, though not infrequent result is an apparent greyness of the hair noticeable in small spots along the course of the affected skin. These latter changes are, we have seen, dependent on inflammation, causing irritation of the hair-bulbs. 4. It cannot be too strongly urged that recurrence in many cases also depends, to a very large extent indeed, upon how they were first dealt with.

5. In some cases the disease spreads all over the body, and leads to great emaciation.

CAUSES.

Climate acts as a direct exciting and predisposing cause, as in the hot weather in India when the kidneys are inactive and the skin suffers from hyperæmia due to compensatory action. It is clear that climate has a more or less direct influence upon the prevalence of this disease, which appears only during the hot weather and rarely in the winter, and is practically unknown or infrequent in colder climates, as in England, where veterinary surgeons seldom witness it, at least as a prevalent disease in the horse. It is not surprising, seeing that the hot weather is a predisposing cause of skin disease in India, to find that a much larger proportion, if not all of the horses are attacked during the summer; and it may be here noted that the special liability of horses to be affected by skin disease in India is not found to obtain in other parts of the world, and must be due to local causes.

2. A consideration of the locality of the disease brings forth some facts which may become of some practical importance. In more than half the cases we have seen the worst were those we met with on the plains, and more commonly in a hot station than in any other. Again, in only a small proportion of the cases seen in cooler stations, in hilly districts, was the disease severe, or the ratio of simple to aggravated cases was about ten to one.

A similar result has been noted by others. I have carefully examined the register of sick animals at several

stations in India, and found hot stations were those in which the largest number of admissions were noted from this disease.

3. Natural dampness of the air, as during the rains in India, which causes maceration of the epidermis and affects normal secretion of the skin.

4. Local irritation connected with improper grooming, collection of dirt, of lice and ticks, etc.

5. Constitutional tendency.—The liability to the disease in previous years promotes the tendency to it, and in such animals the disease may be said to be constitutional. In many cases the animals suffer from a state of disease which is truly chronic, as shown by the veterinary history sheets.

6. Defective action of the correlated organs, leading to hyperæmia of the skin: hence over-feeding, excess of water taken during the hot weather, etc., throw extra work on the skin and lead to disease.

7. High feeding.—The question of high feeding as a cause of disease is not only interesting but important. I will only remark upon it that the greater the amount of nitrogenous food given to animals, and the greater the work thrown upon the eliminatory organs, the greater the liability to disease. If the function of the kidneys, etc., has to be taken up by the skin during the hot weather in India, high feeding only increases liability to disease, and precautious should be taken for its prevention.

PATHOLOGICAL ANATOMY.

The disease, in its origin, is superficial, and seldom or

never implicates the *cutis vera* deeply, until the parts are rubbed by the animal in consequence of extreme prurigo, when subcutaneous effusions and other inflammatory lesions leading to various changes in the structure of the skin, develop as a secondary process, but quite distinct from the primary disease—changes in and around the hair follicles, such as have been described by Dr. George Thin,* of London, and noted by us in several cases we have examined, may then be detected, together with other changes associated with the derma, leading to depilation of the hair, to sclerosis, etc., which may be seen commonly characterising the latter stages of the affection. But, in order to arrive at its correct pathology examinations should be made of the skin, more especially in an early stage of the disease, so as to recognise the specific lesions, which, so far as my own examinations lead me to say, consist mainly in cell proliferation confined principally to the deeper layers of the epidermis. This proliferation is doubtless a result of some constitutional irritation, which explains the consequent desquamation and shedding of the cuticle in small scales, due to improper nutrition, and which is so important a feature in this disease. When the parts are violently rubbed by the animal, or if irritant dressings have been used, then changes in structure may be detected in any part of the skin on microscopical examination; thus, changes in the corium, in the hair follicles and sebaceous glands, and in the subcutaneous connective tissue take place as the result of irritation, and may be characterised as hypertrophic. The disease examined generally shows

* The *Veterinary Journal*, July, 1879, p. 55.

in the field of observation epithelial cells, fibrils, granular particles of pigment, besides fungi, tissue shreds and inflammatory products developed in the process of secondary inflammation. The German veterinary surgeons* have long recognised, and Mr. Henry Tryon,† naturalist and microscopist, Brisbane, has lately noted the presence in this disease, of an exceedingly minute fungus, which occurs in immense numbers in the cells of the cuticle hair follicles. It is not known positively whether this disease is actually caused by the fungus, or by tissue change (See article on 'Vegetable Parasitic Skin Diseases,' *Veterinarian*, Feb., 1888), since various species of micro-organisms have been now isolated from the epidermis of the normal skin, but it is not settled whether in their distribution and in their action they bear any definite relation to the morbid process. We may conclude that to those several species of parasites already known to exist in the epidermis, another species has been added.

TREATMENT.

Pityriasis in the horse would seem a comparatively trivial ailment in England, which under ordinary circumstances soon gets well, but in the same class of patients out in India it sets up a disease of skin which almost defies treatment for several months in the year. Those who are engaged in the study of diseases of the skin in our animals in India will have come across cases of this disease which remain unrelieved, or at any rate

* *Lehrbuch der Pathologie u. Therapie der Hausthiere, Köll.*

† The *Veterinarian*, June, 1888.

uncured, by any local application, but which readily recover by the internal administration of remedies and, as I have found, local blistering over the kidneys. In the treatment of chronic cases I have found nothing to equal the value of local blistering over the region of the kidneys. This treatment has been followed by rapid recovery in several cases, when all local applications to the skin, and the internal administration of medicines had failed. It probably acts in two ways, *viz.*, first, by rousing the kidneys to increased action, promoting diuresis and relieving hyperæmia of the skin; and, secondly, by directly stimulating the nervous system through its action on the spinal cord, and the good effects produced on the skin may be purely of neurotic origin. I do not consider it necessary or prudent to have recourse to blistering in every case of skin disease as a routine treatment, but adopt it in neglected and chronic cases only.

Combined with local blistering over the kidneys, the internal administration of strophanthus in chronic affection of the skin of the horse proves very useful, because, as a diuretic, it is probably second to no other agent with which we are acquainted in practice, or which is more rapid in its action than strophanthus given in the form of tincture in repeated doses.

Among the local applications employed in the treatment of this disease, I may mention those of petroleum and cheerpine oil, which have proved most efficaceous in my hands; and, in a minor degree, kerosine oil. We may be quite sure that the good effects produced by these agents are dependent upon some product of tar present in them, which is so beneficial in skin disease in general.

A partial cure is often effected by the local applications of many favourite remedies employed in rotation; by thorough cleansing of the skin with soap-nut (*reetáli*), or with soft soap and water every other day; and by keeping the animal on low diet. None of these, however, can do more than mitigate the trouble; and the probable ill-effects of such haphazard treatment, and the danger thus incurred is proportionately enhanced by the fact that many of the older cases of previous years, under this treatment, are practically apt to suffer from a state of disease which may be designated as chronic, if not incurable.

Some persons believe that, with the advent of the cold season, these cases get well of themselves and without treatment. But this is an error, and the source of recurrence and non-recoveries innumerable. If we examine the veterinary history sheets of horses which have been affected, we will find that recurrence is the rule; and experience shows it is much more pronounced in cases where early treatment has been neglected. That failures will attend our best endeavours at treating disease we readily admit, for we cannot expect to find such a thing as an unalloyed blessing, and thus there are failures under this mode of treatment, which in some cases arise from the owners' fault, who permit the disease to run on to an advanced stage, in which it is so severe and sometimes so intractable. I need not dwell on the importance of early treatment in so-called 'trivial' cases, to nip in the bud an incipient disease, as unless this is done, it will probably spread to the head and other parts of the body, and may then last for months.

The general indication for treatment in all the cases

of pityriasis, acute and chronic, is to assist the skin as much as possible, by making the correlated organs—the kidneys, lungs, and intestines—do full work in elimination, and thus, aided by appropriate agents, as local applications of tar, etc., to relieve hyperæmia of the skin.

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CHAPTER VI.

"KENCHULI;" OR, PITYRIASIS RUBRA.

I do not exaggerate when I say that the animals suffering from this disease are found covered from head to foot by one mass of scales, having the appearance of a 'crocodile's coat.' The disease begins in hyperæmia and desquamation of the cuticle, notably over the region of the back and thoracic walls, thence rapidly sdreads in all directions, till the entire body, even to the skin of the coronets, is finally invaded, leaving perhaps a small patch of skin under the abdomen and that between the thighs unattacked. The cuticle, along with the hair and inflammatory *débris*, comes away in large scales, probably as large as any we have noticed on the back of the largest kind of fish, and which they somewhat resemble. The main feature of the disease is intense surface heat, followed by recurring desquamation. The presence of the heat, then, and notably the character of the scales, when these begin to come off, are diagnostic of this affection in the horse. Notwithstanding the large extent of surface usually implicated

in this disease, it seldom or never, in my experience of this class of cases, proceeds to the extent of causing disease changes in the corium or still deeper tissues, but always confines itself to the epi-skin only. There is no thickening or induration of the skin below the scales, as observed in eczema and other inflammatory disorders, but the whole process seems to take its origin in or follow a state of simple congestion superficially pronounced, which induces excessive development of the cuticle, resulting in the scales described.

Finally, in my experience, the disease appears to be chronic, or even incurable in the large majority of cases, as those noted by me latterly, including others seen before, have baffled treatment; and very little more than palliative remedies can be suggested in similar cases. In the early stage of the disease I am disposed to think that sedative lotions are alone effective in confining its spread. The disease is easily distributed over the whole of the body; and when this is the case, it is exceedingly unfortunate, for nothing I know of from experience has any power in checking its course.

Applications of lead seemed in some cases to afford partial relief, but even this I find is only transient in its effects, as beyond allaying a little heat in the part, I cannot say it exercises any curative or at all permanent influence over the disease.

Accompanying the disease of the skin in some cases there is also noticed intense congestion of the conjunctival and buccal mucous membrane, the former becoming œdematous and appearing as if it were the index of some low type of fever from which the patient suffered, with a hot mouth, scanty and high-coloured urine,

and great emaciation; but in point of fact there is never any fever present, the patient's appetite remains good throughout, and the temperature never registers higher than 101° F., and generally at normal point.

LITERATURE.

BURKE, *The Veterinarian*, Sept., 1884.
ADAMS, *The Veterinary Journal*, July, 1888.

CHAPTER VII.

"PITH-KHARISH"; OR, HEPATIC PRURIGO.

In the human subject the terms *khárish*, *khárisht* and *khujli* are applied to scabies or itch only; but this arises from a belief common among natives, that the skin was liable to but one form of disease, as they cannot distinguish one from another, except ringworm which is called *dád* or *dinná-eh*. The terms khárish and khujli literally denote the occurrence of itching, and as such may be employed in the case of any disease of the skin in which itching is a symptom. I need hardly point out, that a symptom which is common to so many diseases should be qualified with a prefix, or better perhaps some explanation of the disease it is intended to represent. The term khujli signifies, then, itching. It is in reality the same thing as pruritus described by English authors—a symptom, in fact, of many diseases—a disease wholly different from true scabies. It is most unfortunate that practitioners in human medicine in India should have employed the term khujli to describe this disease. The term khujli, or khárish is now appropriated by general consent to signify, according to the original use for which it was

doubtless intended, a disease of skin which is characterised by itching as its most prominent symptom.

There is a peculiar form of prurigo in the horse, common to the wet season in India, as I must observe, the etiology of which does not seem to be generally understood, but is easily explained, I think, by what is seen to follow the mode of treatment adopted in these cases. I have prescribed large and alternate doses of calomel, muriatic acid, and sal-ammoniac, with the best results, which leads me to conclude that this affection—in the horse, at least—is sometimes referable to retention of the biliary acids in the system, due to imperfect bilification. Symptoms: Itching is among the first symptoms noticeable, particularly in parts previously injured or diseased; *instance*: brand-marks about the neck, on the shoulders, barrel, gluteum, etc.); the vessels of the skin become congested; there is present some amount of heat, snpersensitiveness, etc., followed by effusion into the corium, which is either removed by absorption if early treated, or terminates, as it sometimes goes on to pus formation, in abscess, and finally bursts giving rise to troublesome ulcers. A frequent accompaniment of this disorder is pallidity of the mucous membranes, and also loss of appetite, impaired digestion, fœtor and discoloration of the fæces, etc.—symptoms indicative of biliary derangement.

CAPTER VIII.

"CHARAK"; OR, LEUCODERMA.

Partial leucoderma, in which the pigment is absent in small points over the skin of the face and other regions of the horse, is common enough, although this, like the preceding, has not been recognised by veterinary authors; but general leucoderma, so far as I know, has only once been met with, in the horse that is. And I do not here allude to "piebald states" noticed so commonly in horses, from which it is distinct. The loss of pigmentation in the true disease, is associated with loss of sensation in the part, and even loss of hair, noticeable in patches—having the appearance of a "pig's skin," *minus* the redness, which it closely resembles. Moreover, the 'piebald' colour in horses is a congenital condition, having its origin *in utero*; leucoderma is a disease developed in after-life of the animal, which often recedes, leaving the skin normal for a time, when it may recur. Thus, I know of large blotches of the skin on the face of horses, and in other situations where the skin is less protected, developed in the summer, entirely disappearing in some cases during

the winter, and again appearing on the approach of the following summer. The conclusion is—and it is the conclusion also of Dr. Tilbury Fox, probably the greatest writer on skin diseases of his day in any country—has the heat any influence on this abnormal pigmentation in the skin? In the present state of our knowledge of the pathology of this disease, an answer to the question would amount to mere surmise.

The disease is seen principally in chestnut horses, and sometimes in bays. There is an entire absence of any discharge, vesication, or pustulation, throughout its whole course. It affects, by preference, certain parts of the skin whose epithelium is thin, as the muzzle, below the eyes, inside the thighs, etc., but is gradually generalised.

I have prescribed arsenic and iron, with local friction, in this disease, with some benefit.

LITERATURE.

BURKE, *The Veterinarian*, Sept., 1884.
ADAMS, *The Veterinary Journal*, July, 1888.

CHAPTER IX.

"KORHI;" OR, MORPHŒA.

I have next to consider a disease which is sometimes found in association with the leucoderma just described, *viz.*, morphœa. It is important to note that in leucoderma the colour only is altered, due to deficiency of pigment in the affected parts, but there is no deposit in, or any structural alteration of the skin. This disease is not a mere discoloration, but is caused by a waxy deposit in the skin, leading to changes in its structure. The affected skin becomes hypertrophied, anæsthetic, and hairless in large patches. These discoloured ansæsthetic spots have led to the disease being called leprosy, or *korhi* by the natives, but it is not settled whether true leprosy is seen in the horse. The morphœa of the horse I have described is a local disease entirely, and never leads to degenerations common in leprosy. But perhaps there are undeveloped forms of leprosy, and doubtless there may be cases of discoloration, anæsthesia, and depilation of the hair in patches, without ulceration and tubercular deposits,

especially when occurring in districts where leprosy is met with, which time will show to be instances of aborted leprosy in the horse. The mucous surfaces also suffer, and 'roaring' is sometimes present. Damp and humidity, poor feeding, imperfect grooming, filth, and unhealthy surroundings, are conditions favouring the development of korhi. The natives are strongly impressed with the conviction that it is contagious.

As to the cause of the disease the natives believe that the use of the *arhar* dâl (*cytisus cajan*), a leguminous seed widely cultivated throughout India, is capable of giving rise to something like leprosy, when consumed for any lengthened period. Some of the natives eat it constantly, and the final results are "urticaria,* a sense of heat in the stomach, redness of the mucous surface of the mouth, bronzing of the skin, sponginess of the gums, burning of the hands and feet, dryness, harshness, and cracking of the same parts, rheumatic pains, white spots indicating a leprous taint about the body, and lastly, confirmed leprosy." I have seen it in horses owned by natives and others which were fed on diseased maize; and we know that a form of leprosy in the human subject, called 'pellagra' is also caused by eating ergoted maize. Another dâl, the *lathyrus sativus*, we have shown in a former chapter, induces *kamri*, or paraplegia. How far the use of dâl may be the cause of leprosy requires further investigation. But it must be recollected, after all, that leprosy may result not from the operation of any actual poison in climate or in diet, but negatively from the absence in the diet of certain

* Urticaria is called by the natives *joor-pitty*.

principles, such as nitrogen and potash, and that it is accelerated by bad sanitary arrangements.

The means for remedying this condition are self-evident, the cutaneous changes calling for early removal of the animal to a better locality, combined with good cleaning, and change of diet. But over and above this, it is possible to thwart, by local applications of strong carbolic liniment and internal administration of iodide of potash, liquor arsenicalis and sulphate of iron, the spread of the disease to other parts of the body and to still deeper structures of the skin.

CHAPTER X.

"CHIBER"; OR, PEMPHIGUS*.

The ancients, as well as many mediæval *hakeems* and *baids* of various denominations in India, attributed this malady to some great perturbation of the system, some general change, whereof "chiber" is but a local manifestation. The subject has often been handled by veterinary surgeons in India, but nothing definite regarding it has ever been suggested; and such names as herpes, mange, grease, etc., indicate the nature of views held in regard to its pathology.

Many believe that it is entirely a local disease, but some authorities contend that a disease having a tendency to run a chronic course in so many cases, cannot be considered local in character, and must therefore be classed among the general diseases.

My view of the subject is that the variation in the stages of the disease itself, is some excuse for the variety of opinion as to its pathology which obtains in the profession in India.

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* The *Veterinary Journal*, Dec., 1886.

The disease prevails especially in the rains, and during the winter months, when heavy dews fall, which bathe the animal's legs when turned to grass. Pretty extensive inquiries made in various parts of the country have failed to show the existence of the disease during other seasons or in dry weather.

As to the nature of the morbid change, the most reasonable view seems to be that it is the result of some local irritant entering the tissues through chinks in the epidermis, which spends its action on the neighbouring structures, without ever producing any constitutional symptoms. As there is nothing else to account for the production of these cases, the condition of the grounds over which the horses have been exercised, or let loose, seems the most natural source to look to, and as mentioned above, the dew and moisture about the roots of the grass have been shown to produce this disease in many cases, which leaves not the shadow of a doubt as to its mode of origin.

Friedberger and Fröhner have observed that on account of the wet and cold, this disease especially prevails during the winter in Germany. Prietsche* has found that this disease prevails also as a result of sprinkling salt on the tramway lines during winter months. Straub† has recorded the occurrence of "traumatic eczema" in these parts liable to chiber, noticed in army horses which were exercised over recently-cut fields, which resembled more a form of infectious inflammation of the skin than simple eczema. This form of disease resembled somewhat the

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* *Sachs. Jharesbericht*, 1884.

† *Repertorium der Thierheilk.*, 1853.

ordinary "mauke" described by the Germans, and was characterised by a great number of small ulcers on the skin, which were followed, in aggravated cases, by erysipelas and phlegmonous inflammation of the skin. This infectious dermatitis does not, whether in the German or Indian forms of the disease, occur as a rule, except when the eruptions burst, or cracks take place in the skin from accidental causes, allowing access to septic matters.

Röll, Friedberger u. Fröhner, Anacker, and others describe this disease under the name of "mauke," which they consider to be a form of specific eczema. They notice that the practice of cutting the tuft of hair from the back of the fetlocks in coarse-bred horses, observed in European countries, especially deprives natural protection of the parts, and frequently leads to this disease. Mr. Meyrick,* l. v. s., says,—"The long dewy grass perpetually brushing against the coronets when the horses walk, would, of course, wet the front more than the back of the foot, and the evaporation, by producing a reaction, might bring on inflammation of the skin and other symptoms of chiber." Friedberger u. Fröhner say,—"The hind feet, being more exposed to the irritating action of damp, filthy standings, are generally more subject to this disease;" and veterinary surgeons in India have observed the same fact.

The disease appears chiefly, in India, in horses brought in from damp fields, and their legs allowed to remain wet for long intervals, or imperfectly rubbed dry from

* Meyrick, 'Stable Management and the Prevention of Disease amongst Horses in India.'

neglect or carelessness on the part of *syces*. Simply rubbing the legs dry does not prevent the disease: they should be thoroughly washed before rubbing them dry with a cloth. Washing in stagnant rain water, obtained from ditches along road sides, also produces this disease.

ETIOLOGY.

The disease may be defined as a special form of neurosis* of the blood-vessels of the skin, attended by loss of tone and more or less inflammatory disturbance, followed by exudation of serum, which infiltrates the structures of the skin, and raises the epidermis in blisters. The blisters contain at first simple serum, which, later on, becomes purulent, or sero-purulent in character, containing pus cells, probably due to migration of white blood cells and proliferation of the rete. Bacteria sometimes, though not constantly, appear in the contents of the vesicles. The blisters finally brust, and a watery-yellow, at first odourless liquid, finally becoming purulent or sero-purulent in characher, flows *(stadium madidans.)*

The swollen skin, by the movement of its thick folds from effusion, cracks during the animal's progression, and contractions set in. The cracks in many cases take on inflammatory action, and in a short time again become covered by a scab, causing a matting together of the hair and depilation. In some cases a peculiar fluid oozes from the affected skin, drying up into thin, varnish-like crusts. The surface becomes, after a time, covered with hairless skin, so hard and dense that it resembles

* Heath's "Dictionary of Surgery," art. Pemphigus.

frog-horn (pemphigus foliaceus). The dissase then assumes an entirely new aspect.

"During its latter stages," say Professors Friedberger u. Fröhner, "a peculiar running from the surface of the skin may be noticed, which bathes the epidermis. As a consequence of this we find a colourless, adhesive substance, accompained by fœtor, completely covering the affected skin, and which, finding access through the cracks, causes chronic thickenning of the skin."—(*Lehrbuch der Speciellen Pathologie und Therapie der Hausthiere*, 1886.)

VARIETIES.

It is not necessary to recognise more than two forms, acute and chronic chiber; whilst a multitude of other names, from their pretty constant appearance, may be mentioned as sub-varieties of one and the same affection. The acute form is associated with an outbreak of larger or smaller vesicles, which die away without giving rise to any other changes of the skin or subcutaneous tissues to be met with in the chronic variety (pompholyx), in which the process gradually extends until the greater part or whole of the skin and subcutaneous tissues becomes implicated. Cracks then appear on the surface, the hair falls off, and a nauseous odour exhales from the affected skin. The vesicles appear in successive crops, and horses that have once suffered are not exempt from it afterwards. Professor Friedberger says in rare instances the affected skin has been seen in time to assume the characters of elephantiasis, but this is only seen in bad or protracted cases, and is not characteristic of the disease itself.

The acute variety (*pemphigus acutus*) and the chronic (*pemphigus vulgaris*) are the most common forms assumed by both chiber and its German type, "nauke."

Itching is very marked in many cases, which is evidenced by the horse stamping his feet and rubbing them against each other, the animal frequently breaking the vesicles with his teeth, as well as by friction of the opposite leg, as soon as they are formed (*pemphigus pruriginosus*). Hence the vesicles are not often seen which have formed and recently broken : the epithelium is found ruptured and gathered into folds. In the pruriginous form the vesicles are smaller than in the other varieties. Some authors on human medicine describe this type under the head of "pemphigoid."

There is the disease called *hydroa bulleux* of Bazin, which is the same as chiber, or pemphigus with small bullæ. Bazin tried to show a difference between the hydroa bulleux and the bullæ of pemphigus, the latter being considered always large and the prognosis in the great majority of cases unfavourable. But Dr. Tilbury Fox has shown that differences in the size of the bullæ and their severity afford no ground for distinguishing the eruption from pemphigus. He describes cases of abortive pemphigus in man, characterised by small, scattered bullæ, which may enlarge to the size of a split plea, but are generally not so large, and die away in the course of a few days. The bullæ vary in size from that of a pin's head to that of a split pea ; occasionally an attack will be composed of two or three successive crops, which develop at intervals of a few days. The disease may last, by the development of successive crops of solitary vesicles, for ten days are more. (See *Bullous Eruptions, or Hydroa*,

in 'Skin Diseases,' by Dr. Tilbury Fox.)

The only diseases with which chiber is at all likely to be confounded are herpes and variola, both of which always run a more rapid course than it, and are therefore quite distinct. We have no such thing as protracted vesicular eruptions in herpes and variola, which diseases having once appeared do not show themselves again, or persist like chiber often does. In the acute form of chiber the vesicles and bullæ burst almost as soon as they are formed, so that they often escape detection; in herpes the vesicles do not rupture as a rule, but their contents, after becoming opaque, disappear by *resorption** and rarely by rupture and desiccation into light brownish scabs. In the majority of cases the vesicles in herpes last about eight days, in chiber they burst as a rule as soon as they are formed, or very soon afterwards, and frequently escape detection, except as flakes in the site of the vesicles.

Contagious impetigo in the horse, observed by Schindelka† and myself‡ is characterised by special features, and could hardly be mistaken for chiber. The disease is, moreover, contagious, and chiber is not. Attempts made to communicate chiber from one horse to another, by inserting the contents of the blisters under the skin of the coronet and pastern, have failed

* "Skin Disease," by Dr. Tilbury Fox, 3rd ed. art. Herpes.

† Oesterr. Vierteljahrschrift f. Wissenschaft. Veterinarkunde, 1883, page 61.

‡ Annual Veterinary Report, 1883. The Veterinarian, Oct., 1886.

to produce any results, save a soreness of the skin, which passes off in a couple of days. The disease is, therefore, not contagious.

The pemphigus foliaceus form of chiber might be mistaken for pityriasis rubra, on account of the large flakes that are sometimes thrown off in the site of the bullæ, the disease consisting of bullæ rapidly developed and drying up into lamellæ; but in the latter there is no history of bullæ and the scales also present a different aspect and are more widespread in character than those of chiber. Pityriasis rubra has no thickening of the cutis, no papillary hypertrophy, no history of bullæ, and there is an absence of thick flakes or lamellæ, produced by the collapsed walls of the bullæ, together with more or less secretion present in chiber.

Now it is very important to note that chiber may be very readily mistaken for a number of allied diseases, some of which we have noted, as very often the characters of the disease are masked, and there are many varieties of the same disease. The result of neglecting to attend to this point is that the practitioner regards the type present as an eczema, an impetigo, a herpes, an elephantiasis, or a something else.

TREATMENT.

The treatment will vary according to the stage of the disease. In the beginning cleanliness and dryness, combined with dressings of oxide of zinc ointment, will suffice to effect a cure. In more advanced stages of the disease, more energetic means will be necessary, principally astringents and caustics, to cause it to subside:

alum, borax, catechu, chloral, nitrate of silver etc., are the agents most commonly employed, and are generally attended by good results. Iodoform has been recommended by many German veterinary surgeons, but when once induration and hypertrophy have set in, no treatment is generally of any avail.

In Quain's "Dictionary of Medicine" Hutchinson* is quoted, who thinks arsenic is the only remedy of certain value in bad cases of pemphigus in the human subject. Mr. Meyrick says,—"The internal administration of arsenic in five-grain doses for about a fortnight seems to assist the cure in bad or protracted cases of chiber." The natives of India have employed arsenic in the treatment of chiber from the earliest times, and they believe it is a specific for some forms of this disease. Perhaps arsenic in large doses does good by acting as a diuretic, which relieves hyperæmia of the skin. The foliaceous variety is best treated with repeated blisters of hydrarg. rubrum.

* See a detailed examination of the facts in Hutchinson's "Clinical Lectures," vol. i, 1879, pp. 49-74.

CHAPTER XI.

"MADURA FOOT"; OR, ACTINOMYKOSIS.

I have shown that the disease called fungus foot, or madura foot of India,* which is noticed equally in the lower animals as in man, is caused by a fungus which is allied to, if not identical with, the ray fungus met with in the malady known as actinomykosis, or Rivolta's disease—a disease formerly confounded with sarcoma and scirrhus of the cord, etc. In several recent examinations of the malady in the lower animals we have noted that the actinomyces, seen under a low power, cannot be distinguished from the fungus found in specimens of madura foot of the human subject. Is it possible that the two diseases are alike? In my work on Veterinary Surgical Pathology, published in 1886, I have given a sketch of some of the appearances presented by the actinomyces from the lower jaw of an elephant, and it is to the fungus magnified only 20 diameters, that I wish

* The *Veterinary Journal*, December, 1886.

particularly to draw attention; and if any one will compare Fig. 88 in the work on Skin Diseases, by Dr. Tilbury Fox, which represents the organism found in madura foot, with those of the actinomyces shown in Fleming's work on Actinomykosis lately published, I think he must agree in the general opinion that the nature of the organism which causes the disease called fungus foot of India, requires further investigation.

We are of opinion that the nature of these fungi requires further investigation, and that inquiry will show that the parasite of madura foot is only another stage of transformation of the common variety, *actinomyces*.

I would define fungus foot disease of India, then, as one form of actinomykosis, caused by the growth and action of the ray fungus during a special phase of development, or of a particular species of the same parasite. At any rate, the resemblance in this respect has driven home to us the necessity for further inquiry in this direction, and to seek an explanation of the similar appearances presented under the microscope, there being the greatest resemblance between the parasites seen in the disease of man known as fungus foot, and actinomykosis.

If the food is the vehicle through which the fungus gains access to the mouth of animals, as it is most frequently the part to be first invaded as an organ of prehension, it is equally true that in the human subject it is the foot which is chiefly affected, because the value of boots is known to but few natives in India.

Be the value of our observation what it may, it possesses a certain amount of interest in connection with the minute observations made by Dr. Vandyke Carter, Bagunjee Rustomjee and others, on the fungus foot of India.

CHAPTER XII.

INTERMITTENT AND REMITTENT FEVER.

For some years intermittent fever in the horse was mistaken for anthrax, and, still more recently, has been described under the name of relapsing fever, because of the presence in the blood of organisms resembling spirillæ, and the fever being of a recurring nature. By degrees it has come to be acknowledged, especially since the last few years, that these diseases are quite distinct. Remarkable as it may appear, our first accounts of this disease, as at present recorded, did not come from the region to which it is generally supposed to be indigenous, namely India, but from those sections beyond this, in Europe ; and the first authentic account of this disease, or one which very closely resembles it, was given by Damoiseau under the name of Wechselfieber (malaria, or febris intermittens). We have other accounts of the disease in German works, and from time to time several varieties were noted to which special names have been given, thus : Febris quotidiana, tertiana, quartana, quintana, etc. Also, continued malarial fever,

chronic malarial cachexia, gastric fever, periodic fever, Texas fever, African horse-pest, horse-sickness, etc.

The first or primary symptoms are generally those of languor and fatigue, the animal presents a sluggish gait, frequently hangs its head and refuses food. In a few cases shivering fits are remarked at the onset, and the breathing is noticed to be slightly hurried. The shivering may recur in some, though not in all cases, during the course of the disease. The temperature is found to be 102° F., if taken at the onset, and rises to 103°, 104° F., or even higher. It descends in a few hours to 102° F., and may even come down to normal point, with complete cessation of all febrile symptoms. The pulse and respirations will be increased accordingly. The cases linger to several days and show an apparent improvement, but again manifest acute symptoms. In other cases, on the temperature being taken, it will be found to have risen four, five or more degrees above the normal and to be maintained high throughout the course of the disease, with fluctuations. Frequently there is no regularity in the rise and fall of temperature.

The urine is always albuminous in character, and frequently contains tube-casts. When there is blood in the urine, the act of micturition is often more frequent than at other times. The urine, often clear and limpid, is rosy or crimson when it has been evacuated immediately after extravasation ; but if the blood has remained some time in the bladder, the urine acquires a dirty brown hue, due to the hæmaglobin being changed to methæmaglobin by the action of the acid in the urine. The cases linger to several days and show an apparent improvement, but again manifest acute symptoms. Thirst

is sometimes present, attended with diarrhœa. Paraplegia, pronounced stringhalt, muscular tremors, platting of the legs, etc., develop during the course of the disease, due to effusion on the spine and on individual nerves. These symptoms are seldom permanent in character, and often disappear on removal of the effused fliud due to natural absorption.

Owing to a sustained high temperature in this disease the animals rapidly waste and become lean, presenting that appearance in a few days which is seen in other wasting diseases only after weeks of illness. Convalescence is protracted. The disease leaves the animals so weak that they seldom rally in the great majority of cases, ultimately succumbing to exhaustion.

POST MORTEM CHARACTERS.

The blood is dark and viscid, in some of the larger vessels forming into distinct, long clots. It is not unusual to find ecchymoses in the subserous and submucous tissues. The walls of the heart are soft and flabby, and the pericardial sac contains an excess of serous fluid. The lungs are the seat of congestion and catarrhal inflammation, being enlarged and increased in weight, owing to consolidation. The stomach and intestines show petechiæ and congestions, erosions, sloughs and deep excavated ulcers of various forms and extent. The liver is often enlarged and increased in weight, soft and friable. The spleen is also sometimes enlarged, though not in all cases. In those cases in which paralysis of the hind quarters or other nervous symptoms are well marked, the grey matter of the cord generally shows

blood extravasations and staining of the nerve cells; but beyond a tendency to congestion and occasional blood extravasation, no lesions are usually discovered in the nervous system.

Microscopically examined the blood shows the presence of white cells in excess, with destruction of the red corpuscles, and the presence of numerous short bacilli, and sometimes also infusorial organisms. The presence of these organisms is not conclusive evidence that they have actually caused the disease, inasmuch as endeavours made to communicate malarial fever to healthy animals have all been attended with one error, namely of using the organisms in common with the blood of affected animals; while similar organisms have been met with in the blood of animals enjoying perfect health. We have injected these bacilli and spirilloid organisms mixed with water into the veins of rabbits and dogs not only without any evident result, but without even any rise of the body temperature, which was taken twice a day.

DIAGNOSIS.

From relapsing fever it is easily distinguishable by the following characters:—The digestive organs usually exhibit nothing particular in relapsing fever; in remittent fever of the horse, digestive lesions, both in the stomach and intestines, are found to be common in almost every case, and are characteristic also of remittent fever in man. 2. Pulmonary complications are rare in relapsing fever, but frequently exist in cases of remittent fever in horses. 3. A symptom to which special

attention should be directed is motor disturbances. The motor affection is shown by the frequent paraplegia, twitching and spasms of the muscles, and affects the muscles of the hind legs in particular, producing stringhalt, unsteady gait, etc. Symptoms allied to the above are not uncommonly noted in remittent fever of human beings. The mortality also is usually high, which is more common to remittent than relapsing fever. The diagnosis may not be easy in a few complicated cases, but due observation of the peculiar combination of symptoms will enable careful practitioners to make a good practical diagnosis. The exact knowledge obtained by the methods of inquiry employed, by carefully comparing the temperature charts, symptoms, and *post mortem* appearances of different cases, will lead to an important investigation of the behaviour of this disease, and thus to a more exact method of treatment in the future.

The presence of anthrax may be asserted positively by the presence of rods peculiar to this disease; (*b*) which, moreover, stain readily in special colouring fluids; and (*c*) are inoculable in suitable media and in susceptible animals.

We are of opinion that a careful study of the disease called influenza in the horse would lead to its being divided into three or more distinct affections. Further, we think that the distinctive characters of different forms of fever in the horse are such as in practice could not allow them to be confounded any longer—an opinion which all subsequent observation must tend to confirm. We may have remittent fever and remittent character of the temperature in anthrax among horses, and

although the two fevers are essentially distinct, the one might supervene on the other. No other subject is so replete with interest as that of fevers seen in the lower animals, and although the subject has been somewhat shrouded in mystery in the past, we now have at least the prospect of improvement. The facts and conclusions under any circumstances take some time to collect, but when a general system of inquiry has been encouraged, important solutions will be forthcoming, proving many of our former ideas about disease to be both obsolete and useless.

TREATMENT.

A radical cure of remittent fever is beyond the power of medicinal agencies, but much may be done to increase the chances of recovery in many cases, and for this purpose we must bear in mind the complications, which are so common in this disease. One of the most important of these is the tendency to pulmonary catarrh, and frequent diarrhœa brought on from intestinal irritation. In all cases it is advisable to keep the bowels from becoming constipated by the administration of mild purgatives. Nourishing and easily digested food should be given. Among the remedies which have been tried in the treatment of these cases and found beneficial in some, we will mention sulphate of quinine, sulphite of sodium, antifebrine, antipyrine and carbolic acid.

LITERATURE.

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IN

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