

An inquiry into the rot in sheep; and other animals; in which a connection is pointed out between it, and some obscure and important disorders, in the human constitution / by Edward Harrison.

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AN
INQUIRY
INTO THE
ROT IN SHEEP;
AND OTHER
ANIMALS;
IN WHICH A
CONNECTION IS POINTED OUT
BETWEEN IT, AND SOME
Obscure and important Disorders,
IN THE
HUMAN CONSTITUTION.

By EDWARD HARRISON,
M. D. F. R. A. S. ED.
MEMBER OF THE ROYAL MED. AND ROYAL PHYS. SOC. ED.
OF THE MED. SOC. LONDON, &c.

"For that which befalleth the Sons of Men befalleth Beasts."
ECCLESIASTES.

LONDON:
PRINTED BY W. STRATFORD, CROWN-COURT, TEMPLE-BAR; FOR
R. BICKERSTAFF,
CORNER OF ESSEX-STREET, STRAND.

1804.

INQUIRY
INTO THE
ROT IN SHEEP:
AND OTHER
ANIMALS;

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TO THE
RIGHT HONOURABLE
SIR JOSEPH BANKS, BART.
K. B. P. R. S. &c. &c. &c.

SIR,

A Deep sense of my numerous obligations to the inhabitants of Lincolnshire, first induced me to direct my attention to the subject of the following pages; and I beg leave to publish my observations under the sanction of a Gentleman, who has conferred upon it so many valuable benefits,

When the vast schemes of drainage and other local undertakings, for which we are chiefly indebted to your patriotic and persevering exertions, shall be entirely complete, this large county will be exalted into one of the most fertile and healthy provinces in the island.

If the envious, or malevolent, have presumed to detract from these eminent services, you have only been assailed in common with

the best and most illustrious ornaments of society. Their *misrepresentations* will, I trust, be amply refuted by the result. It will then be ascertained, that no ability less transcendent, nor industry less indefatigable, could have accomplished objects of such vast utility and lasting importance to the prosperity of the British empire.

That so valuable a life may long be preserved to the community, is the anxious wish of him, who has the honor to subscribe himself with the greatest deference and respect,

S I R,

Your most obedient,

and faithful humble servant,

EDWARD HARRISON.

INTRODUCTION.

ANIMALS, in a wild state, are subject to few ailments. It is by domestication and the various refinements of polished life, that they are rendered obnoxious to a great variety of new and complicated miseries. In these respects, dogs, horses, beeves, pigs, sheep, &c. have all suffered by their dependence upon man. Desirous to render them more subservient to his wants and gratifications, he has bestowed uncommon pains upon their breed, diet, and management, without being equally solicitous to prevent and to cure their numerous disorders.

In France, and a few other places upon the Continent, regular establishments have been founded for the instruction of students, in this department of medical philosophy. Since their institution, the practice of animal medicine has in those countries been chiefly intrusted to persons of regular education, and not, as with us, to rash and ignorant pretenders. A national college was lately erected in London, for the education of veterinary practitioners, which has hitherto been confined chiefly to the diseases of horses. In consequence of it, the sufferings of this noble animal have employed the
attention

attention of several ingenious writers, and able practitioners: from their labours, we have reason to believe, that if suitable encouragement were offered to veterinary practitioners, we should soon excel in this, as much as in other departments of the healing art. Had the diseases of kine been properly considered, the introduction of vaccine inoculation, which reflects so much honour upon our country, and promises annually to preserve millions from the destructive ravages of the small-pox, would have been generally exercised long before the dawn of this eventful century. Hitherto, little has been attempted towards combining the scattered principles of animal physiology and pathology into one grand and comprehensive science. Such an undertaking would lead to great practical improvements; for since a chain of connexion is extended through every part of animate nature, the unfolding of it could not fail materially to enlarge our views, and multiply our resources, for the benefit of afflicted mortals. Even the peculiarities of each individual arising from his habits, œconomy, anatomical structure, and employments, would contribute in no small degree to elucidate the constitutional functions of other beings. These observations first suggested themselves to my mind, by an inquiry concerning the rot. When I first entered upon the examination, I supposed that it was confined exclusively to sheep; but I soon discovered, that several others of the brute creation are equally exposed to this dangerous malady, and that

that it bears a striking resemblance to some complaints in the human body. Strongly impressed with the importance of these facts, I became more solicitous to prosecute the subject, from a desire, by this means, to benefit more effectually my own profession. The great prevalence of dry weather, during the two last summers, has materially obstructed my plan, and obliged me to defer its completion to a future season; but, in the mean time, I have ventured to deliver my opinion of the cause and method of preventing the rot, with a view to excite the observations of medical practitioners, and ingenious agriculturists. Persons connected with the cultivation of land, or the manufacture of woollen fabrics, are so well acquainted with the ruinous consequences of a rotting year among sheep, to the agriculture and commerce of these kingdoms, that no arguments, it is presumed, will be necessary to procure their strenuous interference; and, from the medical faculty, I anticipate a zealous co-operation in prosecuting an inquiry, which promises to elucidate so many obscure disorders in the human constitution.

In every point of view, the numerous complaints of sheep seem to be entitled to a very particular consideration. Through them, we may be enabled to clear up several important matters relative to agues, remittents, the yellow fever, dysentery, cholera morbus*, &c.; and probably, on further inquiry,

* In all the disorders above enumerated, I think I can discern the glimpse of a general principle, which I shall probably take occasion, at some future period, to treat more at large.

the Egyptian ophthalmia will be found to resemble the blindness with which sheep are sometimes afflicted in summer*. I may likewise observe, that in certain situations, sheep are much exposed to pulmonary consumptions, from tubercles in the lungs†. This formidable disorder, which annually destroys so many young persons in Britain, might probably receive illustration by examining the lungs of sheep, which have been kept for a long time in high and low situations, in a soft and sharp atmosphere, &c.; but without adverting to any such considerations, whatever has any tendency to improve the condition of sheep, is entitled to the attentive regard of every well-wisher to the prosperity of his country, Hence Britannia sees

Her solid grandeur rise ! hence she commands
Th' exalted stores of every brighter clime,
The treasures of the sun, without his rage :
Hence, fervent all, with culture, toil, and arts,
Wide glows her land : her dreadful thunder hence
Rides o'er the waves sublime, and now, even now,
Impending hangs o'er Gallia's humbled coast ;
Hence rules the circling deep, and awes the world.

* Note A. see the end.

† See my Address to the Horncastle Medical Society, in the Med. and Phy. Journal for Sept. 1802.

AN
INQUIRY
INTO THE
ROT IN SHEEP, &c.

PART THE FIRST.

An Inquiry into the Nature of the Soil, and the Circumstances which induce and prevent the Rot; in which it is attempted to prove, that Marsh Miasmata are equally the Cause of Agues, Remitting Fevers, &c. in the human Subject, and of the Rot in Animals.

IT is well known, that sound Livers grow firm and solid by boiling. By the same process, Livers severely tainted with the Rot lose their consistency, and break down into small pieces.

Rotten Livers remain soft and flaccid after death. In slight cases they preserve their cohesion, but never become hard and compact on boiling.

From this circumstance, I presume, the disease has obtained its name, and may be distinguished from every other complaint. It affects sheep, cows, horses, asses, hogs, deer, hares, rabbits, geese, pigeons, turkies, and poultry*; but since the phenomena and

* Dogs are not entirely free from the Rot. See *Inst. &c. sur les Malad. des Anim. Domest. Année, 1791.*

progress of the disorder have been more carefully observed in sheep, than in other animals, my observations will chiefly be confined to them.

Poor, clayey and loamy lands are most subject to Rot. On them, without great care, water stagnates, and can only be removed by evaporation; for they are too compact and tenacious to permit much of it to sink down and escape below the surface. By judicious drainage, and conveying away the moisture as it falls, such lands become sound; and then sheep may feed securely upon them, in all seasons of the year.

Grounds that are always dry, or always under water, and such as are wet enough to preserve a continual run and circulation, were never known to suffer from the Rot.

Dry lands, and countries that are every where well drained, it is universally admitted, do not rot animals. By an improved cultivation, and the enclosure of open fields, many large tracts, which were formerly very destructive to sheep, have been laid dry, and are become sound land. Mr. Joseph Hardy, of Portland, informs me, that he was born, and lived many years, with his father, at Osbornby, near Falkingham, upon a farm, which is now occupied by his brother. In his father's time the parish was undivided, and contained large portions of low swampy land, where the sheep were so much exposed to the Rot, that he has frequently known fifty or sixty of them to be brought, at one time, into the farm yard, and treated for this disorder. Of these many were choquered, or had a swelling and fluid in the cellular membrane, under
the

the chin. Since the above lands have been enclosed and completely drained, his brother informs him, that neither his farm, nor that of any of his neighbours in the Lordship, is troubled with the Rot.

Ponds of living water are equally safe; but when attempts have been made to drain meres, and other collections of shallow water, which have not entirely succeeded, the places become moist and soft in wet weather, and sheep that feed upon them are very much exposed to the Rot.

A grazier of my acquaintance has, for many years, occupied a large portion of an unenclosed fen, in which was a shallow piece of water that covered about an acre and a half of land. To recover it for pasturage, he cut in it several open ditches to let off the water, and obtained an imperfect drainage. His sheep immediately afterwards became liable to the Rot, and in most years he lost some of them. In 1792 the drains failed so entirely, from the wetness of the season, that he got another pond of living water, and sustained, in that season, no loss in his flock. For a few succeeding years, he was generally visited with the Rot; but having satisfied himself by experience, that whenever the pit was, from the weather, either completely dry or completely under water, his flock was free from the disorder, he attempted a more perfect drainage, and succeeded in making the land dry at all times. Since that period he has lost no sheep from the Rot, though, till within the last two years, he continued to occupy the fen.

So long as any current is preserved, there is little to fear from the Rot. Water in motion is continually

mixing with fresh particles, by which its purity is maintained, and new arrangements are prevented. In such places sheep can remain, for many weeks together, uninjured on grounds that are excessively wet and flabby*. Edmund Turnor, Esq. of Panton House, in the county of Lincoln, a gentleman of great landed property, and extremely well acquainted with most branches of agriculture, has repeatedly informed me, that a field, in his own occupation, was never known to Rot before he attempted to lay it dry. The pasture contains upwards of fifty acres, about thirty-five of which arise, toward his mansion and offices, by a rapid ascent. The remainder is nearly flat, or recedes from the ditch by a gradual acclivity. The water which soaked from the hill sides was considerable before he began to cultivate it, and is now chiefly carried away by concealed drains. In the flat piece a large ditch still remains, by which all the water was formerly conveyed; but from neglect and disuse, this drain has, for some years, been completely stopped up by coarse grass and slime. The mud in it is several feet deep, and of a yellowish or ochrey colour. In some places the surface is covered with a thin layer of stagnant water; in other parts it remains only in the hollows and feet-marks. To this ditch, all the stock, together with the hares and rabbits of an adjacent plantation, had formerly an easy access, and all of them were frequently rotten. Of late years the enclosure has been divided into two parts, and the larger seldom rots, though I observed lately, that it contained a few hollows and inequalities, from

* See Bath, &c. Agricultural Society, Vol. 1st.

which the moisture could only be removed by evaporation. The smaller division includes the open ditch, and continues to rot as much as formerly*.

In the year 1792 the country was uncommonly wet, from the great quantities of rain which fell in the summer months; and this was a most destructive year to sheep and other animals. In the human subject, agues, remittents, and bilious autumnal fevers, were also very prevalent in many places. Graziers soon took the alarm, and became very solicitous about their flocks. A breeder of rams informed me, that to save his finest sheep he put them into closes, which, during an occupation of forty years, had never been known to rot; but he had the misfortune to lose them all. He was equally surprised to find, that other pastures, which had frequently produced the Rot, were this season entirely free from it. Upon inquiry I found, that the suspected land was so much under water this year, that the sheep were obliged to wade for their food; and that pastures of a higher, and consequently of a dryer layer, were, from the deluge of rain, brought into a moist or rotting state.

In the same year Mr. Kirkham, of Hagnaby, occupied his old range in the West Fen, and expected to lose many sheep. He was, however, agreeably deceived, by finding them all sound and well; when, upon the approach of winter, they were removed into his enclosed grounds. The sheep had to wade for their food, and went frequently up to their knees in search of it. He seldom escapes the Rot entirely, as

Note B. see the end.

his flock is confined to a low range in the fen. I conceive, in all these instances, that the ground which rots in ordinary seasons, was made by the great falls of rain too wet; and that more elevated land became moist enough this summer and autumn, to produce it.

Grounds newly laid down for pasture, or ploughed fields, exhausted by repeated crops, where the sward is thin, and the water remains in plashees for want of proper outlets, are peculiarly subject to rot. In such situations there is nothing to ward off the gleams of the sun's rays. Evaporation is therefore copiously performed, and probably some of the water is decomposed; so as to generate, in combination with other substances, the poisonous effluvia, called *miasmata paludum*, which occasion the rot in animals.

The connexion between humidity* and the rot, is universally admitted by experienced graziers; and it is a matter of observation, that since the brooks and rivulets in the county of Lincoln have been better managed, and the system of laying ground dry, by open ditches and under-draining, has been more judiciously practised, the rot is become far less prevalent. It is well known to practical physicians, that agues and remitting fevers are occasioned by emanations from moist situations.

* Sheep die very much of the rot at St. Helena, from the over great moisture on their hills, which are half a mile high, and so moist, that paper in the night could not be kept dry enough to write on. Houghton's Coll. Husbandry, vol. i. 98.

From personal observation and extensive experience, I have for some time been led to believe, that the bilious fevers, and pneumonic* inflammations, which occur in our low districts during the autumnal months, are to be imputed to miasmata. Even the yellow fever has been traced to the same origin by some able physicians; and this opinion seems of late to have acquired additional credit in America †.

In England, agues and remitting fevers were formerly much more prevalent and severe than at this time. In the Holland division of Lincolnshire, it may be safely affirmed, that, from the improved drainage in that fertile district, they have declined very considerably both in frequency and violence. Formerly, it was no uncommon thing, for persons to endure the fits of an intermittent fever for two or three years and the remittents; and bilious fevers were very prevalent and dangerous in autumn. Many of the symptoms and morbid changes in the liver are common to sheep and to mankind; hence we have reason to believe, that a close analogy and intimate connexion subsist among several of their liver disorders. It has even been asserted, that in the first stage of the rot, sheep are hot, and feverish. Should this be con-

* Pneumonia peripneumonia, which is an inflammation of the lungs, was formerly a common disorder in this county. Of late years, it has declined considerably; in consequence, as I suspect, of the sewers and other public works being so much better regulated.

† Vid. Med. and Phys. Memoirs, by Dr. Caldwell.

firmed by future observers, a strong resemblance would indeed be established. In sheep tainted by the rot, the liver is much affected, and is always enlarged. They never recover so entirely from this disorder, as to get very fat, and the mutton and gravy is generally white and pale. When the intermittents of this island were more obstinate, and continued their paroxysms for many months without any abatement, the ague-cake, as it is called by the common people, was a frequent occurrence. This is an enlarged liver, or spleen; and had dissections been more practised at that time, I think other proofs of a morbid similarity, between the human liver, and that of sheep, would have been discovered. In warm climates, bilious, remitting, and intermitting fevers are very common, during and immediately after the rainy seasons. All these affections are frequently accompanied with bilious symptoms, which generally terminate in an enlarged, schirrous liver. The liver seldom completely recovers its former functions, and persons so affected remain pale and fallow for the rest of life. Whether they are less inclinable to feed, than other people, is a matter upon which I am unable to decide. Such as are afflicted with diseased livers, are often bloated and swollen; but this state differs greatly from the general corpulence and obesity to which I allude. According to the observations of Dr. Paisley and others, the grand source of health and disease, in the eastern regions, proceeds from the natural or diseased condition of the liver.

Within

Within the last forty years, plans of great magnitude in drainage and encloſure have been deviſed and conducted, chiefly by the right honourable Sir Joſeph Banks, for the improvement of his native county. When theſe immenſe ſchemes are completely executed, the population and produce of Lincolnſhire will be ſo much increaſed, as to add in no ſmall degree to the ſtrength and reſources of the empire. Theſe patriotic enterpriſes have already ſucceeded ſo well in many parts, that intermittents in the human ſubject, and the rot in ſheep, have conſiderably decreaſed among us.

A medical gentleman of great experience at Boſton, and who is conſiderably advanced in life, has frequently obſerved to me, that intermittents are ſo much diminiſhed in his circuit, that an ounce of the cinchona goes farther at this time in the treatment of agues, than a pound of it did within his own recollection. During his father's practice at Boſton, they were ſtill more obſtinate and ſevere. For my own part, I have declared, for ſeveral years, in various companies, that marſh miasmata are the cauſe of both agues and the rot. And as miasmata are admitted, by the concurring teſtimonies of medical practitioners in every part of the globe, to be produced by the action of the ſun upon low, ſwampy grounds, I hope this intereſting ſubject will be fully inveſtigated, and effectual plans carried into execution, for the preſervation of man, and of the animals which are ſo uſeful to him.

Other soils have been known to occasion the rot; but, unless I am much mistaken, it may be laid down as an established fact, that where the earth is too porous to retain moisture, it will never produce this fatal disorder. Pure sandy and gravelly lands were never known to rot; probably because the water that falls upon or passes over them, descends into the bowels of the earth, before it has suffered any change from the action of the sun and air. When these soils are thin and lie upon strata, the rain, and top water are confined, and they then become liable to rot. "In some parts of Dutch Brabant, the soil is a barren sand, but water is every where to be met with, at the depth of two or three feet from the surface; and in proportion to its distance, the inhabitants are free from diseases*."

In this country, sheep appear to suffer from the wetness of sandy strata, in the same way that our soldiers, and the inhabitants in the Low Countries, were affected by it in 1744-5.

Soils are seldom pure; the most porous are often mixed in different places with principles that enable them to hold moisture; or other strata are interspersed, where water stagnates, and the rot is produced. The banks of the river Trent contain a great diversity of materials. In some places, they consist of mere sand and gravel, in others of clay or loam. The former never produce the rot, although the argillaceous and loamy soils are by

* Vid. Pringle's Diseases of the Army, p. 62.

no means to be trusted in wet seasons. From these circumstances, we are led to conclude, that this disorder does not depend upon any peculiarity in the Trent waters; but that it is produced in some way or other by the action of moisture, in combination with the sun upon particular earths. I believe it will be found to be true, that the rot in animals is always acquired by pasturing on moist soft land*, where, for want of sufficient channels, the water is detained and stagnated.

On marshes exposed to the tides of the ocean, miasmata are effectually restrained by the saline quality of the sea water. Probably some bogs, and swampy tracts in Ireland, which are said to be free from the rot, are protected by the minerals that they contain. I believe that peat mosses do not communicate the infection to sheep. In such districts, the evolution of noxious miasmata seems to be entirely repressed, by a combination taking place between the water and extractive materials of the soil.

I was inclined to believe, that miasmata are less copiously evolved in calcarious† than in other countries, because it is an established fact, that the moisture of the Lincolnshire Wold Hills (a large mass of calcarious matter) seldom produces the rot. It has indeed been suspected, that sheep are sometimes tainted on dry limed land in Derbyshire‡;

* Young's Eastern Tour. Bath, &c. Society, vol. I.

† See note B. at the end.

‡ Path, &c. Society, vol. I.

and as it is a subject of importance, I hope the gentlemen of that county will give it a full investigation. Till the inquiry has been made, I shall retain my former opinion; and I do it with greater confidence, because a relation of mine, who resided a long time at Chapel le Frith, informed me lately, that he never heard of the rot during his residence in that country.

I do not mean to affirm, that the same identical miasmata are equally the cause of all the diseases enumerated in this Essay. Probably a great variety of exhalations are generated in marshy grounds; for it is notorious, that the endemics of different seasons are very unlike one another, both in form and severity. It is also well known, that human creatures and brute animals are assailed by numberless specific contagions; and therefore it does not seem to be an improbable supposition, that lands abounding with a great diversity of soils, and of herbage, in various climates, in different seasons—in dry and wet years, &c. should be capable of generating an almost endless variety of noxious miasmata. It is moreover confirmed by experience, that most contagious epidemics assume something specific and appropriate. For example, so great is the virulence and mortality of the small pox, in some seasons, when compared with others, that medical practitioners have been inclined to admit several species of variolous disorders. This dissimilarity cannot, however, as I conceive, be imputed to any modification in the contagious poison; but

but must arise from the atmosphere being more or less favourable to the diffusion and agency of variolous matter upon the human constitution. This state of the air is peculiarly noticed by the American physicians, and seems of late years to have increased the malignity of the yellow fever.

It does not appear by eudiometrical experiments, that the atmosphere in habitable situations ever undergoes any considerable change in its sensible qualities; and therefore I suspect that the noxious emanations are only diffused in the air, where they remain imperceptible to the most delicate tests * hitherto invented, and on some occasions constitute no inconsiderable part of the morbid atmosphere. It is to this cause that I attribute the fallow complexions, and debilitated constitutions, which so universally prevail among the inhabitants of some swampy districts in the papal dominions. Formerly in the hundreds of Essex, in some parts of Lincolnshire, Cambridgeshire, &c. the people were extremely pale and sickly; but since these districts have been better drained, and consequently have generated fewer miasmata, the peasantry are greatly improved in health, and the rot prevails less among their sheep.

Mr. Vanbreda observes, that during the hot and dry weather in autumn, the oxygen gas in marshy regions has been reduced from 28 to 14 parts; while the azotic air was increased from 72, to 84 or 85 parts in the hundred. He likewise de-

* Vid. Guyton on purifying the atmosphere.

ected a small quantity of carbonic, hydrogen, and ammoniacal gases, which he imputes to vegetable and animal putrefaction. According to this analysis, we find indeed a considerable deficiency of the oxygenous principle, but nothing to which we can impute the disorders that have been attributed to miasmata. The reduced atmosphere of large towns gradually undermines the constitution, and the rosy bloom of rural health; but we know from experience, that it never produces the first attack of a recurrent fever; nor do I believe that it will ever occasion the rot in animals.

CAUSES OF ROT.

It will naturally be expected, that, before the delivery of my own opinion, some notice should be taken of the various theories and hypotheses which have been advanced, with respect to the rot in animals.

The disorder has been imputed, 1st, to a vitiated dew.

2dly, To a gruft, which adheres to the grass after wet weather, or the overflowing of running water.

3dly, To the luxuriant and quick growth of plants, in hot, moist seasons.

4thly, To grazing upon certain herbs.

5thly, To fasciolæ hepaticæ, or their ova, being introduced into the stomachs of animals, by feeding on swampy and low grounds in moist weather.

6thly,

6thly, It has been called the sheep pox, by professor Vibourg, of the veterinary college at Copenhagen*.

7thly, It is ascribed by Daubenton to poor diet, and drinking too much water.

8thly, It seems to be occasioned by poisonous effluvia, which under certain circumstances are emitted from marshy soils.

1st, It was formerly the received opinion, that dews, under various circumstances, differ very considerably from each other; and therefore we cannot be surpris'd, that the rot has been imputed to them. For the preservation of health, it was then judg'd necessary to close the windows of lodging-rooms before sun-set, to prevent the introduction of night air. Since it is believed that aqueous vapours ascend from the earth during the day, and fall again in the night, to refresh the ground and vegetables; which had suffered by a hot sun, the dew is admitted to be pure water freed from earthy impregnations, and to be sent for wise purposes. If the rot were occasioned by the dew, it should appear equally on all hands; but since it is only to be found in certain places, and under peculiar circumstances, I think it cannot be attributed to this cause.

2dly, By beating rains, I can easily believe that particles of the soil, or the gruft as it is called, will be washed among the grass. In this way, sheep swallow it with their food, as they do on many other occasions; but how the texture and fabric of

* This is not properly a cause of the rot.

the liver can be so destroyed, is to me quite incomprehensible. Soft and continued rains are much more dangerous to sheep, than violent storms; and flat and low lands, where the water does not discharge itself freely, and remains some time upon them, are most liable to rot animals.

3dly. In wet, sultry weather, the grass grows luxuriantly; and at such times, it is well known, sheep are most exposed to the rot; no wonder, therefore, that an attempt should be made, to establish some connexion between this disorder and the herbs upon which they feed. And since no fresh vegetables could be supposed to spring up in a few hours, and be capable of producing such a virulent malady, they imputed it to some new and acquired properties in the plants themselves. If all luxuriant pastures were found to communicate the rot in showery and hot seasons, this opinion would be more probable; but as the disorder is confined exclusively to certain grounds, we cannot suppose that it depends upon any change of vegetation.

4thly, Others have imputed this malady to feeding upon some particular herbs, and of these the *Pinguicula vulgaris*, the Butterwort, *Hydrocotyle vulgaris*, the White Rot, *drosera rotundifolia*, round-leaved Sundew, and *drosera longifolia*, long-leaved Sundew, have been chiefly suspected. I have already observed, that twelve different animals are liable to become rotten, i. e. to have friable livers, and flukes in the *pori bilarii*, and *ductus communis*,

communis, from feeding upon moist grounds. Of these, turkies and poultry eat little grass, and pigeons none; these, therefore, are not likely to suffer from herbage of any kind: besides, both the Butterwort and the White Rot are too pungent and sharp for general pasturage. Accordingly, the former, and, I believe, the latter, is refused by sheep, cows, horses, goats, and swine.

Sheep, however, do not reject all acrid plants. In Italy, it is said, they feed greedily upon the *ranunculus arvensis*, and have been poisoned by it. When confined without other sustenance, they will eat the *ranunculus sceleratus* and *bulbosus*. Daubenton kept two sheep eight days upon this food, and they suffered no injury from it. This experiment induces him to conclude, that neither of the latter plants have any tendency to produce the Rot. Had the last season been favourable, I intended to have confined a few sheep of different ages on suspected grounds; and by killing them at regular periods, I expected to ascertain how far they had suffered from the soil and the herbage. By trials of this kind, with careful dissections, I conceive that much light would be thrown upon the Rot, and the other disorders of sheep. It will be stated, in the progress of this Essay, that sheep have acquired the Rot by remaining only ten minutes on wet lands. In that time they could not have gorged much, even supposing them to be fond of any plants admitted to be pernicious; and the disorder has certainly been produced, where none of the suspected vegetables could be ever discovered. If the

disorder is produced by feeding upon plants, I think it would occur most in Spring or Summer, when they are in the greatest vigour.

5thly. Of late this disorder has been attributed chiefly to flukes, or *fasciolæ hepaticæ**; and they are supposed to be taken into the stomach along with the food.

If we admit the presence of these insects in every case of Rot, it will still be a difficult matter to impute to them the friable state of the Liver; they can only affect those parts with which they come into contact, other portions are placed out of the reach of their influence. It may not be generally known, that, in some districts, most aged sheep contain flukes; and yet many of their Livers, I will venture to maintain, from much experience, are perfectly sound.

Why then does it happen, that sometimes the Liver is injured in its texture, and at other times is not disturbed in its functions, by these insects? The hay† of moist lands, under certain circumstances, gives a more virulent and dangerous Rot than any other. The contagions of the plague, and of several infective disorders, it is well known, are preserved for

* See Letters, &c. by the Bath Agricultural Society. *Amœnitat. Academicæ*, &c. For an account of their anatomical structure and form, see Bidloo, and a Paper by Mr. A. Carlisle, in the 2nd Vol. of *Linnæan Trans.*

† *Observations et Inst. sur les Maladies des Animaux Domestiques.* Mr. Wright, of Fisherton, near Lincoln, has repeatedly found that the hay, taken from some moist land in his occupation, gives the Rot to bees and sheep, though it be stacked and eaten in a dry and elevated pasture.

a long time in bales of cotton and in wearing apparel, from which they are emitted with increased virulence. We are, therefore, led by analogy to conclude, that the miasmata are preserved in the hay, which acts as a fomes to them, like cotton, &c. to human effluvia. On this principle the fact admits of a ready solution; though, on any other, we should have great difficulty in explaining it. To me it seems a very improbable supposition, that any being is able to live equally in moist grounds, in hay, and in the viscera of animals. The range of life will not, I conceive, admit of such a diversified existence.

Formerly it was supposed, that human worms were invariably received into the stomach and bowels with the ingesta, but the tinea and ascaris have never been discovered out of the human body; and as to the lumbricus, it is found to differ so much in its anatomical structure, that it certainly ought not to be confounded with the common earth-worm. I am informed, from respectable authority, that a worm, of a peculiar form, has lately been discovered in the mezenteric artery of horses, and in no other place.

In the 48th number of the Medical and Physical Journal, we are favoured with some account of a very curious case, which was read before the Medical Society of Paris by Citizen Deleau Desfontaines. He states, that a man, who had been afflicted with some anomalous symptoms, died suddenly. Upon opening his body, a cavity was found in the middle of the concave surface of the great lobe of the Liver: it was six or seven lines in diameter, and four or five in

depth. This den contained a living insect of an extraordinary kind, and very unlike any hepatic worm that has been described by practitioners. It was four inches long, and of the thickness of a large filkworm. The colour was of a brownish red, and its body was articulated in the form of rings, each being marked by a white spot, in the middle of which was implanted an hair of a resisting nature, and extremely sharp; seen through a lens, it resembled the quills of a porcupine. The head of the insect was armed with an articulated proboscis. The inferior extremity terminated in a large flat tail, like that of a lobster.

How insects, or their ova, can penetrate into the substance of any viscus, or into the blood-vessels, during life, I am utterly at a loss to conceive. I think it will be necessary for the supporters of such opinions, however numerous and respectable they may be, to find some of the fasciolæ out of the body, before they venture to assert, with so much confidence, that they are always admitted with the food, and are capable of living in other animals. John Christiani Frommani observes, in a dissertation, entitled *De Verminoso in Ovibus et Juvencis Reperto Hepate**, that lambs in the womb were found to be affected with the Rot. How fasciolæ, or their ova, can by any means find their way into the liver, before the birth of the lamb, is to me quite inexplicable. We know that a foetus in utero is capable of suffering the fits of an ague†, which is admitted to be pro-

* Vid. Ephim. Act. Natur Curios.

† See Dr. Russel's communication in the Mem. of the Med. Soc. of London.

duced by miasmata; and therefore we are at no loss to believe, that miasmata can occasion the Rot in utero, with all its consequences.

It has been asserted, that suckling ewes, and heeves of more than two years old, are not capable of taking the Rot by grazing; although calves, and sheep of all ages*, are certainly not exempted from it. We know, from experience, that young persons are greater sufferers from contagious and epidemic disorders, than older people. As age increases, the constitution becomes firmer, and the nerves obtain a degree of tone, or possibly of apathy, enabling them to resist impressions, to which they could not have been exposed at an earlier period without apparent injury. It is in this way, as I conceive, that kine acquire, by age, a total exemption from the rot, under circumstances which prove destructive to younger animals of the same species. I have likewise some reason to believe, that, as life advances, sheep become more and more secure, although they are never entirely exempt from the ravages of this fatal distemper.

During pregnancy the animal economy undergoes an extraordinary change; and in consequence of it becomes enabled, in the human subject, to suspend some obstinate mental disorders, and the progress of pulmonary consumptions. From a knowledge of these circumstances, I am inclined more readily to admit, that, during the period of suckling, ewes are in less danger of contracting the

* Bath, &c. Essays, Vol. I,

rot than other sheep. Graziers are of opinion, that sheep in new situations are peculiarly exposed to the rot; and new settlers, it is well known, are more harassed with agues and remitting fevers, in foreign climates, than the native inhabitants. In both cases, however, the predisposition seems to decline gradually, though it is never entirely removed.

Should these facts prove, upon further inquiry, to have been correctly stated, we must look to the nervous energy for an explanation of them; and not to the action of flukes upon the liver, nor to any of the other causes enumerated above. I may likewise be permitted to state, that the hepatic worms of the twelve animals enumerated in a former part of this Essay, are of different sizes, and probably of as many different species; but if they, or their ova, are invariably received from moist grounds, they would resemble one another in every particular. The same egg always produces the same animal.

I may further observe, that the rot always commences with inflammatory symptoms*, and generally with an exudation of coagulable lymph under the liver. The quantity emitted varies in different cases, from a table spoonful to more than four times that quantity; and it is in this substance, as I conceive, that the flukes are placed, when we find them, by some process of nature,

* Note C. See the end.

with which we are not fully acquainted. “ Mr. J. C——— observes, that, on killing a sheep lately, which was seemingly in good health, he examined the viscera carefully, and, in some of the passages leading to the liver (which appeared turbid) he found a whitish thick liquor, which appeared to be all in motion. On applying a pocket-glass, he found it contained thousands of these flukes, which were apparently just hatched, and about the size of mites. These, if the sheep had not been killed, would probably have soon obtained their usual size, and proved its destruction *.”

Monf. Veirac, a Dutch physician of great eminence, has carefully dissected sheep, and declares, that flukes are sometimes not to be found even in the last stage of the rot. Chabert, a celebrated veterinary professor, observes, in an interesting memoir, that tainted sheep are much exposed to different kinds of worms. In such cases, the globulous *tænia*, he says, occupies the brain and lungs. Hydatids establish themselves in the abdomen: other worms are to be found in the trachea, and bowels. Lastly, flukes frequently fix themselves in the liver, which in that case becomes swollen or ulcerated. From all these circumstances, I am inclined to believe, that flukes are never the cause of this complaint, although they are commonly to be found in its advanced stages.

* See Letters, &c. selected from the Bath, &c. Society, vol. I.

On the origin of worms, I wish to be silent. The inquiry forms no part of my present design; and my time is too much engaged to admit of unnecessary disquisitions.

6thly, According to professor Vibourg, the cow-pox has been found to protect sheep from the rot, which he calls the sheep-pox infection. In Hungary too, as we are informed by Dr. De Carro, several proprietors have lately vaccinated their flocks, with the same expectation. I am inclined, however, to believe, that both these gentlemen confound the rot with the true *claveau des moutons*, which is a febrile and eruptive disorder. This complaint bears a strong resemblance to the small-pox, and probably is to be superseded by cow-pox inoculation. The *claveau* as the term is used, in this country at least, is vague and indefinite. It comprises the scab and rot, or pourriture, as well as the febrile disease properly denominated *claveau*. These are very different affections, and ought not, as I conceive, to be included under one general appellation.

The great danger of introducing the *claveau* into these kingdoms, along with the Spanish and Portuguese sheep, which are frequently imported by the favourers of fine wool, has been forcibly stated to the public by the right honourable sir Joseph Banks*. The object is of national concern; for if this fatal distemper once obtains a firm footing, it may be impossible to eradicate

* See Mr. Young's Annals of Agriculture.

it from among us. The Hottentots avoid the small-pox, by marking a boundary line, and punishing all persons who hold any intercourse with the infected. Had the example of these savages been universally adopted in the British empire, a vast addition would have been made to our population; for, before the practice of vaccine inoculation, upwards of 30,000 persons* were annually destroyed by the small-pox, in Great Britain and Ireland.

Should the clauvau ever make its appearance in this island, the infected sheep ought to be immediately killed, and effectual regulations carefully enforced, to prevent its extension to other flocks.

* See a very interesting Account of the baptisms, burials, and deaths, by small-pox, in the parish of Boston, for the last fifty-four years; to which are added, Reflections upon the probable mortality in Europe, from the Small-Pox, within the same period, and the happy effect of Cow-pox inoculation: by the reverend Samuel Partridge, M. A. F. R. A. S. and vicar of Boston, in the county of Lincoln. According to the ingenious observations of Mr. Malthus, the chief hindrance to population, is to be sought for in the want of sustenance. Where that is abundant, the inhabitants of every country continue to increase, notwithstanding other impediments, till they become equal to the average consumption of its produce. And since the power of a nation depends upon the number of subjects, it appears to be the leading policy of every government, as much as possible, to multiply the food, and facilitate its diffusion among the lower ranks of mankind, in order to obtain an increased population. With this view, the diseases of esculent animals are entitled to every attentive consideration, because the strongest nourishment, and most invigorating diet, is extracted from them.

The

The disorders that occasionally attack our domestic animals, are deserving of much attention; and if some medical practitioners, of learning and experience, were to be selected, for the purpose of investigating them, I conceive that important advantages would arise from the measure.

When any epizoick makes its appearance in France, regular practitioners are immediately provided, at the expence of government, to inquire into its nature, and draw up a detailed report for the inspection of the public. By these means, animal medicine has of late years made a very rapid progress, upon the continent. I humbly conceive, that the honourable Board of Agriculture, by adopting a similar measure, would have its sphere of usefulness considerably extended, and thereby be entitled to a still greater proportion of national approbation.

7thly, Daubenton was led, by his penetrating genius, to reject the opinions of preceding writers, and to endeavour to supply their defects. From observing that poor sheep, especially such as by feeding on dry food, were induced to drink great quantities of water, became liable to rot, he concluded too hastily, that poverty of food, and large draughts of water, were causes of this disorder. I have repeatedly observed, that the rot is only to be acquired from particular situations, and that moisture alone will never produce it. I have been informed, by warreners, that in wet weather, the livers of rabbits always swell, and remain enlarged,
 3 while

while the rain continues. They then recover their former dimensions; and all this takes place, without any inconvenience to the animals. I have it from unquestionable authority, that rabbits are very susceptible of the rot; and therefore, if it could be induced by moisture alone, the disease must be discoverable among them in all wet seasons; and yet, I know several large warrens where the disorder is entirely unknown.

8thly, I observed, in a former part of this Essay, that the rot in sheep has been frequently contracted, in a quarter of an hour, by feeding upon marshy or moist lands, in hot weather. This information does not rest upon a single testimony. In the county where I reside, most butchers occupy some land, and are, in consequence, well qualified to discover the causes and early symptoms of this disorder. To them it is well known, that for a few weeks after being tainted, sheep thrive more than at any other period: this complaint is often, therefore, purposely induced for the sake of increased emolument. "*Les moutons qu'on veut vendre ou consommer dans le pays, sont conduits, lorsqu'ils approchent du moment de cette destination, sur les pâturages qui avoisinent les etangs, ou sur les autres lorsqu'ils sont couverts de la rosée & pendant les pluies: on sent que ceux de ces animaux qui sont ainsi nourris prennent bientôt un embonpoint marqué, mais il est de mauvaise nature, & est un acheminement à la pourriture **."

* See also Instruc. et Observ. sur les Maladies, &c. ann. 1790.

When I first entered upon this inquiry, I found it very difficult to obtain any satisfactory information on the subject; but of late the butchers and occupiers of land have acted with a degree of candour and liberality, that calls for my particular acknowledgments. I must not forget my obligation to Mr. Harrison, of Fisherton, near Lincoln, to whom I am indebted for a great variety of useful information*; and if the summer, 1802, had been calculated for the purpose, we had arranged a series of experiments, which were to have been carried into execution, under the superintendence of the right honourable sir Joseph Banks†.

Mr. Harrison resides upon a considerable inheritance, which was formerly tenanted by his father, and grandfather. It consists of high and low lands of a loamy and tenacious nature. While a brook which runs through the farm remains overflowed, and the water continues upon the adjoining flat

* His information was communicated at a meeting of the Boston Agricultural Society, in 1802; of which I had been previously elected an honorary member, under circumstances highly gratifying to myself. For this and other marks of attention, I feel particularly indebted to all the members of that useful and respectable institution.

† Last season, a slight taint was given to a few sheep, by enclosing them in a confined bog; but the body of miasmata was too small, and they were not detained long enough on the ground to produce any great effect. Sir Joseph Banks, whose zeal for the advancement of useful knowledge is unbounded, very obligingly came over from Rievesby to attend the examinations, and carefully opened the biliary ducts, without finding any flukes.

grounds,

grounds, his sheep never suffer any inconvenience, though they are frequently obliged to wade for their provisions. As soon as the flood is subsided, the sheep can at any time be tainted in a quarter of an hour, while the land retains its moisture, and the weather is hot and sultry. The butchers are so well acquainted with the importance of this fact, that when my friend has disposed of any fat sheep, they are usually turned upon his rotten ground to make them thrive faster.

Mr. Harrison has by judicious management laid the greatest part of his farm completely dry, and is now little troubled with the rot, unless when he wishes to give it to some particular animals. His neighbours, who have been less provident, are still severe sufferers by it, nor are their misfortunes confined to sheep alone. Pigs, cows, asses, horses, poultry, hares, and rabbits, become rotten in this lordship, and have flukes in their livers.

Many years since, the grandfather of this gentleman removed ninety sheep, from a considerable distance, to his own residence. On coming near to a bridge, which is thrown over the Barling's river, one of the drove fell into a ditch, and fractured its fore-leg. The shepherd immediately took it in his arms to a neighbouring house, and replaced the limb. During this time, which did not occupy more than one hour, the remainder were left to graze in the ditches, and lane. The flock were then driven home, and in a month afterwards, the other sheep joined its companions. The shepherd
soon

soon discovered that all had contracted the rot, except the lame sheep; and as they were never separated upon any other occasion, it is reasonable to conclude, that the disorder was acquired by feeding in the road and ditch bottoms.

A Lincolnshire farmer purchased some turnips in Nottinghamshire, upon which he intended to winter a flock of sheep. The first division, consisting of about forty, were detained one night at a village near to the place formerly alluded to, by the overflowing of the Barling's Eau, and were put upon a piece of flat land, which leads to the river. The water had not returned to its former channel more than a day or two. Every one of the forty sheep became rotten; whereas the other division, which stopped no where by the way, escaped the disorder, and remained well. Sheep were formerly admitted into some adjoining pastures, in travelling to and from the neighbouring fairs and markets; but so many of them contracted the rot, that, for some time past, the graziers in this country will not suffer their flocks to stop for a moment near the village. I have repeatedly examined the suspected ditches and pastures, but never observed either flukes, or any of the plants, to which the rot has been attributed; though I must candidly acknowledge, that I ought to have sought for them with more care and attention. These ditches communicate with a rivulet, which frequently over-rides its banks, and the enclosures are then deluged with water. The soil consists chiefly

chiefly of loam or clay, and the surface is so flat and level on both sides of the river, that, for want of proper descent, the water is a long time detained upon the ground. I am credibly informed, that in this place the rot affects swine, hares, and rabbits, as well as sheep.

I have likewise been informed, by Mr. David Wright, that a few years since, as a drove of sheep were passing through a long lane in the parish of Irby, one of them, being weary, fell down in the middle of the road. The others were permitted to range at large, till their companion was able to travel. They were then driven altogether into a pasture, and it was soon discovered that only the tired sheep had escaped the rot. As the flock had never been separated upon any occasion, we are entitled to conclude that the disorder was contracted, while the tired animal remained upon the road.

I could state several more cases, of the same kind; but as those which have been related are sufficiently numerous, and can be attested by respectable witnesses, I do not think it necessary to swell the account by further evidence, in support of my opinion. From the various circumstances enumerated above, I think I am justified in attributing the rot in sheep, and other animals, to paludal effluvia; but with respect to their nature and constitution, it is very difficult to form any rational judgment, as they have hitherto eluded the most subtle and delicate inquiries. It must, however,
be

be admitted, *ſi cauſa latet viſ eſt notiſſima*; and conſequently the ſubject, from its great importance to the public in general, is entitled to a ſerious inveſtigation.

Without heat and moiſture, no deleterious vapours can be generated; and yet it is equally certain, that both theſe cauſes are inſufficient to produce either a recurrent fever or the rot, ſince they are confined excluſively to particular ſituations. Other auxiliaries are therefore neceſſary; and I am inclined to believe that vegetable, or earthy particles, and probably both, are required, as well as heat and moiſture, to conſtitute the noxious emanations, or gaſes, called *miaſmata paludum*.

Probably it will be found, on further inquiry, that a great variety of animal and vegetable effluvia are extricated in different places; and that many diſorders ſhould be attributed to them, which are at this time imputed to other cauſes.

Poiſonous vapours are extremely active, and ſudden in their effects, of which proofs may be found in the hiſtory of every contagious and endemic diſorder. We have, therefore, no reaſon to be ſurprized, that ſheep and other animals are ſo immediately affected, by paſturing in moiſt places, where theſe effluvia are copiouſly produced in hot weather. Other cauſes operate ſlowly, and require ſuch a long continued application, that I do not think the rot can be induced by them, though I am of opinion, that, by occaſioning general weakneſs, they make the conſtitution more ſuſceptible,

susceptible; and lay it more open to morbid impressions. In the human body, we know that fatigue, cold, fasting, and other debilitating causes, are efficacious auxiliaries, although of themselves they are totally inadequate to produce any contagious disorder. They therefore seem to contribute equally and in the same manner, to facilitate the operations of marsh miasmata, upon the human body and other animals.

PREVENTION OF THE ROT.

It is confirmed by experience, that whenever any place is laid dry by judicious management, it ceases to occasion the rot*. For my own part, I am acquainted with many sound parishes, which, during their open state, were so injurious to man, and to other creatures, that I cannot sufficiently impress upon my readers the importance of effectual drainage, for the preservation of health. When, from circumstances, the land cannot be laid dry, during the summer months, it requires to be occupied with great caution, since moist grounds are the most prejudicial and dangerous to animal life. I have had occasion to observe, that miasmata are produced in some way or other by the sun's action upon moist ground, and, therefore, when it is well covered with grass, early in spring, we have less

* See Letters, &c. selected from the Bath and West of England Society, vol. i. p. 341.

danger to apprehend, provided we maintain a deep herbage, till the commencement of frosty weather.

Mr. Young, of Claxby, is of opinion, that when land is well covered with grass, it becomes less dangerous to cattle. In 1792, he divided a flock of sheep, and placed fifty upon some good after-math, where, in other seasons, the rot had frequently prevailed. Only this part of his flock escaped the disorder, which he attributed to the meadow not having been grazed, before it was well covered, and defended from the weather.

Some time since, he purchased a close in his own neighbourhood, which was reputed to be unfound. Before any sheep were turned upon it, he permitted the grass to grow, till it would cover a man's ankle; and, during the whole summer, he took care that it should remain an exceeding good pasture. The rot did not appear in the field, though an adjoining close, in his own occupation, and another in the tenure of Mr. Thorpe, of Owersby, suffered more than usual during this year. He ascribes his good fortune entirely to the length of the herbage, which defended, and preserved the soil and roots of the grass, from the solar influence. It is well known, that a wet and warm autumn is always fatal to sheep, because, at this season of the year, the sun's power is considerable. When farmers float their meadows, to produce after-math, they should never discontinue irrigation, until the grass be well grown; by which means the soil

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becomes

becomes defended from the direct influence of the sun, and the generation of miasmata is prevented.

Luxuriant pastures seldom rot, unless they be eaten bare in hot weather. Whilst the ground is well concealed, it is so completely defended and protected, that the sun exerts no deleterious effects upon it. In the fatal year, so often particularized, Mr. Elmhirst, of Bag Enderby, an experienced and zealous agriculturist, who occupied two hundred acres of land in the parish of Croft, near Wainfleet, sold all his heavy beasts, and many sheep, early in the summer. His pastures were thinly stocked with sheep only, during the rest of the year. The rot was extremely destructive in all the adjoining pastures, yet in his closes it never appeared. This exemption from the general calamity of his neighbours, he attributed partly to his land being always well covered with grass, and partly to his grazing during that summer entirely with sheep. In wet weather, beasts and horses, by treading the ground, leave foot-marks, where the water stagnates, and in consequence of it, as he believes, the rot is produced. In justice to the testimony of Mr. Elmhirst, it may be proper in me to add, that he has been an active and judicious cultivator of land on a large scale, for a great number of years. Every observation of his is therefore entitled to particular attention.

I have remarked, that sheep are most liable to rot, immediately after losing their fleeces; and in

the month of November, when the cold first begins. No rot can be contracted without warmth, or in spring, before the sun's influence is become considerable: but when the disposition is once acquired, it can only be subdued by frost, or a long succession of cold weather. Gabriel Plats assures us, with confidence, derived from the experience of seventy-four years, that the only infectious months that beget the great rot, are May and June, when excessive moistures befall those months*. In a few instances, it has appeared in April, when showery weather, and great heats have prevailed. In ordinary years, meadow may be irrigated till May, without any injury to the occupier. In doubtful cases, the generation of miasms will be effectually restrained, by continuing a copious and regular watering, till the grass is well grown. The late Mr. Bakewell was of opinion, that after May-Day, he could communicate the rot at pleasure, by flooding, and afterwards stocking his closes, while they were drenched and saturated with moisture. In summer, rivers and brooks are often suddenly swollen by thunder-storms, so as to pass over their banks, and cover the adjacent low lands. In this state, no injury is sustained during the inundation; but when the water returns to its former channel, copious exhalations are produced from the swamps and low lands, which are exceedingly dangerous to the human constitution, and to several other animals, as well as sheep. I formerly mentioned, that

* See Boyle's Works,

during the summer, Mr. Harrison could give the rot to his sheep in a few minutes, by grazing them upon the moist soft land, from which the water of the Barlings had just retired. While there is any current, the sheep will never become tainted, although they often wade in search of their food.

“ The rainy season in Bengal lasts from the
 “ beginning of June to the middle of October.
 “ All this interval is considered as an unhealthy
 “ time, but especially in the latter part of it, for
 “ the earth then begins to grow dry; the slime left
 “ upon its surface, consisting of decayed vege-
 “ tables, and other putrescent bodies, begins to
 “ corrupt, and the sun, by its violent and continued
 “ action, raises up into the air, not a pure water,
 “ but water impregnated with putrid particles of
 “ all kinds*.”

“ Till very lately, Cherfon, a city endeared
 “ to Britons, as containing every thing mortal
 “ of the philanthropic Howard, was the seat of
 “ naval architecture for the Euxine, and the re-
 “ sidence of a great number of men belonging to
 “ the naval establishment; but it was found so very
 “ unhealthy in the months of July and August,
 “ during the prevalence of a pestiferous wind,
 “ that comes charged with a putrid miasmata,
 “ generated by the great heats in the low grounds
 “ to the left of the Dnieper, which are regularly
 “ overflowed every spring, when the river is swelled
 “ with melted snow and ice;—I say it was found so
 “ unhealthy at this season, that the loss in men be-

* Watson's Chemical Essays, vol. iii.

“ came a national object, even independent of con-
 “ siderations of humanity ; and it was abandoned
 “ for Nicolayef; yet not entirely, as the docks are
 “ still left for building ships, where two of seventy-
 “ four guns are now on the stocks. The necessary
 “ garrison is likewise left ; and as the profits of
 “ trade are considerable, I scarcely need add,
 “ that the unhealthy Cherson is not abandoned by
 “ the merchants, who we see brave all climates,
 “ and all extremes of temperature, where profit
 “ invites ; but, indeed, those very gains enable
 “ them to evade the fatal blast, by quitting the
 “ city during its baneful influence, and leaving the
 “ seasoned clerks to transact the business. The
 “ heat is quite insupportable, in the day-time, for
 “ two or three months of the year, while the even-
 “ ings and nights are remarkably cool : an extra-
 “ ordinary phenomenon, which certainly assists the
 “ putrid miasmata in producing that fatal remittent
 “ of this country, which laid the all-powerful
 “ prince Potemkin in the dust, with so many thou-
 “ sands of the army that he commanded, and much
 “ more terrible to Russia than the Turkish cimeter,
 “ which her cannon and bayonets kept at a dis-
 “ tance*.”

The overflowing of the Nile puts a stop to the
 plague in Egypt ; and it is notorious, that formerly
 agues and putrid fevers were much more frequent
 in the fens of Cambridgeshire and Lincolnshire, in
 very dry than in wet seasons. Probably since these

* A Tour through the Tourida, &c. by Mrs. M. Guthrie.
 counties

counties have been better drained and cultivated, they suffer more in wet than in very dry seasons. According to sir John Pringle, “ The moisture
 “ and corruption of the air were much increased
 “ by the inundations (which had been made about
 “ the fortified towns since the commencement of
 “ the war), and sensibly became more noxious upon
 “ letting off part of the water in the beginning of
 “ summer, after the preliminary articles of the
 “ peace were signed. For these grounds, which
 “ were once entirely covered, being now half-
 “ drained and marshy, filled the air with moist and
 “ putrid exhalations. The States of Holland being
 “ made sensible of this, by the sickness which
 “ raged at Breda, and in the neighbouring villages,
 “ gave orders to let in the water again, and to keep
 “ it up till winter *.”

When miasmata are once formed, they preserve their noxious powers and destructive influence unimpaired, till the cold weather puts an end to their force and activity. In mild seasons, epidemic diseases have been known to afflict the human constitution, during the greatest part of winter; and the pastures which have once become unsound, are only to be recovered by the setting in of frost, or a succession of cold days and nights.

The autumn and winter 1799 and 1800 were remarkably mild and warm. At Candlemas time, sheep that were pasturing on the fen and commons

* See Observations on the Diseases of the Army, p. 62; and Chapter I. of the Air and Diseases of the Low Countries.

at Washingbrough, near Lincoln, took the rot, and died in the following autumn. No farmer in that parish recollected to have suffered, at any other time, from the rot in spring. Mr. Thompson, of Horncastle, informs me, that many years since his brother occupied a low wet close in the parish of Hatton, and lost all his sheep; before winter, of the rot. From that time the land remained unemployed till about Candlemas. It was then filled with strong healthy sheep; but they were all rotten and many of them dead before the following May-Day. He recollects that there was very little frost during that winter, and consequently the effluvia were kept alive by the abundance of the herbage. Plats gives it for an infallible symptom, that when bees fail, and their hives feel light, a great rot of sheep is to be expected; which gives a very seasonable warning to bleed the sheep under the eye, or in the mouth, as oft as they see occasion in the end of summer, or in autumn; or to accustom those which are suspected, to lick salt in troughs, or to take some brine with dry food, as they may easily be trained to it by gentle degrees; or to force down a dose of salt, as is directed*.

Where necessity requires the pasturage of moist grounds in summer or autumn, the shepherd ought carefully to remove his flock into a dry situation before the evening, and provide them with corn, and good hay, or green food.

* See Boyle's Works, vol. vi. p. 356.

A considerable farmer of Bohemia kept his sheep sound in the wet and fatal year 1769, by feeding them every night, when turned under a shed, or into stables, with hashed straw; and by eating it greedily, they were all saved. By this judicious practice, the sheep were removed to sleep in better air, as well as preserved in a more vigorous state of body. Sir John Pringle informs us, that persons have maintained themselves in good health, during sickly seasons, by inhabiting the upper stories of their houses; and I have reason to believe, that merely by confining sheep on high grounds through the night, they have escaped the rot.

After the dew is exhaled by the sun's heat, sheep may be suffered to range in moist and swampy places, with less danger, because the miasmata, which are formed in the night, and remain entangled among the grass, or float in the lower part of the atmosphere, are chiefly dissipated with the dew. Therefore, unless they be very copiously produced in the day time, or are unusually virulent, they will not be sufficiently concentrated to do much injury to healthy sheep. While at rest and asleep, the operations of the system are more feebly performed, and then sheep are peculiarly exposed to diseased actions. By conforming to these regulations, I have known one flock escape entirely, while others have suffered materially in the same open field.

It is confidently asserted, that decoctions of bitter herbs, with salt, have frequently preserved
sheep

sheep from the rot. Salt is supposed to constitute a part of Fleet's celebrated nostrum: and we know, that bitters are deservedly recommended to prevent intermittents, the dysentery, and other disorders, which originate from exhalations.

In Oxfordshire, Dr. Lower has frequently known fix or seven spoonsful of strong brine and stale urine, with foot steeped in it, to be given with great success. This is done at spring and fall of the year, when the dew is counted most dangerous. This course of physic is continued eight or ten days, or till the sheep eat their meat heartily; and if they were taken in time, there seldom died any in a whole flock. For the same purpose, Ellis recommends the following medicine in his Practical Husbandry.

“Take a peck or better of malt, and mash it as though you would brew it into ale or beer, and make eleven or twelve gallons of liquor; then boil in it a quantity of shepherd's purse, comfrey, sage, plantain, penny-royal, wormwood, and bloodwort; add yeast, and afterwards salt to the mixture: then turn the liquor into a vessel. After April comes in, give seven or eight spoonsful to every sheep, once in the week, if the weather be wet, and if dry, not so often *.”

The

* Both these compositions have a purgative operation; and it is on the same principle, as I conceive, that Doctor Harris, of Jamaica, has preserved so many inhabitants, especially new settlers, from the yellow fever, and the ravages of the climate. If persons residing in unhealthy districts, or between the tropics,

The mortality of our foldiers, I am perfuaded, would, on fome occasions, have been lefs confiderable, had the fituations for encampments and military hospitals been choſen with more care and attention. They ſhould always be placed upon dry grounds; and where it is practicable, at a confiderable diſtance from ſtagnant waters, and moiſt plains.

The evening and night air is to be carefully avoided in unhealthy ſituations, except when duty obliges the foldier to expoſe himſelf to it. At ſuch times, he ſhould lie down as ſeldom as poſſible, or remain inactive, and ought to be covered with warm clothes. A doſe of the bark, and a proper quantity of wine, or of ſome generous liquor, will ſometimes be neceſſary, to maintain the vigour of the conſtitution, and protect it from ſurrounding exhalations.

Thoſe eſpecially, who are expoſed to the night-air, ſhould put on additional clothing. In the rainy ſeaſon, woollen clothes will be found both comfortable and neceſſary. It is a very frequent

pics, were occaſionally to empty the inteſtines, in dangerous ſeaſons, with neutral ſalts, and other cooling remedies, I think they would be enabled by that means frequently to avoid the acceſſion of parenchymous inflammation, with all its terrible conſequences. The medicine employed by Dr. Harris, is calomel; and, although I do not mean to object to its uſe in theſe caſes, yet mercurials, under one form or another, are now ſo generally recommended, that I fear much injury has been done, by their indifcriminate application.

cuſtom

custom with those who have resided long in Africa, to wear only a shirt and trowsers, and in this dress to expose themselves at night, when the land-breeze blows, or at other times to sit in a current of air: but, however agreeable the present gratification may be, it is always followed by a feverish dry skin, owing to a stoppage of perspiration, and very often proves a cause of violent diseases, so that it is a practice by no means to be imitated *. It is generally admitted, that ploughed fields well laid down with grass seeds, are not in much danger for the first two years. After this time, the herbage gradually declines, and, in consequence of it, sheep become liable to the rot.

In defenceless places, miasmata have been known to affect persons at a considerable distance from their source. Of this Dr. Frazier has favoured us with a remarkable and striking example, in the 55th No. of the London Medical Journal. Upon succeeding to his father's estate, Mr. Lomax, of Essex county, cut down a grove of trees, which obstructed his view of the Rappahamack River, and of a marsh which lies near it. In the following and several succeeding years, intermittents became very prevalent among the whites and negroes in his house. At length, suspecting the cause, he replanted the trees, and in a few years his family was again completely freed from the ague.

* See Med. Directions, &c. by Dr. Winterbottom, Physician to the Colony at Sierra Leone,

The injurious effects of marshes and swampy districts may therefore be moderated, by planting rows of early and late growing trees, to intercept the vapours, and supply oxygen to the atmosphere.

Till experiments have been carefully made for the purpose, we shall be unable to determine at what distance brute creatures can be assailed by miasmata, and whether they are infected through the stomach or the lungs.

I am of opinion, that the generation of noxious exhalations may be restrained in some measure by judicious husbandry, and by covering the ground with marl or lime. Whether the same object can be effectually obtained by animal manures or other means, is a matter concerning which I am not sufficiently informed; but since judicious drainage constitutes the basis of agriculture, and contributes essentially to the preservation of animal life, I would recommend this system to be vigorously prosecuted, in all moist situations.

PART THE SECOND.

History of the Rot in Sheep.

WHEN in warm, sultry, and rainy weather, sheep that are grazing on low and moist lands, feed rapidly, and some of them die suddenly, there is reason to fear that they have contracted the rot. This suspicion will be further increased, if a few weeks afterwards the sheep begin to shrink, and become flaccid in their loins. By pressure about the hips at this time, a crackling is sometimes perceptible. Now, or soon afterwards, the countenance looks pale, and upon parting the fleece, the skin is found to have exchanged its vermilion tint for a pale red; and the wool is easily separated from the pelt. As the disorder advances, the skin becomes dappled with yellow, or black spots. About this time, the eyes lose their lustre, and become white and pearly, from the red vessels of the tunica adnata, and eye-lids, being contracted or entirely obliterated. * To this succeeds debility and emaciation, which increase continually till the sheep die; or else ascites, and perhaps general dropfy, supervene, before the fatal termination. These symptoms are rendered more severe, by an obstinate purging, which comes on at an uncertain period of the disorder. In the progress

* Note D, see the end,

of the complaint, sheep become what the graziers call chockered, *i. e.* affected with a swelling under the chin, which proceeds from a fluid contained in the cellular membrane, under the throat.

In five or six days after contracting the rot, the thin edge of the small lobe of the liver becomes of a transparent white or bluish colour, and this spreads along the upper and lower sides, according to the severity of the complaint. Sometimes it does not extend more than an inch from the margin. In severe cases, the whole peritoneum investing the liver is diseased; and then it commonly assumes an opaque colour, interspersed with dark red lines or patches. The upper part of the liver is sometimes speckled like the body of a toad, to which it is said to bear a striking resemblance: round the ductus communis choledochus, and hepatic vessels, a jelly-like matter is deposited, which varies according to the severity of the attack, from a table spoonful, or less, to five or six times that quantity. Upon boiling, the liver loses its firmness, and separates into small pieces in the water, or remains soft and flaccid.

Several graziers and butchers, with whom I have conversed at different times, having observed that sheep are much disposed to feed during the first three or four weeks after being tainted, omit no opportunity of producing it to increase their profits. When the first stage is over, flukes begin to appear in the pori biliarii, the ductus communis choledocus, and in the gall-bladder. At first, the
quantity

quantity of these creatures is small ; but as the disease advances, they increase, and before death are often very numerous. In the last part of the complaint, they are sometimes to be found in the stomach, as well as in the intestines and liver. This, like the visceral disorders of the human body, may terminate in resolution—effusion—suppuration, or schirrus.

Ist, The complaint is said to terminate in resolution, when the inflammatory action goes off, without destroying the state and texture of the parts. However, I am strongly inclined to believe, that every considerable inflammation in the human body, and in other animals, although it ends in resolution, leaves behind it some remains, which may be discovered by an experienced anatomist. When the vessels are thrown into inflammatory action for a few days only, effusion commonly takes place, and the coats become thicker, and assume a buffy colour. These changes in the sanguinary system often continue through life, and lay the foundation of many chronic and incurable disorders. Sheep that recover from the rot, exhibit very different appearances after death, according to the severity of the attack ; but the taint is seldom or never entirely removed. I was desired, within these few days, to look at the liver of an old ewe, that died fat, and contained fourteen pounds of suet in her body. The back part of the small lobe was dappled with whitish spots ; the coats of the ductus communis and pori bilarii were considerably thickened, and
more

more solid than usual. In colour, they resembled the human aorta in old people, and were full of flukes: in other respects, the liver appeared to be found and natural. The butcher asserted, that the variegated appearance and alteration in the ducts, were occasioned by a slight taint of long standing, which had not been considerable enough to disorder the œconomy, or impair the health of the animal, sufficiently to prevent its feeding.

2dly, When sheep die suddenly in the first stage of the disorder, an effusion of serum, or of wheyish coloured fluid, may be commonly discovered, in the cavity of the abdomen, and then the peritoneum surrounding the liver is generally covered with a membrane or coat of coagulable lymph. This form of the rot has been frequently confounded with the resp or red water, though it differs from the latter disorder, in the colour of the effused liquid, in being much less disposed to putrefaction, and in several other particulars.

3dly, Abscesses in the liver exhibit another termination of this malady. They are seldom considerable enough to kill immediately; but, in consequence of the absorption of purulent matter from them, the sheep frequently waste away, and die hectic or dropical. When the collections are small, sheep will recover sufficiently to bear lambs, for three or four seasons, and afterwards become tolerable mutton.

4thly, The most common termination is in scirrhi, or what the shepherds call knots in the liver

I have seen the whole substance of this important viscus so full of small roundish lumps, or schirrous bodies, that it was difficult to find any sound part in it. The first attack is unfortunately so very insidious, that the disorder is scarcely observable, before the animal begins to waste and lose flesh. In this advanced state, it is said to labour under the rot or pourriture*, from overlooking the commencement of the disorder.

Hydatides are observed to affect schirrous and purulent livers more frequently than others. When livers are much diseased, the butchers carefully conceal them from the public eye. To me, it is always matter of surprize, to find the mutton saleable in these severe cases. It shews, in an extraordinary manner, the accommodating power of living matter, which is able to maintain life, and increase corpulence, under such unfavourable circumstances. Shepherds and breeders, who make it a general rule to kill every sheep that becomes indisposed, from an opinion that very few of them ever recover from any illness, would do well to examine the livers and other viscera of slaughtered sheep. By such a practice, they would soon be convinced, that sheep are able to endure a great deal. I am persuaded, that the uniform mortality among them, proceeds more from ignorance, or erroneous treatment, than the inevitable tendency of their disorders. This inquiry would point out in a forcible manner, the

* See *Obs et Inst. sur les Malad. des Animaux Domestiques.*

necessity of encouraging some medical person of good reputation, and considerable experience, to turn his attention to the numerous maladies of these useful animals. The diseases of horses have of late years been regularly studied in most parts of Europe; but to Britons, surely no veterinary object is more deserving of encouragement than the management and health of sheep, with which our unrivalled commerce and national glory are so inseparably connected. “ Les plus grands medecins doivent rechercher avec soin la cause et le remède d’un mal, qui menace de détruire des animaux utiles à toutes les nations; et principalement à celles qui savent employer la laine pour les plus beaux ouvrages.” DAUBENTON.

NOTES.

Note A. referred to at Page viii.

WHILE the brave defenders of Britain's glory were conquering in every part of Egypt, the medical practitioners employed themselves with equal ardour to investigate and surmount the evils of the climate. To them we are indebted for many particulars relating to the ophthalmia, so prevalent in the country; although it is to be lamented that, for want of time and opportunities, we are still uninformed as to many circumstances of importance. It may be thought a bold measure in me to associate the blindness in sheep, with a malady so little understood, as the ophthalmia of Egypt; nor do I presume to offer more than conjecture and hypothesis, with respect to either of these disorders. Both affections are sometimes attended with inflammation and suppuration of the eyes, which terminate too frequently in perpetual blindness. Whoever takes the trouble to make himself thoroughly acquainted with the severe sufferings of our brave countrymen in Egypt, will, I think, be inclined to impute the ophthalmia among them, to noxious vapours, rather than to particles of floating sand, to solar reflection, or the intrusion of unseen insects. Mr. Power, who has paid great attention to this subject, remarks, that the night pickets frequently returned from duty, with inflamed eyes, and ulcerated fauces.

An officer of engineers informed me, that, when riding on military duty in Egypt, he felt a sudden shock in both eyes, and that severe ophthalmia was the immediate consequence of this impression.

From the symptoms appearing so soon after exposure, the occasional cause, whatever it may be, seems to produce its effects

effects by a primary action upon the parts, and not through any impression on the general habit. This is so contrary to our experience, with respect to contagious influence in general, that I should be disinclined, from analogy alone, to join in an opinion, that the ophthalmia is ever produced or propagated by infection. Were the disorder of a contagious nature, it would not, I conceive, have been confined so entirely to one of the tents belonging to Hompesch's hussars; but, from the free intercourse that it obtains among soldiers, it would have spread itself through the army in all directions. On the contrary, from its appearing chiefly in the Delta, where, from the nature of the soil, and the numerous streams of water, which flow through the country, the low grounds are poachy and wet, we have more reason to impute it to miasmata. Admitting this to be the true cause, we shall be at no loss to account for its appearing so frequently among the cultivators of rice, or the lower inhabitants at Cairo and Alexandria, since the poor generally reside in moist and dirty places. In both cities the exhalations are greatly multiplied, by the custom in Egypt of watering the streets, and their operation is rendered still more certain, from sleeping at night on terraces, in the open air. It is important to repeat, that a great proportion of men employed on the night duty before Ghiza, returned to their quarters with ophthalmia and ulcers in the fauces. Though we should have great difficulty in explaining this fact, from any of the causes to which this disorder has been attributed, we can easily reconcile it to our notions of miasmata; since it has been observed in all countries, that exhalations are most powerful and dangerous in the night. With the nature of effluvia, we are at present so little acquainted, that, for aught we know to the contrary, the human body is exposed to as great a variety of noxious emanations, as of pestilential contagions.

Note B. referred to at Page 5 and 11.

BEFORE any communication had been made to the public in Mr. Young's *Annals of Agriculture*, Mr. Turnor voluntarily offered, in the most liberal and obliging manner, to provide
me

me with sheep, and to expose them to the rot, in order, if possible, to elucidate the nature of this very formidable disorder. Last summer, he procured two wethers from his tenant, Mr. Johnson, of Kirmond, near Castor, and confined them several weeks on the lowest and most suspicious places in the ditch; but the season was so dry, that neither of them became disordered. The manor of Kirmond contains several swampy vallies; but, from its having been formerly the residence of Mr. Turnor, and being an ancient part of the family estate, it is satisfactorily ascertained, that the whole lordship is free from the rot. I am of opinion, that the security is imputable to a calcarious impregnation from the chalk and marl which is copiously distributed through the Wold Hills.

An ingenious and zealous agriculturist in the same neighbourhood, having discovered that his water-meadows are liable to taint animals, is inclined not to give full credit to my observations. To obviate the difficulties of this gentleman, I conceive it will only be necessary for me to call his attention to an established principle in nature. When water first issues out of a calcarious stratum, it usually holds in solution a large quantity of calx carbonata, *i. e.* of carbonic acid, or fixed air, in combination with quick-lime. Upon exposure, some of the carbonic acid escapes, and, in consequence, the calcarious matter is chiefly deposited. It is to this simple operation that we are indebted for the varied and fanciful incrustations seen at Matlock, and in many other places. As the subsidence goes on, the water becomes less impregnated, and gradually loses its power to resist new changes from other causes.

Note C. referred to at Page 22.

THE inflammation of the investing membrane, hepatitis membranacea, is always apparent, from an acute pain in the region of the liver, and the inflammatory diathesis of the constitution; whereas the hepatitis parenchymatosa, which also constitutes the first stage of the rot, is so insidious in its access, and creates so little disturbance, that it is seldom discoverable, when medical aid could be most successfully employed.

Dr.

Dr. Cullen observes in his Nosology, "Hepatitis (by which we are to understand hepatitis phlegmonodea, acuta vel membranacea per characterem datum evidens et sæpe acuta est; sed alias, videlicet hepatitis parenchymatosa) obscura et chronica; nam in sectione cadaverum, sæpe reperitur apostema hepatis, quando nulla fere, saltem obscura tantum, inflammationis symptomata præcesserint. Recte igitur hepatidem obscuram indicavit Sauvagesius, et omnino optandum est, *ut diligentius inquirant medici, quomodo hujusmodi morbus dignosciqueat.*"

When such a writer delivers his sentiments with freedom, they are entitled to the utmost attention. I am of opinion, that parenchymous inflammation is commonly associated with recurrent fever—cholera morbus—dysentery—the yellow fever, &c. and that its usual termination in an enlarged schirrous liver, is the more to be regretted, because it lays the foundation of invalid health of long continuance. The frequency of such maladies among our adventurous countrymen, entitles the subject to a full investigation; and since happily this inflammation is incidental to brute creatures, as well as to human beings, we have an opportunity, by trials upon the former, to elucidate the nature of a disorder, which is extremely prejudicial to the cultivators of land; to the manufactures* of Britain, as well as so generally injurious to animal life. To conduct a series of experiments, for this purpose, upon a large scale, would be too expensive for a private individual; but I hope, through the liberality of sir Joseph Banks, to be enabled, next summer, to make a progress in the inquiry; as he has given me permission to search for some land upon his extensive property, which will admit of being inundated at pleasure.

* "De toutes les maladies qui affectent le mouton nulle ne porte plus de prejudice à la laine que la pourriture, elle en detruit l'adherence et le ressort; en sorte que la toison reste seche et cassante quelque soit d'ailleurs sa beaute et sa finesse. *Inst. et Obs. &c. Anno 1791.*"

Note D, referred to at Page 46.

WHEN the shepherd determines to examine the eyes of a sheep, which ought to be done frequently, he should place it between his thighs, and hold the head with both hands. He then proceeds to raise the upper and depress the under eyelid; by which means, the blood-vessels of the tunica albuginea are brought into view. When they are red, and in great numbers, the sheep is supposed to be in good health. The caruncula lacrymalis, and inner surface of the eyelids, should be as red as the vessels on the eye-ball. If they are pale, and the veins are in small quantities, and faint-coloured, or livid, the sheep is in a debilitated state, or afflicted with the rot. In all cases, where the blood vessels have entirely disappeared, the mutton is bad. By frequently examining the eyes in dangerous seasons, I conceive, shepherds might always discover the rot, before their sheep begin to shrink, and, consequently, in time to prevent any material injury to their profits. Where the demand is considerable, and the market is not far distant, the grazier may always turn the rot to his advantage, by keeping the tainted sheep while they continue to feed, and taking care to kill them immediately after they cease to thrive.

FINIS.