

## **On the rot in sheep / By Edward Harrison.**

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Harrison, Edward, 1759-1838.

### **Publication/Creation**

Bury St. Edmund's : J. Rackham, printer, 1803.

### **Persistent URL**

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ROYAL MEDICAL SOCIETY OF LONDON

ON THE

# ROT IN SHEEP.

BY EDWARD HARRISON, M. D.

MEMBER OF THE ROYAL MED. AND ROYAL PHYS. SOC.

EDINB. FEL. SOC. ANTIQ. EDINB. MEMB. MED.

SOC. LONDON, &c.

Me Patriæ impulit amor.

BURY, St. EDMUND'S;

J. RACKHAM, PRINTER, ANGEL-HILL.

1803.



TO

THE RT. HON. SIR JOSEPH BANKS, BART.  
P. R. S. &C.

Horncastle, May 25<sup>th</sup>. 1803.

SIR,

AMONG the various disorders of brutes, none is more injurious to the Landed Property, and Commercial interests of this Kingdom, than the *Rot in Sheep*.—I therefore take the liberty to communicate to you my sentiments upon it, that if you think proper they may be made public; and I dare venture to indulge an hope, that the numerous disorders of this useful animal, will soon obtain their due portion of public attention in England as well as in other countries.

If the opinions I have adopted in the following Essay, are confirmed by experience, a plan of prevention founded on them may be easily recommended, which will prove of incalculable advantage to the science, and the practice of Agriculture; while to the medical practitioner, a field of inquiry is laid open, by which he will be enabled to explain, and to obviate some of the most intricate, and important disorders of mankind.

I have the honor to be,  
With great respect and esteem,  
Sir, Your faithful, and,  
Much obliged humble servant,

E. HARRISON.



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*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, and remitting Fevers, &c. in the Human subject, and of the Rot in Animals.*

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**I**T is known that sound livers grow firm, and solid by boiling. By the same process, livers tainted with the *rot* lose their consistency, and break down into small pieces. 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 progress of the disorder have been more carefully observed in sheep, than in other



animals, my observations will chiefly be confined to them.

Poor clay 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, adhesive, 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. 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 complaint. Pure, sandy, peat, 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 more retentive strata, the rain and top water is confined, and then they are liable to the 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 moisture of sandy soils in the same way that our soldiers and the inhabitants of 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 may be discovered where water stagnates, and the rot is produced. 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 stagnates. On marshes exposed to the tides of the ocean, miasms are effectually repressed by the saline quality of the soil. Probably some bogs, and other swampy tracts are equally protected from noxious emanations, by the *minerals* and anteputrescent vegetables they contain. 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 inclosure of

\* *Vid.* Pringles Diseases of the Army, p. 62.



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 fathers 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 the disorder. Of these many were choquered, or contained a swelling and fluid in the cellular membrane under the chin. Since the above lands have been enclosed and completely drained, his brother informs him that neither he, nor any of his neighbours in the lordship, are 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 unenclosed fen, in which was a shallow piece of water, that covered about an acre and an half of



land. To recover it for pasturage he cut several open ditches to let off the water, and obtained an imperfect drainage. From this time his sheep became liable to the rot, and in most years he lost some of them by it. In 1792 the drains failed so entirely from the wetness of the season, that he got another pond of living water, and sustained 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 under water, his flock continued free from the disorder; he attempted a more perfect drainage, and succeeded in making the land dry in all seasons. Since that time, 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 changing its situation, and mixing with fresh particles, by which its purity is maintained and new arrangements are prevented. Edmund Turner, 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 fifteen acres towards the middle is nearly flat, and thirty-five acres of it rise towards his mansion and offices, by a steep ascent: the remainder is upon a more 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 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 contains a few hollows and inequalities, from which the moisture can 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 uncom-



monly 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 enquiry 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 drier 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 his flock is confined to a low



range in the fen. I conceive in all these instances, the ground which rots in ordinary seasons, was made too wet by the great falls of rain, 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 plashes 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 a decomposition produced in the particles of the water. For my own part, I am disposed to believe, that one of the elementary principles of the water, combines with some vegetable matter, and to this union we are to attribute the poisonous effluvia (*miasmata paludum*) which occasion the rot in animals.

The connexion between humidity and the rot is generally 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 drains, have been more judiciously practised, the rot is become less prevalent among us. It is universally admitted by practical physicians, that agues, and remitting fevers are occasioned



by emanations from moist situations. From personal and extensive experience, I have for some time been led to believe, that the bilious fevers, and pneumonic inflammations that 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 the 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 they have declined very considerably, both in frequency and violence, within the last half century. At that time 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. Several of the symptoms and morbid changes are common to all the diseases that have been enumerated; hence we have reason to believe that a close analogy and intimate connexion subsists among them. It is well known that on first taking the rot, sheep are unusually thirsty, and it has ever been as-

\* *Vid. Med. and Phys. Memoirs by Dr. Caldwell.*



sented, that they are hot and feverish. Should this be confirmed 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. 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 more 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 recovers its former functions, and persons so affected, remain pale and sallow 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 swoollen; but this state differs greatly from the general corpulence and obesity to which I allude. According to the observations of Dr. Paisley, the grand source of health, and



disease in the eastern regions, is centered in the natural or diseased condition of the liver. Sheep never recover so entirely from the rot as to get very fat, and their mutton and gravy is generally white and pale.

Within the last forty years, plans of great magnitude have been devised and conducted chiefly by the Right Hon. Sir J. 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 further 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 that are so useful to him.

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 succession 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 vario-



lous disorders. This dissimilarity cannot however, as I conceive, be imputed to any modification in the contagious poison, but must arise from the atmosphere being more or less favorable 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 ever undergoes any 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 constitute no inconsiderable part of every morbid atmosphere. It is to this cause, that I attribute the sallow 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 generate fewer miasmata, the peasantry are greatly improved in health, and the rot prevails less among their sheep.

\* *Vid.* Gayton on Purifying the Atmosphere.



## CAUSES OF ROT.

It will naturally be expected, that before I conclude this inquiry, some notice should be taken of the various theories and hypotheses that have been advanced, with respect to the rot in animals.

This disorder has been imputed—1st. to a vitiated dew.

2ndly. To a gruff, which adheres to the grass in wet weather.

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

4thly. To grazing upon certain herbs.

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

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 surprised that the rot has been imputed to them. For the preservation of health, it was then judged necessary to close the windows of lodging rooms, before sun-set to prevent the introduction of night air. Since it is believed that aqueous vapors 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 lands; but since it is only to be found in certain places, and under peculiar circumstances, I think it cannot be attributed to this cause.

2ndly. 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 the liver can be destroyed by such matters 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.

3rdly. In wet sultry weather, the grass grows



luxuriantly, and at such times it is well known that 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; *hydroctyle 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 biliarie*, and *ductus communis*, from feeding upon moist grounds. Of these animals, turkies and poultry eat little grass and pigeons none, therefore these 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 do not reject all acrid plants. In Italy it is reported, that 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 hath 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 that are admitted to be pernicious, and the disorder has certainly been produced, where none of the suspected ve-



getables 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 in contact; other portions must be 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? Again it seems difficult to suppose, that any being is able to live equally in moist grounds and in the viscera of animals. The range of life will not, I conceive, admit of such a diversified existence. The hay † of moist

\* See Letters, &c. by the Bath, &c. Society.—*Amenit. Accademie*: vol. 4.

† Observs. et. Insts. sur les maladies des animaux domestiques.



lands, under certain circumstances, gives a more virulent and dangerous rot than any other. The contagion of the plague, and of several infective disorders, it is well known, are preserved for 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 to them as cotton, &c. to human effluvia in the plague. On this principle, the fact admits of a ready solution, though on any other we should have great difficulty in explaining it. 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 Med. and Phys. Journal, we are favored with some account of a very curious case, which was read before the Medical Society of Paris, by *Cit. 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 silk worm; 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 to that of a crab. 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, 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 fœtus in utero is capable of suffering the fits of an ague, which is admitted to be produced 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 beeves 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, that enables them to resist impressions to which they could not have been exposed at an earlier period without suffering from them. 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 safe, although they are never entirely secure 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 rot than other sheep. Graziers are of opinion that sheep in new situations are peculiarly exposed to the rot, and new-comers, 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 enquiry to have been correctly stated, we must look to the nervous power for an explanation of them, and not to the action of the flukes upon the liver or 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 paper, 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 bird.



I may further observe, that the rot always commences with inflammatory symptoms, and 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 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 turgid, 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 obtained their usual size, and proved its destruction. \* "

On the origin of worms, I wish to be silent; the enquiry 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

\* See Letters, &c. of the Bath Society, vol. ii. p. 117.



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 possibly is to be superseded by cow pox inoculation. The *claveau* is a vague, and indefinite term; it comprizes the scab, and rot or pourriture, as well as the disease properly denominated *claveau*. These are very different affections, and ought not, as I conceive, to be included under one general appellation.

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, and especially such as by feeding on dry food were induced to drink great quantities of water, became liable to be rotten, he concluded too hastily, that poverty of food, and large draughts of water, are 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, 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 discovered 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.\*

When I first entered upon this enquiry I found it very difficult to obtain any satisfactory information on the subject, but of late the

\* See also *Iust.* at *Obs. sur les Maladies, &c.*



butchers and occupiers of land have acted with a degree of candour and liberality that calls for my particular acknowledgements. To one gentleman Mr. Harrison, of Fiskerton near Lincoln, I am indebted for a great variety of useful intelligence,\* and if the last season 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 an elevated and very respectable character†. 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 overflown, and the water continues upon the adjoining flat grounds, his sheep never suffer any inconvenience, though they are frequently obliged to wade for their provisions. As soon as the flood has subsided, the sheep can at any time be tainted in a quarter

\* This 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 particular obligations to all the Members of that useful and respectable Institution.

† Namely the Right Hon. Sir Joseph Banks, Bart. K. B. P. R. S. &c. &c.



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 they have purchased any fat sheep for immediate use, they are desirous to have them turned upon his rotted 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 chooses 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 Barlings 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 dikes and lane. The flock were then driven home, and in a month afterwards, the other sheep joined its



companions; the shepherd 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, by the overflowing of the Barlings Eau, at a village near the place formerly alluded to, and were first upon a piece of flat land, which runs down 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.

Formerly sheep were admitted into pastures near this brook, in their way 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 overflows its banks, and the enclosures are then deluged with water. The soil consists chiefly of loam and clay, and the surface is so flat and level on both sides of the river, that for want of descent, the water is a long time detained upon the ground. I am told 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 low 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 all that have been related can be attested by respectable witnesses, I do not think it necessary to swell the account, by producing any further evidence in support of my opinion.

Poisonous vapours are extremely active and



sudden in their effects, of which proofs may be found in the history of every contagious 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 and lay it 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 disorders. They therefore seem to contribute equally and in the same manner to facilitate the operation of marsh miasmata upon the human body and other animals.

#### PREVENTION OF THE ROT.

It is confirmed by experience, that whenever any place is judiciously drained, it ceases to occasion the rot\*. For my own part I am ac-

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



quainted 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 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 put fifty upon some aftermath, where in other seasons the rot had frequently prevailed: only this part of his flock had escaped the disorder, and he thinks it was from not grazing the meadow 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



unsound. Before any sheep were turned upon it, he permitted the grass to grow till it would cover a mans 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 pasture in his own occupation, and another in the tenure of Mr. Thorpe, of Owërsby, 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 a good aftermath, they ought not to discontinue irrigation until the grass be well grown, by which means the soil 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; while 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 grazier, who occupied two hundred acres in the parish of Thorpe, near Wainfleet, sold all his



heavy beasts and many sheep early in the summer; his pastures were thinly stocked with sheep only for the rest of the year; the rot was extremely destructive in every part of the parish, except in his closes where it never appeared. This exemption from the general calamity of his neighbours, he attributes partly to his land being always well covered with grass, and partly to his grazing during this year 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. To give more weight to the opinion of this gentleman, it may be proper in me to add, that my informer has been an active and vigilant occupier of land on a large scale, for a great number of years. When the murrian prevailed among cattle, his father, a very intelligent yeoman, made great purchases of beasts, and was so successful in preserving and curing his herds, that he is reported to have acquired a large estate by this national misfortune.

I have observed 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 in the spring season, till 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, taken from the experience of 74 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 at this early season. The late Mr. Bakewell, never parted from any old ewes till he had tainted them, to prevent the loss of his breed. He was of opinion that after May-day the rot could be communicated at pleasure, by flooding and afterwards stocking the closes while they were drenched and saturated with moisture. 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 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

\* *Vid.* Boyle's Works, vol. vi. p. 365.



Candlemas time, sheep that were pasturing on the fen and commons at Washingborough, 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 there was 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 often as they see occasion in the end of summer or in autumn, or to accustom them that are suspected to lick salt in the troughs, or to take some brine with dry food as they may be trained to it by gentle degrees, or to force down a dose of salt as is directed\*.

\* See Boyle's Works, vol. vi. p. 365.



Where necessity requires the pasturage of suspected 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; 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 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.



I am persuaded that the mortality of our soldiers would, on some occasions have been less considerable, had the situations 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 considerable 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 soldier to expose himself to it. As such times he should never lie down or remain at rest, and ought to be covered with warm clothes; a dose of bark and a proper quantity of wine or some other generous liquor, will sometimes be necessary to maintain the vigour of the constitution, and protect it from the surrounding exhalations.

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 rot.

I am inclined to believe that miasmata are less copiously produced in calcareous than in other countries, because it is an established fact, that the moisture of the Lincolnshire wold hills, (a large mass of calcareous matter) seldom produces the rot. When therefore, from insur-



mountable obstacles, land cannot be laid completely dry, 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, I would recommend this system to be vigorously prosecuted in all moist situations\*.

THE Author takes this opportunity earnestly to solicit information, about all the disorders in the human subject and in brutes, that have been imputed to miasmata, as he is collecting materials for a larger publication. *Every hint will be thankfully received*, and in an enquiry so various and extensive, it is obvious that *much assistance* will be necessary to enable any one to satisfy the public in a matter of such importance to society. Communications for this purpose may be directed to Dr. Harrison, at Horncastle, in Lincolnshire, or to the care of Mr. Robert Bickerstaff, Bookseller, corner of Essex Street, Strand, London.—To save the heavy charge of postage, it is particularly requested, that when it can be done, they may be delivered free from expense.

\* A most interesting and important memoir! A. Y.