whose drawings of the cheesemite are held as classical—to those of the indefatigable Bourguignon and Gudden.

The history of observations referring to scabies in the domestic animals is very rich. Youatt quotes Ovid's verses—

> "Lanigeris gregibus balatus dantibus aegros,
> Sponte suâ lanaequa, cadunt et corpora tabent,"

in alluding to a pestilence that prevailed in the Island of Aegina 1300 years before the Christian era.

It is certainly doubtful whether Livy's arguments as to the transmission of the disease from cattle and sheep to man be just. Similar influences, however, might account for the disease *scabius,* so prevalent amongst oxen and the woollen tribe, in the neighbourhood of Rome, 424 years before Christ, being apparently communicated to all the inhabitants of the country, and ultimately to the slaves. Virgil gives a graphic description of the disease. Columella mentions the scab in sheep, and Vegetius Renatus wrote on the mange in horses. The malady was adverted to in the veterinary and agricultural writings of the middle ages, but no new facts were added to those ascertained by the ancients. After speaking of the affection having arrested the attention of sanitary legislators in the seventeenth and eighteenth centuries, Gerlach speaks of the writings of Chabert, Huzard, Wichmann, Wiedebant, and Kersting, the latter, according to Hering, knowing that mange in horses was due to an acarus, as far back as 1784. In 1810, Walz described the scab-insect of the sheep and fox. In 1812, Gohier saw the acari of horse and ox, which Didier described and illustrated; and in 1814 Gohier found the parasites in the Hungarian oxen which followed the Austrian army into Lyons, and were affected with mange in every stage. Bosc, Niemann, and Raspail have contributed by their writings to this subject, and Gerlach alludes to the strange and imaginative drawing of the acarus equi given by Raspail.

Hertwig has been a careful observer on the subject of mange and scab in animals, and in 1827 made experiments on scab in sheep, to prove that the disease was alone communicated by means of acari. In 1835 he published his account and illustrations of the acarus of the horse, and twenty years later, he spoke of the sarcoptes canis. In 1838 Hering published his very remarkable memoir on the acari of the horse, ox, sheep, cat, and chamois; also describing the sarcoptes cynotis and hippopodos, from the suppurating internal ear of dogs, and from canker or paronychia of the feet of horses.

We shall not enter into the history of the zoological classification of the parasites in question. Writers on natural history have been puzzled as much as the pathologist by these insects, and we leave our readers to consult other works, to learn the views of Linnæus, Latreille, and many others. Gerlach speaks of them as belonging to the class Arachnida, the order of mites, or acari, sub-order of crawling mites, family sarcoptes, and he has three genera—*a*, Sarcoptes, that burrow in the skin; *b*, Dermatodectes, that simply bite, and hold on to the skin; and *c*, Symbiotes, living together in large numbers, and not piercing further than the cuticle in search of food. The species belonging to each genus are as follows :—

A. Sarcoptes.	B. Dermatodectes.	C. Symbiotes.
1. S. hominis.	1. D. equi.	1. S. equi.
2. S. equi.	2. D. bovis.	2. S. bovis.
3. S. suis.	3. D. ovis.	(To this genus belongs also:—
4. S. canis.		S. elephantis.)
5. S. cati.		
6. S. caniculi.		

[To this genus belong also:—
S. rupicaprae (Hering.)
S. dromedarii (Gervais.)]

OUR DOMESTIC ANIMALS.

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IN

HEALTH AND DISEASE

BY

JOHN GAMGEE

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CHAPTER XI.

THE STRUCTURE, FUNCTIONS, AND DISEASES OF THE URINARY SYSTEM.

Subdivisions of the urinary system.—Kidneys—Shape in different animals—Internal structure—Medullary and cortical portion.—Malphigian bodies.—The ureters.—The bladder.—The urethra.—The prostate gland.—The urine—Acid in carnivora—Alkaline in herbivora.—Specific gravity of urine—Amount of water varies.—Urea.—Oxalate of urea.—Uric acid.—Hippuric acid.—Extractive matters.—Pigmentary matters.—Inorganic salts.—Composition of the urine of the horse, ox, pig, goat, and dog.—Morbid urine—Its specific gravity.—Urinometer.—Reaction of urine.—Alkality of urine.—Urine in disease.—Blood and albumen in urine.—Bile in urine—Colouring matter of bile.—Sugar and pus in urine.—Diseases of urinary organs.—Simple diuresis—Causes—Symptoms—Treatment.—Complicated diuresis — Symptoms.—Treatment. — Diabetes mellitus.—Honey diabetes.—Saccharine diabetes.—Ischuria.—Dysuria.—Strangury. Suppression and retention of urine.—Albuminuria.—Nephritis.—Cystitis.—Lithiasis.—Calculi of the kidneys, ureters, bladder, and urethra.

We have shown, in the foregoing pages, how a portion of the materials of the primary digestion entered the lacteals, and joined the general circulation, and how a small, yet by no means insignificant portion, passed through the alimentary canal almost unchanged. We have traced the elaboration of the chyle into pure blood; we have shown how, in addition to the chyle, this fluid receives the products of the metamorphosis of the tissues, and having carefully examined its chemical composition, we endeavoured to point out the changes which the blood undergoes in its circulation through the lungs, the liver, and some other glandular organs. The lungs were shown to be materially concerned in the excretion of carbonic acid and water, (besides ammonia). The liver, besides fulfilling certain other functions, we found to be an excretor of hydrocarbons, in which function it is aided by the skin. We have now to consider a system of organs destined to remove from the system the superfluous water and nitrogenous and saline constituents of the blood.

The urinary system in its most differentiated and perfect form, consists of (*a*), the kidneys, two in number, whose function it is to form the urinary secretion; (*b*), the ureters, which are canals leading from the kidneys to a reservoir for the secretion, viz., (*c*), the urinary bladder, where the urine accumulates, and from which it is at intervals discharged through (*d*) the urethra.

The *kidneys* are two glandular organs, situated at the back part of the abdomen, in each lumbar region. They are imbedded in fat, and their inferior surface is covered by the superior surface of the peritoneum. The shape of the kidneys is so peculiar, that objects are often spoken of as kidney-shaped, or reniform, when resembling the kidneys in form.

A kidney presents slightly convex inferior and superior surfaces; an external extremely convex border, and an internal concave border. In this concavity or notch, the ureter, the large vein and artery of the kidney, and the nerves and lymphatics, are inserted; it is called the *hilus* of the kidney. The surface of the kidney is covered by a fibrous capsule, which can be easily separated from the glandular structure, and which is continued on, and forms a sheath for, the vessels of the kidney. The surface is smooth in the horse, dog, sheep, cat, and almost all other animals; it is, however, divided into several lobes in the ox, preserving in this animal, during extra-uterine life, the form in which we find the organ in all animals during fœtal life. (Fig. 149).

Fig. 149.—Shows the lobulated external surface of the Kidney of the Ox.

The kidney possesses a large vein called the renal vein, and a large artery called the renal artery. Having reached the hilus of the kidney, these vessels break up into several branches. The nerves of the kidney are derived from the solar plexus, and form a network around the blood-vessels.

We notice, on making a transverse section through the

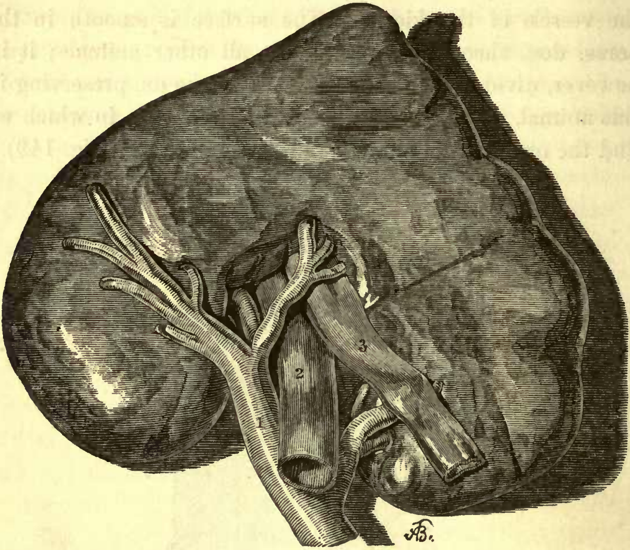


Fig. 150.—The Kidney of the Horse. 1, Renal artery; 2, Renal vein; 3, Ureter.

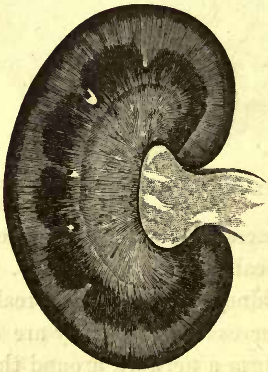


Fig. 151.—Section of Kidney of Sheep.

kidney of the horse, ox, or sheep (Fig. 151), that it consists of an external red cortical portion, and of a lighter coloured internal medullary portion. This medullary portion appears to be composed of a number of conical bodies, the bases of which are towards the cortical portion of the kidney, whereas

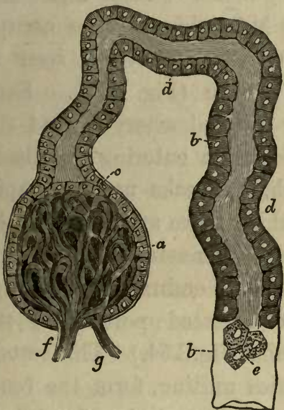


Fig. 152. — (KÖLLIKER.)—Malpighian body, and tube of Ferrein. *a*, Epithelial cells, lining the Malpighian body; *b*, Basement membrane of tubercle; *c*, *d*, Epithelial cells lining the tubercle, *e*, Detached cells; *f*, Artery; *g*, Vein.

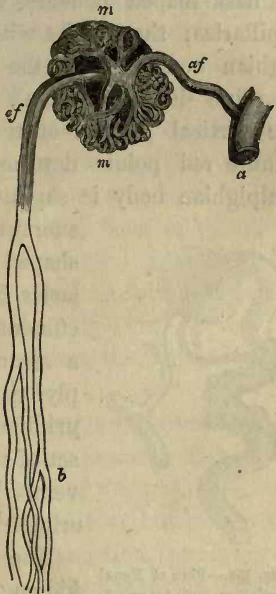


Fig. 153.— (BOWMAN.) — Malpighian body, etc., from the Horse. *a*, Arterial branch; *af*, Afferent vessel; *m*, Malpighian tuft; *ef*, Efferent vessel; *b*, Its branches entering the medullary cone. × 70.

the apices converge towards a cavity called the pelvis of the kidney, which is the commencement of the ureter. Examining into the minute structure of the kidneys, we find it to consist of an immense collection of tubes lined by epithelium. (Fig. 152.) In the medullary portion the tubes are straight they converge from the papillæ of the pyramids of Malpighi, on which they open; on reaching the cortical portion, the straight tubes split up into a radiating arrangement of convoluted tubes; these combinations of convoluted tubes are called pyramids of Ferrein. The convoluted tubes terminate by flask-shaped pouches, which embrace a tuft of renal capillaries; these tufts with their pouches are called Malpighian bodies, (after the distinguished Italian anatomist who first described them). The Malpighian bodies occupy the cortical portion of the kidney, and may be seen as minute red points dotting its surface (Fig. 153). Each Malpighian body is supplied by a renal artery (called the afferent vessel); on entering the flask-shaped pouch, it breaks up into capillaries, from which there arises a vein (the efferent vessel); this vein breaks up into a second network, embracing and supplying the convoluted portion of the uriniferous tube (Fig. 154.) This second set of capillaries uniting, form the renal vein. The epithelium lining the tubuli uriniferi is spheroidal.

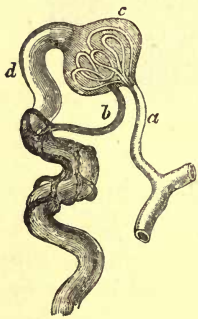


Fig. 154.—Plan of Renal Circulation. *a*, Artery; *b*, Vein; *c*, Malpighian body; *d*, Uriniferous tube.

The rather minute description of the kidney which has preceded, is essential, in order that its physiology may be understood. The various portions of the tubuli uriniferi are supposed by modern physiologists to have different functions. In the Malpighian body, the watery constituents of the urine alone are supposed to transude from the capillaries; in the convoluted portion, the solids of the urine are said to be separated, and in part formed, while the straight portion of the tubes seems to be destined to carry off the secreted urine to the pelvis of the kidney.

The *ureters* are two membranous tubes leading from the pelvis of the kidney to the bladder. They are external to the peritoneum, and pursue a rather oblique course inwards and backwards, entering the base of the bladder; they pass for a certain distance between the muscular and mucous coats of the bladder before perforating the latter. When the bladder is being emptied, the muscular fibres contracting, by the above arrangement, close effectually the open mouths of the ureters, and prevent any reflux of urine into them.

The *bladder* is lodged in the pelvic cavity, which it fills more or less completely, according to the amount of urine which it contains. When the urine is prevented by any cause (as from stricture of the urethra) from escaping, the bladder may become enormously distended. The bladder is composed of an external muscular and an internal mucous coat. It is perforated by three openings, viz., by the two ureters, and by the orifice of the urethra, the canal destined to convey the urine out of the body.

The *urethra*.—The organs belonging to the urinary system, which I have described, are almost precisely alike in the different domestic animals. The canal of the urethra is, however, modified not only in different species, but in the two sexes. In the male it fulfils a double function, conveying the spermatic fluid as well as the urine, whereas in the female it does not form an integral portion of the generative system, however intimately it is connected with it.*

* A complete description of the male urethra involves an account of the form and structure of the penis in different animals, and will be more properly considered under the Organs of reproduction, as the modifications which it undergoes seem more especially to have reference to its function as a generative than a urinary organ. I shall therefore in this place only touch upon the anatomy of the penis in so far as a knowledge of it will enable us to understand the physiology of the urinary organs.

The urethra is a membranous canal, which *in the male* extends from the base of the bladder to the extremity of the penis. It possesses a mucous coat continuous with that of the kidneys, ureters, and bladder, and is enveloped throughout its whole length by longitudinal and circular muscular fibres. At the commencement of its course the urethra is (in the male) surrounded by a body possessing a structure partly muscular and partly glandular, called the *prostate gland.* This portion of the canal is called the prostatic portion of the urethra. A little further in its course it is surrounded by very powerful muscular arrangements, in addition to the layers of muscular fibres enveloping its whole length; this is called the membranous portion of the urethra, and differs much in length in different animals. It is most fully developed in those animals whose penis is either very short or very long; thus, it is remarkable for its development in the ruminantia and carnivora. In the former (*e.g.* in the ox) the powerful muscular arrangement is required to force the urine and semen through the very long penis; in the latter (*e.g.* in the cat) the penis being very short, it serves to propel these fluids beyond the extremity of that organ. The membranous portion of the urethra is continued into the spongy portion, as that division of the urethra is called, which is surrounded by spongy or erectile tissue, a form of tissue which will be described under the generative organs.

The *urine* is a fluid varying very much in different animals; it contains, however, certain substances which seem typical of the secretion.

The urine contains a large amount of water; a very important nitrogenous substance called urea; two important acids, the uric and hippuric; a large proportion of inorganic salts, and certain organic substances of an ill-defined nature, which go by the name of extractive matters; and it possesses besides certain colouring matters.

The urine of the carnivora is acid, clear, and easily decomposed; that of the herbivora is either alkaline, when secreted, or very speedily becomes so; it is often muddy, and deposits a sediment, and froths or effervesces on the addition of an acid. These differences clearly depend upon the nature of the food of these orders; for if a herbivorous animal be subjected to a highly nitrogenized diet, the urine will become acid, and *vice versa.**

The density or specific gravity of the healthy urine of the horse appears to range from 1030 to 1050. Von Bibra found the urine of the ox to have a specific gravity ranging between 1032 and 1040. The urine of pigs, according to the same observer, had a density of 1010 to 1012, and that of the goat was generally about 1008 or 1009.

The amount of water in the urine varies very much. It depends greatly upon the quantity of fluids which have been taken into the system. According to Colin, the amount of urine daily excreted by healthy horses varies from 15 to 25 litres (44·033 to 61·646 English pints). The amount of water in 1000 parts of the urine of the horse, according to the analyses of Von Bibra, Boussingault, Fourcroy, and Vauquelin, ranges from 880 to 930 parts. In the urine of the ox, Von Bibra found, in two analyses, the amount of water to be 912·01 and 923·11 in 1000 parts; and from

* Acidity of the urine of the horse is often noticed, when the animal has from some cause been prevented from taking its usual food; thus it is often noticed in disease. A few days ago I happened to examine the urine of a mare suffering from great constitutional irritation, in consequence of a severe injury of the knee joint and foot, and I found that it presented the external characters of human urine, being light coloured, quite clear, and having an acid reaction. The specific gravity was 1006

the few analyses which have been published by other chemists, it would appear that these numbers represent the usual proportion of water.

The urine of pigs contains much more water than that of horses and oxen. In one case Van Settin found that 1000 parts of urine contained 990·28 of water, and in two other analyses by Von Bibra, the water amounted to 981·96 and 982·57 in 1000 parts of urine.

Urea is the most important of all the constituents of the urine, and one of the most important products of the waste of the tissues. Urea has the composition of $C_2\ H_4\ N_2\ O_2$. When pure, it crystallizes from watery solutions in transparent quadratic prisms, with rectangular terminal planes. Urea is colourless, readily soluble in water and spirit, but is insoluble in ether. It has a cooling saline taste, not at all unlike that of nitre. (Fig. 155.)

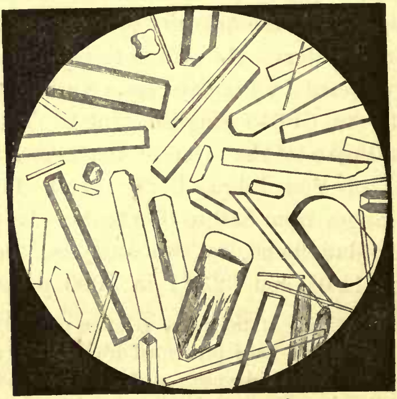


Fig. 155.—(Lehmann.)—Crystals of Pure Urea.

Urea is one of those substances which modern chemistry has enabled us to build up from its elements; it is very readily decomposed. When heated a little above the temperature of boiling water, or when in contact with decaying animal matter, urea readily decomposes. In the latter case it is converted into carbonic acid and ammonia. When heated with the caustic alkalies, urea is decomposed and gives off strong fumes of ammonia.

Urea is also decomposed by nitrous acid, or by nitric acid containing nitrous acid in solution, by nitrate of the sub-oxide of mercury, and by a solution of hypochlorite of soda.

Urea is one of the products of the decomposition of uric acid when the latter is heated with peroxide of lead.

Urea forms several salts, two of which are of great importance, as they enable the chemist to separate and determine the amount of urea present in the urine.

Nitrate of urea ($C_2\ H_4\ N_2\ O_2$, HO, NO_5), may be obtained in considerable quantities by concentrating urine and then adding an excess of nitric acid. The salt separates in beautiful masses, composed of separate plates. When nitrate of urea is allowed to crystallize under the microscope, the

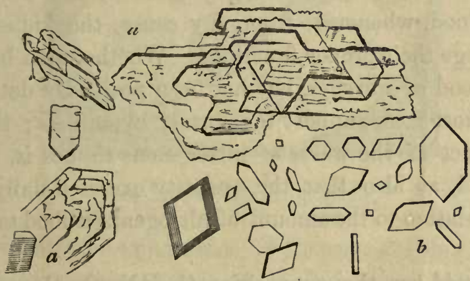


Fig. 156.—(Beale.)—Crystals of Nitrate of Urea. *a*, Crystals obtained from urine; *b*, Crystals of pure nitrate of urea. × 215.

crystals are seen to be beautiful rhombic prisms. The rhombic plates are often combined. (Fig. 156.)

Oxalate of urea ($C_2\ H_4\ N_2\ O_2\ HO,\ C_2\ O_3$) may be obtained by adding oxalic acid to a concentrated solution of urea or nitrate of urea; it crystallizes in rhombic plates and rhombic prisms. (Fig. 157.)

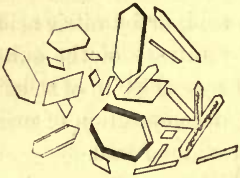


Fig. 157.—Crystals of Oxalate of Urea, obtained by adding oxalic acid to concentrated urine. × 215.

Urea forms several insoluble compounds with nitrate of protoxide of mercury.

Urea is the principal and by far the most important of the solid constituents of the urine; in man its ratio to the other solid constituents is about 9 to 11. In the urine of the horse, it bears a proportion of about 1 to 8 or 1 to 9 of all the others.

Having examined some of the properties of urea, the question arises, whether urea exists in the blood or is formed in the kidneys? Undoubtedly, urea exists in the blood, and is only separated by the renal organs; for it can be detected in the blood of healthy animals, and accumulates in the blood, whenever, from any cause, the kidneys cease to discharge their proper functions. Whether urea be formed in the blood or muscles, has not been positively determined, though most facts support the former hypothesis; that it is the product of the waste of nitrogenous tissues is, however, undoubted, as also that the quantity excreted daily bears a definite relation to the amount of nitrogenized food taken into the body.

Uric acid has the composition $C_5\ HN_2\ O_2\ HO$; it occurs in the urine of man, and almost all the carnivora. The urine of herbivorous animals, if any, only contains traces of this acid; it is in them replaced by another acid, the hippuric. According to Boussingault and Von Bibra, the urine of the pig does not contain uric acid.

Uric acid sometimes occurs as a sediment in healthy urine; if not, it can be precipitated from urine containing it by the addition of an acid such as the nitric, hydrochloric, and acetic. Uric acid presents the appearance of a reddish, greyish white, or white powder, according to its freedom from colouring matters. It is tasteless, almost insoluble in cold water, requiring 14000 or 15000 parts to dissolve it at the ordinary temperature; it is insoluble in alcohol or ether. When examined microscopically, the crystals of uric acid present the most different forms, some of the commonest of which are seen in the annexed woodcut:—

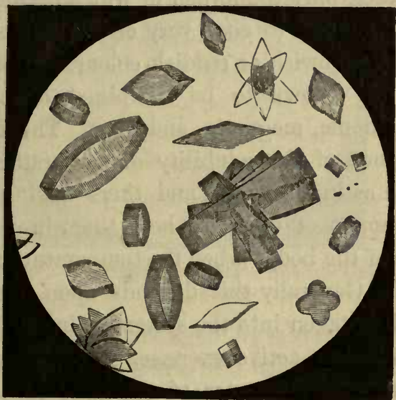


Fig. 158.—Crystals of Uric Acid.

They present the appearance of lozenges, being rhombic plates, with obtuse angles, which have been rounded off. Sometimes the uric acid crystallizes in the form of oblong plates, of cylindrical prisms, and of plates with toothed edges. The crystals are generally of a beautiful yellow colour, from the urinary pigment which adheres to them, and which gives them a somewhat characteristic appearance.

Uric acid is soluble in caustic potash; the alkaline solution is precipitated by acids; the precipitate is formed of microscopic crystals.

When uric acid is dissolved in nitric acid, and the acid solution is evaporated to dryness, and the residue is exposed to the vapours of ammonia, a beautiful purple colour is developed; this is known as the Murexide test for uric acid, and the re-action is characteristic of its presence.

Uric acid, when boiled with peroxide of lead, yields urea amongst other products.

Uric acid is a bibasic acid, and forms acid and neutral salts with bases, only the former of which occur in the urine. Urine, when allowed to cool, very often copiously deposits a sediment of a yellowish or reddish colour, which by chemical examination is known to be composed of a mixture of urates of ammonia, magnesia, and lime. The deposit occurs in consequence of the solubility of the urates not being as great in cold as in hot water, and there having just been a sufficient amount of water to hold them in solution at the temperature of the body; when the temperature falls, they are precipitated. Generally this depends upon the quantity of water which is taken into the system being deficient. It is often noticed after active exercise, when, a great proportion of the superfluous water of the body having been got rid of by sweating, the water of the urine is scanty. The means of detecting these deposits will be afterwards described, when speaking of the urine in disease.*

Hippuric acid, $C_{18}H_8NO_5HO$, is constantly found in the urine of the horse, ox, and all other herbivorous animals, as well as in that of man, but is not found in that of the carnivora.

* From what has preceded it will be inferred that these deposits never occur in the urine of the herbivora.

Hippuric acid possesses a bitterish taste, and is much more soluble than uric acid, requiring for solution 400 parts of water at the temperature of the air; it is much more soluble, however, in boiling water. It is soluble in ether and alcohol, and its solution reddens litmus paper. Pure hippuric acid crystallizes in long transparent prisms, as can be seen in the accompanying engraving:—

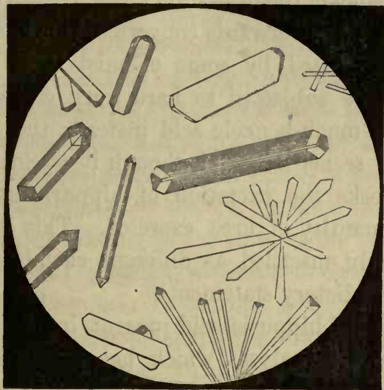


Fig. 159.—(THUDICUM.)—Crystals of Hippuric Acid.

Hippuric acid may be obtained by adding a considerable excess of nitric or hydrochloric acid to the urine of a herbivorous animal. The urine may with advantage be concentrated before the addition of the acid. The crystals, which form in a few hours, have a disagreeable odour; they may, however, be purified by a rather complicated process.

Hippuric acid has been detected in the blood of oxen and calves; it is, therefore, like urea and uric acid, not formed by the kidneys.

It has been found, that when benzoic acid is taken into the system, an almost equal amount of hippuric acid forces its way into the urine; and it was therefore assumed that the food upon which the herbivora are fed must contain benzoic acid; the incorrectness of this hypothesis has been proved by the fact, that the urine of cows contains as much hippuric acid when they are fed on hay as on mangel wurzel; now the latter substance has been carefully analyzed, and found to contain no benzoic acid. It is probable that benzoic acid is a peculiar product of the oxydation of the tissues in the herbivora, and that it is afterwards converted into hippuric acid.

It has been stated by some chemists, that the urine of horses which are subjected to hard work contains no hippuric acid, but much benzoic acid instead; the last part of the statement seems doubtful, though it would appear that hard work checks the excretion of hippuric acid, and increases the quantity of urea excreted. This is a question which is entirely unsettled, as different chemists have made the most contradictory statements.

The quantity of hippuric acid present in the urine varies greatly; from the analyses which have been published by Von Bibra, Boussingault, and other chemists, it would appear that urea and hippuric acid bear a certain relation to one another, for in those analyses where the quantity of urea is small, the quantity of hippuric acid is almost always large, and *vice versa.* The hippuric acid varies from 5 to 15 parts in 1000 of urine of healthy horses.

The term *extractive matters* is applied by chemists to certain of the constituents of urine, which are soluble in alcohol and water, and the nature of which has not been thoroughly ascertained. Such substances as creatine, creatinine, lactic acid, benzoic acid, colouring matters, &c., are comprised under this term.

The *pigmentary,* or colouring matters of the urine, have such extremely complex chemical relations, and their ascertained physiological importance is so slight, that it would be out of place to describe them.

In the preliminary remarks on the urine, it was mentioned that the *inorganic salts* were amongst the most important constituents of the secretion; we must now take up their consideration more minutely. The urine of the carnivora contains sulphates, chlorides, and phosphates. The urine of the herbivora contains a large per-centage of carbonates, with some sulphates, and a little chloride of sodium; these salts give to it its alkaline reaction, and constitute the sediment which, as before mentioned, falls when such urine is allowed to rest. The presence of carbonates in the urine of the herbivora is shown by the effervescence which ensues when a strong acid is added to the urine. When we consider the cause of the great differences existing in the salts in the two great orders of ruminantia and carnivora, we find it to consist in the nature of the food. The flesh, blood, and other parts of animals, as pointed out by Liebig, contain no free alkali, for it is in them invariably combined with phosphoric acid. "The acids formed in the organism by the vital process, namely, sulphuric acid, hippuric acid, and uric acid, share the alkali amongst them, and this of course gives rise to the liberation of a certain amount of phosphoric acid, or what comes to the same point, to the formation of a certain amount of acid phosphates of soda, lime, and magnesia. On the other hand, all the vegetable aliments, without exception, contain alkalies in combination with vegetable acids; potatoes, for instance, contain alkaline citrates; turnips, alkaline racemates and oxalates, &c. All these plants yield, upon incineration, more or less strongly alkaline ashes, the bases of which were contained in the living plants, as salts of vegetable acids."—(Liebig, *Lancet*, June, 1844.)

When taken into the system, the organic acids are burned up, and we find, in the urine, the bases with which they were originally combined existing as carbonates in the urine, rendering it neutral or alkaline. It is to the amount of such organic salts, in the food of the herbivora, that we must attribute the alkalinity of their urine, and the large per-centage of carbonates which it contains.

Vauquelin found that 1000 parts of the urine of the dog contained 18·44 parts of inorganic salts, consisting of 5·95 parts of chlorides, 6·87 of sulphates, and 5·59 of alkaline and earthy phosphates, besides 0·03 of silica,

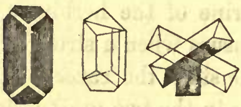


Fig. 160.—Crystals of Triple Phosphate, showing their form.

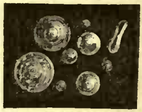


Fig. 161.—Crystals of Carbonate of Lime, seen by reflected light.

Von Bibra found that 1000 parts of the urine of a horse contained 42·20 parts of salts, which contained 78·37 per cent. of carbonates of lime, magnesia, potash, and soda, 13·04 per cent. of sulphate of potash, 6·94 of chloride of sodium, and 0·55 of silica.

In 100 parts of saline residue there were—

Carbonate of lime, . . .	12·50	31·00
Carbonate of magnesia, . .	9·46	13·07
Carbonate of potash, . .	46·09	40·33
Carbonate of soda, . . .	10·33	
Sulphate of potash, . . .	13·04	9·02
Chloride of sodium, . . .	6·94	5·60
Silica, ...	0·55	0·98
Loss, ...	1·09	

The deposit which settled, on allowing the urine of the

TABLE SHOWING THE COMPOSITION OF THE URINE OF THE HORSE, OX, PIG, GOAT, AND DOG.

	Herbivora.					Omnivorous.	Carnivora.	
	Horse.		Ox.		Goat.	Pig.	Dog.	Cat.
	I.	II.	I.	II.				
Water	885·09	912·84	912·01	923·11	980·07	981·96	933·00	...
Solid constituents	114·91	87·16	87·99	76·89	19·93	18·04	67.00	...
Urea	12·44	8·36	19·76	10·21	3·78	2·73	30·10	132·00
Hippuric acid	12·60	1·23	5·55	12·00	1·25	...	...	...
Uric acid	...	...	...	...	...	...	1·00	2·00
Mucus	0·05	0·06	0·07	0·06	0·06	0·05	0·32	Undetermined.
Alcohol extract	25·50	18·26	14·21	10·20	4·54	3·87	17·14	
Water extract	21·32	19·25	22·48	16·43	1·00	1·42	1·00	
Soluble salts	23·40	40·00	24·42	25·77	8·50	9·09	18·44	
Insoluble salts	18·80		1·50	2·22	0·80	0·88		

Note.—The above analyses, with the exception of those of the urine of the cat and dog, are by Von Bibra. The one of the urine of the dog is by Vauquelin; that of the cat by Hyeronomy.

horse to rest, was analysed three times by Von Bibra. It had the following composition:—

	I.	II.	III.
Carbonate of lime, . .	80·9	87·2	87·5
Carbonate of magnesia, .	12·1	7·5	8·5
Organic matter, . . .	7·0	5·3	4·3
	100·0	100·0	100·0

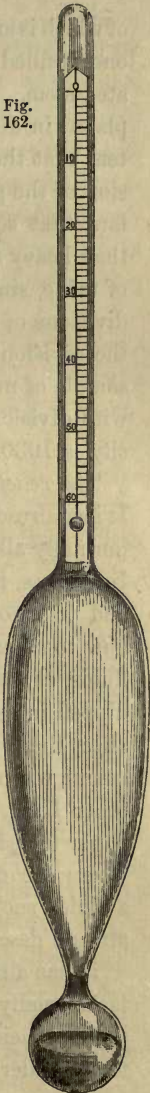
Having entered pretty fully into the chemistry of healthy urine, we must examine the changes which it undergoes in disease, and must ascertain what methods are at our disposal for readily detecting the changes.

We find that in some diseases certain of the normal constituents of the urine preponderate, that in others they are diminished in amount or are altogether absent, and sometimes we can detect the presence of substances which do not form part of the healthy secretion. The whole amount of urine excreted may be either increased or diminished in disease. It is diminished in almost all acute and inflammatory diseases; it is increased in a disease termed diabetes, and under the use of diuretic remedies.

The amount of urine excreted in the twenty-four hours may be increased without there being any augmentation in the solids excreted; the water may be alone in excess. Such urine is light-coloured, and its specific gravity is low. The specific gravity or density of the urine affords us a means of ascertaining to a certain extent whether the solids be in excess in the urine or not; a very low specific gravity indicates a corresponding deficiency of solids in the sample of urine examined, and the converse holds true. On the other hand, we must not, after merely examining the density of the urine, and finding it very high, conclude that an excess of solids is being excreted; for the total amount of urine may be diminished owing to a deficiency of water.

By the density or specific gravity of a liquid, we understand the expression of the weight of a certain bulk of the liquid, compared with the weight of an equal bulk of water. The most accurate means of determining the specific gravity of a fluid, such as urine, is to have a counterpoised bottle which is known to hold a certain weight of distilled water at 60° Far., say 1000 grs. It is exactly filled with the urine of which we wish to know the density, and then carefully weighed in a very delicate balance. The weight of the liquid is of course that of the bottle full of urine, minus the counterpoise; the weight indicates the specific gravity or density. For example, if a counterpoised bottle holds exactly 1000 grs. of distilled water at 60°, and when filled with a certain sample of urine, it weighs 1025, we say that the density of the urine is 1025 (compared with an equal bulk of water which weighs 1000.) Although the most exact, the above is for the practitioner by no means the most useful method of determining the density of the urine, for it necessitates the use of a delicate balance, and the expenditure of considerable time. An instrument usually called the urinometer, (Fig. 162), but to which the more correct name of urogravimeter has been applied, is the one best adapted for the ordinary observation of the medical or veterinary practitioner. It is a small glass instrument with two bulbs, one

Fig. 162.



of which is small, and is filled with mercury; the other, a larger one, is filled with air; from the large one there arises a graduated stem. The weight of the instrument is such that, when placed in distilled water at 60° Fahr., it sinks to such an extent that the water is precisely on a level with the first division of the graduated scale. The instrument, following the law, that solids of a given weight sink deeper in the light than heavy fluids, when introduced into any ordinary sample of urine, sinks, so that the fluid is on a level with one of the divisions of the scale. The instrument is so adjusted that the division indicates the density or specific gravity of the sample of urine examined. Thus if the fluid be on a level with division 30 of the urinometer, we conclude that its density is 1030.

The *reaction* of urine in disease next claims our attention. It has already been stated that the urine of the herbivora is normally alkaline, that that of the carnivora is normally acid. In disease, however, the conditions are sometimes reversed, and it is of importance that the practitioner should know how to ascertain this alkaline urine, like all other alkaline fluids, changes the yellow colour of turmeric paper (paper dipped in an infusion of turmeric) to brown, and does not affect the blue colour of litmus paper, but restores the blue colour when the paper has been reddened by acids. On the other hand, acid urine changes the colour of blue litmus paper to red, and does not turn yellow turmeric paper brown. There are other reactions which enable us to detect whether a fluid, such as the urine, be alkaline or acid, but those already described suffice for all practical purposes.

It has already been stated that the urine of the herbivora is normally alkaline, but that, in disease, it sometimes becomes acid; that the urine of the carnivora is acid, but that, under the use of particular diet, it may become alkaline. The causes which, in disease, alter the reaction of the urine of the herbivora, have not been carefully studied, though they doubtless merit great attention. A probable explanation is, that in being prevented from taking its normal food, the supply of alkaline is deficient, and the waste of the tissues going on rapidly at the same time, the herbivorous animal is placed in the same condition as the carnivorous animal normally is, and more acid is evolved in the system than can be neutralized by the alkalies existing in it.

In carnivorous animals, the urine in disease may become alkaline in two ways altogether different from each other, a knowledge of which is of the greatest importance in conducting the treatment:—1stly, It may become alkaline on account of an alkaline diet, or after the use of alkaline remedies; 2ndly, It may become alkaline from the decomposition of urea, and the formation of the volatile alkali ammonia.

Urea, as I formerly stated, is readily decomposed. When a solution of urea, such as urine, is in contact with animal matters, especially when decomposing, these act as ferments, and cause the urea to break up and evolve ammonia. The same thing occurs when urine is kept for any length of time, especially when the temperature is rather elevated. Such urine becomes rapidly alkaline, and evolves a very perceptible, often a very offensive, odour of ammonia, an odour which we always smell in badly drained stables. This decomposition goes on so constantly and so rapidly, that the careful agriculturist who wishes to avail himself, to all possible extent, of the urine of his cattle, adds some oil of vitriol to the urine, so as to *fix* all the ammonia as soon as it is evolved; that is to say, to form a sulphate of ammonia which will not volatilize, but which will, provided a suffi cient quantity of the acid have been added, remain fixed and in a suitable form to be used as a manure. What occurs in the stable, and the test glass of the chemist, sometimes occurs in the bladder of animals. If mucus or pus be secreted by the coats of that organ, or if the animal be prevented from voiding its urine for a long time, the urea is decomposed, and ammonia is evolved. The ammonia combines with the phosphate of magnesia which exists in the urine of carnivorous animals, and forms an insoluble compound, which is called *triple phosphate,* or phosphate of ammonia, magnesia, and water; thus it is that urine, which has become alkaline from the decomposition of urea, is always thick from the deposit of triple phosphate which it contains (such urine is, in fact, called phosphatic).

The urea and the deposit of phosphates give rise to an irritable condition of the bladder; the animal makes frequent attempts to empty its bladder, but does so ineffectually. The urine which remains in the bladder acts as a ferment to that which is poured into it from the ureters, and thus the condition becomes permanent; the bladder begins to secrete pus; its muscular coat becomes thickened; ulceration of the mucous membrane may set in, and the animal, gradually exhausted by the continued pain and irritation, dies.

How can this alkaline condition of the urine be, then, recognised and distinguished from the alkaline state which is brought on by an alkaline diet and by alkaline remedies, and which is quite compatible with health? In the first place, urine which is ammoniacal emits the odour of ammonia, and *always* contains a sediment of phosphates. In the second place, if a piece of litmus paper which has been reddened by a weak acid, be placed in the urine containing ammonia, the blue colour will be restored, but the red will reappear if the paper be cautiously heated, showing that the alkali present in the urine was volatile. The red colour will, on the contrary, not reappear if the alkalinity has been caused by the fixed alkalies. The experiment may also be tried with turmeric paper, which will assume a brown colour when dipped into ammoniacal urine, and the brown colour of which will disappear on heating.

The chemical views which have been explained in the preceding passages throw important light on the treatment of such cases. We must evidently secure the complete evacuation of the ammoniacal urine, by drawing it off with a catheter, or by washing out the bladder if the animal cannot by its own efforts effectually empty its bladder. We must bring about a healthy condition of the mucous membrane of the bladder, and this is done by the use of certain internal remedies, and we must, lastly, pay attention to the condition of the urine as secreted from the kidneys.

When there exists an evident disease in the bladder, which causes it to secrete matters which act as ferments, or where a stricture of the urethra exists, and by causing retention of the urine for a long time, has induced alkalinity of the urine, we may confine our attention to these organs; our treatment may be local. There are some cases which seem to depend on an excessively acid character of the urine when first secreted, so that, when poured into the bladder, it causes great irritation, gives rise to a secretion of mucus which causes fermentation of the urea, and thus, indirectly, the acid urine becomes an alkaline. Such cases are best treated by alkaline remedies, as by the acetates and carbonates of potash and soda.

Having discussed the methods of ascertaining the specific gravity and re-action of the urine, we should gladly review in succession the changes which the several urinary constituents undergo in disease, as they undoubtedly do; but the actual state of the chemical pathology of the urine of animals is so deficient, that we feel unable to do so. We can only describe the method of ascertaining the presence of certain substances, which sometimes undoubtedly occur in the urine of animals, as they do in that of man.

Blood is sometimes present in the urine. It may be derived from the kidneys, ureters, bladder, or urethra. When from the first of these sources, it gives a generally red or smoky hue to the whole of the urine. When from the urethra, the blood is generally expelled after the urine, often dropping from the penis after the urine has ceased to flow. Urine containing blood, from its containing albumen, coagulates—that is to say, becomes thick, and contains a sediment when boiled. The sediment is not dissolved, that is to say, the urine does not become clear on the addition of a few drops of nitric acid. If a drop of the urine which is supposed to contain blood be examined with the microscope, the cells of the blood will be seen floating in it. This is the only sure and reliable test of the presence of small quantities of blood in the urine.

Albumen, as I have previously shown, is one of the most important constituents of the liquor sanguinis of the blood. In certain acute and chronic inflammations, and other diseases of the kidneys, it finds its way into the urine; and therefore its presence in large amount is always of great importance.

Albumen is recognised by its property of coagulating, when a liquid containing it is boiled. The coagulum, or precipitate, is not dissolved on the addition of nitric acid. Nitric acid causes a precipitate, which is, in its turn, not dissolved by heat. When testing for albumen, if the urine be alkaline, we should add a few drops of nitric acid before boiling the fluid, for the alkali holds the albumen in solution. The two tests are quite sufficient to render us certain of the presence of albumen. Either alone would, however, occasionally lead us into error.

As the urine of dogs contains a considerable amount of phosphates, and as these salts are, under certain circumstances, precipitated when the urine is boiled, and then resemble precisely a precipitate of albumen, unless we added nitric acid, we might mistake the phosphates for albumen, and suppose the dog to be suffering from a disease of the kidneys, when in reality these organs were perfectly healthy.

On the other hand, the urine of dogs may sometimes contain an excess of the salts of uric acid (urates) in solution; in such cases, the addition of a few drops of nitric acid to the urine would throw down a precipitate; we should then be in doubt whether this precipitate consisted of albumen or urates. On boiling the fluid, the precipitate would either be immediately dissolved, or not affected; in the former case, we should be certain that *urates*, in the latter, that albumen, were present.

The *colouring matter of the bile* finds its way into the urine in certain diseases of the liver. It causes the secretion to assume a more or less yellow or porter-like appearance. When such urine is poured into a plate, and nitric acid is gradually added, rings of a blue, violet, and red colour are gradually formed.

It has lately been asserted by Dr Harley, that the acids of the bile are found in the urine, in all cases of jaundice, from obstruction, that is to say, where the bile is mechanically prevented from entering the intestine.*

* The detection of these bodies is made by Pettenkoffer's test, as the difficulties in drawing conclusions from this test are greater than in the case of the bile colouring matter, and as Dr Harley's conclusions are contrary to those arrived at by many other distinguished chemists,

Sugar occurs in the urine of man, in a lingering and very fatal disease called 'diabetes mellitus.' This disease is characterised by the excretion of very much increased quantities of urine, and by the presence in the urine of large quantities of sugar. Although the lower animals often suffer from what is called 'diabetes insipidus,' viz., pass an abnormal quantity of urine, it has rarely been known to contain sugar.

Dr Watson, in the second volume (page 648) of his admirable treatise, "On the Principles and Practice of Physic," tells us that he once had a coach-horse which he thought might have diabetes: "He was a greedy feeder and drank eagerly," says Dr Watson, "yet he grew thinner and thinner; and at whatever door I had occasion to stop, there he invariably began to stale, so that I became thoroughly ashamed of his leaking. Dr Prout was good enough to examine the urine for me. It contained no sugar, but its healthy properties were much changed. It had less than the natural quantity of hippuric acid, and more of earthy matter."

As there is no reason why the lower animals should not be subject to diabetes, and as their urine has been only rarely examined, I think it right to describe the way in which sugar may be detected in urine. In the first place, though the amount of urine is very large, its specific gravity is very high in diabetes. When some urine containing sugar is boiled in a test tube with a little solution of potassa (liquor potassæ), it assumes a brown colour, often nearly approaching that of claret.

The best test is, however, that which is known by the

and have not yet been confirmed, we shall not describe the application of Pettenkoffer's test, referring our readers to Dr Harley's original paper, read before the last meeting (1862) of the British Medical Association, and a notice of which appeared in all the weekly medical journals.

name of Trommer's test. It consists in adding to the urine in a test tube a few drops of a solution of sulphate of copper, so that the liquid shall assume a slightly blue tint. Aqua potassæ is then added in great excess (usually its quantity should be equal to that of the urine); if sugar be present, a precipitate is thrown down, which is re-dissolved as more potassa is added, the liquid then assuming an azure blue colour. On boiling the liquid, if sugar be present, a beautiful yellow precipitate is thrown down, which contrasts very remarkably with the blue solution. The precipitate consists of sub-oxide of copper. In order to familiarise himself with the reaction, the learner may make preliminary experiments with a solution of honey, which contains grape sugar.

Pus sometimes occurs in urine. Urine containing it is always slightly albuminous, and contains a sediment. The sediment, when examined microscopically, contains the cells which, when occurring in large quantities, are almost characteristic of the secretion. They are precisely similar to the colourless cells of the blood, and possess many nuclei, which are brought out most distinctly by the addition of a little acetic acid.

Before leaving the chemistry of the urine, I must mention that it is thus many medicinal substances and colouring matters, when taken internally, find their way out of the system. Chelidonium and rhubarb cause it to assume a yellow colour. Oil of turpentine causes it to exhale an odour of violets, and valerian and castoreum give it an odour of myrrh. The mineral salts, when taken internally, also occur in the urine, where they may be detected by suitable tests.

FUNCTIONAL DISORDERS OF THE URINARY ORGANS.

Diuresis.—Polyuria.—Excessive Secretion of Urine.—Diabetes Insipidus.

By the term *diuresis,* a variety of conditions is indicated in which there is an excessive secretion and discharge of urine. The different forms of diuresis may be included under two heads—the *simple* and *complicated.*

Simple diuresis is that frequent and abundant discharge of urine occurring principally in horses, but occasionally affecting other domestic animals. It is usually an enzootic disorder, manifesting itself on a farm, in a city, district, county, or country. Occasionally a single animal here and there may be affected, but more frequently many animals are seized with similar symptoms.

The *causes* of this disease are such as lead to the production of musty and deteriorated oats and hay. Wet seasons, during which great difficulty has been experienced in making hay, have been frequently attended with very general outbreaks of this disorder. If oats are injured and allowed to get damp, are left to germinate and get musty, they are eminently calculated to induce this disorder. A very remarkable prevalence of the malady was witnessed in the vicinity of Paris in 1850, in the Rhine Provinces in 1845, in Holland in 1851, and repeatedly in Scotland. It is occasionally seen in all large towns, when damaged foreign oats have been sold in considerable quantities. Army horses fed on hay and oats supplied by contractors, who buy up anything cheap enough for their supplies, are liable to severe attacks. Moiroud and Leblanc have noticed in France that horses that belong to plasterers are most subject to the disorder, these animals taking large quantities of water, especially in the summer months, when thirst is greatest. Amongst sheep the disorder has been seen as the result of noxious plants on certain pastures. The disorder is said to be induced in the ovine species by *Anemone nemorosa,* and *Pulsatilla,* but more especially by *Asclepias vincetoxicum.*

Symptoms.—Intense thirst—*polydipsia*—and depraved appetite:—Copious discharge of urine, distinguished from healthy urine by the following characters laid down by Professor Lassaigne. 1st, It is more watery; 2nd, It contains free acetic acid; 3rd, There are no earthy carbonates, yet the essential character of true diabetes, the presence of sugar, is entirely wanting. The languor, stiff and hesitating gait, pallor of visible mucous membranes, dry and clammy mouth, staring coat, and tendency to lick the wall or eat up the litter and filth, are very characteristic signs of the disorder. The animals become rapidly emaciated, especially if kept at work without intermission, and die from exhaustion and impaired nutrition.

The duration of disease varies from a week or ten days to several weeks, or even months. The chronic form is not attended with the copious discharge of urine observed in acute cases.

Post-mortem appearances.—These consist in pallor of the body, generally with a flabby bloodless state of the muscles, of the liver and kidneys.

Treatment.—The food the animals are having must be changed, a dose of purgative medicine given to each, and the diet restricted for some days to sound hay in moderate quantity. This is not unfrequently sufficient to check the disorder. The intense thirst is greatly allayed by the administration of one or two of the following balls:—

℞ Iodide of Potassium, . . . 2 dr.

Common mass, as much as sufficient to make a ball. One daily to horse with diuresis.

Armenian Bole has been prescribed with good effect by Hertwig, Heckmeyer, and others. Delwart has found two-ounce doses of creasote, in water, of great benefit. He has also prescribed iron and carbonate of soda in water. In obstinate cases the tincture of cantharides has been given in half-ounce doses in mucilaginous decoctions. Leblanc recommends substituting linseed tea for water as a beverage, and if the animals have a tendency to lick the walls, &c., he adds magnesia to the tea. In severe cases he has found much good to be derived from the administration of the aqueous extract of rhatany, which is probably not better than other vegetable astringents.

Complicated diuresis is a condition which I have witnessed in overworked animals. It has been seen by Hering and Perosino after an attack of strangles. The difference between this and simple diuresis is the frequent high colour of the urine, with a peculiar slimy character and strong odour. I regard this disease as the *azoturia* of Willis or *ureous diuresis* of other authors, due either to "a too rapid disentegration of tissues, or a defective assimilation of food."

The symptoms are very similar to those of simple diuresis, only the emaciation is more rapid, and in animals much reduced by hard work, the disease is speedily fatal. It is remarkable to notice the extent to which the muscles of the body will waste in a few days. The ligamentum nuchæ is easily felt in a tense cord; there is an anxious expression of countenance, and severe prostration.

The treatment of this disease consists in the use of astringent tonics, mineral acids, easily digested food, and perfect rest.

Diabetes Mellitus—Honey Diabetes—Saccharine Diabetes.

This disorder has been far more rarely observed than the forms of diuresis just described, but it may occur in all animals. There has been very little written on the subject, and I shall restrict myself here to quoting a history of two cases, the one in a dog, and the other in a monkey, reported by M. U. Leblanc:—

The first case was in a large six-year-old greyhound, fed exclusively on flesh. He drank much, urinated often and copiously, ate more than usual, became rapidly emaciated, was constipated, with dry clammy mouth, harsh dry skin, and staring coat. The case was treated by linseed decoction with imperfect success, and 8 grains of the extract of rhatany were then given daily, causing diminution of the urinary secretion, also reducing the enormous appetite and increasing emaciation, the thirst meanwhile continuing as before. At this time—about two months after the onset of the malady—the creature began to cough, and the discovery was made that the urine contained sugar. Accordingly the treatment recommended by Bouchardat in similar cases in the human subject was adopted. The meat diet was continued, 15 grains of carbonate of ammonia were given morning and evening a short time before feeding, the patient was kept in a warm place with a woollen rug over him, and was brushed energetically several times a-day to activate the functions of the skin. Mucilaginous injections were employed to overcome the constipation, and two drops of laudanum daily administered. Under this treatment the appetite diminished, but the thirst continued, and emaciation progressed rapidly. By giving linseed decoction, the appetite was somewhat restored. The animal, however, became gradually worse, the coughing became more violent, and one day he picked up a bit of an old shoe and suddenly swallowed it; some hours later the debris of this body was rejected by emesis, but the vomiting continued, accompanied by bloody stools, and some days afterwards the creature died. No autopsy was made. This case proves that amylaceous articles of diet are not necessary to the development of diabetes *mellitus,* although such agents have been found in the human subject to aggravate the disease. That the whole diet was animal there can be no doubt, as the dog was under the immediate care of M. Leblanc.

The next case occurred in a monkey, and continued for the space of six months, when it ended in death. It was fed on all manner of aliments,—bread, biscuits, vegetables, fat broths, milk, flesh, and confections. He drank every instant if permitted, and passed large quantities of urine, which was repeatedly anlysed by M. Poggiale, Member of the Academy of Medicine, and Professor of Chemistry at Val-de-Grace, and found to contain sugar in large amount.

The treatment consisted in giving bicarbonate of soda and the water of Vichy. The diet was flesh, fat broth, and gluten bread. Linseed decoction was prescribed, but beside this the animal drank large quantities of pure water. This, like the former case, was unsatisfactory, the creature being alternately better and worse, and succumbing at the end of six months.

ISCHURIA—DYSURIA—STRANGURY—SUPPRESSION OF URINE.

The several conditions I here group together are all characterised by the checked discharge of urine. This may consist in suppressed secretion—ischuria; in the painful discharge of a little urine—dysuria; and lastly, in the passage of urine in drops—strangury.

The secretion of urine may be totally arrested, as in nephritis, especially due to an overdose of cantharides or other potent diuretics. Again, in febrile disorders, the urine becomes very scanty and acrid. It induces irritation of the urinary passages, and is discharged in drops.

When there is true suppression of urine, symptoms of blood poisoning—uræmia—occur. There are instances in which the elements of urine are discharged by other organs, and Bernard and Barreswil detected salts of ammonia in the intestinal secretion of animals after extirpation of the kidneys. So long as this vicarious discharge kept up, the poisonous effects of urea in the blood were not manifest. Shivering fits, dulness, laboured breathing, vomiting in dogs, diarrhœa, and fetid exhalations from skin and lungs, are characteristic symptoms of severe forms of this disorder. Death speedily results if treatment is not beneficial.

Treatment depends on the cause of the checked discharge or suppressed secretion. Warm baths in the smaller animals, mucilaginous draughts, and a brisk purgative, are useful remedies. Diuretics are of great service when the secretion of urine is checked without the existence of nephritis. Spirits of nitric ether, in considerable doses, nitre, and digitalis, are much to be relied upon. There are some cases which prove incurable, and there are many which depend on mechanical causes which the surgeon overcomes. These we shall consider under the next head.

Retention of Urine.

The immediate causes of retention are numerous. Hertwig has enumerated them as follows:—1. Inflammation of the neck of the bladder, or of the urethra; 2. Paralysis of the bladder, or spasm of its neck; 3. Calculi or polypi in the neck of the bladder, enlarged prostate or other productions in, or in the vicinity of, the bladder; 4. Calculi or parasites in the urinary passages; 5. Contractions of the latter; 6. Obstructions at the urethral opening, due to contractions or to accumulations of the preputial secretion; 7. Excessive accumulations of fæces in the rectum, prolapsus vaginæ, uteri, &c.

The indirect causes of retention are very numerous. It is an accident much more frequently witnessed in male than female animals. Any causes that may induce the numerous conditions under which it is observed, are of course amongst the mediate or indirect causes of retention, such as the accidental administration of potent diuretics, cantharides, &c., inducing inflammatory disorders, mechanical injuries leading to strictures, &c.

Symptoms.—Frequent and ineffectual attempts to urinate, restlessness, pawing, stamping with the hind feet, and looking round to the flank. The bladder is felt to be distended with urine by physical exploration. This is performed with the hand or finger according to the animal: in the male by the rectum, and in females through the vagina.

The special causes of retention are diagnosed by symptoms described under the separate heads Cystitis, Spasm of the Bladder, Paralysis of the same, Vesical or Urethral Calculi, &c,

Simple cases of colic are frequently regarded by non-professional persons as cases of retention of urine, and this in consequence of the secretion of urine being checked in cases of constipation and spasm of the intestines, especially in the horse. The distinguishing symptom between ordinary colic and retention of the urine, is the attempt to urinate in the latter disease.

Treatment.—This consists in the removal of the cause, in withdrawing the urine by artificial means, and in avoiding accidents which may arise from neglecting animals whilst in pain, &c.

There are various remedies to apply for the removal of the cause of retention, according to the nature of the disease. When possible, a warm bath should be given the animal, and a dose of purgative medicine. Warm water injections, the internal administration of opium, in some cases attended with severe spasm and pain, and the early use of the catheter, are amongst the most useful means to adopt to afford speedy relief.

Catheters have been constructed of leather and metal, or of gutta percha, both for male and female animals.

For the horse a flexible tube about three feet and a half feet in length, with a rounded extremity, to pass freely through the urethra, is usually employed in this country. Hering says that he has left such a tube in the urinary passages days and even weeks without in any way injuring the organs. The horse catheter invented by Professor Brogniez, of the Bruxelles Veterinary College, is a most convenient instrument. It is composed of a tube divided into a smaller part about 11 inches in length, with a rounded head about five lines in thickness. The lesser portion is made of a spiral wire tube, covered by gutta percha. It is attached to a thicker and less flexible tube 17 inches in length. A steel director with

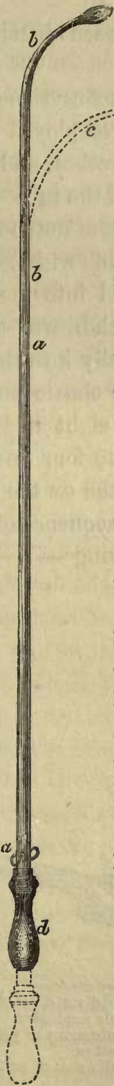


Fig. 163.—*a a*, Straight portion of tube; *b b*, flexible portion; *c*, the same portion flexed after withdrawal of the stilet; *d*, wooden handle of latter.

a wooden handle is employed, and fits accurately to the tube.

In using this catheter, the little instrument here drawn is often employed to open the mouth of the urethra, and facilitate the introduction of the tube. The catheter is pushed up to the notch of the ischium, the stilet is then withdrawn, and the tube is pressed into the bladder. As the stilet is withdrawn, the flexible tube turns naturally into the bladder.

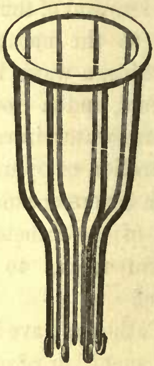


Fig. 164.

The elastic tube for mare or cow is about eight inches in length, and from three to four lines in thickness.

In the ox the catheter cannot be used, in consequence of the curve in the penis, shown in the annexed engraving:—

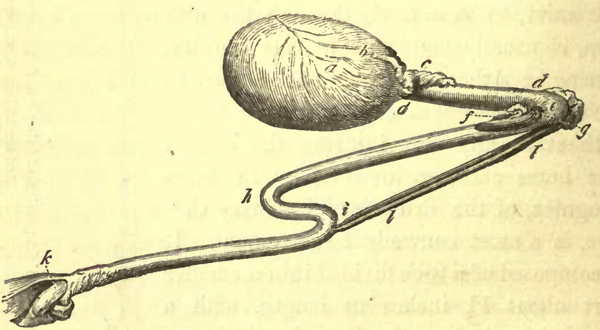


Fig. 165.

a. Urinary bladder.
b. Ureter (divided.)
c. Vesicula seminales.
d d. Membranous or pelvic portion of the urethra.
e. Muscular coat of urethra.
f. Commencement of the cavernous portion of the penis (removed.)
g. First, } Curves of penis.
h. Second, } Curves of penis.
i. Third, } Curves of penis.
k. Anterior extremity of the penis.
l l. Retractus of the penis.

In the dog some difficulty is experienced from the bone in the penis. The catheter for this animal should be from six to eight inches in length, and from one to two lines in thickness. It is readily introduced through the urethra as high up as the superior extremity of the bone of the penis. In pushing it beyond this, we experience the opposition of the sphincter urethræ, and it is only by very steady and persistent pressure, without unduly forcing the instrument, that we succeed in passing the catheter in the dog.

In the ox, and sometimes in the horse, ram, and other animals, the urethra has to be opened in the perinœum This operation will be described under the head Lithiasis.

Incontinence of Urine.—Enuresis.

This disease consists in a difficulty to retain the urine in the bladder. There are two forms of enuresis: one that is not noticed by veterinary authors in this country, and which consists in the constant passage of urine through the open urachus in young animals; and the second is the constant discharge by the natural passage from paralysis of the bladder in cases of ordinary paraplegia, or sometimes in calculous disorders.

Incontinence of urine from pervious urachus, is always noticed in calves and foals shortly after birth. The animals are not seen to urinate naturally, and the secretion is seen to drop from the navel. The hair in this region is always wet, and excoriations are apt to occur. A couple of silver wire sutures through the opening suffice to close it, or applying a little powdered sulphate of zinc or copper over the part, so as to induce granulation and cicatrization.

The involuntary discharge of urine through the urethra in cases of paralysis is apt to be complicated with irritability of the bladder. Enuresis is said to occur in pigs after eating of polygonum hydropiper and lapathifolium. In all these cases we should give a cathartic, and follow it up by the administration of nux vomica, strychnia, and tonic preparations. Cantharides may be given in doses varying from 5 to 15 grains to horse or ox, repeated every other day for 8 or 10 days. It may be combined with strychnia. Cold water injections into the rectum are also very beneficial.

Albuminuria—Bright's Disease—Albuminous Urine—Albuminous Nephritis—Granular Degeneration of the Kidneys.

The presence of albumen in the urine was first noticed by the late Mr William Percivall as far back as 1838. Dr Bright wrote on the disease as affecting man in 1847, and to this day it is known as Bright's disease. Abroad the observations regarding albuminous urine in the horse have been numerous, but some confusion has arisen from including under this head enzootic hæmaturia. It was originally thought that the presence of albumen in the urine depended on a specific disease of the kidneys, but it is seen in many conditions of the system, and especially in diseases of the nervous system in the lower animals. It is witnessed in horses that have been overworked, and in those suffering from diuresis. Rodloff says that it occurs in the contagious disease of the generative organs of stallions, so prevalent in some parts of the Continent. Diseases of the skin and of the liver are apt to become complicated by albuminuria, and in proportion to the quantity and quality of the albumen excreted, is there danger of the development of organic changes in the kidney. This observation, made first by human physicians, has been confirmed by veterinarians. The circumstances under which albuminous urine occurs in the horse support the views published by Mr Hamon on the nervous nature of albuminuria.

Hamon finds (1) that activity of the voluntary muscles causes an increase of the albumen in the urine, proportionate to the degree of exertion. (2.) Digestion also increases the amount of the albumen in proportion to the indigestibility of the food. (3.) Purgatives increase the albumen according as they excite the intestinal peristalsis. (4.) Diuretics do not aggravate, rather diminish, albuminuria. (5.) Emetics cause mostly an increase, sometimes a diminution, of the excretion of albumen. (6.) Attacks of dyspnœa aggravate the renal disorder. The author's general conclusions are the following: "Albuminuria is not a primary renal disease, for there is albuminuria without pre-existing renal disease, and albumen often disappears from the urine while the renal disease persists. Albuminuria is a sign of cerebro-spinal affection, and can be produced by directly acting on the nervous system, or by diseases of the same."*

Albuminuria is therefore, as a rule, symptomatic of other diseases. There are cases, however, which justify our speaking of one form as essentially idiopathic. Mr Percivall's remarks on the disease can be very appropriately quoted here. He says:

"To this subject my attention was first drawn in December, 1838. An officer's charger, six years old, thoroughbred, who, before he came into the possession of his present owner, had been much used, and had obtained a good character as a hunter, exhibited some rather strange symptoms, respecting which my first impression was, that he might have sprained his loins under too heavy weight in the riding-school. With a view of shedding some additional light upon his case, I desired that some of his urine might be caught; and this circumstance it was that at once unravelled the nature of the disease of which he was the subject. The urine proved to be

* *Year-Book of Medicine, Surgery, &c.* London, 1862.

light-coloured, but very thick in its consistence; in fact, when poured into a glass, it resembled so much melted calf's-foot jelly. I lost no time in consulting some of our best works on human medicine on the subject, and soon learned that the case must be one of 'serous or albuminous urine,' a conclusion in which I became afterwards confirmed by the application to the fluid of the usual tests. Since this I have noticed two other cases.

"The *symptoms* observed in one slight case were, a continual desire in the horse to stretch himself out in his stall, and in this position to continue, with his fore legs extended under the manger and his hind ones backwards, unless disturbed, all day long; not for the purpose of staling, but apparently because that posture seemed an easy or a comfortable one to him. In another case, the horse stood in his stall 'all of a heap,' with his back roached and his hind legs advanced underneath his body. Led out, the animal in his gait evinces stiffness in the back and loins, which is most manifest in turning round. There is some fever attendant; but this, in a slight case, will but amount to some heat of mouth and acceleration of pulse, without materially affecting, perhaps, either the spirits or the appetite. In a severe attack, however, there will be rigors, and a great deal of irritation, manifested by accelerated respiration, by loud blowing or puffing at the nostrils, by anxious countenance, and small quick pulse; combined with extreme disinclination to move, and great pain and difficulty in progressing and turning the hind parts. The bowels are commonly confined.

"The state of the urine, however, must constitute our diagnosis. The groom must seize the earliest opportunity to collect some. Should it prove albuminous, it will assume a deep or dead straw-colour, and be found of the consistence of a thick solution of gum. Submitted to the test of bichloride of mercury, it will yield a copious milky flocculent precipitate resembling white of egg; and in some cases—not in all—the albumen contained in it will coagulate on exposure of the urine to heat: when this last test fails, I take it the failure is attributable to the large quantity of water with which the albumen is united. Its coagulation, however, may still be effected by adding a little acetic acid, and afterwards some prussiate of potass.

"The adult period of life seems the time at which we are to look for this disease. My patients were aged six, seven, and eight years.

"*Relapse* took place in one instance. The first attack, but slight, happened in April 1839; the second, very severe, occurred in March 1840.

"During cold weather the disease has appeared. I have had no case in summer."

On the subject of analyzing the urine for albumen, I have to direct the reader's attention to page 26.

The treatment of albuminuria has not been made the subject of any important observations. It is found that regulating the diet, and supporting the animal by mineral acids and mineral tonics, is the best treatment in cases due to overwork Opium is recommended by Mr Percivall to check the discharge of albumen. Tannin has been also used for this purpose. Special treatment is required in the various maladies of which albuminuria is but a symptom.

HÆMATURIA—DISCHARGE OF BLOOD WITH THE URINE.

This disease is amongst the most frequent ones affecting horses and cattle. There are two varieties, the *idiopathic* and *traumatic.*

The traumatic hæmaturia occurs as the result of strains—

cart-horses with heavy loads to draw or to support down hill, hunters in taking extraordinary leaps, and other animals from blows and other acts of violence, sustain injury to the kidneys, whereby blood is discharged. In calculous disorders bloody urine is not unfrequently discharged.

Traumatic hæmaturia is characterised by symptoms of pain in the lumbar region, feverish excitement, sometimes paralysis of the hind quarters, and the blood discharged clots. It is apt to separate from the urine on the floor, so that the colour of the urine is not a uniform red as in cases of enzootic hæmaturia.

Owing to the difficulty in healing of some renal wounds, we find some horses after severe attacks of hæmaturia liable to a recurrence of the disease, if subjected to any extraordinary exertion. Such relapsing hæmaturia renders an animal unsound, and indeed useless.

Treatment in traumatic hæmaturia consists in keeping the animal quiet, pouring cold water over the loins, or giving a cold water injection, and administering internally; should the hæmaturia persist, acetate of lead, sulphate of iron, sesquichloride of iron, tannin, catechu, or other mineral or vegetable astringent.

The following prescriptions are of service:—

℞	Acetate of lead	10 gr.
	Acetate of zinc	½ dr.
	Catechu	2 dr.

Common mass as much as sufficient to make into a ball. A similar dose to be repeated for several days if necessary; or,

℞	Tannin	½ dr.
	Powdered catechu	1 dr.
	Powdered opium	1 dr.

Treacle, as much as sufficient to make into a ball with a little common mass. The dose to be repeated several times if necessary.

Idiopathic Hœmaturia is a disease observed under a great variety of circumstances. It occurs in the horse, cattle, and sheep, as an enzootic disease, and it is remarkable that there are districts where the disease prevails amongst horses, there are others where it prevails amongst cattle of all kinds, male and female, and there are others where it affects only cows after parturition.

Enzootic Hœmaturia of Horses.—This malady has been described by the Germans under the head of "Schwarze Harnwinde." It prevails in Bavaria, and especially on the borders of the Danube. It has been regarded as a blood disease; it occurs in horses, and very rarely in mares, and its victims die in the course of from one to three days.

Symptoms.—Stiff gait, weakness of the hind-quarters, frequent pulse, redness of visible mucous membranes, anxious expression of countenance, and sweating; a remarkable swelling of great firmness occurs over the loins and hips, and there is a copious discharge of urine of a very dark red or brown colour. Great difficulty of breathing ensues, tetanic symptoms supervene, and death.

Post-mortem appearances reveal the dark semifluid condition of the blood, ecchymoses, absence of any inflammatory complications, soft condition of liver and kidneys, and distension of the bladder by a dark-coloured urine.

The treatment resorted to consists in blood-letting, purgatives, and then followed up by the astringents recommended above for traumatic hæmaturia.

The other forms of idiopathic hæmaturia have been classified by Hering under two heads—sthenic and asthenic.

The *sthenic hœmaturia* is connected with active congestion, and even leads to inflammation of the kidneys. The usual symptoms consist in discharge of urine which is at first rather dark coloured, reddish, transparent, and afterwards bloody. The quantity of urine is usually scanty, and it is emitted with pain. The symptoms of a slight renal inflammation appear, such as stiff gait, sensibility of the loins, staring coat, fever, loss of appetite, suspended secretion of milk, &c. The symptoms of irritative fever and renal inflammation may be severe, and the animals die. In some cases abscesses form in the kidneys. The disease lasts from one to three weeks.

This disease is essentially enzootic. It occurs principally in the spring, and when, with great heat, there is a scarcity of water. It is due principally to the astringent principle of plants and young trees which animals eat. In France the malady is due in extensive tracts of land, to genista hispanica, and is hence termed "genestade." Mercurialis annua and perrennis have been noticed to induce the disease by Junginger, Dubois, Schack, and Hering. Kuers has found it due to polygonum hydropiper, when the malady occurs late in the season. Hübner has traced the malady to be due occasionally to arnica montana, and Schneider to aconitum gracile, which induces discharge of blood with the milk as well as with the urine. In Holland, enzootic hæmaturia has been attributed to aconite, digitalis, ranunculaceæ, and especially pedicularis palustris. Weinmann has found it due to pyrola rotundifolia.

The treatment of this disease consists in removing the animals from the pastures where they have suffered, administering a full dose of a saline purgative, and following this up by large doses of linseed tea. When the amount of depression is great, camphor and ammonia should be given in gruel or linseed tea. If the discharge by the kidneys is excessive, small and repeated doses of opium must be resorted to.

Asthenic hœmaturia is a disease characterised by debility and prostration of the vital powers, coupled with a urine of a red colour, varying in intensity. The symptoms are otherwise not very different from those of sthenic hæmaturia. There is a greater tendency to anæmia, and this is indicated by the pallor of the visible mucous membranes, cold and clammy mouth, venous pulse, palpitating heart-beats, and cold extremities. Jaundice is not an unfrequent complication.

On opening the body the tissues are found to be more or less pale, the kidneys healthy but pale, the liver usually congested, but the blood throughout the body watery and fluid, ecchymoses are not unfrequently met with on the serous membranes.

This disease has been recognised abroad as connected with damp lands and wet seasons. It occurs in hot weather, and when food is scanty and of inferior quality. It is seen always on pasture lands, and never in stall-fed animals, except in Britain, where it occurs amongst cows fed on turnips grown on damp land.

Red water in cows, which prevails to so great an extent in different parts of the United Kingdom, is essentially a form of asthenic hæmaturia.

The cause is almost invariably feeding on turnips that have been grown on damp, ill-drained land, and very often a change of diet stops the spread of this very troublesome disease in a byre. Other succulent foods, grown under similar circumstances, may produce the same symptoms; tending to disturb the digestive organs and blood-forming process.

In the course of my investigations as to the cause of red water, I have found that it is unknown on well-drained farms and in dairies where turnips are used only in a moderate degree. The lands of poor people furnish the roots most likely to induce the disorder; and I can confirm the statement of the late Mr Cumming of Ellon, who, in his very interesting essay on the subject,* says, particularly in reference to Aberdeenshire, that it is "a disease essentially attacking the poor man's cow; and, to be seen and studied, requires a practice extending into the less favourably situated parts of the country. On large farms, where good stock is well kept, and in town dairies, where artificial food is used to supplement the supply of turnips, it is seldom now seen."

Symptoms.—General derangement attracts the dairyman's attention, and on looking at the urine the cow has passed, it is observed red or of a reddish brown or claret colour, sometimes transparent, at others clear. The colour increases in depth, other secretions are checked, the animal becomes hide-bound, and the milk goes off. Appetite and rumination are suspended, the pulse becomes extremely feeble and frequent, though, as in all debilitating or anæmic disorders, the heart's action is loud and strong, with a decided venous pulse or apparent regurgitation in the large veins of the neck. In some cases, if even a small quantity of blood be withdrawn, the animal drops in a fainting state. In red water the visible mucous membranes are blanched, and the extremities cold, indicating the languid state of the blood's circulation and the poverty of the blood itself. Constipation is one of the most obstinate complications; and many veterinary surgeons, knowing that if the bowels can be acted on the animal is cured, have employed purgatives in quantities far too large, inducing superpurgation, and even death.

* *On Puerperal Red Water in Cows.* By Mr M. CUMMING, V.S., Ellon, Aberdeenshire. *Transactions of the Highland and Agricultural Society of Scotland*, vol. iv. page 9.

Occasionally diarrhœa is one of the first, and not an unfavourable symptom.

Post-mortem appearances.—The emaciated body of a cow that has died of red water is throughout devoid of blood, the cavities of the heart itself are almost entirely empty, whilst the condition of the blood-vessels would lead any one to suppose the animal had been bled to death. Frequently, like in other blood diseases, there are spots of extravasated blood or ecchymoses on the serous membranes, and particularly within the heart, beneath its inner lining or endocardium. Occasionally, the tissues of the body are yellow, the gall-bladder is often full of bile, and the large intestine is distended by dry hardened excrement.

Treatment.—Large quantities of good linseed tea. Warm water clysters should be persevered with. If the discharge of urine be very abundant and very much discoloured, half a drachm of powdered opium may be given twice, with an interval of six hours. The second day a bottle of linseed oil may be given. When the animal recovers, there must be a complete change of diet.

Favourite remedies for this disease have been stimulants, astringents, and a strong decoction of the common nettle. The disease is never inflammatory, and blood-letting, though recommended by some, is decidedly prejudicial.

Atrophy and Hypertrophy of Kidneys.

Both the wasting and enlargement of the kidneys are frequent conditions in the lower animals. Indeed the two conditions may occur together, as the atrophy of one of the organs leads to hypertrophy of its fellow, and not unfrequently the remaining organ has been found as much as twice its natural size.

Atrophy of the kidneys is met with most frequently in the pig, and it is not uncommon in this animal, in some parts of Europe, to find one kidney absent, its fibrous capsule alone remaining, distended by a yellow fluid, of strong urinous odour, whereas the opposite organ is much enlarged. There are some interesting specimens of this disease in the Italian museums.

Hypertrophy is a common disease in cattle. It is met with in the finest and fattest oxen. There is no structural change of importance. The kidneys appear paler and softer than in their healthy state, but their structure is normal. They attain as much as two or two and a-half times their proper weight, and it would appear that this frequent condition of the urinary apparatus is due to stimulating and moist food, which keep up a constant state of diuresis.

Mr Percivall quotes two cases of hypertrophy of the kidneys in the horse. He says:—

"Of enormous enlargement, a case is related by Mr Freeman, V.S., Winchester, in the *Veterinarian* for 1839. The horse was a coach-horse, entire, seventeen hands high, who became, from being *light* in his carcass, 'as large as a cow.' And when he lay upon his *left* side, there could be seen and felt a tumour of large size, arising from something pressing against the parietes. There was also much anasarca of the belly and scrotum. The horse covered up to this time. Before his death occurred he staled blood in large quantities, though that might have arisen from instruments improperly used. The right kidney was enlarged to that degree that putting my arms round it, I could only clasp my hands, but could not lift it. The natural texture was lost; it seemed to consist of cheesy matter enveloped in a strong tunic. The other kidney was healthy, though rather larger than natural. The enlarged kidney was supposed to weigh upwards of 112 lbs.

"M. Clipy was called to attend a horse for being off his feed, which up to that time had always enjoyed good health. He found his gait difficult, especially of the hind quarters, and that the slightest pressure upon his loins produced great pain, particularly when he was made to bend downwards, which he with all his power resisted. Urinary secretion scanty and bloody. The next day, in raking the horse, the rectum was found hotter than natural, the bladder in a state of semi-plenitude, and thrust, as it were, into the pelvis; the kidneys of an enormous size; and at the least touch of them the patient expressed great pain, and struggled to rid himself of the man's arm by violent contractions of the abdominal muscles. In spite of the most active antiphlogistic treatment, death ensued in eight days. The kidneys were found enormously enlarged, weighing each from twenty-four to twenty-seven pounds, occupying all the posterior part of the abdomen, and in some measure blocking up the opening into the pelvis, their inferior surface being upon a level with the pubes. Their surrounding cellular tissue was very much infiltrated, and their internal substance generally reddened."

Other organic diseases of the kidneys are rare. Fatty degenerations, tubercular deposit, and cancer of the kidney are not common. Far more frequently we have cystic disease in the kidneys, due to echinococci or to obstructions in the uriniferous tubes, accumulations of urine, and thickening of the saccular dilatations thus induced. Melanotic deposits occur in the kidneys, as in other organs, in old grey horses.

Inflammation of the Kidneys—Nephritis.

This is a comparatively rare disease in the lower animals. When it does occur it is found due to injuries, such as blows and strains, or to the internal administration of poisonous, or of small, but repeated, doses of stimulant diuretics, such as various resins, cantharides, &c. It is also a disease due to the introduction of other irritant poisons into the body, and especially of vegetable products possessed of much astringency. The malady is not unfrequent in studs where grooms are encouraged in drugging horses and giving diuretic balls, and other favourite nostrums.

Symptoms.—The malady is characterised by colicky symptoms and considerable fever. The loins are very tender, and the animal stands with its hind limbs wide apart and stiff, back arched, and has no inclination to lie down. There is a peculiarly stiff gait, and occasionally lameness in one of the limbs. The secretion of urine is very scanty, and so concentrated that it irritates the bladder, and there are frequent but ineffectual efforts to discharge urine. Sometimes blood and pus are discharged with the urine. The general symptoms increase in severity. The pulse is frequent, and the artery feels wiry under the finger; the mouth is hot and clammy, thirst intense, and bowels constipated. The breathing is frequent but short, and in the latter stages the expired air is very offensive. The skin is dry, coat staring, and in very acute cases there are partial sweats, and a strong urinous odour emitted with the perspiration.

If the animal is not relieved, signs of exhaustion, listlessness, and even coma supervene. The animal falls, struggles at intervals, and dies.

Post-mortem appearances.—One kidney is, as a rule, more especially affected. It is enlarged, of a dark colour, and with red streaks or spots of congestion dispersed through its substance. Whenever there is a spotted redness, it is found due to the congested state of the malphigian tufts. Occasionally the inflammation attacks a part of one kidney, and wherever the organ is affected it is found red, with inflammatory exudation on its surface and in its substance; the structure is easily broken down, and sometimes an abscess is found.

Treatment.—The intestine must be cleared out as much as possible, and rather frequently, by means of simple warm water injections. Linseed tea or other emulsions should be given with liberal doses of acetate of ammonia. In dogs, small doses of the potassio-tartrate of antimony are very useful. In the horse, it may be advisable to give a dose of aloes, but it is best to avoid all active remedies that require to be given in large doses. Warm fomentations to the loins, mustard poultices, or a hot sheep skin, afford great relief. If the pain continues, considerable doses of camphor and opium are called for.

Abscess and Fistula.

D'Arboval mentions an interesting case of this disease, which Mr Percivall has rendered in his work on "Hippopathology," in the following terms:—

"A mare fell into a hole, out of which she was got with great difficulty. From that moment she experienced inconvenience in locomotion. The vertebral column appeared inflexible, the pulse tense and irregular, the urine scanty, thick, and sometimes mingled with streaks of blood. The mare lay down but little, not being able to raise herself up again, without great pain. M. Chouard being called to her, perceived at the superior part of the right flank a considerable swelling which had been there some time, and had continued to augment from day to day without any sign of inflammation. At the end of a month he opened the tumour, and let out a prodigious quantity of pus. The puncture cicatrised; but in six months' time a deep fistula had formed in it, which, every time the horse moved, ejected a stream the size of the finger of white grumous pus. Notwithstanding it was twice laid open, the fistula would not heal, and the horse sank. Pus was found effused in the abdomen. The right kidney was four times its natural magnitude. Its pelvis, greatly distended, contained about three pints of grumous pus, communicating outwards through an opening in the posterior border of the kidney, which led into the fistula that had formed between the peritoneum and psoas muscles. The left kidney was larger than common, and its pelvis was distended with nearly a quart of limpid urine. The bladder, shrunk and thickened in its coats, contained but very little urine, and that sedimentous."

Cystitis.

Inflammation of the urinary bladder is due to causes very similar to those which induce nephritis. I have seen this disease as the result of the internal administration of cantharides. It is attended with serious complications in the shape of irritation of the intestine, and even nephritis.

Symptoms.—The mouth and fauces, and indeed the whole of the alimentary canal, being excessively irritated or inflamed, the buccal membrane is red, and there is considerable difficulty in swallowing. Dogs vomit, and efforts of a similar nature are made by horse and ruminants. The genito-urinary organs are very much affected; sometimes there is diuresis, at others, strangury; the testes are drawn up close to the inguinal canal. In all animals there appears to be a certain degree of sexual excitement. The urine is voided with difficulty and pain, as it is irritating and burning; it is highly albuminous; the fæces are covered with mucus and mixed with blood. At first the animals appear excited, and soon prostration of strength supervenes; cold sweats bedew the body; there are muscular twitchings, paralysis of the hind quarters, and death.

Post-mortem appearances.—The intestinal tube and genito-urinary apparatus are congested or inflamed. The kidneys may sometimes appear perfectly healthy, but the lining membrane of the bladder is always reddened. There are ecchymoses and even spots of ulceration in the intestine.

Treatment.—Mucilaginous and albuminous draughts, linseed tea, a strong emulsion of gum arabic, white of eggs, are all very useful. Carnivorous animals should be excited to vomit. Emollient clysters are of great service. Oleaginous draughts are to be avoided, as oil dissolves the cantharidine, and favours its absorption.

Lithiasis—Gravel—Urinary Calculi.

The deposit of solid elements from the urine in the form of concretions in different parts of the urinary apparatus, occurs not unfrequently in the lower animals. To this disease the term 'lithiasis' has been applied, from the Greek λιθος, a stone.

Causes.—The state of knowledge on the subject of lithiasis in the lower animals is not so advanced as to enable us to say much as to its causes. We know that the urine becomes charged with principles likely to crystallize or induce crystallization in the living body. The principles are derived from the food and water. Accordingly, we find that calculous diseases are enzootic, and connected probably with peculiarities of soil which lead to the waters of a district becoming specially charged with salts of lime, magnesia, &c. Certain manures are apt to favour the development of the disease, and especially the phosphatic deposits. In order to acquire an accurate knowledge on this subject, it is essential to study the chemical constitution of calculous concretions, and of the food, water, soils, and manures used in the districts where they occur. As yet the most accurate information obtained we owe to a very distinguished German veterinary surgeon, Fürstenberg, who wrote in 1844, about the same time that Professor Morton published his very interesting and useful work on "Calculous Concretions."

Fürstenberg has shown that there is a wide difference between the urinary calculi of herbivorous and of carnivorous and omnivorous animals. In the herbivorous he found the inorganic compounds of these concretions to be—

1. Carbonate of lime.
2. Carbonate of magnesia.
3. Oxalate of lime.
4. Silicic acid.
5. Phosphate of lime.
6. Ammonio-phosphate of magnesia.
7. Sulphate of lime.
8. Carbonate of iron.
9. Oxide of iron and manganese.

In carnivora and herbivora Fürstenberg found an excess of—

1. Ammonio-phosphate of magnesia.
2. Phosphate of lime.
3. Carbonate of lime.
4. Silicic acid.
5. Oxalate of lime.
6. Oxide of iron.

The inorganic principles of urinary deposits in all animals are mucus, a trace of fat, fibrin, particles of straw, &c.

In carnivorous animals uric acid and its salts are in excess, as well as cystin.

Fürstenberg remarks that the carbonate of lime met with in such enormous quantities in the urinary calculi of herbivora is due to the peculiar nature of the food of these animals. Lime is combined with various vegetable acids in many plants, and the carbonate may often be developed in the animal body.

The carbonate of magnesia is found in much smaller quantity in the urinary calculi of herbivora, and the phosphates of the same bone are also comparatively rare in them. The next most important constituent of these concretions in vegetable feeders is the oxalate of lime. Silicates are derived from water, and are especially found in the calculi of cattle and sheep.

It is in animals living partially or entirely on animal food that we find the ammonio-phosphate of magnesia, and the phosphate of lime building up concretions in the urinary apparatus.

To favour the formation of urinary calculi, the urine must be alkaline, and the materials are most readily deposited in conditions in which they are difficult of solution, or easily crystallized. A nucleus usually exists, and this may be simply composed of mucus or saline materials accidentally solidified, or foreign substances introduced into the urinary organs. In female animals, bits of stick, straw, wire, stone, &c., have been found to constitute such nuclei.

Urinary calculi are classified, according to their position, into (*a*) renal, (*b*) ureteral, (*c*) vesical, (*d*) urethral, (*e*) preputial; and lastly, (*f*) the deposit in the form of gravel.

(*a*) *Renal calculi* are lodged in the substance of one or both kidneys. They are usually single and large in the horse, and occur more frequently in this animal than in any other. They are of a brownish white, brown, and sometimes bluish colour; of irregular, ovoid, or nearly spherical shape; often nodulated, and always more or less rough, owing to the irregular deposition of the carbonate of lime. They are lodged in cysts, with firm parietes, and containing a quantity of thick urine. They have a strong urinous odour when first removed from the kidney. On cutting them in halves, the materials are found deposited in layers, which are more or less distinctly seen. In cattle calculi are found with a surface of a bright metallic lustre. These calculi occur in considerable numbers, and vary in size from a millet seed to a pea.

Fürstenberg furnishes us with several analyses of renal calculi in different animals.

Renal Calculi of the Horse.—(*Fürstenberg.*)

	1.	2.	3.	4. Corral form.	5. Round form.		6. Round form.	7. Laminated form.	8. Sedimentary form.
Specific gravity	2·263	2·241	2·121	2·283	2·194	...	2·193	1·918	1·6
					Centre of stone.	Surface.			
Carbonate of Lime	84·20	69·4	85·90	41·30	78·46	73·24	38·45	40·57	89·40
Carbonate of Magnesia	1·56	9·1	5·20	11·04	4·66	5·37	38·29	16·28	3·35
Oxalate of Lime	5·31	6·5	Trace.	28·46	15·11	17·22	14·49	...	...
Phosphate of Lime	...	...	...	7·03	...	...	...	...	...
Chloride of Calcium	...	Trace.	...	...	...	...	...	...	...
Sulphate of Lime	...	Trace.	...	...	...	...	...	...	...
Organic material	6·05	5·5	7·70	10·37	0·56	2·92	7·65	40·72	4·35
Water, Iron, and loss	2·88	9·5	1·20	1·80	1·21	1·25	1·12	2·43	2·90
	100·00	100·0	100·00	100·00	100·00	100·00	...	100·00	...

Renal Calculi of Ass and Ox.

	Ass.	Ox.	Ox (with pearl-like lustre.)	Ox (with metallic lustre.)	Ox (of white colour.)		Ox (small grey calculi.)
Specific gravity	2·177	1·76	2·109	2·301	2·306	2·308	1·109
Carbonate of Lime	88·69	74·81	78·18	84·8	91·16	92·38	11·09
Carbonate of Magnesia	3·68	12·57	10·01	10·0	1·93	4·95	6·81
Oxalate of Lime	...	...	...	...	...	...	7·01
Ammonio-phos. of Magnesia	...	...	...	...	...	...	39·28
Phosphate of Lime	...	...	...	...	...	...	16·59
Carbonate of Iron	...	...	...	0·6	...	...	...
Organic matter	4·49	10·82	7·09	1·6	1·47	0·24	13·07
Water and loss	3·14	1·80	4·72	3·0	5·44	2·43	6·15
	100·00	100·00	100·00	100·0	100·00	100·00	100·00

Renal Calculi.

Sheep.—(Fürstenberg.)		Dog.—(Lassaigne.)	
Specific gravity............	1·355		
Silicic Acid........	42·24	Uric Acid....................	58·0
Carbonate of Lime..........	21·21	Ammonia.....................	30·8
Carbonate of Magnesia.....	7·07	Phosphate of Lime.........	10·1
Organic matter..............	27·64	Oxalate of Lime...........	1·1
Water, and a trace of Iron	1·84		
	100·00		100·0

Renal calculi do not usually give rise to symptoms by which their presence may be diagnosed. Attacks of colic are apt to occur, and sometimes there is tenderness of the loins, discharge of blood, and sabulous matter with the urine. The majority of renal calculi discovered have been found by men engaged in slaughtering horses or in dissecting-rooms. I need scarcely say that, under such circumstances, it is not necessary to consider any method of treatment.

(*b*) *Ureteral Calculi.*—Small calculi formed in the kidneys, pass into the ureters, and then give rise to excruciating relapsing colic. It is owing to a calculus becoming lodged in one of the ureters that we find the accumulation of urine in the pelvis, of kidney, and atrophy of the latter organ, especially in the pig.

(*c*) *Vesical Calculi.*—There have been remarkable instances of enormous calculi lodged in the bladder, and which have occasioned very slight inconvenience during the lifetime of an animal. Other stones, much smaller in size, have a tendency to press backwards against the mouth of the bladder, and induce retention of urine. In these cases animals have an awkward gait; they keep their hind limbs apart, and often try to void urine. The contents of the bladder are sometimes discharged very suddenly from displacement of the stone, and a state of fulness of the organ. Symptoms of colic, the discharge of urine which deposits a thick sediment, the occasional discharge of blood, are all symptoms of stone in the bladder. The diagnosis is rendered certain by examining the bladder per rectum, when the presence of a stone is readily ascertained, or by sounding with a metallic instrument. Such a sound is used in female animals, though even for horses a flexible metallic instrument has been devised by Mr Taylor of Nottingham.

In all male animals the urethra must be opened over the ischiatic notch. The operation is a very simple one, and is usually attended with success. The catheter being passed, an incision is made in the middle line into the urethra, and with the aid of a pair of forceps, and sometimes of a dilator, the stone is removed.*

In the mare, lithotrity, or crushing of the stone, has been resorted to with success. The urethra should be dilated with an instrument devised for the purpose, or in some cases it has been found necessary to make an incision into the urethra.

(*d*) *Urethral Calculi* are frequently seen in male animals, and are especially common and fatal in rams, in consequence of their not passing readily through the vermiform appendix. The calculi of the urethra pass from the bladder and lead to symptoms of retention, such as I have described at page 36. That the difficulty of voiding urine is due to a calculus in the urethra, is ascertained by examination of the penis.

In sheep, urethral calculi often occur in certain districts, as on the Cotswold hills. The affected animals pant and refuse food, they grunt, attempt to urinate, are very restless, alternately rise and lie down, and are very dull and listless. The symptoms become more violent, abdominal pains increase, the irritative fever is very marked, and the animals

* See the *Veterinarian's Vade Mecum.*

Vesical Calculi.—(*Fürstenberg.*)

	Horse.					Ass.			Ox.
	1. Yellowish white calculi.	2. Brown calculi.	3. Brown calculi.	4. White hard calculi.	5. Sedimentary form.	6. Yellowish brown.	7. Yellowish white.	8. White hard calculi.	9.
Specific gravity	2·231	2·104	2·107	2·245	2·076	2·213	1·767	2·257	1·265
Carbonate of Lime	87·10	83·25	61·55	85·03	84·30	69·90	67·75	80·3	21·48
Carbonate of Magnesia	3·63	5·73	8·97	3.62	8·34	6·75	9·93	15·5	7·60
Oxalate of Lime	2·10	2·60	17·57	...	...	4·44	10·25	Trace.	...
Phosphate of Lime	...	...	4·32	5·81	...	4·37	...	...	...
Ammonio-phos. of Magnesia	...	...	...	...	...	...	...	...	...
Silicic Acid	...	...	...	...	...	...	..	...	47·26
Uric Acid	...	..	...	...	...	...	...	...	...
Organic matter	5·45	6·67	5·95	4·21	5·95	12·75	10·95	2·9	21·29
Water and loss	1·72	1·75	1·64	1·33	1·41	1·79	1·12	1·3	2·37
Iron	Trace.								
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

	Sheep.								
	10. White rough calculus.	11. Cretaceous.	12. Black.	13. Sedimentary form.	14. Sedimentary form.	15. Sedimentary form.	16. Yellowish white form.	17. Yellowish white form.	18. White angular variety.
Specific gravity	1·467	1·391	1·326	1·138	9·576	1·451	1·463	1·475	1·601
Carbonate of Lime	Trace.	0·95	14·15	10·22	2·07	Trace.	4·40	2·80	3·80
Carbonate of Magnesia	...	...	...	...	...	...	...	...	...
Oxalate of Lime	...	...	...	...	...	...	...	...	..
Phosphate of Lime	4·32	1·26	4·19	9·48	11·36	Trace.	9·84	...	8·17
Ammonio-phos. of Magnesia	81·56	91·76	74·02	70·90	76·52	91·32	76·13	88·35	81·56
Silicic Acid	...	...	...	...	..	...	...	...	...
Uric Acid	...	...	...	...	...	...	3·00	...	...
Organic matter	2·40	1·32	2·83	2·07	1·38	1·34	2·53	1·50	2·80
Water and loss	8·72	4·71	4·81	7·33	8·67	7·34	4·05	7·35	3·67
Iron									
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

die. In a number of cases spontaneous recovery is noticed, and this owing to the urethral calculus finding its way through the penis above the vermiform process. This accident in rams renders them useless for breeding purposes.

URETHRAL CALCULI *analysed by Fürstenberg.*

Brown variety (Horse.)		Greenish calculi with metallic lustre in Cattle.	
Specific gravity	2·203	Specific gravity..............	3·122
Carbonate of Lime	74·93	Carbonate of Lime	79·80
Oxalate of Lime....	2·76	Carbonate of Magnesia	8·76
Phosphate of Lime	0·25	Carbonate of Iron............	0·85
Carbonate of Magnesia.....	10·91	Silicic acid.....................	0·76
Organic matter...............	9·51	Organic matter................	2·13
Water and a trace of Iron	1·64	Water and loss...............	8·42
	100·00		100·00

In all cases of urethral calculi the treatment consists in cutting down on them and removing them.

(*e*) *Preputial Calculi.*—These concretions occur sometimes in horses, but much more frequently in pigs. They are ovoid in shape; in the horse from two to three inches in length, and about one in thickness; in the pig they vary from a hazel to a walnut. They are rough on their surface.

PREPUTIAL CALCULI *analysed by Fürstenberg.*

HORSE.		PIG.		
Specific gravity.........	2·103	Specific gravity......	1·348	1·410
Carbonate of Lime.....	70·94	Ammonio-phos. of Magnesia.......	88·65	90·14
Calculate of Lime......	13·13	Phosphate of Lime..	1·28	Trace.
Phosphate of Lime.....	4·74	Carbonate of Lime..	0·78	Trace.
Sulphate of Lime.......	0·17	Organic matter	2·19	2·58
Carbonate of Magnesia	0·32	Water and loss	7·10	7·28
Organic matter	9·15			
Water, and a trace of Iron.............	1·55			
	100·00		100·00	100·00

Until these calculi have attained the sizes just indicated, they endure no inconvenience, but then they cause stranguary. The sheath must be examined, the stones dislodged, and the parts greased with oil or lard.

Small calculi occasionally form on the hairs growing from the prepuce of the ox, or on the wool of the abdomen of the sheep. These calculi are small, sometimes numerous, and may offer a mechanical impediment to the protrusion of the penis from the prepuce.

In cattle, these calculi have a specific gravity of 1·325, and contain—

Ammonio-phosphate of magnesia, . . .	51·63
Oxalate of lime	11·15
Carbonate of lime	2·40
Mucus and hairs	27·78
Water and loss	7·04
	100·00

The calculi on the wool around the prepuce of sheep have a specific gravity of 1·343, and have been found by Fürstenberg to contain—

Ammonio-phosphate of magnesia . . .	89·05
Carbonate of lime	3·45
Organic matter	4·56
Oxalate of lime	(a trace)
Water	2·94
	100·00

(f) Gravel.—By this name a disease is known, which consists in the discharge of the material composing calculi, but in the form of sabulous matter. It is a condition that has been especially witnessed amongst horses and pigs, but it may occur in other animals. The deposit is detected in the

discharged urine, and there are usually symptoms of irritation of the bladder. Animals affected with this disease cannot thrive, and attract special attention from making frequent attempts to discharge urine. In the horse, the deposit consists of mucus, carbonate of lime, and magnesia, whereas in pigs it is composed of mucus, crystals of ammonia, and phosphate of magnesia.

The treatment of gravel may necessitate the operation of urethrotomy, and washing or scooping out of the earthy sediment from the bladder. In all recent cases, lithontryptics, viz., internal remedies to dissolve the deposit, should be used, such as hydrochloric acid. Horses should be allowed demulcent drinks in abundance, so as to relieve the local irritation. Such demulcent draughts may consist of decoctions of linseed or simple mucilage.

CHAPTER II.

THE SKIN AND ITS APPENDAGES.

Skin—Its component parts.—Cuticle or epidermis, true skin or corium.—Structure of epidermis.—Structure of true skin.—Difference in animals.—Blood-vessels and nerves of skin.—Glands of skin, sebaceous or oil glands; sudoriparous or sweat glands.—Functions of skin.—Secretion; insensible and sensible perspiration.—Sebaceous secretion.—Smearing-stuffs.—Absorption.—Penetration of unctuous remedies.—The endermic method of using medicines.—Resistance by the skin to the introduction of materials in watery solutions.—Poisoning sheep with dipping-mixtures.—Hair and wool.—Hair-follicles.—Varieties of wool.—Classification of the breeds of sheep according to the character of the wool.—Long-woolled, intermediate, and short-woolled.—The value of keeping the skins of animals clean.—Sheep baths.—Sheep-shearing.—The practice of clipping and trimming horses.—Cold, tepid, and warm baths.—The hot-air bath.—Its application to training purposes.—Its uses in medicine.—Clothing for animals.—Diseases of the skin and hairs.—Confusion on the subject in English works.—Classification of skin diseases.—General remarks on their nature and treatment.—Diseases arising from general causes.—Erythema.—Excoriations.—Saddle galls.—Cracked heels.—Erysipelas.—Urticaria.—Lichenous eruption.—Prurigo.

THE surface of an animal's body is covered by a skin which acts as a most effectual protecting structure, preventing the penetration of noxious materials, and, at the same time, allowing of the escape of effete matters in the secretions constantly exhaling from it. As a protecting covering, we find the skin on its surface covered with a layer of horny scales, the presence of which, however, does not interfere with the important functions of elimination of waste matters from the body, nor with the tactile sensibility which renders the skin so useful and so safe a shield to the delicate structures it clothes.

The skin is, therefore, divided into two parts—its outer covering, scarf skin, cuticle or epidermis, and its vascular, sensitive, and secreting portion, the true skin, cutis vera or dermis. Connected with the skin are certain accessory textures or appendages, viz., hair, wool, horns, nails, claws, hoofs, and feathers.

The cuticle or epidermis is that layer of tissue which may be obtained from any skin by macerating it. If a blister is applied, the cuticle is raised from the true skin, and in various diseases, such as epizootic aphtha, we notice that the lymph raises the cuticle from the true skin wherever the eruption occurs. This cuticle is composed of layers of cells which, when recently formed, are round, nucleated, elongated, or pressed into polygonal shapes. The deepest layers of cuticular cells are the softest, and the superficial ones are flattened, hard, horny, and translucent. They are very closely packed, and adhere firmly together, until, by progressive addition of scales in the deeper layers, the superficial ones become useless, get detached, and thrown off in the shape of dandruff, or the white dusty powder which the groom obtains in such quantities in dressing a horse. The cells undergo no further change, from their first formation to the time they are shed, than drying, and they imbibe water and regain their opacity very readily. This is seen if the hand is dipped in water for any length of time.

From the deeper layers of cuticular cells being much softer than the superficial, the cuticle has been divided into two portions, the deeper of which, owing also to its perforated aspect, wherever the papillæ of the skin pierce it, has been called rete mucosum. It is in this deep layer that we can observe the pigment, or colouring matter, which renders an animal's skin black. The pigment is lodged in the form of dark granules in the cuticular cells.

Not only does the cuticle penetrate between the folds and prominences or papillæ of the skin, but tubular prolongations enter the ducts of the glands of the skin and the hair-follicles, so that the whole surface of the body is effectually enclosed by the cuticle.

Speaking of the pigment of the skin, Mr Erasmus Wilson says: "Colour of the skin has reference to energy in its action; thus, in the tropics, where light and heat are in excess, and the skin is stimulated by these agents to vigorous action, colour is abundant and intense; while in the frigid north, where both are wanting, the lungs, the liver, and the kidneys relieve the skin of part of its duties. The same observation relates to summer and winter: under the enlivening warmth of the summer sun, with its flood of light, exposed parts of the fairest skin become brown; that is, their pigment-forming energy is increased. But the winter's scarf-skin is white and pigmentless, and restores the fair complexion when the summer's scarf is worn away. The law of colour, as relates to man, is, therefore, the same as that which sheds its influence over the vegetable world: the winter's flower and the first blossom of spring are cold and pigmentless, while the warm hues of the dahlia are borrowed from the bright sun of summer and early autumn."

The true skin—cutis vera, corium, or dermis—is a dense layer of connective or delicate areolar tissue, highly endowed with the properties of feeling and secretion, and serves as the bed or matrix for the hairs, &c. Its structure is continuous with all tissues beneath it through the connective-tissue. It is firmly attached over the trunk, neck, and face in quadrupeds, to a skin muscle, *panniculus carnosus,* which may be seen violently to contract when any parasite or other object irritates the skin. There is also a deep layer of fat, *panniculus adiposus*, deepest in young animals, which raises the skin,

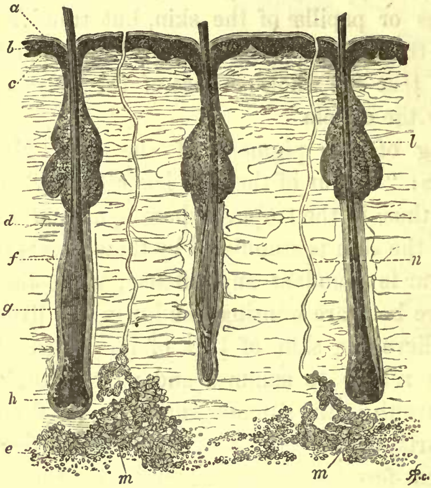


Fig. 166.—(MÜLLER.)—Section of horse's skin enlarged 30 diam. *a*, Epidermis; *b*, Rete mucosum, containing the pigment; *c*, Papillæ; *d*, True skin; *e*, Connective tissue, containing fat; *f*, Stem of hair; *g*, Hair-follicle; *h*, Hair-bulb with papilla; *l*, Oil or sebaceous glands; *m m*, Sweat glands; *n*, Duct of a sweat-gland.

and is the cause of the rounded forms so much admired. The skin varies in thickness in different animals and in different parts of the same animal. It is thin and elastic over the belly, thick and less yielding on the back. Where the skin has to cover unyielding structures, it is tightly bound down, but over the greater part of the body it is loose, and in parts thrown into folds. In a healthy animal, even a thick skin is supple and yielding. It is loose and elastic in the young ox that is laying on flesh without difficulty; but in the horse, ox, or other animal out of condition, or suffering from disease, the skin becomes tight and unyielding, it cannot be raised, and the animal is declared 'hidebound.'

The difference in the thickness of the skin of different animals depends in a great measure on the thickness of the corium, and we find that it is composed of delicate white and yellow fibres, which interlace each other in every direction, and are packed closely. Blood-vessels and nerves ramify through this bed of interlacing fibres, and the whole structures on the surface are found disposed in eminences or papillæ and folds, or rugæ, so as to extend the surface over which the cuticle is formed. When the blood-vessels and nerves approach the surface, they are disposed in a horizontal plexus, from which branches pass up perpendicularly into the papillæ. Lymphatics also abound in the substance of the skin.

In the open structure of the deeper layer of skin, clumps of fat, the coiled sweat-glands and hair-follicles are seen. As we approach the surface of the skin, we see principally the densely-packed vessels and fibres of the skin, with the straight slender ducts of the sweat-glands, the ascending hairs, and the sebaceous glands, which open into the hair-follicles. A careful examination, however, indicates also the existence of an abundance of muscular tissue disposed in delicate strips, connected obliquely with the hair-follicles so as to lead to changes in the position of the hair on the surface.

The glands of the skin merit special attention. They differ considerably in different domestic quadrupeds, and have been carefully studied by Gurlt and Ercolani. The observations of the first were made in 1835, and of the second in 1854.

The glands may be classified under two heads—the tubular, which include the sweat-glands and glandular masses in different parts of the bodies of animals; the saccular, or sebaceous glands.

The tubular, or *sweat-glands*, consist in fine tubes coiled singly into bulbs of a reddish colour, which is due to their vascularity, and lodged in the deeper part of the skin. From the deep coil the tube passes up to the cuticle, through the cells of which the secretion is forced, and a passage is made which appears twisted like a corkscrew in some animals, and in others, as in the dog, the opening is funnel-shaped.

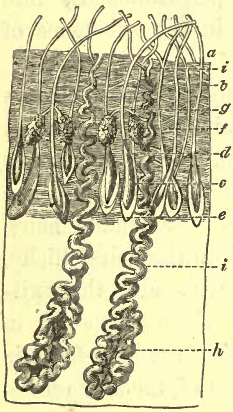


Fig. 167.

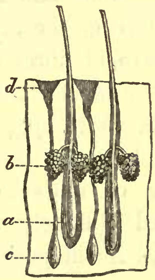


Fig. 168.

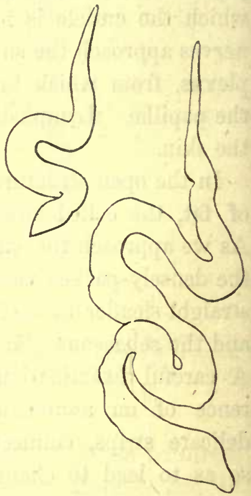


Fig. 169.

Fig. 167.—(Gurlt.)—Section of sheep's skin. *a*, Epidermis; *b*, True skin; *d*, Bulb of wool; *e*, Stem of wool; *f*, Hair-follicle; *g*, Oil-glands; *h*, Sweat-glands; *i i*, Their ducts.

Fig. 168.—(Gurlt.)—Skin of dog showing the hair-follicles and hairs. *a*, The oil-glands; *b*, The ovoid and elongated sweat-glands, *c*, with their funnel-shaped openings, *d*, at the surface.

Fig. 169.—(Ercolani.)—Sweat-glands of the ox, showing the simplicity of their forms.

In some animals each sweat-gland is a tube but slightly coiled, and more open than in the typical form just mentioned. Indeed, in the ox they have been described as simple oval capsules; but, as shown in the annexed engravings, they attain a certain complexity in different parts, becoming flexuous and considerably elongated. The sweat-glands are largely developed in the horse and sheep, but much smaller in the dog. They are, as a rule, colourless and translucent, except in the scrotum of the horse, where they contain a black pigment.

Between the digits of the sheep is a canal which consists in an inflexion of the skin. It is called the biflex or inter-digital canal, from its position and from the peculiar curve it takes. Its opening is situated anteriorly, above the cleft of the hoof, and a small probe may be inserted downwards and backwards a short distance, where it is stopped, owing to the canal turning upwards and forwards, and terminating in a blunt extremity or cul-de-sac. If a section of the lining of this canal is examined, it is found studded in its deeper parts by yellow bodies, which prove to be coiled tubular glands, containing a yellow secretion. None of the glands present the characters of sebaceous follicles, and Ercolani says that this yellow secretion, mixed with the sebaceous matter discharged through the hair-follicles, loses much of its yellow tint and tenacity. It becomes diffluent, and does not obstruct the canal.

A group of sweat-glands, emitting a peculiar secretion, is also seen on the face of the sheep a little below the eye, in a depression which is readily felt. In the ewe, other masses of sweat-glands, yielding a peculiarly unctuous secretion, are seen on either side of the udder, between the folds of the skin.

In the mare, a deep layer of sweat-glands is seen, where the skin merges into the mucous membrane over the vulva.

The *sebaceous glands* are simple or compound saccular glands, consisting in vesicular dilatations which communicate with a general reservoir from which the secretion is discharged into a hair-follicle, or occasionally on the surface of the skin through a single aperture. These glands are very fully developed in the dog, the sheep, and horse. Ercolani has noticed the coalescence of two or more of these saccular glands in the dog and sheep.

Fig. 170.

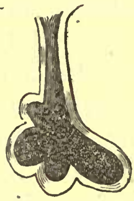


Fig. 171.

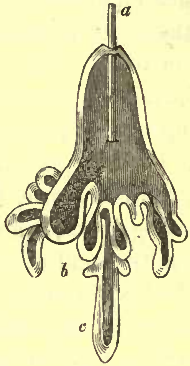


Fig. 172.

Fig. 170.—(Ercolani.)—Simple oil-glands from near the foot of the sheep.
Fig. 171.—Compound oil-gland from the skin of the mammæ in the ewe.
Fig. 172.—*a*, Stem of hair; *c*, Hair bulb and follicle; *b*, Sebaceous glands.

So far, then, the skin is seen to consist in a vascular and sentient membrane, provided with myriads of glands for the purpose of secretion, containing fine networks of blood-vessels and lymphatics for absorption, and, at the same time, protected by layer over layer of horny scales, which especially prevent the indiscriminate penetration of substances into the body through its surface.

The secretion by the skin is abundant from both kinds of glands. The sweat-glands have been estimated in man as not less than 2,300,000 in number, and the length of each

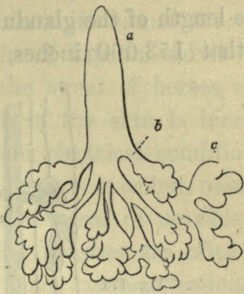


Fig. 174.

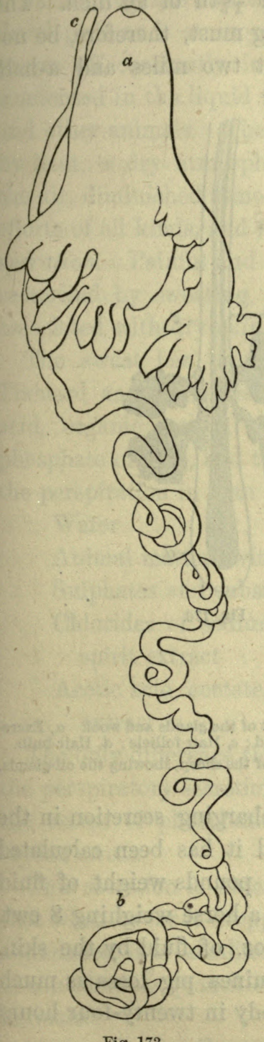


Fig. 173.

Fig. 173.—(Ercolani.)—*a*, Compound sebaceous gland from the skin of dog's scrotum; *b*, Sweat-gland in the dog; *c*, Its opening.

Fig. 174.—*a*, Sebaceous gland from the skin of horse's scrotum; *a*, Duct of gland; *b*, Lesser ducts; *c*, Acini or glandular follicles.

tubular coil, when unravelled, about $\frac{1}{15}$th of an inch. The entire length of the glandular tubing must, therefore, be not less that 153,000 inches, or about two miles and a-half.

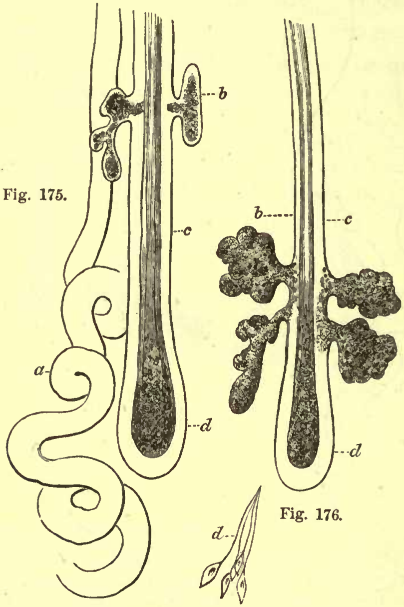


Fig. 175.

Fig. 176.

Fig. 175.—(ERCOLANI.)—Showing the arrangement of the glands and wool. *a*, Excretory duct of a sweat-gland; *b*, Oil or sebaceous gland; *c*, Hair-follicle; *d*, Hair-bulb.

Fig. 176.—Hair-follicle from the interdigital canal of the sheep, showing the oil-glands.

The sweat-glands are constantly discharging secretion in the form of *insensible perspiration,* and it has been calculated that a man thus loses nearly two pounds weight of fluid daily. It has been estimated that a horse weighing 8 cwt. loses, in 24 hours, about 14 lbs. 5 oz. of fluid by the skin. Milne Edwards has found that a Guinea pig loses as much as the twelfth of the weight of its body in twenty-four hours by cutaneous exhalation.

In the dog, the sweat-glands are very perfect and largely developed, and, strange to say, in this animal the sweat passes off constantly in the form of vapour, and is never condensed in the liquid form of the sweat of horses, cattle, and other animals. The secretion of the skin is increased by heat, a dry atmosphere, certain electrical conditions of the air, diminished atmospheric pressure, exertion, pain, and efforts of all kinds, and is then called *sweat* or *sensible perspiration.* Painful and debilitating diseases are often characterised by sweating, whereas many acute affections are associated with dry skin and checked perspiration.

The sweat has been analysed by a number of chemists. Thénard and Berzelius found in it water, acetic and lactic acid, organic matter, chloride of potassium and sodium, phosphate of lime, and traces of iron. Anselmino found that the perspiration in man contained in 1000 parts:—

Water	995·00
Animal matters with lime . .	·10
Sulphates and substances soluble in water	1·05
Chlorides of sodium and potassium, and spirit extract	2·40
Acetic acid, acetates, lactates, and alcohol extract	1·45

The only difference that Anselmino could detect between the perspiratory secretion of man and that of the horse, was, the excess of phosphate of lime and animal matter in the equine sweat.

This secretion is stated by all to be acid; but Colin found that when sweat is dropping off the surface of an animal in abundance, it is alkaline. Carbonic acid gas is thrown off in considerable quantities from the surface of the body in all animals.

Although, to all appearances, an animal in a quiet state does not appear to lose much by the skin, yet the secretion cannot be checked without danger to the animal. Such secretion serves the double purpose of purifying the blood and regulating the temperature of the body. If the skin is covered with an impermeable coating of tar or other material, death speedily results. The blood becomes poisoned, is unfit to support the functions of the nervous system, acquires a dark colour, and the animal dies as if suffocated. When death occurs under such circumstances, the intestines are found gorged with blood, the lungs congested, heart ecchymosed, air passages full of a frothy bloody liquid, and, in fact, all the lesions exist of an animal destroyed from the effects of a potent blood poison.

The sebaceous secretion which we find so abundant in the skin of the sheep, is destined to lubricate the surface of the skin and of the hairs. It protects the skins of our domestic quadrupeds from water and from contact with acrid liquids, such as urine, &c. It is characterised by a special odour peculiar to the animal in which it is secreted.

Esenbeck found that the sebaceous secretion in man contained—

Animal substances	358
Fatty matters	368
Phosphate of lime	200
Carbonate of lime	21
Carbonate of magnesia	16
Chloride of sodium, acetate of soda, &c.	37
	1000

The sebaceous secretion under ordinary circumstances is sufficient to protect the skins of animals, and especially the skins and fleeces of sheep, from the effects of excessive moisture. Farmers have, however, found that in wet climates an artificial grease may be applied with benefit to the skin, and for this purpose large quantities of smearing stuffs are annually sold, such as Gallipoli oil, tainted butter, tar and butter, &c.

In a sound condition the skin does not absorb. We can introduce medicines and poisons rapidly into the skin by first removing the cuticle by means of a blister, and this has been termed the endermic application of medicines. Greasy preparations may be rubbed into the skin so as to overcome the opposing influence of the compact layers of cuticular cells, and thus get to the vascular skin, and be absorbed. We notice beneficial results to follow the application of iodine over swellings, and this effect could only occur by absorption of the principle into the system.

It has been noticed at different times by physiologists, that substances in solution in water were not readily introduced into the system by cutaneous absorption, and yet medicinal baths have been recommended by physicians with great faith as to the introduction of their active principle into the blood of those bathing in them. Colin mentions, in his work on the "Physiology of the Domestic Animals," that the skin absorbs but feebly and slowly when its tissue is intact, and its epidermic covering is not destroyed. This structure may remain for long in contact with poisonous substances which have no chemical action upon it. Arsenious acid of baths in which sheep are immersed for whole hours never induces phenomena of poisoning.

I had occasion to perform a number of experiments on cutaneous absorption in 1858, with a view to determine if a dipping-mixture which killed 850 sheep out of a flock of 869 could produce such effects without being swallowed by the animals, owing to the negligence of those engaged in the dipping. The conclusion I arrived at, and in which I am supported by all recent experimenters, is, that substances dissolved in water are not absorbed through the skin.

Fortunately the skin does not absorb animal poisons as a rule, unless it is abraded. Some acrid matters destroy the cuticle, and induce inflammation of the skin, but usually the cuticle affords sufficient protection against the accidental introduction of noxious principles into the blood by the skin.

I have, in the next place, to consider the cutaneous appendages, and the first to notice is

HAIR.—The hairy covering of animals is continuous with the cuticle, and on the application of a blister, not only is the cuticle raised, but the hairs are drawn out of their follicles.

Hair is composed of a softer, medullary portion or pith, and a harder cortical layer. The medulla or pith is traced from near the point to the deepest part of the hair-follicle, where masses of spherical cells are seen to envelop a papilla

Fig. 177.

Fig. 178.

Fig. 179.

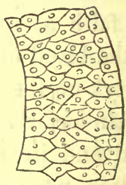


Fig. 180.

Fig. 177.—(REISSNER.)—A hair papilla, showing its relations with the hair bulb and lining of the hair follicle.

Fig. 178.—(REISSNER.)—Portion of stem of wool from the sheep, showing the imbricated scales of the cortical substance.

Fig. 179.—(REISSNER.)—Transverse section of a developing hair in its follicle; *e*, Outer sheath of the hair; *f*, Inner sheath; *h*, Stem of the hair.

Fig. 180.—(REISSNER.)—Transverse section of the inner sheath of the hair in the pig.

or vascular projection of the skin, from which, indeed, the hair is formed. The spherical cells, which constitute the root of the hair, may be seen continuous with the cells of the same shape in the epidermis, and which line the hair-follicle so as to form a sheath or *vagina pili* to the hair-bulb. The cells which advance from the thicker portion of the medulla, in the hair-follicle, become dry and flattened so as to form the hard, scaly, cortical portion of the hair; the margin of the latter, when examined by a good microscope, is always found to be imbricated, or, in other words, the cells are superimposed, but their edges are one beyond the other, as in the arrangement of tiles or slates on the roof of a house. It is by friction that, as the cells advance from the root, and become dry and detached, the hair grows thinner and thinner from the loss of cortical scales, and by this simple process the hair tapers to a point. The imbrication of these cells renders wool of great value for the manufacture of various fabrics. It is to the projecting serrated margins of the cells that fine waved transverse lines on the surface of the hair are due, and which are seen by the microscope.

The cells immediately beneath the imbricated scales are fusiform and flattened, so as to give rise to the fibrous appearance.

The colour of hair is due to pigment granules diffused between the cells, and which are sometimes confounded with little air-cavities, best seen in white hairs, and between the longitudinal fibres of the cortical substance.

It is a remarkable fact, that "notwithstanding the closest search, Laër was unable to discover any special pigment in the hair, although the microscopical examination of the cortical substance of differently coloured hairs,—that is to say, the existence of certain coloured molecules,—indicates the presence of a definite pigment. It is, however, well known that white hair is especially rich in air, and that to this circumstance it mainly owes its glistening colour. Laër has further shown, by numerous experiments on differently coloured hair, that the iron which is present, and to which Vauquelin had drawn attention, exerts no influence whatever on its colour."—(LEHMANN.)

The medulla or pith before mentioned is in some thin hairs entirely absent, or the spherical cells are scanty, and pressed into various shapes.

Mr Wilson says, "Although the central part of the hair of man is a loose pith, in which the original spherical form of the cells is more or less completely lost, yet in many animals this form is retained with the most exact precision, and such hairs appear to contain in their axes a very beautiful string of beads, rendered strikingly obvious, in dried hairs, by the emptiness of the cells. Such is the appearance of the very fine hairs of the hare or mouse. In thicker hairs from the same animals, there are two or three or more rows of cells, and the largest hairs, from the number of these rows, bear a resemblance in structure to an ear of maize. This is the chief modification which the pith of the hair undergoes in the animal kingdom, being more completely or less cellulated, and holding a greater or less proportion to the entire bulk of the hair; sometimes, indeed, as in some hair in my possession, from one of the deer tribe, the whole texture of the hair is cellular, the other two portions being condensed into a thin envelope. In the feather of a bird, which is a modification of hair, the white pith with its dense external covering is very evident in the shaft, while the quill is an illustration of the outer parts alone, the transparent puckered membrane, which is drawn out of the quill when first cut, being a single row of dried-up cells. In the growing feather, the contents of the quill would be found distinctly cellulated.

"The fibrous portion of hair is the source of its strength, and the degree of strength possessed by these delicate threads is almost beyond belief. 'A single hair from a boy eight years of age,' says Robinson, in his Essays on Natural Economy, 'supported a weight of 7812 grains; one from a man aged twenty-two, 14,285 grains; and the hair of a man of fifty-seven, 22,222 grains. Muschenbroeck found that a human hair, fifty-seven times thicker than a silk-worm's thread, would support a weight of 2069 grains, and a horsehair, seven times thicker, 7970 grains; a part of this extraordinary strength is undoubtedly due to the high degree of elasticity which it possesses. Weber found a hair ten inches long stretch to thirteen inches; and a hair stretched one-fifth returns to one-seventeenth of its original length.'"

The hair is found occasionally to change or lose colour with great rapidity, and the cause of this has always remained a matter of mystery. Mr Erasmus Wilson says, "I am little disposed to speculate on the *modus operandi* of this change of colour of the hair, but am content, for the present, to give a fitting place to the fact as it stands. The phenomenon may be the result of electrical action; it may be the consequence of a chemical alteration wrought in the very blood itself; or it may be a conversion for which the tissue of the hair is chiefly responsible. In any case, the following explanation, offered by an eminent French chemist, Vauquelin, I should feel inclined to discard, as partaking too largely of the coarser operations of the laboratory. 'We must suppose,' says the author in question, 'to explain the sudden change of the hair, that at the critical moment when Nature is in revolution, and when, consequently, the natural functions are suspended or changed in nature, that an agent is developed in the animal economy, and passing into the hair, decomposes the colouring matter. This agent must be an acid.'

"The rapid blanching of the hair derives an important illustration from the animal kingdom. Several of the animals which inhabit the polar regions are known to become white during the winter season, and among the most remarkable of these is the lemming. Sir John Ross remarks that, finding the lemming, like the polar hares which had been tamed and kept in confinement, preserve its usual colour during the winter, he placed one in the open air, on the first of February, when the thermometer stood at 30° below zero. The next morning, the fur of the cheeks, and a spot upon each shoulder, had become perfectly white. On the following day the hinder part of the body, and the flanks were of a dirty white hue, and at the end of a week, the animal was entirely white, with the exception of a saddle-shaped patch on the middle of the back. No other change ensued, although the poor animal was kept exposed to the cold until it perished. When the skin was examined, the white hairs were found to be much longer than those of the unchanged patch, the blanching being confined to that portion which exceeded in length the natural hairs. So that, when the white ends were cut off, the animal appeared to have regained, with very little alteration, its summer coat, and without any reduction in the length of its fur."

Kölliker first described the muscles connected with hairs, which had the power of inducing the elevation of these appendages. Mr Lister confirmed this discovery, and the arrangement of these muscles is well shown in the subjoined figure:—

Mr Lister says:—The annexed figure "is slightly reduced from a camera lucida sketch of such a section, made in a plane perpendicular to the surface of the scalp, and at the same time parallel to the sloping hairs. I find that such a plane always contains the muscles in their entire length, the reason of which will appear shortly. In this figure *d* is the corneous, and *e* the mucous layer of the epithelium; *b, b,* . . . . are the hair-follicles with their contained hairs, both have been more or less mutilated by the process of section; the second hair from the right being a short one, its bulb is seen: *c c* . . . are the sebaceous follicles, also more or less mutilated: a_1 a_2 . . . . a_6 are the muscles, which appear, under this very low power, merely as transparent streaks, and require a higher power to make out their tissue. The muscles are seen to arise in all cases from the most superficial part of the

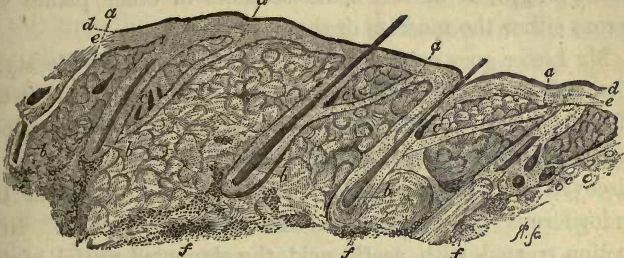


Fig. 180.

corium, and to pass down obliquely to their insertions into the hair-follicles immediately below the sebaceous glands. It will be remarked that the muscles are here all on the same side of the respective hair-follicles, viz., on that side towards which the hair slopes: and such I found in the examination of a large number of sections to be always the case. This is an interesting fact, as such an arrangement of the muscles is exactly that which is best adapted for erecting as well as protruding the hairs, which must be drawn by their contraction nearer to the perpendicular direction. That this erection as well as protrusion of the hairs does occur, I have proved by artificially exciting the state of cutis anserina upon my own arm and leg. Tickling a neighbouring part will often induce horripilation, and if the eye is kept on an individual hair at this time, it is seen to rise quickly as the skin becomes rough, and to fall again as the horripilation subsides. I have never seen more than one muscle to each hair-follicle in the scalp; and in order that a single muscle may by its contraction simply erect a hair, it must be placed in a plane perpendicular to the surface of the skin and parallel to the hair; this explains the fact before alluded to, that a section made in such a plane is sure to contain the muscles in their entire length, if at all, while sections in other planes cut across either the muscles or the hairs."

Mr Lister goes on to say, that "With regard to the statement of Henle, that muscular tissue exists in parts destitute of hairs, I have searched with diligence many good sections of both the palm and the sole, without having been able to discover any evidence of it on the exterior of either the sudoriferous glands or blood-vessels of these parts. In a section treated with acetic acid, the elongated nuclei of the internal coat of a small blood-vessel sometimes give it an appearance that might at first sight be mistaken for that of unstriped muscle; but this is an error easily avoided by care, and I cannot but agree with Kölliker in thinking that, in some way or other, his boiled preparations have led Henle into error.

"In order to verify Kölliker's statement that no unstriped muscle exists in connexion with the vibrissæ of mammalia, I examined the feelers of a cat. These large hairs extend far down into the tissues beneath the skin, and have a more complex muscular apparatus than the small hairs of the human skin. Bundles of muscles extend from the lower part of the gigantic hair-follicle obliquely upwards to the inferior aspect of the skin, and, in addition to these, there is muscle surrounding the large nerve that enters the base of each hair-follicle. These muscles were all of the striped kind, but extremely soft and extensile, and among the fibres were a number of very elongated nuclei, but I saw no distinct evidence of the admixture of unstriped muscle."

Development of Hair.—At the spot where a hair is to develop, a thickening is noticed. Here the epithelial cells accumulate in large numbers, and press on the hypertrophied portion of vascular skin which is to be the papilla. By the progressive accumulation of the cells, a deep recess is formed, which becomes the hair-follicle. From the vascular papilla, by this time fully formed, material is thrown out by which the cells are enabled to multiply, and, being pressed up in the follicle, find their way at last through the superficial layer of cuticle beneath which cells first began to accumulate. Thus the hair breaks its way through the solid epidermis, and is, as Virchow would express himself, the result of the *proliferation* of the deeper cells; or, in Dr Beale's phraseology, may be described as 'formed material' advancing, and in different stages of change, from the 'germinal matter' near the vascular papilla, to the corneous cortical layer and point.

In some animals, and especially in the domestic sheep, the hair is of singular fineness, and acquires properties well known to belong to it as wool. Sheep in a wild state have much hair, mixed with the wool, on their bodies, and it is only by careful management in breeding that the *kemps* or hairs do not deteriorate the fleeces of our Lincolnshire, Leicestershire, South Down, and other sheep. Wool grows from papillæ within follicles like ordinary hair, but is delicate and curly. Its softness is due not a little to the yelk secreted by the skin, and which amounts in weight to about half an unwashed fleece. Vauquelin has shown that the yelk is composed, Firstly, Of a soapy matter with a basis of potash, which formed the greater part of it; Secondly, A small quantity of potash; Thirdly, A perceptible quantity of acetate of potash; Fourthly, Lime, whose state of combination he was unacquainted with; Fifthly, An atom of muriate of potash; Sixthly, An animal oil, to which he attributed the peculiar odour of the yelk.

The yelk is alkaline, and dissolves in water like soap, so that a fleece containing much of it is readily washed in water. Shepherds know that if they wash a flock of sheep in a pool, the first animals immersed are not cleaned so rapidly nor so thoroughly as those that are placed in the water after a considerable amount of the yelk has been mixed with it.

The fleece varies considerably amongst different breeds of sheep, and a classification of the breeds has been adopted, based on the varying length of the wool. Thus we have 'long-woolled,' 'short-woolled,' and 'intermediate.'

Though we take the character of wool as the basis of a distinction in breeds of sheep, they are found to differ much in feeding qualities. Mr Lawes made an elaborate investigation into this subject, "comparing Hampshire and Sussex Downs, Cotswolds, Leicesters, cross-bred wethers, and cross-bred ewes, giving forty of each kind oil-cake, hay, and swedes during five or six months, and weighing food and increase; and the following, stated generally, are the results arrived at:—

"Of the six lots experimented upon, the Cotswolds gave by far the largest average weekly increase per head; indeed about half as much more than either the Sussex, Leicester, or cross-bred sheep, and nearly one-fourth more than the Hampshires, which were the second in order of rate of increase per head per week.

"Leaving the point of the amounts of food consumed, per head, the variations in which, as far as the dry foods are concerned, depended on the varying original weights of the different lots; and looking only to the amounts consumed per 100 lbs. live weight of animal, or to produce 100 lbs. of increase, it was found that, although the oilcake and clover chaff were in each case given in proportion to the original weights of the sheep, yet the result was that, taking the average throughout the entire period of the experiment, the Leicesters had less of these dry foods in relation to their average weight than any of the other lots, and more particularly than the Hampshires, Sussex Downs, and Cotswolds. Notwithstanding this, however, the Leicesters also ate less in relation to their average weight of the turnips, which they were allowed *ad libitum*, than any of the other breeds. This less consumption of total food in relation to their weight by the Leicesters might be in their favour, if the result were that they consumed also less for the production of a given amount of increase. But the fact was, that, in relation to the increase they yielded, the Leicesters consumed quite as much food as the cross-breds, and notably more than the Cotswolds. Leicesters, cross-breds, and Cotswolds, however, all gave a larger amount of gross increase for a given amount of food consumed than either the Hampshires or the Sussex sheep."*

In the annexed table the classification of breeds is given, in which the weight and colour of different kinds of sheep, and the weight and value of their fleeces are noticed. The table has been principally drawn up with the aid of Professor John Wilson's Essay on the various breeds of sheep in Great Britain, published in 1855:—

* Morton's *Farmer's Calendar.*

Table showing the Classification of the Breeds of Sheep, and Striking Peculiarities of each Breed.

Breeds.	Weight of Sheep.	Colour.	Horns.	Weight of Fleece.	Price of Fleece. Per Pound.	Remarks.
LONG-WOOLLED.						
Lincolnshire.	At 1 year, 80–100 lbs.	White.	None.	Lowland, 10 lbs. Upland, 8 lbs.	Wethers, 12½*d.* Hogs, 13*d.*	Crossed with the Exmoor, the South Down, and the Bampton, but chiefly with the Leicester. The wool of the Lincolnshire breed is white and silky.
Leicesters	At 1 year, 80–100 lbs.	White.	None.	7 lbs.	Wethers, 12*d.* Hogs, 12½*d.*	Beneficially crossed with the Cotswold.
Cotswold	At 1 year, 100 lbs.	White.	None.	7–8 lbs.	Wethers, 12*d.* Hogs, 12½*d.* to 13*d.*	The ewes are prolific, good mothers, and the lambs are covered with a thick, close fleece. The wool produce is an important item in a Cotswold flock.
Romney Marsh.....	At 2 or 3 years, 120–140 lbs.	White.	None.	8 lbs.	13*d.*	Soft, rich wool, finer in quality than the Leicester. In Kent the lambs are generally shorn, therefore there are very few hogs.
Black-faced Scotch	At 3 or 4 years, 60–65 lbs.	Black face and fore legs.	Horned.	3 lbs.	8*d.* to 9*d.*	The wool is lessened in value by the kemps or hairs which are mixed with it. The practice of smearing is general in the Highlands, increasing the weight but reducing the price of the fleece.
Exmoor	At 4 or 5 years, 75 lbs.	White.	Horned.	4–5 lbs.	Wethers, 12*d.* Hogs, 12½*d.*	A pure mountain breed, indigenous to the forest of Exmoor, and its vicinity.
Devonshire South Hams.............	At 2 years, 100–120 lbs.	Brown face and legs.	None.	9 lbs.	9*d.* in the grease.	This breed is found in South Devon, from the vale of Honiton to the borders of Dartmoor. Smearing practised much in the hill districts.

BAMPTON	At 2 years, 120–150 lbs.	White.	None.	7 lbs.	Wethers, 12½*d.* Hogs, 13*d.*	An old but nearly extinct breed, met with in Devonshire and West Somerset.
HERDWICKS	At 4 or 5 years, 50 lbs.	Face and legs mottled.	None.	3–4 lbs.	8*d.* to 9*d.*	In the mountain districts of Cumberland and Westmoreland.
INTERMEDIATE.						
DORSET	At 2 years, 80–100 lbs.	White.	Horned.	6 lbs.	13*d.* Lambs' wool, 16*d.* to 18*d.*	An old breed, remarkable for the fecundity of the females.
CHEVIOTS	At 3 years, 70–80 lbs.	White.	None.	5 lbs.	Ewes and wethers, 12½*d.* to 13*d.* Hogs, 13½*d.* to 14*d.*	A small-haired wool of medium length. The breed is found throughout Scotland, and in the border counties of England
RADNOR AND WELSH SHEEP	At 4 or 5 years, 30–40 lbs.	..	Some with horns and others not.	1–1½ lb.	12½*d.* to 13½*d.*	The Welsh breeds are hardy, active, small, and yielding little wool, which is kempy.
SHORT-WOOLLED.						
SOUTH DOWN	At 12 months, 80 lbs. At 2 years, 108–120 lbs.	Brown legs.	None.	3–4 lbs.	13*d.* to 14*d.*	Produces the most valuable of our native wools.
HAMPSHIRE DOWN	At 12 months, 80–100 lbs.	Brown face and legs.	None.	3 lbs.	13*d.* to 13½*d.*	Met with generally in Wilts, Hants, and Berks.
NORFOLK DOWN	..	Black face and legs.	Horned.	..	12½*d.* to 14*d.*	A rapidly declining breed.
SHROPSHIRE DOWN	At 1 year, 80–100 lbs.	Face and legs grey or spotted.	None.	7 lbs.	13*d.* to 14*d.*	The wool larger and brighter than that of other short-woolled breeds.
RYELAND	At 2 or 3 years, 50–75 lbs	White.	None.	4 lbs.	13½*d.*	An old and almost extinct breed. The finest quality of wool grown in this country, and similar to the Merino.
MERINO	At 2 years, 110–120 lbs.	White.	None.	6–8 lbs.	14*d.* to 15*d.*	Few Merino sheep in Britain. Many imported for slaughter into London.
SHETLAND	30–40 lbs.	White, black, grey, and brown.	None, or very small.	1½ lb.	8*d.* to 9*d.*	Very fine wool, picked off by hand, leaving the hair or 'scudda' as a natural protection for the sheep.

The wool is obtained from the bodies of the sheep by tearing or shearing. The first plan is limited to some of the northern Highlands, where the sheep have a peculiar coat, half wool and half coarse hair, which separates when the old wool rises from the skin and can be pulled off, leaving the hair firmly implanted. Sheep are ready for shearing in the months of May and June, but there is a considerable difference according to the breed, season, climate, &c. The weather must be warm enough to ensure that the winter's coat is shedding fast, and an early spring naturally leads to an early shearing time. Sheep to be shorn are washed in a pool or running stream, and, for the comfort of the men engaged in washing the sheep as for the benefit of the sheep themselves, a proper bath should be constructed. The good sheep baths are too few in number, and I therefore draw attention here to a bath which I described in the 4th volume of the *Edinburgh Veterinary Review:*—

Every sheep-farmer will certainly find it to his interest, wherever a stream runs through or near his farm, to construct a bath, such as I have much pleasure in drawing attention to. A professional visit at Court Hill, tenanted by an enterprising and most successful farmer, Mr Simpson, afforded me an opportunity of admiring a contrivance, which I think it is to the interest of many to be made public. I made a sketch at the time, and have therefore the advantage of illustrating my description by a drawing, which will materially aid the reader in understanding the plan of the bath, and in having a similar one constructed.

Mr Simpson occupies one of the hilly farms on the Duke of Roxburgh's estate in Berwickshire, and is in a district famed for the many streams, teeming with delicious trout, and whose waters flow into the river Tweed. It is not unimportant to mention, that the annual sheep-dipping with an arsenical bath is carried on at a distance from the bath I have now to describe, although I know from general observation that, after having bathed the sheep in dipping mixtures, the residue is often thrown into such streams, and thus hundreds of trout must fall victims to a useless and dangerous practice. I have often stated that one great objection to arsenical baths for sheep is the danger of entrusting to shepherds large quantities of a deadly poison.

To return, however, to the plain-water bath, it will be seen from the sketch, that a space is enclosed with flakes or hurdles, so as to confine a few score of sheep. The soil has been excavated over the length of about 21 feet on the one side of the stream, and a strong wooden bank, constructed with boards about two or three inches thick. Strong stakes having been forced into the ground to a depth of about four or five feet below the bottom of the stream, the boarding has been fixed to them so as to confine the water within a certain limit, and leave ample space beyond for several men to stand on dry soil. In order to swell the stream, that the water may attain near to the level of the board or within a few inches of it, a sluice or dam is constructed below, a suitable stone wall to fix it having been raised on each side. When the sluice is lifted, the water flows off, and the stream is very shallow; when closed down, the bath is full, though the water still runs slowly over.

At the upper part of the bath, a gradual ascent is provided, so that the sheep may be turned on their legs, and made to walk out on to the green open field above.

The annexed woodcut indicates the manner in which strong beams support the boarding, and leave space between them for the men to stand on dry ground.

An ingenious provision has been made in the event of water overflowing. There are two or three plugs which may be opened to allow the escape of water, or lifting the sluice and lowering the level of the water in the stream. (See Fig. 181.)

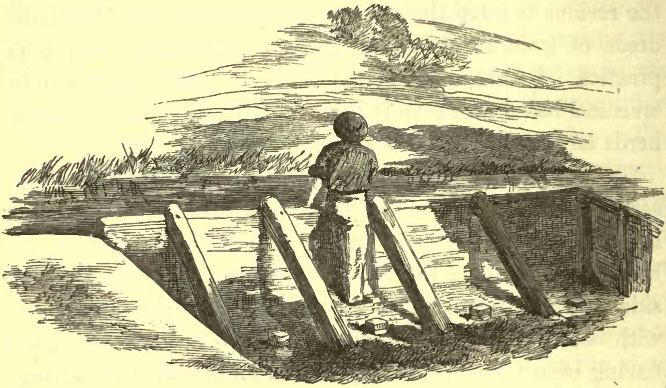


Fig. 181.

The men stand against the boarding, which is about four feet high, and without wetting themselves, can wash the sheep as follows:—One stands at the opening of the enclosure and secures a sheep; he turns it on its back and hands it to the first man engaged at the bath, and the second seizes it forthwith by the fore-legs. These two handwash the fleece as well as they can, and force the sheep on to the next two men, who, in their turn, deliver it to another assistant, who rolls the sheep over on its legs, that it may run up the hill. Five men are sufficient for the work, but seven or eight can be employed, and the bathing more speedily and effectually carried through.

The water can be renewed at any time by lifting the sluice and allowing it to flow off; but we are assured by Mr Simpson's very experienced shepherd, that it is not advantageous to change the water too often, as after several sheep have been bathed, the bath becomes charged with the yelk from the skins, and this has a soapy property which facilitates the cleansing of the fleeces.

In order, however, to have a clear stream, the bottom should be well excavated, and filled with gravel if necessary. Many of the mountain streams need no such trouble, but a sound gravel bottom keeps the water in perfect purity. The enclosure for the sheep and the walk out of the bath are also gravelled.

Mr Simpson affords his neighbours an opportunity of using his valuable bath; but in order to preserve his exclusive right to its use, charges a trifle for every hundred sheep bathed in it. Many a score may be washed in a day, and the men engaged in the task leave off dry and not over-fatigued, as when they have to labour a whole day in the water.

Having washed the sheep, a few days are allowed to elapse, and the mellowness of the fleece is remarkable, owing not a little to an abundant secretion of new yelk.

The practice of tearing the wool off the sheep's back, attended as it is with the advantage of leaving the hair or "scudda" behind it, was at one time more general than at present, and early descriptions of the operation indicate that it was not unattended with cruelty. Youatt quotes Mr Low's description from the "Fauna Orcadensis." In the Orkney Islands, "about Midsummer, there is a particular day published for *rowing*, when all the men in the parish attend with their dogs, turn out and drive the whole flock, without any preparation of washing, into narrow pens, and from thence, I may say, to the place of execution, where the wool is torn off their backs—an operation which brings their whole blood into their skin, and is not only disgusting, but, if the season proves harsh, is the cause of great destruction;

but, however cruel it may seem, it is almost the only notice that is taken of these useful animals by their unfeeling masters until that time twelvemonth."

The shearing of sheep is performed with great dexterity by experienced shepherds and their assistants; and if proper attention is not paid to the operation, and to the weather, accidents occur. Not unfrequently shorn sheep die of tetanus, or are affected with a peculiarly malignant form of erysipelas. Some very mysterious cases have occurred, in which it appeared as if an animal poison was the cause of destruction amongst a flock of shorn sheep. It is necessary to notice, that in hot weather, when sheep are shorn, they should be kept without food for a few hours prior to the operation, and then turned out where there is shelter. It has been the practice in the East, and elsewhere, to clothe sheep after being shorn, or to house them. Nothing can be more absurd than imagining that a malignant fever, such as small-pox, should, under any circumstances, originate, owing to a "chill" after shearing. This does not happen. Far more likely to occur are attacks of inflammation of the lungs, and of the skin itself.

Wool is known in the trade by various names, according to the age and kind of animal it is obtained from. *Hog's* wool is the term used to indicate the first shorn fleeces of the long, deep-stapled kinds, and *tegs* to a similar fleece of the shorter kinds. *Wether* fleeces are those obtained at a second shearing, and "the term ewes is applied, in long-stapled wool, to the shorter, tender, and inferior fleeces which are generally shorn from old or diseased shep; and in short-stapled wools (such as Downs) it is applied to the shorter grown fleeces, generally both ewes and wethers." *Skin wool* is that kind obtained from sheep slaughtered for human food, and varies much in length, coarseness, &c.

With time my dislike to clipping horses becomes confirmed, and, as it is a very common practice, it is proper to state the reasons why nature's clothing should be left on the horse's skin during the winter months. The great advocates of the clipping system are grooms and clippers—the first, because it saves them trouble in cleaning and drying a horse; and the latter, because the operation is a very remunerative one. Not a few horsemen also declare that the animals move more freely, and stand more work. A clipped horse, moreover, pleases the eye of the so-called connoisseur. There is no doubt that some animals during a couple of months in the dead of winter have a rough appearance, and, in exceptional instances, it may be excusable to clip or singe for appearance sake, but the disadvantages are many.

In the first place, a young horse from a warm stable, where he has been covered with heavy rugs, after the loss of his natural covering, stands shaking and suffering, on a frosty morning—affections of the respiratory organs necessarily result, and sometimes of a fatal nature.

We have known such a sudden impression induced on a horse as to lead to tetanus. The case occurred on a four-year-old grey gelding, in Edinburgh, clipped as a mere matter of fancy in the month of November. No sooner was the operation concluded than the horse was heard to champ with its jaws, and the signs of tetanus were soon marked. The animal died.

Horses of all kinds are clipped, and many with the most delicate coat and tender skins. As the scissors are not adequate to the clearing every particle of hair off the skin, the singeing apparatus is used, and valuable animals are scorched, and even permanently blemished. The owner has perhaps the annoyance of seeing a patch of white hair, or no hair at all, where a black coat should grow.

It is well known that clipped horses are very apt to scratch themselves at fences, and get thorns in their skin; and for this reason the absurd practice is carried out of not clipping the legs or belly, but only the body. Such an animal may please "a judge's eye," as the dealer facetiously informs us, but we must confess it does not please ours.

I have been induced to make some remarks on this subject, from the amount of injury which we have witnessed inflicted on cab and cart horses in Edinburgh during the present winter. Many of these animals are clipped all over, but very few escape the removal of hair from the heels and legs. The result of this is exposure of the skin to wet and dirt, causing chronic inflammation, ulceration, deep fissures in the heels, attacks of grease, swelling of the legs, and stiffness of the joints, &c. Some horses have lost their lives by it, and we unhesitatingly say that the operation is attended in its results with the infliction of much cruelty.

Both clipping and singeing are comparatively modern practices. Sir Francis Head tells us that, "about fifty years ago, during the Peninsular war, it was observed that the Spanish muleteers gave to the animals they had charge of great apparent relief by rudely shearing off the hair that covered their bodies; and, on the idea being imported into England, our hunting men, principally at Melton, commenced the practice by clipping, at a cost of about five guineas, their hunters. This operation, which in its infancy occupied four or five days, was succeeded by the practice of shaving, which in about as many hours left the animal as bare as the hide of a pig that had just been killed, scalded, and scraped. This latter operation, however, was found to be attended with two opposite disadvantages, for, if perpetrated too soon, it required to be repeated, or rather to be succeeded by clipping; and if delayed till the growth of the thick coat had subsided, the horse remained throughout the winter naked like an elephant. In order, therefore, to shorten the coat exactly in proportion to its uncertain growth, it was determined, gradually and repeatedly, to burn it by fire to the minimum length prescribed—that is, leaving only sufficient to conceal the bare skin."

Strange to say, the practice of depriving a horse of his superb hairy covering has especially been used amongst animals that need it least. Our well-bred hunters need it not, and we can only explain the resolute adherence to the plan in the same way that we see many absurd practices perpetrated in the stables where clipping is chiefly in vogue. In such stables the amount of quackery which is carried on is extraordinary, and the mortality amongst horses great.

Our stage-coach proprietors, and the hunting men of the past and early part of the present century, were ingenious enough to adopt any expedient to render their animals better fit for the hard work they had to undergo; but they never saw the necessity of clipping horses like French poodles. We have resisted the extension of the practice as much as possible, and wherever clipping has not been resorted to, cracked heels and swollen legs have not tormented the horse proprietors. We have known whole studs this winter lame and helpless entirely from the legs being deprived of their only efficient covering, and in all wet seasons the number of cases of dangerous illness from this cause is very great.

The skin of animals destined by nature to be covered with hair cannot be exposed with impunity—no number of horse-cloths and no degree of stable heat, obtained as it is at the expense of purity of the atmosphere, can make up for the uniformly-distributed hairy coat. Any portion of skin uncovered dries, and is affected by heat and cold to such an extent as to produce inflammation and ulceration, which occurs so readily and so constantly in horses' heels. Speaking of the purposes of hair, Mr Erasmus Wilson says:—"That it effects an important one, we have evidence in its almost universal distribution among the mammiferous class of animals; and, indeed, if we admit the analogy between feathers and hair among all warm-blooded animals, additional evidence is obtained in the perfection of its structure, and, again, in its early appearance during the development of the young. As a bad conductor of heat, it tends to preserve the warmth of the body."

We therefore conclude by saying, that clipping does more harm than good, and all good horsemen should choose, for hunting and other such purposes, animals that can carry their unequalled natural protector—a good coat—as well as a good weight on their backs across any country.

Construction of the Roman Bath for Cattle.

Dr Barter, aiming at the general adoption of the Roman bath and the necessity of rendering it inexpensive, has recommended the following plan:—

"The foundations are laid in the usual way of either brick or stone, and the outside walls carried up to a height of about 12 inches over the surface, and at a thickness of from 15 to 18 inches, the whole of the work being laid level. Upon this foundation a framework of upright deals is raised, cut $4\frac{1}{2} \times 1\frac{1}{2}$ (or four out of a 3-inch deal), about 9 feet high to the wall plate, and placed at intervals of about 15 inches from centre to centre, the uprights being set with their greatest depth in the thickness of the wall. The intervals are then filled with a wall built with one brick on edge, care being taken to range the work with the outer face of the uprights, by which means from half-an-inch to one inch of each upright will project on the inner side of the work beyond the finish of the brick-work. Across these uprights the laths are nailed, and the plastering finished in the usual way; the outer portion of the brick-work being either rough plastered with a mixture of clay and lime or rough-cast.

"The roof is constructed of a single joist laid flat from one side to the other of the span of the building, cut 4 inches by 1½, a sufficient fall for the rain being obtained by taking from 1 to 1½ inch off the outer edge of the roofing joist at either side next the cave, this being gradually reduced to nothing as the cut reaches the centre. Upon these thin sheeting boards are nailed, and over them the ordinary roofing calico, on which a coat of mineral paint or boiled tar is applied, which renders the work perfectly waterproof. The whole is then ceiled with lath and plaster under the joists in the usual way. On each of the sides of the hot room, opposite each other, and as high up as the building will allow, are placed two air holes or windows, through which a free current of air always passes, thereby keeping the air in the bath (no matter to what number of degrees heated) as pure and fresh as the outside air.

"The heating apparatus consists of an ordinary boiler grate, with a flue carried back from it into the hot room, and running three sides of it, returning along the opposite side of the outer room, and carried up a chimney placed outside the square of the building, as indicated on the plan. The flue is constructed on the ordinary plan of a hothouse flue, about 20 inches every way externally, the whole being raised off the ground about 3 inches by bricks set as blocks, and the bottom of the flue being formed of large tiles, bridged from one brick to the adjoining one, placed about 18 or 20 inches asunder. By this means the air of the chamber circulates freely around the flue, and a considerable saving of fuel is effected.

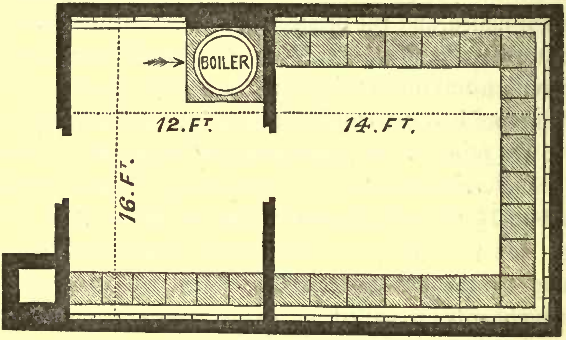


Fig. 182.

"The ordinary heat for a cattle bath, and beyond which it is generally undesirable to raise it, is from 110 to 120 degrees.

"Where economy is an object in the construction, turf, being a non-conductor of heat, may with great advantage be substituted for brick in the outer walls, the other portions of the plan remaining unaltered."

Provision should be made in connection with a Roman bath for the effectual ablution of animals. Washing a cow's skin with soap and hot water during the period of active sweating, and then dashing a quantity of cold water over the body, is a very essential part of the process in using the bath. The beneficial reaction preserves the cow from cold or other disturbing influence, and every attention must be paid to the comfort of the animal.

In any shed or stable can a Roman bath for horses or cattle be erected, by raising close wooden partitions with appropriate ventilation, and carrying a brick flue, protected by wooden covering, round three sides of the chamber. There should be ample provision for draining off water, which may be used in washing the animal whilst in the hot chamber; and outside the latter, provision might be made with a common hose, for a very effectual cold water douche.

Method of using the Roman Bath.

Any animal should be tolerably warm before being subjected to a very high temperature. This is not essential—but desirable. The chamber should not be raised above 120° or 130° Fahr. An abundance of fresh water should be provided for the animal to drink. The purity of the air in the hot-air chamber should be insured by good ventilation; this I hold to be of the very highest importance; moreover, if the animal urinates, a pail of water should be at hand to clean off that which in an apartment with an elevated temperature would rapidly rise in the form of noxious vapour through the atmosphere which the animal is breathing, and which should be as pure as possible. Any excrement voided should be at once removed.

When the animal is freely sweating, scrapers should be used, and an alkaline wash, composed of a little washing soda in a pailful of warm water, may be poured over the skin. If it be a parasitic skin disease for which the bath is used, an abundance of soft soap may be smeared over the skin, especially where diseased.

After twenty minutes stay in the hot chamber, the animal may be taken out, and receive at once a complete shower of the coldest water. This operation should not last above a minute or two, and then scrapers and rubbers should be used to dry the animal; the latter may be kept comfortable with a loose cloth over its body for an hour or two.

When an animal has once had a Roman bath, its repetition need not be attended with quite so much loss of time and trouble, but with valuable cows, in high condition, approaching the period of parturition, or when slightly disordered, every attention must be paid to the thorough management of the operation.

On the use of the hot-air bath for training purposes, my father says: "We were amongst the earliest in this country to recommend the Roman bath to favourable consideration and fair trial; but we would suggest by way of caution that the said Roman bath, if unduly or prematurely praised, may disappoint expectations, and fall into unmerited disuse. Admiral Rous has favoured the public with his opinions, but so far as we have seen, has adduced no facts or reliable evidence to support the doctrines he inculcates. I also, in the absence of positive evidence, must make use of some of a negative kind in support of my opinions.

"With a knowledge that the hot-air bath was fairly on its trial at some of our training establishments, I have refrained from writing on the subject, though urged by friends to do so, until trials and time afforded reliable proofs of its effects. Having been professionally engaged occasionally in the vicinity of the north of England training grounds, I visited one of the moors, and consulted trainers on the subject of the Roman bath. Amongst the strings of horses I saw in work, one horse, a grandson of Birdcatcher, was pointed out to me as having been submitted to the bath two or three days before. Using my own judgment in that particular case, I saw that a very different treatment was required to reinstate the horse in his former action and value. From all that I saw and heard in Yorkshire, where the Roman bath was on trial for horses in training, I came to the conclusion that the time has not yet arrived to determine and advise in the matter. The trials have been few and limited in extent of time, and are inconclusive in their results. Thirty-two years ago, Sir Hedworth Williamson consulted me on the question as to whether hot-air baths might not be used to some extent in substitution for the ordinary process of sweating race-horses. Then a young practitioner, basing my opinion on physiological grounds, I expressed that more than one object was sought in the ordinary mode of sweating horses. By that process, the animal system threw off matter, absorption was excited, and at the same time the whole muscular system, both voluntary and involuntary, was put to that exertion hitherto deemed essential to the full development of speed and power of endurance. This consultation took place at Florence, where Lord Normanby, with the co-operation of the honourable baronet alluded to, and other gentlemen, had established English races. The Roman bath, besides being now on its trial at the principal centres where horses are trained in England, is also on its trial on a more extensive scale, under the surveillance of eminent scientific men. With some of these we are intimately acquainted, and from them have been in the way of periodically receiving information as to the results of their experiments.

"Agreeing as I do with the honourable writer, that there are many defects in the management of race-horses which call for reform, I am nevertheless at a loss to see any connection between these and the supposed influence of the Roman bath. Abusive employment of drastic purgatives and other drugs, internally and externally applied, violently sweating horses too heavily clad and sent over the ground at too fast a pace, all this, with imperfect ventilation of stables and other defects, admit of remedy apart from any consideration of the Roman bath. In a few short sentences we are told that 'the Roman bath invigorates the horse's frame, gives increased action to his liver, improves his appetite, cleanses the pores of suppressed perspiration, and fortifies the skin from extreme heat and cold; the joints become more supple, the sinews more elastic, and the heart, lungs, and kidneys, being freed from fat, horses are able to take the stronger exercise without suffering from internal fever.' In another paragraph, touching the breaking and training of yearlings, the Admiral says:—'As far as these early trials are concerned, the experiment can now be made at half the risk of destroying the colt, or, in other words, laying the seed of future unsoundness, by using the hot-air bath for absorbing his internal fat and superfluous flesh.' Some of the above enunciated doctrines are questionable; with others I totally disagree. Does the Roman bath invigorate the frame, or only temporarily excite? If the latter, will the excitement, if pushed, become exhaustive? Does it increase the action of the liver; and, if so, is that desirable? The improved appetite is accounted for by the laws of nature; it is her effort to draw fresh material to supply the waste which the bath has induced. Is there usually suppressed perspiration in race-horses under the present system of training? Observation and experience do not show this. Can the Roman bath be relied on for rendering the skin proof against the extreme action of heat and cold? The sinews, we are told, become more elastic through the influence of the hot-air bath! This is the first time we ever saw it deliberately written that sinews were elastic at all; and since, for obvious reasons, nature has not made them elastic, it is not desirable, even if it were possible, that the art of man should render them so. However, by other destructive influences, not noticed by the Admiral, a very opposite condition of the tendons (sinews) ensues. About the internal fever which is said to prevail I must plead ignorance as to what the definition points to. Besides curing cutaneous eruptions, the Roman bath, we are told, cures rheumatism and sore shins in horses. No matter what the causes and character of these different diseases, the Roman bath is to cure all. What a wonder that the old Romans, who used their baths in great measure as a luxury, should have overlooked all these miraculous properties!

"On the next important physiological question noticed, the use of the bath for absorbing the fat and superfluous flesh of the yearling colt, I submit that a healthy well-managed colt, which has been allowed space for voluntary exercise, will not at the age of 18 or 19 months have accumulated deposits of fat that require other means to diminish than the necessary breaking and training process. As to the superfluous flesh spoken off, I never before heard of such a thing, except when uttered by those whose limited knowledge lead them to speak of flesh and fat as one and the same substance. I had always believed that trainers, in conformity with physiological laws, tried to increase flesh, it being the very element of power and speed; any process, including starvation, that causes the flesh to be absorbed, would prove as destructive to race-horses as to any other animal. Whilst I am no adherent to old errors if once detected, I consider it equally important that we should not run from one extreme to another. The old errors were of slow growth, and have had their sharp edges taken off. New projects, plausible in themselves, and warmly advocated, may mislead; and if so, the retracing our steps may be very difficult and very costly. If the tender yearling colt could, by being submitted to the hot-air bath, be prepared for trial as to speed and power, what will not art be able to accomplish? Such doctrine contemplates a reversal of some of Nature's fundamental laws; physical power in all animals, as well as mental power in man, increases by exercise; and to my own mind it would seem to be as impossible that a colt should attain to speed and enduring power by the short cut of a Roman bath alone, as that a lad should be taught in six lessons to speak French, to write a fair hand, or to play tolerably on the flute.

"There are several important points in Admiral Rous' letter on which lack of space prevents me entering at length, viz., the ventilation of stables, the question of how and when to clothe horses, the amount of walking exercise required in training, and whether, as a rule, this latter should be given once or twice in the day. As to training grooms preferring in such matters to consult their own convenience, that supposition is opposed to the character drawn of trainers by the Admiral himself, and totally at variance with my own experience of all trainers with whom business has brought me in connection. I have always found these men scrupulous, sometimes fastidiously so, in the execution of all details, and am persuaded that if it were known that horses would be the better for being exercised three times a day, there is not a respectable training groom in England who would not adopt the plan. I have for years past looked at the achievements accomplished by English trainers, who have brought their horses so admirably to the post, as surpassing anything in modern times in the art of the management of horses. Over many of the defects justly complained of, trainers themselves have no control: running colts at an early age, some yearlings, and all at two years old, the hurried process of getting them early to a great size, much in the way that cattle and calves are forced, more with a view to bulk and early sale than to their permanent utility—these are all errors against which the trainer has peculiarly to contend. As to the art of shoeing race-horses, when to begin the process, and how to do it, as well as other questions regarding the ill effects of bad management of feet, trainers are unable to help themselves, however willing they may be, and however much they may deplore existing evils.

"The question remains—will hot-air baths prove a substitute for all these drawbacks? I say, no. We have not yet sufficient practical data upon which to make the answer in the affirmative, and for my own part I doubt whether matured experience will prove the effect of the bath to be so rapid or so universal as to justify the sweeping statements in the Admiral's essay."

As a *therapeutic agent* the hot-air chamber holds an intermediate position between evacuants and stimulants. It is undoubtedly a general tonic, because it fits important organs for the free and healthy exercise of their functions, and this operates beneficially on the blood, on the function of nutrition, and hence invigorates the body. That it is evacuant no one can doubt, who has witnessed the kind and quantity of cutaneous secretion, whether in man or animals.

With regard to the action of a thermal temperature applied to the skin, Dr Erasmus Wilson has summed up that it induces—

I. An improvement of organic structure.
II. An improvement of secreting functions.
III. An improvement in circulation and respiratory power.
IV. An improvement of innervation and sensation.

Dr Wilson has very wisely said "that the thermæ is not to be trifled with; it is a medicine—a great and a powerful medicine; and can only be applied with safety and advantage by those whose vocation it is to study the physiology of man (or animals, I may say), and to treat its diseases." So sanguine is this orthodox and learned physician of the advantage of the hot-air bath, that he says—"In the judicious hands of the essentially practical medical men of Britain, I look to see thermotherapeia occupy a useful and a dignified place; and I trust that in a short time, in every small village and hamlet in England, wherever a medical man is found there also will be found a British thermæ."

Viewing the subject as a veterinarian, I unhesitatingly say that we have in the thermæ the most effectual diaphoretic, the most active depurant, and the most effectual means of inducing a healthy reaction, that we have yet had at our disposal. It is a great addition to our therapeutic means. We needed a satisfactory means of acting on the skin of the lower animals in febrile and other diseases, and we here have it.

The Value of Clothing and Cleanliness.

The skins of our domestic animals, coated as they are with hair, do not, as a rule, require much additional covering, and it is only the finer breeds, with delicate skins and accustomed to be covered, that do not resist the effects of a cold atmosphere. Habit leads to the necessity for horse-cloths, &c., which animals would not need if always exposed, provided they had sufficient room to move, and a certain amount of shelter, which is essential to all animals on the occasion of severe storms. Veterinary surgeons have often striven to overcome the strong prejudice, which all persons connected with the stable have, of keeping animals excessively warm, both at the expense of air to breathe and air to circulate around an animal's body. A sleek skin is thus obtained at the expense of a sound constitution, and there are no animals more delicate than those submitted to the very extraordinary system of management permitted by individuals who themselves delight in fresh air, sponge baths, light clothing, and constant exercise. Extremes should always be avoided, and if we are not inclined to recommend the practice of some veterinarians, who, following, or rather exaggerating, the late Professor Coleman, turn their horses adrift the coldest nights when suffering from severe affections of the respiratory organs, and that even without the slightest covering, we nevertheless condemn the hoods and breast-plates, and bandages, and two or three heavy rugs, which oppress and interfere with the proper aëration of the skin's surface. It must not be supposed by this that we look upon the animal skin as a true breathing surface, through which oxygen is absorbed as by the mucous membrane of the lungs. The skin exhales freely, and the current of air on the surface favours the exhalations, and accelerates the discharge of the superficial cuticular cells, which are constantly replaced by rapidly forming cells on a healthy skin.

The error which uneducated persons commit is to regard clothing as heat-giving, whereas it confines the natural heat of the body, which is produced in direct ratio to the activity of the breathing and the circulation. No animal, then, should be swaddled so as to prevent it bending its limbs and lifting its head, and seeking warmth in exertion.

No animal should be permitted to shiver in the cold, and it is a wise rule to adopt, that every creature should, to all appearance, be comfortable. We find animals like human beings, removed from a hot to a cold climate, suffering much unless clothed in the latter, and I have seen fatal disease in hairy dogs induced by exposure the first few months after being imported into England from India, Spain, or Italy.

But whatever animal has to be clothed, it should not be oppressed with heavy sheets, such as we find, piled one over the other, on our hunters and fashionable coach horses. A wrinkle should be taken from the Frenchman, who is seen in the depth of winter with a blue blouse over a warm coat. The smock-frock seems to be destined to catch all the wind, and appears at first sight to be a cold garment, but experience teaches us the reverse, and science explains its teachings. As the best material to keep a body warm is that which carries the heat off with greatest difficulty, so do we find that all substances, such as wool and feathers, which imprison a considerable amount of non-conducting air around an animal, are those which are best calculated to maintain the heat of the body. The blouse, like a light linen sheet thrown over a common horse-rug, has a stratum of air beneath it which is an admirable non-conductor. We obtain the largest amount of heat with the least possible inconvenience to the animal in that way; and it is for this reason, that in bandaging the cold limbs of a sick animal, the bandages should be put loosely round the limbs, and not rolled round as if they were intended to nip the horse's legs in two. Hay and straw bands should also be rolled lightly round the limbs when required, and a very desirable way of favouring a healthy exhalation by the skin, and still keeping sick animals warm, is to place a layer of straw between a horse's skin and a common rug.

I look upon clothing in changeable and cold climates as essential, especially for horses; but I am anxious that it should be employed with judgment, and especially that the groom's labour should not be saved by such a preposterous practice as that of cutting a horse's natural coat off, and making up the deficiency by means of sweltering and unhealthy horse-rugs.

The clothing used for animals is not often beaten, brushed, and washed, but it is very essential to attend to cleanliness in this way. I have known the most violent irritation of the skin kept up to a great extent by foul clothing and in some diseases of the skin it is absolutely indispensable to attend to the frequent changing and purification of the coverings of the body.

It is well known that, however necessary a free circulation of air in a stable may be to promote the health of the skin, as of every other organ of the body, it is indispensable to have the distribution of the currents uniform. Any special current striking against any part has the effect of lowering the temperature of the skin below the usual standard, and then a reaction occurs which is apt to be the cause of congestion and inflammation. This explains the occurrence of cracked heels from a draught of cold air playing directly on the heels of a horse standing in front of a door, when, perhaps, the only inlet for air is through a fissure left by accident, or occurring as the result of a door shrinking after having been fixed by a carpenter.

In order to keep a horse's skin in good order, it is indispensable to give him exercise, and, occasionally, exercise calculated to make him sweat. This facilitates the cleaning the skin of effete material, in the shape of waste cuticle, which cannot otherwise be easily detached; and by attention to the rules laid down as to clothing, and not overfeeding, animals are found to live to a good old age in perfect health.

Baths cannot be used much, except for small animals. Washing the skin, the feet and legs more particularly, is a plan to be recommended for horses, if care is taken to dry them well. Most animals would experience good effects from the cold-bath system adopted by human beings, only their hairy coat prevents the same beneficial reaction being obtained, without entailing a large amount of labour which can well be dispensed with.

For the smaller animals, tepid baths are of great service, and I here subjoin a table showing the temperature of different baths used for medicinal purposes, or merely for the purification of the skin:—

TEMPERATURE OF SIMPLE BATHS.

BATH.		VAPOUR.	
		Not Breathed.	Breathed.
Tepid Bath,.......	85° to 92°	96° to 106°	90° to 100°
Warm Bath,......	92° to 98°	106° to 120°	100° to 110°
Hot Bath,.........	98° to 106°	120° to 160°	110° to 130°

Simple baths are most used in dog practice. Vapour baths have very justly had strong advocates amongst those who have treated the diseases of the horse. The above scale of temperatures is that used for man, and is adhered to for animals.

DISEASES OF THE SKIN AND HAIRS.

In this country the skin diseases of the lower animals have been all included under a general head—mange—and in the most elaborate work on the diseases of the horse, the maladies referred to are surfeit, urticaria, greasiness of skin, saddle scald, ringworm, grub of the skin, mange, hidebound, lousiness, warts, grease, and cracked heels. With the knowledge at present possessed of the many varieties of skin disease in man and animals, the very names, apart the number, of the morbid conditions of the skin thus alluded to, appears ludicrous.

Some of the best continental authors describe no less than fifty skin diseases, and many of these appear to occur in a variety of forms, so that a rigid classification would perhaps necessitate the recognition of a still larger number of skin affections. It is my desire to simplify, and not to complicate the subject, and, with this view, I shall consider the maladies as closely as possible in accordance with Mr Erasmus Wilson's classification, differing only where it is necessary, owing to the peculiarities of these affections in the lower animals. One object attained in applying Mr Wilson's classification to veterinary purposes is to facilitate comparisons which it is important for veterinary surgeons and others to make until very decided and independent progress is made in the study of cutaneous diseases in the lower animals.

Perhaps the first impression produced on my readers may be, that I am uselessly complicating the subject by adopting this course; but I am persuaded, that any one taking a little trouble to study the matter will find that a good classification enables us to obtain a clear view of a subject that is usually considered very difficult and puzzling.

Mr Wilson divides the diseases of the skin into those affecting the general structure, and those affecting the special structure of the skin.

Under the first head I exclude the diseases which are described as arising in man from the syphilitic poison, and confine my remarks to—

1. Diseases arising from general causes.
2. Diseases arising from special external causes.
3. Diseases arising from special internal causes.
4. Diseases arising from animal poisons, and which constitute the eruptive fevers.

It is, moreover, needless for veterinary purposes, at all events, with our present knowledge of skin diseases in the lower animals, to consider the diseases of the special structure of the skin in eight groups. We can simplify this arrangement by considering—

1. Diseases involving the elementary tissues of the skin or its superficies.

2. Diseases of the glands of the skin.
3. Diseases of the hair-follicles and hair.

Mr Erasmus Wilson explains that, by the expression 'general superficies of the skin,' is to be understood not only the apparent surface of the skin, but also that portion of the surface which forms the vascular walls of the follicles and excretory ducts of glands.

Mr Wilson shows the fundamental relationship between different skin diseases which are apparently very different from each other. He says, "In considering the pathological phenomena of inflammation of the superficies, we find ERYTHEMA (signifying redness), or simple vascular congestion; LICHEN (signifying roughness), or congestion of the pores and superficial portion of the follicles, producing a tumid state of those parts, and constituting pimples; ECZEMA (to boil out, or seethe), a vascular congestion accompanied by effusion of liquor sanguinis, lymph, or serum, and giving rise to vesicles; IMPETIGO, a similar pathological condition, resulting in the production of pus and *pustules;* and FURUNCULUS, vascular congestion, with loss of vitality of a part of the structure of the skin."

Mr Wilson goes on to say, that "as simple inflammation is capable of, and is the active agent in, producing the several morbid conditions of the skin, we are not surprised at finding that they are mutually convertible; that an erythema, for example, may become a lichen by the development of pimples, an eczema by the evolution of vesicles, or an impetigo by the production of pustules. In the same manner, the pimples of lichen having subsided, the lymph or ichor of eczema being dried up, and the pus of impetigo exfoliated in crusts, there may remain behind a chronic erythema, to which another term, namely *psoriasis,* has been applied."

"Therefore in essential nature, erythema, lichen, eczema, impetigo, and psoriasis are simply modified manifestations of inflammation of the skin, corresponding with recognised stages of common inflammation; the modifications resulting from intensity, cause, and idiosyncrasy, in other words, from accidental conditions."

A few remarks on the practical management of cases of skin disease may not be unimportant.

There is, perhaps, no class of affections which demonstrate more the importance of correct diagnosis. Both the particular constitutional state, and the characteristic local manifestation, must be duly appreciated by the practitioner, and I have had numerous instances to prove that a purely local skin disease has baffled the skill of veterinary surgeons who for months have groped in the dark in attempting to combat the affection, whereas, in other cases, the simplest internal remedies have speedily cured inveterate and reputed incurable cutaneous disorders.

The practitioner must distinguish between cause and effect, and this is by no means an easy distinction in some cases. He has to judge whether a special general disturbance is the cause of a skin disease, or whether the latter is the cause of constitutional symptoms. When the nature of the eruption is recognised, it is, as a rule, comparatively easy to determine what relation the general symptoms hold to the local, but it is in the recognition of the nature of this eruption that failure is of every-day occurrence.

Skin diseases are not always difficult to cure in proportion to their length of standing. I make this remark, because it is a common notion amongst dog fanciers, keepers, and sportsmen, that after a certain time a disease *gets into the blood* and cannot be cured, and this is believed of parasitic affections, that are eradicated with one good dressing.

With very few exceptions, if any, all skin diseases are curable, but some, depending on constitutional causes, recur at periodic intervals.

Cutaneous disorders are cured in two ways: Firstly, by the employment of systemic remedies, which are either evacuants, tonics, or specific remedies; secondly, by means of local remedies, which are curative or palliative in their effects.

Systemic remedies.—Amongst the evacuants we must regard purgatives as probably the most important. Diaphoretics are often of great service, but they may do harm. The hot-air bath, followed by a cold douche, seems to be beneficial in most cutaneous disorders, but its effects are most marked when used in combination with purgatives. It is indispensable to clear out the bowels, and to keep them regular by judicious diet. Different purgatives are used, according to the animal treated. Aloes must be preferred for the horse, sulphates of magnesia or soda for cattle, castor-oil and syrup of senna or buckthorn for the smaller animals. Sulphur is a valuable laxative in skin diseases.

Animals that are reduced by a skin disease, or in which the cutaneous eruption is really a symptom of weakness, require tonics, and the best of these are the preparations of iron. The diet must be liberal in such cases, but never in excess, and whatever food is allowed should be given with regularity.

Of the specific remedies in chronic diseases, none can exceed in value arsenic, and especially the liquor potassæ arsenitis, which proves an admirable systemic restorative in all cases in which chronic congestion and irritation of the skin exist, independently of any active agent operating locally on this structure.

The *local remedies* are sufficient for the cure of some simple inflammations of the skin, and those diseases induced by parasites. Baths, washing with soap and water, applying water-dressing or a diluted solution of diacetate of lead, are attended with great relief. If any acrid discharge is thrown off, an alkaline lotion is invaluable, and relieves irritation more readily than any other known remedy.

Ointments of various kinds are used, and it is of the highest importance that they should be fresh, and having the least possible tendency to become rancid. The admixture of powdered gum benjamin, with melted lard, to the extent of ten grains to the ounce, has been found to prevent the decomposition of ointments.

Mr Wilson is a great advocate for a preparation which I find of great use in inveterate cases of cracked heels, and other inflammations of the skin. It is the benzoated oxide of zinc ointment, which Mr Wilson says, if "properly prepared, is the most perfect local application for all chronic inflammations of the skin that is known. It is cleanly and agreeable, of a cream-white colour, not diffluent and oily, like other ointments; and it has a tendency to concrete upon the skin, and constitute an artificial cuticle to an irritated and denuded surface. It is rendered further acceptable to an inflamed and heated skin by the addition of spirits of wine, in the proportion of a drachm to the ounce, or, if preferred, spirits of camphor. The mode of application of this and other ointments is a matter for attention; it should be gently rubbed upon the eruption with the finger, or, if the diseased skin be too tender, with a camel's hair brush, rubbed so as to distribute it in a moderately thick layer over the whole of the affected part, to introduce it into all the cracks and hollows that may be present, and to insinuate it as much as possible under any crusts that may have formed in the disease. Once properly applied, it will loosen the crusts, and prevent further crusts from collecting, while it serves the several purposes of a new cuticle to the abraded skin, a water-dressing, and a barrier to the rapidly-oxydizing action always present in inflammation. If secretions are poured out, the eruption may be wiped, but not washed, and a fresh application of the ointment may be made morning and night, or as often as the previous layer of ointment has been disturbed or displaced.

"If we look upon an ointment when applied in this way to the skin in its true light, we shall see that it presents conditions and advantages which no other local application possesses; and we cannot but arrive at the conclusion, that it is a most valuable remedy, and one for which no equally efficient substitute can be found. It is light, produces no pressure, is thin as a film of varnish, and yet excludes the air from the inflamed part, thus preventing desiccation and oxydization, and it retains the ordinary moisture of the skin, acting, as I before remarked, as a water-dressing or natural poultice. I make it a prominent part of my directions, that the morbid part should not be washed after the application of the ointment; it may be wiped with a soft napkin as much as may seem necessary, but when the ointment is once applied, it should not be removed by washing without good reason."

I have quoted thus at length from Mr Erasmus Wilson's work, inasmuch as I can testify to the soundness of his remarks, though, since the introduction of glycerine into the pharmacopeia, I have found great advantages from the use of glycerine lotions of various kinds. Glycerine is an active solvent of many agents which are useful remedies in skin diseases. With collodion, it forms an admirable protecting mixture, and with sulphur, a good preparation for parasitic diseases of the skin. It is a good vehicle for the application of soothing remedies, such as opium and belladonna in skin diseases attended with much irritation, and as it has no exciting, irritant, or acid properties, it is to be recommended as much, if not more, than the benzoated ointments.

Diseases arising from General Causes.

ERYTHEMATOUS OR EXANTHEMATOUS ERUPTIONS.

These are maladies characterised by inflammatory blush. The redness of inflammation is not so constantly an appreciable symptom in the lower animals as in man; but the irritation, swelling, and heat diffused or circumscribed, enable us to distinguish, in animals at least, three of the four disorders described in man included under this head.

ERYTHEMA.

Under this head are included inflammations of the surface of the skin, produced by causes operating locally, and often dependent on systemic or constitutional causes.

The causes of erythema are cold and heat alternately operating on the skin; wet, depriving the skin of its natural covering, hair or wool; dirt, friction, pressure, and keeping dirty clothing or harness on animals. As constitutional causes, we have plethora in some cases, and poverty in others.

There are three diseases included under this head.

ERYTHEMA INTERTRIGO.

The term 'intertrigo' signifies a chafe, gall, or fret, and the expression 'erythema intertrigo' is employed to indicate all those inflammations of the cutaneous surface dependent on the friction of one part of the skin against another, the irritation due to discharges flowing over the skin, &c.

In the horse this disease is seen in hot weather from abundant sweating, and the animals being allowed to remain dirty. The skin is thus apt to be chafed by the harness, &c. On horses going long sea voyages, when the urine is apt to flow over the skin, especially in mares that cannot conveniently stale without wetting their thighs, considerable excoriations occur. The same happens in animals that are slung. In the latter instance, however, the inflammation is often severe from excessive pressure, and such a case properly belongs to the next form of erythema.

In calves, erythema intertrigo is seen in cases of pervious urachus, when the urine is apt to induce inflammation of the skin over the abdomen. Very fat cattle are apt to become chafed between their thighs, in the arm-pits, &c., when travelled on a hot day and along dirty roads.

In sheep this form of superficial inflammation is common after shearing, especially in warm climates. In Germany, the sheep suffer much in the filthy stables where they are congregated in large numbers.

In the summer of 1846, Mr Robert Read, of Crediton, reported that the number of shearling sheep that had died from traumatic erythema amounted in his district to three out of every ten, or even more. Farmers attributed the loss to the hot and scorching weather during the month of June, in conjunction with the attacks of flies. The symptoms of the disease were—heat, redness and tenderness of the skin; the areolar tissue beneath soon became infiltrated with serum, and, in some cases, the skin assumed a yellow colour, with petechial spots. The swellings which occurred were at first hard, and then indented on pressure, and death followed as the result of gangrene.

Erythema intertrigo is a disease of common occurrence amongst greyhounds. The scrotum and inside of the thighs are often found red and sore from friction.

Erythema Paratrimma.

This form of erythematous inflammation is due to pressure, and no more favourable instances can be adduced of it than the galls due to the saddle or collar.

Saddle-galls or saddle-scalds are frequently seen on ladies' horses, on the off-side of the withers. They are due to the saddle not fitting. The shoulder-galls, due to the collar not fitting, are especially met with in summer weather, and more in young horses first put to work than in seasoned horses.

The first symptom is that of the animal evincing pain on pressure being applied to the skin where it has been bruised. A swelling then occurs, and chronic induration of the skin may result, or perhaps more frequently an abscess forms. If the case is attended to early, and proper treatment applied, both the formation of the pus and the thickening may be avoided.

Erythema Chronicum.

Under this head are included the chapped hands of human beings, the cracked heels of horses, and the chaps which occur on the teats of newly calved cows, or on the udders of ewes and lips of lambs. I have seen remarkable attacks of this disease in well-kept flocks at spring-time, when the animals were plethoric.

In the horse, cracked heels may be divided under two heads: firstly, those that are recent, and amount to superficial excoriations; and those that are deep, and consist in indolent and sometimes sloughing ulcers. The recent or acute cracked heels become chronic and confirmed by inattention, but often the unfavourable character of the ulceration appears from the commencement, owing to a special constitutional state.

The superficial excoriations are often seen in clipped horses, and in other animals whose heels suffer from wet and dirt. An exciting cause of cracked heels is sometimes a draught of cold air, in an ill-ventilated place, in which a current is induced to strike directly against the heels of a horse when close to a fissure, below a door, &c.

The ulcerated heels are so difficult to cure, that the French have applied the name of "javart cutanée" (cutaneous quittor) to such cases. They occur in animals that are much over-fed and irregularly worked. They are seen chiefly on the hind extremities, when these are often œdematous, or when the circulation in the limbs has been much disturbed by repeated attacks of lymphangitis.

Treatment of Erythema.

All recent cases of superficial inflammation of the skin yield to cold or warm fomentations, to the application of tincture of arnica, with which a lotion is made, consisting of one part of the tincture to 12 of water, and to poultices. It is occasionally necessary to use active depletives, such as bloodletting, purgatives, and diuretics. In some instances the skin should be protected by the application of glycerine lotion or drying powders, such as oxide of zinc, common flour, starch powder, and fuller's earth. I have used the oxide of zinc powder with great success in many cases. In clipped horses the hair is allowed to grow on again, and attention is paid to the skin of the heels being kept clean and dry. In the case of chapped teats the milk should be drawn off by means of teat tubes, or a milking machine, and if the young animal has to suck, the teat should be protected by a gutta percha shield. Equal parts of collodion and glycerine constitute an admirable application for the protection of chapped teats, and it is probable that in all such cases the use of the milking machine is preferable to the rough handling in milking with the hand. I have seen the teats of ewes deeply eroded from the lambs sucking during attacks of erythema; and in these cases it was essential to take the lamb off the ewe, and turn the latter on bare pasture, attending at the same time to the local wounds.

Erysipelas.

This disease consists in diffuse inflammation of the skin and areolar tissue, associated with fever. Some confusion has arisen from diseases being regarded as erysipelatous that are really not so. Thus lymphangitis or weed has been described as œdematous erysipelas, and the blue-sickness of the pig has been spoken of as gangrenous erysipelas.

Simple erysipelas occurs in all animals, but it is seen more often amongst sheep and dogs than all other animals. It is either due to plethora and the effects of a sudden check to the secretions of the skin, or it may supervene in cases of injury. Severe attacks of erysipelas have been seen in sheep after shearing, when the skin has been cut. Erysipelas is apt to extend over the leg from a bad cracked heel.

Treatment consists in placing the animals on low diet, purging, and following up the purgation by doses of nitre. Solution of the diacetate of lead applied with water over the inflamed skin is very beneficial. Mr Wilson says, that in man he has found great benefit from using a lotion composed of a drachm of sesquicarbonate of ammonia, the same quantity of diacetate of lead, and half an ounce of laudanum to a pint of water; he adds, that simple inunction with lard is in every way superior to all fluid applications.

URTICARIA.

Nettle rash, technically termed urticaria, is a frequent form of exanthematous eruption in the horse. I have seen many cases characterized by the somewhat sudden appearance of elevations of the skin, varying in size from a hazel nut to a walnut, and sometimes as broad as the palm of a man's hand, in different parts of the body. The irritation of the skin is sometimes considerable, and it is found to occur chiefly in plethoric animals and in hot weather. Mr Percivall mentions a case under the head 'Surfeit,' which, from the description, must be regarded as urticaria. This description is as follows:—

"1840, *May 3d.*—A four-year-old mare, this morning had four lumps make their appearance: two upon the inner part of each thigh, directly opposite, and touching each other; which were flattened, quite circular, and about the size of a small captain's biscuit; another, somewhat smaller, appeared upon the belly; and a fourth, still smaller, upon the back, in the place where the points of the saddle-tree bear. Their singularity of character consists in the perfect roundness of their figure; only one of them, that upon the belly, having a humpy sort of divergence to one side of the circle. The submaxillary glands of the left side were also enlarged, and the Schneiderian membrane reddened. They made their appearance quite suddenly. Since the attack, the mare experienced a violent fit of coughing; and yet the appetite and spirits are not affected. Nothing done. *May 4th.*—Since yesterday, kept upon mashes. These large lumps have diminished and become more diffused, but numerous small ones—of the ordinary size of half-marbles—have made their appearance in all parts of the surface. *May 5th.*—The lumps have decreased, and appear to be on the decline. Prepare for physic. *May 7th.*—Yesterday, the physic operated; it indeed still purges a little. And now the lumps, both large and small, are all but gone: only slight elevations in their places can be perceived."

Mr Percivall also quotes Hurtrel D'Arboval, who evidently speaks of urticaria as *partial* and *general*. He says:—

"In the first, the lumps are few, diffused, and isolated, nowise affect the health of the animal, though at times they occasion itching. They last fifteen days or three weeks, sometimes much longer. They disappear by resolution, without leaving marks of their existence. They do not always vanish in this way: now and then they become converted into abscesses, which burst, discharge a serous fluid, and become crusted over.

"In the second variety, the lumps arise at once, and upon almost every part of the body. They are unequal: some are small, some large. All of them are flattened, and disposed in groups, presenting often little vesicles, from which issues a glutinous fluid. The animal's health is disturbed. The appetite is impaired; the skin warmer than usual; the visible membranes flushed; respiration accelerated; pulse full and hard. Eruption, attended with itching and fever, may turn out serious, through metastasis, as frequently happens in young horses that, during the previous winter, have suffered from hard work and poor living. The most common metastasis is that of the air-passages; and it is one likely to ensue when the eruption suddenly disappears."

Although in many cases the disease is of a very transient character, it is sometimes associated with febrile symptoms, and calls for rather energetic treatment. This consists in free purgation, low diet, and washing the skin over for two or three days. Hot-air baths are likely to afford speedy relief in such cases, and the symptoms are sometimes severe enough to make us desire a prompt remedy.

Urticaria has been described by Rychner as occasionally occurring in cattle. The swellings appear suddenly, and the hair is apt to fall off them in a few days. The eruption disappears in about a fortnight. Haubner has described a similar disease in the pig.

ROSEOLA is another of the skin eruptions classed with those just described, but we have no information concerning its occurrence in the lower animals.

LICHENOUS OR PAPULOUS ERUPTIONS.

Three diseases are described under this head by authors on human skin affections. In the lower animals we usually recognise but one, viz., Prurigo; but Professor Haubner, of Dresden, has furnished a description of lichen as it occasionally occurs.

LICHEN.

This consists in the development of pimples, about the size of millet seeds, on the surface of the skin. The Germans have described the malady under the title Schwind-Flechte. Hering declares that it is common, but always benignant. The malady would seem to be the same as the one described in man under the name 'lichen pilaris,' in which the pimples are developed around the openings of the hair-follicles, as it is declared to occur chiefly when animals shed their coat in the spring months.

The eruption occurs in the form of small pimples, and on the hairs falling off the skin remains rough and bare. Haubner describes two varieties of the disease, viz., lichen cinereus and lichen albescens.

The patches of eruption are numerous and about half an inch in diameter. They remain unaltered for five or six weeks, and then a layer of cuticular cells drops from their surface, and the hair begins to grow. The malady is apt to recur, but calls for scarcely any treatment beyond attention to diet and cleanliness.

Prurigo.

This disease, also known by the name of Pruritus, is indicated by heat and severe irritation of the skin. Not unfrequently the skin becomes thickened and indurated, and the animals affected are extremely troublesome, as well as constitutionally unfit for work in some cases.

Mr Percivall notices this disease under the head 'Surfeit.' He says, "I employ this term ('Prurigo') to signify those hot and itchy states of the skin, under which horses rub their heads or necks, manes, roots of their tails, hind quarters, &c., and thus render those parts bare. This is the simplest form of surfeit, and requires nothing beyond some modification of the stable regimen: bran mashes in lieu of corn; green meat, if it be in season, or additional work. The itchiness may be relieved by using a lotion composed of half an ounce of sulphuric acid and a quart of water: with this the parts are to be wetted.

"There is a sort of cutaneous furor to which horses—pampered and little worked—are liable, and which appears to be constitutional in its origin. The horse experiences an insufferable itching, and to allay this will bite and tear himself with his teeth, and inflict wounds in his skin upon the places rubbed or pressed by the saddle or harness, and by rendering them sore or raw, reduce himself to a state of comparative uselessness. This habit, or rather disorder, once contracted, is exceedingly difficult, in some cases impossible, to get rid of."

Every practitioner can recal to his mind a number of cases of prurigo, which consist in irritation of some part of the body, or of the surface generally. In cart horses the stamping and rubbing of one leg against the other is a frequent source of severe injury, and if the skin is examined, little is seen to account for the persistent and intolerable itching.

I have been called to cases where the stall has been padded, sheet over sheet thrown on a horse's body, a cradle placed round the neck, and attention paid that there should be no chance of the animal biting or rubbing itself.

Very generally such cases occur in the hands of injudicious horse keepers, and it will be found that beans and oats are allowed four times a day, and hay *ad libitum.* In other cases sloppy mashes are given in huge quantities daily. It is then important to stop the supplies, to purge, to wash the skin with soap and water, and keep the horse on little more than half a peck of oats daily, and 12 or 14 pounds of hay. Nitre should be given occasionally, and great care taken to keep the animal's skin clean. A sweating in a hot-air bath must prove of advantage in such a case, but occasionally the plans of treatment here recommended have failed. It is then necessary to administer arsenic internally, in doses of from three to five grains daily given in food.

I have not seen any benefit derived from bloodletting in such cases; and if the animal affected is fat or plethoric, it is best to reduce condition by purgatives and exercise.

Exercise is sometimes sufficient to cure ordinary attacks of prurigo, but it cannot be relied on entirely. Prurigo may be seen in horses that are daily at work, and the regularity of exercise, with excess of food, favours that state of plethora which so often induces the irritation of the skin.

CHAPTER XIII.

THE SKIN AND ITS APPENDAGES.

Diseases of the skin arising from general causes, continued.—Vesicular eruptions.—Humid tetter, or eczema simplex.—Eczema rubrum.—Eczema impetiginodes.—Eczema chronicum, or psoriasis.—Rat-tails.—Mallenders and sallenders.—Pustular eruptions.—White face and foot disease, or impetigo fascialis.—Neck mange, or impetigo colli.—Impetigo larvalis, or 'breaking out' on the mouths of young animals.—Cracked heels.—Grease.—Impetigo erysipelatodes.—Ecthyma in man and animals.—Herpetic, or bullous eruptions.—Herpes.—Herpes phlyctenodes.—Herpes labialis.—Herpes caleus.—Herpes exedens.—Hydrargyria.—Herpes decalenno.—Herpes scabiosus.—Pemphigus.—Furuncular eruptions.—Boil.—Sty.—Carbuncle.—Scorbutic eruption.—Purpura.—Purpura hæmorrhagica.—Diseases arising from special external causes.—Scabies in all animals.—Its parasitic nature.—Gerlach's researches.—Description of the parasites.—Development of the disease.—The treatment of scabies.—Its prevention.

ECZEMATOUS OR VESICULAR ERUPTIONS.

THESE eruptions are characterised by the development of numerous small vesicles clustered together on an inflamed skin. Of late years, in this country, the term 'eczema' has been applied to the prevailing plague commonly known as the foot-and-mouth disease, or vesicular murrain. This has been a great error, and has created endless confusion, as the epizootic aphtha must be described with the eruptive fevers arising from the introduction of animal poisons into the system.

Eczema is a very common disease in all our domestic animals, but especially in the horse and dog. It is non-contagious, always sporadic, usually due to peculiarity of feeding, and very commonly dependent on an oat or oatmeal diet. It cannot therefore be confounded with the epizootic affection so readily communicated from the sick to the healthy, and from animals of one species to those of another. The common skin affection, eczema, is constantly recurring in the same animal, whereas, like all other eruptive fevers, epizootic aphtha occurs, as a rule, but once in an animal's lifetime. Eczema is one of the most common of indigenous skin diseases in the United Kingdom, whereas the vesicular murrain is entirely of foreign origin. We cannot well have broader distinctions between two diseases than between simple vesicular eruptions of the skin and that disease which has been most improperly termed eczema epizootica.

There are three forms of eczema that I have seen in the dog, and they consist in eczema simplex, eczema rubrum, and eczema impetiginodes. In the horse simple eczema is seen in its well-marked characters, and chronic eczema or psoriasis in the cases of 'mallenders' and 'sallenders.'

Eczema Simplex.

In man this disease has been termed 'humid tetter,' and in the lower animals it constitutes one of the many *mangy* affections. It is found to commence usually as a local affection, and in animals that, up to the time of manifesting irritation, commonly about the back and thighs, appear in perfect health. It is unassociated with fever, and we can only notice cluster after cluster of minute vesicles develop and dry up on the sore skin, or discharge the liquid that seems to favour an extension of the disorder. The hairs are rubbed off, and the red skin is exposed, being entirely denuded of cuticle, and usually moist with the discharge. The disease may break out in different parts of the body, and it is found that at one time the surface is raw in one place, and at another the eruption is more marked at a distance from the first part attacked. The irritation is intolerable.

Mr Percivall describes two characteristic cases, one under the head Surfeit, and the other under Saddle-scald. The first case illustrates the ordinary variety of eczema simplex. His report is as follows:—

"*Oct.* 5*th*, 1850.—A four-year-old horse (A 25) was shown me this morning, with one circular patch, nearly bare, upon his rump, close to his dock, and several others (three or four) on the off quarter, lower down. Little vesicles, containing fluid, first came. These run into one another, and break, the hair matting over them, and coming off along with desquamations of the cuticle, which lies in cakes or scabs around the places where the vesicles appear. I viewed the places through a magnifying glass, and distinctly saw heaps of these scabs, which, when they separate, bring the hair off with them, and leave the places bare until new hair springs up and covers them. This horse has got the tushes, and is now cutting his five-year-old teeth, *without* any reddening of gum, or the slightest irritation."

In the subjoined case the peculiarity is one often seen in man and in the dog, in which the small confluent vesicles are so closely aggregated as to give rise to one continuous vesicle of great breadth, as described by Mr Erasmus Wilson in his treatise on skin diseases. Mr Percivall furnishes his readers with the following interesting particulars:—

"D 10, a grey mare, was shown to me 28th Oct. 1840, for 'eruptions' upon the body and limbs. The lumps are scattered, being over the skin some distance apart, and but few in number; they are the size of marbles, and such as have broken have discharged a serous, yellow-looking matter, which sticks and mats the hair together—in fact, the places look as if so many blisters had been applied. A dose of physic was given, and the broken places sponged with warm water, and I heard no more until about November the 4th, when it was again presented with a fresh crop of similar eruptions: some of the former ones having apparently gone back, as they felt hard and insensible. Now it was bled to 8lb., and Calomel, ʒj., Purg. Mass. C. ʒx. given. It quitted again quite well on the 7th. After the operation of the physic, I heard no more of it until the 12th, when it was again brought with more eruptions and lumps. To take daily, Calomel, ℈i., Ant., ʒj., in powder daily. Nov. 14th.—It was admitted into infirmary. There are now about twenty lumps on the body, more upon the near than upon the off side, while the near fore leg has been the especial object of attack. There are several large blotches upon the arm, mostly on the outer, one only upon the inner side, and none below the knee. When closely examined, or if they be bathed with warm water, there is found a partial separation of the hair, which comes off with the incrustation, and exposes the cutis bare and raw. Nov. 16th.—To-day, it has had a rigor, after which I had it bled again to 8lb., and gave it P. M., ℥ss., Fever M., ℥ss., Calomel, ʒj., as a purgative, in consequence of the leg having become greatly swollen, and the eruptions discharging much. The pulse is about 55. The mouth rather feverish. The appetite continues pretty good. The eruptions to be cleansed with warm water; the near fore-leg to be fomented, and the mare to continue the exercise twice a-day. 17th.—The off fore-leg has become attacked; shows many eruptions, which, to-day, are seen upon both the legs, and the limbs are swollen likewise.

Repeat the ball, with exercise and fomentation. 18th. Much the same; does not purge; repeat ball. 19th. Purges briskly; no fresh eruptions; legs less swollen. Foment and exercise. 20th. Again better. No fresh eruptions; old ones becoming dried up and shrinking. Swelling less in the limbs. Continue exercise and fomentations. 21st. Going on well. 30th. Sent to the troop-stable. No fresh eruptions having appeared, and the old ones having broken and discharged a sort of glutinous or albuminous fluid, which had matted the hair together, and afterwards caused its separation, while the cuticle came off in white scales, like so much scurf."

In the dog the first indication of simple eczema is the animal scratching itself and rubbing its back violently, which is not unfrequently accomplished by running to and fro underneath a sofa. If such cases are not well attended to, they soon result in the severe form of eczema which I have next to describe.

Red Mange—Eczema Rubrum.

This is the common red mange of smooth terriers and greyhounds, in which the eruption of vesicles is seen to occur on an inflamed skin, of a very red colour, and excessively irritable. The limbs, belly, and chest are red and sometimes swollen. The surface of the skin is often moist and excoriated, and the discharge which thus flows is acrid, irritating, and keeps up the disorder.

A form of eczema rubrum is induced by mercury, and is termed eczema mercuriale or hydrargyria. Mr Percivall refers to this in his work on the "Effects of Medicines." A considerable number of cases have been recorded as occurring in cattle and dogs, and due to the incautious application of mercurial ointment to the surface of the skin. An eruption occurs, characterised by round, irritable patches of skin, from which a secretion oozes, and which are denuded of hair. The skin is at first red, swollen, and afterwards rough and hard. In dogs the eruption occurs chiefly on the limbs and scrotum. The general symptoms are loss of appetite, salivation, closure of the eyelids, great dulness, offensive exhalations from the skin, and sometimes death. Recoveries occur slowly.

Chronic Red Mange—Eczema Impetiginodes.

This eruption is seen in dogs that have long been suffering from red mange. The skin is very red and swollen, and the vesicles are apt to run together. I have seen considerable tumefaction of the skin over the scrotum, on the inside of the arms and on the back, and these parts naturally denuded of hair. Impetiginous eczema is essentially a severe form of eczema rubrum.

Eczema Chronicum, or Psoriasis.—'Rat Tails.'

From inattention to the treatment of the form of eczema already noticed, a chronic inflammation of the skin remains, associated with some thickening, and not unfrequently with the formation of cracks and fissures, whence flows an abundant secretion. The hairs and cuticular cells are apt to be matted together by the secretion, and produce a marked roughness of the part affected. The popular name for this disease in the horse has been 'rat tails,' from the peculiar shape of the elevated patch of scabs felt usually over the skin at the back part of the limbs of animals. Other names used are 'mallenders,' for the disease in the fore-legs, and 'sallenders' in the hind. Greve long since gave these conditions their proper scientific names, and termed them *Psoriasis carpi et tarsi.* Psoriasis occurs chiefly in long-haired animals that are neglected, and from the accumulation of scabs on the aspects of flexions of the knees and hocks, as well as from the swelling around the eruption, the motion of the joints is much impaired. This chronic eczema is frequently seen on all four legs, and sometimes only on one or two. It is very difficult to treat, and calls for great attention.

The treatment of all the forms of eczema consists, firstly, in giving a purgative, and then following this up by doses of acetate of potash in water. A horse should have an ounce or two of this salt daily, and a dog about half a drachm—more or less, according to the size of the animal. The diet should be changed, and moderate, and the severe irritation of the skin relieved by the application of an alkaline lotion, consisting of liquor potassæ in water, or a little carbonate of soda in water.

In all chronic forms of eczema, I find the internal administration of arsenic of the greatest benefit, and the skin must be treated locally by means of frequent washing, oxide of zinc or creasote ointment, glycerine lotion, and alkaline preparations.

IMPETIGINOUS OR PUSTULAR ERUPTIONS.

It is not uncommon to observe in the lower animals attacks of cutaneous inflammation of greater severity than is necessary for the development of the diseases already described. Suppuration occurs on the surface of the skin, and beneath the epidermis. *Pustules* are therefore characteristic of this class of inflammations, and the practitioner knows that they characterise many diseases which he has to deal with amongst horses and cattle.

Two kinds of pustules have been described in impetiginous affections in man, and they are both to be seen in the lower animals. One is a small pustule, often irregularly circumscribed, producing but a slight elevation of the cuticle, and terminating in a laminated scab. The second is commonly of a large size, raised on a hard, circular base, of a vivid red colour, and succeeded by a thick, hard, dark-coloured scab. There are two kinds of pustular eruption to describe, viz., impetigo and ecthyma.

Impetigo Labialis s. Facialis.

Professor Röll, of Vienna, refers to this malady in the following terms:—"There occurs amongst horses with a white face, and only at pasture, an eruption which consists in small pustules, over which yellowish crusts form, which adhere to the rough and thickened skin. An ointment is required to favour the separation of the scabs, and no further treatment is called for." Rychner, of Berne, speaks of the disease as common, but in Britain it had not been described until 1860, when one of my students, Mr George Robertson, now practising at Ellon, favoured me with a communication on a "White face and foot disease." It had never been heard of in Mr Robertson's district until the year 1857, and Mr R.'s observations were made in the month of July, 1860, when he was requested to attend a mare with an eruption in the face. In the course of a week, the whole of the animals on the farm were affected with the exception of one mare, which *had neither white hairs on the face nor on the pasterns.*

Mr Robertson has informed me that, as the name given to the disease implies, it is strictly confined to the white skin, over which small pimples or pustules form. There is much irritation, and the rubbing resorted to by the animals to allay the itchiness leads to excoriations of the skin, which, if roughly touched, bleeds freely. The eyelids become swollen, and there is a continuous discharge of pus and blood from the parts affected.

Mr Robertson applied at first a lotion consisting of half a drachm of sulphate of zinc, and half a drachm of acetate of lead, in a quart bottle of water. This had no effect, and the ointment of the nitrate of mercury was resorted to with the greatest advantage.

Some information may be gleaned as to the probable cause of this disease. In 1841, a German veterinarian, Steiner, reported that, during the summer of that year, the leguminous plants, especially the vetches, became subject to honeydew, and all the white horses, or those that had white marks, that partook of those plants, were affected with a peculiar skin disease. The white skin was inflamed and sloughed, whereas all dark-coloured horses, and the dark portions of the skin, remained healthy.

A similar disease has been seen amongst young sheep, goats, pigs, and, more rarely, cattle and horses fed on buckwheat. On exposure to the sun, the white portions of the skin swell, are intensely red, and slough. Hering saw the disease in 1833 and 1834, amongst animals which partook of buckwheat in flower and seed. In 1828, the foals at a breeding depôt at Alt-Ulrichstein suffered very severely, and it was attributed to the wet weather and eating a variety of wild polygonum.

Time must decide whether all the cases noticed under impetigo labialis, or facialis, are really cases of impetigo, or whether some of them should be considered under a different head. There seem to be sufficient points of analogy between the cases here referred to and the disease spoken of by Röll as impetigo labialis, to warrant their being grouped together.

Neck Mange—Impetigo Colli.

This is the Mähnen and Halsgrind of the Germans, and consists in a pustular eruption, which occurs at the root of the mane, and on either side of the neck. The pustules are about the size of peas, and get covered by yellowish, or yellowish-brown scabs, to which the hairs adhere. A purulent discharge is apt to accumulate beneath the scabs. The disease is especially prevalent in spring, and yields to mild treatment.

A similar eruption occurs occasionally at the root of the tail, and is attended with much itchiness. This is chiefly caused by dirt, and is cured by attention to cleanliness, washing with soap and water, &c.

Impetigo Larvalis.

This pustular disease assumes various forms in the lower animals. In all young animals eruptions are apt to occur about the lips, and various descriptions have been published of impetigo of the face and lips in calves, lambs, goats, and pigs.

Often in lambs, either in the under or lower lip, are seen round pustules, from which a thick scab or crust drops off in a few days, leaving a red and inflamed skin. In calves the eruption occurs mostly on the upper lip, and there is a continuous 'breaking out,' with an extension of the disease into the mouth, and around the nasal apertures. In pigs the impetigo occurs around the eyes, and spreads over the neck and back.

The causes of impetigo are richness of the milk which young animals suck, and, later in the season, it is due to green food, which may sometimes contain irritating materials; not unfrequently we find that lambs, folded on long grass, especially when there is an abundant dew, suffer from excoriations and pustules. I have seen many cases associated with considerable fever, but all symptoms disappeared on removing the cause, viz., changing the diet.

Those who can read German will find good descriptions of impetigo larvalis in German works, under the names 'Maulgrind,' 'Lämmergrind,' 'Kälbergrind,' 'Teigmaul,' &c.

PUSTULAR ERUPTIONS OF THE HEELS IN HORSES.

Impetigo Sparsa Digitorum (Greve).

This is a very common morbid state in clipped horses, and in well-bred animals with a thin skin, which are ill managed. The heels become hot and swollen; pustules then form, burst, and leave behind a sore ulcerating surface. There is stiffness of gait, pain, and sometimes itchiness. During wet seasons, especially when horses' legs are much trimmed, the disease assumes a chronic and inveterate form. It may pass on to grease, or fissures in the skin form, with hard edges, and a slow sloughing process tends to incapacitate the animal for work.

The treatment in these cases consists in moderate diet, cleanliness, keeping the limbs clean and dry, and using mild lotions similar to those recommended for grease. Advantage is derived from the use of oxide of zinc in powder, which may be applied alone, or mixed with some finely-powdered starch.

Under the name 'Impetigo Rodens,' the skin disease and casting off the hoofs which occurs in poisoning by ergot have been described by Greve, Hering, and others.

Grease—Impetigo Erysipelatodes.

Greve applied the above name to the well-known disease, *grease*, which Röll has termed Paronychia impetiginosa.

Grease may be defined an inflammation of the skin at the back of the fetlock and heels, on which pustules form, yielding a fetid purulent discharge; it is associated with a febrile condition, varying considerably in intensity.

Symptoms of general disorder usually precede swelling of one or more legs, and especially of the skin of the heel; the hind limbs are more frequently seized than the fore, and the swelling extends upwards over the back of the leg. It is at first like simple phlegmon, with much heat, stiffness, and pain. The exudation sometimes extends up behind the tendons so as to render the knees and hocks rigid. In the course of a few days clusters of pustules rise, which are at first filled with a clear, yellowish lymph. It is this lymph which, from inducing an eruption in cows and in human beings similar to that of true variola, has been distinguished by the name of *equine lymph,* and the term equinia has been applied to the eruption. The impression, in fact, that cow-pox is generally due to the communication of a virus from the horse, has been founded on good observations made by Jenner and his successors. Mr Ceely says: "I have met with several intelligent dairymen whose relatives had seen good reason to ascribe its occurrence to the contagion of the equine vesicle, communicated by the hands of the attendants of both animals, but very little of that disease has been noticed of late years, though I know of several farriers who have been affected from the horse, and resisted subsequent variolation or vaccination, and have seen a few who distinguish between the equine vesicle and the grease, a recurrent disease—eczema impetiginodes—as it appears to me."

I have always described two forms of grease in the horse: the one in which the lymph was capable of inducing a well-marked eruption in man, and the other very similar in character, but unassociated with the development of a specific virus, and which is commonly the result of diffuse cutaneous inflammation occurring under a variety of circumstances, and often as a sequela in cases of inveterate cracked heels.

The lymph which bursts from the pustules in grease irritates the skin, which becomes sore and partially denuded of hair. The disease is then very apt to assume a chronic character. The heat and pain are no longer so marked, there is a tendency to chronic œdema, and the skin is constantly moist, or feels greasy, owing to a fetid and thick discharge, which dries and mats the hairs together, and produces scabs, which accumulate and form a solid layer on the hairy legs of cart-horses. Ulcers and fissures of various depths occur, the skin undergoes disorganization, and becomes studded by fungoid masses of granulations, which spring from the unhealthy sores, or by abnormal deposits of cuticle over clusters of hypertrophied papillæ. These irregular excrescences have been termed 'grapes.' In some cases the lymphatics of the limb are apt to inflame, abscesses, and even farcy buds form. In other cases the acrid discharge induces degeneration of the frog and sole, so that the malady becomes complicated by an attack of canker. Professor Hering of Stuttgart has found in chronic grease large numbers of acari similar to those found in scabies.

The limb affected with chronic grease is apt to become enormously enlarged, and the skin acquires great thickness. The name elephantiasis has been given to this condition, which is well represented in the annexed engraving, on next page, from a photograph made by me of a remarkable specimen in the Berne Museum.

The causes of grease are numerous. Low-bred horses, especially those with abundant hair on their limbs, and bred on damp, marshy lands, are very liable to its attacks. Wet and dirt are often exciting causes, and some seasons the disease is so prevalent as almost to assume the form of an epizootic. The disease occurs mostly in animals with white legs; and it is always found that when a horse predisposed to the disease has but one hind leg white, it is always the one most frequently and severely affected. The disease is unquestionably hereditary, and certainly contagious when the specific lymph is developed, which I have before spoken of.

The treatment of grease varies materially, according to the stage of the disease. Poultices should be applied to remove the scabs and soften the skin. Detergents should

Fig. 183.

then be used, and the preparations of chlorine, especially the chloride of zinc, has been found of great service. The alkaline permanganates have been used with marked good effect, as also carbolic acid. Mr Calvert, of Manchester, recommends one pound of the acid to be diluted with one gallon of water, and applied to the skin with a brush or India-rubber glove. Many other applications can be recommended, such as the following:—

℞	Glycerine, ...	℥ij.
	Sulphate of zinc, ...	ʒij.
	Water, ...	1 quart.

Or,

℞	Sulphuric acid, ...	ʒj.
	Sulphate of copper, . . .	℥ij.
	Water, ...	1 quart.

Zinc ointment is also useful in cases that are recovering, and care should be exercised not to use too much water to render the skin sore and thick. Wet should always be avoided except at intervals, when caustics and astringents have to be applied.

In addition to local applications, the animal must be treated constitutionally by occasional purgatives, regular exercise, and, in inveterate cases, by the internal administration of arsenic, giving an ounce of Fowler's solution daily for a month or two. Great attention must be paid to cleanliness of the skin.

Ecthyma.

Writers on veterinary medicine are silent on the subject of ecthyma in the lower animals. The term is applied in man to "an acute inflammation of the skin, characterised by the eruption of prominent pustules of a rounded form and considerable size, upon any part of the surface of the body. The pustules are distinct and scattered, they are developed on a hard and inflamed base, and terminate in dark coloured crusts, which leave a deeply congested surface, and often a brown stain, on their fall, and sometimes a superficial ulcer followed by a cicatrix." The fact that the domestic animals have their skins covered with a dense coat of hair accounts for the non-recognition of this eruption. I have, however, seen it on the mammæ and inside of the thighs in ewes. In examining flocks with a view to determine if they were affected with small-pox, I have met with eruptions which correspond to the appearance of ecthyma in man. I have also seen the disease affecting the vulva in the cow, and pustules existed not only in the external skin, but also in the mucous membrane. Whilst on this subject, it is not unimportant to notice the severe attacks of ecthyma which veterinarians so commonly suffer from, after attending cows in difficult labour. In the first volume of the *Edinburgh Veterinary Review*, I published a paper in it, with a coloured lithograph, representing an eruption on my own arm. About twelve hours after being called to a cow, on the 23rd of November 1857, I felt a strong itching sensation on my right arm; my left was not altogether exempt, and in looking carefully I found that the skin of both was the seat of a diffuse rush. Next morning the redness had augmented on both arms, but chiefly on the right; and the pruriency was replaced by pain. On the Tuesday evening an abundance of small circumscribed pimples had formed, which suppurated on the Wednesday. By the afternoon of the 25th, they were well-formed pustules. These were large, distinct, and surrounded by a red areola. Both arms were painful, the auxiliary glands slightly swollen, and I suffered somewhat in general health. On the right side the pustules were very numerous, exceeding one hundred, but less so on the left. I was prevented lecturing only for one day, and in accordance with my friend Mr Lister's advice, the arm was dressed with a lotion containing diacetate of lead and opium. This relieved the pain, but some of the pustules attained the size of a large pea, others became encrusted with a brown scaly scab, and others, in bursting, left behind a cicatrising sore.

I was tormented for six weeks, when the only indication of the pre-existing eruption was the brown appearance of the skin where the pustules had existed. Early in March, however, at a spot on the inside of my right arm, just above the elbow, where the redness had not completely subsided, a large boil formed, which, on being opened, was found to contain a considerable slough. This boil was attended with much pain, and healed very tardily. Two other persons that attended the cow, including one of my students, suffered in a similar manner. Many cases are on record which indicate the dangers incidental to exposing the arm to the contact of the vagina, and the acrid fluids it contains, in cases of difficult labour in the lower animals.

Herpetic and Bullous Eruptions.

Bullæ are large vesicles which differ from the eruptions already described in little more than size. They characterize the group of diseases now to be spoken of, and clusters of bullæ, or globular vesicles, are found studding patches of inflamed skin. The difference between herpes and pemphigus is established by the relative size of the bullæ or blebs, which are always smallest in herpes, and, altogether, the latter disease is the mildest of the two. Pemphigus is known only as it occurs in man.

The term 'tetter' is popularly used for herpes, and there are many forms of this eruption.

Human physicians divide herpes into the phlyctenoid group and circinate group. The first "is characterized by the irregularity of form and distribution of the clusters; it is typified by the variety herpes phlyctenodes, and embraces all the local forms. The circinate group, on the other hand, is remarkable for the circular arrangement or form of its clusters; hence the herpes zoster consists of irregular clusters disposed in a circular form around the trunk of the body; herpes circinatus is characterized by the disposition of individual vesicles in the form of a circle; and herpes iris presents the same peculiarity in the form of concentric circles." —WILSON.

HERPES PHLYCTENODES.—PHLYCTENOID TETTER OF THE HORSE.—This skin affection was first described in 1840 by a French veterinarian, Dard, under the name of 'Rhinite pemphygoide;' and in 1843 Professor Bouley of Alfort, and M. Patté, a Parisian veterinary surgeon, published two papers on skin diseases in animals, one of which was principally devoted to the form of tetter, which they had found to be most common in the horse, and which they declared was of the phlyctenoid variety.

It is characterized by the eruption on a usually circumscribed surface of agglomerated vesicles, which are in great part so small and transitory as to require careful observation during their development, in order to see them; there are some, however, usually two or three larger, and about the size of a pea, and elongated. If the portion of skin affected is only thinly coated with hair, the nature of the eruption is readily made out. When, on the other hand, a group of herpetic vesicles forms where the hairy coat is dense, the hairs are seen to stand erect in clusters, and cannot be smoothed down. At the same time there is considerable irritation of the part, and scabs form which entangle the hairs. The hairs and scabs then fall off together, and violet-coloured, tender, or irritable patches of skin remain exposed. Occasionally the affected surface ulcerates, though most commonly the skin soon regains its normal character, and the hairs grow again.

Herpes phlyctenodes is apt to attack the lips, face, and even the Schneiderian membrane, so that it has been improperly taken for farcy and even glanders. It is very important not to confound it with such serious disorders, as it is a mild affection, and rarely associated with constitutional symptoms. Treatment consists in purgatives, low diet, and the local applications to be preferred are alkaline and sedative lotions.

Herpes Circinatus.—Vesicular Ringworm.

In the year 1841, a Dutch veterinarian, Heckmeyer, recorded a very remarkable case of vesicular ringworm in the horse. It was observed by him, in the summer of 1837, on a chestnut gelding, 13 years of age, the property of an army veterinary surgeon. The previous history of the horse showed that he had suffered somewhat from derangement of the digestive organs. When Mr Heckmeyer saw the animal it was covered over the whole body with about two hundred patches of denuded hair, and here and there scabs were adherent. The patches varied in size from a sixpence to a crown-piece. On examining the eruption it could be readily seen that exudation had occurred, so as to raise considerable vesicles, which, in many places, had dried up so as to form a scab of equal thickness over the whole surface. Wherever the vesicles had formed, a circular portion of skin was affected. On removing the yellowish-brown scabs, many hairs fell off, and the skin was found beneath to be red and tender. Slight friction over the scabbed portions of the skin seemed to be agreeable to the animal, but there was not much itchiness. The pulse was hard and full. The mucous membranes red, fæces hard, urine brown and scanty, appetite diminished, countenance dejected, and the horse appeared lazy and dull.

Heckmeyer considered the immediate cause of the eruptions to be plethora, and that the intense heat of the sun's

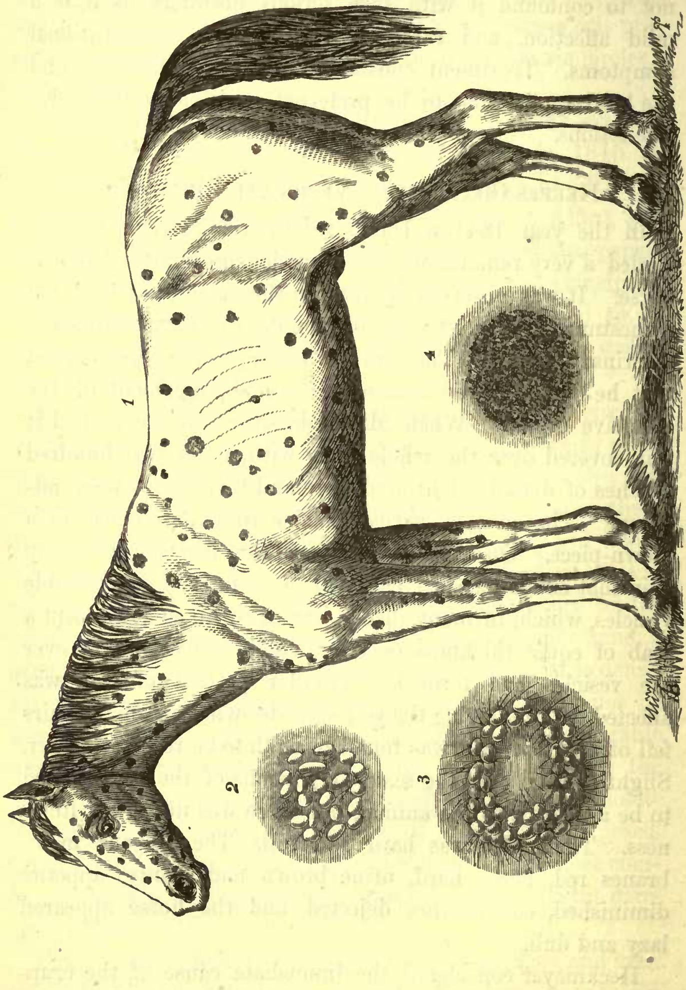


Fig. 184.

rays during the animal's exposure at grass had favoured the development of the skin disease. The horse was housed, bled, and purged, and in the course of three weeks was restored to health.

Furuncular Eruptions.

To the comparative pathologists this group of skin diseases is of special interest. It includes the boils and carbuncles which in man and animals vary in severity, from a simple pimple to a fatal anthrax. This subject has been ably handled by Dr Laycock in a paper on the Pathology and Treatment of the Contagious Furunculoid, published in the *Edinburgh Medical Journal* for November, 1856. The great difference between furuncular eruptions and those already noticed in this work, is the depth of inflammation and the loss of vitality of a portion of the true skin beneath the surface; the dead tissue is termed the core of the boil. In stating the characters of distinction between furunculus and anthrax, Mr Wilson says, " Furunculus is more prominent than anthrax, but the latter extends most deeply into the skin, and involves a greater breadth of the structure of the derma. The colour of furunculus is a deep red, becoming, as the disease advances, more or less dull and blueish; that of anthrax presents the same tints in a heightened degree, the deep red is still deeper and darker, often approaching a mahogany hue, and the blueish tint of furunculus becomes a deep purple and livid tint in anthrax. The core, which is single in furunculus, may be multiplied to twenty or thirty in anthrax, until the numerous openings formed on its surface for the crust of the cores give it the appearance of a sieve or colander. Lastly, the pain, severe in furunculus, is more intense and more burning in anthrax."

Boils and carbuncles occur very commonly on the lower animals, and human beings are known to suffer much from contact, direct or indirect, with animals affected with these diseases. This is seen at seaport towns, where hides are imported in quantities, and in manufactories, where hair is worked up. Dr Laycock mentions, in his paper above quoted, that, according to M. Trousseau, "in two factories at Paris, where hair from Buenos Ayres is used, twenty persons have died in about ten years from carbuncle, although only six or eight were employed daily. Rayer saw several cases of the disease while attached to the Hôspital St Antoine, all of which came from the same factory, and where hair from Russia was worked up. It is more than probable, therefore," adds Dr Laycock, "that at least some of the worst cases of carbuncle which have occurred in the United Kingdom have been really due to direct contagion from imported fomites, although we may not be justified in attributing all to this source." Further on Dr Laycock says, "There is another epizootic source of simple furuncle, which is worthy of mention in this place. It is well known that the cavalry of armies are particularly liable to suffer from furunculi. Alibert mentions the case of a Cossack, upon whose nates and lower extremities he counted above a hundred boils. The sacral region is, in fact, specially the seat of them in cavalry soldiers. But grooms and others, who have to work amongst horses, are also peculiarly liable. It is not improbable, therefore, that the *materies morbi* in cases of this kind is of equine origin, and this class of furuncle is to be discriminated at least ætiologically from the epidemic form."

I shall have occasion elsewhere to notice the malignant anthrax of animals and malignant pustule in man, and I have only to add, that ordinary boils and carbuncles in animals are treated in the early stage by poultices, fomentations and attention to the animal's general health, and in chronic cases the system is supported, the diseased tissues are incised, and caustics used.

Scorbutic Eruptions.

Still following out Mr Wilson's classification of skin diseases, I must here notice that condition of the system in which blood is effused in the substance of and beneath the skin. There is but one form of this disease which is seen in the horse, and which has been described under the head of

Purpura Hæmorrhagica.

This disease, though implicating the skin above all other parts or textures in the body, is due to a condition of blood favourable to passive hæmorrhage, or physical transudation of the constituents of the blood through the coats of the vessels. The disease was first described by the late Mr John Field under the title Pyrrecchymosis, and as Mr Field's remarks on the subject were quite original, and are often referred to, I here reproduce them.

"So designated by Dr Willan, where petechial spots appear on the skin, with or without fever.

"Affects the skin, mucous membranes, cellular tissue, parenchyma of internal organs, as lungs and kidneys; also issues from the brain, from between the coats of the intestines, and from the mucous cavities of the body.

"*Varieties.*—Purpura simplex, purpura hæmorrhagica, and purpura urticans, resolve themselves into the acute and sub-acute in the horse, both proceeding rapidly either to a favourable or unfavourable result.

"*Symptoms.*—Effusions beneath the skin, of irregular form, on the thighs or fore-arms, or under-part of abdomen, gradually or suddenly increasing; petechial spots on the Schneiderian membrane; swellings of nose or lips; ecchymosis of conjunctiva; painful tumefaction of thighs or forearms, occasioned by similar extravasation beneath the fascia, or in the cellular texture of muscles; occasioning limited motion, incapability of flexing the legs sufficiently to rise when down; sanguineous exudation from skin; in this state much constitutional disturbance; accelerated respiration; partial sweating; frequent, wiry, or full and strong pulse; scanty excretions. As the disease advances the swellings become confluent; greater depositions of lymph, as well as blood, take place in the thighs and nose, and under the eyes; a sero-sanguineous discharge takes place from nostrils; the Schneiderian becomes nearly black; the membranes not affected, or the buccal, rather paler; the respiration is snuffling, from effusion into the nostrils; the pulse becomes more frequent and feeble; the horse paws, or looks back, or anxiously turns his head from side to side; sometimes small portions of blood are voided from the nostrils, or with the urine, but these are not common in the horse; great debility quickly supervenes; the animal totters if made to walk about; his blood becomes thin and pallid; it separates very rapidly when drawn, and does not, according to Mr Lane, exhibit the normal tendency to assimilate its chylous particles. The urine, in Mr W.'s had much albumen in it, was ropy, and coagulated with nitric acid and heat. The skin is often distended, sometimes so much so that, through flexing, very large ulcers are occasioned.

"*Duration.*—From 3 to 7 days, in fatal cases: if the horse survive that period, though the circumstance is favourable, it may recur, and prove fatal by deposits in vital organs, or by gradually exhausting the vital powers.

"*Morbid Appearances on Dissection.*—Dark or black blood effused beneath the skin or fascia, or in the fibres of muscles, giving a dark modena or purple or black colour to the portions in which it occurs, and a lighter hue to the other parts of muscles; much effusion of lymph in contiguous structures; deposits more extensive in the more quiescent muscles, as the pectorals and psoæ, if the horse remains quiet; also, between the coats of that portion of duodenum tied to the capsule of Glisson, terminating abruptly, where it is loosely held by mesentery before crossing the spine; and also at the pylorus: ecchymoses on the pleura, and in the substance of the lungs; slight blush in the bladder, and spots of elevated ecchymoses in bladder and ureters, or inflammation and deposits in the coats of the intestines, either in the colon, cæcum, or small intestines; the heart is affected; deposits of blood, various, upon the cerebrum and cerebellum.

"*Pathology.*—1, An increased tenuity of the blood; 2, dilatation of the mouths of the capillaries, admitting natural blood to pass through them; 3, tenderness of the coats of the vessels, giving way from the ordinary impetus of the blood; 4, increased impetus, rupturing healthy vessels; 5, obstruction in the capillaries; 6, two or more of these causes combined. Still, the universality of the disease does not allow of the proper explanation of the phenomena from either of the above causes, and the more rational mode of explaining it seems that which refers to an alteration in the condition and vital properties of the blood.

"*Exciting Causes—Pre-disposing Causes.*—Debility, induced by previous inflammatory disease, either severe or mild; poor living; frequent irritation; it occurs, also, without any assignable cause.

"*Diagnosis.*—It can hardly be confounded with other diseases in the horse, melanosis differing so essentially.

"*Prognosis* must be guarded, and can only be favourable when the fever has abated—when the swellings are confined to the limbs, not attended with difficulty in motion—when symptoms of internal mischief are absent—when there is plentiful diuresis: but if the urine be scanty, ropy, voided in small quantities; if there be much painful distention of the thighs from effusion beneath the fascia; if there be much extravasation about the nose and head, and effusion beneath Schneider's membrane, &c., the prognosis is unfavourable; and, moreover, if symptoms of internal disease exist.

"*Treatment.*—Aperients are useful when not pushed too far. Bleeding is admissible, and seems demanded in the plethora which certain cases manifest, or when vital organs are affected or threatened, but rarely benefits; though the pulse, in some instances, requires it. Turpentine is given, advantageously, in all forms: the oil may be too irritating to the urinary passages, cause some effusion of blood, and require to be discontinued.

"The acids are advisable as tonics and styptics.

"The sulphate of iron is useful.

"Pure air of the country, out at grass; exercise.

"Cold affusion particularly good.

"*Remarks.*—A disease of the highest interest in a pathological point of view, and requiring more investigation, and seemingly referable to a morbid condition of the blood and fluids."

Very few of the cases reported by veterinary surgeons as cases of purpura merit the name, inasmuch as they are clearly instances of a fatal affection occurring in animals at all ages, and associated with symptoms of stupor, prostration, and disorganization of tissue, which are quite exceptional in purpura in man.

Purpura hæmorrhagica, properly so called, occurs principally in the dealers' and jobmasters' horses purchased as three or four year-olds in Yorkshire, Lincolnshire, and elsewhere. These horses are fat and overgrown; they are in the condition in which human beings liable to purpura are seen; there is an excess of certain elements in the blood, and it is in this respect that purpura differs from scurvy, which is due to the want of certain essential nutritive principles, or to defect in the assimilations of food under circumstances which tend to reduce the animal's vital powers. The history of purpura in the horse has yet to be written, inasmuch as we need special inquiries into the constitution of food that the affected animals have lived upon prior to their attack, and we also need more details as to the condition of the animals themselves. As yet veterinarians have been unsuccessful in treating cases of real or supposed purpura hæmorrhagica, and I am anxious that the sesquichloride of iron should be continually tried, given in moderate doses twice daily, in combination with the spirits of nitric ether. Small and repeated doses of turpentine have been found useful, but I would not recommend a remedy which I know to be dangerous as usually administered to horses.

Purpura hæmorrhagica has been witnessed in cattle, swine, and sheep, but in none so commonly, according to the reports of practitioners, as in the horse. My belief is, that, of all animals, swine are more subject to it, and I trust we may glean some further information to throw light on this hitherto somewhat mysterious disease.

MANGE, SCAB, OR ITCH IN THE LOWER ANIMALS.

Scabies.

Scabies is a skin disease of a purely local nature, due to an insect which induces irritation, ulceration, suppuration, and encrustation on the surface of the body generally. It is a contagious disease, never originating spontaneously, and requiring for its development the passage of the parasites or their eggs from diseased to healthy animals. In man this disease is termed 'the itch,' and in the lower animals it is usually alluded to as 'mange,' and in the sheep it is well known as a fearfully destructive disease under the head Scab.

There are some important points in the history of scabies which apply to this disease as it affects the animal kingdom generally. There is no species in the class mammalia that is not attacked with an insect inducing such a disease, if we perhaps except those that live mostly in water. Zoological gardens and travelling menageries have been very liable to mange or scab amongst the animals exhibited; and it has been ascertained, that though the weak, dirty, and ill-nourished condition of some animals renders them very liable to the disease, they only become affected when diseased animals accidentally come in contact with them. A most important point, very clearly established, is, that although any animal may accidentally be the carrier of contagion between other two, such as a cat or a dog carrying disease from one elephant to another, or from one horse to another, that it is essential for the development of a real scabies on any animal that the insect should be proper to that animal. Thus human beings engaged around mangy horses carry the malady from one animal to another, and suffer but very slightly, and only for a very short time, themselves. The parasite which lives on the horse does not live on man, and the parasite that lives on the sheep does not contaminate the shepherd's dog, though the latter may, like the shepherd, or the many rubbing-places on driftways, be the means whereby the malady spreads.

It appears, however, that animals of the same genus, though of different species, may be attacked by precisely the same insect. Thus, the cat, the lion, the tiger, and other feline animals have one kind of insect common to the whole.

It must be evident to all, that before entering further into the purely medical history of mange and scab in the lower animals, we must know more of the parasites.

That scabies has been due to parasitic acari from the earliest days of the world's history, is of course certain, but we have no record of the disease whereby we can satisfy ourselves as to its being known to the ancients. "It is doubtful," says Gerlach, "if in the 6th verse of the 13th chapter of the book of Leviticus, reference be made to the itch." We believe it most probable, as in speaking of the leper it is said, "And the priest shall look on him again the seventh day: and, behold, if the plague be somewhat dark, and the plague spread not in the skin, the priest shall pronounce him clean; it is but a scab: and he shall wash his clothes, and be clean." It is doubtful whether the lice (φθεῖρες) which Aristotle mentions as growing in the flesh, were true acari. The first certain information is given by Avenzoar, a Moorish physician in Spain, who mentioned the itch-insect under the name of Soab, as small lice—pedicelli, or in Arabic, asoabat, which could scarcely be seen, and which burrowed beneath the skin of the hands and feet, causing the development of pustules filled with water. Four hundred years later, Scaliger published the first accurate account of the acarus scabiei and its habits; the people of Padua then called it pedicello, in Turin it was known by the name of sciro—hence acarus sciro, and in Gascony, brigant. Gerlach has furnished us with a complete history of this subject, alluding to Aldovrandi, Moufet, Hauptmann, Hafenreffer, Bonomo, and Fabricius. Wichmann appears to have been one of the earliest who looked upon itch as depending solely on the parasite, and not on a specific dyscrasia. Gerlach has furnished his readers with a brief sketch of the history of this interesting subject from the days of Galès—

whose drawings of the cheesemite are held as classical—to those of the indefatigable Bourguignon and Gudden.

The history of observations referring to scabies in the domestic animals is very rich. Youatt quotes Ovid's verses—

> "Lanigeris gregibus balatus dantibus aegros,
> Sponte suâ lanaequa, cadunt et corpora tabent,"

in alluding to a pestilence that prevailed in the Island of Aegina 1300 years before the Christian era.

It is certainly doubtful whether Livy's arguments as to the transmission of the disease from cattle and sheep to man be just. Similar influences, however, might account for the disease *scabius*, so prevalent amongst oxen and the woollen tribe, in the neighbourhood of Rome, 424 years before Christ, being apparently communicated to all the inhabitants of the country, and ultimately to the slaves. Virgil gives a graphic description of the disease. Columella mentions the scab in sheep, and Vegetius Renatus wrote on the mange in horses. The malady was adverted to in the veterinary and agricultural writings of the middle ages, but no new facts were added to those ascertained by the ancients. After speaking of the affection having arrested the attention of sanitary legislators in the seventeenth and eighteenth centuries, Gerlach speaks of the writings of Chabert, Huzard, Wichmann, Wiedebant, and Kersting, the latter, according to Hering, knowing that mange in horses was due to an acarus, as far back as 1784. In 1810, Walz described the scab-insect of the sheep and fox. In 1812, Gohier saw the acari of horse and ox, which Didier described and illustrated; and in 1814 Gohier found the parasites in the Hungarian oxen which followed the Austrian army into Lyons, and were affected with mange in every stage. Bosc, Niemann, and Raspail have contributed by their writings to this subject, and Gerlach alludes to the strange and imaginative drawing of the acarus equi given by Raspail.

Hertwig has been a careful observer on the subject of mange and scab in animals, and in 1827 made experiments on scab in sheep, to prove that the disease was alone communicated by means of acari. In 1835 he published his account and illustrations of the acarus of the horse, and twenty years later, he spoke of the sarcoptes canis. In 1838 Hering published his very remarkable memoir on the acari of the horse, ox, sheep, cat, and chamois; also describing the sarcoptes cynotis and hippopodos, from the suppurating internal ear of dogs, and from canker or paronychia of the feet of horses.

We shall not enter into the history of the zoological classification of the parasites in question. Writers on natural history have been puzzled as much as the pathologist by these insects, and we leave our readers to consult other works, to learn the views of Linnæus, Latreille, and many others. Gerlach speaks of them as belonging to the class Arachnida, the order of mites, or acari, sub-order of crawling mites, family sarcoptes, and he has three genera—*a*, Sarcoptes, that burrow in the skin; *b*, Dermatodectes, that simply bite, and hold on to the skin; and *c*, Symbiotes, living together in large numbers, and not piercing further than the cuticle in search of food. The species belonging to each genus are as follows:—

A. Sarcoptes.	B. Dermatodectes.	C. Symbiotes.
1. S. hominis.	1. D. equi.	1. S. equi.
2. S. equi.	2. D. bovis.	2. S. bovis.
3. S. suis.	3. D. ovis.	(To this genus belongs also:—
4. S. canis.		S. elephantis.)
5. S. cati.		
6. S. caniculi.		
[To this genus belong also:—		
S. rupicaprae (Hering.)		
S. dromedarii (Gervais.)]		

Gerlach adds some remarks on the classification and on the procreation and development of these parasites; he further alludes to them as the cause of skin diseases, and mentions the facts known with reference to the diffusion of the species and the methods of discovering them in animals.

"The itch and mange insects," says Gerlach, "are met with in cold and hot climates; it appears, however, that the itch is most rife in southern regions; but, as regards mange, this has not been established. It is not probable that there is a real geographical limitation in the spread of these parasites; their spread depends on so many causes, such as habits, customs, methods of living, state of cultivation, rearing of animals, sanitary laws, and the method in which these are enforced. There are certain forms of parasites imported in a district, where, under certain circumstances, they may readily remain stationary, without genuine development from any determined local condition, depending on the position, or otherwise, of the locality; in this way there are certain geographical itch and mange stations, and in some territories both may be seen; whereas in others, as in large cities, in some parts there is one form of insect, and another elsewhere. Of the mange insects, that of the sheep, and nextly that of the horse, are most widely spread. Poland would appear to be a geographical station for all the mite tribe, at least for the mange insects; from there severe invasions of these parasites occur on our land, especially among sheep and horses: in Berlin, the dog-mange is stationary; in Westphalia, the mange in cats; in France, the scab in sheep; in Switzerland, the scab amongst goats, which, at all events, in the north of Germany, does not exist.

"The acari are not immediately and essentially affected by meteorological changes, as they live on living organisms; we cannot, therefore, as for other insects, speak of productive and unproductive seasons, and the severity of mange in certain years can be attributed as little to changes in the weather, vegetation, &c., as the spread of plagues or epizootics can be imputed to diet, pasturage, &c."

A question of immediate practical importance is the finding of acari on animals, and we therefore transcribe Gerlach's interesting remarks on the subject. Gerlach says:—"The finding these insects has, as yet, been attended with great difficulty; in man, however, it is easily done by following the little grooves upon fresh papulæ, and especially in the larger tracts, at the blind end of which there may or may not be nodules or vesicles. It has not been possible heretofore for veterinary surgeons to discover these parasites with certainty, because the various insects and their chief characters have not been known, and they have not been regarded as the ontological cause of scabies." The various procedures to find the acari are as follows:—

1. Animals are placed in the sun and carefully examined; the acari do not get on the surface of the epidermic scales and on the hairs as dermatodectes do, and these can be seen with the naked eyes.

2. The sarcoptes are found below the scales or scabs, which may be so adherent to the skin, that, on being removed, the latter may bleed. The dermatodectes are observed after the animals have been exposed to the sun, on the outer part of these scales, but the sarcoptes are only seen on the inner. The scales examined should always be fresh, and they may be laid on black paper in a warm place in the sun, and then examined by a weak lens embracing a wide field of view. The small sarcoptes are only discovered when the cuticle has been removed with the scab.

3. The sarcoptes are most certainly and easily found when

the scales are laid with their under surface uppermost on the arm. In the course of twelve hours they pass from the scales on the arm and burrow into the skin at the part covered by the scab. On removing the latter, the parasite is seen as a white spot on a somewhat reddened skin, or upon the small red papula. With the point of a needle the white summit of the epidermic vesicle is punctured, and the sarcoptes is obtained. If the inflammatory nodule be allowed to pass to the state of a bladder, then the mite is rarely found. If there be only a few of the acari on the scales applied to the arm, the red points or nodules are only seen next day, and before the appearance of this eruption the insects are not, as a rule, to be found on the skin; if many of the parasites exist on the scales, then in the course of a few hours they may be obtained on the arm.

The dermatodectes, especially of cattle and horses, are very readily found in a similar way. Sometimes the scales need only be on the human skin one hour.

The symbiotes are not discovered by this procedure, but they are readily obtained from beneath the scales, by laying the latter on a paper in the sun, where next day they are found in small clusters.

When sarcoptes are sought by placing scabs on the skin of the arm, lest any should have remained behind, the skin should be rubbed with a little turpentine oil or some oatmeal. With the other forms of parasites mentioned this precaution is unnecessary.

Gerlach's descriptions of the itch insects are excellent. With reference to the scarcity of male in comparison to the number of female acari to be found in cases of itch, he believes that though there is, no doubt, a majority of females, nevertheless the males, in a great measure, elude detection. They are small, and very active, burrowing only in short grooves, so that the skin does not bear so distinct an indication of being affected where the male acari exist, as where the femal‘ s are lodged, in deep furrows, giving rise to much irritation.

Referring to the incubation of the eggs of sarcoptes hominis, the author avers that all the statements hitherto made are incorrect, not excluding Bourguignon's. The changes which the latter gentleman declares to have observed in the course of ten days, occur, according to Gerlach, in the incredibly short period of three days. A very simple process was adopted by Gerlach to prove this. He placed some eggs of sarcoptes hominis in a depression on a piece of glass plate, and having added a few drops of water, another bit of glass was gummed over the cell containing the eggs, and the apparatus was then bound round the arm; every twelve hours a few drops of water or saliva were added. Sometimes the incubating apparatus was carried about in a pocket close to the body, and generally the eggs were hatched in three days, and not usually in more than three days and a few hours. This explains the rapidity with which a person may be covered with acari, though only one or two might have crawled on the body at first.

It is probable that so soon as the female has deposited her eggs she dies, and Gerlach believes that her life does not extend to more than four or five weeks. The males do not die after sexual intercourse, and one male may fecundate many females, a proof of the necessity for less males than females.

When removed from the skin, sarcoptes die more from drying and shrivelling up than from hunger. Under the influence of dry heat they soon become weak, and perish in from three to four days. If they are kept in a warm and moist medium, they may survive eight or ten days.

We need not dilate here on the characters of the itch eruption; but referring to the spread of the disease, it is of course evident that a male acarus or unimpregnated female can only induce a temporary eruption on healthy skin. The contagion is usually immediate, and generally from persons sleeping with each other, inasmuch as acari do not adhere to clothes, and pass from the skin, which is their natural resting place. Moreover, they are most active under the influence of warmth, and according to some authorities they are nocturnal. The sarcoptes of man does not live, as proved by Bourguignon, on the dog, cat, rabbit, porpoise, rat, or birds. On three different occasions Gerlach placed three, four, and five pregnant female acari on those portions of horses' skins which were finest and least covered with hair. Irritation supervened, and even papulæ formed. In one case recovery was not complete until the 18th day. Nothing was perceived after placing acari on oxen, sheep, and pigs. In cats and dogs temporary disturbance resulted. One dog recovered only after eight weeks.

An inveterate form of human scabies was first observed by Böck in Norway, and hence received the name of *Scabies Norwegica Boeckii*, or *Scabies Crustosa.* It was believed to be a specific form confined to Norway, but was afterwards observed by Fuchs in Göttingen, Hebra in Vienna, Gumpert in Würzburg, and Rigler in Constantinople. The disease is chronic, and attended with the development in different parts of the body of scabs, half-an-inch in thickness, and consisting of epithelial scales, dried exudative matter, the spawn and excrement of acari. Beneath these scabs living acari are observed. Fuchs, Hebra, and Gerlach are in favour of the view that this form of itch is similar to the common variety, only aggravated, perhaps, from constitutional taint. Gerlach adds the reasons which seem to warrant the conclusion he has arrived at.

Scabies of the horse has been considered by Gerlach under three heads:—*Scabies equi sarcoptica, Scabies equi dermatodectica*, and *Scabies equi symbiotica.*

The insect met with in the first form had not been described before; Gerlach drew attention to it, and stated that he had found it in two-thirds of the cases of mange met

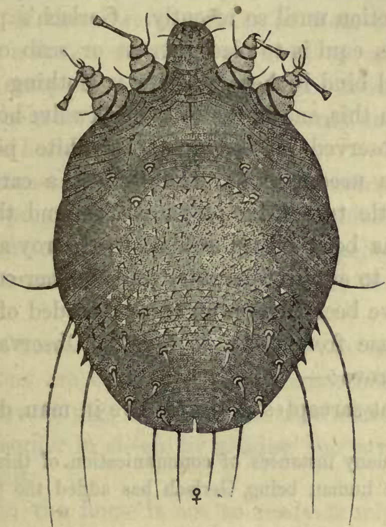


Fig. 185.—(GERLACH.)—Sarcoptes equi.

with in the practice of the Berlin Veterinary School. The fact of this insect not having been known until Gerlach has furnished us with its peculiarities and history, is explained from the difficulty experienced in finding it, and not from its rarity. In the arrangement and character of portions of the body, this acarus is very like sarcoptes hominis, only the female is longer and not so broad as that of the latter. The eruption ensuing on the skin in which the sarcoptes equi has spread is very similar to the appearance of itch in man, only not so distinctly recognised. We cannot be certain of the real nature of the disease until the insect is found, and the ordinary methods of searching for acari fail to effect this, as proved by the parasite having eluded detection until so recently. Gerlach's plan to obtain the sarcoptes equi is to place a crust or scab on the skin of the arm, and bind it there. There is nothing to be apprehended from this, and in the course of twelve hours the parasites are observed on red spots as white points, readily caught on a needle, to be submitted to a careful examination. A little turpentine oil rubbed around the part where the scab has been placed suffices to destroy any remaining insects, and to ensure immunity from further consequences.

There have been numerous cases recorded of transmission of this disease from horse to man.* Observations and experiments prove:—

1*stly*, That sarcoptes equi may live in man, developing the

* To the many instances of communication of this form of horse mange to the human being, Gerlach has added the following list of references:—

1. *Viborg Sammlungen, &c.*, vol. i. p. 281.
2. *Osiander Abhandlung über Kuhpocken*, 1801, p. 3.
3. *Sik Unterricht für den Landwirth*, 1807, p. 56.
4. *Grognier Jahresbericht über die Lyoner Schule in Annal. de l'agriculture franc*, 1817.
5. *Greve Erfahrungen*, vol. i. 1818, p. 77.
6. *Froriep's Notizen*, vol. v. 1823, p. 45.
7. *Magazin von* Gurlt *und* Hertwig, vol. i. pp. 187–190, and vol. xix. pp. 281-283.
8. *Mittheilungen aus den Veterinär-Berichten von* Gerlach *und* Leisering, 1st year, pp. 6, 7, 8; 2nd year, pp. 14, 15, 18; 3rd year, pp. 14, 17.

form of mange observed in the horse, but which has no true character to distinguish it from the human itch.

2ndly, The horse mange in man disappears spontaneously, the eruptions diminishing progressively in intensity; sometimes it continues so long that treatment is found necessary.

3rdly, The predisposition for this disease is very different in different persons. Some men recover from it in the course of a fortnight or three weeks, others in from six to eight weeks, and, in a few, treatment is required to cause the disappearance of symptoms within this time. A soft and very hairy skin is the most favourable to the spread and long continuance of the horse mange on man.

4thly, The transmission occurs through several insects of both sexes, or pregnant females. Persons suffer that attend to mangy horses, even when these are not much affected.

5thly, The treatment is similar to that for itch, only not so severe.

This form of horse mange is transmissible to cattle. Further observations are called for to prove its communication to the dog, cat, and pig. Gerlach has not succeeded in inducing the disorder in sheep, by placing the sarcoptes equi on these animals.

Contagion in the horse is not so ready as might be supposed, and a healthy horse may stand for weeks near a mangy one without suffering. This depends on the state of the system, and individual peculiarities.

Scabies equi dermatodectica is that form of mange which we are most conversant with, as connected with the existence of an acarus known to veterinarians since the days of Gohier, and which is the acarus alluded to by Kersting, Hertwig, Hering, Erasmus Wilson, and others. We are all acquainted with the irritation, denudation of hair, and development of scurf which indicate the presence of this parasite, so readily

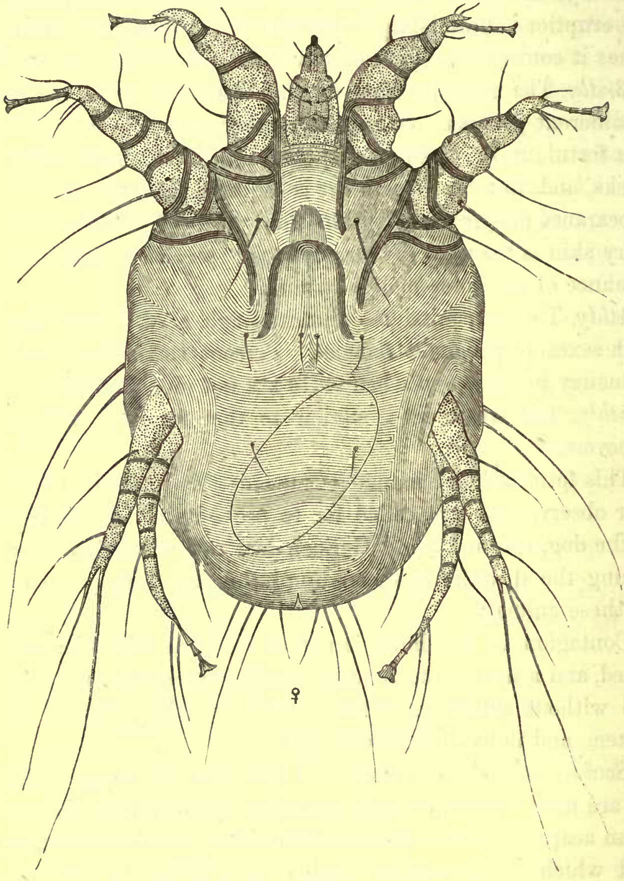


Fig. 186.—(GERLACH.)—Dermatodectes equi.

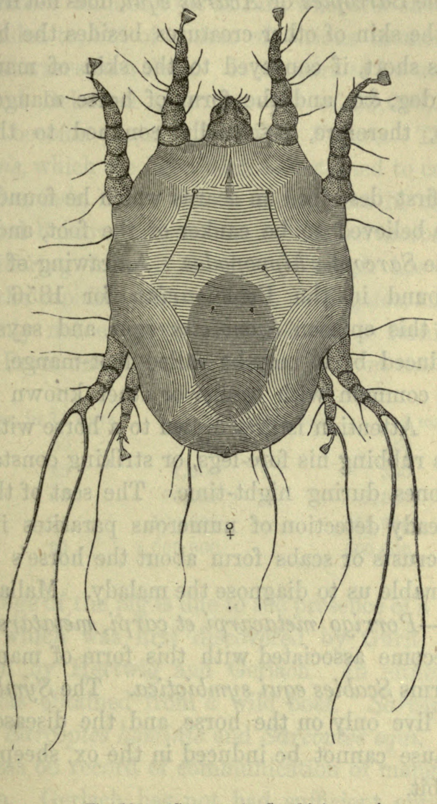


Fig. 187.—(GERLACH.)—Symbiotes equi.

found by scraping the skin and examining the mass of hairs, exudation, and desquamated cuticle with a fair lens. The *Dermatodectes equi*, which has hitherto been looked upon as the veritable *Sarcoptes* or *Acarus equi*, does not live, like the latter, on the skin of other creatures besides the horse. Its existence is short, if conveyed to the skin of man, or of an ox, sheep, dog, &c., and the form of horse mange which it induces is, therefore, essentially confined to the equine species.

Hering first described an acarus which he found in a case of what he believed to be canker of the foot, and he called the parasite *Sarcoptes hippopodos.* A drawing of this insect will be found in the *Veterinarian* for 1856. Gerlach designates this epizoon *Symbiotes equi*, and says that the disease induced by it may be called foot-mange, but it has nothing in common with canker or other known cutaneous eruptions. Attention is first drawn to a horse with this disease by his rubbing his fore-legs, or striking constantly with the hind ones during night-time. The seat of the disease, and the ready detection of numerous parasites in clusters where the crusts or scabs form about the horse's heels, &c., suffice to enable us to diagnose the malady. Mallanders and sallanders—*Porrigo metacarpi et carpi, metatarsi et tarsi* —often become associated with this form of mange, which Gerlach terms *Scabies equi symbiotica.* The *Symbiotes equi* appears to live only on the horse, and the disease of which it is the cause cannot be induced in the ox, sheep, pig, dog, cat, or rabbit.

The ox is more rarely affected with mange than the horse. Gerlach says he has found two distinct parasites belonging to the species *Dermatodectes* and *Symbiotes*. These are very similar in form to those met with on the horse, but do not live on the latter animal. The parasite which Gohier mentioned, and Hering described and delineated under the name *Sarcoptes bovis*, is Gerlach's *Symbiotes bovis.*

The sheep scab Gerlach calls *Scabies ovis dermatodectica*, and our author alludes to it as rare wherever sheep are properly attended to, but of course of serious moment when it spreads unawares in a flock. It appears to be stationary in Poland, and Delafond says that out of 35,000,000 sheep, 1,000,000 become yearly affected in France. The *Dermatodectes ovis*, which we have been accustomed to call *Acarus*, or *Sarcoptes ovis*, but which is clearly not in the habit of piercing and burrowing the skin, is like *Dermatodectes equi*, though differing from it in size. Gerlach has spoken at length of the rapidity with which it propagates, and a rough, but certainly not exaggerated statement, is furnished us as follows:—From one pregnant female, or from the

1st generation, in		15 days,	10 females and		5 males are born.	
2nd	...	30	100	...	50	...
3rd	...	45	1,000	...	500	...
4th	...	60	10,000	...	5,000	...
5th	...	75	100,000	...	50,000	...
6th	...	90	1,000,000	...	500,000	...

The mange of the pig is due to the presence of a burrowing sarcoptes, which was first discovered by Gurlt, and afterwards seen by Hertwig and Gerlach. In either case the parasite was obtained from a wild boar. *Sarcoptes suis* is much like *Sarcoptes hominis* and *Sarcoptes equi*. There are several cases on record of communication of mange from the pig to man. Gerlach has not had sufficient opportunity to verify or negative the statement that *Sarcoptes suis* may live on the horse, ox, sheep, and even dog.

In alluding to the dog mange, our author attributes it to the *Sarcoptes canis*, and he mentions that the different varieties of sarcoptes, as we have already seen, differ little except

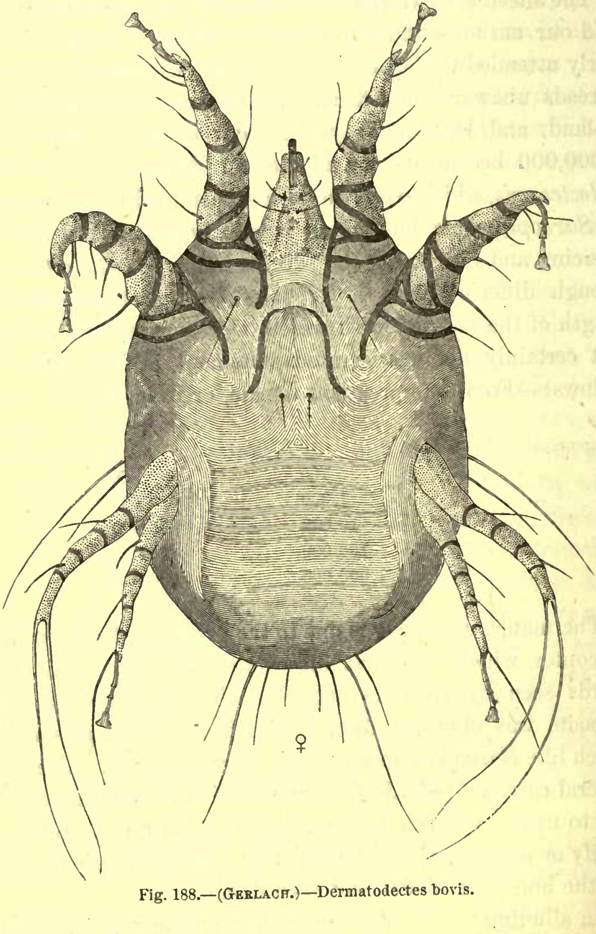


Fig. 188.—(Gerlach.)—Dermatodectes bovis.

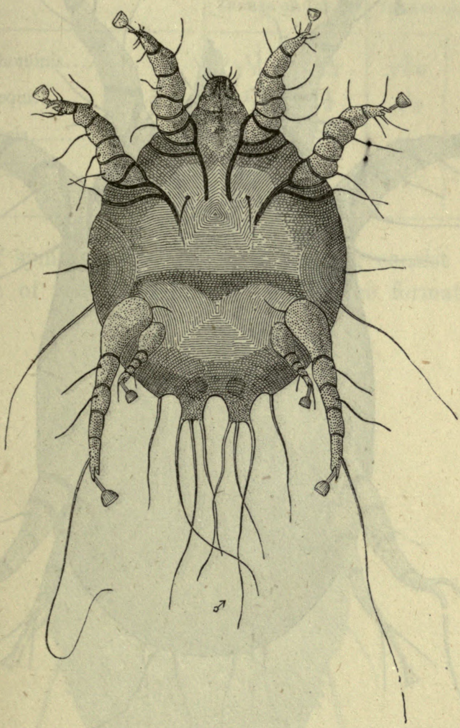


Fig. 189.—(GERLACH.)—Symbiotes bovis.

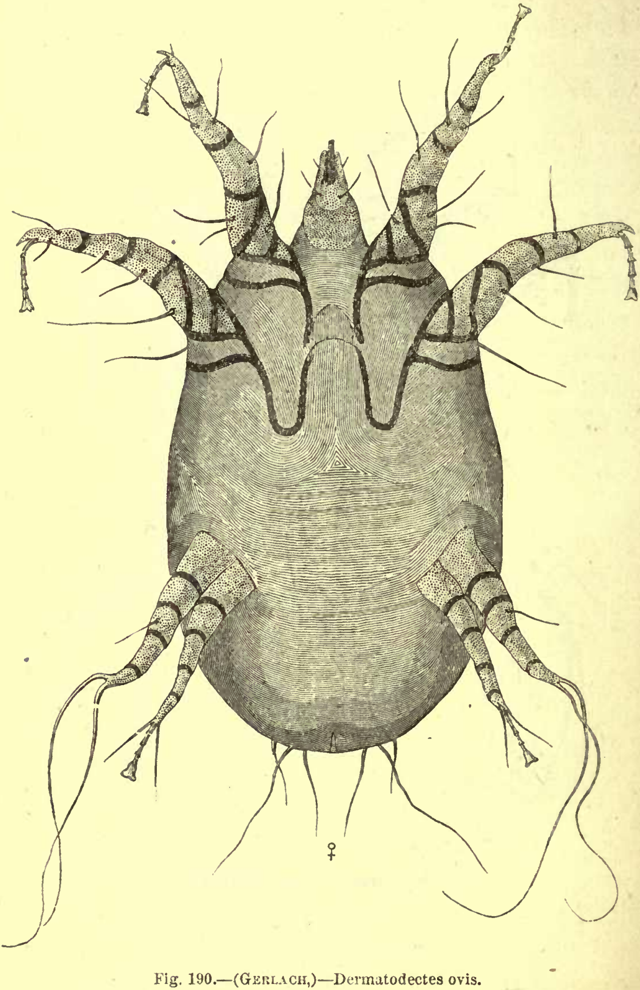


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Fig. 190.—(Gerlach,)—Dermatodectes ovis.

in relative size, and the following table shows the proportion they hold to each other in breadth and length:—

	Length. Inches or Lines.		Breadth. Inches or Lines.	
Sarcoptes hominis....................	$\frac{1}{77}$	$\frac{2}{13}$	$\frac{1}{100}$	$\frac{1}{8}$
,, equi..........................	$\frac{1}{57}$	$\frac{1}{5}$	$\frac{1}{83}$	$\frac{1}{7}$
,, suis..........................	$\frac{1}{66}$	$\frac{2}{11}$	$\frac{1}{90}$	$\frac{2}{15}$
,, canis........................	$\frac{1}{84}$	$\frac{1}{7}$	$\frac{1}{111}$	$\frac{1}{9}$

The chief symptoms of scabies in the dog consist in the development of red spots like flea-bites, the formation of

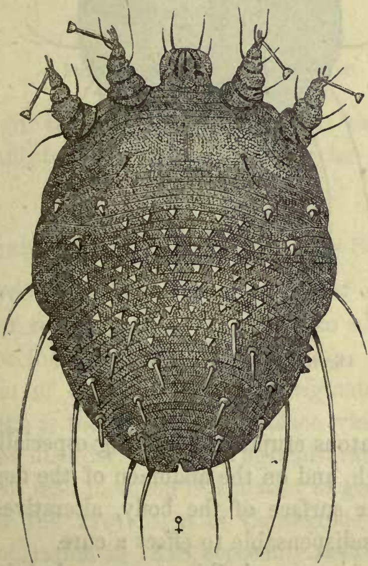


Fig. 191.—(Gerlach.)—Sarcoptes suis.

pustules and scabs, the falling off of hair in different parts of the body, such as about the ears, and head, and back. As it has proved difficult to find the insect in true dog mange, its diagnosis may be for a time uncertain, though we have found that treatment soon clears the mystery, as in true scabies external remedies suffice to effect a cure, but in the very

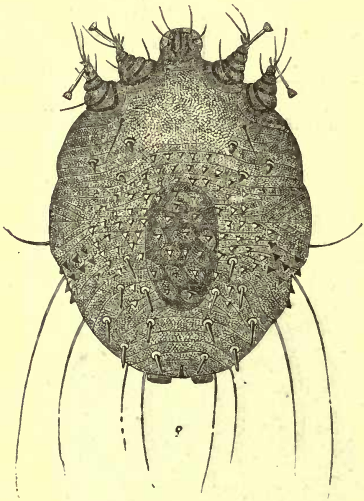


Fig. 192.—(Gerlach.)—Sarcoptes canis.

frequent eczematous eruption, occurring especially in the inside of the thigh, and on the abdomen of the dog as well as upon the upper surface of the body, alteratives, especially arsenic, prove indispensable to effect a cure.

Dog mange is transmissible to man, but it disappears spontaneously from the skin of the human being in from a fortnight to a month. It is not yet known whether the malady is communicable to other animals.

Sarcoptes cati is the smaller of the burowing mites inducing scabies in animals. It would appear to live on different feline animals, to be capable of inducing a temporary eruption on the skin of man, and to give rise to some

Fig. 193.—(GERLACH.)—Sarcoptes cati.

symptoms in the horse and dog; but cattle and sheep remain unaffected, though the parasite be placed on their skin.

PREVENTION AND TREATMENT OF SCABIES.

Before proceeding to the enumeration of remedies for the treatment of scabies, I think it proper to allude to general measures for the prevention of the disease. Whatever may be the form of scabies, it cannot originate spontaneously, and contagion is the all-potent influence which leads to the spread of the disorder. To the agricultural community the prevention of scab in sheep is a matter of great moment, and the Act for the Prevention of Contagious Diseases, which came into operation in 1848, especially refers to this malady. Notwithstanding this, a flock of sheep cannot enter some of our largest markets without contracting scab, and a very extensive cattle and sheep dealer in Lincolnshire told me recently, that it was impossible to purchase sheep in the Islington Market without communicating the scab to farms on which such sheep were placed. It is, therefore, the practice in many parts of England to use mercurial ointment as a dressing for newly-bought sheep, and the result is the destruction of many animals by mercurial poisoning.

Since my first general inquiries into the nature of prevailing diseases amongst animals in different parts of the United Kingdom, I have repeatedly been informed of the destruction amongst sheep by a disease of the lungs, occurring in Lincolnshire, especially during the spring months. From the 1st April this season (1863), many flocks have been decimated, and my attention has been again drawn to the subject by Mr John George Dickinson, veterinary surgeon, Boston.

As usual, a great diversity of opinions has tended to perplex the farmer, and no systematic inquiry has been conducted. It has been said by some that the highly manured turnips induced the disease, others looked upon the rank grass as its cause, and not a few have recognised that the flocks have been poisoned by the salves used for the treatment of scabby sheep.

The importance of the subject may be appreciated when we learn that the losses amongst flocks have varied from 5 to 25 per cent.; that some flockmasters have lost a hundred sheep or more, and one veterinary surgeon has been dispensing drinks by the thousand, having four or five thousand sheep in his neighbourhood more or less affected.

It were well if farmers could be made to understand that no such frightful and general losses can occur without mismanagement; and it is much to be deplored that there is as yet no special machinery whereby proper inquiries can be instituted, whenever whole districts are more or less impoverished by the operation of causes destructive to animal life.

At the root of the present evil is that easily prevented but widespread parasitic and contagious disease, "scab." We have a law relating to the prevention of contagious maladies, but it has not been enforced. We condemn a few scabby sheep coming from the Continent, and permit our markets to be infected by our own. One individual had recently 100 scabby sheep. The animals might have been cured in twenty-four hours and sold sound, but they were neglected, and week after week seven or eight were sold off in the public market in Boston. The results of such a system are such as might be anticipated. The malady spreads, and the farmers spend for the application of mercurial ointment. One dressing is often not effectual, and repetitions are common. Money, labour, and time are squandered, and not only fleeces destroyed, but the lives of sheep sacrificed.

I have rarely been more interested in the study of any disorder, than in the one which the Lincolnshire flocks have been specially the victims of. The immediate causes I find to admit of classification under three heads. Firstly, the mercury absorbed by the skin, especially when sheep are dressed more than once, tends to reduce the animal's powers, and to prevent the system effectually withstanding any morbid influence. In some instances it is the direct cause of death, and, as usual, about the ninth or tenth day after the application of the ointment. Attention has been drawn at various times by scientific men to the fact that ruminants, and especially sheep, are more readily poisoned by mercurial applications to the skin, than any other of the domestic quadrupeds.

Secondly, the grease with which the mercury is incorporated in preparing the ointment, tends to mat together the long fleeces of the Lincoln sheep. If the wool is opened out a few days after salving, it will be found knotted and plastered together so as to form an effectual and impervious covering, condensing the perspiration on the surface of the skin, and, indeed, soon arresting the action of the skin altogether. This cause operates most potently in inducing a poisoned condition of the blood, and is, in my opinion, the direct cause of the apnœa or suffocation, the pulmonary congestion and suffering characteristic of the "supposed lung complaint in sheep."

Physiologists have long since shown that covering the skin with an impermeable coating is destructive to the life of an animal. Fourcault, Magendie, and others have observed that if any quadruped has its skin covered with an impermeable varnish, or if the body is covered closely by a Mackintosh, leaving the head alone exposed, death soon occurs from suffocation. I have drawn attention in Scotland to the fatal results of covering lambs, especially when in a plethoric state, with the skin of the natural offspring of a ewe. Many more would die from this cause if the skins were kept longer on; but in any flock with a tendency to blood-disease, the lambs die in a few hours, with their lungs gorged and frothy mucus in the air-passages. These results are due to the accumulation in the blood of carbonic acid, ammonia, and organic products, which should be constantly thrown off by the skin. It is very important that I should notice the influence of the dry weather in producing the disorder. Had there been much rain the fleeces would have opened up and been moist, whereas the dust and dirt have materially contributed to consolidate the matting which has so effectually checked the skin's exhalations.

Thirdly, my inquiries lead me to regard the transition from poor feeding to rich pastures as deleterious to sheep, especially when such a common cause of plethora operates on a system poisoned by mercury, and by being covered with an almost impermeable coating due to the ointment.

Before referring to the symptoms, nature, and treatment of the disease, I may be expected to state on what grounds I have been led to refer the recent mortality among sheep to the above-mentioned causes. All the flocks I have inquired into the history of have been salved. Those that have been dressed most frequently have suffered most severely. A considerable number of cases have presented the symptoms of mercurial poisoning, such as salivation and loosening of teeth. Several of the most intelligent farmers have distinctly traced the accidents to the "salving," and have noticed the escape of animals not dressed, or dressed only once, and the deaths of others that had been treated most severely and repeatedly with the sheep ointment. The losses have been greatest when four or five sheep alone have been smeared to the pound of the dressing. The fatality has ceased in about a fortnight or three weeks, but a number of animals have survived over that period with laboured breathing and other symptoms, indicating that their constitutions have suffered.

Symptoms of the Disease.—The reports I have generally received as to the appearance of the suffering animals have indicated that sheep in health have been suddenly seized with signs of suffocation, and have died in an hour or two. The animals pant, have a small, frequent pulse, blood-shot eyes, and sometimes splutter frothy mucus from the nose immediately before they die.

I am satisfied, however, that the presumed absence of premonitory signs is rather due to the imperfect observation of shepherds than any other cause. I have inspected a flock, when several manifested languor, quick breathing, dilated nostrils, and capricious appetite, and yet the shepherds thought the sheep were all right. Some had noticed salivation and soreness of the mouth, indicated by the animals collecting their food with some difficulty. A few have witnessed occasional shaking and shivering. This is a very important symptom, as in all cases of suppressed action of the skin the temperature of the body is lowered.

There is no doubt, that when the mercury has accumulated in the system, and the poisons which should have been thrown off by the skin have sufficiently modified the blood, severe symptoms occur so as to destroy life in a very short time; but that is only the result of a destructive process which has been in operation ever since the application of the salve.

After death the blood in the heart and vessels is dark-coloured and fluid. The lungs are gorged with blood, and frothy mucus fills the trachea and bronchial tubes. The abdominal organs are healthy, and there are none of the signs of blood extravasations characteristic of anthrax or braxy.

Nature of the Malady.—My readers will understand from what has been said, that, according to the circumstances under which animals are attacked, they die of congestion of the lungs or suffocation, and sometimes from pure mercurial poisoning. The fact that many deaths have occurred after repeated applications of mercurial ointment, indicates that not a few sheep must have had their systems highly charged with mercury, and I expect that chemical analysis will demonstrate this. I shall not be astonished, however, if many of the carcases show but a faint trace of mercury in them, owing partially to elimination, and chiefly to the prompt death from other impurities accumulating in the blood.

Treatment.—I hope that the light at present thrown on this malady will diminish the number of animals to be treated; but it is quite evident that the proper measures to adopt consist in effectually washing or clipping all sheep that have been salved, in keeping the animals quiet on bare pasture, or sheltering the sick ones in the farm-yard. Blood-letting must be avoided, as it favours the absorption of the mercury, and weakens the vital resistance of the sheep. Tonics, oats, barley, common salt, &c., recommended by some, must be avoided. I do not approve of the animals being much disturbed by drenching, especially as all the sick ones, owing to the condition of their respiratory organs, may be choked by physic passing down the windpipe.

The *prevention* of the disorder consists in preventing scab and other parasitic diseases, by enforcing the law relating to contagious affections amongst cattle, sheep, &c. Poisonous drugs should only be used by qualified professional men, and here we have a good illustration of the monstrous effects of quackery in the country. Preparations of arsenic, mercury, &c., so largely used by flockmasters, should not be sold as they are. Non-poisonous skin-dressings can and must be employed, and it is to be hoped that veterinary surgeons will turn their attention to the preparation of compounds destructive to parasites, but harmless to sheep and human beings. Whatever dressings are used should not be too stiff, and should be usually saponaceous. When flocks are scabby, veterinary surgeons should be employed to treat them, and see to their health, comfort, and safety, just as much as they have to do with regard to horses. They should not be called when animals are gasping for breath and moribund. It is unfair to them, as they cannot perform miracles and purify poisoned blood in the way in which pure water may be made to displace impure from a pitcher. This is a stupid notion which professional men encourage when they bleed as a means of purifying the blood.

Whilst on this subject, it is proper to refer to the management of markets and to the transmission of diseased animals by railways. Firstly, with regard to the markets, it would be well to substitute iron pens for the wooden enclosures at present employed. Wood splinters, and portions of fleeces especially from scabby sheep are entangled, and remain adherent from market day to market day, being admirable nests for the ova, whence living parasites crawl on to any sheep approaching them. After each market the enclosures should be thoroughly washed. This practice would entail a slight expense, but it is essential for the prevention of disease. It is desirable that the washing should be combined with the use of materials destructive to parasites, and the best for such a purpose would be soda in abundance, and impure carbolic acid, such as is used in London for the destruction of carcases condemned as unfit for human food. In addition to these very necessary precautions, it is all-important that scabby sheep should be seized and not allowed to be exposed in markets. In fact, all farmers having scabby sheep should be compelled to report the same, as they had to do when their flocks had the small-pox, and the disease would then be extirpated. It is quite possible to organise such a system that scabby flocks should be effectually cured, and not allowed to travel about and contaminate healthy animals. Such a system would save many thousands sterling annually to the United Kingdom.

With regard more particularly to railway trucks, it is probable that in the course of time sanitary inspectors may be found necessary to attend to the health of travelling stock. This is a plan in favour abroad, and which I have no doubt will be speedily introduced in some parts of Germany; but, in its absence, it is quite possible to insist on the effectual washing and purification of cattle and sheep trucks, and even of other means of conveyance, such as the steamers which trade between Ireland and Britain, or between Britain and the Dutch or Danish ports.

I have on several occasions shown that it was impossible to prevent any widespread malady, by adopting means such as inoculation to render the animals insusceptible of taking the malady. To prevent scab, farmers have only adopted the plan of smearing their sheep. The practice is a useful one, and year after year farmers acquire some additional information which tends to prove the necessity for the protection of their flocks by destroying the many parasites which infest the fleeces, and preserving them from wind and rain, sleet and snow, by means of applications which render the woolly covering somewhat impermeable to air and water. In our northern counties nature modifies the fleece. It is firm and kempy. It is coarse and harsh, and contrasts strongly with the delicate wools of warmer latitudes. By cross-breeding, sheep bearing fine fleeces are distributed widely; but losses are sustained unless special attention is paid to make up for the wants of these animals in trying climates. Unfortunately this department of husbandry has not been studied sufficiently by men of science. Valuable items of experience lie scattered without applying them to the profit of the flock-master, and at no time has there been a greater necessity than at the present for properly-conducted investigations on the subject.

Few persons are so situated as to be enabled to compare results, and we have had occasion from time to time to conduct experiments, and note the effects of a number of materials used for *smearing*, *pouring*, or *dipping* sheep. All substances used contain active principles which are intended to destroy the vermin which live and breed on the sheep's backs, and to fix in the fleeces materials which should not be washed out with the first shower of rain. These active principles are mixed with various kinds of solid fats, oils, and soaps. It so happens, however, that many of the active principles injure the sheep and the wool; whereas the fats and oils are apt either to destroy the colour of the fleeces, or so mat them together as to render them dangerous to the sheep, and prevent the clips realising a fair price in the market.

An examination of many fleeces smeared with all kinds of material has led us to notice, that farmers have been much misled in being induced to use the compounds hitherto offered them; and when we consider that, in addition to the eightpence or tenpence which it costs them to smear the sheep, they lose from one to several shillings per fleece when their flocks are shorn. It is evident that the question is one of the greatest economic importance to the flock-masters of the United Kingdom. We shall first notice the active principles used, and, in the next place, the materials with which these principles are mixed.

Active principles.—Mineral poisons, such as mercury, in the state of oxide or as corrosive sublimate, and arsenic, have been often condemned. We have only to repeat that they should never be used. Many of the advertised dipping compositions should not be applied without first sending them to a chemist, and if found to contain any of the above or other mineral poison calculated to kill the sheep or other farm stock, they should be returned to the vendor.

Common or Venice turpentine, white tar, as some call it, is used largely with mercury and in combination with other materials. It does not kill the sheep, but it deteriorates the value of the fleece. We have seen many fleeces treated with this substance which could not be sold at even a moderate price, in consequence of the manner in which the wool was plastered and entangled especially, towards the surface. This renders the material difficult to work; it interferes with the working of the machinery through which it has to pass, and it causes the wool to tear and break up. These results vary according to the quantity of white tar or Venice turpentine applied.

Common tar is a substance which the wool-merchant condemns. It renders the fleece unfit for use, except for dark-coloured goods, and when applied in large quantities, it is apt to pack the fleece to such an extent as really to injure the sheep. Deaths have occurred in far greater numbers than could be imagined from this cause. American tar is now not to be had, and we hope that Scotch farmers will be induced to give over using tar in the way they have applied it of late years.

Oil of tar kills the parasites, but it has also been known to kill the sheep. It does not mix well with other smearing stuffs, and has not the tenacity which, according to some, is the most valuable quality of common tar.

Resins employed to stiffen salves have been found even more objectionable than Venice turpentine, and have not, as a rule, the same power to kill vermin.

Fats, Oils, and Soaps.—These materials are often used when very ill adapted for smearing. Some of the fats are rancid and mixed with fifteen, twenty, or even thirty per cent. of water; so that the farmer who thinks he is smearing a sheep with 12 ounces of grease, is really only applying 8, and paying dear for water, which he knows is not a good material for his fleeces. Other fats colour the wool and give it a golden tint. Few oils are of use. Fish oils are objected to much by experienced wool merchants, and all oils are deficient in the tenacity required in any smearing stuff. They may be used in low countries occasionally, but even then require to be mixed with a proper active principle. Soaps are used in dipping, but they are only fit to clean the wool, and are washed out readily. They are valuable in skin diseases, but, like the oils, require to be mixed with proper materials so as to destroy the vermin.

Itch and mange are known to be essentially skin diseases, curable alone by topical remedies; and the medicines used are valuable almost in proportion to the rapidity with which they destroy the life of the parasites which give rise to the irritation and other morbid appearances. About fifty years ago, Walz sought to prove the efficiency of agents by observing their effects on acari placed under the microscope. This method has since been adopted by Gerlach, Hertwig, and others; and the subjoined table embodies the facts ascertained with reference to the time in which different substances will destroy acari:—

Agent.	Dead in Hours.	Dead in Minutes.	Observations.
Creosote	...	$\frac{1}{4}$–$\frac{1}{2}$	
Creosote, 1 part; Spirit, 10 parts; Water, 30 "	...	$\frac{1}{2}$–$1\frac{1}{2}$	
Creosote, 1 part; Water, 80 parts	...	2–$2\frac{1}{2}$	
Creosote with fat 1·20	...	1–$1\frac{1}{2}$	
Creosote with fat 1·24	...	$3\frac{1}{2}$–5	
Creosote with oil 1·24	...	$3\frac{1}{2}$–7	
Creosote with oil 1·40	...	$5\frac{1}{2}$–9	
Iodine, tinc. of, pure...	...	1–2	Matthieu.
" " with water, 1·4	...	4–6	Matthieu.
Iodide of potassium with water, 1·2	...	9	Matthieu.
" " " " 1·4	...	20–26	Matthieu.
Caustic potash, 1 part; water, 24 do.	...	2–$2\frac{1}{4}$	
Caustic potash, 1 part; Water, 10 parts; Tar, 2 "; Hartshorn oil, 2 " ...	...	$1\frac{1}{4}$	

Agent.	Dead in Hours.	Dead in Minutes.	Observations.
Caustic potash, 1 part; Water, 16 parts; Tar, 2 „; Hartshorn oil, 2 „ ...	...	7–12	
Sulphuret of potassium with water, 1·10...	...	15–30	
Sulphuret of potassium with oil, 1·10 ..	10–20	...	
Chloride of lime, with water, 1·30	...	15–30	
Hartshorn oil, pure	...	3–4	
„ „ with water, 1·10	...	30	
Oil of turpentine	...	5–9	
Barbadoes tar	...	5–9	
Tar (Pix liquida)	...	8–13	
Photogen, pure	...	7	
Photogen with oil, 1·5 ...	1	...	
Photogen with oil	...	...	
Photogen with oil, 1·10 ...	...	...	Were living 7 hours after immersion.
Concentrated vinegar, pure ...	...	1–1¾	
„ „ with water, 1·1	...	2–3½	
Acetic acid with water, 1·1 ...	...	2	
Concentrated sulpuric acid With water 1·24	...	7–8	
Concentrated sulpuric acid With water 1·48	...	32–35	
Decoction of tobacco 1·5 ...	...	10–20	
Decoction of tobacco 1·10 ...	2–5	...	
Decoction of tobacco 1·50 ...	4–10	...	
Tessier's arsenical bath	...	7–25	Matthieu. White arsenic, 1 part. Sulph. of iron, 10 parts. Water, 100 parts.
Matthieu's arsenical bath	...	15–16	Matthieu. White arsenic, 1 part. Alum, 10 parts. Water, 100 parts.
Over-saturated solution of arsenic in water, 1·6	2–3	...	Hertwig.
Green soap	½–1	...	A dilute solution does not kill.
Liquor ammoniæ	¼–1	...	Hertwig.
Solution of corrosive sublimate, 10 grains, 1 ounce	...	15–45	Hertwig.
Infusions of henbane, belladonna, and Persian insect-powder, 1·16	12–16	...	
Decoction of black and white hellebore, 1·16	6–36	...	
Infusion of digitalis, 1·16	24–36	...	
Walz's ley, containing caustic potash, hartshorn, oil, and tar	6–48	...	

Gerlach considers creosote the most active and useful agent in cases of scabies in animals with short hair over the body, and decoction of tobacco for the woollen tribe. In the treatment of this disease, however, the chief thing to consider is, that the remedy destroying the parasites should not kill our patients, and that it should be applied in the proper manner. He alludes to the extensive use made of arsenic, and the attempts made, by combining it in baths with sulphate of iron or alum, to guard against its poisonous effects, but he thinks it can be well dispensed with in treating the disease under consideration. Tobacco decoction, if strongly concentrated, such as one part to five or one part to ten, may poison our domestic quadrupeds, especially the ox, but a more dilute preparation is effectual as an application for the skin, and not dangerous. A dog or sheep may be immersed for five or ten minutes, in a decoction formed by one part of tobacco to twenty-five or thirty of water, without giving signs of disturbance. Tobacco alone would therefore supersede arsenic.

In treating mange in the horse and ox, Gerlach insists on the importance of covering the body with soft soap, washing it off some time afterwards with warm water, and having the animal well brushed; or, a wash may be used consisting of one part of caustic potash to 50 parts of water; or, lastly, the animal may be greased with linseed oil, train oil, &c., and, one or two days afterwards, washing with soap and water or potash ley. He then recommends, if necessary, a dressing with considerable friction, using creosote water according to the following prescription:—

℞ Creosoti . . . ℥ jss.
Sp. vini rect. . . ℥ xv.
Aquæ font. . . . ℥ xl.–℥ xlv.

M. Sufficient for one horse. Dressing to be repeated twice or thrice.

Another creosote application consists of one part of creosote and from 25 to 40 parts of oil, and a third is the creosote ointment in the proportion of 1 to 20. Photogen is of itself too active a preparation for use, and it requires to be combined with 8 parts of oil. The remaining prescriptions for mange in the larger quadrupeds, contain—1*stly,* Oil of turpentine and oil of hartshorn, either alone or mixed with tar and petroleum; 2*ndly,* Tar and petroleum without further addition; 3*rdly,* 1 part of potash to 10 of water added to 2 parts of tar and 2 of petroleum; 4*thly,* Solution of caustic potash, which should be less active for our domestic animals than for man, and 1 part of the alkali to 25 of water is considered an active preparation; 5*thly,* Sulphuret of potassium in water, in the proportion of 1 to 5 or 10 parts; 6*thly,* Decoction of tobacco in the ratio of 1 to 20 or 25; this is the most easily used, and one of the cheapest of the preparations; 7*thly,* 1 part of sulphuric acid to 24 of water is likewise to be recommended; and, *lastly,* Concentrated vinegar.

Whenever scabies is treated, it is essential to purify all objects with which animals can come in contact. Thus, with horses, it is important to boil the clothing, and dress the harness and saddles as well as washing the stable. The preparation that I have usually employed for saddles has been a solution of corrosive sublimate, in the proportion of two grains to the oz. of water.

Pastures in which scabby sheep have been should be kept empty for at least two months, and all rubbing places should, wherever practicable, be purified. In examining a scabby flock to ascertain if it is cured, the fleece must be looked at, to see if the scab is raised. A portion of wool may then be pulled out, and with a lens the wool beneath the scab can be looked at for parasites. A scabby flock may appear cured a few days after any preparation has been applied, and the sheep may be at rest and feeding, but this may depend on the living acari having been effectually destroyed, and the eggs are apt to remain untouched. If the preparation used adheres to the fleece, so soon as fresh acari are born they are killed, but with many dips the skin is left clear, and the parasites can again prey on it. The partial cure of scabby flocks is a great cause of the disease being perpetuated in a district, and great attention should be paid to the effectual treatment of any diseased sheep.

CHAPTER XIV.

THE SKIN AND ITS AFFECTIONS.

Vermin in the skin.—'The fly.'—Maggots in sheep.—Lice in animals.—The common flea; pulex irritans.—Warbles or wornils.—Œstrus bovinus.—Bracy Clark on the gad-fly.—Origin of the word 'gad.'—Metamorphoses of œstri.—Œstrus bovis in the human subject.—Ticks.—The dog-tick.—The ox-tick.—Hippoboscidæ.—Hippobosca equina, or horse-fly.—Melophagus ovinus; sheep louse or tick.—Poultry lousiness in the horse.—Phthiriasis equi.—Descriptions of the disease by M. Bouley and Mr Henderson.—Simulum reptans.—Chrysops cœcutiens.—Argas Persicus.—Argas Americanus.—Burns and scalds.—Ambustio.—Different kinds of burns and scalds—Treatment.—Effects of caustics.—Frost-bites.—Diseases arising from special internal causes.—Elephantiasis.—Eruptive Fevers.—Typhus.—Scarlatina.—Rubeola.—Variola.—Variolous fever in different animals.—Cow-pox.—Small-pox in sheep.—Varicella.—Epizootic aphtha.

VERMIN IN THE SKIN.—'THE FLY.'

A VERY considerable number of parasites live on the skins of animals, besides the mites which we have before referred to, and which induce scab in sheep and a similar disease in other animals. The effect of the development of these parasites on the skin and on the health of the domestic quadruped varies greatly. No more loathsome affection can exist than the one which is very common in Scotland in hot sultry weather, and which consists in the development of thousands of maggots, from eggs deposited by the large blow-fly (*musca vomitoria,* or *sarcophaga carnaria.*) This fly, like all other dipterous insects, passes through a complete metamorphosis, and its larvæ or pupæ are white worms without feet, which burrow in any putrescent deposit. The blow-fly has its eyes wide apart, its body covered with hair, its face downy and yellow, its belly of a shining dark coffee colour, and with yellow spots dispersed over it, the thorax grey, with three black stripes. As the maggot comes into existence without being endowed with powers of flight or other means of locomotion, the female deposits its eggs wherever putrescent matters accumulate; and large numbers are found on putrid flesh, on living earthworms, on the putrid sores of men and animals, and in the fleeces of sheep. One species of blow-fly—*Sarcophaga mortuorum*—frequents burial-grounds, vaults, &c. The attacks which sheep suffer from depend, no doubt, on the quantity of organic matter, yelk, &c., which the blow-fly finds in the fleece for its larvæ to live on.

It is in the summer season, and especially during sultry weather, and after showers, that the fly is most troublesome amongst sheep. The immediate cause of the fly depositing its eggs is often the dirty condition of the tail and quarters in animals that are suffering from diarrhœa. Amongst rams and other sheep with small horns in their foreheads, when they take to fighting and wound each other, the fly is apt to blow on the sore heads. Filth and wounds, therefore, render sheep liable to be destroyed by the maggot.

When the sheep is attacked the wool is seen to be raised over the part injured, and the animal is dull and evidently in pain. Often an animal is seen hiding its head, looking dejected and listless, standing apart from the flock, and soon unable to stand.

The maggots burrow, devour, and render the skin sore, suppuration speedily sets in, the worms continue to devour, and soon deep chasms result. The sufferings of the sheep are great; and, unless the maggots are promptly destroyed and the wound kept clean, death results. Strange cases have occurred in man; such as a labourer, sleeping on a hot day in July beneath a tree, with some meat and bread on his chest under the shirt, has been attacked by the maggots to such an extent as to induce a fatal wound. The American soldiers suffered severely in 1862 from maggots in the wounds inflicted in the battle-field, or by the surgeon, and a new remedy was recommended in the shape of elder ointment. Unfortunately, rank poisons have been distributed amongst shepherds to ward off the attack of the fly. The fly oil in perhaps greatest repute owes its efficiency to no less deadly material than corrosive sublimate, the extreme solubility and destructiveness of which places it at the head of the list of dangerous poisons which farmers and others should avoid using. Many substances will kill the maggots without danger to the sheep, and it were well if farmers acted more under professional advice rather than trust to quack preparations, which often kill. Indeed, it is best to prevent the attack of the fly by impregnating the fleece with some material which prevents putrefaction, and which must there interfere with the wellbeing of the maggots.

Lice in Animals.

The following table and description of the natural characters of these parasites are abridged from "Denny's Monographia Anoplurorum Britanniæ:"—

Class.
INSECTA (Insects.)

Sub-Class.
HEMIMETABOLA
(undergoing an imperfect
metamorphosis.)

Sub-Class.
METABOLA
(undergoing a perfect
metamorphosis.)

Order.
THYSANOURA
(Springtails).

Order.
ANOPLURA
(Lice).

Sub-Order.
MALLOPHAGA *vel* MANDIBULATA.
Mouth with two horny
mandibles.

Family.
PHILOPTERIDÆ.

Genus.
TRICHODECTES.

Species.

T. Equi, . . .	Louse of Horse.
T. Scalaris, . .	Louse of Ox.
T. Sphærocephalus, . . .	Louse of Sheep.
T. Lutus, . . .	Louse of Dog.
T. Subrostratus .	Louse of Cat.

Sub-Order.
RHYNCHOTA *vel* HAUSTELLATA.
Mouth with a tubulose very short
haustellum.

Family.
PEDICULIDÆ.

Genus.
HÆMATOPINUS.

Species.

H. Eurysternus, .	Louse of Ox.
H. Vituli, . . .	Louse of Calf.
H. Asini, . . .	Louse of Ass.
H. Suis, ...	Louse of Pig.
H. Piliferous, . .	Louse of Dog.
H. Stenopsis, . .	Louse of Goat.

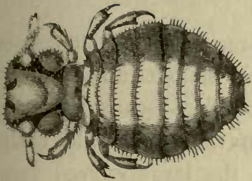


Fig. 202.

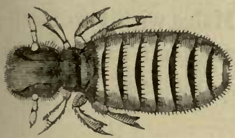


Fig. 201.

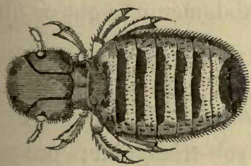


Fig. 200.

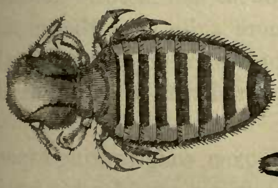


Fig. 199.

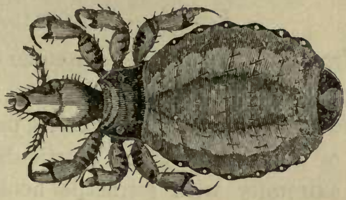


Fig. 197.

Fig. 198.

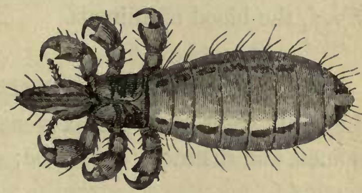


Fig. 195.

Fig. 194.

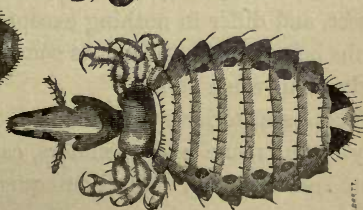


Fig. 196

Family—PEDICULIDÆ, (LEACH).

Essential Character.—Antennæ of five joints, mouth with a fleshy haustellum.

Natural Character.—Apterus, parasitical; mouth, consisting of a fleshy, tubulous, inarticulate haustellum, armed at the extremity with retractile hooks; legs scansorial, tibiæ short, thick, armed at the apex on the inner side with a strong tooth, which, together with the large curved tarsus and unguis, forms a claw; tarsus, one jointed, unguis, single; œsophagus, none; biliary vessels, four, free, equal in length, enlarged towards their extremities. Males with two testicles on each side; females with five ovaries on each side the uterus. Coitus exercitur mare femine submisso.

Food, the blood of animals.

Genus—HÆMATOPINUS.

Legs all scansorial; thorax generally narrower than the abdomen, and distinctly separated; abdomen of eight or nine segments.

Hæmatopinus Eurysternus, (Louse of Ox, Fig. 194).

Chestnut and shining; head, sub-triangular; occiput, rotundate; thorax, transverse, quadrate; abdomen, large; ovate, ashy white; spiraculi, prominent and fascus. Length, 1 to 1½. The young are much more agile than the mature insect, and differ in nothing except a want of proportion, the limbs being much thicker as compared with the bulk of the body, than when adult.

This parasite is very common on oxen, congregating especially on the mane and shoulders, causing considerable irritation and rubbing, with consequent loss of hair on those parts.

Hæmatopinus Vituli, (Louse of Calf, Fig. 195).

Chestnut; head, sublyrate; abdomen, long, and subcylindrical, ashy white; legs very thick. Length, 1 to $1\frac{1}{4}$.

Remarkable as being parasitic on the young, and not on the mature animal, having been found only on the calf, never, so far as I am aware, on the ox.

Hæmatopinus Asini, (Louse of Ass, Fig. 196).

Ferruginous; abdomen large, light tawny-yellow white, with horny excrescences on each side, surrounding the spiracula; head very long, deeply sinuated behind the antennæ. Length, 1 to $1\frac{3}{4}$.

Common upon the ass, frequenting the mane and back It is found also upon the horse.

Hæmatopinus Suis, (Louse of the Swine, Fig. 197).

Dusky ferruginous; abdomen, grey or ashy-yellow; flat and membranaceous, with a black, horny excrescence surrounding each spiracula, which is white; legs long, thick; femur, banded; tibia very abruptly clavate, dark at the apex. Length, $1\frac{1}{4}$ to $1\frac{3}{4}$.

This species is found in great numbers on swine, more especially those freshly imported from Ireland.

Hæmatopinus Piliferous, (Louse of the Dog, Fig. 198).

Testaceous; abdomen cadaverous, thickly covered with pale fuscous hairs.

Found on the dog, but not of common occurrence; found also on the ferret.

Hæmatopinus Stenopsis, (Louse of the Goat).

Testaceous, unicolored; abdomen elongated, oval; with thinly set long hairs. Length, 1.

Family—PHILOPTERIDÆ (BURMEISTER).

Essential Character.—Antennæ filiform, with three or five joints; maxillary palpi, none; mouth with strong mandibles.

Natural Character.—Mouth beneath; maxillæ, none; mandibulæ nearly concealed by the labium; pro-thorax narrower than the head; meso-thorax none, or hid by the meta-thorax, which is very large; abdomen with nine segments; œsophagus long, unilateral, ending somewhat acutely in the cæcum; biliary vessels, four, free, equal, without any particular enlargement. Males with two testicles on each side; females with five ovaries on each side the uterus. Coitus exercetur mare feminæ submisso hijusque pedes tertios tenente antennis, si hae sunt cheliformes. Metamorphosis indistinct, perhaps none?

Genus—TRICHODECTES.

Antennæ three-jointed; tarsi with one claw; parasitic upon quadrupeds. *Food*—hair, wool, and the exfoliated particles of the epidermis.

Trichodectes Equi, (Louse of the Horse, Fig. 199).

Head and thorax bright chestnut, the former large, transversely quadrate; antennæ with the third joint the longest and clavate. Length, 1.

Common on the horse and ass, especially when fresh from pasture.

Trichodectes Scalaris, (Louse of the Ox, Fig. 200).

Head and thorax bright ferruginous, the former obcordate; antennæ with the third joint the longest and fusiform. Length, $\frac{1}{2}$.

Common on cattle, frequenting the mane. Also, occasionally found upon the ass.

Trichodectes Sphærocephalus, (Louse of the Sheep, Fig. 201).

Head nearly orbicular; clypeus rugulose, and ciliated with stiff hairs; the third joint of the antennæ the longest and clavate.

Trichodectes Latus, (Louse of the Dog, Fig. 202).

Pale fulvous; head and thorax ferruginous-yellow, the former subquadrate, with two black spots in front and two diagonal fasciæ from the antennæ to the occiput; abdomen oval. Length, $\frac{1}{2}$ to $\frac{3}{4}$.

Common upon dogs, more especially puppies.

Trichodectes Subrostratus, (Louse of the Domestic Cat).

Clypeus elongate, triangular; apex bituberculate.

To the apterous insects belong also the fleas.

The Common Flea—Pulex Irritans.

Little need be said of the irritation of skin induced by fleas, especially amongst dogs and cats. In hot and dry countries the common flea is a great source of torment to man and animals. Not only are the active full-grown animals troublesome, but they undergo a series of metamorphoses by which they tend more and more to invade and injure the skin and hairs. The female flea, larger than the male, deposits about a dozen eggs, which adhere to the part they are laid upon, and are of a white colour. A little worm, without feet, white at first and then red, emerges from each egg, it then spins a cocoon round its body, and from this silky apartment the perfect flea issues in the course of time.

The best remedy that I have used for fleas is oil of aniseed in common oil. The dog or cat must be well smeared, and a few hours afterwards is to be washed with soap and water. Abroad a specific is used, and is found indispensable to travellers in the East; it is the Persian insect powder—Pyrethrum roseum—which can be bought now-a-days at most of our chemists' shops, in india-rubber balls, from which it can be sprinkled over the skin of any animal. It is essential to attend to cleanliness, and to destroy all fleas or their larvæ, wherever dogs are accustomed to sleep, such as in kennels, &c.

Warbles or Wornils—Œstrus Bovinus.

Reaumur, Vallisneri, Numan, Clark, and others, have written descriptions of the gad-fly which attacks cattle in the summer months, and whose larva is enclosed in the swellings of the skin so constantly seen amongst cattle living in the open air.

Bracy Clark says:—"Of all the European species of this genus, this is the largest, and is not unfrequently seen in country situations in the backs of oxen and cows. They form tumours as large as pullets' eggs on the sides, about the back and loins. With us among the country people they are called warbles, wornils, wormuls, and sometimes bots.

"When I first took up the investigation of these animals, I was in considerable perplexity what this species could be, since I possessed the Œstrus Bovis of Linnæus, agreeing perfectly with the description, and which was a horse bot; nor had I then seen the writings of Vallisneri or Reaumur, which, as Linnæus had seen and referred to, I did not suppose could have fallen into such an error as to have omitted entirely this remarkable species, or have confounded it with the equi; but it so proved; and on obtaining the perfect insect from the back of the cow, the mystery became unravelled;

for I was not certain, indeed apprehended after such authority that the same species inhabited both animals as Linnæus had stated. 'Habitat intra Boum dorsnm, in ventriculo Equorum sæpe ipsis lethalis.' Lin. Sys. Nat., p. 969. This insect was not known to Linnæus, and, indeed, has been rarely seen; Vallisneri, after years of labour, procured only one mutilated specimen of it; and Reaumur, after great pains and expense, only two or three. A mode of obtaining this fly, which succeeded with me perfectly well, I shall now describe, by which I obtained out of three larvæ two perfect flies, one so perfect, that it flew away while I was making some experiments in presenting it with different objects; the other I gave to Thomas Allen, Esq., after drawings had been made from it for the use of the Linnæan Society. One I also fortunately caught of these flies, between Salanche and Bonneville, in Savoy, flying in the road, and settling on some dung where cattle had recently passed; this specimen, on my return through Germany, I presented to the venerable and worthy Professor Daniel Schreber, of Erlang, the intimate friend and pupil of Linnæus, who till then had not seen it.

"The following is the simple means for obtaining them perfect, which may be not unacceptable to those who for their cabinets or from curiosity may wish to see them:

"During the latter months of the summer, about which time the larvæ are found fully grown, and about to quit their habitations, which can be known by the superior size of the abscess, and especially the increased diameter of the external opening; such being selected for the experiment, we remove the hairs round the tumour to a considerable distance with a pair of scissors as close to the skin as may be; and a piece of leather, thickly spread with pitch, being provided, through the centre of which a hole is cut about the size of the finger, and into this a small gauze pouch or bag is inserted, hanging out an inch or two from the leather: this plaister with its pouch is then placed upon the skin, to which, from its warmth, which is very considerable, it readily adheres, the pouch being opposite the opening. Whenever the insect makes its way out and falls from the abscess, it is caught by the bag, in which, as it cannot escape, it remains till removed by the person looking after them. The larva thus obtained, as it is full fed, will hardly fail to produce a perfect fly; it is only necessary to put it into a pot with some loose light earth for it to change upon.

"That we may continue the history of these flies with some degree of uniformity, we shall commence its operations with some remarks on the deposition of the eggs, as we have done with the former species. This act appears to be attended with severe suffering or apprehension at least, which makes the cattle run wild and furious and gad or stray from the pastures; and hence the ancient epithet of gad-fly. When yoked to the plough, the attack of this fly is attended with real danger, since they become perfectly uncontrollable, and will often run directly forwards through the hedges, or whatever obstructs their way. There is provided on this account, to many ploughs a contrivance immediately to set them at liberty. When the cattle are attacked by this fly it is easily known by the extreme terror and agitation of the whole herd; the unfortunate object of the attack runs bellowing from among them to some distant part of the heath or the nearest water; the tail, from the severity of the pain, is held with a tremulous motion straight from the body, and the head and neck stretched out to the utmost. The rest from fear generally follow to the water, or disperse to different parts of the field.

"And such is the dread and apprehension in the cattle of this fly, that I have seen one of them meet the herd when almost driven home, and turn them back, regardless of the stones, sticks, and noise of their drivers; nor could they be stopped till they reached their accustomed retreat in the water."

Further on Mr Clark says:—"When young the larva is smooth, white, and transparent; as it enlarges it becomes browner; and about the time it is full grown it is totally of a deep brown colour.

"The larva having attained its full growth and size, effects its escape from the abscess by pressing against the external opening, which occasions its enlargement by the points pressed upon being absorbed, and the skin also may give way and extend itself under their impression. When the opening has obtained the size of a small pea, the larva writhes itself through, a ring or segment at a time, till, arriving at the narrower part of its body, it falls out, and tumbles to the ground, and, seeking a convenient retreat, becomes a chrysalis.

"After leaving the abscess, and preceding their change, they contract themselves into a much smaller space, and assume a different figure. They never change or throw off their skin, apparently, but the same serves them through their whole growth, and at length also forms the shell of the chrysalis, as in the other species of this genus.

"If we examine the sac which enclosed the larva beneath the skin, it appears formed of condensed cellular membrane, and is rough on the inside. The pus secreted is mostly of a yellow colour, and sometimes flows from the opening, and dries about the orifice. After the exit of the caterpillar the abscess disappears, and the wound in the skin closes up and is healed in a few days: but although the skin heals up on the exit of the larva, we may remark, that the union is not so firm as was the original skin, but is effected by a sort of agglutinating deposit, which afterwards, on the skin being dried and hammered by the tanners, gives way and cracks again in these places, shewing the union to have been of a less perfect nature than the original skin; the succedaneous nature of the repair of broken skin, has been remarked by late physiologists, and we mention this fact as confirmatory of their doctrine.

"The chrysalis is of a dark brown colour, and in figure somewhat resembles the half of a walnut shell, being narrower at one end than the other, and flat on one side, and very rounded and convex on the other. Those which I bred remained in the state of chrysalis from the latter end of June till about the middle of August, when the fly appeared. I have, notwithstanding, observed full-grown larvæ in the backs of cows as late as the ninth month, or September, which must have produced their flies as late as November or December, or perhaps not till the ensuing summer.

"The larva after being immured in the chrysalis a sufficient time, and its soft members dry and in a degree hardened, bursts from its confinement by forcing open a very remarkable triangular lid or operculum, and makes its way out at the small end.

"The larva at the period of making its way from the back of the beast is weak and tender, and exposed to imminent danger, if on land, of being trod on by the cattle or picked up by birds: if on the water, where the cattle stand during great part of the day at this hot season of the year, it perishes by drowning or becomes the food of fishes.

"It is worthy of remark, that Reaumur has stated that its escape from the back of the beast usually takes place at a very early hour of the morning, at two or three o'clock, or at sun-rise; now, if it be so, it is remarkable that in this way much of the danger is avoided, as the animals at this time would most probably be upon dry land, and in a more quiet state than at mid-day, and the birds also would not then be present."

It is not unimportant for me to notice here that the gad-fly is apt occasionally to attack the human being. Dr Matthews Duncan contributed an interesting paper on this subject to the first volume of the *Edinburgh Veterinary Review.* He refers to the subject as follows:—"Travellers have brought us, from remote regions, accounts of bots being found in men, in such numbers in one individual, and in so many cases, as to give the question of the existence of an œstrus hominis in these regions a quite different aspect from what it presents if we confine our attention to Europe. Kirby and Spence,* for example, believe that the Spanish traveller Azara mistook this insect when he said, 'that in South America there is a large brown moth, which deposits its young in a kind of saliva upon the flesh of persons who sleep naked. These introduce themselves under the skin without being perceived, where they occasion swelling, attended by inflammation and violent pain. When the natives discover it, they squeeze out the larvæ, which usually amount to five or six.' In his edition of the 'Systema Naturæ,' Gmelin says:—'Habitat larva in America australi per sex menses sub cute hominum abdominali, si turbetur, profundius penetrando periculosa, adeo ut fertur, lethalis; imago muscæ domesticæ magnitudine.' Again, MM. Humboldt and Bonpland, speaking of certain districts of the equatorial regions, make the following remark:—'Aux mosquitos se joignent l'œstrus humanus, qui dépose ses œufs dans la peau de l'homme, et y cause des enflures douloureuses.'† And I believe

* *Introduction to Entomology*, p. 72.

† *Essai sur la Geographie des plantes.* Paris, 1807. P. 136.

Latreille represents Humboldt as having seen Indians whose bellies were covered by little tumours, which he believed to result from the presence of bots in that region.* Similar accounts are reported from La Condamine, Barriere, and other travellers in America; and a physician to the King of Cayenne has sent to the French Academy of Sciences an account of the frequent occurrence of bots in men and women there. Further, D'Abreu is reported by Siebold, in his article on parasites in Wagner's 'Handwörterbuch,' as describing the frequent occurrence of bots in a certain province of Brazil.†

"These numerous examples of the comparative frequency of this affection in foreign countries, and especially in South America, might be much extended by further quotation from the article in the Transactions of the French Entomological Society, already referred to, as well as from the paper of the Rev. Mr Hope, in the Transactions of the Entomological Society of London. If they convince us of the real frequency of the disease in these countries, and if we observe the remark of Gmelin on the smallness of the imago, we may be left in hesitation as to the existence of a distinct species in these quarters.

"Although the disease is rare in Europe, yet cases of its occurrence in almost every region of it, from Iceland to Italy, are on record.‡ The case which came under my observation, and particulars of which were communicated to the Medico-Chirurgical Society of Edinburgh in 1854,§ was,

* *Annales de la Sociéte Entomologique de France.* II. 518.

† *Handwörterbuch der Physiologie.* II. Band, p. 655.

‡ Besides the papers already noticed, there is said to be a collection of observations in the work of Keferstein on insects injurious to men and animals. Erfurt, 1837.

§ *Monthly Journal of Medical Science,* July, 1854, p. 80.

I believe, the first ever published of its occurrence in Scotland. But then, as now, I felt assured that cases were not so rare as this circumstance might seem to indicate. I was therefore greatly gratified by the perusal of an excellent paper on this disease in the *Edinburgh Medical Journal* for November 1858, by Dr Spence of Lerwick, who gives an excellent account of several cases of it occurring in the Shetland Isles, and states his previous announcement of similar observations in his inaugural dissertation presented to the Medical Faculty of the University of Edinburgh in 1848.* The frequency of the disease in this gentleman's district, leads us to express a hope that still farther observations may be made by him on this interesting subject, and especially that facts may be collected as to the subcutaneous migrations of these animals. It might also be ascertained to what size the larva grows in the human subject, and the careful tending of the mature larva in its subsequent metamorphoses might lead to the decision of the question of the existence of an œstrus peculiar to man. At present the circumstances already enumerated, the occurrence of the larvæ in the exposed parts of the body, and in women who are all loosely dressed, and in those much exposed in the habitats of the œstrus, lead us to believe that in this country the human insect is merely a stray or misled bovine bot.

"E. C., a girl, aged 13, came from Perthshire in September 1853 to reside in Edinburgh. She had never been in bad health till shortly after leaving the country, when she began to suffer pains which she connected with the bots. She first felt a little lump on the back of the neck, which slowly changed its position in various directions. Then a hole opened over it, and a worm was squeezed out. Some weeks

* See *Edinburgh Veterinary Review*, vol. i. p. 400.

afterwards, another similar lump was felt on the right side of the trunk. It also wandered about subcutaneously till a hole opened over it, and it was forcibly rubbed out. A third made its appearance over the spine, high in the chest, then travelled up the neck, when for a time it was lost, and was supposed to reappear on the right side of the neck, where a hole formed over it. Now, [on 3rd March] I was fortunate enough to be called, and observed a small, not inflamed tumour, of the size of a large field bean, and having an opening on the top as big as a pin-head. Peeping into this hole, I saw one or two black points which rolled about. On squeezing moderately the little lump, there was discharged a living larva, half an inch long, evidently of the œstrus bovis, and the same as those previously noticed by the girl. A little dirty yellow juice issued with the animal, containing a few blood globules and pus corpuscles. The girl says that, while in Perthshire herding cows, she was much exposed to the air, and was frequently stung by insects."

TICKS.

The ticks, keds, or fags, which are found on the skins of horses, cattle, sheep, and dogs, are parasitic species of the genus Ixodes or Ricinus of Latreille. They belong to the class of Arachnida.

The Dog Tick.—Ixodes ricinus is of a reddish-brown colour, with light red or greyish-brown abdomen. It is from 3 to 6 lines in length. It lives in woods, and passes on to the bodies of cattle, sheep, and dogs, whose blood it sucks.

The Ox Tick.—Ochsenzecke of the Germans is Ixodes reticulatus of naturalists. It varies from 5 to 6 lines in length, is of an ash-grey colour, with dark red spots and circular stripes on its body. It lives on cattle and sheep.

Usually mistaken with the ticks, are the Hippoboscidæ which have been said to "exhibit such remarkable variations in their typical structure that they have been regarded by some authors as forming a distinct order. The head is received into a cavity in front of the thorax; it is divided transversely into two parts, the anterior or smaller of which supports the mouth and two small tubercles, almost imbedded at the lateral angles, being rudimental antennæ. The mouth is composed of two curved setæ, inclosed in a tubular canal, covered by two narrow elongated coriaceous plates, regarded by Latreille as palpi. The ocelli are wanting. The body is short, flat, and very coriaceous; the wings are either large or entirely wanting; the nerves of the anterior margin are very strong, but they are effaced behind. In the winged species a pair of balancers are also present. The legs are very strong, and terminated by robust curved claws, which are toothed beneath. The abdomen is composed of a continuous leathery-like membrane, capable of very great distension, which peculiarity is owing to the remarkable circumstance that the young of these insects are singly nourished within the body of the parent, where they not only acquire their full size, but actually assume the pupa state, under which form, like very large eggs, they are deposited by the female. This egg-like cocoon is at first soft and white, nearly as large as the abdomen of the parent fly; but by degrees it hardens, becomes brown, of a rounded form, and often notched at one end, which is covered by a shining kind of cap, which is detached on the insect's assuming the perfect state. This cocoon is moreover entirely destitute of annular incisions, in which respect it differs from those of other Dipterous Insects. It is composed of the uncast skin of the larva, beneath which the insect becomes a real inactive pupa, with the limbs of the perfect insect laid along the breast, as in other species which undergo the strict coarctate species of transformation.

M. Réaumur was the first to discover these curious particulars; and he was so anxious to observe the development of the insect from these singular eggs, that he carried them in his pocket by day and took them to bed with him at night, in order that they might have a uniform degree of warmth; great was his surprise therefore when, instead of grubs as he expected, perfect flies were produced.

"These insects are interesting in their habits. They live exclusively upon quadrupeds and birds; the horse is especially subject to the attacks of one of these species, hence called *Hippobosca equina.* This species is the type of the genus *Hippobosca,* in which the eyes are large and distinct, being placed at the sides of the head; the antennæ are in the shape of tubercles with three dorsal setæ; the wings are large. Mr Curtis observes that these flies move swiftly, and like a crab, sideways or backwards; they are very tenacious of life, and live principally on horses, attaching themselves to the belly between the thighs and under the tail, where they are less protected by hair. It is remarked by Latreille that the ass fears them most, and that horses suffer very little from them. In the New Forest they abound in a most astonishing degree. Mr Samouelle says, 'From the flanks of one horse I have obtained six handfuls, which consisted of upwards of a hundred specimens. They abound most on white and light-coloured horses.'

"The other genera are:—*Ornithomyia, Craterina, Oxypterum, Hæmobora, Melophagus, Feronia, Lipotepna,* and probably *Braula.* Of these the first three are British, and are found upon various birds, the *Craterina hirundinis* depositing its egg like a cocoon in the nest of the swallow, where it receives all the necessary warmth; for which it repays the poor swallow by sucking its blood. The wings in this genus are very long and narrow. The genus *Melo-*

phagus comprises a single species, *M. ovinus*, which is destitute of wings, and attacks the sheep. It is of a dark reddish colour, with the abdomen whitish. It is commonly called the Sheep Louse, and is so tenacious of life that Ray states that it will exist in a fleece twelve months after it is shorn, its excrements even giving a tinge to the wool, which is very difficult to be discharged."*

These lice or ticks abound on the ewes in spring, and when shearing time arrives the lambs are tormented by those which pass on to them from their shorn dams. The weaker lambs are most infected, and whatever animal is attacked by these blood-sucking parasites is prevented from thriving by the state of irritation it is kept in. It is to destroy these ticks that lambs are dipped, though, when non-poisonous dips are employed, the ewes should be dipped before they are shorn, and this will tend to preserve the lambs to a greater extent. Mere washing with soap and water is of no use against the ticks, and active agents are needed to destroy the parasites.

Poultry Lousiness in the Horse.—Phthiriasis Equi.

In 1850 Professor Bouley of Alfort drew attention to a severe skin disease, occurring in horses that are kept where poultry abound. In the *Veterinarian* for April 1851, M. Bouley's observations are published. Referring to the disease, he says:—

"Its commencement is instantaneous. All at once the horse is seized with a violent continued general itching. So sudden and irresistible is the desire the animal possesses to scratch himself, that he is not easy for a single moment. He rubs his skin against every resisting body near him, stamps the ground continually, strikes his belly, bites every place he can reach with his mouth, manifesting by his continual

* Knight's *English Cyclopædia.*

movements the burning itching by which he is devoured. At night his torments increase; so much so, that should the animal be abandoned to himself, he rubs and bites himself to that degree that he tears his skin, and carries portions away in his mouth, denuding himself extensively of his scarf skin; nor does he relax until smarting pains succeed the insupportable torments of the itching.

"At the time these symptoms of prurience are making their appearance, the skin is the seat of an eruption of very small vesicles; some solitary—others, in greater number, congregate, occupying more or less extent of surface. These vesicles contain, at the period of their maturity, scarcely serosity enough to raise the epidermis, which becomes detached, dragging the hairs with it that run across, leaving behind it a small bare surface, perfectly circular, of the diameter of a lentil, or the smallest silver coin. This bare part becomes covered with a crust of dried serosity, which soon exfoliates, and is replaced by a new epidermis, perfectly smooth

"This primary stage of the disease is difficult to meet with, because, ordinarily, horses are not submitted to examination before depilation has commenced, the sequel of the dessication of the vesicles.

"At the second stage of the poultry lousiness, the most pathognomonic lesion is the depilation consecutive on the vesicular eruption; and this is so characteristic, that, once the disease is observed in its true form, and traced to its cause, a simple *coup d'œil* is all that is necessary to recognise and distinguish it from all other cutaneous affections.

"The depilation is of that remarkable character that it reflects exactly, in the general impression it makes upon the skin, the form of the vesicular eruption, solitary or confluent, of which it is the latest vestige. In fact, the surface is marked by regular circular patches, of the diameter of a lentil, giving it the aspect of tiger spots. In places where the eruption has been the most confluent, the depilation spreads between the vesicles, and so extends over a considerable patch of surface; but, even in these places, the circular disposition of the denuded patches, the primary expression of the original vesicular eruption, is still maintained in the smooth condition of the epidermis.

"This depilation spreads, like the vesicular eruption of which it is the consequence, with very great rapidity. In two or three days the horse with the most shining coat may have it spotted over with circular patches bare of hair, and in the course of a week will the hair and epidermis be destroyed over a large extent corresponding to the parts where the eruption has been the most confluent. Such is the rapidity of the depilation that we are but too apt to date the disease back to a long period when it is, in truth, but of a few days' duration.

"It is only at this stage of the *phthyriasis* that horses ordinarily come under observation; and therefore does it become difficult at such a time to assign to the disease any specific character: the vesicular kind of eruption serving to distinguish and classify it having left no trace upon the skin save circular depilation. Sometimes, at this stage of the disease, solid papulæ form within the substance of the skin, which become crowned with secondary vesicles, whose progress is identical with that of those we have already pointed out, disappearing after the formation and detachment of the crust which succeeds the secretion.

"During the whole of this stage, as at the first breaking out of the disease, the patients are tormented with continual burning itching, causing them to rub themselves incessantly and without relaxation; so that we observe upon the skin, in those places the most rubbed, lesions, which we may call *trau-*

matic, consequent on the violent action occasioned by the bodies against which the animal rubs himself. These epidermic excoriations appear either in series of lines or in broad patches, or in places irregularly circumscribed, according to the regions in which they are found, and the nature of the bodies against which the friction has taken place. They are principally remarkable upon the lateral parts of the head and neck, upon the back and croup, upon the sides and flanks, and upon the internal parts of the limbs. They look either very angry or bloody when observed immediately after the rubbing, or they are covered with red incrustations more or less adherent, according to the length of time they have existed; or else they appear in a state of granulation and suppuration, whenever the skin has become sufficiently deeply injured. But these superficial lesions of the skin do not by right belong more properly to poultry lousiness than to any other pruriginous disease; and, so far from being considered as one of their peculiar features, we ought to look upon them as simulating those affections to which they in truth belong, and which they stand in the place of.

"This disease in no way interferes with the integrity of the general functions. Apart from the violent excitement the animal may experience, and the consecutive irregularity of his respiration and circulation it may occasion, he presents all the aspect of the most perfect health. When, however, the disease becomes of long duration, the subject of it will be apt to fall off his appetite, to grow thin, and to lose his condition for work from the gradual wasting of his powers. Indeed, there occur cases in which this privation of rest (from continual excitement) brings on complete marasm, and such inability for work, that the proprietor feels himself compelled to get rid of his horse at any price."

The late Mr Henderson, of Park Lane, London, addressed a letter to the *Veterinarian*, immediately after the perusal of M. Bouley's article. He says:—

"It is very many years ago—I think about five-and-thirty—that my attention was first drawn to this disease. Notwithstanding this lapse of time, however, from its being a remarkable occurrence, I have all the circumstances so strongly impressed on my memory that I shall, without hesitation, comply with your request, by relating to you the simple facts as they then, in my recollection, occurred.

"My attention was first drawn to the subject through being called to see eight horses that were used in a pair-horse stage-coach, which at that time ran from Kensington to Leadenhall Street. These horses occupied an eight-stall stable, built expressly for their use, and totally unconnected with any other stable in the yard. The stable-man told me that two or three of the horses which stood at one end of the building had been rubbing and gnawing themselves for some days past, which increasing until it became serious, it was thought requisite to apply to me about it. On examining them, I confess that I was somewhat puzzled to determine the nature of the malady. It was unlike both mange and surfeit in any form I had ever before seen them. Still, I commenced at once to treat them the same as I had been accustomed to do cases of mange, by giving them a good mercurial dressing. This appeared to have the desired effect for a time. But we found that the other horses, one after another, became similarly affected; and that even those which we considered as cured relapsed as bad as ever again. One day, as I was standing watching the operation of dressing, an old coachman drove into the yard, and soon began to ask 'what was the matter.' I confess I felt myself somewhat puzzled, by way of answer to his question, to give the disease a name, when the old boy followed up his inquiry by asking 'Where's your hen-house?' The place being pointed out, the door was no sooner opened than a spectacle was disclosed to us which I shall not readily forget. The accumulation of filth in the place, which had not to all appearance been cleaned out for years, was only to be compared in aspect and consistence to lumps of decayed cheese, swarming with mites. (I trust this observation may not prejudice the table, or prevent any gentleman indulging in his fondness for cheese in that state: it has not at all interfered with my partiality for mitey cheese.) This secret being discovered, the nuisance was immediately removed, the stable being well cleaned out, and the horses thus freed from their annoying companions. The man who looked after the horses now told us that *he* had been frequently annoyed by the insect which he supposed to be a 'louse,' and that the apprehension of being called 'lousy' made him unwilling to disclose the fact before. Since the above, I have not met with more than two or three cases of the kind; but be assured, my first inquiry in each was, 'Where is your hen-house?' At the remote period in which the above cases occurred, I was a very young man in practice, and had very little time (however I might have been inclined) to dip deeply into philosophical investigations. Had these cases occurred in the present age of advanced scientific research, the affair would have received a much more strict inquiry, and would, probably, have revealed facts highly beneficial to our science. In closing this narrative, let me whisper one word to my young friends,—'Never turn a deaf ear to the observations of *old age.*' Had I done so, or considered it beneath me to attend to what may at the time have been thought the impertinence of a stupid old coachman, I might to this day have enjoyed my ignorance, and would consequently have been unable to avail myself of this opportunity of adding my testimony in support (if I may presume so much) of the exceedingly clear and well-written account of Mons. H. Bouley."

Messrs Woodger, Moon, and others, have since published interesting observations on the disease, which Mr Henderson was perhaps the first amongst veterinarians to observe.

Horses and other animals have been destroyed by wasps and various flies, such as Simulum reptans, a very dangerous animal, and which occurs chiefly in Hungary and the East. In Africa another fly—Chrysops cœcutiens—attacks horses' eyes, and blinds them. Argas Persicus torments, and even kills the Persian horse, and it is said that in St. Domingo, another parasite, Argas Americanus, bites the ears of horses, and leads occasionally to fatal results.

BURNS AND SCALDS.—AMBUSTIO.

The list of skin affections is not complete without reference to injuries arising from excessive heat or cold. In the first place, with regard to burns and scalds, though not so frequent or so deadly in the lower animals as in the human subject, cases are not rare, and unless properly treated, they prove very troublesome, and even fatal. The only difference between a burn and a scald, is, that the latter is usually caused by hot liquids, and covers a wide surface of skin, without, as a rule, injuring it to a great depth. A burn is commonly understood to be an injury resulting from flame, or the contact of a burning solid object with the skin. Dupuytren, the renowned French surgeon, classifies the conditions of skin induced by excessive heat as follows:—

1. "Erythema or superficial inflammation of the skin, without vesicles.

2. "Inflammation of the skin, with separation of the cuticle, and the production of vesicles filled with serum.

3. "Destruction of the papillary layer of the skin.

4. "Disorganization of the entire thickness of the skin, down to the subcutaneous cellular tissue.

5. "Destruction of all the superficial structures, together with the muscles, to a variable degree of depth short of the bones.

6. "Carbonization of the entire thickness of the burned part."

Without entering into details concerning the many varieties of burns described by Dupuytren, it may be said, in general terms, that the effects of excessive heat applied to the skin vary greatly in degree of severity, and that according to the extent of surface, or depth of skin injured, the local and constitutional symptoms vary both in kind and intensity. The symptoms are also different, according to the mode in which heat is applied.

Firstly, Superficial burns and scalds may induce mere redness of the skin, some soreness and desquamation of cuticle. This form of burn is noticed in party-coloured pigs with a scanty coat of bristles, from the action of the sun's rays on the white patches. The technical term applied to this condition is *ephelis*. It is also seen as the result of the prolonged application of hot fomentations and hot poultices to a part. The constitutional symptoms are mild, and amount to slight irritative fever.

Secondly, The skin is more deeply injured by the contact of hot iron to the skin, or the scalding by boiling water. Veterinary surgeons very commonly see the first injury as the result of an operation, and they are well acquainted with the heat and pain, swelling and tension observed on the part. Blisters form, burst, and discharge coagulable lymph. The surface of the skin may be so injured as to destroy hair follicles and epidermis to such an extent as to blemish seriously. The parts are apt to suppurate and ulcerate.

Scalds of a dangerous kind are more rarely seen in the lower animals than in man. I have seen cases of boiling liquids from brewers' vats falling over the hips of horses, and occasionally hot steam, as well as boiling water, in manufactories accidentally injure animals. The pain the animals experience is very great, the excoriation which results is extensive and rapid. The red skin, unless speedily and effectually protected, suppurates or mortifies; the animal is dull and very feverish, and with extensive burns, death may result in a few hours.

Thirdly, Deep burns, followed by sloughing, are seen in animals that are rescued from burning buildings, or when the operation of deep and close firing is unwisely resorted to. Animals sometimes die of shock with this variety of burn, or they recover for a time, and are liable to secondary affections of other parts of the body.

Treatment.—The means found most advantageous to give relief in cases of burn and scald are—1*stly,* Protection of the part from contact with foreign objects, and especially from exposure to air; 2*ndly,* The application of evaporating and sedative lotions; 3*rdly,* Attention to the state of the system generally, especially to the condition of the bowels and kidneys.

It is necessary to caution farmers against the use of agents which clog the surface of the skin, such as oils and ointments. I have known an animal to have suffered for long with ulceration of the skin of the back, from the use of the common turpentine or digestive ointment, after a burn resulting from a portion of burning timber falling on the back. The most soothing application is a lotion composed of equal parts of sulphuric ether, or chloroform, and spirit of wine; and to each ounce of this mixture half a grain of morphia is added. Flour may be dredged over the skin if the epidermis be intact, and the part must then be enveloped in finely carded cotton wool, which should be kept on four or five days, and if the wool adheres, poultices should be applied to favour its separation, or simple water-dressing may serve. It has been recommended to use stimulants, both internally and externally. Mild aperients and salines are usually very beneficial.

Caustics may produce effects analogous to those resulting from hot applications. We must check their ravages by dilution with water in most instances, and by chemical decomposition in others. Thus, if nitric acid is the active agent, it may be washed off; if sulphuric acid, the addition of water would increase its effects, so that lime or carbonate of soda should be immediately sprinkled over the surface; if potassa fusa or quicklime be the active agents, their action may speedily be checked by the use of dilute acetic acid; insoluble and harmless acetates are formed.

FROSTBITE.—GELATIO.

In the human subject the effects of cold on the skin are well illustrated by the ordinary chilblain. In the lower animals, cases are recorded of a similar inflammation attacking the skins of the extremities, and sometimes, in very cold regions, of sloughing of the skin occurring to a considerable extent. The best application in cases of frostbite is a stimulating ointment, such as the ordinary turpentine dressing.

DISEASES ARISING FROM SPECIAL INTERNAL CAUSES.

In man the maladies included under this head are remarkable for their chronic character and obstinate resistance to treatment; the internal cause they are ascribed to is obscure, and their study in the lower animals, tends to throw little light on their nature, as only one form has been at all recognised, viz., Elephantiasis. Of these diseases in man there are five, viz., Lepra, Lupus, Scrofuloderma, Kelis, and Elephantiasis. The reason why the lower animals are rarely attacked by any of these disorders is perhaps to be found in their being not unfrequently of syphilitic origin. Mr Erasmus Wilson says:—"The cause of the present group of diseases is obscure; it is, probably, some poison present in the blood, engendered by conditions either external to the body, or within the economy itself. Numerous observations have led me to the conclusion that lepra originates in the syphilitic poison, the poison being modified by transmission through one or more generations. Lupus, in some instances, is clearly referable to the poison of syphilis; in others it seems to appertain to an infection equally mysterious, namely, scrofula; and scrofula, I believe to derive one of its sources from syphilis. Kelis is allied with scrofuloderma, often making its appearance on the cicatrices of scrofulous sores, or in children suffering under scrofulous affections. The cause of Elephantiasis is as much a mystery, as deeply plunged in obscurity at the present day, as it was before the commencement of the Christian era, when it made its first outbreak among the inhabitants of the banks of the Nile. From Egypt it travelled through Syria to Greece; from Greece it pursued a westerly direction through Europe. After exhausting itself in England, it moved northward into Scotland, from Scotland to the islands of Orkney and Shetland; and at the present moment, rages with severity on the coasts of Norway and in Iceland."

Though enlarged limbs in horses have been regarded as due to elephantiasis, the only malady that seems to have been described with any proper foundation under this head is—

Fig. 203.—Elephantiasis Bovina.

Elephantiasis of the Ox.

Several observers have witnessed, in hot countries, a disease of the skin of the ox, which they have regarded as identical with elephantiasis of the human subject. The only specimen I have seen relating to it is one in the Bologna museum, and in the foregoing woodcut, a representation of the stuffed skin is given. The case was regarded as one of congenital elephantiasis.

From the descriptions of Cruzel, Géllé, Taiche, and Pradal, it would appear that when attacked with this disease, the skin of the ox becomes dry, hard, thick, and wrinkled. It is hot in some parts, and firmly adherent to the prominences over joints in others. The hairs are dry, and pimples form at the opening of the hair follicles. The cuticle separates in many directions, and deep fissures soon form, which increase in breadth and depth, and discharge a serous fluid, or even pus; the discharge is always fetid. Scabs form, which render the cutaneous surface very rough, and the hairs drop off. The disease may attack the whole surface of the body, or only one part, such as the head. When the head is principally affected, the eyes are closed and the eyelid deeply cracked, but vision remains unimpaired. The discharge from the eyes causes the hair of the face to fall off; the conjunctiva is red and infiltrated; the lips and margins of the nostrils are thickened and tumefied; the Schneiderian membrane is of a pink colour, and a dense, yellow discharge flows from the nose. The buccal membrane retains its normal appearance, and the outbreathed air is not fetid.

If the limbs are affected, they become enormously swollen and very rigid from the knees and hocks downwards; the animal cannot walk, and obstinately stands or lies, and if it maintains the erect position, it does so until it falls from sheer exhaustion. The skin of the digits is nodulated, and ulcers form, which itch to a certain extent, and which the animal licks constantly. The constitutional symptoms are those of disturbed functions—cows cease to yield milk, the appetite is capricious, and so on. The disease is always chronic, and lasts several months. Its treatment is attended with very doubtful results, and success depends more on judicious diet and cleanliness, than the use of medicines. Some recommend occasional bleeding, but the majority are opposed to this practice. Low diet is suggested for the febrile stage, and setons have been inserted in the dewlap. Active purgatives have been strongly recommended, and locally the use of emollients, of healing ointments, &c.

DISEASES ARISING FROM ANIMAL POISONS OF UNKNOWN ORIGIN, AND GIVING RISE TO ERUPTIVE FEVERS.

Fevers associated with characteristic cutaneous manifestations are included under this head. They are measles, scarlatina, variolous fevers, varicella, and that wide-spread plague—epizootic aphtha. Typhus has been included in the list, but as it cannot be called a local disorder, we shall treat of it elsewhere. They cannot be regarded as local disorders, and might more properly be classed with systemic diseases than with affections of the skin.

MEASLES.—RUBEOLA.—MORBILLI.

Measles in the human subject has been defined to be "a contagious febrile disease, characterised by catarrhal symptoms, and the occurrence of a rash upon the skin about the fourth day, without the disappearance of the fever." It has often been confounded with small-pox. In this country the term measles has been most erroneously applied to two diseases of the pig—the one being a parasitic malady due to the existence of cysticerci in the muscular system of the hog; and the other, a disease of the blood, usually associated with severe gastro-intestinal derangement, and well known as the 'blue disease,' or hog cholera. German veterinarians have furnished us with histories of outbreaks of a contagious fever amongst sheep and swine, which is probably the same disease as human rubeola. It is not known whether it is one and the same disease in man and these animals, or whether it is transmissible from animals of one species to those of another. The definitions of the disease given by continental veterinary surgeons is in substance the same as the above, quoted from Dr Wood's "Practice of Medicine," and which might well stand for a translation of the following definition by Professor Hering: — "Fieber, mit catarrhalischen Zufällen und einem unregelmässigen Ausschlag (Entzündung und Knötchen) auf der Haut verbunden. Acuter verlauf, ansteckend."

Ryss—a German veterinarian—seems the first to have described the disease as he witnessed it in a flock of sheep in 1811. In addition to the symptoms of a slight irritative fever, he observed that the animals sneezed, coughed, had a discharge from the nose, swelling of the head, especially in the parotid region, heat of mouth, dryness of skin, want of appetite, and constipation. Towards the end of the second day a reddish eruption rose over the chest, then on the thighs, sides of the body, face, &c. The eruption had the character of irregular red spots, which became white on pressure with the finger, and in the centre of which a hardness was felt, so as to give to the skin an uneven feeling when the hand was passed over it. Twenty-four hours were required for the development of the eruption. The cutaneous secretions had a peculiar odour, and after the eruption was well out the fever ceased, the swelling of the head subsided, and the papulæ assumed a brown red colour by the 4th or 5th day, disappearing altogether from the 9th to the 11th. Desquamation of the cuticle usually followed, and some catarrhal symptoms continued. When colic and diarrhœa set in, about the ninth day of the disease, the malady proved fatal. The disease was inoculable by using the discharge from the nose and the scales from the skin. Of 103 animals inoculated, only one died. Hofacker declares that the disease thus described by Ryss was only a form of variola ovina, or common sheep-pox.

Viborg gives a description of measles in the pig. With the first symptoms of the fever there is cough, vomiting, redness of the eyes, and flow of tears; red papulæ then form on the back, eyes, axillæ, and inner surface of the thighs, and at a later period, desquamation of the cuticle over these parts is observed. The disease only proved fatal when an offensive diarrhœa set in, or inflammation of the lungs supervened. Viborg recommended the separation of sick from the healthy; paying great attention to cleanliness and free ventilation, and not using much medicine. If the eruption did not manifest itself promptly, he recommended a dose to be given every two hours, consisting of one drachm of carbonate of ammonia and half a drachm of camphor. Amongst sheep it has also been recommended to enforce the separation system, and allow them nitre to lick at will, with water to drink.

Scarlet Fever—Scarlatina.

This is another of the human disorders which is of doubtful occurrence in the lower animals. Mr Erasmus Wilson says,—"Scarlatina is an acute inflammation of the tegumentary investment of the entire body, both cutaneous and mucous, associated with fever of an infectious and contagious kind. It commences with fever, which invades at an indefinite period between the second and the tenth day after exposure to infection or contagion. On the second day of the fever, the eruption is developed in the form of minute points and papulæ, which constitutes patches of large size, or a general efflorescence of a vivid scarlet colour. The rash terminates at the end of six or seven days, leaving the skin rough and harsh, and the epidermis peeling off in the purpuræ and thin laminæ." British veterinarians have described cases of sporadic and apparently non-contagious disease which they have called scarlatina. Messrs Percivall, Webb, Turner, Woodger, Hunting, and others, have recorded such instances.

As an illustration of the class of cases, I may quote Mr Hunting's, which occurred in a six-year-old pony, belonging to the South Hetton Coal Company, on the 10th May, 1856. At that period, and for several weeks preceding it, scarlatina had been exceedingly prevalent in the district, and had proved unusually fatal amongst children. On the 2nd of May, 1856, five cases of what is called distemper (a name applied in Durham to four distinct diseases: viz., catarrh, influenza, strangles, and glanders) were reported in the pits, but the malady, Mr Hunting says, was in reality a combination of strangles and malignant scarlatina. The five animals, four years' old ponies, were drawn to the surface, and placed in the infirmary stables; on the third day, two out of the five died, and, on the following day, the third case sank.

" The six-year-old pony before mentioned, was drawn out of the pit and placed in the infirmary stables, (four days after the three first cases died). His symptoms were cough fever, sore throat, enlarged parotid glands; lips somewhat swollen; *sub-maxillary space quite free from swellings*, the mucous membranes presenting the same yellowish purple hue, as is frequently seen in bad cases of influenza; the mouth hot, and the tongue and gums covered with a soapy saliva; the pulse small, and almost imperceptible at the jaw, beating 60 per minute; the breathing quickened, but not laboured; deglutition difficult, countenance dull; thin mucous discharge from nostrils; extremities rather cold; loss of appetite; fæces dark-coloured, passed in small quantities, and covered with a slimy mucus; great disinclination to move in his box.

"On the second day after entering the infirmary stables, the Schneiderian membrane was studded with bright scarlet spots, varying in size from a pea to a pin's head; in two or three places the petechiæ had apparently spread from the centre to the circumference, so as to coalesce, forming irregular patches; scarlet spots were also observable on the membrane lining the lips. Some days the spots and patches were very much brighter in colour than in others; and when so, the general symptoms were less favourable than at other times. The treatment consisted of a mild aperient fever medicine, counter-irritation to the throat, and warm water enemata. Little or no alteration of symptoms occurred until the fourteenth day after his first attack, when the infirmary horsekeeper came in haste to say that the pony had been kicked during the night, and the 'rind' of his belly was broken, the man supposing it a case of hernia. On visiting my patient, I found an enormous dropsical enlargement extending from the ensiform cartilage backward, involving the whole of the prepuce. On the evening of the same day, the effusion had extended to the left fore-leg. On the following day, the breast and right fore-leg were affected; the breathing now became increased, and somewhat laboured; the pulse full and much stronger; the countenance became anxious, and the animal immoveable. Notwithstanding the constant employment of warm fomentations, the swollen parts were hot and painful on being pressed, and pitted considerably on the application of pressure. On its withdrawal, the indentations remained for some time.

"My patient being *much debilitated*, having eaten but little for fifteen days, I was doubtful, under the circumstances, whether it would be prudent to adopt active depletive measures; but remembering the passage in Dr George Burrow's well-written article on scarlatina, in the 'Library of Medicine,' wherein he says: 'It might be expected that these dropsical effusions, which are so often the symptoms of constitutional weakness, and which follow a disease characterised by great depression of strength, would require a stimulating plan of treatment to remove them; but experience, and examinations of fatal cases, have proved that these dropsies ought to be treated by antiphlogistic remedies:" I determined to follow the principle there laid down. Active aperients and diuretic medicines were given internally; 6 oz. of blood taken from the jugular vein; hot fomentations applied to the enlargements for twenty-four hours successively; after which, hand rubbing and gentle exercise were ordered.

"As soon as the bowels began to act freely, a decided improvement for the better was visible. Three days after, depletive measures were resorted to, the pulse became exceedingly weak and imperceptible at the jaw; the serous effusions, however, had almost disappeared, and the appetite was improving. Tonics and stimulants were now administered, and in ten days my patient was convalescent, and able to take an hour's walking exercise daily."

Whether it be right to call such cases scarlatina, cannot well be determined. Professor Hertwig of Berlin looks upon them as cases of typhus, whereas Spinola describes cases occurring in a number of three and four-year-old colts, presenting all the characters described by Mr Hunting, and regarded by Professor Spinola as instances of scarlet fever.

VARIOLOUS FEVERS.

Man and many animals are subject to a specific inflammation of the skin dependent on a blood poison which is thrown off in pustules, and leads constantly to the reproduction of the disease. Human small-pox may be regarded as typical variola, and the same poison induces a very characteristic eruption, but less severe constitutional symptoms on the horse and cow. Of all animals, sheep are attacked by the most malignant form of variola—a form which is not transmissible to man, and only occasionally to other animals, such as the dog. Swine are also destroyed by a specific form of variolous fever, but rarely; and the same remark applies to goats and poultry.

All variolous fevers are contagious. Contagion is their only known and well-ascertained cause. They occur as sporadics or epizootics, according to the circumstances under which communication occurs. Thus, amongst flocks of sheep, variola is usually epizootic. Amongst horses kept separately, it is usually sporadic.

All variolous fevers are characterised by a definite course and duration. They cannot be cut short without endangering the patient's life, and in all there is a period of incubation, eruption, and dessication. Symptoms of general fever, however, prevail, or occur simultaneously with the first indications of any cutaneous disorder.

Cow-Pox (*Variolæ Vaccinæ*).

This very simple affection is not often noticed, and so many forms of eruption are observed on the teats, that it is somewhat difficult to detect the true from false varieties of cow-pox, at certain stages of the eruption. This disease has claimed a very large share of attention on the part of scientific men, from Jenner's discovery in the dairies in Gloucestershire, where he observed that the people milking cows with the cow-pox suffered from an eruption on their hands, but never had the malignant small-pox of the human being. This was the origin of vaccination.

The cow-pox, like other forms of variola, is a contagious pustular eruption of the skin, running a very regular course, accompanied by slight fever. It is communicable between animals of different species.

Causes.—The primary cause of cow-pox is unknown. The majority of cases occur in spring and summer, shortly after cows have calved. The state of congestion of the udder at this period favours the development of the disease, and it has never been observed to arise spontaneously in bulls, oxen, or heifers, before calving. It is chiefly seen in cows from four to six years of age. Mr Ceely makes the following sensible remarks on the causes and origin of the disease. Referring particularly to the Vale of Aylesbury, he says:—

"The *variolæ vaccinæ* seem to have been long known in the vale and neighbourhood. They have been noticed at irregular intervals, most commonly appearing about the beginning or end of spring, rarely during the height of summer; but I have seen them at all periods from August to May, and the beginning of June. By some it is presumed that cold and moisture favour their development; by others, that the hard winds of spring, after a wet winter, are supposed to have the same influence. I have, however, seen the disease in the autumn and middle of winter after a dry summer. The disease is occasionally epizootic, or prevalent at the same time in several farms at no great distance, more commonly sporadic or nearly solitary. It may be seen sometimes at several contiguous farms; at other times, one or two farms, apparently under like circumstances of soil, situation, etc., amidst the prevailing disease, entirely escapes its visitation. Many years may elapse before it recurs at a given farm or vicinity, although all the animals may have been changed in the meantime. I have known it occur twice in five years in a particular vicinity, and at two contiguous farms, while at a third adjoining dairy, in all respects similar in local and other circumstances, it had not been known to exist for forty years. It is sometimes introduced into a dairy by recently purchased cows. I have twice known it so introduced by milch heifers. It is considered that the disease is peculiar to the milch cow —that it occurs primarily while the animal is in that condition—and that it is casually propagated to others by the hands of the milkers. But considering the general mildness of the disease, the fact of its being at times in some individuals entirely overlooked, and that its topical severity depends almost wholly on the rude tractions of the milkers, it would perhaps be going too far to assert its invariable and exclusive origin under the circumstances just mentioned; yet I have frequently witnessed the fact that sturks, dry heifers, dry cows, and milch cows milked by other hands, grazing in the same pastures, feeding in the same sheds and in contiguous stalls, remain exempt from the disease. Many intelligent dairymen believe that it occurs more frequently as a primary disease among milch heifers; but I have not been able to confirm this remark by my own observation. It does not appear to be less frequent on the hills than in the vale. It has been seen primarily on the stall-fed as well as on the grazing animal.

"*Origin of the disease.*—I have met with several intelligent dairymen whose relatives had seen good reason to ascribe its occurrence to the contagion of the equine vesicle, communicated by the hands of the attendant of both animals; but very little of that disease has been noticed of late years, though I know of several farriers who have been affected from the horse, and resisted subsequent variolation or vaccination, and have seen a few who distinguish between the equine vesicle and the grease, a recurrent disease—eczema impetiginodes—as it appears to me. For many years past, however, the spontaneous origin of the variolæ vaccinæ in the cow has not been doubted here. In all the cases that I have noticed I never could discover the probability of any other source.

"There is much difficulty in determining with precision, at all times, whether the disease arises primarily in one or more individuals in the same dairy; most commonly, however, it appears to be solitary. The milkers pretend in general to point out the infecting individual; but as I have more than once detected the disease in a late stage on an animal not suspected of having it, I am not very prone to confide in their representations, unless my own inspection confirms or renders them probable."*

* "An early conviction of the necessity of almost entire self-dependence in these dairy investigations soon led to the adoption of the following rules:

"1st, Not to be too fastidious in my footsteps.

"2nd, To be on the best possible terms with the milkers.

"3rd, To obtain all possible information from them, and believe nothing important which could not be confirmed.

Cow-pox among cattle and small-pox among ewes have been repeatedly observed to prevail at the same period. Mr Gibson, in a sketch of the province of Guzerat, states that variola carries off annually many persons, and "the same disorder is at times very fatal among the cattle." Mr Macpherson, writing from Murshidabad in 1836, observes that the disease among the cows has not occurred in the province for two years; that during the same interval very few cases of variola have been known, and from these circumstances he infers "that the unknown causes which favour the disease in the human subject, have the same tendency in the cattle; in fact, that variola and mhata, or gotee, owe their origin to the same cause." Mr Lamb, stationed at Dacca, remarks in 1836, that during the prevalence of variola, the cow-pox "appeared in one muhalla and carried off fifteen or twenty cows."

Cases have been noticed by Mr Ceely, which show that cows have been infected from human small-pox effluvia.

Symptoms.—There are general symptoms of a mild fever, and the characteristic signs are purely local. Constitutional symptoms have been described in some cases as follow: —Sudden sinking or loss of milk, dribbling of saliva from the mouth, and frequent inflation and retraction of the cheeks, staring of the coat, arched back, limbs drawn together, and

"4th, To inquire into the temper and habits of every animal to be inspected.

"5th, To inspect with gentleness and caution, remembering that there was danger from behind as well as before.

"6th, Never to be without a small pocket-lanthorn, glazed with a thick plano-convex lens, wax candles, and the means of ignition, either to explore in the absence of daylight, or to obtain a perlustration of parts on which daylight can rarely impinge.—*Trans. of the Prov. Med. Assoc.*, vol. viii."

rapid loss of flesh. In about three or four days, red hard spots are seen, which soon appear circumscribed; the teats become painful and slightly swollen. The spots attain the size of a horse bean, and milking becomes generally very painful to the animal. They rapidly increase in size and tenderness, and become charged with a limpid fluid, and

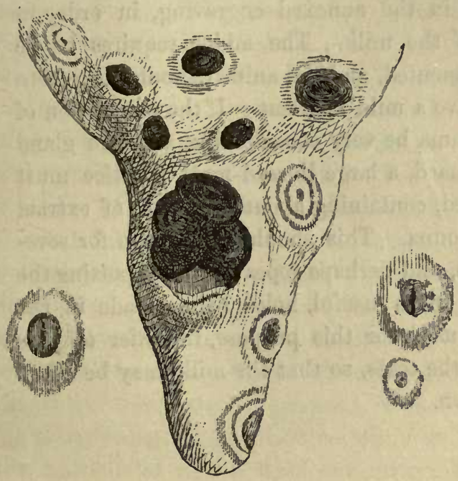


Fig. 204.

are surrounded by a red base or areola. The limpid fluid becomes opaque and purulent, and the distinctive feature of the pustule is, that it has a depression on its summit, as seen in the above woodcuts. It is technically termed "umbilicated." It is most perfect about ten days after its first appearance.

Mr Ceely has carefully examined the structure of the pustules, and finds the fluid enclosed in meshes, formed by fibres which intercept the vesicle. A scab forms over the spot, which is thrown off within the third week of the eruption.

Treatment.—From the great soreness of the teat, cows cannot readily be milked, and it may be essential to introduce in the milk duct a tube, as seen in the annexed engraving, in order to draw off the milk. The udder requires to be freely fomented, and the animal should, in severe cases, have a mild aperient. If the congestion of the mamma be very considerable, and the gland become hard, a large linseed-meal poultice must be applied, containing about a drachm of extract of belladonna. This should be kept on for several hours, and perhaps repeated. Supporting the udder is often useful, holes being made in the bandage used for this purpose, in order to pass through the teats, so that the milk may be often withdrawn.

Fig. 205.

SMALL-POX IN SHEEP.

Small-pox in sheep spreads both through contagion and infection. Observers are agreed that it is not safe for a healthy flock to come to within 500 yards of a diseased one. A fixed virus is deposited in stables, on pastures, roads, railway trucks, &c., by diseased sheep, and many agents may thus act in favouring an indirect contact. Human beings carry the disease for miles, and shepherds have often communicated the malady to distant flocks. It is said that hares and rabbits are subject to the disorder, and may be the carriers of the contagion. Sheep dogs certainly can be the means of transmitting the virus. The malady has been observed on them, and a marked case occurred in Wiltshire. Mr Charles Percivall had an opportunity of observing the disease on Mr Stephen Neate's dog, and informs me that the symptoms were identical with those of variola ovina, and there could be no doubt that the dog contracted the disorder from the diseased sheep. The disease has been communicated by inoculation to man and cattle.

When small-pox enters a flock, it may be checked and limited to a few cases, or it may affect the whole. I have observed that the disease is far more severe in countries where it is the practice to house the sheep. Few escape, and the majority die. It is this that renders all the German veterinarians such decided partizans of the practice of inoculation. They find that sometimes not one per cent. die where flocks are inoculated, whereas 50, 60, 80, and upwards of 90 per cent. are destroyed by the natural disease.

In proportion to the close, hot, and ill-ventilated condition of stables in which sheep are congregated, is the mortality heavy. The malady spreads far more certainly and rapidly amongst the continental flocks than our own. Here the course of the disease usually consists in the attack of one or two animals which probably survive, but not being separated from the flock, contaminate dozens. In the course of about a month several score of sheep are affected, and in two, three, or four months, every member of a flock of one or two thousand sheep may have been seized. Where a flock of sheep is housed, the disease is propagated to every animal in as many weeks as it takes months on our hills. Many vigorous animals in a flock prove rather refractory to the influence of the virus, and some may escape altogether. This is not seen where causes combine to weaken the system and favour the repeated approach of contagious matter.

In France the mortality observed amongst flocks affected with this disease varies from 20 to 40 per cent. In England it has attained 50 per cent.

Every writer of merit in Europe attributes this disease to the introduction of diseased animals across the Russian frontier into Poland, Hungary, Prussia, Pomerania, &c. This malady, like pleuro-pneumonia in cattle, epizootic aphtha, and contagious typhus, spreads *invariably* from east to west. It is a malady which never has, and never will, originate spontaneously in this country.

It is perpetuated in some countries, such as Prussia, and especially in its eastern divisions, by the practice of the yearly inoculation of lambs born on farms frequently visited by the disorder.

Mr Mayer, writing in 1848, said, with regard to inoculation for small-pox in sheep, "I should myself question its policy, as it tends to perpetuate a disease in the country which, by sanitary regulations on the part of the Government, and the active co-operation of local authorities and agriculturists, might be arrested in its course and thus die out." I shall consider the subject of inoculation further on, but cannot refrain from quoting Mr Mayer's words, which are pregnant with truth. Europe has lost hundreds of thousands of sheep, and has suffered from repeated outbreaks, entirely from the absurd practice of inoculation. It is the most active cause tending to propagate the disorder with rapidity over the greater part of the continent of Europe. Thus, if a flock of infected sheep communicates the disease to one or two districts in Mecklenburgh, the appearance of the disorder is notified to the magistrate, and the districts are proscribed. This is the signal of alarm which leads forthwith to the inoculation of flocks in a number of districts, and for miles around the seat of the first outbreak. The result may readily be conceived; a whole country is at once affected.

It is somewhat remarkable that our flocks should have escaped attacks of small-pox during the first five years which succeeded our importations; but my inquiries in London amongst very well informed dealers, butchers, and others, are satisfactory. The sheep imported were at that time very inferior. They were not, like the cattle which communicated pleuro-pneumonia, bought up for store purposes, but sold at once and slaughtered. The London market was then not so common a resort as at present for farmers who purchase sheep to feed for a few months, and at most some butchers might have kept a few over from one week to another, or a little longer. Some of these kept sheep often died, so much so that those who bought them did not repeat the experiment, and lean small sheep were dressed up *as lamb*, and sold in the east end of London amongst the poor. Whilst lamb was at a high price in the west end, it was at 4d. or 6d. a pound where the lean, small, and pallid foreign sheep were sold as such.

But a very satisfactory explanation of the alarming introduction of small-pox in 1847 is to be found in the extraordinarily sudden increase in the importation of sheep. In 1847, 139,371 sheep were imported, whereas the total amount for the five years previously was 111,222. The number was as low as 210 in 1843, under 2000 so late as in 1844, under 16,000 in 1845, and 91,732 in 1846. The foreign dealers were exerting themselves to increase the supply of sheep, and it is not at all to be wondered at that small-pox spread westward. It must not be forgotten that the countries with which we immediately trade were as healthy as our own in the early days of our importations, and it was only when they had to import for our supplies that they suffered and injured us.

The outbreak of small-pox in 1847 continued until 1850, and it interfered with the foreign trade. It was as late as 1850 that the importation of sheep again attained the number of 1847; indeed, it exceeded that number by nearly 4000 sheep, and there was a rapid increase in our importations up to 1852. They then attained 217,649, and although individual outbreaks of small-pox had occurred since 1849, especially amongst the stocks of butchers, it was in this year of extraordinary increase in the foreign trade that we began to suffer more severely. More severely still in 1853, and then, thanks to the general practice of slaughtering foreign sheep in or near London, we escaped until 1862.

Merino sheep imported from Tonning, but most probably reared in Mecklenburgh, were the first to communicate the disease to British stock. Fifty-six of these sheep, purchased on the 26th July 1847, led to an outbreak at Datchett, near Windsor. They were imported from Tonning, on the coast of Denmark. Another lot of 166 were brought into the port of London from Hamburgh by the "Mountaineer," and one of 80 by the "Princess Royal." A part of a large cargo was purchased on the 26th of July, of two salesmen, by Mr B. Weal of Woodhall, Pinner. "These lots," says Mr Simonds, "were equally divided between himself and his brother, and in both of them the disease has shown itself." A portion of the same cargo of sheep by the "Princess Royal" was sold to Mr Goodchild of Kingsbury, and they are reported to have been also affected with it.

In 1847, 1848, 1849, and 1850 the disease committed great ravages not only in Middlesex and Surrey, but particularly in Norfolk, Cambridgeshire, Suffolk, and Hampshire.

In 1858 Professor Gerlach stated that statistics indicated the greatest and constant prevalence of the sheep-pox in the principal provinces of Prussia, Posen, Pomerania, and Brandenburg; in Silesia and Saxony only isolated outbreaks occur, whereas the western provinces have remained free. The disease is, therefore, stationary in certain provinces, and the question is, must it be regarded as an enzootic disorder due to local influences, or is the cause of its persistence in these parts the preservation and reproduction of the small-pox virus by means of yearly inoculations as a precautionary measure on the part of many flockmasters? Some inoculate, and others do not; the *contagium* is, therefore, preserved or regenerated at several or many points. Under these circumstances it is scarcely possible, adds Gerlach, to avoid the spread of the disease from the inoculated herds; and this happens with great certainty and frequency, in consequence of the absence of all sanitary regulations with regard to the inoculated flocks.

My inquiries, when in Germany in 1862, resulted in the confirmation of all I had previously heard and read as to small-pox in that part of the Prussian dominions. I learnt, however, that in 1861 the disease was worse than it has been for many years, and, as usual, the alarm of small-pox outbreaks led to many farmers inoculating their flocks, and establishing many centres whence the disease could extend itself.

The year 1862 was one of extraordinary losses by contagious disorders.

Small-pox in sheep broke out in April at Hinter Ribnitz, and thence it spread to many farms in the neighbourhood of Rostock. The attention of the Mecklenburgh Government was directed to the subject in the month of June. District after district was rapidly proscribed, and many farmers, alarmed at the approach of disease, inoculated their flocks.

My inquiries in Mecklenburgh led me to believe that districts were proscribed long after small-pox had been in them. Though the Government regulations are stringent, there are no means employed to ensure that they are enforced. It will be observed that it was officially announced that small-pox was at Quassel only as late as the 6th of September, whereas by that time the disease had committed great ravages, and had in reality been in a flock four months. Many other cases of a similar nature occurred. I also found that infected sheep and the skins of animals that had died of the disease were sold.

The first farm I visited on my way from Hamburgh to Rostock was Quassel, near Pritzier, towards the south-west of Mecklenburgh Schwerin. The proprietor farms his own land. He is a wealthy man, possessing also an estate on which he has sheep and cattle beyond Lübeck. At Quassel he had in the month of May 1862, 250 sheep. As none are bred on this estate, and only purchased to fatten for the butcher, 400 sheep were bought about the middle of May. The 250 fat ones were then sold, but not removed by the dealer. Both purchase and sale were effected by the proprietor, Herr von Paepke, with a Mr Reuter, a large dealer in Hagenow. Herr von Paepke could not at the time learn, because Herr Reuter chose to conceal, whence the 400 sheep came, but afterwards was informed that they came from an infected district in the neighbourhood of Gustrow. Very shortly after purchase, disease appeared in the new flock, and spread so rapidly that in July it was thought expedient to clear out the fat ones, which were sent to *Hamburgh for the English trade.* On this point my inquiries have been most particular, and I state the facts as gleaned from Herr von Paepke himself, his land steward, and shepherd. In August all the sheep were inoculated, and with apparent effect. I examined the seat of the inoculation, the ears, in many, and the appearances indicated that the inoculation had taken effect. Many severe cases resulted from the inoculation, and some apparently natural cases occurred, and early in October, a very severe outbreak was witnessed in which many of the sheep had a well-developed eruption, and others were seized chiefly in the head, and were suffering to a great extent from partial paralysis of the hind quarters.

Not only, however, had Herr von Paepke sold sheep since the disease broke out on his farm, but I noticed in a shed a large number of skins. I was told that these were the 145 skins of the dead sheep, and that such was the fact their appearance amply betokened. It was considered a great pity to bury the sheep with their skins, and the law had been evaded as it is daily in Mecklenburgh.

When in Hanover I visited several farms for the purposes of an official inquiry. I ascertained that much disease had been due to the travelling of diseased sheep across the country from east to west, and towards Holland. Dealers had purchased diseased sheep, and no less than 200 were sold from one infected flock at Erstorf early in the summer. They were fat, and it was thought best to sell them before they took the disease. The losses were severe on this farm.

The chief outbreaks in Hanover first occurred about the months of March and April.

That small-pox has been very prevalent on the continent during the last two or three years is also proved by an outbreak in Belgium. It is rare to observe the disease in that country, more rare than I had been led to understand before visiting it. It is stated that no outbreak had occurred since 1823 and 1825 until 1860. Three hundred sheep from Germany, purchased in the latter year by a farmer at Petit

Bœulx lez Nivelles, and mixed with 700 or 800 more sheep, soon manifested signs of the disease. Eight per cent. were lost before a competent veterinarian was consulted. Separation and inoculation were resorted to, and owing to great precautions taken, the disease was limited to the one flock.

I particularly notice this outbreak in Belgium, as it shows how German sheep travel far westward, crossing Hanover into Holland, as well as through Holstein from Mecklenburgh, for the English markets.

Holland has suffered severely for the last four years. Its sheep-rearing province is Drenthe, famed for its sandy plains, heather, buck-wheat, and flocks of sheep. In no other Dutch province are the flocks so large or so numerous. Herr Moss, veterinary surgeon at Assen, has witnessed outbreaks annually since 1858. He has inoculated many flocks, and the losses have occasionally been very numerous. The districts most injured by it in 1862 were Rolde Gieton, Borger, Buiven, Peize, where it has been for two years, Kolonie and Veenhuizen. In the two latter places it was raging severely when I was in Holland. In 1861 the disease appeared in Friesland, but there are no flocks of sheep there of any importance, and it has not committed great ravages in consequence. Some outbreaks have been witnessed in Gröningen, but none in North and South Holland, or Zealand, so far as I could learn.

That diseased sheep were, however, exported from Rotterdam early in 1862 for England, I had ample opportunity of learning in the province of Utrecht. The farmers in this province have flocks varying in number from 100 to 200 sheep. The country is open, and I met many sheep crossing fields and travelling on the road. As in Wiltshire, the drovers prefer crossing country to the high roads, and every outbreak that I could trace was attributed to contact of flocks with the diseased sheep driven through the province. I observed the malady at Den Oond and in two farms at Schalwijk. When the malady was raging at Den Oond in the month of August, twenty-six sheep, apparently in health, were sold to passing dealers for the English trade. The twenty-six sheep were the only ones of a flock of about 120 that had not taken the disease at the time of their sale. They were, of course, infected sheep. Before I left Utrecht on the 28th of October, I learned that the disease had spread to Gooij, and other farms near Holstein.

I am now led to consider the outbreak of small-pox in Wiltshire, in 1862.

Mr Joseph Parry, of Allington, owned, at the commencement of the year 1862, one of the choicest flocks in Wiltshire. It was exclusively home-bred, and consisted of 992 ewes, 9 rams, and 710 lambs. Such a flock in the centre of the North Wiltshire downs might justly be regarded as not likely to suffer first from any contagious disorder.

But the district turns out to be one not unfrequently visited by contagious disorders, and my attention was specially directed to the peculiarities of that portion of country which render it liable to invasions of scab and the foot-and-mouth disease, as well as the sheep pox.

The farm of Allington, about six miles north-east of Devizes, stretches over St Anne's Hill, or Tanhill, which is the centre of an extensive sheep district. It is also the locality in which there is an extensive sheep fair, held annually on the 6th of August. Skirting this hill, and through the heart of the district about to be described, is the celebrated "Wan's, or Devil's dyke," one of the divisions of the old Saxon heptarchy, and now levelled in some parts, but prominent at others. The Wan's dyke takes a somewhat serpentine course from east to west. Standing on the Wan's dyke at Tanhill, and circumscribing a circle with a radius of six miles, an area is embraced of about 70,000 acres of land, resting on the chalk formation, with considerable tracts of the upper greensand, and the soils are proverbially healthy for sheep. Over this district there is, in many parts, one sheep to the acre, and the total amount of stock was computed, in July, to be about 50,000 sheep.

The system of management consists in folding the sheep on fallow land or green crop, according to the season, extent, and quality of the down, to which the sheep are driven every morning from April to November. Each farm has therefore a certain amount of arable ground in the vale and a strip of down on the hill. These strips of down are often connected with the arable land by a mere right of way or small strip of down, and the downs are limited for each farm by some faint undulation or mark, which we often failed to recognise, and which shepherd and farmer alone can define. Practically the downs are quite unenclosed, though legally we understand that the land apportioned to each farmer is looked upon as fenced, so as to protect him from intrusion, and is considered enclosed ground. Our readers may imagine in what sense this may be accepted, when we tell them that we have ridden and driven for miles on the downs, straight through all the infected farms, without deviating right or left, and without passing ditch, hedge, stone wall, or gate.

Standing on an elevated spot, the flocks are seen in every part moving side by side, one after the other, crossing each other's track, and affording ample opportunities for communion amongst the shepherds.

The district is traversed in all directions by driftways, so that drovers can pasture their sheep on the downs for days, and go from Bristol to London with the payment of a single toll, or from Southampton to Ilsley, &c., in the same way. An extensive dealer has assured me that many hundred sheep driven for many days along the Wiltshire downs cost for travelling expenses 4s. a day. No money is needed for food, shelter, or tolls.

There are some notorious dealers who have no farm or down on which to keep their flocks. They pick up odd animals at a low price, here and there, and drive over the downs, where they sleep, and move gently backwards and forwards on the pretext of travelling, but in reality getting food for their flocks. Many instances have occurred of the spread of contagious disorders, such as scab, the foot-and-mouth disease, foot rot, &c., from these infected flocks passing over the downs along the Wan's dyke.

The lowland portion of the Allington farm is skirted by the canal, and it is said that the sheep were near this canal when the disease first broke out. I find, however, that the first case occurred amongst a portion of the flock that had been daily to the down for about a week. My authority is the shepherd who drove them.

I visited the downs repeatedly, rode across them with gentlemen who knew the country well, spoke to drovers, shepherds, and other persons, and the more I inquired the more evidence did I obtain in confirmation of the facts gleaned by me the first morning I commenced my investigations.

My inquiries abroad indicate that of late years, but especially in 1861, and early in 1862, small-pox has been raging severely in the countries whence we derive stock. There have been no seizures of infected sheep, but many have undoubtedly been introduced in this country. Many were imported in the spring. With all these facts, I think the evidence is as complete as we need have it with regard to the contamination of the Allington flock. The very fact of that flock being away from public roads endangered it, and rendered the chances greater that drovers' sheep would feed by its side.

The Allington flock communicated disease to the sheep on Mr Harding's farm at Etchilhampton. Then Mr Stephen Neate, whose lands adjoin Mr Parry's, discovered the malady, but only after having been to a fair at Marlborough with a lot of lambs. Fortunately Mr Neate was so quick in getting back the lambs he had sold that they led to no further outbreaks. I ascertained the existence of the disease at Stanton, Horton, Hillwood, Avebury, and Langley farm. There was no mystery as to the communication of the disease in any case, with the exception of Mr Church's flock at Hillwood, which, however, was folded by the roadside, where thousands of sheep are constantly passing. The extent of the loss sustained in Wiltshire is shown in the subjoined table.

TABULAR STATEMENT AS TO SMALL-POX IN SHEEP IN WILTSHIRE.

Name of Farmer.	Name of Farm.	Total Amount of Stock.	Losses before Inoculation.	Number of Sheep Inoculated.	Total Losses.	Date of Outbreak and Inoculations.
Jos. Parry..	Allington	1711	200	800	500	July 1, 1862. Inoculated 2nd and 7th Aug.
— Harding	Etchilhampton	400	18	380	19	August 22. Inoculated 3rd week in Aug.
Step. Neate	Allcannings.....	1000	14 cases but no deaths.	976	80	August 23. Inoculated 26th and 27th Aug.
J. Simpkins	Stanton..........	100	...	None.	2	End of Aug.
T. Giddings	Horton	450	...	None.	2	August 27.
T. Church..	Hillwood........	360	...	None.	15	August 27.
W. Hulbert	Langley Farm..	400	3	380	140	August 30. Inoculated 15th and 16th Sept.
Isaac Dark.	Avebury	400	...	one.	2	September 12.
S.Hitchcock	Allcannings....	300	None.	300	19	Inoculated beginning of Sept.

Had all the flocks seized been inoculated, I am quite sure that the outbreak of small-pox would not have been brought to so quiet a termination. Had I inoculated Mr Gidding's, Mr Dark's, and Mr Church's flocks, I have no doubt whatever that many more farms would have been infected by this time; and it is satisfactory to notice how very insignificant the losses were amongst the non-inoculated as contrasted with the inoculated flocks.

The losses on 3811 sheep were 221 before inoculation had been practised, and the loss since has amounted to 537, or a total of 758 on 3811, viz., very nearly 10 (19.89) per cent., whereas on 1310 sheep not inoculated the loss amounted only to 21 sheep, or 1·6 per cent.

On all the farms where the separation system was carried out, the cases were very severe, but removed as a rule before they could contaminate other animals. The exception to this was Mr Church's flock, in which one or two mild cases were observed late. The mortality on the cases at Hillwood was as high as 70 per cent., so that it could not be said that the disease was not virulent in character. Again, at Horton the cases were very severe: one animal recovered with difficulty, and the second died from a confluent variety of the disease. They were both confluent cases that I examined at Avebury, and one of the sheep at Stanton was very severely affected.

Symptoms of Small-pox in Sheep.—There are three important stages of this disease, viz., invasion, suppuration, and desquamation. Usually within a week, and sometimes exceeding this time, after a sheep has been in contact with diseased animals, or has been inoculated, slight fever marks the invasion of the disease. The shepherd notices that the animal is dull, its ears are drooping and wool clapped. On the parts of the skin free from wool, a flea-bitten appearance is noticed, and each red spot increases in size so as to form a lenticular inflamed papula. About the 8th or 10th day the centre of the papula becomes elevated and transparent. A clear limpid liquid accumulates, and soon becomes turbid. The pustule has a white and then a yellowish opaque appearance; the skin around it is pale. Each pustule is flattened

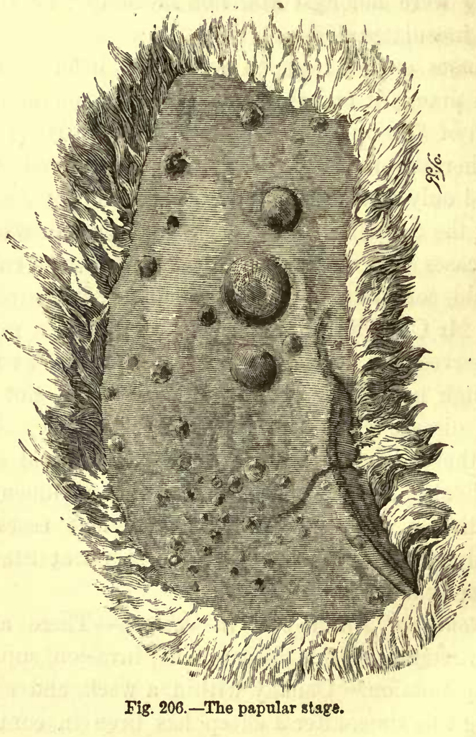


Fig. 206.—The papular stage.

and rarely umbilicated. A certain amount of transudation of lymph occurs, and the pustule then dries, and in a few days a yellowish grey or brown scab is perfectly formed. The scabs fall off, or leave a red depression in the skin.

The constitutional symptoms vary in severity according to the character of the case as indicated by the eruption. There is severe fever, intense thirst, bloodshot eyes, &c., in all cases in which the papulæ are numerous and running together, or in other words, *confluent*. Discharge from the eyes and nose, quick breathing, and tendency to blueness of the mucous membranes, are conformable signs. The fœtor of the cutaneous exhalations and of the expired air is often intolerable; and in the latter stages of fatal cases, the

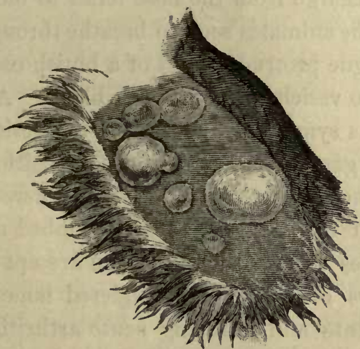


Fig. 207.—The pustular stage.

animals are seen to pant with their tongues protruding out of their mouth. In mild cases the fever disappears when the eruption is well developed.

The appearance of the dark circumscribed scabs is very peculiar, and has been compared to that of black, round heads of nails. It is owing to this that the French use the term claveau, from *clavus*, a nail.

The eruption of the face, purulent discharge from the eyes, swollen nose, difficult breathing, fœtor of exhalations and expired air, with rapid breathing and accelerated pulse, are signs observed in the affected members of a flock.

The disease is observed to assume very irregular forms:—

Firstly, The fever may be so intense as to destroy without the manifestation of any eruption. The lymphatic glands swell, ecchymoses occur in the mucous membranes; the prostration is great; there is profuse diarrhœa, and intolerable fœtor of all the secretions.

Secondly, There may be a general eruption over the mucous membrane, especially of the respiratory and digestive systems. This is attended with marked symptoms of suffocation. The discharge from the nose tends to block up the air passages, and the animal is seen to breathe through the mouth, having its tongue protruded, and of a bluish colour.

Thirdly, The vesicles may fill with blood. At other times emphysematous symptoms appear, and the vesicles are found filled with the gaseous products of decomposition.

There is much irritation of the skin wherever scabs are forming, and if these are prematurely rubbed off, ulceration, sloughing, caries of cartilage and bone are apt to supervene. Many members of a flock are rendered lame by eruptions implicating joints and inducing acute arthritis, or affecting the feet, and causing the throwing off of the hoofs.

The duration of the disease extends over 20 days or a month. In confluent cases, death occurs about the 8th or 9th days after the eruptions, and usually before any signs of the formation of lymph have occurred. Death may occur much earlier and much later; early, from the intensity of the fever, and late, from complications in the course of the disease.

Post-mortem Appearances.—Body much swollen, and exhaling a fetid smell. The eruption is seen on the parts affected. The eyes and nose are closed with scabs and dried purulent discharge. The wool is easily detached, or is falling off. On skinning the animal, circumscribed red solid nodules are cut through over the whole body. The red stains are seen on the skins of animals that have died of the disease, long after these skins are dried. They may serve to indicate whether parcels of skins are sound or unsound. There is an infiltration of serum in the subcutaneous areolar tissue, especially of the extremities.

The mucous membrane of the mouth, lips, soft palate, pharynx, œsophagus, and rumen, is the seat of yellowish or red spots, nodules or *vari*, and of more or less extensive ulcers. Similar lesions occur over the respiratory organs, and the lungs are often the seat of congestion and ecchymoses.

The lymphatic glands, especially of the neck, near the anus, and in the mesentery, are enlarged, tumefied, and marked with red spots.

Prevention and Treatment.—From the preceding statement it will be gleaned, that prevention of the disease in this country depends on excluding diseased animals from our ports and markets, and on rigid separation of infected animals wherever the disease may appear. The sick animals may be slaughtered; but if placed where they cannot possibly infect other animals, they may be treated by means of nitre and other neutral salts, and allowing them water and easily digested food. No remedy can be relied upon to cut short the disease, and the utmost that can be done is to diminish the animal's sufferings, and favour a mild course of the disease. Cleanliness, warmth, ventilation, &c., are of the highest importance.

Variolous Fever in other Animals.

Abroad, occasional outbreaks of variola occur amongst goats, pigs, dogs, and domestic fowls, characterised by symptoms similar to the forms already described.

VARICELLA BOUM.—CHICKEN POX OF CATTLE.

Various authors have discovered a severe pustular eruption of the teats of cows, occurring when they are fed on vine leaves, which are often given to them on the Continent, or other green food,

Symptoms.—Some constitutional disturbance, though slight. Pustules form round the coronet of the hind feet, rarely on the fore-feet or on the lips, but very constantly on the teats, commencing in the shape of very small hard inflamed knots on the skin, which suppurate. The matter is discharged, and a scab forms over each pustule. The disease lasts from twelve to fourteen days. Gellé has compared it to acute ecthyma in man.

Treatment is very simple, and indeed precisely similar to that suggested for epizootic aphtha.

A form of varicella has also been described as occurring in sheep, and the principal observer has been Haxthausen It seems to be a variety of the true sheep pox.

CHAPTER XV

EPIZOOTIC AND ENZOOTIC DISEASES.

Epizootic diseases.—Their definition and enumeration.—The steppe disease, or contagious typhoid fever.—Its symptoms, nature, and prevention.—Epizootic aphtha.—Its history on the Continent and in the United Kingdom.—Its general symptoms.—Special symptoms amongst cattle, sheep, and pigs.—Its communication to the human subject.—Its treatment and prevention.—Enzootic diseases.—Their definition, and general causes.—Anthrax, or carbuncular fevers.—General remarks.—The occurrence of such fevers in the United Kingdom.—Different forms of anthrax.—Carbuncular fever, without local complications.—Carbuncular fevers, with erysipelatous complications.—Form of anthrax, with the development of boils and carbuncles.—Splenic apoplexy.—Braxy in sheep.—Black-leg.—Glossanthrax.—Anthrax in the pig.—Parturient fever, or dropping after calving.—Heaving pains, or 'inflammation' in ewes.

EPIZOOTIC DISEASES.

The difficulties of definition are not easily overcome in stating what we recognise as an epizootic disorder. It is a malady spreading far and wide over a country or countries. But not every malady which attacks a large number of animals in many districts and many counties is termed 'epizootic.' For among such diseases some are due to local influences, which being accidentally repeated in many different places, give rise to the coincidence of simultaneous outbreaks of disease over a wide extent of country. And accordingly we distinguish those widespread plagues which are independent of local influence from the disorders which can be proved to depend on damp, exposure, malaria, improper feeding, and similar local causes.

The line of demarcation between these two classes of disease is very essential in the present study, and is perhaps more easily established in veterinary than in human medicine. It is to the first class only that the word *epizootic* is applied. The diseases included in it having originated in some definite region of the globe, spread in all directions without regard either to the breeds of animals, or to soil, climate, and other local influences. Such are the following:—The *typhoid* or *enteric fever* of cattle, which always spreads from the Russian steppes; the *pleuro-pneumonia* of cattle, ever extending from central Europe, though probably traceable to Asia and Africa, in some parts of which it is a very common disease; the *epizootic aphtha,* or *vesicular murrain,* which seems indigenous to Hungary and south-eastern Europe, to which it may first have passed from Asia; the *sheep-pox,* or *variola ovina,* also imported from Asia and Africa, but constant in eastern Europe, and spreading westwards through central Europe.

All these maladies are contagious. They are mildest, as a rule, where they develope spontaneously, or where they have been, as it were, acclimatized, and are very destructive in their progress beyond such regions. They are most severe when they first break out in a fresh district, and many causes combine to diminish their fatality as they continue. Fresh accessions of virus by renewed importations, and the constant renovation of stock (in consequence of the short lives of our animals, and the rapidity with which they are bred), lead to local exacerbations, the frequency and severity of which are in proportion to the extent of imported disease, and the number of susceptible animals in the locality.

Epizootic maladies travel in Europe from east to west, and exist more generally and constantly on continents than on islands. The British islands have been exceptional since the free introduction of foreign stock for our densely peopled cities. The smaller islands, such as Jersey and Guernsey, most renowned for their valuable cattle, are free from such diseases.

Having described elsewhere the lung disease of the ox tribe, and different forms of variolous fever, it only remains for me to speak here of the Russian plague, and of the vesicular murrain.

The Steppe Disease.—Russian Cattle Plague.—Contagious Typhoid Fever of Cattle.—Typhus Contagiosus Boum.

This terrible disease, so peculiar to the ox tribe, that the Germans call it "Rinderpest," is a very contagious fever, characterised by specific lesions of the intestines similar to those of enteric fever in man. It originates invariably in Asia or the Russian steppes, and though confined to the bovine species, and only rarely affecting sheep, it attacks cattle of all breeds with equal virulence. It spreads somewhat slowly, and is not very fatal where it originates as an enzootic, but it is propagated very rapidly, and is the most fatal of all cattle plagues when it passes into central Europe.

Fortunately for us the contagious typhus is much dreaded in the countries with which, at all events indirectly, we are in communication. Cattle have to travel several days to reach Hamburgh or Rotterdam from the eastern portions of Austria and Prussia. The disease has a short period of incubation, and is characterized by alarming symptoms which warn people early of its outbreak. It is not so insidious a disorder as pleuro-pneumonia. It is not seen in a latent form, and cannot so readily penetrate a country unobserved. Notwithstanding all this, we must not forget that annually there are exposed in the Altona and in the New Islington Market, Podolian and Hungarian oxen. It is true that these are fattened at the distilleries of Austria and Prussia, but they come from districts not very remote from those where the contagious typhus has appeared within the last two years. If Russia became engaged in war with Prussia or Austria, and our import trade continued as at present, I think it would be impossible to avoid an importation of this terrible disease.

We must not forget that it appeared in Turkey and in the Crimea during the Crimean campaign. Its outbreak then was only in accordance with the circumstances under which similar outbreaks occurred last century, as well as this one, and similar circumstances endangering this country still more may again recur.

Symptoms.—The period of incubation during which there are signs of disorder, lasts from four to eight days. It may be as short as twenty-four hours, and sometimes, but very rarely, of nine or ten days' duration.

The first signs consist in dulness, prostration, and a short husky cough. The appetite is not lost, but is irregular; rumination is also slow and irregular. The animal grinds its teeth, yawns, arches its back, draws its legs together under its body, and manifests tenderness of the loins.

A fever shiver ushers in the third stage. The animal becomes hidebound, its coat stares, there is still greater tenderness of the lumbar region. The gait is stiff, joints rigid, ears and horns alternately cold and hot; pulse frequent, hard, and full; breathing laboured, and secretions generally scanty. Rumination is suspended; deglutition performed with difficulty: thirst intense, and mouth hot and clammy. The drooping ears, extended head, spasmodic jerking of the muscles of the body are very characteristic. There is a watery discharge from eyes and nose. The eyes are bloodshot, eyelids swollen, and soon encrusted with the dried inspissated secretions from them. The lips are also somewhat swollen, partially closed, and allowing saliva to drop out of the mouth. If blood is drawn, it coagulates slowly, and sometimes not at all. The dry excrement and high-coloured urine are scanty and discharged with some difficulty. The abdomen is tense and tender. In cows the secretion of milk is stopped, and the udder is flabby and shrivelled up. In some cases, general emphysematous swellings form at this period, and there are exacerbations of all the symptoms towards night-time. This stage lasts about three days.

The symptoms increase in severity. Diarrhœa supervenes, and the animal is extremely weak. It stands and walks with difficulty, and lies much. The pulse becomes weak and indistinct at the jaw. It beats from 90 to 100 per minute. The discharge from nose and salivation increase. The cough becomes less audible and soft. On the buccal and Schneiderian membranes, as well as in the clefts of the feet, a vesicular eruption is often seen. Ulcers result wherever the vesicles burst.

The coldness of the extremities or of the body generally, the stupor or drowsiness, quick breathing and fœtor of the exhalations, with spasmodic action of the alæ nasi, and moaning, are amongst the most unfavourable symptoms. There is often an involuntary discharge of fluid fæces, more or less tinged with blood. Cows abort, and all symptoms of sensibility or consciousness are lost. The animal dies from the third to the tenth day of the development of the disease.

In favourable cases there is an early diminution in the severity of the symptoms; the diarrhœa is not severe, and there is a pustular eruption over the body, or a desquamation of cuticle. The convalescence is long, and may last several weeks.

Post-mortem Appearances.—These have been very carefully studied and described by Dr Röll, of the Vienna Veterinary School, Jessen, Spinola, Brefeld, &c., &c. The lesions are peculiar in three different stages.

In the first, or catarrhal stage, the mucous membrane of the fourth stomach, especially near the pylorus, as well as the lining of the small intestine, is swollen; there is a uniform colour or redness around the glandular follicles, and red spots or streaks on the membrane. The neighbourhood of the glands—both solitary and agminated—is red, swollen, and open. The surface of the membrane is covered with a viscid, tenacious, reddish or bloody secretion, which is more or less mixed with the intestinal contents, and in the submucous tissue there is a turbid semi-fluid exudation. In the large intestine the lesions are few. There is a general redness of the cœcum, as there is of the mucous membranes in other parts of the body, such as in the sinuses of the head, in the trachea and bronchial tubes, urinary and generative organs. The lesions of the first stage, says Röll, are not characteristic of the disease, as they indicate a catarrhal condition of the stomach and intestine which may exist in other diseases, but coupling the above lesions with the history of a number of similar cases occurring one after another in any place, they may materially assist in determining the nature of the disease affecting any stock.

In the second stage the morbid lesions are more characteristic. There are numerous patches of yellow exudation most abundant in the neighbourhood of Peyer's patches, but also seen in the fourth stomach, near the pylorus. In the latter organ, the dullish red or violet-coloured patches, where the membrane is thickened considerably, occur chiefly towards the free edges of the mucous membrane. The deposit occurs beneath and around Peyer's glands, and is then of a yellowish brown or reddish tint. The glands have a perforated appearance, and at all the apertures there are little yellowish white plugs of exudation which are readily squeezed out. In the vicinity of these deposits there is a sort of catarrh or secretion from the mucous membrane.

In very severe cases the free surface of the mucous membrane of the small intestine, extending over one or more feet, is covered by a discharge of a greyish or dirty red colour. A similar slimy secretion is seen in the cœcum sometimes, as well as in the colon and rectum, where there may be redness of the mucous folds, which is apt to be mistaken for excoriations.

In some lean-conditioned animals the exudation on the surface of the mucous membrane is not seen. There is a tenacious albuminous, yellowish white or reddish brown fluid deposited in or beneath the mucous membrane of both small and large intestines. Peyer's glands seen thus, appear swollen and perforated.

In the third stage the exudations before referred to, get loose from their periphery towards the centre. They become soft, and when still adherent at the centre, especially at the seat of Peyer's patches, there are floating masses of this exudation, which at last get quite free, and are discharged with the excrements. The portions of membrane from which these sloughs have separated are red and ulcerated, but the ulcers are not usually deep.

In a Russian report on this disease* two coloured plates

* *Bericht über die ersten Impfungen der Rinderpest* &c., &c. St. Petersburg, 1854.

have been given, showing the ulcerated glands of Peyer, ulceration of the membranes of the stomach, and the sloughs found free in the intestine.

The other organs of the body do not indicate any specific change. There is more or less redness and tumefaction of all the mucous membranes. The heart is soft and flabby, the lungs normal or slightly congested, the liver is of a dark colour, and its ducts and bladder full of bile. The kidneys are red and swollen. Spleen healthy, and nervous centres unchanged.

The mesenteric glands are apt to be swollen, and contain a yellowish red exudation, and may attain twice their natural size.

Nature of the Disease.—The *post-mortem* appearances just described, correspond remarkably with those of typhoid enteric fever of man. I long since noticed this fever, reading carefully the best descriptions published of it, and suggested, that instead of calling it contagious typhus, it should be called contagious typhoid or enteric fever. Some of the older authors regarded the malady as an impaction of the third stomach, and hence called it Löserdurre, but the distention of the omasum with solid food is usually seen in all diseases of ruminants, and not always in the cattle plague.

Different observers have given a very different account of the nature of this disease, as indicated by the many names applied to it, such as Magenseuche, Gallenseuche, Uebergalle, Grossgalle, bösartiges Ruhrfieber, and so on. The disease is certainly not a form of typhus, and, so far as I can learn, the only real difference between it and the enteric fever of man, is its plague form and exclusively contagious character. Fortunately for us, it is not enzootic here, and, like pleuropneumonia, epizootic aphtha, and variola, spreads exclusively by contagion.

Treatment and Prevention.—The curative treatment of this disease has failed as a rule. Preparations of chlorine, iron, or neutral salts have been used, and only with success in mild cases, and especially in Russian cattle.

The prevention of the disease when it is known to originate spontaneously, or to exist constantly, is sometimes attempted by inoculating the cattle, a practice recommended first during the last century, when the disease appeared in Britain. When, however, the disease enters a country like our own, it is proper and prudent to kill out the diseased and infected animals, and prevent contagion by all known means.

Epizootic Aphtha.—The Foot-and-Mouth Disease.

In 1840 and 1841 the 'epidemic' broke out in England and Ireland. The then so-called epidemic is the epizootic aphtha of continental authors; the eczema epizootica of Professor Simonds; the Tongblaar of the Dutch; Maul und Klauenseuche of the Germans; and la cocotte of the French.

It is a contagious eruptive fever, affecting all warm-blooded animals, and attacking man, under certain circumstances, as readily as any of our domestic quadrupeds.

Valentini noticed, as early as 1695, the existence of this disorder in cattle, in Hesse, and at the same time aphthæ amongst human beings.

Thanold, Heusinger, and other learned writers on epizootic, and epidemic diseases, have furnished us with abundant proof of the spread of epizootic aphtha, from east to west, and it has been frequently traced into Asia, whence I believe it invariably enters Europe.

In 1707, the disease was described as existing in Franconia, and in 1708 in Silesia and Poland.

Epizootic aphtha prevailed frequently after this period, but little is written on the subject until 1763 and 1764. Aphthous disorders, and gangrenous anginæ, were very rife amongst cattle, and also amongst human beings, at this period. They were widely distributed over the European continent, and Sagar specially mentions a severe outbreak of epizootic aphtha amongst the domestic animals, and communicated to human beings.

No special notice of this disease was published until the beginning of the present century. It was very prevalent in the years from 1809 to 1812. Heusinger publishes the details of an outbreak spreading through Europe, from east to west in 1817. It was also severe in 1824, and several Italian authors then wrote on it. In 1827, the malady committed much damage in various parts of Europe, and in Bohemia the disease was noticed amongst the people.

In 1834, the foot-and-mouth disease rapidly travelled through Podolia from east to west, and Heusinger specially remarks, that England escaped, as it had done in every previous outbreak. At this time, repeated observations were made as to the communication of the disease from animals to man. Hertwig performed experiments at Berlin, and many cases were reported on, having been witnessed in France.

From 1834 to 1840, and '41, the disease continued to prevail on the European continent. It was very rife in Poland, Eastern Prussia, Hungary, Pomerania, and spread up through Hanover, and Saxony, to Belgium, Holland, and Great Britain. Numerous were the observations there of the disease in the human subject.

In 1839 the malady was very severe, and its attacks amongst human beings were especially observed.

Heusinger furnishes us with a table indicating the spread of the disease from east to west.

Writers in the *Veterinarian* for 1841, notice the prevalence of the disease abroad, and in a very interesting communication by Mr Holmes, of Thirsk, reference is made to information of the spread of the disease through Hungary, Bohemia, Prussia, Holland, Belgium, France, *"and then to England."* "I believe," said Mr Holmes, "the disease shewed itself with a greater degree of virulence in Holland than in any other country." It also seems to have passed over from France hither, by means of the Channel intercourse, into the southern counties, and so along by the western districts, until every district has been more or less visited.

As to the spread of the disease through the Bristol market, I can quote the statement of another able veterinarian, Mr Lepper, of Aylesbury. Writing in January, 1841, he says, "I am of opinion that it is a contagious disease, although it may be difficult for me to give the why and the wherefore. I have attended cattle with the disease, the property of fifty-two persons; out of which number about fifteen or twenty positively affirm, that they brought disease to their stock by purchasing heifers, many of which were bought at the fairs; at Leighton Buzzard, in Bedfordshire, and at Winslow, in Buckinghamshire. Nearly the whole of the beasts that were purchased at Bristol fair, in the month of April last, either came home with the disease on them, or fell ill with it, in a very few days after their being safe in the possession of their new owners." . . . . "Twelve or fourteen persons out of the fifty-two, admit the probability of their cattle having travelled on the road after diseased animals."

As usual many causes have been assigned for the disease, but the most careful investigation into the history of all outbreaks in Great Britain indicates, as the foregoing references show, that the malady *is invariably introduced here, and* *spreads exclusively by contagion.* There is not a single satisfactory instance recorded of a spontaneous development in the United Kingdom.

In 1862 I saw the disease in the three kingdoms, and in all parts of the Continent which I visited. Since 1840 we have never been free many months. Town dairy cows especially have suffered, and when making an inquiry into the health of the cows in the city of London last January, I distinctly traced the disease to Dutch importations. It spread rapidly northwards, and I saw it in Edinburgh a week after it broke out fiercely in London. A few days later it was taken to Dundee by cows exposed in the markets. There were three general outbreaks in Edinburgh during the first year. The malady has not been completely away for many months, and it has interfered very considerably with the supply of wholesome milk for our citizens.

Wherever I travelled last year I saw the disease bad amongst the pigs. In Birmingham especially I saw a lot of Irish pigs very severely affected, losing their hoofs, and presenting a pitiable appearance. I learnt in Waterford, at the large bacon manufactories where there is accommodation for several hundred pigs, that, when a lot of animals with epizootic aphtha had been in the sties, the virus adhered to the wood and saw-dust used as bedding so as to lead to every lot of pigs being contaminated for weeks after the first affected animals had been placed in them.

The contagious matter is discharged in great abundance with the saliva, and from the vesicles which form in the mouth, on the teats and feet. The milk of animals affected with the disease is charged with the virus, especially when vesicles on the teats discharge lymph as the milk is drawn. The virus is destroyed by preparations of chlorine.

Symptoms of Epizootic Aphtha.—There are certain symptoms common to man and animals, and there are others which are peculiar to each.

a. The disease is invariably characterized by a brief period of incubation, varying from 24 hours to three or four days. It is ushered in by a shivering fit, and a vesicular eruption occurs in the mouth and on the digits; in female animals, usually also on the teats. There is a tendency in young animals, especially such as are sucking or drinking milk, to a similar eruption on the fauces and pharynx, with irritation of the larynx and of the whole digestive tube. Diarrhœa in these cases tends to exhaust the young animals whose sore mouths prevent the taking of food.

The eruption in the mouth is first indicated by smacking of the lips, salivation, and loss of power from the prehension and mastication of food. The pain is evidently intense, and on opening the mouth vesicles are found about the size of a bean or hazel-nut. They are sometimes congregated in patches, on the inner surface of lips and cheeks, on the tongue, and occasionally on the Schneiderian membrane. In about 18 hours the vesicles burst, and the red painful spots thus exposed are soon covered with epithelium in favourable cases, whereas in others unhealthy ulcers develope.

When the eruption occurs on the feet, it is observed around the coronet and in the interdigital space of cloven-footed animals. The intense pain indicated by inability to stand, or lameness, and the swelling above the hoof, are usually the first signs noticed. The vesicles which form burst soon, in consequence of the animals' movements. The vascular secreting structures of the whole foot may be so inflamed as to lead to casting of the hoofs.

When the eruption occurs on the mammæ, the teats are sore and swollen. Vesicles form as in the mouth. They are large and well raised from the surface of the skin—never umbilicated or pustular. They contain a clear fluid, and soon burst or dry up, so that in five or six days thin scales cover the spots where the vesicles have existed.

All symptoms of fever subside in favourable cases by the fourth day; the appetite is restored, and convalescence well established by the seventh or eighth day. Complications are not unfrequent; the fever runs high, ulceration spreads, the animal becomes exhausted, the hoofs slough off, the blood becomes impure, and death occurs about the ninth or tenth day. A very large number of such cases have been witnessed this year in Holland, and in the United Kingdom. In some cases a heavy per-centage of deaths has been witnessed in Scotland; and several instances have come to my knowledge of four, five, and six cows in dairies, usually containing eight, ten, or a dozen animals, having died of the disease, or been slaughtered in time to bleed them, so as to sell the flesh. Though usually mild, there are occasions when this disease is very virulent.

b. Special Symptoms in different animals.—Amongst cattle the constant drivelling, blood-shot eyes, quick breathing, accelerated pulse, arched back, and difficulty to stand, are leading signs of the disease. When it attacks a lot of dairy cows, great inconvenience to the owner and danger to the animals arise from the eruption on the teats. The vesicles are soon burst by the milkmaid, and, in grasping the teat, the ulcerated surface bleeds and the ulcer spreads. It scabs over between the periods at which the cow is milked, but the scab is removed repeatedly, and with the intense local pain there is a disposition on the part of the animal not to allow herself to be milked. She kicks and holds back the milk, so that the udder is not 'stripped,' and this soon leads to an attack of mammitis, which may be fatal, or may lead to induration and ultimate atrophy of one or more quarters of the udder.

In *sheep* the emaciation is considerable; they cannot eat, and move about with difficulty. The injury to the feet is the most serious complication amongst our flocks. It is not easy to attend to the feet of many hundred animals; dirt and earth tend to irritate the sore skin, and unhealthy ulcers persist. Chronic foot disorders from this cause are frequent, and lead to serious loss to the flockmaster, as sheep cannot be got into condition so long as they are lame.

In *pigs* the disease is characterised by considerable fever and pain. The animals scream as they move about, and champ with their jaws. There is a great tendency to sloughing of the hoofs, and in markets it is not uncommon to see numbers of the hoofs strewed where the pigs have passed. The animals become emaciated, and, when young, are very apt to die.

It has been asserted that the disease originates spontaneously more readily in the pig than in any other animal, and that the communication of this disease from one country to the other on the Continent of Europe depends chiefly on the pigs driven to markets by dealers. Thus have many outbreaks in Prussia been attributed to Polish swine, and Tschudi ascribes an outbreak in Austria to herds of swine driven from Servia and Bosnia.

The communication of the disease to man admits of no doubt. The history of the various outbreaks of the disease demonstrates this. There have been many contradictory statements on the matter, but the symptoms repeatedly noticed in man after drinking the milk of diseased cows are unmistakeable. Very good descriptions of these are to be found in the *Veterinarian* for 1841, at the time the foot-and-mouth disease first appeared in England.

Treatment and Prevention.—Though epizootic aphtha is not often a fatal disease, attention must be paid to the proper treatment of affected animals, so as to mitigate the losses sustained by it, in interfering as it does with the thriving of cattle, and especially with the well-being of dairy stock. Laxatives and salines must be had recourse to, and the affected parts require to be dressed with chlorine water, carbolic acid lotion, or other antiseptic and healing applications. The practice of rubbing common salt in the mouths of animals, is a cruel one, as it leads to extensive excoriation, and for days food cannot be properly grasped with the lips, and effectually masticated. It is not desirable to attempt to feed animals affected with this disease, except allowing them slops, such as gruel, &c.

The prevention of epizootic aphtha in this country, can only be secured by a different system of management at our ports where cattle land and in our markets. Many cargoes of animals infected with this disease are regularly imported from abroad, and it spreads with great rapidity. Dairymen declare that they would rather have the lung disease than the murrain amongst their stock, and to avoid it they should be careful with their purchases. Newly bought animals should be placed in quarantine, and milked last by the milkmaid, so as to prevent the milking of healthy cows after the diseased one. The hands should be well washed after a cow with this disease has been milked, and antiseptics should be freely used. The complications, such as severe irritative fever, mammitis, &c., which occur in epizootic aphtha, call for special treatment according to circumstances.

ENZOOTIC DISEASES.

The very important and extensive class of diseases, the leading character of which is a dependence on the peculiarities of soil, climate, and system of culture, has never attracted the attention it merits. However desirous I may be to enter fully on the consideration of these disorders in the present work, it is impossible to do justice to the subject. They destroy our cattle to the extent of 1½ or 2 per cent. over the United Kingdom, our sheep up to 5, 10, and 15 per cent., and swine to a similar extent, especially in Ireland. They are very rarely, if ever, contagious; they impoverish many districts best suited for the breeding and rearing of stock, and especially of sheep; they seriously interfere with agricultural progress and prosperity; they are all preventable, and would richly repay careful investigation and the adoption of measures for their eradication.

Our domestic animals are born healthy, with sound constitutions, and the term of their lives is short. Taking an average amongst cattle, sheep, and swine, the age they attain does not exceed four years. A knowledge of the management of such stock under the many circumstances that induce the local diseases which destroy it, would preserve it in vigorous health until ready for slaughter. They enjoy fresh air, are well fed, sheltered, and carefully watched. Every farmer knows that it is his interest to protect his stock, and, as a rule, the many causes which induce human diseases in early life are not in operation as affecting the lower animals. There are few congenital defects; very few instances of morbid hereditary predispositions. There is no syphilis. Born healthy and sound, very few should die a natural death. Accidents must occasionally happen, but there are favoured situations, free from enzootic disorders, where the losses amount to an extremely small per-centage, as a rule perhaps not attaining ¼ or ½ per cent.

As matters have stood hitherto, no inducement has been offered for the study and prevention of these diseases. If we refer, for example, to the enzootic diseases of sheep, we find that veterinary surgeons have very rarely been consulted regarding them. Shepherds have been trusted to. The excessive mortality of one year has been set against the low rate of loss of another, and landowners or their agents have had to calculate that, in consequence of a particular disorder prevailing on farms, the rental must be reduced so as to enable the farmer to meet his losses. Thousands of acres of land in different parts of the United Kingdom would be worth much more than they are if enzootic disorders were prevented. I believe that attention to this subject would for many years to come add more to the resources of the United Kingdom than the reclamation of land does. By all means extend the available amount of country for the production of food, but let us not forget to secure the full benefit of what can be derived from the land on which our stock has been fed for ages, which is deteriorated largely in value by noxious properties that only require to be known in order to be counteracted. These points will be best understood by reference to the classifications of enzootic disorders which I here append.

Firstly, Enzootic disorders vary according to the geological characters of districts and counties. Altitude exerts a manifest influence on these diseases. The character of indigenous vegetation on mountains, hills, and lowlands materially influences the production of diseases in animals.

Secondly, Enzootic disorders are due to excessive richness and to excessive poverty of land. They are also due to excessive moisture, or, on high and dry lands, to exposure. They vary with different systems of culture: they are engendered by forcing land to produce the largest and best crops, or by impoverishing the soil in attempting to rear more than it will bear.

Thirdly, Enzootic disorders are induced by the manner in which lands are overstocked, or animals of different species are brought together, and made to live in common.

There are, therefore, enzootic disorders due to *natural*, and others due to *artificial*, causes. Human intelligence has suggested how to correct *natural defects of land* for the purpose of rearing crops, and it can suggest means to correct them with a view to protect stock from disease. The *artificial causes* are, however, counteracted more readily, and with much greater certainty.

Anthrax, or Carbuncular Fever: Milzbrand (German); Miltvuur (Dutch); Maladies Charbonneuses (French); Typhus—Blutseuche—Pustula Maligna.

There are many forms of anthrax fever. They all originate spontaneously in herbivorous and omnivorous quadrupeds; they are communicated by contact or inoculation to all warm-blooded animals when they occur under circumstances favourable to the development of the anthrax poison; they have raged as plagues in past centuries, and are apt to assume the epizootic character in hotter countries than our own; they rarely, if ever, spread by contagion in the United Kingdom, whereas continental observers attribute general outbreaks of these diseases chiefly to contagion.

Anthrax is a blood disease; a fever in which there is a very sudden change in the physical characters and physiological properties of the blood, and in which passive hæmorrhages, ecchymoses, phlegmons, boils and carbuncles, and gangrenous complications, occur with fatal effect. It originates spontaneously in young animals more readily than in old, in the thriving and vigorous more readily than in weak animals; in those that are suddenly changed from spare to liberal keep, and on rich lands that are usually damp and ill drained.

Anthrax has been regarded as due to malaria. Lessona, Verheyen, Bojanus, Schütz, Hartmann, &c., have regarded it as essentially dependent on the emanations from swampy soil, and Heusinger says, that to this cause its existence has been attributed in Siberia, Orenburg, in the lands around the Wolga, in Finland, Liefland, Ehstland, Poland, Posen, Saxony, Bavaria, Friesland, Sologne, Brene, Brenne Beauce, Provence Apulia, the West Indies, &c. Although there is much anthrax where ague prevails to a great extent, still it occurs in countries where ague is unknown.

There is no doubt that the development of anthrax in different parts of a country like our own, depends on the geological peculiarities of districts. Heusinger has said that it occurs on the granitic and chalk Alps, on the granite of Lapland and Finland, on the transition chalk of St. Petersburg, and on all the tertiary strata.

In Great Britain and Ireland anthrax is the most fatal of all enzootic disorders, spreading widely over the richest pastures of fertile valleys, on the old and new red sandstone formations, on the soil over the lias of Somerset and Gloucester, on the crag forms of Norfolk and Suffolk, on the compact soil of the Oxford clay in Oxfordshire, Wilts, and the county of Lincoln. In the counties of Edinburgh and Haddington we find it particularly prevalent, stretching from Dalkeith to the Lammermoor Hills, indeed, in the south of Scotland along the whole tract of Cambrian and Silurian rocks. The hills of Scotland and the pastures of great fertility intervening between them teem with cattle and sheep, amongst which there is a heavy mortality from the different forms of anthrax. The black-quarter of cattle, which is one of the most characteristic forms of this disease, prevails to a great extent on the old red sandstone of the counties of Ayr, Stirling, Perth, Forfar, Aberdeen, and Kincardineshire. It is seen often in the same formation in the eastern portions of Banff, Inverness, and Caithness. It is common also in Kincardine and Aberdeen, prevailing perhaps as much on the lower silurian of the latter county as on the same formation in Peebleshire and Berwickshire, and on the igneous rocks of Renfrew and Kinross. Though I have here mentioned most of the formations in which the various forms of anthrax prevail, I must not omit to speak of its ready development on the clays of Mid-Lothian, Linlithgow, Lanark, and Renfrew. The soils on the coal measures, where not well drained, are favourable to the development of anthrax in cattle, and although it may seem puzzling to state where carbuncular diseases do not occur, still they will be found rare on the thin soil of the upper chalk, on the sand soils over the green sand, on the millstone grit and magnesian limestone, where the latter formations occur, in Durham, Yorkshire, Derbyshire, Staffordshire, Devon, and elsewhere. In Ireland anthrax prevails in all parts.

My own experience concerning the causes of anthrax in all its forms in the United Kingdom would lead me to the following conclusions:—

First, That the circumstances favourable to the development of the disease are to be found where the lands are best, and where the pastures are most luxuriant and nourishing. During hot seasons it prevails principally on ill-drained lands, and in wet seasons on dry, rich, and stiff soils.

Second, That as a dangerous plethora occurs more readily in animals that are in poor condition, and then put upon rich keep, such a practice favours the development of anthrax.

Third, Animals are destroyed by anthracoid diseases, when fed on very rich food, the produce of a richly manured soil, and especially when they are kept within narrow limits, so as not to get sufficient exercise, as in folding sheep on turnips, and allowing turnips, straw, and other food *ad libitum* to stall-fed cattle.

Fourth, When animals are on rich pastures, and have access to a very abundant supply of rich artificial food, they are apt to die more readily; and this is especially the case with sheep, at the periods of full moon, when they eat night and day, and die off in great numbers.

Fifth, The majority of the animals are seized at night-time, and die in the morning. This is more particularly the case when the nights are cold, when winds, sleet, and snow tend to check the cutaneous exhalation and favour internal congestions.

Sixth, Hill stock is destroyed to a great extent for want of proper shelter, and the sudden variations in the weather are ill borne by animals forced on the system of feeding in this country.

I have not found that *bad food, deficient ventilation, over-crowding, noxious plants,* and similar causes, operate in the production of anthrax in the United Kingdom. The most virulent forms occur in the summer months and in the hottest seasons. The anthrax poison is then developed even as far north as Aberdeen. The tendency to the development of this poison has been on the increase, as proved by the death of pigs and dogs that have eaten portions of animals that have died of anthrax. Human beings have also suffered, and fatal results have been witnessed. This I state on the authority of Dr Keith, of Aberdeen.

Interesting observations as to the circumstances under which carbuncular fevers occur have been made of late years in Belgium, where the Government attends to the collection of statistics referring to diseases of the lower animals. In the *Bulletin du Conseil Supérieur d'Agriculture* for 1858, under the head of 'Charbon,' it is said, that of all the provinces Liége has suffered most. Many, indeed, had no such disease amongst their stock, but from time immemorial anthrax had been enzootic in the province of Liége, and especially at la Hesbaye, le Condroz, and le Pays de Herve. In hot seasons the destruction is greatest, and this is supposed to be due to malarious emanations. The disease prevails where there is much clay, and the sub-soil very stiff and retentive. Professor Verheyen, the reporter, spoke to me of this when I was in Belgium, and said, "Dans les parties de la Belgique on il y a le Charbon les paysans ont un roubinet dans la cave." He meant by this that water was obtained in large quantities by merely tapping the soil at no great depth.

Certain it is that in the United Kingdom drainage has led to the diminution of anthrax, and from some districts it has been extirpated in this way.

It is, however, singular, that wet seasons are not favourable to the development of the disease. Such seasons are not attended with sufficient heat, and, in countries where carbuncular affections are very malignant, as in Prussia, they commit less ravages in wet years. But Hildebrandt has shown that the districts most free in hot seasons suffer more than usual when the fall of rain is great, and *vice versa.*

With reference to the year commencing 1st April, 1853, and ending in March, 1854, Gerlach says that carbuncular affections had been rarer than usual. Indeed, similar reports were published from 1851 to 1857, and this was attributed to low temperature and abundant rains. In the year 1855–56, the disease prevailed to a far greater extent in certain districts. In the summer of 1857 they were very severe.

From 1851 to 1857 the most severe outbreak occurred in 1852–53, when 107 circles suffered from carbuncular affections, but in the summer of 1857 the number rose to 125 circles, and the number of cases in each circle was also far greater in the latter year.

The provinces that suffer most in Prussia are Saxony and Silesia, and especially the Regierungs Bezirken Merseburg, Magdeburg, Breslau, Oppeln, and Posen. It is rare in the Rhine provinces, in Brandenburg, and Westphalia, and it occurs still more rarely, or scarcely ever, in the Regierungs Bezirken Danzig, Marienwerder, Stralsund, and Cöslin.

Indubitable evidence has been afforded by many continental observers that carbuncular affections spread by contagion.

I shall notice two cases. Veterinary surgeon Krüger reported an outbreak in the circle of Naugardt, in 1854. It occurred amongst a flock of sheep. The bodies of the dead animals were skinned and left in the stable. The horses employed to drag the straw into and out of the stable used for the sheep, having to remain for some time in the stable, at the loading or unloading, became affected with anthrax, and died.

The second case is a very singular one. It is reported by Dr Rabe of Neumark, Königsberg. A dealer in pigs had to leave three sick ones behind out of a drove; they died, and their carcases were in part buried, and in part eaten by dogs. One dog, having eaten some of the flesh, bit two cows and a healthy pig. Both cows fell lame in the hind limb which the dog had bitten; a very decided carbuncle formed at the seat of the bites, and both animals died the same day. The pig was also seized with anthrax and died. A second dog bit a bull and a pig, and both these animals took anthrax and died. The dogs, however, remained in perfect health. These were the only cases of anthrax which occurred in the district.

Since I first described the outbreaks of splenic apoplexy in this country, I have had occasion to draw the attention of veterinarians and stock-owners to changes occurring in the nature of prevailing disorders, and to the great danger attending the slaughter of animals dying of blood diseases to be disposed of as human food. Every year we now learn of cases of malignant pustule in man; and of pigs, dogs, and other animals dying when fed on the bodies of certain diseased cattle or sheep. This summer, an East-Lothian farmer had a diseased bullock dressed by a butcher, and the carcass was sent in a hamper to some large town. Not long after the despatch of the carcass, it was found that the pigs which were eating of the entrails were dying, and few, if any, were saved.

During the international Congress of Veterinary Surgeons held in Hamburgh, it was remarked that among the maladies which called for legislation with a view to their prevention was the anthrax fever, which in the United Kingdom is only rarely a contagious affection, but which threatens to become more prevalent in the course of time. On my return from Hamburgh, I learned that a telegram had been received from Lincolnshire, at the New Veterinary College, on the 18th of July, requesting the immediate attendance of one of its Professors. Professor Law, who, in my absence, proceeded to Lincolnshire, returned to Edinburgh after having carefully ascertained the origin and nature of the raging malady, and I was requested to attend as soon as possible, and found, as Mr Law had reported, that animals of various kinds were dying from anthrax.

On the banks of the forty-foot drain (which drains the fens of Eckington and Swineshead, and empties itself into the sea) about seven miles from Boston, are some low undrained fields, on which horses, cattle, sheep, and pigs are fed. The district is a healthy one, but about three years ago several animals died of what at that time was supposed to be diphtheria. Some of the oldest inhabitants remember that in the year 1826, during the summer of which there was intense heat and long-continued drought, the pike died in large numbers in the forty-foot, and animals were carried off to such an extent, that out of one flock of fifty-three, only two were saved. This season has been a dry one; the land is cracking up for want of moisture; the canal has little water in it; its water is saltish and fetid; it contains a great abundance of putrefying vegetable matters; and the pike are dying in large numbers. I found half-a-dozen large dead fish on the canal side in walking a very short distance, and could see many more on the opposite bank. Boatmen and other persons have noticed the pike rising to the surface, swimming rapidly round, and then turning on their backs quite dead.

About the 10th June, one sheep, out of a flock of 130, was taken ill, and died. Others soon appeared ill, until ninety were seized, and thirty of these succumbed. The remainder were disposed of healthy and fat, whilst the malady was progressing.

Amongst the sheep were six head of cattle, and they all took ill; one died speedily, and the others are now convalescent, but one has been kept alive with difficulty. Another lot of twenty cattle in another field that had been amongst the sheep were soon seized. They have all had the disease, and only nine survive. Perhaps one or two more will die. Fourteen pigs were driven backwards and forwards amongst the cattle and sheep. They soon manifested the symptoms of malignant quinsy, and several have died. Two other lots of pigs in the district have been seized, and the mortality has been heavy.

The list of casualties is not ended, for the district has been unfortunately the seat of great mortality amongst human beings. Fevers have been rife, and diphtheria deadly. One man, a shepherd, was dressing a sheep's foot, and scratched his arm. The result has been a severe malignant pustule or phlegmon, which has very nearly terminated fatally.

Amongst the observations indicating that heat is essential to the full development of the anthrax poison, are some communicated by Luseau to the Société Vétérinaire de Lot et Garonne in 1852. Luseau had seen dogs eating with impunity the flesh of oxen that had died of the disease in spring and autumn, whereas others died after eating such flesh in the hot months of summer.

My inquiries in Holland indicated that anthrax is confined to Friesland and North Holland. It is there prevalent in very damp districts, and it is very fatal in hot seasons. In "Notes on Cuba, by a Physician," Heusinger tells us that it is reported that cattle die in large numbers of gangrene, or the malignant pustule of the French, and the blacks are often infected and die. This is especially observed in *hot seasons*, and from the months of June to November.

I have seen various forms of anthrax in the marshy plains of the Papal States during the summer months, especially in July, August, and September. The activity of the developed poison was very great, and one instance more particularly struck me. One of the fine white bullocks of the Roman States was conveyed in a cart to the slaughter house at Ferrara, in the month of August 1854. Professor Maffei condemned the animal as being affected with carbuncular fever. The animal was buried, but a jobber determined to sell the flesh, and during the night disinterred the carcass. He removed the meat in bags to a hiding-place, and in doing so carried the bags over his shoulders. He had thrown off his jacket and set to work in his shirt. Next morning a diffuse erysipelatous inflammation set up over the back, notwithstanding that no abrasion of the skin could be detected, and the juice of the flesh had had to permeate through the bags and shirt. In three days the man was a corpse. Fortunately it is rare to witness such effects from the anthrax poison so far north as the British Isles.

Malignant pustule is not uncommon in Tuscany. It is extremely prevalent in some parts of Piedmont, Lombardy, and Venice, especially during the hottest seasons. No such disease is seen in winter.

In some parts of the Neapolitan dominions anthrax prevails to such an extent that shepherds migrate with their flocks into the Abruzzi and Appenines. This is, indeed, a practice throughout Italy. Flocks of sheep and goats pass the winter in low marshy districts, where pasture is to be had all the year round, but, fearing the diseases of hot weather, and having wholesome food on the hills, they leave the plains for the latter early in spring. In the Neapolitan provinces of the Capetanata, Bari, Otranto, and Basilicata, many thousand sheep are wintered, but if they are kept there beyond the 1st of May, not only are their lives sacrificed, but those of many human beings. Cattle suffer likewise.

The islands of the Mediterranean furnish us with many interesting facts. Our own dependency, Malta, with its calcareous rocks, and scanty but fertile and well-cultivated soil, is not free from anthrax; but Sicily, Corsica, and Sardinia suffer much more. Professor Lessona of Turin has repeatedly spoken to me of the frequency of malignant pustule in the latter island. In Corsica it is not seen in the heights of Monte Piano, Padro, d'Oro, and Rotondo, but in the fertile valleys between them.

Without extending further these notes on the peculiarities of districts in different parts of Europe where the many forms of anthrax prevail, I may conclude by stating—*a*, That the British Isles are peculiar for retentive soils favourable for the development of anthrax. *b*, Prior to the introduction of improvements in agriculture, and especially prior to the appreciation of the value of drainage as a means to increase the productiveness of the soil, certain fatal forms of anthrax were more common than they are at present. *c*, It is not frequent that the anthrax poison is developed in this country, and, as a rule, its development is limited to hot seasons and the summer months. *d*, This anthrax poison induces malignant pustule in man, but not with the same frequency in the United Kingdom as in warmer climates. It would appear, however, from the increased prevalence of splenic apoplexy, that there is an increase instead of a diminution in the danger of human beings suffering from malignant pustule or allied disorders.

The diseases which I shall now more particularly refer to under this head, are all regarded as forms of anthrax in different parts of the Continent, or as usually associated with the development of a poisonous principle that cannot be distinguished from the anthracoid virus. The best writers on carbuncular diseases have classified the different forms under three heads:—

I. *Carbuncular Fever without local complications.*—This includes the anthrax fever of Solipedes, and the 'blood striking,' 'Blutstaupe,' of cattle and sheep. The latter disease is not regarded by Delafond as a form of anthrax, but it is by all other continental authors. It is also called 'sang de rate,' or splenic apoplexy. Braxy in sheep.

II. *Carbuncular Fevers, with erysipelatous complications.* —The black-leg or quarter-ill of Britain, known to the Germans under the names of Milzbrand, emphysem des Rindviehes, fliegendes feuer, &c., &c.; black spald in sheep; carbuncular erysipelas, and carbuncular angina of the pig, are the principal erysipelatous forms.

III. *Forms of Anthrax with the development of boils and carbuncles.*—This includes the malignant carbuncles occurring in all parts of the body of animals and human beings. The pestis anticardia of Sauvages, so destructive amongst horses; glossanthrax in cattle and sheep; stomatanthrax hordeolum of the pig; and another singular form in the same animal, termed Kopfanthrax and Kropfbrandbeule by the Germans, soie or piqué by the French, and setola by the Italians.

I shall limit my remarks to—

Splenic apoplexy in cattle and sheep.
Braxy in sheep.
Black-leg or quarter-ill in cattle and sheep.
Glossanthrax in cattle and sheep.
Anthrax in the pig—apoplexy or hog cholera.

Having made some observations on these diseases, I shall add some remarks on other diseases incidental to plethora, and especially on—

Parturient fever in cows.
Heaving pains in ewes.
Navel-ill; and
Hepatic disease in lambs.

Splenic Apoplexy.—Blood Striking.

Congestion and extravasation of the spleen occurring suddenly in plethoric animals, is a disease dependent on blood changes, which occur principally amongst ruminants. From the tendency to engorgement of the spleen in anthrax, it was formerly believed, especially in Germany, that anthrax fever was a gangrene of the spleen, hence the term 'Milzbrand,' as applied to this disease. The French have recognised that the malady primarily affects the blood, and have termed it 'sang de rate' or 'maladie de sang.' Until within the last five years, British veterinarians ignored the existence of this disease. I had lectured upon it as far back as 1855, having had occasion to witness a severe outbreak of it amongst the cows kept by the Grand Duke of Tuscany, at the Cascine, about a mile beyond the Florence gates. I had also read many articles on the subject abroad, and it was only in 1858 that I first saw it in the north of England. My own students then reported outbreaks in various parts, especially in Aberdeenshire, and we now know that the disease occurs not unfrequently in various parts of the United Kingdom. It is certainly becoming more prevalent, as there are districts where it has recurred several times of late years, and where the malady was in former times quite unknown. In this country cattle have suffered oftener than sheep, whereas in fertile districts on the Continent, and especially in France, it commits serious ravages amongst sheep and especially amongst lambs. As an illustration of the appearance of the disorder in districts where formerly it must certainly have been rare if it ever existed, I may allude to its prevalence in the valley of the Yeo, near Ilchester, in Somersetshire since 1855; its occurrence in Northamptonshire and Lincolnshire only within the last three or four years, and its outbreaks of late in county Meath in Ireland. It is also singular that splenic apoplexy first made its appearance in New South Wales in the year 1847. It occurred on the estate of a Mrs Cordeaux, at Leppington. The viscera of some of the animals that died were sent to Dr Eckford of Liverpool, for examination, and being eaten by a number of pigs belonging to the keeper of the hospital, caused their immediate death. In March 1849 the malady reappeared at Leppington, and two men, father and son, died from skinning a heifer. It again broke out on the same estate towards the end of 1849, and in February

1850 it spread into the township of Liverpool, and along the cow pasture road to the southward as far as Camden. A man died of the disease on the 9th of February, having contracted it in skinning a bullock. Some sheep were afterwards seized, and a shepherd who skinned them also died.

Causes.—Splenic apoplexy occurs amongst animals in high condition. It is fatal amongst cattle or sheep transferred from poor to rich pastures, and then always attacks first the animals that are in best condition. It has been met with on dry high-lying farms, where, however, the green crops are forced by the richest manures distributed in large quantities. It is perhaps most deadly on ill-drained lands during hot seasons, and under these circumstances the anthrax poison is developed in the bodies of cattle and sheep. Horses drinking out of a pool of water, in which blood of cattle slaughtered when suffering from this disease has flown, have died. Pigs, dogs, and ferrets, licking the blood or eating the flesh and the entrails of such animals, have suffered severely, and have usually died. In the United Kingdom, and even in France, there is a certain irregularity in the development of the anthrax poison in splenic apoplexy, and this has led to some persons doubting whether the disease was really anthrax. It certainly appears that the waters animals have access to when they become affected with this disease, may be *apparently* pure, but are usually highly charged with organic products, the results of decomposition. Professor Vœlcker analyzed the water which cattle drank in Somersetshire, where splenic apoplexy prevailed, and found that it contained no less than 235 grains of solid matter in the imperial gallon, composed of various medicinal salts which necessarily affected the animals' whole constitution. The water was clear-looking. I have noticed that waters drunk by cattle under similar circumstances have been highly charged with mineral and organic products, and pike in canals and rivers containing such water died. It is reported that Dr Davaine has found a species of bacterium in the blood of sheep affected with splenic apoplexy. Bacteria are filiform, microscopical animalcules, said to abound in animal fluids in a state of decomposition; but Dr Davaine found that the protozoa which he detected in the blood of splenic apoplexy disappeared when that blood began to putrefy. There is evidently a new field for research, and it is most important we should know that splenic apoplexy is to a great extent a new disease in the British Isles, and that it is becoming more prevalent each succeeding year.

Symptoms.—It not unfrequently happens that the first appearance of splenic apoplexy amongst cattle is ascertained by one or more animals being found dead. Calves, cows, and bullocks may be seen in apparent health in the morning, and dead by mid-day. Sometimes the animals appear excited, the eyes are prominent, and the visible mucous membranes injected. Symptoms of uneasiness suddenly manifest themselves, and colicky pains indicate abdominal disorder. The urine voided is high coloured, and even tinged with blood, as are also the fæces. The back is arched, and the animal fixes itself, hanging on to anything by which it may be tied in a stall, or it presses back against a tree, or into a corner of the yard or shed in which it is enclosed. The pulse is quick and hard, then feeble, frequent, and small; the breathing is accelerated, short, and often stertorous. The animal soon drops, and is seized with convulsive twitching. A red, frothy liquid then escapes from the nostrils, and the animal bellows, moans, and dies. The disease lasts from 4 to 24 hours. Causing the animal to move about briskly, or bleeding, seems to prolong life.

With regard to the symptoms of splenic apoplexy amongst sheep, Delafond says, that though inexperienced persons rarely detect any premonitory signs, still such occur, and chiefly consist in an appearance of liveliness and activity, coupled with a florid hue of the mucous membranes. If blood is drawn from the animal at this period, it is found dark, and it coagulates very rapidly. As the flock moves about, the best, youngest, and fattest sheep are seen to stop, to stretch their neck, dilate their nostrils, open their mouth, and to breathe with some difficulty. This passes off, and the animal begins to eat, but has a tendency to tympanitis. If the sheep is then made to urinate by closing its mouth and nostrils, a red bloody urine is seen to flow, and on looking about, the fleeces are observed tinged from the urine of the affected animals. The fæces become rather soft, and are covered with a glairy whitish mucus often mixed with blood. All these premonitory symptoms Delafond has described as observable in a flock from amongst which some animals die every two or three days. They assuredly indicate that the disease is in the flock, and some casual circumstance, such as a full meal, a storm, &c, leads to many deaths. The acute symptoms are rapid, and with laboured breathing, bloody froth discharged from the nose, hesitating gait, impaired vision, and convulsive twitching of the limbs, the dying animal falls over. Urine tinged with blood, and even bloody excrements, are then expelled, and in a few minutes, or at longest in from one to three hours, the sheep dies.

Post-mortem Appearances.—Cattle, sheep, or other animals dying of this disease speedily decompose. The abdomen swells up, and there is prompt but transient cadaveric rigidity. On removing the skin, it is found congested, and the subcutaneous areolar tissue is the seat of bloody infiltrations, especially about the neck, in sheep. On opening the abdomen a certain quantity of bloody serum flows, and the first organ which strikes the examiner as having undergone material change is the spleen. The spleen of the ox, varying in size from 2 to 3 lbs., is of a deep red colour, and swollen up to three or four times its natural size. In the sheep the spleen weighs in health from one to two ounces, whereas in splenic apoplexy it weighs from 8 to 16, and even 20 ounces. Sometimes it is ruptured, but in animals that are bled early the spleen is not so much distended. The rumen and other stomachs are usually found healthy, but there is generally redness of the true stomach, and extravasations of blood in some part of the intestinal tube. The kidneys are also found of a dark colour, and on cutting through them are seen to be ecchymosed. The bladder is commonly found distended, and its membrane tinged with blood. The thoracic organs are healthy, with the exception of blood spots on the lungs and heart. Not unfrequently there is a considerable quantity of bloody serum in the pericardium. The nervous centres are healthy. Sometimes there are bloody extravasations in the cranium and spinal canal. More frequently there is simple excess of the fluids in the ventricles of the brain and in the arachnoid.

Treatment.—Many cases prove fatal, whatever treatment may be adopted. Success has attended the practice of those who have aimed at moving the affected animals rapidly about, dashing cold water on their bodies, and following this up by a full dose of purgative medicine with carbonate of ammonia. In the earliest stage of splenic apoplexy bleeding may be of service. Preventive measures should be resorted to, and those consist of low diet, active exercise, purgatives, and neutral salts in water.

Animals that die of splenic apoplexy should never be sold as human food. Sometimes their flesh might not injure, but very often it certainly would.

Braxy in Sheep.

I believe I am not exaggerating when I say that one hundred and fifty thousand sheep die annually of braxy in Scotland alone. The mortality on the best sheep-walks is frightful, and over wide districts every flock of sheep is annually decimated by the disease.

The term *braxy* is derived from *broc* or *brac,* and signifies sickness or disease. From the circumstance that sheep on the hills die off in great numbers from this malady, it has been called "hill braxy." It is an affection as widely distributed over the world as flocks of hill-fed sheep. It is very destructive on certain high moorlands, but rages annually to a great extent in the three kingdoms amongst sheep that in the beginning of winter are fed on turnips, and forced on other highly nutritious food.

As the names *braxy* or *sickness* are as ill-defined as the terms *influenza,* distemper, or any other of the category, one must not be astonished if it is applied to a number of diseases of a totally opposite character. The shepherd speaks of dry braxy, which he regards as inflammation of the bowels; dumb braxy, or dysentery, and watery braxy, which is supposed to consist in over-distension of the urinary bladder, and consequent inflammation.

So far as our observations extend, from careful inquiry in different parts of Scotland, we find that the different forms of braxy may be classed under two heads—the braxy proper, or, if we might be allowed the expression, the "blood braxy;" and the false forms of braxy, or other diseases erroneously regarded, by persons who are not acquainted with the true braxy of Scotland, as braxy. The most common disease thus termed, is chronic diarrhœa or dysentery.

If we define true braxy as a blood disorder, we are not prepared to accept the views of Sir George Stewart Mackenzie, who says:—"The disease in all its varieties is inflammatory, and from the great tendency of the inflammation to run into mortification, it may be termed a *putrid disorder.*" Braxy is *not* an inflammatory disease, and it is *not* a putrid fever. James Hogg, the Ettrick shepherd, whose work indicates the most acute powers of observation, and is singularly suggestive, though speaking of *four* different kinds of braxy, refers to the similarity between them; and his *bowel sickness, sickness in the flesh and blood,* or *black spauld,* and *dry braxy,* are varieties of one and the same disease. Under the head 'dry braxy,' he has included colic and its consequences, which cannot be regarded as a form of the very general disease under consideration. Hogg alludes too much to inflammation, but far more truth than has usually been believed to exist in his writings may be found under the head of causes, and of the different forms of the disease; he says, "It is probable that the one originates in a stoppage of the blood-vessels, and the other in a stoppage of some parts of the bowels."

Gasparin refers to the malady as a "gastro-enteritis sans eruption," and throughout the whole chapter in his book on this subject he indicates that the prevalent opinion in France is to the effect that the disease, as the Scotch shepherds describe it, is 'bowel sickness,' or inflammation of the intestine. This depends on the confusion created by the presence of extensive ecchymoses, which are regarded as inflammatory lesions, and we often find reference made to the inflamed condition of the heart, whereas this organ is simply studded inside and out with subserous extravasations of blood.

It is undoubtedly a fact that braxy in the Scotch Highlands is not a contagious disease, and for ages have the sheep dying from this disease been dressed as braxy mutton. I am not aware of any experiments having been performed as to the inoculation of the disease, but as causes favouring the development of the malady are prevalent in the winter months, this may be a sufficient reason for the absence of any virus, and the safety with which the animals may be eaten by human beings. Braxy mutton is not sold, but 'braxy hams' can be seen hanging up, and many being smoked in the farm-houses of sheep-rearing districts.

Change from poor to rich living endangers the life of the sheep; but it is also a steady advance in condition, and especially when animals are confined for space, such as when they are folded on turnips or enclosed on a rich pasture, and being allowed rich artificial nutriment, in order to be early fit for slaughter, that favours the development of braxy.

The sheep fed on turnips in Fife, East-Lothian, and other counties, always suffer at the time when they are first receiving forced food, and when they are nearly ready for the butcher. In the first instance, the sheep is submitted to a very sudden change, and, in the second, to a system which is beyond the powers of its organism.

There is no doubt that the fundamental cause of braxy is the rich, dry, and blood-forming food; but there are many accidental causes which prove exciting, or determine the attack. The most strange and interesting is the influence of the full moon. Many of the old writers allude to this as affecting animals to no small extent; but we do not pretend that any extraordinary influence difficult of explanation should be attributed to the moon. Its operation is simple. The shepherd well knows that, with a full moon, he always has a lot of trouble with his sheep. They rove about and stray, and they do not, as on dark nights, lie down, rest, ruminate, and digest the food they have collected during the day. The reverse happens; for, with greed peculiar to it, the sheep gorges itself to repletion, and when morning arrives, is found struck down by the most fatal braxy. We have very carefully considered this cause, and have compared shepherds' books, especially on low lands, where full feeding on turnips, &c., is the cause of the disease, and we have found most deaths at the period of the full moon.

A circumstance which would appear precisely the opposite to the foregoing is, however, a very common exciting cause of braxy. Dark, cold, tempestuous nights are attended often with a fearful mortality amongst the finest sheep. Sir George Stewart Mackenzie, who wrote in 1809, says:—"Costiveness from eating hard, dry food, drinking cold water when the body is overheated, or its being plunged into water while in that state, or suddenly drenched by rain, or chilled by a shower of snow, may all contribute to bring on this dangerous malady." Hogg also says: "Any shepherd will tell you that it is always on sudden changes from fresh weather to a frost that its ravages are most felt; and so much are they aware of this, that I have frequently seen them on such mornings put on an old hat and old clothes in order to carry them home, not doubting in the least but that some of them had fallen a prey to it." Hogg believed this cold to act upon the stomach: the true explanation of the influence of cold, of frost, and even of dark showery nights, in producing the disease, is, that the action of the skin is checked; indeed, all the organs of secretion become torpid, the blood cannot be purified or relieved, the blood-vessels are filled to repletion, and the sudden effect of the cold also enervates and paralyses the animal. The influence of cold cannot be understood, unless we consider its effects on the secretions, and the effect of an arrest of secretion on a rich and abundant blood.

Thus, braxy is caused by circumstances which make the animal thrive, or circumstances which operate suddenly and actively on the blood and organs of secretion.

We cannot conclude the consideration of the causes of braxy without alluding to a very remarkable fact. We have said that on moonlight nights sheep rove about and feed more than their systems can bear; but if a sheep is observed with the first symptom of braxy, and is made to trot about, the attack may be warded off. The exertion accelerates the circulation, causes a free action of the skin, and even of the bowels and kidneys, and overcomes the excessively plastic and dangerous state of the blood. In splenic apoplexy in cattle, a disease closely allied to braxy, and due to rich food, it is also observed that exertion, a two or three miles' walk, or a country journey by railway, will preserve the animals from death for many hours.

Symptoms.—These are rarely observed except in the last stage of the disorder, and from the rapid manner in which it runs its course, opportunities are not given to study the symptoms, as in other disorders, so as to guide the application of remedies in accordance with its progress or results.

Whenever a sheep is observed from the first, especial notice should be taken of the animal's peculiar look. It moves about, picks up a blade or two of grass, and staggers. The animal trips forwards, or stumbles backwards, and with this hesitating gait we observe the bloodshot eye, hot and red mouth, a full, strong, and frequent pulse, a panting, laboured breathing, and a burning heat all over the body. If any fæces are voided, they are observed hard, dry, and in small quantities. The urine is scanty, and of a dark colour. The animal often experiences difficulty in voiding both excrement and urine. The eye becomes languid and watery, the wool clapped, and the animal drops with a throbbing heart, a haggard look, and stertorous breathing; sometimes the sheep falls into a ditch and is drowned, or it rolls over on its back, and, with extended head, gasping for air, it soon dies. We cannot enter into the many peculiarities of different cases. In some there is decided pain, in others total unconsciousness and insensibility, from the commencement of the attack, and in a few we observe a lingering hot fever, which makes them stand sequestered from the rest of the flock, and dying more slowly, with symptoms similar to those of any ordinary febrile attack.

A very marked feature of the disease is the way putrefaction sets in, even before death. The animal swells, and the swelling is peculiar to different forms of braxy. Thus, in the common variety there is gas formed in the tissue beneath the skin, and this is elevated along the back and sides, so that a crackling sensation is observed in pressing the back and loins. In the forms of braxy, associated with derangement of the stomach and intestines, abdominal swelling is observed, particularly on the left side, produced by the distended paunch. In either case, immediately after death, the whole of the skin is puffed out by fetid gas, which is the result of decomposition in the structures beneath.

Post-mortem Appearances.—The lesions in the body, resulting from this disease, have been mistaken by the common observers, viz., shepherds and sheep-owners. Any redness has been ascribed to inflammation, but very erroneously. There is bloody frothy mucus about the nose. On separating the skin, we find the fœtor intolerable, the blood-vessels filled with black blood, and often a yellowish-red stained appearance of the superficial structures. On cutting into the belly, a little straw-coloured or reddish fluid often escapes, the intestines and paunch being enormously inflated by gas. The whole surface of the organs is red and congested. The third stomach is usually filled with solid food. Here and there a darker hue is observed, and, on opening the digestive tube, extravasations of blood, quite circumscribed and beneath the mucous membrane, are seen. The lungs are found turgid with blood, and the heart—often spoken of as inflamed—is marked both on its external and internal surfaces with blood spots of a dark purplish hue, and is filled with dark and partly coagulated blood.

It is not easy to determine the nature of the peculiar process by which animals in the most robust health, with great activity of all the organs of the body, should be seized suddenly with a change in the condition of the blood, or an arrest of certain functions, whereby they suffer *instantaneous* death. There is no doubt at all that the process is a very simple one, and is not inflammatory, though the condition of the animal is certainly favourable to inflammatory disease.

From the first symptoms of ill health, to the period of dissolution, there is not sufficient time for the development of inflammation. We find the blood clotted in the blood-vessels, but no exudations of lymph or other lesion indicating an inflamed state of any organ. As in splenic apoplexy and black quarter, there are extravasations of blood, but these seem to depend on sudden congestions, attended by rupture of the vessels, and consequent sanguineous effusion. In exceptional instances, when animals live on for several days, there may be inflammatory complications; but, as a rule, a sheep is dead within a couple of hours from the time it has been in the enjoyment of perfect health. Pathologists may regard the disease as apoplexy, but from the complete absence even of blood effusions in the most sudden cases, I am inclined to believe that there is a general stasis, a clotting of blood within the smaller vessels of tissues, the vitality, and hence the functions, of which are suddenly impaired. In the mountains of central and southern Europe, the disorder is regarded as a carbuncular fever. There is no doubt that it is attended with the development of an anthrax poison in the summer months, where the usual temperature is far higher than in Scotland. Nevertheless, even abroad, shepherds have faith in 'braxy mutton.' Gasparin* says, "Les chairs du mouton mort du charbon interne ne sont mullement dangereuses guand l'animal a été saigné au moment de sa mort, et qu'elles sont cuites: on en fait journellement usage dans nos fermes. En Languedoc, les bergers se font apprêter quelquefois le charbon des bêtes a laine et disent que c'est un morceau délicat." Gasparin, however, says in a foot note:—"Au moment où je termine ceci, j'apprends qu'une femme ayant saigné un mouton mort du bescle, et ayant laissé tomber deux seules gouttes de sang sur sa main, il est survenue deux pustules malignes aux endroits où elles étaient tombées. Le mouton qui a été mangé, n'a causé aucun accident."

Treatment of the Disease.—The rapid manner in which animals are attacked precludes in many instances the adoption of remedies; but, in the event of a case being seen in the early stage, the sheep should be moved briskly along, and bleeding should be resorted to as promptly as possible. It is often found that blood flows tardily, and like a thick tarry liquid, so that the common method of cutting the ears and tail to draw blood is a very unsatisfactory one. It will always be found that sheep will not lose much blood without inconvenience, and the amount to be removed should not exceed eight ounces. It may be drawn from the thigh or neck veins, or from the veins of the face as described by Daubenton. The absence of wool, and other facilities offered in bleeding from the vein of the face, should recommend it to all. The vein is opened just in front and below the sharp prominent process of bone on the side of the face, and in

* *Des Maladies Contagieuses des Bêtes a Laine.* Paris, 1821.

order to fill the vein it is pressed upon by the fingers at the margin of the jaw. Braxy is one of the diseases which unquestionably call for blood-letting.

Purgatives, though slower in producing the decided effects required to stop the progress of this disease, are of very great value, and Epsom or Glauber's salts should be preferred, in doses varying from 4 to 6 oz. Warm water injections are of great service to unload the intestines. Common salt is a good substitute in the absence of any other purgative.

Prevention is truly better than cure for this disease, and the difficulty in the way of ensuring it depends more on the routine, which cannot be overcome, than on any other cause. Shelter has long since been shown as of great service in districts where frost is invariably associated with braxy; and no other means can preserve well-fed and thriving animals from the injurious influence of wet and cold.

A careful study of the causes on any particular farm may suggest special means of preventing the disease. Thus, in some parts, a more regular system of feeding, and avoiding changes from poor to rich land, will suffice to check a heavy mortality, though we find that greater success attends our efforts on lowland farms, where the sudden deaths by braxy are evidently due to excess in the richness of grass and turnips. We have always found the happiest result attend the use of nitre mixed with bran and bruised linseed, in the proportion of about 20 grains to each hog daily. The supply of food must be checked if the deaths are numerous, and as moonlight nights commence, the animals should be placed in a bare field.

On the hills the system of managing sheep is one incompatible with drugging, incompatible with effectual shelter, and incompatible with altering the nature of the diet. In the face of all these difficulties it is not to be wondered at if the prevention of the disease is a matter of great doubt; nevertheless, the intelligent farmer, made conversant with the true and several causes of the disorder, may overcome some of the prejudices, and adopt means calculated to save an enormous per-centage of his stock.

There is no question more important for the sheep-owner of Scotland than the prevention of braxy, and it would be of great advantage to obtain satisfactory answers to the following problems:—How best to shelter hill stock? How, when occasion requires, food can be most conveniently and economically changed, or diminished in quantity? and lastly, How the neutral salts, such as nitre, may be combined with food and given to animals when braxy appears with unusual severity amongst them? The practical farmer must lend his aid to the veterinarian in order to furnish a satisfactory solution to questions propounded, such as the above, for his own especial benefit.

On the subject, Mr Matthewson says:—"The treatment of all diseases in this animal is difficult, from the circumstance that, before the symptoms can be noticed, the disease is generally too far advanced. The sheep is naturally gregarious, and, though affected with disease, it will cling to the flock as long as it can. In pastoral districts, too, the charge of one shepherd is spread over a wide extent of land, so that, unless they segregate from the rest of the flock, he is unlikely to notice them.

"The course usually followed by the shepherd, when he discovers an animal affected with braxy, is to give it a brisk run down-hill, then pull out his pocket-knife, and bleed from the jugular vein. The quantity usually abstracted is a teacupful, or perhaps a little more. Sometimes the blood is so thick and plastic, that very little will run from the incision, though very often it is of no inconsiderable dimensions. He then gives it a good dose of castor-oil, generally about two wine-glassfuls. Some prefer, instead of castor-oil, large quantities of treacle, while others again have faith in nothing but sugar, half-dissolved in milk or cream. The next thing is, that the animal dies in the course of a few hours. I never saw more than one or two cases in which the animal recovered, and in these instances it is questionable whether the disease was braxy or not.

"I have never seen any other course of treatment followed, unless it be the omission of the bleeding, which is now more commonly the case than it was a few years ago. This is the course of treatment pursued by non-professional persons. I have never seen this disease treated scientifically; but surely a more rational mode than the above might be followed. I have had no opportunities to experiment, yet I may here venture to suggest that, along with a purgative, injections may be given to aid the action of the intestines, and I think very beneficial effects will result from their use. Of course I will not recommend bleeding, but a teaspoonful of liquor ammonia largely diluted, or ʒi. of the carbonate, may be beneficially administered; it would tend to the liquefaction of the blood, also act as a stimulant to arouse the animal from its stupor."

Black Quarter in Cattle and Sheep.—Anthrax of the Extremities.—Erisipelas Carbunculosum.

This form of anthrax occurs over a very wide extent of country in the three kingdoms amongst yearling cattle. It is not confined to cattle, as the Scotch shepherds are, in many districts, such as in the counties of Roxburgh, Berwick, Selkirk, and Peebles, acquainted with "black spald" of one-year-old sheep or hoggets. In the midland counties it is called "blackleg," and also affects young sheep.

Mr Youatt has described this malady as inflammatory fever, but refers to other names by which the disorder is known in different parts of the country, viz., *quarter evil*, *joint murrain*, *hasty*, &c. The Germans have called it Milzbrand emphysem, Rauschender Brand, Fliegendes Feuer, Viertheil, &c.

It is rare to see black quarter in animals above two or three years of age. It may occur in older animals, as cases have been seen by myself and others in cows of eight or nine years of age. I need not add to the general history of causes of this form of anthrax, as they are those common to all forms. It prevails principally on undrained retentive soils, and, next to pleuro-pneumonia, is the most fatal of all cattle disorders in this country.

Symptoms.—The best animal of a lot of yearlings is seen to move about with difficulty, to indicate lameness on one of its limbs, either fore or hind, and, at the same time, the pulse rises to 80, 90, or 100, is full and strong, the breathing quick, expression of countenance indicating much disturbance, and the prostration great. The protruded head, bloodshot eyes, hot mouth, low moan, total loss of appetite, and intense thirst, are very characteristic. The loins and back are tender, and there is a painful swelling, commencing either at a fetlock, knee, or hock joint, or as high up as the stifle, elbow, or shoulder. The animal staggers and drops helpless to the ground at an early stage of the disease. There are symptoms of emphysema of the sub-cutaneous areolar tissue, and the crackling or pressure over the affected limb and trunk is a very significant symptom.

The animal is very costive in the early stage. The fæces afterwards become softer, and streaked with blood. The urine, at first high coloured, afterwards becomes tinged deeply with the blood colouring matter.

The skin sloughs over the swelling, and especially where it has been unduly pressed upon. An ichorous sanious discharge flows from the wounds thus resulting, and foul ulcers remain. Smaller ulcers occur in protracted cases on the mucous membranes, especially of the tongue and cheeks.

The increasing emphysema, coldness of extremities, and surface of body generally, small pulse and stupor, continue for a day or a little more, and the animal dies.

Post-mortem Appearances.—A general emphysematous state of the animal, great distension of the abdomen, slight cadaveric rigidity, and a discharge of bloody froth from the nose and mouth, are characteristic of the body of a yearling that has died of this disease. On removing the skin, it is seen that the cutaneous vessels are turgid with blood, and over the quarter affected or over the loins, as well as over a shoulder or thigh, the sub-cutaneous areolar tissue is found infiltrated with dark-coloured blood and emphysematous. On making an incision into the tissues, it is found that they are matted together by a black-coloured exudation, and in a state of gangrene. Blood that does not present any disposition to coagulate is found between the muscles, usually, in protracted cases, between the long muscles of the back. The serous membranes are covered with ecchymoses. The lungs are usually congested, and, according to the side on which the body has been lying, do we find right or left lung much distended with blood, and the bronchial tubes filled with a bloody froth. The pericardium is studded with ecchymoses, and the turgid but flabby heart is full of black semi-fluid blood in both auricles and ventricles. On washing the heart it is found that there has been free transudation of blood beneath the endocardium, especially over the fleshy pillars. The valves are also discoloured, and the aorta is stained with blood.

The same sanguineous infiltration is apt to occur in other parts of the body, such as in the liver, kidneys, beneath the mucous membrane of the alimentary canal, and within the cranial cavity.

It is important to notice, that in very rapid cases, or when animals are slaughtered in the early stage of the disease, it is only one of the fore or hind quarters which indicates the disease of which the animal has died. The other three quarters may and have often been sold as sound meat. Recently I was consulted as to the disease in a number of yearlings, and though these animals were not very fat, the only traces I could get of those that had died previous to my visit were the fore limb of one and the hind quarter of another. These had been buried, and were exhumed for my inspection, but the remaining part of the bodies had been sold to a butcher.

Prevention and Treatment. — Black quarter amongst young stock has been successfully prevented by proper drainage, by keeping up the condition of young animals with oil-cake, and by the use of purgatives and setons. In districts where the disorder has been very rife, farmers have experienced great benefit from the administration, once a-week, to each animal, of half-an-ounce or an ounce of nitre in food.

The majority of cases prove fatal, and the most active antiphlogistics fail. Indeed, the active bleeding which Youatt so strongly recommends, often hastens death, unless practised in the very earliest stage of the disease. Purgatives and carbonate of ammonia should be freely administered. The local swellings should be opened up and the wounds made dressed with chloride of zinc lotion. Sulphite of potash and stimulants may be administered in ample doses every two or three hours until the animal seems to rally. Greater success, however, attends the preventive than curative treatment of the disease.

Glossanthrax or Blain.

This disease, as described by Youatt in his work on cattle, and observed by many veterinarians in former years, does not prevail to any extent now-a-days. It is a form of anthrax, characterized by the development of malignant carbuncle in the mouth, and especially on the tongue. It is the Zungenkrebs of old German authors, and the Zungen-Karbunkel of others. The disease has been seen by Morel in France amongst sheep, though it is a form of anthrax almost entirely confined to cattle; and when the virulent poison developed in the course of the disease enters the system of other animals, it produces a putrid fever, diarrhœa, &c., and not necessarily the carbuncle in the tongue.

Glossanthrax appears without premonitory signs. Rychner says that cases may be looked for in districts where anthrax prevails when the foot-and-mouth disease is raging. White pustules occur on the tongue, cheeks, lips, palate, or near the frænum linguæ. The pustules vary in size from a bean to a hen's egg; usually there is one large pustule. Whether there be one or more, their malignant character is discovered by observing a rapid change in their colour from white to red and purplish black. There is much constitutional disturbance, and as the disease advances there are the signs of stupor, languor, &c., peculiar to putrid fever, or blood diseases. Sometimes slight fever precedes the local eruption, but usually succeeds it. In about 12 or 14 hours, the affected part begins to slough off, and the whole tongue sometimes drops piecemeal out of the mouth. Death occurs in from 24 to 30 hours.

The post-mortem lesions are similar to those of black quarter, with the exception of the local appearances in the mouth. The ecchymoses, &c., occur in different parts of the body.

Hering says that glossanthrax is the most constant of the forms of anthrax, spreading occasionally as an epizootic, and attacking many cattle, owing to its virulent contagious character. Gellé says that the disease is purely local until the pustule bursts. The absorption of virus which then occurs speedily affects the whole system.

The most recent case of glossanthrax reported is in the *Edinburgh Veterinary Review* for December 1862.

It must not be supposed, however, that glossanthrax does not occur much more frequently than would be indicated by the smallness of the number of cases recently recorded. I have no doubt that the disease is rather common in some parts of Ireland, but there are no veterinary surgeons to report on it. A few years ago a large number of cases were seen in Aberdeenshire.

Treatment.—What has been said concerning the prevention and treatment of black quarter applies to glossanthrax, though special attention may be drawn to the use of caustics and antiseptics on the eruption of the tongue. The early use of the hot iron is of great benefit in malignant outbreaks. Chronic lotions are undoubtedly amongst the best to correct the virulence of the discharge from the ulcers.

Anthrax in the Pig.

Wherever carbuncular diseases prevail, swine are badly affected with them. It is not easy to define what blood disorders are to be regarded as forms of anthrax in animals, and which are not. I must, however, notice the *carbuncular* *angina*, the *stomatanthrax hordeolum*, the *neck anthrax*, or *soie* of the French, *carbuncular apoplexy*, and, lastly, the *blue sickness* or *hog cholera*. The two last-named forms are very prevalent in the United Kingdom, and interfere with the production of sound pork.

1. *Carbuncular Angina.*—This disease is ushered in by symptoms of general disturbance, such as loss of appetite, vomiting, constipation, &c. A very painful inflammatory swelling occurs then around the pharynx and larynx. There is difficulty of breathing, panting, and great heat of the expired air. Signs of apnœa supervene, such as blueness of the visible mucous membranes and of the skin, protrusion of the swollen tongue, interference with the function of deglutition, and a painful cough. There is a hard, hot, and painful swelling extending downwards in the course of the windpipe, and extending beneath the chest. Sloughing of the mucous membrane around the fauces occurs, and the symptoms of a typhus fever develope. The animals die in from one to three days.

Hering says, that without doubt, pigs are seized with this affection when they have eaten the flesh of animals that have died of anthrax. I can confirm this from the frequent attacks to be observed amongst flesh-fed pigs. I am informed that eight pigs died in Fife, presenting symptoms such as the above. They were fed entirely on diseased cattle and horses.

2. *Stomatanthrax hordeolum—Rankhorn der Schweine, &c.*—This form of anthrax is very similar to the glossanthrax of cattle and sheep. It commences with loss of appetite, uneasiness, trembling, anxious and staring look, hot mouth, and increased secretion of saliva. Marked symptoms of fever are developed rapidly, and early during the attack an eruption occurs on the buccal membrane. In different parts

of the mouth vesicles form, which are rarely numerous; sometimes there is but one about the size of a bean. There is considerable inflammation around the seat of the vesicles, which are themselves at first white, and some of a brownish or blackish colour. They burst, and sloughing of the tissues beneath occurs rapidly. There is a tendency to fetid diarrhœa, discharge of blood with the excrement and urine, and there is great prostration of the vital powers. The animals die in from 24 to 48 hours from the commencement of the disease.

3. *The Neck Anthrax—Kropfbrandbeule of the Germans —Soie or pigue of the French—Setola of the Italians.*— This form of anthrax is not so common as the foregoing varieties. In this country it is very rare. Heusinger says that it is common in Poland, Hungary, and southern Europe.

The early symptoms are similar to those of other forms of anthrax, and the features which characterise it are due to an eruption over the parotid region or on the upper part of the neck. Small boils form, on which the bristles are erect, hence the names applied to the disease by continental authors, such as soyon, maladie piquante, poil piqué, setolone, &c. The bristles are stiff and dry; the pig experiences great pain if they are pulled, and around the base of each hair there is a depression. The skin is discoloured and usually of a purplish tint. The intense thirst, loss of appetite, grinding of teeth, and dulness perceived at the early stage, are but the premonitory signs of a severe fever; total inactivity or a state of stupor supervenes. The mouth becomes intensely hot and clammy; there is occasionally a free discharge of saliva; deglutition is interfered with, and the breathing is oppressed. Diarrhœa sets in, the affected parts occasionally slough, erysipelas spreads from the neck downwards, and the animal usually dies on the third day of the attack. It may live on to the seventh, eighth, or ninth day. The cadaveric lesions are similar to those of other forms of anthrax.

4. *Apoplexy in Pigs.*—This disease often occurs under circumstances when it is quite easy to determine that the malady is not of the nature of anthrax; but there are differences of opinion as to other forms.

Thus, I was called the year before last to look at a number of pigs kept by a miller in the suburbs of Edinburgh. Three had died very suddenly and in rapid succession; others were ill, and some still healthy.

The pigs had been fed for a day or two on much richer food than they had had previously. They were accustomed to get the mill sweepings, with some bran and kitchen refuse; but the mill sweepings happened to contain a large amount of solid grain when last got in, and the pigs, which were in beautiful condition, died. They suddenly left off eating, appeared restless, had peculiarly prominent bloodshot eyes, foamed at the mouth, and fell over dead. We stopped the food, administered emetics, and the disease disappeared.

To this form of disease we must attribute the cases published in the *Medical Times and Gazette* for the 29th of November, 1862.

5. *The Hog Cholera.*—Many names have been applied to this disease. It is known in Ireland as the "blue disease," "blue sickness," "distemper in pigs," "red soldier," and the "hog cholera." The latter names have been also employed for it in America. Continental authors have theorized on the nature of the disease, and named it, in accordance with their respective opinions, *typhus, erysipelas carbunculosum, gastro-enteritis, anthrax, &c.*

It is a malady which first affects the digestive organs, and then the blood undergoes changes favourable to transudations, which occur in different parts of the body. The best and most recent memoir on the subject was published in the "Magazin für die gesammte Theirheilkunde" for 1862, by Mr C. Schmidt, veterinary surgeon in Jesberg-Kurhessen. Schmidt does not look upon the disease as anthrax. He agrees with Falke and others in regarding it as *typhus*. On this subject there are differences of opinion.

Symptoms.—The death of one or more pigs under mysterious circumstances, directs the attention of persons to the health of the stock, and though the premonitory signs occur rarely and late, some pigs are noticed to be dull, not to seek for food or water, to creep beneath the straw, or in any dark place, and their head is held low, and ears are drooping. Signs of abdominal pain are often well marked, and, as a rule, there is a disposition to lie on the belly. In some instances there is much cerebral irritation, and in others stupor. The animals are either wild, frantic, or quite unconscious. The retching is occasionally violent, and food may be vomited, or mucus and bile.

In the early stage the fæces are of normal consistence, and urine pale. Slight diarrhœa sets in, and the excrement is then dark and fetid. The pulse rises to 100 or 120 per minute, and the heart-beats are barely perceptible. The staring look, tendency to press on the abdominal organs, rolling about, inability to stand, &c., are indicative of increasing pain. There is a singular jerking or spasmodic breathing in all the cases, complicated by congestion of the lungs. There is marked weakness of the hind quarters from the commencement of the attack. The animal staggers, its limbs cross each other, and at last are paralysed and cannot move. It is then found that the animal cannot scream, and there is a subdued hacking cough. The blood does not flow if a vein is opened, and ecchymoses occur over the whole body. The discoloration of the skin and mucus membranes, which has suggested so many names for the disorder, commences some time before death, and occurs especially on the belly, on the inner surface of the hind extremities, on the back, ears, &c. The redness or purplish colour disappears wherever the skin is pressed, except in parts where any extravasation of blood has occurred. An eruption is apt to appear, and the cuticle desquamates. There are no signs of erysipelas. Schmidt says that on many animals the red colour is wanting, and does not occur even after death. In the rapid cases the mucous membranes are of a bluish red colour, and in the chronic cases of a dirty yellow. The temperature of the body is at first increased, but afterwards lowered. Schmidt has seen blood oozing through the skin in two cases. In both it appeared as a critical sign, and the animals recovered after it.

Death occurs in from three to six hours from the commencement of this disease. Animals that recover, unless well treated, continue to suffer from paraplegia or from rheumatic inflammation of the joints.

Post-mortem Appearances.—The skin is black and blue, as if the animal had been knocked about during life, and ham and bacon dealers pass such blotches off for bruises. The capillaries and moderately sized veins of the skin and subcutaneous tissue are dark coloured, and gorged with blood. A yellow serum is apt to accumulate wherever there is this ramified redness. The serous and mucous membranes are studded with ecchymoses, which are most developed as a rule in the thoracic organs. Impaction of solid material in the intestine is frequently observed. The liver and spleen are congested, of a dark colour, and the parenchyma of the liver more particularly is soft. The lungs may be much congested. The blood is dark, seems fluid, and coagulates very slowly and imperfectly.

Prevention and Treatment of Anthrax in the Pig.—Wholesome vegetable diet, a sparing allowance of only well-cooked animal food, and cleanliness are the best preventives for anthrax in the pig. When the disease breaks out, keep the animals on low diet; give them an emetic such as white hellebore, and follow this up by purgatives and clysters. Exercise, fresh air, and sluicing the animals over with cold water, are measures to be recommended.

Parturient Apoplexy in Cows—Dropping after Calving—Fievre Vitlaire.

When breeding animals are treated judiciously, they are not liable to accidents at the period of parturition. A sufficient diet and plenty of exercise are admirable preparations for cows that have to calve, or ewes approaching the lambing season, but too much rich food and a state of perfect quiet are too favourable for the development of a fatal plethora.

Amongst the many animals slaughtered for human food, there are not a few that succumb in the act or after parturition, and it is therefore important that I should refer to the subject at some length. Indeed, as with puerperal fever, it is certain, that notwithstanding the sporadic nature of parturient apoplexy in cattle, it is marked by the development of a poison capable of inducing a similar disease in other animals, of affecting the human frame, and hence rendering the flesh of animals affected by it unfit for human food. Of late years the disease has become much more prevalent than it was formerly; and there are many cow-feeders who once would have refused to buy a cow after having calved, now prefer them passed over this period, which they know to be attended with many dangers. The increased prevalence of the disease is accounted for by the better quality of food reared, but perhaps more by the changes in the cow trade within the last few years. Cows are preferred in high condition, to be fit for the butcher whenever attacked by pleuro-pneumonia, and they are forced on to suit the markets. However good a milker a lean cow may be, the town cow-feeder knows that he had better pay more and get an animal fit at any moment to be slaughtered.

Distributed over the country there are many select stocks kept up in a high condition for the purposes of shows, and amongst these parturient fever is very common. Large quantities of artificial food are used; steaming, pulping, or boiling are resorted to, and the best crops of hay are devoted to the dairy. The cows that calve in spring, having been forced during winter with an extra allowance of rich food, die in great numbers. As the summer advances, and grass alone is used, and especially if cows are kept constantly in the field, the disease is not so severe or so common; but during good seasons every precaution must be used to counteract the deadly influence of the forcing system.

As we have referred to artificial food, it is necessary to state that the highly nitrogenised varieties are the most dangerous. Oilcake in moderation tends probably to prevent the disease, but draff or dreg, boiled barley, steamed hay, and turnips, are not used to excess with impunity.

Milk fever in cows rarely, but occasionally, occurs before calving. It is almost invariably seen immediately after parturition, and this is no doubt owing to the rush of blood to the head when the womb contracts, and there is no call for an excess of nourishment for the calf. That the blood is then diverted is proved by the checked secretion of milk during the disease. When a cow has once suffered from milk fever she is liable to it ever after, and it is most important to prevent the disease, not only from its great fatality in a first attack, but from the predisposition which is engendered.

Cows that give an enormous quantity of milk are very subject to the disease, if in good condition, and, *cæteris paribus*, the malady will be most severe in the finest and best animals in a stock.

The symptoms of dropping after calving are unmistakeable. Usually within twenty-four hours after parturition the animal totters, appears weak in her hind legs, and falls. A staring look, suspended animation, checked secretion of milk, are usually noticed before the cow drops. When down, the fixed and blood-shot appearance of the eye is also connected with a peculiar twitching of the eyelids; the ears, horns, and forehead become intensely hot, and the animal either sinks into a perfect state of stupor or coma, or dashes about violently, and is in danger of knocking off her horns.

It is evident, at an early period of the disease, that the animal is blind—the nerves of vision are paralysed, and the pupils are widely dilated. If fluids are poured into the mouth, they are at first swallowed, but deglutition soon becomes imperfect.

The discharge of excrement is stopped, no urine flows, and constipation is a very marked sign. The disturbance of the digestive organs is soon indicated by the disengagement of gas in the stomach, and the belly swells rapidly, so as to interfere considerably with the breathing. If the animal is lying on the left side, the oppression is greater than if she is on her right side.

From the commencement of the disease, the pulse is full and rapid, and the breathing is frequent. The throbbing of the temporal arteries, prominence of the veins of the head and neck, indicate the determination of blood to the head.

The coldness of the legs, and scanty secretion of milk, are symptoms to be specially noticed.

In fatal cases there is a tendency to convulsions; the head hangs, and death occurs within forty-eight hours of the commencement of the attack. In favourable cases the duration of the disease is longer. There are early symptoms of returning consciousness; the limbs and body generally, however, are cold, and the neck and head hot. The secretion of milk begins to flow, fæces and urine are discharged, and with the aid of a little propping up, the standing position is regained. The animal needs assistance a few times before she can get up and down comfortably.

Post-mortem Appearances.—The body has every appearance of having been well nourished. Dark-coloured blood fills the blood-vessels. The womb is apt to be somewhat congested. Ecchymoses are usually visible in the heart. The important lesions, however, occur on the cerebro-spinal system. Extravasations of blood are witnessed on the cervical portion of the spinal cord. Whenever the animal has dropped and died very suddenly, there is a considerable clot pressing on the medulla oblongata.

I have found cases in which the nervous system indicated no lesions of importance. The blood-vessels were turgid and puncta-vasculosa marked. The fluid accumulated in ventricles is then in excess, and the nervous tissue of the upper part of the spinal cord is softened.

Parturient apoplexy is a relapsing disorder. A cow that has once had it is seized again after the birth of another calf, and seized more severely than the first time. Repeated attacks have occurred under the notice of able practitioners, who have successfully treated cases. Mr Charles Hunting of South Hetton, one of the best informed veterinarians in this country, reports a case in which the apoplectic symptoms occurred shortly before calving, in an animal that had had parturient apoplexy twice or thrice previously. Such a case is rare, and it is usual for the attack only to occur within ree days after parturition, and especially when the act has been prompt, and attended with very little inconvenience or disturbance.

Many animals suffering from this disease are slaughtered, and their flesh sold as human food. This practice tends to render dairymen careless as to the adoption of means for the cure or prevention of parturient apoplexy.

The malady is amenable to treatment, and I have the greatest success by having recourse to blood-letting in the earliest stages, before coma and paralysis have supervened. This is to be followed up by the administration of a full dose of purgative medicine, and should it be too late to bleed, the physic is still of great service. Ice is applied constantly to the head and neck. Liquor ammoniæ is given to counteract the tympanitis. Warm water injections are used, and the catheter passed to relieve the distended bladder. The limbs and the mammæ are rubbed, and the body kept warm. Linseed tea is given frequently during the day with a stomach pump, as deglutition is imperfect, and there is great danger of suffocating the animal. By these means and very careful attendance the mortality is very trifling.

Prevention affords even greater prospect of success: attending carefully to the animal's diet before and after calving, administering two or three doses of purgative medicine at intervals of about ten days or a fortnight before parturition, relieving the udder often and effectually after parturition, &c.

It cannot be said, then, that the stock-owner is compelled by unavoidable losses to sell cows suffering from the disease to the butchers, and yet I have known them taken to the Edinburgh slaughter-houses, dressed, and sold in this city.

After Pains, Heaving Pains, or Parturition Fever in Ewes.

In many sheep districts, especially in the south of England, great losses are annually sustained from parturition fever in ewes. The expression 'heaving pains' is employed to indicate this disorder, in consequence of its leading symptom, which consists in violent straining, very similar to severe labour pains.

Like parturient apoplexy in cows, it is a disease of ewes in a highly plethoric state—animals that have been well cared for all the year round, and are allowed very rich artificial foods near the lambing time. They are placed in the best pastures, and perhaps get an abundance of turnips and salted hay. Mr Spooner of Southampton says that the disease occurs "mostly on farms where it is customary to keep the ewes pretty much upon turnips."

Cases have been recorded where a mortality of twenty per cent. has been witnessed in flocks, and it has been said that the sheep have not been in high or low condition—some living on swedes, and others on white turnips, but not having a great quantity of either. The turnips were, however, very good, and salted hay was being given to the sheep.

Salt is a very dangerous agent to give to cattle or sheep when they are in good health and plethoric. It is a most useful substance for low-conditioned animals, but it activates the process of digestion, favours a concentrated condition of the blood, and hastens on attacks of braxy, splenic apoplexy, parturition fever, or any other untoward result of the plethoric condition.

Moreover, sheep kept in the turnip-field never have sufficient exercise, and it is best to make them roam about for food over a bare pasture. There are two great conditions favourable to the development of parturition fever in all animals, viz., want of exercise and too much food.

It is found that a flock of ewes suffering from heaving pains is usually one remarkable for bringing forth a large number of fine lambs. The disease occurs in seasons when twin lambs are numerous, and immediately after the birth of these, there is a great rush of milk to the udder.

It is a remarkable fact, that this disease is unknown on the Continent, and this may be accounted for from the foreign sheep not having the same tendency to thrive rapidly, from their not being fed on turnips to any extent, and, in fact, not being forced like many English breeding flocks of the best description. The malady is not an old one in this country, and the first reference to it is in the 6th volume of the *Veterinarian*, at page 300, where some remarks by the late Mr Friend of Walsall, are to be found on what he called "gangrenous inflammation in ewes." A farmer had been giving his flock an unlimited quantity of turnips on his best grass land. Mr Friend, on being called, found eight of the finest ewes lying in the folding yard; they were, in fact, all that had lambed, and all had died. Mr Friend placed the remainder of the flock on bare pasture, gave oil and other medicines, and stopped the progress of the disease.

Symptoms.—About the second or third day after yeaning, the affected ewe appears restless, full, and has a staring look. Panting and straining then commence. There is little urine or excrement discharged; what urine does flow is very high coloured, and strongly ammoniacal. Symptoms of irritative fever run high, the vulva becomes swollen, and the mucous lining of the vagina is hot, red, and as the disease advances, gets of a darker colour. The violent heaving or straining may be regarded as the most characteristic symptom, and it is evident that the animal soon becomes exhausted, sinks, and dies.

Post-mortem Appearances.—After death, the principal lesions are in the uterus, which is inflamed, ecchymosed, and sometimes gangrenous. In some rather protracted cases the uterine veins contain pus, and the animals really die of purulent infection.

Treatment.—Low diet and exercise are the best natural preventives. They can be combined with purgatives and neutral salts with advantage. Curative treatment is of little avail, and consists in the use of clysters, opiate injections into the womb, and carrying out vigorously an antiphlogistic system of treatment.

CHAPTER XVI.

ENZOOTIC DISORDERS.

Red water in sheep.—Sanguineous ascites.—Maladie de sologne.—Pourriture aigue.—Blood diséase in lambs.—Navel ill.—Joint ill.—Lamb disease in America.—Parasitic diseases.—General remarks on parasitism.—Parasites never originate spontaneously.—Mode in which entozoa injure and destroy life.—Classification of parasites.—Cystocestoid worms.—Nematoid or round worms.—Trematode or sucking worms.—Measles in the pig.—Measles in cattle.—Hydatids of the liver and other organs.—Echinococcus veterinorum.—Sturdy, gid, or turnsick in cattle and sheep.—Tapeworms in different domestic quadrupeds.—Parasitic lung disease in lambs, calves, and other animals.—Fluke rot in cattle and sheep.—On pentastoma tænioides of the sheep.—Enzootic diseases of the horse.—Periodic ophthalmia.—Influenza.—Glanders and farcy.

RED WATER IN SHEEP.—SANGUINEOUS ASCITES.—MALADIE DE SOLOGNE.—MALADIE ROUGE.—POURRITURE AIGUE.

THIS enzootic disease prevails to a considerable extent in Ireland. It appears also to be a disease of modern date, and the first and best account of it in this country, was published by Mr T. W. Gowing, a highly intelligent veterinarian, residing in Camden Town, London. Mr Gowing's observations were on a farm in Middlesex, and the disease appeared on rich ground, where the grass was good, and no noxious plants existed on it. During the same year—1849—and since, many outbreaks have been alluded to, and the mortality induced by the disease is occasionally very great.

From the importance of the subject, I am induced to extract the following from Mr Gowing's report:—

"The disease in question was first noticed by the person who had charge of the sheep, in the month of April; he says:—"On visiting them early one morning, I found two lambs very unwell, they staggered in their gait, had separated themselves from the others, were dull and dispirited, their heads drooping, their mouths closed so firmly that I could with great difficulty only open the jaws, and a frothy saliva covered their lips. I administered to each a small quantity of castor oil, mixed with some warm milk, and as they appeared a few hours afterwards to be somewhat better, I placed them again with the ewes. The medicine having operated, they gradually recovered; but remained very weak for several days. From this time all went on well, until the commencement of the following month (May). I had left the flock apparently in perfect health over-night, but on the succeeding morning, one of the ewes presented similar symptoms to the lambs; in addition, however, she was considerably hoven, and breathed with much difficulty. I immediately gave her a full dose of castor oil, and had her walked about very slowly; this, however, caused evident distress. As no fæces had passed by noon, I repeated the oil, and late in the afternoon, the ewe being still in the same state, I determined on exhibiting a saline aperient, but she died while taking it. On opening the body, the paunch burst from the pressure of the great mass of food which it contained; and as little or no gas escaped, I concluded she had overgorged herself, which produced a stoppage in the bowels and death.

"'A few days afterwards, a lamb, which to all appearance was well at noon, was found dead about 4 P.M.; and on the third succeeding day another was discovered dead, on the flock being visited early in the morning. A third was taken ill two days after this, to which I gave a dose of castor oil, and bled it in the eye and ear veins; the blood was very dark in colour, and flowed slowly. This lamb lived until the following morning: the breathing was laboured and difficult, and at intervals was suspended for several seconds. The medicine operated freely, but no diminution in the severity of the symptoms was observable.'

"The lamb above alluded to was sent to my establishment, and my attendance on the flock was also requested, in consequence of the serious and fatal character the disease had now assumed. In conjunction with my friend, Mr Varnell, I instituted a *post-mortem* examination of the lamb, and found the following lesions:—

"The abdominal viscera were free from structural disease; but the chylopoietic veins generally were distended with dark blood. The biliary ducts and gall-bladder were also very full of bile. The liver was larger than natural, and darker in colour than we usually find it; the spleen normal; the lungs slightly congested, and a small quantity of limpid fluid in each pleural sac; the thymus gland large and dark in colour, which seemingly depended upon venous congestion; the pericardial sac contained about two ounces of fibrin and serum—the fibrin was in a state of semi-coagulation, but not adhering to any part of the membrane, which showed no redness or abnormal thickening. The external part of the heart, particularly on the left side, was observed to be studded with dark-looking spots.

"On making a section through the outer wall of the right ventricle, from its base to its apex, the cavity was found to be empty, and the lining membrane free from disease, but at the upper part, and near to the septum ventriculorum, a group of petechiæ existed beneath the membrane. The right auricle was normal; the left ventricle contained some coagulated blood of a dark hue, which, being removed, showed similar spots on the septum to those seen in the right ventricle. The muscular structure of the outer wall of this cavity was discoloured by blackish streaks and spots.

"On arriving at the farm, I first made an autopsy of another lamb, and found similar morbid appearances to those above described, with the exception of the petechial condition of the heart. My attention was then specially directed to a lamb which was suffering from the disease; the symptoms were analogous to those named by the bailiff. I ordered its removal to a well-ventilated shed, prescribed some aperient medicine, and gave directions for it to be kept apart from the others. On minutely inspecting the flock, I could not discover any indications of ill health in the animals; but concluding that the quality of the food was mainly concerned in producing the attack, I determined on making a complete change both in the management and feeding of the sheep. I therefore had them turned on to a common where the herbage was scanty, and where they could roam at liberty, and ordered that they should be carefully watched. On the succeeding morning another ewe was found dead, which was also forwarded for my inspection. This I sent to the college, when the following lesions were discovered:—

"The abdomen was found to contain a large quantity of fluid of a sero-sanguineous character, and venous congestion of all the abdominal viscera existed to a considerable extent, some parts being nearly black. The vena porta and the contiguous portion of the posterior vena cava were distended with coagulated blood. The spleen was likewise much enlarged. The biliary ducts, gall bladder, and ductus communis choledochus were full of bile; and the liver, as in the lamb, was large and dark in colour, from repletion of its vessels and ducts. A small quantity of fluid was found in each pleural cavity; the lungs were much congested, but no structural disease existed; the pericardial sac contained about its usual quantity of fluid. The heart had an unnaturally large appearance. On laying open its right side, both cavities were found to contain a large quantity of coagulated blood, which likewise extended into the large vessels connected therewith, particularly the anterior and posterior cava and coronary veins. The right auricle, when freed from its contents, also exhibited ecchymosed spots in its muscular structure beneath the lining membrane. The left side of the heart contained but a small quantity of blood, which was likewise of a dark black colour, but showed no marks of structural disease."

Other diseases are occasionally termed red water, and, in the majority, the leading symptom amongst sheep, as amongst cattle, is the redness of the urine.

Professor Murray, of the Cirencester Agricultural College, speaks of red water in ewes as characterized by jaundice, port wine colour of urine, and loss of condition; as the disease advances, the anæmic condition is very marked, the heart's action is frequent, sometimes up to 140 per minute, and its sound loud, the respirations are also rapid, and the animal soon sinks from sheer exhaustion.

The pallor, or yellowness of the tissues of the body, softened condition of the liver, and scanty quantity of blood, are the characteristic post-mortem appearances.

Treatment consists in giving nutritious food and tonics, both mineral and vegetable.

Delafond describes a variety of these blood diseases under the name *diarrhœmia,* and their general characters are—breaking up of the blood, ecchymoses, secretions tinged with blood; and as an illustration of the cause of these conditions is defective nutriment, he alludes to the appearance of such symptoms in 1851 amongst some horses purchased for anatomical purposes, and which were kept several days without food.

Blood Disease in Lambs.—Navel Ill.—Pyœmia Agnorum.

This, the so-called "new malady in lambs," was first observed by me in 1861. It had destroyed some lambs in various farms for a year or two previously, but it only manifested itself in great severity in the year that I was first consulted, owing to an outbreak in Northumberland. In England, and especially in Hampshire, Wiltshire, and the county of Gloucester, the disease has been very prevalent and very fatal for some time past. In Scotland the disorder has been seen principally in Berwickshire. The seasons during which it has been most rife, have been remarkable for the good condition of the ewes, the heavy crop of lambs, and abundance of food. Deaths have risen rapidly in a flock from one to a score in the first week or two of the lambing season, and instead of diminishing with mild weather and an improving crop of grass, it has killed so rapidly that I have been frequently informed by the farmer, that he counted the number of deaths up to thirty or forty, but they occurred so rapidly then that he "got confused in his calculations."

I have usually found that the flocks affected with this disease have been kept in a confined space in winter. The ewes have been fed well, and not been allowed to move about sufficiently. It was thought at one time that contagion was one of the causes favouring the spread of the disease. This arose from the death of all lambs which were caused to suckle foster mothers. As twins and triplets are common when this disease prevails, many of the young ewes that can scarcely be supported by their own mothers, are placed with the ewes which had lost their offspring. To make the ewe take to the lamb, the skin of the dead one is put on the latter, and this is attended with bad results. The lamb thus covered up often dies, and it was thought that this depended on the young animal catching the prevailing disease. It turned out, however, that the real cause of death was suppressed action of the skin, or poisoning the blood of the otherwise plethoric lamb.

The symptoms of the disease are sudden staggering and drooping look of the finest lambs. They are sometimes costive, and at others purged. The navel is then felt to be swollen and flabby. The eyes get yellow. The animal cannot stand, but if lifted to its dam, attempts to suck. It dwindles, and dies in from a few hours to a week.

After death, dark blood is found in the viscera; the umbilical veins are swollen, the liver is engorged, and studded with multiple abscesses, and there is often yellowness of the tissues of the body generally.

Treatment consists in placing the flock on bare keep, and either giving purgatives or doses of neutral salts to the ewes.

As to prevention, moderation in feeding is the great secret, so as to keep up the condition of stock, without having an excess of internal fat, and an extraordinary richness of blood. All the organs of these animals must be kept in activity, by appropriate exercise. It is bad for all breeding animals to be kept too quiet. They should be made to run about, even after they are drafted out in the order they are to lamb. It is impossible to be too careful with this. Some have suggested giving common salt to the ewes in food. This is a useful agent in rot and other disorders attended with an impoverished state of blood, but it is very injurious in animals that are plethoric. If any medicine is required in consequence of the excessive good condition of a flock of ewes, it should consist in epsom salts to purge them, or nitre to cool them. They will lick up nitre greedily, and it is an admirable preservative.

Joint Disease amongst Calves and Lambs.

In conjunction with the blood disease already described, and sometimes independently of any such affections, young domestic ruminants suffer at, or immediately after, birth, with a form of arthritis, dependent partly on a scrofulous cachexia, but having most of the characters of a rheumatic disease. This arthritic disease has been much on the increase of late years, and especially amongst lambs. Mr Robertson, of Kelso,* who has studied this disease with his usual care and intelligence, considers that its causes are constitutional and local. The constitutional and predisposing causes are a scrofulous and a rheumatic taint. Certain exciting causes are essential to the development of the disease, and "animals which have undoubtedly inherited either a scrofulous or rheumatic diathesis may, under favourable conditions, escape being affected; while others, less fortunately circumstanced, may fall victims, or, as in certain cases, both these tendencies are associated in the same animal."

Mr Robertson declares it as his opinion, that calves are most frequently affected by true rheumatism. The animal is seized when some weeks old, and it is observed to be very lame. The pain experienced is evidently intense, and general fever high. The temperature of the body is increased, the visible mucous membranes injected, and the pulse frequent and full. The appetite is capricious or lost,

* See the *Edinburgh Veterinary Review*, vol. v. 1863, p. 529.

the animal is costive, its urine high-coloured, and the affected joints are hot, tender, and swollen. The capsules of the joints are distended, and there is more or less general tumefaction. The local symptoms may disappear from one joint, and attack another, or several. The joints undergo degeneration if the disease continues.

When calves are scrofulous and seized with joint disease, Mr Robertson finds that the stifle joint is chiefly involved. The disease is more one of the ends of bones—the epiphyses—than of the synovial membrane, or other structure of the joints. The joint is very tense, hard, and swollen. There is a tendency to tubercular deposit in the bone, and softening.

In lambs the form of disease is chiefly of the second variety above described, the animals are either born with the diseased joints, or show symptoms shortly after birth. Mr Robertson says, that the shepherd is apt to remark that "this or that lamb cannot live, it is pocking at the navel." The belly is pendulous from the presence of a turbid fluid in the peritoneal cavity; in this fluid are floating shreds of unhealthy looking fibrin. The umbilical cord is always much enlarged, so much so as to attract attention, whenever the lamb is dropped; it is soft, flabby, and the vessels filled with very dark coloured blood. There does not seem the least inclination to that early change of these structures, into the well defined ligamentous cord extending to the liver, characteristic of the perfectly healthy animal; instead of this there is developed a chain of cysts, containing pus mixed with tubercular matter, extending from the umbilicus to the liver, this latter organ exhibiting change of structure, and the presence of pustular and tubercular matter; the omentum and mesenteric glands occasionally showing like morbid conditions, from which, as a sequel, we have the presence in the abdomen of the already mentioned purulent serous fluid, and externally, evident pendulous abdomen. In all such cases when the constitutional cachexia is so marked and destructive in its progress, we are only able, by the most careful treatment and nursing, to save a small minority; and I am of opinion it is better not even to attempt this, as any that may recover are never remunerative as breeding, and very rarely as feeding animals."

Treatment.—In any cases of this disease which it is deemed proper to treat, the young animals should have acetate of potash, or the acetate of ammonia, given to them in water repeatedly. The joints must be kept still, and a starch bandage often benefits much, especially in calves a few weeks old. When the local swelling assumes a chronic character, iodine preparations are needed, or fly blisters.

With regard to preventive measures, Mr Robertson strongly insists on the selection of sound breeding stock, and goes on to say, that although it does not appear that any one has as yet been able to detect with such nicety, as in the human family, those unmistakeable characteristics of a scrofulous tendency, still there are certain points, which as unmistakeably stamp an animal as objectionable, because of an unhealthy disposition, as others, which give him favour in our eyes as of a superior class, and in the enjoyment of the most vigorous health. I do not suppose there is any one who, knowing even little of sheep, would select, as fit for breeding, an animal with a thin neck, narrow chest, pot belly, narrow loins, tender eyes, very small bone, and fine wool, which is sparingly distributed about the head, belly, and legs." Mr Robertson alludes also to moderation in diet, and abundance of exercise, which I have insisted on, as a preventive against the blood disease in lambs.

Lamb Disease in America.

In the spring of 1862, the lambs in all the counties of New York suffered severely from a peculiar malady, described by Mr Randall, in the "Albany Country Gentleman."* The lambs affected had the appearance of a general want of physical development at the time of their birth. Their bodies were small and lean, or if not, they had a peculiarly flaccid feeling, as if the muscles had not attained their normal consistency. The bones generally lacked the usual size. The back and neck were thin, the legs slender, the head small, and the face oftentimes singularly attenuated. When to these appearances was added the not unusual one of a coating of wool and hair much thinner and shorter than usual, the resemblance to a prematurely born animal was striking.

"Some were brought forth so feeble that they never rose to suck. A portion survived for a few moments or hours; others lingered along from two or three days to a week. They were usually dull, made but languid efforts to feed themselves if their dams were at all shy, and many of them would scarcely follow their dams about the yards or fields. Those that survived required extra care, and very few of them attained ordinary size and plumpness, however plentiful their supply of milk.

"Congenital goitre in some instances accompanied the preceding symptoms. In several flocks, a few of the lambs were born with their heads and necks so drawn down, and occasionally also twisted sideways, by the action of the muscles, that they could only suck with difficulty, and by assuming the most unusual postures. In the worst cases, the lambs starved if they did not receive assistance from the

* See the *Edinburgh Veterinary Review*, vol. v. 1863, page 105.

shepherd until they acquired strength to make the unusual exertions required of them. In the same or other flocks, another set of symptoms appeared. Strong healthy lambs a week or two old suddenly lost the use of their legs to a greater or less degree. Some hobbled about as if lame in every foot; others could scarcely walk. A portion grew no worse, and after a few weeks recovered. A small number became unable to stand even when placed on their feet; but they continued to look healthy, fed heartily when assisted, and, so far as my own immediate observation extended, most of them gradually recovered when the weather became settled and warm.

"The local visitations of the epizootic of 1862 were quite capricious. While many flocks of sheep of all grades in this (Cortland) county wholly escaped its effects, much the larger number were losers by it, in proportions varying from 10 to 90 per centum—or practically to 100 per centum, for the few that recovered in badly diseased flocks were of little value. The average loss in the *larger* infected flocks was, I think, about 50 per centum. My flock lost 40 per centum, my son's 70, and a neighbour's 90."

Referring to the causes Mr Randall says:—"That our flocks of sheep in New York were unusually confined during much of the winter of 1861–2, is certain. Uncommonly deep snows fell about the first of February, and though they wasted away towards spring, their hard crusts prevented sheep from straying from the immediate vicinity of their stables. Many flocks scarcely moved fifty yards from their stables during the last ten or twelve weeks of their pregnancy. Their appetites were kept keen by the steady cold. The free consumption of food, inaction, and advancing pregnancy, increased their flesh, and these causes reacted and rendered them perfectly contented in their confinement. Many flockmasters have remarked to me that they never before saw their sheep so quiet, so disposed to remain constantly in their stables, and so fleshy towards spring. Having eaten, they lay most of the time in their bedding until they again rose to eat. Flocks accustomed to run in pastures in the winter, and to dig down to the grass, were of course entirely cut off from their usual supply of succulent food."

At the conclusion of his paper Mr Randall refers to the same points I have so often insisted on as to the overfeeding of ewes, and keeping them in an inactive state. He says:—"I believe that I have seen the fact repeatedly established, that it will not do to let pregnant ewes obtain green food by roving about the fields and turnip patches, for the first two or three months of pregnancy, and then confine them rigorously to a small yard and dry food. Some farmers habitually do this, but I never saw it done with impunity in a large flock. In winters unfavourable to sheep, it often leads to a wholesale destruction of even the grown animals.

PARASITIC DISEASES.

The subject of parasitism has within the last twenty years afforded scope for the most interesting researches.

In former times there was a tendency amongst medical observers to attribute many of the most fatal and most common diseases of man to the influence of animal or vegetable parasites, which were often supposed to generate spontaneously under stated circumstances. As Leuckart says, "There was no severe or dangerous disease which parasites, and especially intestinal worms, were not supposed to induce."*

* Die Menschlichen Parasiten und die von ihnen Herrührenden Krankheiten von Dr Rudolf Leuckart, Leipzig, 1862.

A reaction occurred amongst pathologists, and as many products supposed to be parasitic proved to be nothing of the sort, it was supposed that entozoa existed in the bodies of men and animals for some wise purpose, and excited the secretions, favoured digestion, &c. Amongst veterinarians Bracy Clark advocated such views early in the present century, and went so far as to recommend horsemen to give their horses some of the germs of œstrus equi, that their stomachs might not be deprived of the healthy stimulus which they enjoy in a state of nature from the usual system of propagation of these parasites. Bracy Clark thus advocated doctrines which had been defended by no less eminent naturalists before, such as Götze and Abildgaard.

It was supposed by others that parasites developed in animals previously diseased, and that a predisposition had to be acquired by a certain state of ill health for the production of any parasitic malady.

We now know that parasites are not generated in certain morbid conditions, and do not exist in animals to excite the normal functions of their organs. They are offensive products foreign to the bodies of the men and animals they afflict, and dependent entirely for their development on the introduction of germs into bodies suited to their growth, protection, and reproduction.

A few parasites exist in or on all human beings and animals, but certain parasitic animals and vegetables induce actual disease, and often diseases of a very fatal nature.

The manner in which entozoa injure and destroy is not always the same. Some induce disease and irreparable structural changes in important organs, from their mere growth and multiplication in those organs. Thus the brain of the ox or sheep is destroyed by coenuri and echinococchi. The latter parasites and flukes lead to destruction of the livers especially in sheep, and tens of thousands of these animals are annually destroyed by the distoma.

A variety of diseases are induced according to the manner in which the parasites lodge in an organ, or according to the peculiarities of the organ itself. Thus echinococchi not unfrequently induce cardiac tumours in the lower animals, attended by all the symptoms of chronic heart disease, and ending in sudden death. Parasites in the cranial cavity lead to paralysis, wasting of the body, and many complications ending also in death.

Tubular organs are obstructed by parasitic accumulations. Thousands of the calves, sheep, fowls, pheasants, &c., are annually suffocated by round worms in their wind-pipes. Obstructions of the alimentary canal occur in young animals from the accumulation of ascarides.

I have said that parasites induce ill effects from the manner in which they lodge in an organ. The trichinæ afford us an excellent example, in penetrating the sarcolemma, and taking the place of the active muscular elements, as described by Leuckart.

Leuckart has spoken of the usually accepted view, that parasites injure by impoverishing the blood of their victims. He has made an interesting calculation on the subject. He says, a tapeworm (botriocephalus latus) of 7 metres in length, weighs about 27·5 grains. It may, during its growth, lasting as it does from five to six months, require from four to six times its weight in nutritive material, but that is of no importance to a man. Greater losses are sustained by children when large numbers of ascarides accumulate in the intestines. The only instance of a parasite killing by draining the blood of man is the blood-sucking anchylostoma duodenale (strongylus quadridentatus), which attaches itself to the mucous membrane of the intestine of the Egyptians and other oriental people, and in such numbers that on opening the intestine it appears covered with leeches.

So far as my own inquiries extend as to parasites in the lower animals, none kill by merely draining the system of blood. I shall refer elsewhere to this supposed action of distoma hæpaticum.

Parasites are living and moving bodies, and in their perigrinations through the system, or in their movements in a part in which they are lodged, they induce great derangement, and may kill. I have witnessed this in my experiments with coenuri, and when many germs are introduced into the system of pigs and calves, &c., for the development of hydatid disease, deaths are frequent when the embryos bore through the tissues. In the pig death occurs from the piercing of the intestine by echynorhyncus gigas, &c.

Leuckart refers particularly to the injurious effects of the movements of parasites. They induce an irritation which is followed by congestion and inflammation varying in intensity according to the number of parasites, and the rapidity of their movements. He adds that " the most striking example of the truth of these statements is afforded by the trichinæ, which, on their passage into the intestinal canal, induce a malignant enteritis with the production of false membranes, and lead to appearances which have a great resemblance to those of typhus. This happens, at all events, when the number of imported parasites is great, amounting, perhaps, to upwards of 100,000, as is not rarely found after the eating of trichinous meat. I have seen a corpse in which half-an-ounce of flesh contained about 300,000 trichinæ. In other cases the direct results of the parasitism are milder, but always under the form of a congestive state and catarrhal affection."

Not unfrequently parasites induce indirectly a derangement of an important organ. We have instances of this in the epileptic seizures or other convulsions of children and of young animals suffering from intestinal parasites.

The parasites, I have to refer to, belong to the three orders of cystocestoid or tapeworms, nematoid or round worms, and tremadote or sucking worms. Of some of these, particularly of tapeworms and sucking worms, it is characteristic that in their development they pass through a non-sexual stage, during which they may infest different animals from those in which they dwell during the sexual and reproductive stage of their existence. And thus the same parasite may kill more than one animal. Human beings derive most of their parasites from the domestic quadrupeds. Leuckart says, "The chief result of our observations on the life history of the helminthoid animals is to the effect that by far the greater number of these creatures live in their various conditions in different animals. Applying this conclusion to the human parasites, we find that in all probability the greatest part of our entozoa are derived from animals. It is the animals with which we come most in contact, viz., our domestic animals, and especially those we eat, that communicate parasites to us— . . . "The justness of this conclusion is demonstrated without doubt by observations and experiments. The domestic animals furnish us, in fact, with the greater number of parasites, but under different circumstances. The parasites which we derive from the animals we eat, such as the tapeworm and the trichina, belong to the developed intestinal worms. We acquire them in their young state, the tapeworm as hydatids, and the trichina as an encysted muscle worm, and both from pigs, which are the animals that mostly give us the eggs and embryos of their entozoa, which then develope in our bodies in their early condition. Of the encysted parasites the dog, above all others, supplies us with germs. It is it that favours the spread of pentastomum denticulatum, cysticercus tenuicollis, and echinococcus, from the development within the nasal sinuses of pentastomum tænioides, and in its intestine of tænia marginata and T. echinococcus. Also the muscle trichinæ of men may in some cases, especially when they are few in number, be communicated from dog to man."

Of the internal parasities, or entozoa, affecting the domestic quadrupeds, there are many, and have been classed under two general heads—*infusoria* and *worms.*

The infusoria are constantly found in the bodies of animals. Sometimes they engender disease, and no more interesting illustration of this can be adduced, than that of the Bacteria, belonging to the family of Vibrios, and which have usually been described as rigid, filiform animalcules, moving in a vacillating, rather than in a serpentine, or undulating manner. These parasites vary from 2 to 5 millimeters in length. Bacteria were supposed to develope, and live principally in putrid liquids, but M. Davaine has found them in the blood of animals affected with splenic apoplexy, and has observed, that putrefaction destroys the infusoria as well as the blood. They can be transferred from one animal to another by inoculation, and multiply with very great rapidity in the vessels of their new host.

The Bacteria kill the animals they invade, and if the blood containing them is rapidly dried, the infusoria are thereby preserved, and can resist the temperature of boiling water. This explains how in some arthracic diseases, the flesh of animals may prove deleterious after being cooked.

Of the family of Monads, it is asserted, on the authority of Leuwenhœck, that Cercomonas urinarius is frequently met with in horses' urine when fresh.

In the stomach and intestine of the herbivorous quadrupeds, infusoria usually abound, and special attention has been paid by Leuckart to the occurrence of Paramæcium coli in the colon of the pig. Leuckart has found the parasite very constantly and in large quantities in the alimentary canal of this animal, and has been inclined to regard its occurrence in man as the result of accidental transmission from the pig.

Various infusoria have been occasionally seen in putrid discharge from suppurating wounds.

Worms are classified into tape and cystic worms, sucking worms, and round ones, as follows:—

Cystocestoid Worms.—Bladder and Tape Worms.

A. Tæniæ.

I. Tænia mediocannellata of man.
Cystic form in muscles of ox.

II. Tænia solium of man.
Cystic form is the measle or cysticercus cellulosæ of the pig.

III. Tænia serrata of dog.
Cystic form is the cysticercus pisiformis of the rabbit.

IV. Tænia cœnurus of dog.
Cystic form is the cœnurus cerebralis of cattle and sheep.

V. Tænia echinococcus of dog.
Cystic form is echinococcus hominis s. veterinorum of man and animals.

VI. Tænia cucumerina of dog.
Cystic form is C. cucumerinus of rabbit. (Cobbold).

VII. Tænia marginata of dog.
Cystic form is the cysticercus tenuicollis in the sheep, pig, &c.

VIII. Tænia crassicollis of the cat.
Cystic form is cysticercus fasciolaris of the rat and mouse.

Tapeworms whose cystic forms are as yet unknown:—

IX. Tænia nana of man.

X. Tænia expansa of the ox, sheep, gazelle, chamois, &c.

XI. Tænia denticulata of the ox in France and Germany.

XII. Tænia Plicata of the small intestine and even stomach of the horse.

XIII. Tænia mamillana of the large intestine of the horse.

XIV. TÆNIA PERFOLIATA of the cœcum, and sometimes of the small intestine of the horse.

XV. TÆNIA ELLIPTICA of the cat, declared by Van Baneden to be the same as T. cucumerina of the dog.

XVI. TÆNIA INFUNDIBULIFORMIS from the intestine of the domestic fowl, duck, swan, &c.

XVII. TÆNIA PROGLOTINA of the common fowl.

In the intestines of domestic and other fowls, the following have also been found: Tænia crassula, Tænia malleus, Tænia lanceolata, Tænia setigera, Tænia sinuosa, Tænia fasciata.

B. BOTRIOCEPHALI.

I. DIBOTHRIUM DECIPIENS. Botriocephalus of the cat, found in the small intestine.

II. DIBOTHRIUM SERRATUM. Botriocephalus of the dog, found in the small intestine both of the dog and fox.

Nematoid, or Round Worms.

A. LARVAL FORMS.

One form has been found in the human trachea, and another in a cyst in the kidney of a dog. Little is known of these nematoid worms.

B. PERFECT FORMS.

I. GENUS OXYURIS.

Species a. Oxyuris curvala of the horse and ass; found very frequently in the cœcum and colon.

b. Oxyuris vermicularis of man; found in the large intestine and rectum.

II. GENUS ASCARIS.

Species a. Ascaris lumbricoides of man, and probably of the ox; found in the small intestine.

b. Ascaris megalocephala of the horse, ass, mule, &c.; found in the small intestine, and sometimes in the stomach and in the large intestine.

c. Ascaris mystax s. alata of the cat, lynx, tiger, &c., and also of the human subject. (Bellingham, Cobbold.)

d. Ascaris ovis. This round worm of the sheep has been found only once in Vienna.

e. Ascaris marginata of the dog; found in the small intestine.

f. Ascaris suilla of the pig.

Many other species of ascarides have been described, and especially Ascaris vesicularis of the common fowl and turkey; Ascaris dispar of the goose ; Ascaris inflexus of the domestic fowl ; Ascaris maculosa of the pigeon, &c.

III. GENUS SPIROPTERA.

Species a. Spiroptera megastoma of the horse; found in tumors developed at the cardiac end, and in the walls of the stomach.

b. Spiroptera sanguinolenta of the dog and wolf; also found in tumors of the œsophagus and stomach. In some countries these parasites are common, and as some observers have found them in rabid dogs, there was a belief at one time that rabies depended on this worm.

c. Spiroptera strongylina of the pig and wild boar; found in the stomach.

d. Spiroptera hamulosa of the common fowl.

e. Spiroptera uncinata of the tubercles of the œsophagus.

IV. GENUS TRICHINA.

Species a. Trichina spiralis ; in the muscular fibres of man, pig, ox, rabbit, and other domestic quadrupeds.

V. GENUS TRICHOSOMA.

Species a. Trichosoma plica of the dog; found in the urinary bladder.

b. Trichosoma brevicollis of the goose.

c. Trichosoma longicollis of the domestic fowl.

VI. GENUS TRICOCEPHALUS.

Species a. Tricocephalus dispar of man.

b. Tricocephalus affinis of the dog; found in the cœcum of ruminants.

c. Tricocephalus depressiusculus of the dog; found in the cœcum.

d. Tricocephalus crenatus of the pig and wild boar; found in the large intestine.

VII. GENUS FILARIA.

Species a. Filaria lacrymalis of the horse and ox; found in the rabbit.

b. Filaria papillosa of the horse, ox, and ass; found in the globe of the eye, said to be in the anterior chamber, but usually in a cyst within the cornea.

c. Filaria immitis of the dog; found in the heart.

d. Filaria trispinulosa of the dog; found by Gescheidt in the capsule of the crystalline lens.

VIII. GENUS DOCHMIUS.

Species a. Dochmius hypostomus of the sheep, goat, and other ruminants; found in the intestine.

b. Dochmius tubæformis of the cat; found in the duodenum.

c. Dochmius trigonocephalus of the dog; found in the stomach and intestine. A variety declared to exist in the right side of the heart.

IX. GENUS SCLEROSTOMA.

Species a. Sclerostomum armatum of the horse. Found in the intestine, in the arteries, and sometimes in other cavities of the body.

b. Sclerostomum tetrachantum of the horse. Found in the cœcum and colon.

c. Sclerostomum dentatum of the pig. Found in the cœcum and colon.

d. Sclerostomum syngamus from the trachea and bronchial tubes of fowls.

X. GENUS STRONGYLUS.

Species a. Strongylus radiatus of the ox, and several other ruminants. From the small intestine and colon.

b. Strongylus venulosus of the goat. Found in the small intestine.

c. Strongylus micrurus of the horse, ox, ass, &c., infesting the air passages.

d. Strongylus filaria of the sheep, goat, camel, &c., also infesting the air passages.

e. Strongylus paradoxus of the pig; found in the trachea and bronchial tubes.

f. Strongylus filicollis of the sheep; met with in the small intestine.

XI. GENUS ANCHYLOSTOMUM.

Only one species of this genus — anchylostomum duodenalis, has been described, and it occurs very rarely, if ever, in the lower animals. It usually infests the duodenum of man.

XII. GENUS EUSTRONGYLUS.

Species. Eustrongylus gigas of the horse, ox, dog, &c. Found in the kidneys, bladder, and areolar tissue, beneath the peritoneum.

Trematode, or Sucking Worms.

I. Genus Monostoma.

Species. Monostomum leporis, attacking the rabbit, and found in the peritoneal cavity.

II. Genus Distoma.

Species a. Distomum hæpaticum. This parasite attacks ruminants principally, but it has also been found in the horse, ass, pig, rabbit, and man, in addition to many wild animals.

b. Distoma lanceolatum of domestic ruminants, besides the pig, cat, and rabbit. Found in the biliary ducts.

III. Genus Holostomum.

Species. Holostumum alatum of the dog. Found in the intestine.

IV. Genus Amphistomum.

Species a. Amphistomum conicum of the ox and sheep. Met with in the stomachs.

b. Amphistomum crumeniferum of the ox.

c. Amphistomum explanatum of the ox. Found in the liver.

d. Amphistomum truncatum of the cat.

Aranthocephalis, or Armed Worms.

Genus Echinochyncus.

Species. Echinochyncus gigas of the pig; found in the intestine.

Aconthotheci.

Genus Pentastomum.

Species a. Pentastomum constrictum of ruminants and man.

b. Pentastomum tænioides of the dog, horse, mule, sheep, &c. Found in the frontal and ethmoidal sinuses.

Measles in the Pig.—Scalesiasis; Cachexia Hydatigena; Ladrerie, Fr.; Finnen-Krankheit, Germ.—Tænia Solium in Man.

This disease of swine has been entirely overlooked by veterinarians in this country, and it has been only since the researches of V. Siebold and Küchenmeister that British physicians have ascertained the frequent existence of parasites in pigs, which, on reaching the human intestine, develope into tæniæ.

The very inappropriate term "measles" is applied to that morbid state induced by the presence of cysticercus cellulosæ in the muscular structures of swine. It is a purely parasitic disease, and depends for its origin on the introduction into the system of the pig of the mature and fecundated ova of tænia solium.

The process of development has been carefully watched by many observers. The embryos of the tapeworm are globular and armed with spines, which pierce, by working in a horizontal plane from within outwards, the mucous membrane of the alimentary canal of the pig. They penetrate the tissues, and are washed through the larger vessels by the blood current until they reach their destination in the muscular structures. A very large number of the embryos are thus dispersed, but only in young animals. They cannot find their way through the tissues of adult pigs, and any experiments performed with animals above a year old fail as a rule. This, as we shall afterwards see, is the same with other parasitic diseases.

Pigs are said to be born measly, and one of the most constant means whereby the disease is propagated is by breeding from measly sows. French veterinarians long since noticed that if a measly sow was bred from, all her produce was measly, and similar observations have been made in this country by the bacon factors.

If pigs are born healthy they cannot have fully developed cysticerci in their flesh under two months and a half. From 30 to 40 days after the introduction of the germs into the body of the pig the parasites vary in size from one to four millimetres. They consist in small cysts, or bladders, containing a clear fluid, and in the wall of the cyst there are many distinct vessels. A rudimentary head soon appears, and then a row of hooks, and, lastly, suckers around them develope. Each cysticercus is enveloped in a cyst, its body grows, and is in reality drawn into the bladder, with which it is continuous at the opening, so that the vesicle proper to the animal is in reality the tail. Cysticerci continue to grow for four or five months, but then remain stationary, and, although occasionally killing the animal in whose flesh they have accumulated in countless numbers, they usually have no means of escape until the natural term of the pig's existence is at an end, and then they pass into the bodies of human beings.

I have seen pigs, in whose flesh cysticerci abounded, in apparently the most perfect health, and very fat. Indeed, it is necessary to examine an animal closely during life in order to determine if it be measly. The parasites are usually situated superficially under the tongue, and may be felt on the inner side of the eyelids. In very severe cases the neck is swollen, there is difficult breathing, and a hoarse voice. It is a mistake to suppose that measly pigs have red spots on the skin, or any sign of cutaneous eruption.

After death the presence of cysticerci is easily seen in the different muscles, and in the internal organs. It is especially when a pig is cut into two halves, and the muscles of the neck are cut through, that the greatest mass of these parasites is exposed. The pork butchers usually make an incision into the psoas muscles to determine if a pig is measly. The presence of many cysticerci in the flesh leads to an open condition of the texture favourable to the imbibition of fluids, and for this reason measly pigs are easily pickled.

My inquiries indicate that measles prevails to a much larger extent in Ireland than in Britain, and may be regarded, in fact, as enzootic in the former country. I have been informed by a Wiltshire bacon factor that not one pig in a thousand reared in England or Scotland is found diseased, whereas the Irish pigs suffer much from this disease, and some years to an extent of six, seven, and eight per cent. The Irish have an adage that every pig has its measle, and if I consider what number of animals have a few cysticerci in their flesh,the per-centage of measly animals is far higher than above stated. When we speak of a measly pig there is an accumulation of many hundred such parasites in the animal's body.

I found that the malady was most prevalent in those counties in Ireland where pigs are reared in small lots by poor people. The disease has diminished considerably of late years, in consequence of the pigs being fed in larger numbers by farmers. I found that measles were very rife in some parts of Cork, in Limerick, Tipperary, and Queen's County. Of the counties in the province of Ulster, Monaghan is by far the greatest sufferer by this disease, and I regret that I have not had an opportunity to follow out my inquiries further as to the causes which lead to the extraordinary losses by this disease in special counties.

It is certain, however, that those pigs suffer most from measles that live in common with human beings; that are allowed to roam about at will; and to eat human excrement around the cottages, in the roadside, &c. A very few people affected with tapeworm discharge joints enough to contaminate an immense number of pigs. Each tapeworm has an average lifetime of two years. It produces in that time 1,600 joints, and each of these contain 53,000 eggs, making in all 85 millions.* Every egg is capable of developing into a cysticercus, but fortunately the great majority of the joints of a tapeworm are destroyed. Were they not, every pig would soon be measly, and every man, woman, and child suffer from tænia solium.

* Leuckart, *loc. cit.*, p. 83.

Measles in Cattle.—Tænia Mediocanellata (Küchenmeister).

Recent researches by Dr Leuckart demonstrate incontestably that there is a form of tapeworm, not unfrequently confounded with tænia solium, which does not originate in man from eating measly pig, but from eating imperfectly cooked veal and beef. In many parts of the world a hydatid prevails amongst cattle, which developes into tænia mediocanellata in the human intestine. That hydatid is found in many parts of Europe, and probably exists occasionally in this country. Dr Cobbold has a specimen of tænia mediocanellata in his collection, obtained from Sheffield, and he informs me that we shall probably find that this variety of tapeworm is not at all rare in this country. There is a specimen in the New Veterinary College Museum, for which I am indebted to Dr Keith of Aberdeen. Leuckart quotes an observation which interests us as Englishmen. He says that Knox observed a tapeworm epidemic during the Kaffir war in 1819 amongst the English soldiers, due to their being fed on unsound beef. Abyssinians are affected with this disease, and observations have been made in Germany and Russia as to the occurrence of tænia mediocanellata amongst children, fed—"aus diätetischen Gründen"—on raw beef.

Dr Leuckart has succeeded in inducing measles in the calf, by feeding it with joints of tænia mediocanellata.

As hydatids prevail to a very extraordinary extent amongst cattle and sheep in this country, it is very important that a carefully conducted inquiry should be prosecuted, with a view to determine the existence or non-existence amongst us of tænia mediocanellata, and the cysticerci which induce them.

Hydatids of the Liver in Animals, Cysticercus Tenuicollis.—Tænia Marginata in the Dog and Wolf.

The pigs in Ireland, and both cattle and sheep throughout the United Kingdom, suffer to a very great extent from hydatids in their livers. Amongst these cystic parasites we find a large number of the species Cysticercus tenuicollis. These cysticerci are apt to take up their abode also in the internal organs of man, and it is probable that they often lead to the development of cysts supposed to have been due to the presence of echinococchi, and I am inclined to attribute to this parasite the cystic tumours which Dr Brinton, and even Dr Gairdner, consider arise in human beings eating raw or underdone animal food. Human beings suffer from these cysticerci under circumstances similar to those which lead to the development of cysticercus cellulosæ, and which I have before alluded to.

There is no doubt that eggs of the tapeworm developed from cysticercus tenuicollis in the intestines of the dog, will develope into hydatids in the mesentery and liver of human beings, as it does, according to the experiments of Luschka, Leuckart, and others, in the organs of the domestic quadrupeds.

It is of the greatest importance that careful and extended inquiries should be made as to the prevalence of these cysticerci in animals. It is evident, from the observations of Küchenmeister and others, that many individuals of these species, forming extensive cystic tumours, are to be found in pigs, and not unfrequently there has been a confusion between cysticerci and echinococchi. Thus, in Ireland, the endemic cystic disease appears to be due to both these hydatids.

ECHINOCOCCUS VETERINORUM, TÆNIA ECHINOCOCCUS.

Numerous cases have come under my notice of disease in horned cattle, sheep, and pigs, induced by this parasite. Von Siebold has shown that tænia echinococcus lives in the dog's intestines, and thousands of thread tapeworms may exist in an animal.

It has been a much agitated question whether there are several species of echinococchi. The earlier observers believed in two species, ecchinococcus hominus, and ecchinococcus veterinorum. Weinland says: "As to the difference of the two species there can be no longer any doubt, since the investigations of Küchenmeister and Leuckart." The latter author, however, says, at page 330 of his new work, referring to other authorities on the subject; "They thought themselves so much the more justified to make this difference, inasmuch as the first (E. hominis) are characterised by the presence of secondary and tertiary bladders (tochter und enkelblasen) within them, whereas the others usually present a simple cystic form. But it is known that the multiple form of Echin. hominis occurs also in the domestic animals such as the horse, pig, &c., and *vice versa*, it is not rare to find in human beings the simple forms of E. veterinorum. Sometimes, moreover, both forms of echinococcus are found in the same individual." Leuckart refers to the simple form of echinococcus hominis in some cases, and to the complicated form, E. veterinorum, in others; and, after reference to the shape and number of hooks, concludes by saying: "Naturally under such circumstances I can no longer participate in Küchenmeister's views, that there are two species of echinococcus, and the forms of this parasite indigenous with us are only varieties of a single species, whose fully developed condition is to be met with in our dogs."*

Tænia echinococcus, first seen by Von Siebold in experiments on dogs, is a small tapeworm with only three or four joints, the last of which, in a mature condition, exceeds in size the remaining part of the body. As a rule, their number in the dog's intestine varies from a few to 30 or 40.

I have seen masses of echinococchi, weighing many pounds, appended to the apex of the heart, others connected with the lungs, liver, spleen, kidney, and the last specimens I obtained were in the cranial bones of a bullock. Echinococchi are far more frequent in Italy, where I have seen them in enormous numbers, than in the United Kingdom, but they are very common in this country also.

Cœnurus Cerebralis in Cattle and Sheep; Gid, Sturdy, Turnsick.

The very common disease, sturdy or gid of the sheep, Dreh-Krankheit of the Germans, prevails to an extraordinary extent in all parts of the United Kingdom where sheep are kept. There are districts comparatively free from the disease, and others where there is an annual loss of one and two per score among year-old sheep.

From the very satisfactory explanation of the origin of

* I have had numerous opportunities of examining echinococchi from man and animals in Italy, as well as in this country, and have very frequently studied them carefully. I have always referred to my own observations in the lecture room as leading me to differ from those who considered that there were two species of echinococcus; and during the past session, before I had the pleasure of reading Dr Leuckart's admirable work, I entered at length in the class-room on the supposed but imaginary differences between the echinococchi of man and those of our domestic quadrupeds.

this disease, which is afforded us by a knowledge of the source whence sheep or cattle derive coenuri, I attempted to convince the farmers, several years back, as to the real cause of the disorder and the ready means of prevention. As the German zoologists had done, I gave dogs the hydatids from the brains of sheep affected with sturdy, and obtained large numbers of tæniæ. The joints of tænia coenurus thus obtained were given to lambs, and sturdy was induced in them.

In 1859 I drew up tables showing the results of many experiments performed in different countries on this subject, and 41 experiments as to the development of tænia coenurus showed that of about 50 dogs fed on whole or portions of coenuri from the brains of sheep, 33 became affected with tapeworm. As many as 400 tæniæ have developed from one cyst, and the fourth part of one hydatid swallowed by a dog led to the development of 191 tapeworms. In less than a fortnight the tapeworms are observed in the intestines, from a line to two in length, showing no trace of joints or transverse folds; they may attain an inch the third week, and 4 inches the fourth. Worms developed in 155 days are mentioned as being from 2 to 2½ feet in length, but by one experiment it was found that this length could be attained by the tapeworm in less than three months. The tæniæ remain in the small, and obtain exit from the body through the large intestine. They are never expelled whole, but separate proglottides or joints, each of which is charged with many hundred eggs, are evacuated with the fæces.

Failure in the experiment depends on diarrhœa causing the expulsion of the cyst before the heads can attach themselves and grow. Occasionally a disease such as distemper may prevent the retention of the parasites.

To demonstrate that the cerebral hydatids are produced by introducing ova from the dog's tapeworms, 39 sheep and 2 calves received proglottides of tænia coenurus, and out of these 22 became affected with sturdy. Symptoms of the disease became manifest from 7 days to 2 and even nearly 4 months after the proglottides had been swallowed by the sheep. The rapidity with which sturdy developes is almost in direct ratio with the length of time, within certain limits, that the joints of the tapeworm have been exposed to the air and moisture. The tardy manifestations of symptoms in some cases probably depends on the ready adaptation of the brain to the developing cysts. The number of coenuri found in the brain varied from 4 to upwards of 200. They were generally distributed throughout the substance of the brain. Encysted and undeveloped embryos are found frequently in the muscular tissue, especially of the œsophagus, intestine, diaphragm, and heart. The experiments fail if proper attention be not paid in procuring mature joints of tænia cœnurus.*

It is a fact that sturdy rarely affects sheep above two years of age, usually lambs under a year old; it is more frequently seen in some breeds, such as among the Cheviots, than in others, and affects enfeebled animals, more especially in the

* Until 1853, the period of Küchenmeister's experiments on the transmission of cœnurus cerebralis, many were the supposed causes of sturdy. As a matter of curiosity, a few may be referred to, and I shall mention those which have been most believed in by farmers and shepherds:—Lullin and Gerike thought sturdy was serous apoplexy, or dropsy of the brain, from violent blows. Many have believed that humidity produced the disease, and Navières suggested that a fly deposited eggs in the brain by perforating the skull, and the eggs developed into the hyatid met with in the sturdy. The Ettrick Shepherd stated that sturdy was due to cold affecting the sheep's loins, especially during windy and rainy winter seasons. We have been asked how to explain the prevention of sturdy by covering the sheep's loins. Admitting that occasionally this may protect them, we shall afterwards

autumn and winter months. I find, however, that in some districts there is greater prevalence of sturdy in summer. This occurs when, during the hot months, sheep are kept on unenclosed pastures on hills where they must be constantly "herded," whereas during the winter the flock is transferred to enclosed fields, and dogs are more or less removed from them. Sturdy will always be found to prevail on farms with open pastures, where flocks constantly need the guardianship of shepherds *and dogs*, or on enclosed farms where sheep are fed on turnips, confined daily within limited space, *with one or more dogs amongst them.* These are the conditions favourable to the development of sturdy, and they are those favourable to the dissemination of tapeworm eggs by dogs, and the penetration of the eggs in the bodies of the sheep. These eggs find a favourable nidus in the cerebral mass of the lamb, and they there develope into the coenuris cerebralis.

Sturdy is occasionally confounded with other diseases; and my attention has sometimes been called by farmers of great experience to a sheep presenting certain anomalous symptoms, which, though distinctly due to the presence of the

show that all conditions calculated to favour the healthy and robust state of the sheep will prevent the introduction and development of parasites in the body, not excepting the cœnuris cerebralis. Fromage de Feugré declares that when lambs are too fat they are most liable to sturdy; and Reynal only recently advocates the theory of Huzard, that those lambs become affected with sturdy which are born of ewes that have suffered during pregnancy, or that are naturally weak; and, lastly, that the produce of rams of an enfeebled constitution is very subject to the disease. Many shepherds have observed a connexion between the development of sturdy and the presence of dogs amongst the flocks. Many intelligent farmers have a great dislike to dogs amongst sheep, in the belief that by being worried, the sheep become affected with sturdy.

cœnurus cerebralis in the brain, have not been considered those of sturdy. The variety of ways in which the sturdy manifests itself, depends entirely on the number of, and the position held by the parasites in the brain. Usually but one hydatid is found within the skull, sometimes several, and then the symptoms are complicated.

The usual form of sturdy depends on the presence of a hydatid in one of the hemispheres of the cerebrum, or brain proper. The sheep then turns right or left, according to the hemisphere affected. If the bladder be situated between the hemispheres, the head is protruded and elevated, and the animal moves in a straight line forwards. Lastly, if the bladder be lodged in the lesser brain or cerebellum, there is defective co-ordination of movement; the creature loses control over the voluntary muscles, there is a peculiar uncertainty of gait; the limbs do not obey the will.

In addition to the above symptoms, there are others which have not been studied as much as they might have been, though of great interest to the physiologist. Such signs are peculiar to different stages of sturdy. We observe that when first affected, the symptoms are very severe; there is much cerebral disturbance from the congestion produced by the presence of the hydatid. As the brain substance yields to the latter and is absorbed—in other words, as the contents of the skull adapt themselves to the parasite,—the symptoms may subside more or less, and a sheep decidedly giddy, stupid, and dull at first, may appear partially to recover; but the growth of the parasite, or any cause favouring cerebral congestion, induces a marked exacerbation of symptoms. But, as Dr Davaine has correctly stated, the vertigo cannot be explained as depending on simple morbid irritation, or looked upon as a symptom of paralysis or incomplete hemiplegia. The attacks of giddiness, the running round and round, become more frequent and are more prolonged as the hydatid grows; the rapidity of movement increases until paralysis is induced, and the animal cannot stand. Many tumours and hydatids of a different species to the cœnurus cerebralis are met with in the brain, but the peculiar symptoms of sturdy are not induced by them.

The cœnurus consists in a bladder provided with a variable number of exsertile heads, and Dr Davaine believes the nervous substance may be excited by the heads, which protrude from the bladder and penetrate the brain substance nearly two lines in depth. Sturdy is, therefore, a phenomenon of excitation of one of the cerebral hemispheres, and Dr Davaine asks if very manifest phenomena of excitation would not result by plunging into the substance of the brain one or two hundred pin-points at a depth varying from one to two lines. As the cœnurus increases in age, the number of heads augments, and the points of contact with the encephalon multiply, and in this way Davaine explains the increase in frequency and duration of the vertiginous attacks as the malady advances.

It is certainly remarkable, that though the echinococcus veterinorum may lodge in the brain of sheep or oxen, it does not produce the characteristic symptoms of sturdy caused by the cœnurus cerebralis, and the probable explanation of this is, that the heads of the former are not exsertile, whereas those of the cœnurus protrude from the distended cyst.

The vertigo observed in true sturdy is altogether peculiar; that is to say, the lamb turns round and round, describing concentric circles, and Davaine states that it has been entirely by false analogy that some authors have admitted the existence of sturdy in man.

Admitting that the cœnurus cerebralis exerts a peculiar influence on the brain, it must be remembered that the " running round" is not a constant symptom. In the early stages, it is often absent, the sensorium and voluntary muscles being more or less affected with dulness and partial paralysis, stiffness of back and awkward gait; there is a peculiar appearance of the eyes dependant on the dilated pupils, the bluish colour of the conjunctiva, and apparent prominence of the eye-ball. Total blindness may result, and the animal feeds but little, cannot follow the flock, strikes against trees, walls, or other obstaclcs, which it may meet with in moving about.

When the cœnurus cerebralis exists in the cerebellum, a remarkable combination of symptoms may present themselves. The animal advances with its head elevated, can scarcely lift its fore legs, and there is a hesitating movement of all the extremities. Having accomplished the first steps, the creature rapidly advances, occasionally by a succession of imperfect leaps and falls; it then struggles to rise, and may not succeed, or it rolls on its side several times in succession. Emaciation advances, and death ensues sooner or later, but as a matter of certainty, unless the animal is relieved naturally or artificially. The natural method of relief, which is by absorption of the bones of the skull, and evacuation of the hydatid, is very rare, though occasionally a farmer is astonished to learn that a sheep affected with sturdy has struck against a sharp stone, broken its head, and recovered. The explanation of this is, that the skull having become thin, the blow produces a penetrating wound, through which the cœnurus cerebralis may escape. A plan is successfully resorted to occasionally for the removal of the hydatid and cure of sturdy.

Sturdy is occasionally mistaken for functional disorder of the brain, due to impaction of the third stomach, which is a disease of the spring season, of an acute nature, characterized by constipation, delirium, convulsions, and early death, unless the animal be relieved by a brisk purgative.

Sturdy is also confounded with the attacks of the sheep-bot, which is lodged in the frontal sinuses, and produces great irritation, swelling of the pituitary membrane, and discharge from the nose. The animal loses appetite, becomes dull, prostrate, is attacked with convulsions, and sometimes dies.

The Scotch shepherds have become expert in the treatment of sturdy. They feel for the softened part of the skull, pierce the brain with an instrument called a borer, draw off the liquid from within the cyst of the parasite through a canula by means of a syringe, and, if possible, they seize the bladder and draw it out. Many cases are successful if operated on sufficiently early, and when there is but one bladder in the brain.

ROT IN SHEEP: CACHEXIA AQUOSA; THE FLUKE DISEASE; ATTACKS OF DISTOMA HÆPATICUM.

This most destructive disease has attracted more than ordinary attention of late years, owing to its extraordinary prevalence in 1860, and also in the year now closing. Professor Simonds, in a recent essay on this malady,* says, after referring to a number of extraordinary outbreaks:—"From 1830 to the present time several visitations, which were more or less severe, took place. One of these occurred in 1853–54, when many thousands of sheep were swept away, and not only in undrained districts, but also in others of a more healthy character. Since 1830, however, no outbreak can at all be compared to the one of the autumn and winter of 1860. Speaking in general terms, it may be affirmed

* *The Rot in Sheep, its Nature, Cause, Treatment, and Prevention,* by James Beart Simonds. London, 1862.

that all the western and southern counties of England, together with several of the eastern and midland, suffered to a ruinous extent. As in former years, so in this, the attacks of the disease were due to an excess and long continuance of wet weather. Eighteen hundred and sixty will be long remembered by agriculturists, not only as producing the rot among sheep, but likewise for its baneful effects on the root crops, as also on the hay and corn harvests.

"We are acquainted with several instances, in our own immediate neighbourhood on the verge of London, where the losses of sheep amounted from 600 to 700 in a flock. These sheep were principally Welsh ewes, which had been bought at the latter part of the summer for breeding by being crossed with Leicester tups. Some persons lost nearly all, and one in particular, who buys about 800 of these ewes annually, had not more than 40 or 50 which escaped. Tups, wethers, lamb-hogs, and half-breds, alike succumbed to the inroads of the affection. A similar fatality attended the progress of the disease in all other districts. In many parishes in Devonshire where we investigated the malady, and of which Bridgerule may be taken as an example, five-sixths of the sheep perished, or were sold for a few shillings each for slaughtering, to the detriment of the health of the poorer classes.* In the instance thus particularized the losses occurred among the stock of small occupiers, the ill consequences of which were greatly added to by their young cattle being found to be affected by flukes to such an extent as seriously to injure their health later on in the year.

* The Rev. S. N. Kingdon, the resident minister at Bridgerule, reported to the author, that on October 1st, 1860, 492 sheep were existing in the parish as the joint property of several small farmers; and that, by the end of the month, 410 of them had either died or been sold at a price very little above the value of their skins.

"In Sussex and in several parts of Surrey, the fatality was equally great. In the neighbourhood of Eastbourne a flock of about 600 Southdown ewes of great value was completely destroyed. Numerous cases of this kind might be narrated, but enough has been said to show not only the extent of the disease, but that sheep of every description, and placed under different systems of management, equally succumbed. It is much to be regretted that means do not exist whereby the total loss could be ascertained. People are left in doubt as to the amount of food of which they were deprived in one year by this disease alone, and of the efforts which must be made to replace the losses. The time, we predict, cannot be far distant when agriculturists will be convinced, not only of the propriety, but of the positive necessity of making returns, at least of the *losses*, they sustain among their cattle, instead of simply deploring these among themselves. Elsewhere we have drawn attention to this important subject, upon which very much might now be said, if it were not somewhat unsuited to an essay of this kind."

Mr Spooner, in his work on sheep, says, "Though a million of sheep or lambs have frequently been destroyed annually by this disease, in the winter of 1830–31, this number, it is supposed, was more than doubled; some farmers lost their whole flocks, others a moiety, and many were ruined in consequence. These facts were proved before a Committee of the House of Lords in 1833, and it was there stated by one farmer that he lost £3000 worth of sheep on his farm in Kent, in the course of three months. Even at this time there were 5000 less sheep taken to Smithfield every market-day in consequence of the mortality two years previously, so extensive and general had it been."

My inquiries in 1862 indicate that the mortality in many parts exceeded that of 1860. It has far surpassed it in Ireland; and amongst the most extensive sheep dealers in the midland counties and the south of England I have learned that the destruction over extensive districts has been almost unparalleled in their experience.

When I was last in Dublin (Dec. 13, 1862) my advice was asked concerning this disease, which seems to have prevailed on lands usually quite free from rot, and I learned that the malady was very destructive in Kilkenny amongst cattle. Serious complaints have been heard from Clare, Limerick, Roscommon, King's County, Wexford, parts of Kildare, Longford, Leitrim, and Armagh. I am quite certain that not less than 500,000 sheep have this year suffered from rot in the United Kingdom, reducing them in value two-thirds and more, and leading to a loss of several hundred thousand pounds to the country at large.

Rot is a disease of low lands, marshy ground, and wet seasons. Flooding pastures suffices to render them unsound for sheep for a season, and this is owing to the dissemination of distomata in their partially developed condition, and fit for their term of existence, in the ruminant's liver. Apart, however, from the prevalence of flukes on low land and especially marshy pastures, we find that sheep do not keep up in condition on soft watery grass. Solid dry food suits the constitution of the sheep best, and during wet seasons we find rot prevailing to an alarming extent on sound lands, and on opening the bodies of the sheep very few flukes are found in their livers. Notwithstanding the existence of flukes in the liver it is possible to counteract the state of weakness, and stop the progressive emaciation by rich food, tonics, and common salt, which do not tend to expel the parasites so much as to counteract the condition of the system induced by quality of food the animal has been on, coupled with the morbid changes in the liver from the presence of the flukes.

Rot developes most readily from the month of June to the month of October.

The fluke, distoma hepaticum, is found in the livers of sheep in a perfect condition, with organs of generation developing or developed, and masses of ova surround the parasites. They are often packed together in scores in saccular dilatations of the gall ducts, and I have seen the most extraordinary specimens of livers, with varicose gall ducts encrusted with cholesterine and other solid principles of bile. The ova, which abound in the gall ducts, pass out through the intestine of the sheep, and fall into stagnant pools, ditches, &c., or are washed from the land during rains into streams. Most of the ova are fortunately destroyed as a rule, but many are hatched, and embryos develope. Steenstrup's investigations on this subject were very remarkable. The embryos were found to acquire great activity, and would move freely, owing to the vibratory cilia formed in their surface. They are eaten by mollusks, the common physæ or limneæ of pools and ponds. The embryos here acquire a sort of hydatid form, are provided with alimentary canal and organs of locomotion. By a process of interior budding *cercariæ* form, which are the young sucking worms, endowed with great activity, and, thanks to a rudder tail, which renders them not unlike a tadpole, they can swim and find their way into water; where they live free until some favourable *crustacean* or mollusk appears, into which they pass by means of spines developed on their head. They lose their tail, and become encysted; their internal organs continue to develope, and on the animal they are infesting being accidentally swallowed by a sheep or other creature, they escape free to pass into the liver, acquire generative organs, and lay eggs for another generation. The metamorphoses here noticed are probably similar for all trematode worms, and are presumed to be those of distoma hæpaticum, whose cercaria form has not been discovered.

Sheep are very liable to suffer from parasites, and in conjunction with the flukes in the liver, we usually find parasites in the lungs and parasites in the stomach. Mr Simonds refers to having recently "brought to light another and a fruitful cause of the death of sheep of all ages," with symptoms "remarkably akin to those of rot," and due to "the existence of an undescribed variety of worm of the class *filaria* within the abomasum,—the digestive stomach." The truth is, that the parasite Professor Simonds refers to, from the brief notice he gives of it, is one which has been frequently referred to before, and is noticed in all German, French, and Italian veterinary works which are at all up to date in matters of science. Bellingham long since noticed the occurrence of strongylus contortus in the sheep in Ireland. He found it in the small intestine, but it is as a rule found in the fourth stomach. It was first described by O. Fabricius in Denmark, who stated that the head of the worm was armed with cilia, probably the barbs which Mr Simonds has noticed. The German authors refer to the disease induced by the gastric parasites in sheep as a "Magenwurmkrankheit." Spinola calls it Magenwürmerseuche, or strongylogenesis ventriculi, and characterizes the disease as "eine cachectische herdekrankheit."

It is, moreover, in the condition of system noticed in sheep rot that many other parasites prey on the bodies of living animals, and echinococchi, cysticerci, &c., are not uncommon in rotten sheep.

Symptoms of Rot.—A flock placed on damp land, or a flock purchased from a country where it has contracted rot, appears to thrive well, lays on fat, and promises to turn into good mutton. Inactivity and dulness are soon apparent. In some cases the disease is rapid in its course, and this season (1862) a large number of sheep have been killed very quickly on lands usually reputed as very sound. Pallor of the visible mucous membranes, wasting, &c., could be seen in these sheep, but only to a moderate extent, and they have died very suddenly. After death the liver has been found greatly enlarged, its peritoneal surface often adherent to the diaphragm and other abdominal organs, and few flukes contained in the liver. The small quantity and pale character of the blood indicate, however, the real condition of the sheep.

As a rule rot progresses at first in an insidious form; the flanks get hollow, the back rigid, and there is a decided yellow colour of the eye, and, where visible, often of the skin; the fleece drops off in patches; the belly enlarges; the back droops; and there is a disposition to dropsical swellings in different parts of the body. There is frequently an insatiable thirst as in other dropsical diseases, the pulse is frequent and very feeble, the heart-beats active, and anæmic murmurs are heard; the breathing becomes quick and short, there is a slight cough, most marked in all cases complicated by the presence of strongyli in the air passages.

The most remarkable of the dropsical swellings is around the throat. A sheep thus affected is said to be *chockered*. The alimentary canal is disturbed, and, with the quantity of liquids drunk, diarrhœa is apt to supervene. Weakness and listlessness, amounting to a state of stupor, increase, and the animals die in a hectic state.

The treatment of rot in sheep requires the early removal to sound pasture; feeding on corn, peas, beans, and other nutritious grain; allowing full doses of common salt and sulphate of iron in the food, and, when necessary, administering a purgative so as to keep the digestive organs in good order.

Parasitic Disease of Lungs in Calves and Lambs.—Phthisis pulmonalis verminalis, Lungen-wurmseuche.

Next to rot, this is by far the most destructive disease of young sheep in the south of England. It is not so destructive in Scotland, but has injured farmers much this season in Ireland.*

If the lungs of sheep are examined in butchers' shops, a very large number of them will be found studded with deposits, once regarded as tubercular.†

This tubercle, in reality, consists in a deposit of ova of the *strongylus filaria* (Reed), surrounded by epithelium and granule cells, oily and crystalline deposit, with debris of healthy lung tissue. Generally this opaque and semi-gelatinous material is observed towards the more healthy part of the lungs in the shape of circumscribed masses, often not exceeding the size of an ordinary pin's head, and if each little nodule be squeezed, a gritty substance, the result of cretifaction of the above-mentioned deposit, is felt between the fingers. Each nodule indicates a spot where the germs of the strongylus filaria have been deposited, giving rise to irritation and the exudation of material around them; in this material granule and pus cells develope, and fatty, and lastly calcareous

* As an indication of the importance of this disease, I may mention that the farmers of Cornwall, through the Bath and West of England Society, recently offered a prize of £30 for an essay on this disease, which has been awarded to Dr Edward Crisp, who proves that the disease is due to overstocking, and especially to the feeding off a second crop of clover with lambs after the first crop has been consumed by sheep.

† I was not aware myself of the real nature of this deposit until 1854, when I had the privilege of prosecuting, with Dr Ercolani, of the Turin Veterinary School, some researches as to the methods of propagation of parasitic worms.

degeneration ensue. The eggs are of an oval shape. They are at first transparent, but in all those that are fecundated the yolk cleaves, and, by progressive subdivision of cells formed out of the yolk, a cellular mass is formed, which assumes an elongated and coiled appearance, and presents the external form and internal organisation of the strongylus filaria. The parasite, coiled on itself and alive in the cell, moves about, and at last becomes free and grows to its full size, passing out of the tissue of the lung into the air passages, whence it is coughed out and often deposited on grass and other substances likely to be eaten by the sheep. How it attains the lungs to deposit its eggs is involved in mystery, —perhaps by directly piercing the tissues from the stomach to the lungs; though, from the eggs being universally disseminated over the lung, we might be led to conjecture that the ova are introduced into the circulation and stopped in the pulmonary capillaries, where they produce irritation, and the deposit, before described, accumulates around.

The strongylus filaria is a worm from one to two and a half inches in length, the male smaller than the female and yellowish, whereas the latter is white. The body is of uniform size, but tapered at the extreme ends. Anteriorly is the head, short, stumpy, and matted, not tuberculated as that of other strongyli, but rather angular. From the mouth extends a short œsophagus into a short but elongated stomach, and from this the straight intestine extends back nearly to the extreme end of the tail, a little anteriorly to which is the anus. In the male an undivided circular aliform expansion, obliquely situated to the line of the body, surrounds a space in which the penis is observed. The tail of the female is pointed, the vulva situated near the anus, and from the vulva extend the oviducts full of eggs, and containing also live young.

In calves similar parasites abound under certain circumstances in the respiratory organs. The *strongylus vitulorum* (Reed), or *Str. micrurus* (Mehlis), is one of the armed strongyli with a filiform body, short caudal, long in the male, and mouth with three papillæ. This species is met with in the air passages of calves, and occasionally in the ass. Nicholls, in the first volume of the Philosophical Transactions, mentions the *husk*, common amongst calves under one year old, as dependent on worms in the windpipe; and in 1788, when Camper was engaged in investigating the cattle plague, and especially the advantages of inoculation as a preventive, he learned that one of his neighbours who had saved 50 calves by inoculation, lost 30 by this parasitic affection. On the 2nd of September of the same year, Camper had occasion to examine the trachea and lung of a calf that had died, as he expresses himself, with myriads of these worms in the air passages. On another calf Camper noticed a perfect ball of these worms effectually obstructing the windpipe. He described the worms well, and observed that they were viviparous. In his literary researches on the subject he found that Gesner had called a worm *Wasserkalb*, calf of water, of which he knew not the origin, but that calves swallowed them with the water to the great peril of their lives—*magno etiam vitæ periculo.*

In the pig a similar affection has been observed, and the worm has been described best by Mehlis and Gurlt. It has been called *strongylus paradoxus* (Mehlis); *gordius pulmonali apri* (Ebel); *ascaris filiformis cauda rotundata* (Goeze); *asc. bronchiorum suis* (Modser); and *strongylus suis* by Rudolphi, who looked on it as a doubtful species, having seen but two specimens which he had received from Bremser, and which had been found in the air passages of the domestic pig. Gurlt speaks of them as infesting the wild boar and the domestic pig, but that it is rare. Alessandrini, on the other hand, says that in Bologna he has found large numbers in the lungs of pigs killed in the public slaughter-houses, and it has since been recognised as frequent in Switzerland and France. The *strongylus paradoxus* has a narrow mouth, furnished with three papillæ ; the caudal bag is bi-lobed, and turned downwards. In the female there is an enlargement where the anus is observed ; the tail is short and pointed. The male is from eight to nine lines in length, and the female about an inch and a half. The females are by far the most numerous of the two.

Returning now to the parasitic disease of the lungs of sheep, it is clear that there are two distinct stages of the affection, the one mistaken for true tubercular disease, and the other when the worms are fully developed, and lodged in the air passages. Waldinger* was probably the first to give a good account of the latter stage, but the nature of the first was not brought to light until 1840, when La Harpe, of Lausanne, examined the affected lungs, and discovered the ova and young worms in the solid deposit, and recognised them as analogous to the strongylus filaria, met when full grown in the air passages, and sometimes in the act of piercing from the lung tissue through the mucous membrane into the bronchia.†

Unaware of La Harpe's discovery, Dr Ercolani, in 1843, when prosector to Professor Alessandrini in the University of Bologna, was struck with the appearance presented by

* Abpaulung äberd Wurmer und Lungen a Staape. Wien, 1818

† I do not agree with Dr Crisp's theory of the germs of the parasite being carried back from the stomach to the mouth in the act of rumination, and then finding their way into the trachea. As with the germs of the cysticerci only the young animals are affected, because they cannot pierce the tissues of older ones.

some sheeps' lungs he had purchased on the butcher's stall. Many strongyli existed in the bronchia, and grey nodules or tubercles on the surface of the lungs. These nodules Ercolani found to contain small worms and eggs, in which the young strongyli were in a state of development, already alive and active. Since then Ercolani has made some interesting observations on the tenacity of life of the young strongyli. These parasites show signs of life on being moistened after drying for thirty days, and at other times after having been immersed in spirits of wine at 30°, or in a solution of alum and corrosive sublimate. Ercolani, moreover, says that the ova, abundant in the mucus of the bronchial tubes, containing worms, sink into the air vesicles, become coated by an albuminous material, and thus are imbedded in the lung tissue. This would lead us to believe that when worms are swallowed by healthy sheep they immediately find their way into the windpipe. I must confess I doubt this. Of course the eggs of the worms developed in the lungs are deposited in the lungs again, or may move indirectly into the system of another animal, but the migration from the mouth or alimentary canal to the lungs, certainly requires a more complete explanation than has hitherto been given. The number of embryo worms met with in the lungs of one sheep is sufficient to infect a whole flock, so that the disease has manifested itself as enzootic or epizootic.

Perhaps as early as La Harpe and Ercolani, did Dr C. Radcliff Hall, of Torquay, investigate the question. In 1856, in the British and Foreign Medico-Chirurgical Review, Dr Hall says, "For fifteen years past I have been in the habit of noticing the lungs in butchers' shops and slaughter-houses. I have never seen a single specimen of the lung of a full-grown sheep that was entirely free from entozoic disease. The disease is not hereditary, since the lungs in young lambs are healthy. Nor, I conclude, is it restricted to any specific locality, since I have found it at every place in Great Britain, France, Germany, and Switzerland that I have happened to visit. The lungs, then, of any full-grown sheep, taken indiscriminately, will be found to contain, and often to be thickly studded with, small nodules, varying in size from a pin's head to a barleycorn, or larger. The cysts are full of clear fluid, and contain cysticerci hanging upon an epithelial lining membrane. The firm, soft deposits consist of granule cells and molecular matter, in which minute ascaris like worms are found. The gritty nodule is one or other of these, which has undergone calcareous transformation. The particular point bearing upon my subject is, that the pulmonic affection does not prevent the sheep from furnishing excellent mutton." Further on Mr Hall has introduced a diagram to show the changes undergoing around the germs of the strongylus in the lung tissue, and says that there is nothing during the lifetime of the sheep to lead us to infer that it suffers pain, distress, or constitutional disturbance during the formation of this boundary of plastic inflammation around the nodules in its lungs.

Dr Ranke exhibited at the Pathological Society, on Tuesday, November 3, 1857, the lungs of three sheep affected with the disease, and he carefully described the morbid changes due to the parasites.

On examining the sheep slaughtered, we find that the larger number of them are fat and robust, yielding wholesome meat, but there is likewise a per-centage, and not a small one, conveyed to the butcher, because feeding cannot improve them, and to allow them time would be to allow them time to die by the disease. That the development of the germs in the lungs is always unattended with the slightest inconvenience, is not the case, and though the worms may not have found their way into the air passages, the changes going on in the early stages of the disease are associated with symptoms of spasmodic cough, irritation in the throat, and occasionally, as some of the small worms get free and coughed up into the nasal chambers, the sheep may be seen rubbing their head and nostrils on the ground, and sniffling to remove the cause of the irritation. It rarely happens, I believe, that large accumulations of worms in the lungs do not lead to emaciation, anæmia, and defective nutrition, with great debility and dropsy, unless the animals are suffocated by a lump of worms closing the windpipe.

It has been thought by some that the constitutional condition must precede the deposition of the germs and the development of the strongyli in the respiratory organs, but that this is not correct is proved by the animals continuing to thrive until, by the number of full-grown worms, the breathing is disturbed, the sheep are tormented, and fall back in condition. Other parasites accumulate in the liver or in the alimentary canal, and the animal falls into a state of hectic, with a manifest tendency to dropsy.

Concerning the prevention and treatment of this disease, it is only necessary to indicate, in the first place, the dangers attending the feeding of young sheep on the second and third crops of clover, after the first has been fed off by older sheep. To prevent the disease, you require fresh and sound pasture, and it may be necessary to supply a considerable quantity of artificial food. To cure the disease, inhalations of chlorine gas are recommended, or the internal administration of camphor and turpentine, in oil or ether. Sound food, such as oats, linseed-cake, cotton-cake, turnips, &c., must be allowed, with ferruginous tonics. The iron may be given to the extent of ten or twenty grains daily to each lamb, with a drachm of common salt.

On Pentastoma Tænioides of the Sheep.

Leuckart* has recently shown by experiment that Pentastomum denticulatum, which is found not unfrequently in the bodies of rabbits, is the partially developed Pentastoma tænioides which occurs frequently in the nasal cavities of the head or sinuses of the dog. Moreover, Leuckart has shown, that when this parasite has attained maturity in the dog's head, ripe eggs are thrown off to ensure the multiplication of the species. These eggs are given off and discharged with the mucus in the act of sneezing, &c., and they are then taken up by animals, in whose bodies the embryos undergo a certain stage of development.

The pentastomum had not been seen in its undeveloped state as scolex in all our domestic animals. It had been found in the abdominal cavity of goats and cats. In the first, the parasite was the pentastomum denticulatum, and in the second, pentastomum fera. Colin, however, has recently found it in the sheep and dromedary.†

In the mesenteric glands of the last-named animals, there exists an asexual linguatula, which acquires a generative apparatus on changing its habitation. These parasites penetrate the gland, and are lodged in a capsule which contains several individuals. As the containing capsule enlarges, disease of the gland tissue occurs. The parasite of the mesenteric glands is born of the eggs of the parasite of the dog, which are gathered up by the sheep with their food. The worm only remains a definite time in its first abode, as it pierces the glands and leaves a cavity which soon gets filled up.

* *Bau und Entwickelung der Pentastomen.* Von R. Leuckart. Leipzig and Heidelberg. 1860.

† See *Edinburgh Veterinary Review*, vol. iii. p. 682.

When a dog or wolf eats the entrails of animals in whose glands the parasites exist, the embryo may adhere to the lips and nose, and then pass into the nasal cavities. Fürstenberg says that the linguatulæ pass up the nose rapidly, and fix themselves by the hooks so as not to be expelled in the act of sneezing. These worms, which so suddenly change their habitat, increase in size, and their generative organs are developed in less than two months. They must remain a year in the nose of the dog, in order to attain complete development.

There can scarcely be a doubt, says Fürstenberg, that the linguatulæ found in mesenteric glands of sheep, belong to the same species as those discovered in cysts in the lungs of rabbits, and whose complete development in the dog Leuckart has witnessed.

Fürstenberg has therefore confirmed Colin's observations, and added some new facts as to the escape of the linguatulæ from the mesenteric glands.

EPIZOOTIC AND ENZOOTIC DISEASES OF THE HORSE.

Periodic Ophthalmia.

This is an affection of the eyes peculiar to the equine race, and which is often incurable and eminently destructive to the organs affected. It is a constitutional disease, localizing itself in the eyes, and generally leading to blindness. To this malady the names of *periodic* or *specific ophthalmia* are given, on account of the certainty of its recurrence even after an apparent cure; and that of *moon blindness,* from its recurring monthly, or, as was supposed, with special changes of the moon. It is sometimes sporadic, but at others enzootic, and affects a large proportion of the animals in a district. A knowledge of the causes of the malady is thus of much more importance than that of any system of treatment that has been suggested. The causes are *predisposing* and *exciting*. Among the predisposing causes may be mentioned the following:—

1*st*. Soils of a clayey and humid character have a deleterious influence on horses raised on them. These are soft and flabby, with a predominance of areolar tissue, thick skins, long hair, flat feet, and a general lymphatic temperament. Such horses seem more susceptible to morbid influences, and especially to those producing this disease. If removed to dry calcareous soils, the predisposition may remain latent throughout life; but, on the other hand, horses bred on the latter soils, and afterwards removed to the former, are very liable to contract the malady.

2*nd*. Soils naturally damp from their own character, or from that of the subsoil, and which have not been ameliorated by drainage, have the same influence on the constitution of the horse, and predispose to this affection in the same way as the argillaceous.

3*rd*. Excessive humidity of the atmosphere exerts a similar determining tendency, and, accordingly, periodic ophthalmia is a common disease on the banks of large rivers and lakes, and, in some cases, in the vicinity of the sea. So great is the influence of the peculiarities of soil and climate on the development of this disease, that Spanish dealers are said to buy up affected animals in the south-western departments of France, being convinced that, if they are transported to certain regions beyond the Pyrennees, the malady will disappear. Many parts of Ireland afford excellent examples of the truth of the above remarks.

4*th*. Fodder of inferior quality, which contains a larger amount of aqueous and few nutritive principles, has a debilitating effect on the general system, and thus predisposes to the disease. This influence is especially marked in the case of foals early separated from their dams and supported on fodder raised on marshy pastures. Horses imperfectly supported in other respects are similarly predisposed.

5*th*. Certain kinds of eye seem especially disposed to contract this malady. It is more prevalent in the small sunken eye than in that which is full, bright, and prominent. Percivall mentions black eyes as being most obnoxious to the malady, while Messrs Castley and Goodwin have seen lighter eyes suffer in an equal degree.

6*th*. Consanguinity is mentioned by Reynal as a predisposing cause, its mode of action being by reducing the stamina of the progeny.

7*th*. Of all influences tending to the development of the disease, none is more clearly established than the hereditary predisposition. Our best Yorkshire breeders would not employ a blind sire or dam, and, where such are had resort to, the progeny usually inherit the propensity in a marked degree. A similar conclusion has been arrived at by the best English and foreign veterinarians; and Reynal remarks that predisposition may remain latent in one generation and re-appear in the next.

Young horses, about the time of teething, are frequent subjects of the disease, and, accordingly, the French and some English veterinarians attribute it to the local plethora attendant on dentition. Percivall and D'Arboval have noticed its greater prevalence in geldings than in mares, a circumstance which has been explained by the greater local irritation in the former, connected with the cutting of the canine teeth.

Symptoms.—The malady may make its onset slowly, and show itself by a profuse flow of tears and some redness of the conjunctiva; but more commonly it originates suddenly, often during the night, and is first recognised by swollen eyelids, nearly closed, abundant lachrymal secretion, strongly injected conjunctiva, opacity of the cornea, protrusion of the haw over the globe of the eye, and considerable intolerance of light. It is generally referred to a blow; but the evident pain on exposure to light will often show that the deeper parts of the eye are involved. There is some fever indicated by hot dry mouth, hard pulse, and slight costiveness, but the appetite may still be good. On the second, or from that to the sixth day, the opacity of the transparent cornea becomes more marked, the whiteness being referrable to the interior of the eye, and a close examination shows this to be composed of a number of albuminous flocculi floating in the aqueous humour, and entirely hiding the iris. These flocculi have a white, or dirty yellowish-white, colour, and, in a day or two after their appearance, become in great part deposited in the lower part of the anterior chamber. They subsequently change to a greenish or brownish hue.

The symptoms commence to disappear at a time varying from the fourth to the tenth day or even later, and the tenderness becomes gradually removed, the intolerance of light ceases, and the cornea becomes clear. In the turbid aqueous humour numerous flocculi remain, and behind it the iris is seen, with a dull greenish or brownish aspect. As the absorption goes on, the cornea and anterior chamber become perfectly clear. The duration of an attack may vary from four or five days to forty. The first attacks are usually the longest, and their duration diminishes, as a rule, with their recurrence. During the progress of apparent recovery a relapse is not unfrequent, and the term may be thus indefinitely lengthened. The interval between the attacks is, on an average, about sixty days. The eye may seem quite clear during the intermission; but it has not returned to its normal condition. The outline of the upper eyelid is usually altered. It presents a slight bend in its internal part, so that the upper joins the lower lid, at the inner angle, by a right in place of an acute angle. This is best marked after several severe attacks, and gives a triangular outline to the opening between the lids. The iris of the affected eye is more contracted than the opposite; it has lost its lustre, and does not contract and dilate to the same extent as in the normal state, on the access of light and darkness. With the aid of the opthalmoscope, fibrinous deposits can commonly be seen on its surface, delicate flocculi in the anterior chamber and on the anterior aspect of the lens, and the choroid is observed to be altered in hue, with slight elevations on its surface.

The common termination of periodic ophthalmia is in cataract or opacity of the crystalline lens or its capsule. The iris sometimes gets attached to the anterior aspect of the capsule of the lens, and either remains permanently fixed, or, becoming lacerated during its movements, retains for the future a ragged margin, while the adherence of the colouring matter to the anterior aspect of the lens constitutes lenticular cataract. Amongst the ultimate results of this malady, Reynal enumerates opacity of the cornea; slight turbidity of the aqueous humour, with greater thickness and a more glutinous character; the formation of false membranes on the iris; metamorphosis of the lens, more or less completely, into a fibrous or cretaceous structure; adhesion of the lens to its capsule; partial or complete disappearance of the lens, probably by absorption; adventitious deposits in the vitreous humour, especially at its posterior part, where, in bad cases, there may be calcareous deposit; fibrinous deposits in the retina, and atrophy of the optic nerve as far as the corpora quadrigemina; similar deposits in the choroid, which presents numerous small rounded eminences; and, lastly, similar products of inflammation on the inner aspect of the sclerotic, and puckering of its substance commensurate with the absorption of the liquid contents of the eye.

Treatment.—In a disease such as that before us, preservative measures are much more effective than curative. These will consist in counteracting the various causes which predispose to the malady. Among them, efficient drainage, ventilation, and cleanliness; the use of aliments of good quality, and the avoidance of sires or dams that may have suffered from the affection, will hold prominent places.

Its therapeutical treatment is unsatisfactory. Bleeding—local and general—scarifications of the conjunctiva, purgation, fomentations, blistering, setons, rowels, collyria—sedative, astringent, and caustic—and numerous medicaments given internally, have been resorted to in turn, with only partial success. With or without these measures, the disease sooner or later disappears; but it is only for a time; and if one or other of the agents enumerated hastens the ameliorative process, very little has been gained, no medicinal measures can secure the eye against a succeeding series of attacks, until the inevitable consequence, the destruction of vision, results. Different veterinarians have recommended the application to the eye of strong solutions of nitrate of silver, bichloride of mercury, and the like; though perhaps an equal amount of good will accrue from the employment of milder astringent lotions of similar agents. Belladonna may be employed in the form of a lotion, to be applied to the eye daily during the severity of an attack, the object being to dilate the pupil, and break up any connections that may form between the iris and lens. The ordeal bean of Old Calabar has been employed in human medicine to contract the pupil, and, being applied alternately with belladonna, will move the iris through a greater space. When with the fever there is costiveness, a mild laxative will prove beneficial. In all cases, darkness will be found not only grateful to the patient, but also highly favourable to recovery.

INFLUENZA.

The term *influenza*—the Italian for INFLUENCE—is a highly improper one, but it is applied to a catarrhal or rheumatic affection usually associated with much derangement of the liver, subacute or latent inflammation of the pleuræ, and a low form of fever commonly called *typhous* or *typhoid.* The marked feature of the disease is its appearance amongst many animals simultaneously, often laying up all the horses on a farm, and carrying off several. It is especially within the last thirty years that information has been collected concerning this occasionally very prevalent disease, and its supposed—but not proved—greater frequency of late years, has been regarded as evidence of a change of type of disease from that form in which animals would bear free blood-letting to certain kinds in which active bleeding or purging are usually followed by great weakness and often by death. We can trace back to 1819 distinct outbreaks of the same influenza that we witness occasionally at the present day.

Influenza is essentially a protean malady, varying in its source in different outbreaks, and much according to the state of the weather. It is most common about spring and autumn, and said to be most dangerous during the prevalence of easterly winds. Influenza attacks young horses more than old, and is occasionally communicated from the sick to the healthy by infection or contagion. Veterinary surgeons have noticed that the animals they have ridden about in their practice have caught the disease from patients they have been attending, and there is usually such a succession of cases when one marked instance of influenza occurs, that it is likely that contagion exerts some influence in the spread of the disease. Continental authors, such as Professor Hering, describe three forms of influenza:—1st, The catarrho-rheumatic form; 2nd, The gastric, or bilious rheumatic form; and, 3rd, the gastro-erysipelatous form. In this country the line of demarcation between different forms of influenza has not been so finely drawn, though that there are differences may be gleaned from the recorded notes on various outbreaks. As a rule, with symptoms more or less prominent of a general febrile condition, there is great dulness and debility, frequent and weak pulse, scanty discharge of dry excrement and high-coloured urine, appetite lost, and there are often decided signs of jaundice. The eyes are more or less sunken, upper lid drooping, the conjunctiva of a yellowish-red colour; the buccal membrane of a similar tint, and the lips hanging; the animal's skin is dry and coat unhealthy-looking. In many cases of influenza, cough, and sore throat, a tendency to catarrh, or, in more common cases, to subacute or latent pleurisy, are characteristic features of the disease. In other cases, again, the symptoms of stomach staggers and partial paralysis of the hind quarters occur. In this, as in other forms of the disease, there is a great disposition to œdematous swellings, which have been regarded as erysipelatous on the Continent.

In 1861 a somewhat general outbreak of influenza occurred, which Mr Chapman of Gainsborough, in Lincolnshire, describes as having proved a fearful disease, "commencing in the *first stage* with *great prostration*, excited respiration, in some cases terribly laboured, accompanied with a painful grunt, ending in a sigh; pallid membranes; mouth filled with frothy mucus, very fœtid; extremities deadly cold; pulse, in many of the worst cases, imperceptible at the jaw, in the milder attacks very feeble, running up to 70 or 80.

In some cases there *seemed* abdominal irritation; the animal crouching, and pawing occasionally with the off fore foot; bowels sluggish in action, but *not* constipated. Auscultation showed *partial* congestion in the lung or lungs, with feeble and *peculiar action* of the heart."

The *post-mortem* appearances of influenza vary according to the character of the disease and the complications which arise during its progress. Very generally there is effusion on the thorax, recent adhesions, evidence of pericarditis, and sometimes of inflammation of the pericardium. In all forms of influenza of a rheumatic type, the lesions just named are discovered; whereas, in others, there is more evidence of bronchial catarrh, pneumonia, and the blood-changes are indicated by ecchymoses beneath the serous membranes, especially in the cardiac surfaces.

The treatment of influenza consists in placing the animal where it can breathe fresh air, and be without restraint. A loose box is the best place to keep it in. A mild purge I find usually to benefit the animal, using Cape instead of Barbadoes aloes. This is followed up by the following:—

Nitrate of potash	2 oz.
Carbonate of ammonia . .	1 oz.
Solution of the acetate of ammonia .	12 oz.
Water	12 oz.

This is to be divided in four doses, to be given night and morning. If effusion in the chest is threatened, I prefer giving digitalis and nitre in diuretic doses thrice daily for a couple of days; and the benefits derived from this treatment are great. Mustard poultices may be applied to the chest, but I do not approve of active blisters, rowels, or setons. When the acute symptoms subside, ferruginous tonics are highly beneficial, and the animals require a liberal diet and moderate exercise. Blood-letting, and other active depletive measures, cannot be too strongly condemned in the treatment of this disease.

Farcy and Glanders.

Under certain circumstances a specific disease is developed in the horse, characterized by the formation of a virulent animal poison, which is very destructive when introduced into the system of man and various warm-blooded animals. This specific disease is termed *farcy* when the local manifestations affect the skin; whereas, in a more severe form, the lungs are implicated, and the system is so generally impregnated with the poison as to destroy life with certainty, sooner or later—it is then called *glanders*. The terms farcy and glanders are meaningless and inappropriate. The first is an importation from the French by Sir William Hope, who translated Solleysell's work on the horse, and reproduced in the English version of this work the French word *farcin*. The second is derived from the word *glans*, gland, and has been applied to the disease from the enlargement of the submaxillary lymphatic glands met with in every case of this disease.

Farcy and glanders are diseases of temperate climates. They are unknown in very hot countries, and rare in very cold ones. They are capable of spontaneous origin in the horse, and especially is this the case with farcy; but the common cause of both affections is contagion. It is extremely rare to see a case of farcy or glanders that we cannot trace to communication from the diseased to the healthy; but in very foul stables, in badly ventilated mines, in the holds of ships on long and rough sea voyages, glanders may break out with great virulence. The two diseases are rife in times of war amongst horses engaged in the transport service, as well as those used by the cavalry. The prevalence of the diseases, under these circumstances, has been ascribed to privation, dirt, and bad management. Probably it is not a little due to the necessary congregation of animals of all kinds, healthy and unhealthy, and to the facilities for inoculation amongst animals often bruised, cut, and otherwise injured. It has been noticed, that mules engaged in the transport service in times of war suffer very severely from acute glanders, and, like asses, they are rarely attacked by chronic farcy or the slow and insidious form of glanders. In the French army the average annual loss by glanders amounts to 23.8 per 1000 horses, and 1.5 per 1000 die of farcy.

Symptoms of Farcy.—In the acute form of this disease, there are first the symptoms of irritative fever, such as shivering, followed by heat of body, frequent pulse, hurried breathing, dulness, &c. In the chronic form, the local signs first appear, and they consist in papulæ, or circumscribed inflammatory swellings of the skin, either situated around a wound, or on the course of the principal vessels of the head, trunk, or limbs. One or more isolated swellings or buds may occur, but usually they are seen to congregate, and are more or less connected with each other by corded lymphatics, which are very tender on pressure. Generally in the course of these inflamed lymphatics, slight tumefactions occur at the seat of the valves, and wherever a swelling begins a farcy bud forms. Each farcy bud suppurates; the pus discharged may at first be laudable, but is soon more or less ichorous and irritating. The opening through which each abscess bursts becomes enlarged by ulceration, and has no tendency to heal. The part which is the seat of the eruption may be more or less diffusely inflamed, and this happens especially with the hind extremities, which are the most frequently affected. The fore limbs suffer next in point of frequency, and next to the extremities we find the head most commonly implicated. The lymphatic glands in the vicinity of the part affected tumefy. Farcy may kill in eight or ten days, or continue in a chronic form for several months. When it kills it has usually been followed by glanders.

Symptoms of Glanders.—As in farcy, we find the premonitory signs of fever in this form of disease, and the animal dull and dispirited, with discharge at the nose. The discharge is at first watery and then purulent; it may attack only one nostril, right or left, or both, and the submaxillary lymphatic glands are swollen, solid, and have a tendency to adhere firmly to the inside of the jaw. The nostrils are often swollen, and more or less closed by the glutinous discharge, which soon becomes fetid and sometimes sanious. On opening the nostrils, pustules and ulcers are seen on the Schneiderian membrane, and as the disease advances, the ulceration extends so as even to lead to an open communication between the two nasal chambers. In some mysterious cases of glanders, the ulceration occurs in the false nostril; and I have often seen French veterinarians pass their thumb into the false nostril to feel for any such ulcer.

Ulceration of the Schneiderian membrane may occur in other diseases of the horse, but so rarely that we are apt to look upon it as truly diagnostic of glanders, and the diagnosis is confirmed when, on auscultation, the lungs are found implicated. The signs of the lung complications are,—difficult breathing; considerable constitutional disturbance in many instances, whereas in others there is simply dulness and percussion; and absence of respiratory murmur over considerable portions of lung, with tolerable resonance and loud murmur over others. The lung affection consists in the development of many abscesses interspersed throughout the lung tissue, and often associated with some amount of pneumonia. Too little attention has been paid to the auscultatory phenomena of cases of glanders, whether acute or chronic. When the lungs become much affected, the animal's appetite is disturbed, there is considerable weakness, anæmia, and tendency to wasting.

Death from glanders is due, in many instances, to the direct effects of blood-poisoning, characterized by stupor, fetid secretions, and impeded circulation. In other cases the animals sink in a state of hectic.

Farcy may be successfully treated by applying blisters round the buds, and caustics to the ulcers, whilst the system is supported by tonics. The remedies employed with greatest success internally have been arsenic, cantharides, sulphate of copper, sulphate of iron, quinine, and other vegetable and mineral tonics. Locally, the free use of antiseptics, such as chlorine water, carbolic acid, Condy's permanganates, &c., is to be recommended. Where an eruption of farcy buds occurs around a fetlock joint, and in the vicinity of a wound which is much inflamed, a poultice may be applied composed of linseed meal. When the warm poultice is made, a few ounces of liquor plumbi diacetatis can be mixed with it with advantage, and caustics afterwards applied. Attention must be paid to the organs of secretion, and laxatives or diuretics are required at intervals.

Glanders is an incurable affection, and any animal suffering from it should be instantly destroyed. We cannot too strongly condemn the practice of experimenting with glandered horses, as the danger of infecting men and animals is too great to be trifled with, and prevention is decidedly better than cure under such circumstances.

CHAPTER XVII.

NERVOUS ACTION.

Muscular irritability and nervous stimuli.—Reflex actions.—Physical nervous actions.—Mental nervous actions.—Nerve-cells and fibres.—Their functions.—Analysis of nervous matter.—Spinal cord.—Its structure and functions.—Functions of the groups of cells.—Crossing of sensitive impressions on the cord.—The brain.—Oblong medulla.—Pons varolii.—Cerebrum.—Cerebellum.—Their functions.—Uses of the medulla in respiration and deglutition.—Vital point.—Effects of pricking the floor of the fourth ventricle.—Effect of removing the cerebellum.—Turning or rolling as a result of injury to certain parts.—Removal of the cerebrum in birds, and its effects.—Cranial nerves.—Olfactory nerves.—Optic nerves.—Their functions.—The influence of their crucial and other fibres.—Auditory nerves.—Common motor nerves of the eye.—Pathetic nerve.—Abducent nerves.—Trifacial nerves.—Their varied functions.—Sympathetic ganglia on their course.—Facial nerve.—Its influence on the salivary glands.—Glosso-pharyngeal nerves—Their influence on deglutition.—Pneumogastric nerves.—Chauveau's experiments.—Effects on breathing.—Effects on the lungs when divided.—Action on the heart; on the stomach.—Spinal accessory nerves; their influence on the voice.—Hypoglossal nerves.

The nervous system is that part of the animal body to which all others are subservient, since it possesses the power of controlling and harmonizing the various functions essential to life.

The organs and tissues of the economy are, by virtue of properties inherent to them, capable of responding to stimuli or exciting causes, in such a manner as leads to the exercise of their individual functions. This inherent property is known as the excitability or *irritability* of the tissue. It is well exemplified in the contraction of muscular tissue on the application of a mechanical or chemical stimulus. Thus, if the point of a knife be applied to the muscle of a recently slaughtered animal, a contraction is induced of a more or less powerful character, according to the previous healthy and vigorous condition of the muscle. Again, if the leg of a frog be separated from the thigh, the skin removed, and the poles of a galvanic battery brought into contact with the surface of the exposed muscles, an energetic contraction takes place whenever the electric circuit is completed. In the healthy condition, this excitability is called into play through the nervous system, so that all the animal functions, whether these be of nutrition, sensation, secretion, absorption, or locomotion, &c., are subservient to this important apparatus.

In this case, however, the stimulus is not usually applied directly to the part the functions of which are to be activated; it is more commonly originated at a remote part of the system, or in the brain as the consequence of a mental act, and, in either case, is conveyed through the nervous system to the organ it is destined to affect. In this manner it is that the contact of sapid substances with the mucous membrane of the mouth leads to a secretion of saliva, or that the falling of luminous rays on the delicate expansion of the nerve of sight induces a contraction of the pupil.

It will be further noticed that these reflex actions, as they are called, when the impression is received at one part, and conveyed by the nervous apparatus to an organ more or less remote, co-operate to bring about the healthy exercise of the vital functions, and the maintenance of the frame in a condition of integrity. This is well exemplified in the above-named instances. The secretion of saliva, when aliment has been introduced into the mouth, is necessary to assist in mastication, deglutition, &c.; and when a powerful light falls upon the eye, the closing of the pupil is no less needful to intercept the luminous rays, and to prevent them striking on the bottom of the eye, dazzling the sight, and otherwise injuriously affecting the organ. The acts above cited are known as *physical nervous actions*, since they take their origin in a physical impression on some part of the economy. By means of this mechanism are sustained all the important vital functions, such as circulation, respiration, digestion, &c. In all such cases, the stimulus must be properly regulated as regards character, force, time, and direction, as otherwise it might prove not only abortive but even eminently injurious.

In *physical nervous actions*, the primary impression and the resulting movement may, one or both, be taken cognisance of by the mind, or *vice versa*. Thus, when a limb is suddenly withdrawn as a result of contact of the toes with a hot or other irritating body, both impression and result are quite patent to the mind, though the muscles of the leg were in action before the will had time to command. The act of breathing, of which we are quite conscious, results from an impression made by the circulating blood on the system, but especially on the lungs and brain, and of which we are unconscious, unless we for a time voluntarily suspend the respiratory process. Lastly, as an example of the exercise of both without the mind perceiving it, may be mentioned the movement of the intestines, as a result of contact between the ingesta and the mucous membrane. It may be concluded, that though the mind may take cognisance of, and even perfect such an action commenced independently of it, still in no case is perception or the exercise of the will necessary to the performance of such an act.

In addition to those spoken of above, may be mentioned physical nervous actions due to a morbid origin. Such are the involuntary movements which sometimes take place as a result of diseased conditions of the great nervous centres. These differ from those already noticed in not being due to reflex action, and accordingly bear an analogy to mental nervous actions.

Besides the purely physical nervous acts, there is another class of necessity connected with the mind, and hence termed *mental* or *psychical nervous actions.* These are of three kinds—*acts of perception, of emotion,* and *of volition.* 1*st,* Acts of perception include general and special sensibility, &c.; an impression in this case is made on some part of the body, and from that conveyed to the mind. 2*d,* Acts of volition, in which any portion of the body is moved in obedience to a mandate of the will: this, unlike the last, originates with the mind, from which the necessary stimulus is conveyed through the nervous system. 3*d,* Acts of emotion, with which we shall have less to do, are those actions which originate in peculiar psychical conditions, as in joy, anger, fear, &c., and which are in great part independent of the will.

In connection with the above mentioned functions, it is worthy of note, that, of all the systems of the animal body, the nervous alone is that upon which the mind can directly act, or which can act immediately upon the mind. This system, moreover, is peculiar to animals, and is a distinguishing characteristic of the latter, as compared with the vegetable creation. In the words of Dr Todd, "it is obviously the presence of a psychical agent, controlling and directing certain bodily acts of animals, which has called into existence the peculiar apparatus which the nervous matter is employed to form."

The nervous system is made up of two elementary structures—*cells* and *fibres*. "The nerve-cell has been described as consisting of an envelope, granular contents, and a nucleus with one or more nucleoli. So far, there is no difference between the so-called nerve-cell and any other cell; but it is the great diversity in size, its frequent coloration with pigment, and the brilliancy of a vesicular nucleus which may be regarded as somewhat characteristic of the nervous element, which is usually stellate, round, or

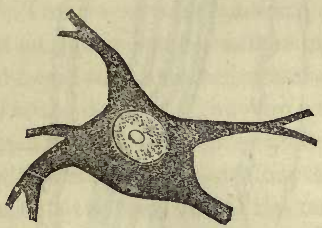


Fig. 208.—Multipolar nerve-cell, showing its nucleus and nucleolus.

oval, and connected with fibrous prolongations. Some of the cells are as large as $\frac{1}{300}$th of an inch in diameter, and they are not unfrequently as small as $\frac{1}{3000}$th. Vesicular bodies are interspersed amongst the cellular elements."

"The nerve-fibres are found in the nervous centres, and in the nerves which connect the latter with the peripheral parts of the body. They are combined with, or spring from, the nerve-cells in the grey matter of all nervous ganglia. The ultimate nerve-fibres are of two kinds—tubular or white and grey or gelatinous. The white have a *special envelope*, in the interior of which is Remak's primitive band or axis cylinder (Purkinje), surrounded by a medullary sheath or white substance of Schwann. The tubular fibres have been called medullated by Kölliker, to distinguish them from the non-medullated. The latter occur in organs of special sense, when delicate plexuses are formed as in the retina, or the olfactory and auditory apparatuses, and have a structureless envelope containing a clear granular axis without the white substance."

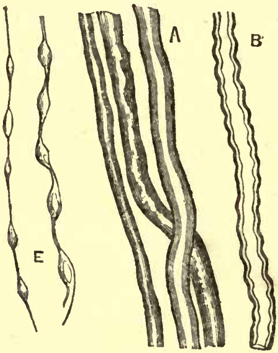


Fig. 209.—Tubular or white nerve-fibres. A indicates the dark outline produced in the medullary sheath by exposure; B shows the double contours in a nerve-fibre; and E the varicosities resulting from traction or pressure.

"Gelatinous fibres have been described by Remak, Henle, and others, and are found associated with the elements already noticed. They are flat, slightly granular, nucleated, and about $\frac{1}{5000}$th of an inch in diameter."—*Anatomy of the Domestic Animals. Gamgee and Law.*

The nerve-cells which exist in the grey or cineritious matter of the brain and other nervous centres, are the generators of nervous force and recipients of sensory impressions, and their presence in any part indicates it to be a nervous centre or ganglion. They generate nervous force, however, only when a proper stimulus is conveyed to them, as referred to under the heads of Physical and Mental

Nervous Acts. In some few instances they may be supposed to originate such force, as exemplified in the persistent contraction in which are maintained the sphincter muscles of the anus and neck of the bladder. Some nervous centres (in the brain) are alone capable of taking knowledge of sensory impressions; and these impressions accordingly, if from distant parts, and especially from such organs as are supplied by the sympathetic nerve, have to traverse one or more ganglia before they can be made patent to the mind.

The nerve-fibres are incapable of generating nervous force of themselves. Their sole functions are to convey such force generated in the nervous centres to the peripheral parts of the body, and to convey sensations and impressions from such parts to the centres. They are simply conductors of nervous force, and are aptly represented by the conducting wires of an electric machine, whilst the centre, as the generator of force, is the analogue of the machine itself.

The white fibres make up a great portion of the brain and spinal cord, as well as almost the entire bulk of the nervous trunks, with which these are directly connected. They seem much more tough and resistent in the nerves than in the centres; but as the fibres are in the two cases identical, this appearance is entirely dependent on the amount of white fibrous tissue by which the nervous fibres are enveloped.

The grey fibres make up the main part of the various branches of the sympathetic nerve, and enter in varying proportion into the formation of the cerebro-spinal nerves.

Nerve-fibres lie side by side in the nerves, but throughout their whole course they maintain an entire independence of each other. There is no union of individual fibres in the nerve, nor any bifurcation of single fibres to permit a more extensive distribution. A nerve accordingly possesses a definite number of fibres at its point of origin from the nervous centre, and has neither more nor less at its peripheral extremity, each fibre passing in an unmodified condition from its origin to that part of the tissue or organ in which it is destined to ramify. Nerves, it is true, frequently become connected or anastomose with each other, but this union results alone from an interchange of fibres, while each of these continues to maintain its distinct individuality. The anastomoses of nerves is thus principally intended to ensure a wider distribution of nervous fibres coming from the same centre, and to obviate to some extent the occurrence of paralysis from injury to a single centre or nervous trunk. Where a free anastomosis of this kind take place between a number of nerves, the structure is known as a *plexus.*

Regarding the origin of fibres in a nervous centre, there is some difference of opinion. Some anatomists assert that the fibres form loops which lie in the grey substance and in contact with the nerve-cells, with which, however, they have no direct structural connection. On the other hand it has been clearly demonstrated that in the ganglia the fibres arise directly from the tails of the caudate (stellate) cells, and Schröder van der Kolk and others have satisfactorily shown that a similar origin is at least frequent in the spinal cord.

The modes in which nervous fibres terminate in the tissues are varied. The nerves commonly break up into small branches, which arrange themselves in plexuses, and from these individual fibres are given off to terminate as follows: 1st, *In loops,* a single fibre bending backward in the substance of the tissue and entering either the same or an adjacent nervous trunk, in which it is understood to follow a retrograde course to the nervous centre; 2d, Sometimes the fibres seem to loose their dark outline and white substance, become less distinct, and are ultimately lost in the substance of the tissue; 3d, In some cases the ultimate nerve-fibres seem resolved into minute plexuses, as in some of the serous membranes; 4th, Sometimes they terminate in free ends which may enter minute ovoid bodies—*Pacinian bodies*—met with at certain parts of the surface of the true skin; 5th and lastly, they may terminate, as in the eye and ear, by becoming connected with true nerve-cells. The presence of such cells, however, constitutes the part a true nervous centre.

Nerve-fibres, we have said, are conductors of impressions and of nervous force. It is remarkable that in the performance of these different acts special fibres are employed, and this remark applies equally to the cerebro-spinal and sympathetic systems. Thus, in both alike there are certain fibres which conduct impressions only towards the nervous centre (*sensory, afferent,* or *centripetal*), and others conduct only *motor force* (*efferent* or *centrifugal*). No nerve fibre can convey more than one kind of impression. There is no difference in the size or appearance of these fibres to indicate their special functions, so that their relative properties can only be ascertained by observing their action under the influence of a stimulus. This is ordinarily supplied to sensory nerves by external objects applied to their extremities, and to motor by the will, or some reflex stimulus through the medium of a nervous centre. Any stimulus, however, applied to the trunk of a nerve, is sufficient to bring it into a state of activity; and it does not import whether this stimulus is mechanical, chemical, electrical, or a simple excess of heat or cold. The application of any such excitant to the trunk of a sensory nerve leads to the idea of pain, &c., not only in the irritated point, but also in those parts in which the peripheral ends of the nerve are situated. It is on this account that, after the amputation of a limb, pains are often endured, which are referred by the patient to the excised member. If, on the other hand, one of these stimuli be applied to the trunk of a motor nerve, a contraction takes place in the muscles to which it is distributed, notwithstanding that the nerve may have been divided in the interval between the part irritated and the nervous centre. It is thus seen that the functional activity of a nerve may be aroused by a simple modification in the condition of its fibres, and the effect is the same as if it had originated in the nervous centre or peripheral extremity as the case may be, and had been conveyed along the whole length of the constituent fibres.

Nerve-fibres can only act in one direction. Thus, if a sensory nerve be divided, and the peripheral extremity subjected to irritation, no sensation is experienced. Irritation of the portion still in connection with the brain, however, gives rise to the most lively pain, referable, as above stated, to the part from which the nerve conducted. In the same manner, if a motor nerve be divided and an irritant applied to the end still in connection with the brain, no effect either sensory or motor is produced; but when that in connection with the muscles is treated in a similar manner, a contraction in the latter immediately follows. These experiments can only be satisfactorily made by cutting down upon and irritating the inferior and superior roots of the spinal nerves, the former being exclusively motor, the latter exclusively sensory. At any other point of their course, the nerves contain fibres of both varieties, and no relative experiment can be made.

When a section has been made of a motor nerve, and its detached end stimulated so as to produce a powerful muscular contraction, cries of pain are frequently elicited, which Bernard considers due to what he styles a *recurrent sensibility* in the nerve. Brown-Séquard, however, and Chauveau, the able teacher of anatomy and physiology in the Lyons Veterinary College, who have carefully investigated the subject, deny the truth of Bernard's theory, and attribute the pain to the violent muscular contraction alone.

It is worthy of note, that if a nerve is subjected to a serious injury, it often loses for a time all power of performing its accustomed functions. Of this kind is the condition of shock which supervenes on serious accidents, and in which the patient may remain for hours quite unconscious of any painful sensation.

Chemically considered, nervous-tissue is composed of water, albumen, fatty matters, and salts. No perfectly satisfactory relative analysis of the white and grey nervous matter has been made. The best is the following, by Lassaigne:—

	Grey.	White.
Water, ...	85·2	73·0
Albuminous matter, .	7·5	9·9
Colourless fat, . .	1·0	18·9
Red fat, . . .	3·7	0·9
Osmazome and lactates,	1·4	1·0
Phosphates, . . .	1·2	1·3
	100·0	100·0

Fremy states that the fatty matters consist of cerebric acid, which is most abundant, oleic, margaric, and oleophosphoric acids, and of cholesterine. He remarks, further, that in the brain the fatty matters are confined to the white substance, and that the latter loses its colour when these have been removed. Vauquelin remarks that the spinal cord contains more fat than the brain; and L'Heritier, that the nerves contain more albumen and soft fat than the brain.

In Mammalia, the nervous system is in two great subdivisions—the *Cerebro-spinal* and the *Sympathetic*.

The *Cerebro-spinal* system, called by Bichat the nervous system of animal life, includes the brain and spinal cord, together with the nerves connected with these centres, and the ganglia situated on the course of the nerves or in the brain. This division presides over those acts with which the mind is more immediately connected,—as the mental, and even a large proportion of the truly physical nervous actions.

The *Sympathetic* or *Ganglionic* system presides over those physical nervous actions which are not directly connected with the mind,—as the functions of digestion, circulation, nutrition, &c. On this account it has been named by Bichat the nervous system of organic life. It consists of a series of nervous ganglia, lodged in different parts of the body, connected with each other, and, to a less extent, with the *Cerebro-spinal* system, by nervous cords, and sending off nervous trunks to ramify in the surrounding tissues.

ANATOMY AND PHYSIOLOGY OF THE SPINAL CORD.

The spinal cord or spinal marrow is that part of the cerebro-spinal system which is contained in the spinal canal of the backbone, and extends, in our domestic animals, from the head to a short distance behind the loins. It is an irregularly cylindrical structure, divided into two lateral symmetrical halves by fissures; a superior and an inferior median, of which the former is the deeper. It terminates posteriorly in a pointed extremity, which is continued by a mass of nervous trunks (Cauda Equinæ). Running along the supero-lateral aspect of each half of the cord, is a third, though much shallower groove (supero-lateral), corresponding to the points of origin of the superior roots of the nerves, and dividing the inferior from the superior column. In the middle of the inferior column is a line formed by the exit of the motor roots of the nerves, and which is sometimes made to signify a further division into inferior and lateral columns.

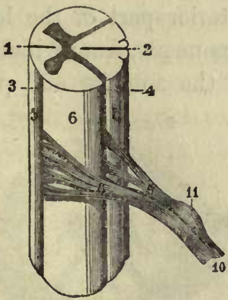


Fig. 210.—Portion of the spinal cord showing its cut end. 1, Inferior longitudinal fissure; 2, superior longitudinal fissure; 3, inferior columns; 4, line giving origin to the sensory roots of the spinal nerves; 5, line of origin of the motor roots; 6, lateral columns; 7, superior columns; 8, motor roots; 9, sensory roots; 10, mixed nerve; 11, intervertebral ganglion on the sensory roots.

A transverse section of the cord reveals that it is composed of white matter externally, and of grey internally. The grey matter is arranged in the form of two crescent-shaped masses, placed back to back, and joined to each other by a transverse portion or *commissure* (grey commissure). The *horns*, of grey matter, extending upwards from the commissure, are longer but narrower than those which project downwards. The former extend to the surface of the cord, at the point where the sensory roots of the spinal nerves are connected with it; the latter extend downward and outward towards the anterior roots, but stop short before reaching the surface. The inferior columns are still further connected by a portion of white matter extended across, between the grey commissure and the inferior median fissure. This is the *white commissure* of the cord. The cord is not of a uniform diameter throughout. Its dimensions vary according to the number and size of the nerves which originate from any particular point; as, for example, in those parts which correspond to the lower end of the neck and the posterior part of the loins, it presents two considerable enlargements, from which originate the great nervous trunks of the anterior and posterior limbs. The

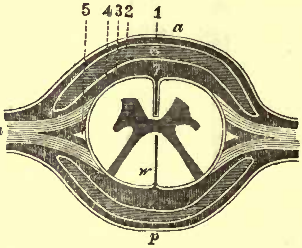


Fig. 211.—Transverse section of the spinal cord and its membranes. *a*, Inferior aspect; *p*, superior aspect; *n*, nerve; 1, dura mater; 2, 3, outer and inner layers of arachnoid; 4, pia mater; 5, ligamentum denticulatum; 6, arachnoid cavity; 7, subarachnoid space.

weight of the cord in middle-sized animals is, according to Chauveau—in the horse, 75½ dr. (300 grammes); in the donkey, 38 dr.; in the cow, 55 dr.; in the sheep and goat, 770 gr.; in the pig, 1078 gr.; in the dog, 539 gr.; in the cat, 123 gr.; and in the rabbit, 77 gr.

The spinal cord does not fill up the whole spinal canal. The latter contains, besides, a large venous sinus, fatty matter, the membranes of the cord, and the cerebro-spinal fluid. The latter is a serous liquid, which exists between the cord and its serous covering, on both its superior and inferior aspects, and is so abundant that the cord seems to float loosely within it. It is usually more abundant in old animals. Bernard remarks that, owing to the collection of blood in the sinus during expiration, and to its withdrawal through the suction power of the chest during inspiration, this fluid is thrown up toward the brain in a regular succession of waves; and that a prolonged expiration will accordingly lead to more or less vascular compression of the brain.

The spinal nerves—42 or 43 in number in the horse—arise each by two roots, a superior or sensory, and an inferior or motor. The former, which is the larger, has, at the point of exit from the spinal canal, a small ganglion, in which, according to Leydig, the nerve-vesicles are *bipolar* (having two prolongations). One prolongation of each cell is continuous with an afferent fibre, whilst the other is prolonged into one passing to the cord. Outside the spinal canal, the roots meet to form mixed nerves, which contain both sensory and motor filaments.

A knowledge of the minute structure of the spinal cord, and the mode in which its various parts are connected with the nerves, is an essential preliminary to the proper understanding of the purpose it fulfils, in connection with the various movements of the body.

The antero-lateral columns of the spinal cord, according to Van der Kolk, consist of white fibres running in great part longitudinally and parallel to each other; though, to some extent, arranged in a transverse direction. The former class seem to pass directly to the brain, and probably convey volitions to the motor ganglionic cells in the anterior horn of grey matter. Of the transverse fibres, some are merely the nearest of the longitudinal turned inward to gain the ganglionic cells; others consist of fibres passing across the inferior or white commissure, which is entirely made up of such decussating fibres; a third class are the fibres which form the roots of the motor nerves passing outward, usually in two bundles, toward the surface of the cord.

The anterior horns of grey matter contain superficially a number of marginal or circumferential fibres intermixed with small ganglionic cells. These fibres, which are derived from those of the column, are connected with the cells, and these in turn with larger ganglionic cells placed in the middle and anterior part of the horn. The large cells are arranged in groups, and each group, according to Van der Kolk, represents and presides over a muscle or a group of muscles, which act always in concert. These cells are *multipolar*, the prolongations going some to connect them with superficial small cells, or directly through the longitudinal fibres of the anterior column with the brain; some to the adjacent cells of the same group; some to join the cells in the posterior horn of grey matter; and others to form the roots of the motor nerves.

The posterior columns are, like the anterior, made up of (1.) longitudinal fibres externally, which become oblique internally before they pass into the grey, and (2.) of transverse fibres, which, passing outward from the grey matter, form plexuses amongst the longitudinal. Some of the longitudinal fibres are continuous with fibres of the superior roots of the nerves, which accordingly proceed directly to the brain without entering the grey matter: these are the sensitive fibres. The transverse fibres seem, on the other hand, to be the reflex roots. These latter pass through the substance of the superior grey horn to join some groups of

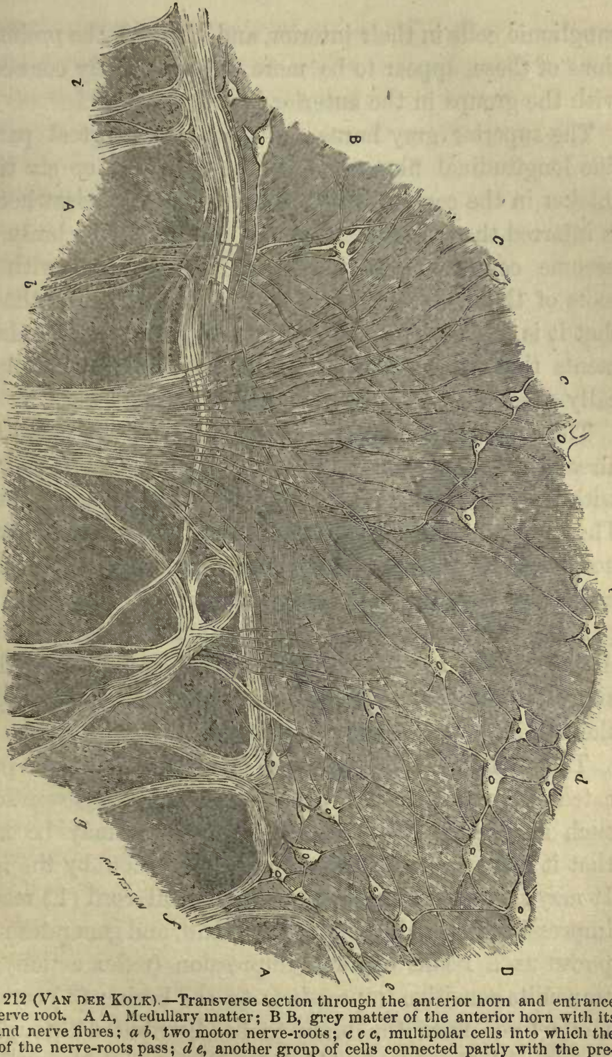


Fig. 212 (Van der Kolk).—Transverse section through the anterior horn and entrance of a nerve root. A A, Medullary matter; B B, grey matter of the anterior horn with its cells and nerve fibres; *a b*, two motor nerve-roots; *c c c*, multipolar cells into which the fibres of the nerve-roots pass; *d e*, another group of cells connected partly with the preceding, partly with one another, and which receive numerous filaments from the marginal fibres surrounding the grey matter; ***f g h i***, grey radii; their fibres either pass at once into cells, as at *f*, or penetrate to the remote cells, as at *h*, or they form marginal fibres, as at *i*, all of which seem to be lost in remote cells, and decussate with the nerve root ***a***, without passing into it.

ganglionic cells in their interior, and, through the prolongations of these, appear to be more or less directly connected with the groups in the anterior horns.

The superior grey horns are made up in great part of fine longitudinal fibres, and, as they are five or six times thicker in the cervical and lumbar bulbs than elsewhere, it is inferred that the fibres do not extend to the brain, but become connected, at these points especially, with the roots of the motor nerves. This is supported by the fact that it is in the parts presided over by the above enlargements that reflex actions are most frequently and energetically effected.

The centre of the superior horns presents the nerve-cells already referred to, and their surface has marginal fibres with smaller cells similar to those of the anterior horns. The grey commissure is formed of white fibres; these are not, however, any more than those of the white commissure, connected directly with any nerve-roots. They seem, in part at least, to connect the ganglion cells which on the different sides receive the reflex roots, and Van der Kolk suggests that they may insure a co-ordinate movement of the two sides of the body in reflex actions.

The spinal cord is possessed of all the functions predicated of nervous centres, being itself but an aggregation of such structures. This simple reservation may be made, that it cannot directly affect or be acted on by the mind. It may be stated shortly, that the spinal cord (1.) receives impressions from all parts of the trunk, and generates motor power as a result of such impression (reflex action); (2.) transmits sensitive impressions to the brain; (3.) conducts motor force from the brain to be distributed through the corresponding nerves; (4.) harmonizes motor power, and leads to a simultaneous and uniform action of muscles, which contribute to the same movements in the body. Before noticing these, however, a few remarks will be given on the excitability of the cord itself.

It is held by many physiologists, that the columns of the cord correspond to the roots of the spinal nerves in this; that while the anterior columns are possessed of no sensibility the posterior are acutely sensitive throughout. M. Chauveau has carefully investigated this matter, having sacrificed as many as eighty horses in his experiments, and his conclusions are such as to modify greatly the above statement. The following are his results :—

1st, *On the Cord separated from its connection with the Brain.*—In this case, when the division of the cord was made in the upper or middle third of the neck, respiration was kept up artificially. On pricking or scratching the surface of the anterior or lateral columns, care being taken not to come in contact with the motor nerves, *no evidence of sensibility was obtained.* On treating similarly the surface of the posterior columns, *contractions* took place in the muscles supplied by the adjacent motor nerves. When slightly irritated, muscular contractions took place on the same side only; when more actively irritated, similar effects were noticed on the opposite side, and on both of a more extensive character.

2d, *On the Spinal Cord connected with the Brain.*—Scratching of the anterior and lateral columns produced, as before, *no result.* Irritation of the posterior columns led to signs of pain and active (involuntary) muscular contraction. Varying the amount of irritation produced effects similar to those observed in the detached end, and the pain was most lively when the outer border of the column was touched, becoming less and less so toward the superior median fissure.

3d, *Excitability of the deep parts of the Spinal Cord.*—The cord having been carefully cut across in the interval between two spinal nerves, and the adjacent cut surfaces scratched, no effect is produced even in the case of the posterior columns, while the excitability of the outer surfaces of these is retained, though less vividly than before. Again, a needle may be passed in any direction through an unsevered cord without producing the slightest effect, provided always the surface of the posterior column is respected. If passed into the latter, pain and convulsions are noticed as it penetrates the outer layer, but after this it passes through the cord in any direction without effect If, in the course of this experiment, the roots of the nerves were touched, or the nervous matter in their immediate vicinity, effects were induced exactly like those resulting from the direct irritation of those nerves.

4th, *After Death.*—If the surface of the superior column, or the root of the sensory nerve, be scratched immediately after the last beat of the heart, they do not respond, while, if the application is made to the motor nerve, active contractions may for some time take place.

Dr Brown-Séquard, who met with results identical with those of Chauveau, remarks, that while physiologists had erred in attributing a lively sensibility to the whole posterior column, at the same time the stimulus used in his and Chauveau's experiments might be insufficient to elicit the slight sensibility inherent in the internal parts of the cord. It may, however, be safely concluded that the sensibility of the spinal cord only exists to any extent on the surface of the posterior columns.

The reflex action of the spinal cord has been already referred to (page 387). It is the sole act of the cord as a nervous centre, is in itself entirely independent of the will, and consists in the reception of an impression through the sensory nerves, and the consequent generation of nervous force to be transmitted through the motor trunks. According to Van der Kolk, the transmission is effected through the ganglionic cells in the superior horn of grey matter, and the fibres which connect these with the motor cells in the inferior horn; nervous force is generated in the latter, and conveyed along the motor nerves. Each group of cells in the anterior horns is understood to preside over a distinct muscle, or over several which act in unison, so that the application of a stimulus to a group leads to a natural and harmonious action. The groups being connected somewhat less intimately with each other, a more powerful impression leads to a simultaneous emission of force by two or more adjacent to each other, and to a more extensive though still natural movement. Moreover, the cells in the two lateral halves of the cord are connected in an analogous way, and accordingly reflex movements on the two sides simultaneously are by no means uncommon.

One of the most remarkable instances of this latter movement is in the case of the decapitated frog. He will remain quite still until an irritant is applied to some part of the body, when, if not severe, a foot may be mechanically raised to remove it; if, on the other hand, an active irritation is made, the reflex movement will be much more extensive, and may even go the length of a leap. An instance almost quite as remarkable is that in which, from disease or injury of the spinal cord, its lower portion is cut off from all communication with the brain. No pinching or injury of the lower limbs can be felt, and no effort of the will can effect their movement; yet, by tickling the sole of a foot, a sudden withdrawal of the limb may be still brought about.

The excitability of the cord, as exemplified in reflex actions, may be morbidly increased or diminished. In certain states of disease, as tetanus, or in poisoning by strychnia, it becomes so susceptible that the slightest sound or touch will often throw the whole voluntary muscular system into violent spasmodic action.

This reflex action is highly important as a protecting agent in case of irritants brought into contact with the body, but it is an agent in many other functions of a no less important character. The sphincter muscles of the bladder and anus are entirely dependent on a constant reflex action to keep them closed. Accordingly, when injury or disease has destroyed the functions of the lower part of the spinal cord, these relax, and the contents of the bowels and bladder escape involuntarily, and it may be without the knowledge of the patient.

The dilator muscle of the iris is under the control of that part of the cord which corresponds to the second dorsal nerve. Under the stimulation of the posterior columns or sensory roots at this part, the muscle contracts, and a marked dilatation of the pupil is effected. The transmission takes place through the sympathetic nerve.

By reflex actions the spinal cord seems to control, to some extent, the movements of the intestines, nutrition, and animal heat. Thus organic diseases of the cord are always accompanied by obstinate constipation, evidently dependent principally on the absence of the muscular movements of the intestines. The wasting of paralyzed parts may probably have a similar origin, since the circulation, and necessarily the nutrition, is greatly favoured by the muscular movements. Lastly, the heat of the body is largely dependent on the integrity of the cord, since, in broken-backed animals, the parts supplied by nerves given off below the lesion are usually cold, but always vary in temperature.

The spinal cord is a conductor of sensitive impressions to the brain, and it has been held that the transmission is effected through the posterior columns, while the anterior columns conduct motor power only. This, however, seems incorrect. The transverse section of one-half of the cord, and the posterior column of the other half, does not prevent the transmission of impressions of sensation to the brain. Bernard, who found such impressions conveyed even after cutting the anterior and lateral columns, rightly concludes that sensative impressions are largely conveyed through the gray substance; but Dr Nonat, Brown-Séquard, and others, have arrived at the conclusion, founded on numerous carefully conducted experiments, that not only do the grey matter and posterior columns convey such impressions, but that the anterior columns as well are to a limited extent possessed of a similar property. Dr Nonat, moreover, insists that not only do the anterior columns convey sensory, but that the posterior, in their turn, are capable of transmitting motor force. In either case, however, this substitution takes place only to a limited extent.

The fibres of sensation cross each other in the whole length of the spinal cord, those of motion only in the medulla oblongata. Brown-Séquard cut transversely through one lateral half of the spinal cord, and then divided the motor roots of the lumbar nerves on the other side, that the opposite hind limb might not be contracted by reflex movement; and on pinching the limb on the same side as the cord was divided, the most marked symptoms of suffering were elicited. The opposite limb had at the same time become insensible. The decussation of the fibres would seem to take place close to the roots of the nerves into which they enter, as the following experiments show. 1*st*, A part of the spinal cord was bisected longitudinally, so as to separate the two lateral halves of the cord from each other; the result was, that sensibility was destroyed in the parts supplied by nerves which leave the cord opposite the portion operated on. 2*d*, The right half of the cord was cut across in the dorso-lumbar, and the left half in the cervical region, with the effect of inducing a paralysis of sensibility, complete, or nearly so, in both hind limbs. The left half of the body and the left fore limb were in this case morbidly sensitive, while the right fore limb was almost destitute of this property. The crossing of the fibres conducting these impressions has been well illustrated by Lockhart Clarke.

Fig. 213 (Lockhart Clarke).—Diagram showing the crossing of the sensory fibres in the spinal cord. *r*, Right side; *l*, left side; *s*, section in loins; *s'*, section in the neck; *f*, fibres imparting sensation to the right hind limb; *f'* to *f''*, fibres imparting sensation to the left hind limb.

We have remarked that the anterior columns are the chief conductors of motor power from the brain. Schiff, however, goes further, and ascribes to the anterior columns proper the transmission of such to the limbs only, while he particularises the lateral columns as performing a similar office with regard to the muscles of the trunk. They would seem also to be presided over by distinct nervous centres, so that they act in a great measure independently of each other. In support of this view, it may be mentioned that *hemiplegia* is not, as its name would indicate, paralysis of one-half of the body, but only of the muscles connected with the two limbs (fore and hind), while those of the trunk remain unaffected, as evinced in the normal continuance of respiration.

THE BRAIN.

The brain or encephalon is that part of the cerebro-spinal axis, which is contained within the cranium, and may be considered as simply an enlargement, consisting of numerous ganglia at the anterior extremity of the spinal cord. This part alone can hold direct intercourse with the mind; it only conveys sensations to the intellect, and gives rise to acts of will. Forming thus the highest part of the system, one rightly expects to find it attaining its greatest development in those creatures which are most exalted in the animal scale. This is true in general terms, and yet requires considerable qualification. It will be seen, by reference to the table given below, that if we judge of the intelligence only by the relative size of the brain, we must place the cat highest, followed by the dog, rabbit, ram, goat, and donkey. The horse will be degraded to a rank below all these, and placed on a level with the most stupid of ruminants. It would thus seem that nothing can be more liable to sources of fallacy than any attempt to predicate the extent of the intellectual endowments from the comparative development of the brain. Not to enter at present into the discussion of this subject, it may be stated that in no other animal does the brain, as compared with the body, attain a bulk at all proportionate to that of man—that in no other class is its development so great as in mammals; and that in no invertebrate animal is the brain so large as in the lowest specimens of vertebrata.

Table indicating the Weight of the Encephalon and Spinal Cord, as compared with that of the Body.—(Colin.)

Species of Animal.	Weight of Body.	Weight of Brain.	Weight of Cerebellum.	Weight of Medulla oblongata, and Pons varolii.	Total Weight of the Encephalon.	Weight of the Spinal Cord.	Weight of the Encephalon and Spinal Cord.	Relation between the weights of the Encephalon and Body.	Relation between the weights of the Cerebro-Spinal Axis and Body.
Stallion, .	382·000	494	76	46	616	304	920	:: 1 : 620	:: 1 : 415
Gelding, .	380·000	559	77	39	675	300	975	:: 1 : 563	:: 1 : 389
Mare, . .	408·000	510	71	34	615	269	684	:: 1 : 663	:: 1 : 461
Ass, . .	175·000	316	45	24	385	159	544	:: 1 : 454	:: 1 : 321
Hinny, .	186·000	466	67	31	564	198	762	:: 1 : 329	:: 1 : 244
Bull, . .	293·000	403	52	33	488	177	665	:: 1 : 600	:: 1 : 441
Cow, . .	332·000	416	44	30	490	225	715	:: 1 : 677	:: 1 : 464
Ram, . .	46·000	112	15	10	137	52	189	:: 1 : 336	:: 1 : 243
Goat, . .	37·500	95	15	12	125	48	173	:: 1 : 300	:: 1 : 217
Pig (fat), .	157·500	132	18	12	162	70	232	:: 1 : 972	:: 1 : 679
Sow (lean),	74·000	85	11	9	105	44	149	:: 1 : 705	:: 1 : 497
Dog, . .	7·450	56	8	4	68	13	81	:: 1 : 110	:: 1 : 92
Cat, . .	2·342	20	4	2	26	7	33	:: 1 : 90	:: 1 : 71
Rabbit, .	2·135	...	...	...	8·5	4	12·5	:: 1 : 251	:: 1 : 171

That portion of the cerebro-spinal axis contained within the cranium has been subdivided into four portions, namely, the oblong medulla, which is continuous with the spinal cord; the brain (cerebrum), which occupies the greater part of the cranial cavity, and is placed anteriorly; the little brain (cerebellum), placed behind the brain proper and above the oblong medulla; and, lastly, the *pons Varolii*, or *tuber annulare*, a ring-like eminence at the anterior part of the medulla, and occupying the point of union of the three above-mentioned parts.

The whole mass consists of a series of ganglia and nerve-fibres, the former being sometimes connected individually with others in adjacent parts of the encephalon, so that a short outline of its anatomy will be needful.

The oblong medulla presents an external appearance somewhat similar to that of the spinal cord; it is, however, larger, especially in a sense transversely from side to side, and more flattened from above downward. The increase of bulk depends on the presence of a considerable amount of grey matter in its substance, on new fibres originating from this and passing in a longitudinal direction, and on numerous transverse fibres passing across between the various grey nuclei or coming from parts adjacent to the medulla. The superior and inferior fissures, which are so noticeable in the spinal cord, have almost disappeared in the medulla.

On the lower aspect of the medulla, we observe on each side of the median line a pyramidal mass (anterior pyramid) of white matter, wider and more diverging from its fellow in front than behind. It is not continued back into the cord, but makes its appearance on the lower aspect of the medulla, where many of its fibres seem to arise from masses of grey matter, and terminates anteriorly in the pons Varolii. Its internal fibres, which, according to Stilling, represent the motor-fibres of the lateral column, decussate in the median line with similar fibres from the opposite side; and it is here, accordingly, that volitional motor force crosses from one side to the other. The rest of its fibres pass up to the brain on the same side. It consists entirely of white nervous matter. The *restiform bodies* are two rope-like bodies on the outer side of the anterior pyramids. They are continuous with the posterior, and part of the antero-lateral, columns of the cord, but are made up also in great part of fibres originating from grey masses in the medulla, and of others descending from the cerebellum, into which it seems to be continuous, forming its posterior peduncle. On the superior aspect are seen two pyramidal bodies (posterior pyramids), which originate in some fibrous bundles on each side of the superior median fissure, and on reaching the medulla diverge from each other, becoming applied against the inner side of the restiform bodies, with which they seem to coalesce. Arnold has, however, traced them up into the brain proper. The interval between the posterior pyramids is the floor of the fourth ventricle of the brain, at the anterior part of which is the opening of a minute canal, which is continued along the whole length of the spinal cord between its grey and white commissures.

The *pons Varolii* is a quadrilateral elevation on the lower aspect of the brain, and forming the anterior limit of the medulla and the posterior of the brain proper. It is broader in front than behind, and has well-defined anterior and posterior borders. It is composed of grey matter, and of longitudinal and transverse fibres; a large number of the latter pass upward to form the middle peduncles of the little brain.

In the cerebrum or brain proper, the white matter is placed on the surface and the white within, so that it differs in this respect from the parts already noticed. Viewed from above the cerebrum is seen to be composed of two symmetrical halves (hemispheres), divided by a deep median longitudinal fissure. The surface is not smooth, but thrown into a great number of convolutions with intervening fissures, penetrating more or less deeply into the white substance, and thereby largely increasing the superficial extent of the grey matter. The grey matter of these convolutions preside over mental acts; and accordingly in animals, with a large intellectual development, a proportionate increase in the number and depth of those convolutions is met with. A transverse groove on the lateral aspect of each, between the anterior and middle third, is known as the *fissure of Sylvius*. In this fissure are some semi-detached convolutions, known as the *island of Reil*. These are the first convolutions to appear in the lowest animals possessed of a cerebrum.

On turning to the base of the brain, a number of objects come into view, the principle of which we will enumerate, commencing from behind. From the anterior border of the *pons Varolii* start out two considerable columns, the *pillars of the brain*, or *crura cerebri* (*d d*.) These diverge in passing forward towards the right and left hemispheres, and leave between them a space known as the *intrapeduncular space.* The cerebral pillars are crossed in a direction from without forward, and inward by two rounded white bundles (optic tracts), (2″ 2″), which, on reaching the median line suffer an interchange of fibres with each other, so as to form the *optic commissure* (2′.) The optic tracts form the anterior boundary of the intrapeduncular space. In the intrapeduncular space is the pituitary body (*e*), the use of which is unknown. Beneath this is a mass of grey matter, perforated by a canal which leads to the third ventricle (infundibulum), close beside the last is a small grey mass (tuber cinerium), behind which is a white body (corpus albicans), and still more posteriorly the *posterior perforated space,* through which many fibres from the medulla pass upward to gain the cerebral hemispheres.

In front of the optic tracts are the anterior perforated spaces which lie beneath two striated bodies (corpora striata) placed on the floor of the lateral ventricles. In front of each anterior perforated space is the *olfactory bulb,* a considerable prolongation of nervous matter, grey without, white within, and containing a cavity which communicates with that of the corresponding lateral ventricle.

Turning once more to the superior aspect of the brain, and separating the hemispheres, we meet at the bottom of the longitudinal fissure with a mass of white matter (corpus

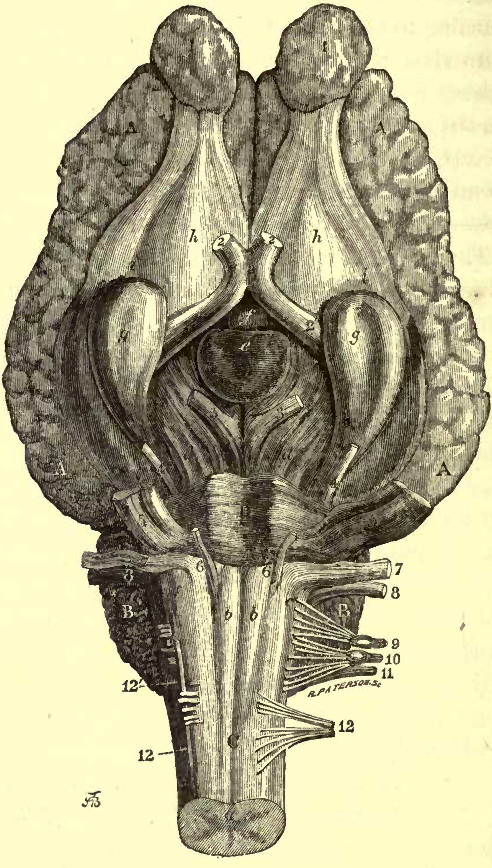


Fig. 214.—The lower part of the encephalon. A A A A, Hemispheres of the brain; B B, cerebellum; *b*, oblong medulla; D, pons Varolii; *a*, posterior cut end of the medulla; *b b*, anterior pyramids; *c c*, restiform bodies; *d d*, pillars of the cerebrum; *e*, pituitary body; *f*, corpus albicans; *g g*, mastoid lobes; *h h*, anterior perforated spaces; *i i*, external roots of the olfactory bulbs; 1 1, olfactory bulbs; 2 2, optic nerves; 2′, optic commissure; 2″ 2″, optic tracts; 3 to 12, corresponding cranial nerves; 12′, spinal roots of the spinal accessary.

callosum) consisting of fibres passing between the hemispheres. It is only about two-thirds the length of the hemispheres, and approaches nearer the anterior than the posterior extremity. Its function seems to be the connecting of the two hemispheres in intellectual acts.

If we cut off one of the hemispheres just above the level of the corpus callosum, and make a downward incision to one side of the latter, we open into the lateral ventricle of that side. The principal objects to be seen on its floor are:—1*st,* Toward the outer and anterior part of the ventricle a pear-shaped body (corpus striatum, 4 4) formed

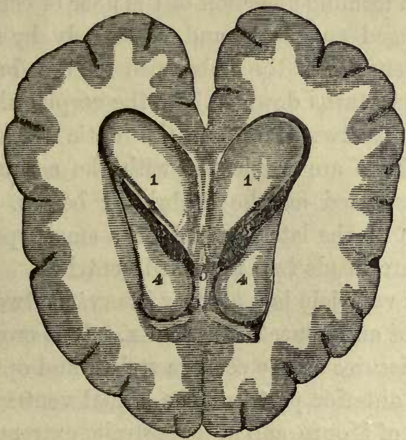


Fig. 215.—Transverse section of the cerebrum, showing the lateral ventricles. 1 1, Hippocampi majores; 2 2, teniæ semicirculares; 3 3, choroid plexus; 4 4, corpora striata; 5, portion of the fornix.

of grey matter externally and white internally. This is connected with the substance of the brain and the *optic thalamus.* The latter is a considerable eminence at the posterior and inner part of the ventricle, where it is covered by the *choroid plexus* (3 3), an intricate network of minute blood-vessels projecting into the ventricle. A bundle of white fibres passes between the corpora striata on the two sides, and two commissures, one white and one grey, between the optic thalami. The lateral ventricle has two prolongations, one into the olfactory bulb and the other downward outward and forward into the substance of the hemisphere. In the latter are noticed a large curved eminence, the *hippocampus major*, or *cornu ammonis*, so called from its resemblance to a ram's horn, and an elongated white ridge, the fimbriated body. The *fornix* is a triangular white structure placed between the two optic thalami, and forming a portion of the floor of each ventricle. It is prolonged anteriorly and posteriorly by four pillars which descend into the substance of the brain. Each anterior pillar turns down to join the corpus albicans, and is reflected backward to join the optic thalamus. The posterior pillars are connected with the corpus callosum, and are continued as the fimbriated bodies. From the anterior part of the lateral ventricle a small opening (foramen of Monro) leads into the third ventricle.

The third ventricle is a cleft or interval between the two optic thalami and beneath the fornix. It is crossed by the three commissures of the corpora striata and optic thalami, opens at its anterior part into the lateral ventricle through the foramen of Monro, and at its posterior extremity through the aqueduct of Sylvius into the fourth ventricle.

Behind the third ventricle, and in front of the cerebellum, are some important structures. Applied against the posterior part of the optic thalami, and connected with these and with the anterior pillars of the fornix by two bands of white matter, is a small reddish body, the *pineal gland*. Immediately behind this, and above the aqueduct of Sylvius, is a large body partially divided into four by two fissures which cross each other at right angles. These are the corpora quadrigemina. These are larger in the lower animals than in man; the two anterior are largest in solipeds and ruminants, and the two posterior in carnivora. On each side of the corpora quadrigemina are two grey bodies bent upon themselves (corpora geniculata), which, with the former and the optic thalami, give origin to the corresponding nerves of sight. From the posterior part of the corpora quadrigemina two considerable white processes pass upward and backward into the little brain, of which they constitute the *anterior peduncles.* Stretched across between these peduncles, and above the anterior part of the fourth ventricle, is a white expansion containing also grey striæ, and known as the valve of Vieussens. In this valve may be noticed the fibres of origin of the fourth cranial nerve.

The *little brain* or *cerebellum* lies above the medulla and behind the brain. It is of considerable size in our domestic animals, and consists of two lateral lobes joined in the median line by an elongated worm-like eminence (vermiform process). The whole surface is covered by rugæ, with intervening depressions, in which the external grey matter dips deeply into its substance. The great depth of these grey folds gives to the central white substance an arborescent appearance, from which it takes the name of Tree of Life (arbor vitæ). In the substance of each hemisphere is a grey nodule indented at its edges, the dentated body of the cerebellum. This body contains ramifying white layers internally.

The white substance of the cerebellum is connected to adjacent parts by six prolongations of its substance, arranged in pairs, and known as its *peduncles.* The *anterior peduncles* pass downward and forward to join the corpora quadrigemina. The *middle peduncles* pass directly downward to join the lateral parts of the pons Varolii. The *posterior peduncles* pass downward and backward to become continuous with the restiform bodies.

In passing from the spinal cord to the medulla oblongata, the grey matter is met with more abundantly, becoming mixed up with all parts save the anterior pyramids. The superior horns become enlarged, diffused, and extended in a more lateral direction. Special grey nuclei likewise appear near the superior aspect of the medulla, and give origin to the roots of the nerves, such as the glosso-pharyngeal, hypoglossal, vagus, auditory, and spinal accessory. The posterior of these are imbedded in the substance of the medulla, but more anteriorly they stand out as rounded grey masses on the floor of the fourth ventricle. Two pairs of the nuclei lodged in the restiform bodies demand especial mention. These are the *olivary bodies.* They consist externally of a white material containing a grey nucleus thrown into folds or indentations, and in this, in turn, is a central white matter thrown into diverging branches. These bodies, which are extremely rudimentary, are connected respectively with the roots of the facial and hypoglossal nerves.

The fibres of the posterior columns are generally held to enter the substance of the restiform bodies, and proceed directly to the cerebellum. Van der Kolk, however, affirms that they terminate in the medulla in those nuclei which form the seat of sensation, while the fibres of the posterior peduncles of the cerebellum which join the restiform bodies become transverse, and either pass directly to the same pillars on the other side, or terminate in grey nuclei within the medulla.

Of the lateral column some fibres join the restiform bodies and ascend to the cerebellum, some decussate with their fellows in the median line and pass chiefly to the opposite anterior pyramids, while a certain number pass directly upward through the posterior perforated space to enter the substance of the hemispheres of the brain. Van der Kolk supposes that most of these fibres end in nuclei in the medulla which presides over respiration, and that the ascending fibres are conductors of impulses of volition from the brain to those centres.

The anterior columns seem to give up a portion of their fibres to the restiform bodies and cerebellum, while others decussate in the anterior pyramids like those of the lateral columns, and ascend through the pons to the corpora quadrigemina and cerebral hemispheres.

The *pons Varolii* is composed of numerous transverse and longitudinal fibres interspersed with much grey matter. The superficial white layer of transverse fibres is continuous with the middle peduncles of the cerebellum. Beneath this is a layer formed of similar transverse fibres, and the longitudinal fibres from the anterior pyramids, largely mixed up with grey matter. Still deeper is a layer of longitudinal fibres forming the continuation of the lateral columns.

The cerebellum may be looked on as a great ganglion, with the grey or ganglionic matter surrounding the white fibres on all sides except the lower, where the latter pass out as the peduncles. Of these peduncles the median passes chiefly into the two lateral lobes, the anterior into the posterior part of the vermiform process, and the posterior into its anterior and middle portion.

The principal masses of white fibres in the brain are arranged in three sets—the *ascending, transverse,* and *longitudinal.*

The *ascending* are those of the pillars of the brain, which, coming from the *anterior pyramids, lateral columns,* and *posterior pyramids,* acquire additional fibres in passing through the pons Varolii, optic thalami, and corpora striata, and from the latter diverge into all parts of the hemispheres. Fibres of a similar kind are derived from the anterior peduncles of the cerebellum, the corpora quadrigemina, and the corpora geniculata.

The *transverse fibres* pass between the two sides of the brain, and are collected in great part into the corpus callosum. The white bands which connect the corpora striata and the optic thalami belong to the same order.

The *longitudinal* fibres are represented in great part by the fornix, the fibres of which, passing from the optic thalami, join the corpus albicans, whence they turn upward and backward in the median line, and ultimately bend down to become connected on each side with the hippocampus major and fimbriated body. At its posterior part it is connected with the pineal body. A layer of longitudinal fibres on the upper aspect of the corpus callosum, and several other smaller bundles of the same kind, likewise belong to this class.

The oblong medulla performs functions similar to those of the spinal cord as a conductor of nervous force. These are more important, however, as it will be seen from its position that all truly sensory impressions from parts supplied by spinal nerves must traverse the medulla in their course toward the sensorium, and in all voluntary movements of such parts the motor impulse must pass through its substance to gain the nerves of innervation. The same may be said of all reflex motor power originating in the medulla itself.

As a nervous centre this portion of the brain likewise performs functions in the highest degree important to animal existence. It presides especially over the two functions of deglutition and respiration, and accordingly its removal leads to a sudden cessation of breathing and almost instant death.

The component parts of this organ would seem, as regards sensibility, to have some relation to the corresponding parts of the spinal cord. Thus, Longet found that irritation of the anterior pyramids seemed painless, whilst the slightest touch of the restiform bodies led to acute suffering. In addition, the anterior pyramids are the sole conductors of motor power, in proof of which Magendie observed, after section of one of these, a complete absence of voluntary movement on one half of the body, the sensibility meanwhile remaining unimpaired. The fibres of the anterior pyramids, moreover, cross over from one side to the other in the median line—a fact explanatory of those cases of transverse paralysis in which, from injury of one side of the pons or ganglia of the brain, paralysis of voluntary movement ensues on the opposite side of the body. Motor nervous force, accordingly, from the two sides of the brain, decussates in the oblong medulla, as we have already seen that sensory impressions do in the whole course of the spinal cord. The crucial transmission of impressions to and from the brain is best illustrated in some cases of disease. Several cases are on record of paralysis of one side of the body co-existing with atrophy of the opposite side of the brain (Van der Kolk); and every one conversant with sheep is aware of the imperfect control over one half of the body, when the opposite half of the brain contains a large hydatid.

The vital importance of the oblong medulla depends chiefly on the functions it performs as the centre of the respiratory process. To effect an inspiration, a very complex series of actions are brought about; thus, the muscles of the nostrils and cheeks must be acted on by the facial nerve, the larynx opened by the pneumogastric, the diaphragm contracted by the phrenic, which leaves the spinal cord at the fifth and sixth segments of the backbone, and the muscles of the trunk thrown into action by the spinal nerves in the region of the back, before a satisfactory inspiration can be brought about. This is not all, however. The action of all the muscles implicated must be simultaneous, not only with each other, but especially so with those of the opposite side, and a perfect harmony must exist as to force and duration of impression. According to Van der Kolk, the various nuclei of these nerves are intimately connected with each other by nerve-fibres, and those on the two sides are similarly connected through the numerous transverse fibres that exist in the substance of the medulla. He holds, moreover, with Sir Charles Bell and Schiff, that the lateral columns of the cord preside especially over the respiratory movements of the trunk, and that as these terminate in nuclei close to the origin of the pneumogastric nerve, the intimate connection of movement between these and the others referred to is easily understood. Here, then, as in the spinal cord, are groups of ganglionic cells, forming the origins of different nervous trunks, and so intimately connected by intervening fibres, that under a single impulse they lead to a harmonious action of muscles situated in widely different parts of the body.

The impression which leads to the respiratory process seems conveyed principally from the lungs through the pneumogastric nerve, and results from the presence, in the pulmonary capillaries, of blood charged with carbonic acid. The extensive connections of the oblong medulla, however, leads to its being affected by many other causes, and a sudden full inspiration results, as every one knows, from the sudden contact of the surface of the body with cold water. Even the normal respiratory movement does not depend on the pneumogastric nerves alone, since, when both these nerves have been divided, a slow and irregular breathing is still kept up.

Some influence may be exerted by the spinal cord over the muscles of respiration, which supply the trunk, since Richardson and Brown-Séquard mention that they have noticed the respiratory movements in newly-born mammals after the oblong medulla had been entirely removed. There can be no doubt, however, that the action of other parts is almost, if not entirely, subsidiary. Thus, if the whole brain be removed, care being taken not to injure the medulla, life may continue for a considerable time, and respiration may continue uninterrupted. A complete division of the spinal cord at the lower end of the neck paralyzes the thoracic muscles, so that the movements of the thorax are thereafter continued only by the diaphragm. Again, section of the cord in the upper part of the neck paralyzes the latter, and breathing is at once arrested. Respiratory movements of the face may still take place, but none whatever in the body.

Flourens has attributed to a small nucleus of grey matter, lodged in the floor of the fourth ventricle, and close in front of the point where the posterior pyramids diverge from each other, the function of presiding over respiration, and to some extent over the movements of the heart. The nucleus in question he called the *vital point*, from the circumstance that when it was pricked or otherwise irritated, respiration was at once arrested, and frequently the action of the heart ceased as suddenly. Brown-Séquard has, however, actually excised this nucleus without respiration being at once arrested or interfered with, and finds, moreover, that it has no power to arrest or reduce the heart's action if the pneumogastric nerves have been previously divided. He concludes from this that the so-called vital point is not essential to life, and that the fatal interference with respiration and circulation, resulting from a wound of this nucleus, is entirely dependent on the irritation of adjacent parts.

It results that the oblong medulla is the centre of respiratory movement, and, accordingly, any serious injury of this organ is instantly fatal, while the remainder of the brain may be entirely removed, if done with proper precautions, without immediate cessation of vital processes.

The process of deglutition, like that of respiration, is dependent on the oblong medulla, as is proved by its persistence after the brain proper and the cerebellum have been removed, and by the inability to swallow after the medulla has been disorganised in experiments. This complex act is effected through the facial, hypoglossal, glosso-pharyngeal, pneumogastric, and probably the spinal accessory nerves acting on the jaws, cheeks, tongue, palate, pharynx and gullet. The whole is a reflex act, and results from the successive and regular action of the above nerves on the different parts engaged. The nerves on the two sides must also act in perfect unison, and all this seems dependent on the peculiar and intimate connection of the grey nuclei from which they originate.

The olivary bodies, in the opinion of Van der Kolk, preside over the articulation of sound, and their partial or complete destruction, in the human subject, leads to a corresponding loss of the power of speech. The above author instances a number of cases in which the patients could understand but could not articulate speech, and in which examination after death revealed that these organs were either altered by disease, or otherwise partially or completely absent. This theory would seem further corroborated by the fact, that though in the domestic quadrupeds two of these bodies exist on either side, they are so rudimentary that veterinary anatomists have frequently denied their existence. Both in man and in animals they are connected with the nuclei of origin of the facial and hypoglossal nerves.

It is curious, as shown by Bernard, that the pricking of the floor of the fourth ventricle, between the roots of the eighth and tenth cranial nerves, causes diabetes mellitus (secretion of sugar in the urine). If the pricking is made a little higher, the secretion of urine is diminished, and it becomes albuminous. If the puncture is made still more forward, near the pons, and close behind the root of the trifacial nerve, it leads to a great increase of the salivary secretion.

The pons Varolii is the medium of connection between the three other divisions of the brain, and, accordingly, contains fibres from each of these parts. The difficulty of experimenting upon this organ, from its position and its proximity to other parts of the most vital importance to life, and the numerous functions it possesses as a conducting agent, renders it extremely difficult or impossible to ascertain its precise properties. Longet found that the irritation of the inferior parts was not painful, but produced convulsions of the face, limbs, and other parts. Interference with the posterior part, on the other hand, produced lively suffering. Brown-Séquard infers, from the analysis of cases in which this organ was diseased, that its central part is the conductor of sensory impressions to parts higher up, while the inferior portion is the conductor of volitional force.

As a nervous centre, it seems to preside to some extent over some cranial nerves, such as the facial and abducens, which are connected with ganglia in its substance. It seems, besides, to be the first cerebral centre in which any power of sensation resides. This is proved by the experiments of Flourens and Longet, in which, after removal of the cerebral hemispheres, cerebellum, optic thalami, corpora striata, and corpora quadrigemina, so as to leave nothing but the pons and medulla, the animal still cried out on its tail being pinched, and raised its paw to its nose when that part was irritated by ammonia. The subject sought to lie in an easy posture, and if disturbed immediately resumed it. When left alone, the animal invariably remained quite passive and motionless. When the pons itself was removed, no further response was made on the application of an irritant, but the creature remained quite dead to surrounding things, the only vital movements retained being those of the respiratory and circulatory processes.

The functions of the cerebellum are by no means well understood. It has been held by Gall and Spurzheim, that it presides over the reproductive function, and varies in size according to the activity of the latter. Facts, however, rather oppose this theory. Many animals which are notoriously salacious, as kangaroos and monkeys, have comparatively small cerebelli, and the relative weights of this organ in entire and castrated horses point in the same direction. M. Leuret took the weight of the cerebellum absolutely, and as compared with that of the cerebrum, in ten stallions, twelve mares, and twenty-one geldings. The result of the absolute weights is given in the following table :—

	Average.	Highest.	Lowest.
Stallions, . . .	61	65	56
Mares, ...	61	66	58
Geldings, . . .	70	76	64

The greater weight of the cerebellum in geldings is the more remarkable, that the cerebrum of the stallion is on an average heavier than that of the gelding. This tends the more to remove the suspicion of fallacy in the comparative examination.

Flourens, Hertwig, Longet and others, have removed the entire cerebellum of birds piecemeal, and found that when the middle layers were reached, the movements became violent and irregular, while after the removal of the whole, all power of springing, flying, walking, or standing was lost. Sight and hearing, with sensation, volition, and memory, were still retained, and the bird would struggle violently to escape from any loud noise or threatened blow. It could no longer control and harmonize the action of its muscles in its attempts to fly; but fluttered and reeled as if intoxicated. From these experiments Flourens inferred that the cerebellum controlled and harmonized the various muscular movements, while Foville, with quite as much reason, attributes the symptoms to the loss of muscular sense.

Brown-Séquard calls both of these theories in question, and insists that the want of harmony between the movements depends not on the destruction of the cerebellum, but on the irritation to which the neighbouring parts are subjected. In support of this he adduces a case in which the cerebellum was deeply wounded in the human subject, notwithstanding which the man could still walk steadily, and even ascend a ladder alone.

He is further of opinion that the cerebellum controls to some extent the circulation in the cerebrum and its nutrition, and that injuries of the former will, by modifying the latter, lead to various abnormal influences in different parts of the body. Among these he enumerates amaurosis, vomiting, headache, dilatation of the pupils, local or general convulsions, epilepsy, and hemiplegia, all of which occur also from certain conditions of the viscera, as in intestinal worms. In each case, he supposes the brain and oblong medulla as the immediate agent, acting under the influence of the cerebellum or intestines, as the case may be. Many symptoms, accordingly, noticed as resulting from injuries of the cerebellum, are not attributable to it as a separate nervous centre, but rather to the influence it exerts on those adjacent.

The different parts of the brain proper seem entirely destitute of sensibility, and may be cut away piecemeal without inducing the slightest indication of pain. The irritation of certain parts, however, gives rise to convulsive movements of various kinds, and the most remarkable is that of turning or rotation of the animal on its longitudinal axis. It is found that irritation or transverse section of one pillar of the cerebrum near the optic thalami causes the subject to roll over and over from the wounded to the sound side, and this movement may continue uninterruptedly for hours or days. Injuries to various other parts induce a similar rotation, or a turning from one side to the other, after the manner of a horse in a circus. Brown-Séquard has tabulated the results of these injuries, as follows :—

Parts producing Turning or Rolling after an Injury on the Right Side.

TURNING OR ROLLING BY THE RIGHT SIDE.	TURNING OR ROLLING BY THE LEFT SIDE.
1. Anterior part of the optic thalamus. (Schiff.)	1. Posterior part of the optic thalamus. (Schiff.)
2. Hind parts of the crus cerebri. (Schiff.)	2. Some parts of the crus cerebri near the optic thalamus. (Brown-Séquard.)
3. Tubercula quadrigemina. (Flourens.)	3. Anterior and superior parts of the pons Varolii.
4. Posterior part of the middle peduncle of the cerebellum. (Magendie.)	4. Anterior part of the middle peduncle of the cerebellum. (Lafargue.)
5. Place of insertion of the auditory and facial nerves (Brown-Séquard and Martin Magron.)	5. Place of insertion of the glosso-pharyngeal nerve. (Brown-Séquard.)
6. Neighbourhood of the insertion of the lower roots of the pneumogastric nerve. (Brown-Séquard.)	6. Spinal cord near the oblong medulla. (Brown-Séquard.)

Brown-Séquard remarks, that in some cases turning may result from vertigo, but attributes it, in the great majority, to spasms of the muscles on that side to which the animal turns. The fibres conveying the impression are, in his opinion, a special set, and quite distinct from those which usually act under the control of the will.

The corpora quadrigemina and corpora geniculata, which are connected with the roots of the optic nerves, seem to preside over the sense of sight, and destruction of these by disease or otherwise invariably leads to blindness. Wasting of the eyes may likewise induce diminution of these organs. In either case, the effect takes place on the opposite side—thus, disease on the right side of the corpora quadrigemina produces blindness of the left eye.

Injury to one side causes, as already noticed, a rotary movement of the body, probably from the induced blindness and vertigo.

The optic thalami, notwithstanding their name, do not preside over vision; and they may be removed without, to any extent, interfering with this sense. The removal of one optic thalamus, however, leads to continued rotary movements; the animal standing and turning perpetually to the injured side. If both are removed, the animal can still stand, and even use his limbs in walking, but no longer turns to one side. The turning thus seems dependent on a want of balance between the action of the two organs. The true physiological importance of these bodies is by no means well understood.

The corpora striata are placed between the crura cerebri and the hemispheres, and contain many fibres passing from the one to the other. They may consequently be supposed to exercise some influence on sensation and volition, but what their real functions are has not been satisfactorily made out. A more or less complete paralysis of the posterior extremities followed their mechanical injury in the experiments of Colin and others; the effects, when one only was injured, showing themselves on the opposite side of the body. This is, however, not invariable; and the statement of Magendie, that animals, after removal of these bodies, show an irresistible tendency to move rapidly forward, has been contradicted by more recent investigators.

The hemispheres of the brain are acknowledged, on all hands as implicated in the performance of the higher mental acts in the human subject, and in those acts of memory and intellect by which the animals immediately below man are characterised. The size of the hemispheres, accordingly, and the amount of the superficial grey matter, as determined by its thickness and the depth of the convolutions, bear an approximation, though not constant relation (see Table, page 410), to the development of the intellect. In the highest fishes they are still extremely rudimentary, their size not exceeding that of the corpora quadrigemina (optic lobes). In reptiles, their size is relatively much greater; and in birds, they have so much increased as almost to hide the corpora quadrigemina from view. Amongst quadrupeds, the dog presents himself as at once possessed of considerable intelligence and a large cerebral development; but above all, in the elephant do we meet with the greatest mental endowments, and, relatively to the size of his body, the largest cerebral hemispheres. It need scarcely be added that of all animals the human subject presents the best example of a large cerebrum and a correspondingly powerful intellect.

In further confirmation of this view, it may be stated that in man congenital deficiency or atrophy of the hemispheres is usually accompanied by a corresponding deficiency of mental power. Sudden and severe injury of the hemispheres, as in apoplexy, may instantly deprive the subject of all power of mind. Gradually increasing pressure, as in the case of hydatids, in one of the hemispheres produces a stupor which constantly augments with the development of the cyst and the absorption of brain matter. Lastly, the removal of the hemispheres leads to results of a similar nature. This can be effected in birds without any immediate danger to life. In the language of Dalton, "the effect of this mutilation is simply to plunge the animal into a state of profound stupor, in which he is almost entirely inattentive to surrounding objects. The bird remains sitting motionless upon his perch, or standing upon the ground, with the eyes closed and the head sunk between the shoulders. The plumage is smooth and glossy, but is uniformly expanded by a kind of erection of the feathers, so that the body appears somewhat puffed out and larger than natural. Occasionally the bird opens his eyes with a vacant stare, stretching his neck; perhaps shakes his bill once or twice, or smoothes down the feathers upon his shoulders, and then relapses into his former apathetic condition." Common and special sensibility are retained, but the animal is unable to associate the impressions with the ideas of their ordinary causes or sequelæ. Thus, the pinching of a foot causes the animal to move uneasily once or twice from side to side, but does not otherwise affect him. A pistol discharged behind his back leads him to open his eyes and turn his head half round, but does not seem to suggest any idea of danger or injury, and he immediately relapses into his condition of quietude. Longet found that by moving a lighted candle before the eyes of the bird, in a dark place, the eyes and head often follow it from side to side, and the eyes are sometimes fixed for several seconds on an object in the quiescent state.

The power of connecting ideas received from external objects seems entirely lost, and memory does not appear to retain an impression from one moment to another. But a tolerable control is exerted over the voluntary muscles, and if thrown into the air, the creature is still capable of flying.

The hemispheres, thus, do not seem essential to sensation, or even to some acts of volition, but are especially designed to receive and retain impressions, to associate ideas, to draw conclusions from them, and to preside over those movements which require a deliberate act of the mind.

The physiology of the remaining parts of the brain proper is by no means well understood. The corpus callosum has been supposed to effect a connection between the two hemispheres in the more complex mental actions. It should be remarked, however, that cases are known of absence or destruction of one hemisphere, in which all the more common acts of the mind seemed to be quite normally carried on.

The fornix and commissures of the optic thalami and corpora striata are supposed to connect those organs on the two sides between which they are placed, so that the action on the two sides may be uniform; but their true function has been by no means satisfactorily ascertained. The functions of the pineal and pituitary bodies are equally involved in mystery.

The nerves originating from the encephalon are 24 in number, and arranged in pairs, which are named first, second, third, &c., counting from before backward. They also receive special names, according to their functions, or the parts to which they are distributed. They may be classified according to their functions; thus, 1st, *Nerves of special sense*—olfactory, optic, auditory, part of the glosso-pharyngeal, and the lingual branch of the fifth. 2d, *Nerves of common sensation*—the greater part of the fifth, and a portion of the glosso-pharyngeal. 3d, *Nerves of motion*—third, fourth, smaller division of the fifth, sixth, seventh, and twelfth. 4th, *Mixed nerves*—pneumogastric and spinal accessory.

The first pair, or olfactory nerves, arise from the olfactory lobes, two prolongations of grey matter from the anterior part of the cerebrum, and of very large size, in the domestic animals. The nerves pass, as numerous filaments, through two perforated bony plates, to ramify in the mucous membrane in the depth of the nasal chambers. It is acknowledged on all hands that these nerves preside over the special sense of smell, and accordingly we find them largely developed in those animals which possess this sense acutely. M. Bernard has, however, thrown some doubt on the question whether these are the only nerves presiding over this sense. His objections are principally founded on the case of Marie Lemens, in whose brain the autopsy showed an entire absence of olfactory lobes. Singularly enough, the testimony of those most intimate with this woman went to show that she disliked very much the odour of tobacco; that she was fond of flowers, and smelt them like other people; that she worked in a kitchen, and smelt and tasted the dishes in the usual manner. And, lastly, that in her last illness she constantly complained of the disagreeable odour of her abundant perspirations. Standing alone as this case does, and being, moreover, a congenital infirmity, too great importance ought not to be attached to it, and stronger evidence must be adduced before it can be acknowledged that the fifth, the only other nerve which sends branches to the nose, assists in any degree in the appreciation of odours.

Optic Nerves.—The second pair of nerves consist of white bands, which, from the corpora striata, corpora geniculata, and especially the corpora quadrigemina, pass downward round the outer side of the crura cerebri, turn forward and inward to decussate with each other in the median line, and proceed through special bony canals to their respective eyeballs. Their expansion in the eyeball (retina) contains numerous ganglionic cells, and must be considered as a true nerve centre. At the point of decussation, some fibres pass from the cord on the one side to that proceeding to the opposite eye; some pass into the cord which proceeds to the eye on the same side; some pass into the opposite cord, in which they proceed backward to the brain; and a fourth set, coming from the eye on the one side, crosses over and reaches the opposite eye without becoming connected with the brain. This nerve presides exclusively over the sense of vision, and by these crossings of the fibres, and the resulting connection of the centres implicated, the unity of vision is most satisfactorily accounted for. These nerves likewise give rise to the reflex action by which the pupils contract. They are utterly insensible to pain, and if irritated, give rise only to the impression of sparks or vivid flashes of light. If divided, vision is lost, and the iris ceases to contract through loss of its accustomed stimulus of light.

AUDITORY NERVES.—The nerve of hearing originates from a grey nucleus on the floor of the fourth ventricle, close to the median line. In passing outwards, its fibres are a good deal scattered, and in the intervals pass numerous longitudinal bundles, which, with the intimate connection between its nucleus and those adjacent, in the opinion of Van der Kolk, enables this nerve to act in a reflex manner upon these, and on the occurrence of a loud noise, to place the whole body as it were instinctively in a position of defence. The two nuclei are, moreover, closely united by transverse fibres, so that a sound falling on the two ears simultaneously produces a single, and not, as might have been expected, a double impression. The ramifications of these nerves in the internal ear present numerous ganglionic cells, so that this, like the retina, is truly a nervous centre. These nerves can convey sound only, and may be destroyed without producing pain. Inflammation existing in the internal ear or adjacent parts, gives rise to such perceptions as buzzing, ringing, rushing of water, &c. It is remarkable that mechanical destruction of the internal ear on one side leads to the phenomenon of the animal turning continuously to that side.

Motor Oculi.—The third pair, the motor nerve of the eye, is connected with the grey nucleus in the crus cerebri, the corpora quadrigemina, and the valve of Vieussens. It is distributed to the muscle which raises the upper eyelid, and to all those of the eyeball except the superior oblique, which is supplied by the fourth, and the external straight muscle, which is moved by the sixth. In section or paralysis of this nerve, accordingly, the upper lid falls, and the eye squints outward from the constant and unopposed action of the external straight muscle. This nerve is connected with the sympathetic through a ganglion in the cavernous sinus, and with the fifth nerve at the ophthalmic ganglion. Through one or both of these means it is supposed to influence the iris, since the pupil generally dilates when it has been divided. (See "Sympathetic Nerve.") The intimate connection of the roots of this and the optic nerve enables the animal instantaneously and instinctively to adjust the axis of vision to luminous rays coming from any direction.

Pathetic Nerve.—The fourth nerve, which is the motor of the superior oblique muscle of the eye, arises from the valve of Vieussens close to the corpora quadrigemina, so that it is readily affected by impressions on the optic nerve. When cut or paralyzed, the opposing muscle draws the inner portion of the pupil upward, and from the light falling on points of the two retinæ which do not correspond, a peculiar form of double vision is induced.

Abducens.—The sixth cranial nerve goes exclusively to the external straight muscle of the eyeball, of which it is the motor. Its section or paralysis is followed by squinting of the eye inward, from the unopposed action of the internal straight muscle.

Trifacial, Trigeminal.—The fifth cranial nerve has two roots—a sensory and a motor—which arise from the lateral part of the pons, the latter slightly above the former. They are connected with grey matter within the medulla oblongata, and the sensory root may be traced backward as far as the origin of the hypoglossal nerve. A ganglion (Gasserian) exists on the larger root opposite the great foramen, at the base of the cranium, and immediately in front of this it breaks up into three branches—the ophthalmic, superior maxillary, and inferior maxillary—which are distributed to the parts about the eye, the upper and the lower jaw. The ophthalmic enters the orbit, and supplies the various parts therein contained, sending branches to the ophthalmic ganglion of the sympathetic, the conjunctiva, muscles of the eye, lachrymal gland and duct, the mucous membrane of the nose, and the skin upon the forehead.

The superior maxillary division passes forward beneath the orbit, and through a special canal in the superior maxillary bone. It is distributed to the maxillary sinus, the upper grinding teeth, and to the skin and muscles on the side of the face, nose, and upper lip.

The inferior maxillary contains a considerable portion of the fibres of the large root, and the whole of the small one. The fibres of the latter are motor, and this division accordingly contains both sensory and motor fibres unlike the other two, which are sensory only. This portion is distributed to the muscles, teeth, skin, &c. of the lower jaw, and presides over the movements of the muscles acting on the latter, namely, the temporalis, masseter, two pterygoid, and the mylo-hyoid. A branch to the anterior part of the tongue presides over taste and common sensation in this part.

The trifacial is the great nerve of common sensation to the face, as shown by the entire absence of this property in the skin, eye, and nostrils when it has been divided. The ophthalmic and superior maxillary divisions are exclusively sensory; but they nevertheless exercise considerable influence over the facial muscles by presiding over their muscular sense. They are further the natural excitants of many reflex actions in the facial muscles. That they are not motor is proved by Longet's experiment of stimulating them with galvanism, which produced excessive pain, but no convulsions. In the same way the lower maxillary division confers sensibility on the muscles, integuments, &c., of the lower jaw—with this addition, that it is the motor nerve of the muscles of mastication. When cut on one side, mastication is performed with difficulty, and entirely on the opposite side, and the animal falls off rapidly in condition. This division supplies, moreover, through its lingual branch, the special sense of taste to the anterior half of the tongue, so that this sense depends on two nerves, the glosso-pharyngeal and trifacial. On the integrity of this nerve depends indirectly the activity of the secretion in the lachrymal and salivary glands; an irritant touching the eye, or a sapid substance the tongue, producing an impression on the nervous centres, which through reflex action leads them to secrete.

It is very interesting to notice the influence which this nerve exerts over the nutrition of several structures—the seats of special senses. The division of the nerve, or of its ophthalmic branch, causes immediate contraction of the pupil, and in less than twenty-four hours acute inflammation of the conjunctiva and opacity of the cornea; followed by a purulent discharge; the iris becomes involved and loses all power of movement, and sight is lost, though the optic nerve and retina are unaffected. These results come on much more slowly if the section is made between the Gasserian ganglion and the brain, which seems to indicate that they depend in greater part, though not entirely, on the fibres of the sympathetic received at this point

Indeed, the ganglia of the sympathetic (ophthalmic, spheno-palatine, and otic) situated on the course of this nerve, at the points where branches are given off to the organs of the senses, seem intended to exert some special influence over the nutrition of those parts. It is well known that if we cut the division going to the nasal mucous membrane, which has the spheno-palatine ganglion connected to it, an inflammation in that membrane supervenes which renders smelling impossible. Furthermore, the nutrition of the whole side of the face is impaired if the principal trunk of the nerve is divided.

FACIAL NERVE.—The seventh nerve arises at the oblong medulla from grey matter, which is intimately connected with the roots of the trifacial and auditory nerves, and with the anterior olivary body. It leaves the cranium along with the nerve of hearing, from which it is quite distinct, and is distributed to all the muscles of the head except those of mastication. It is essentially the motor nerve of all the muscles of the face, with the exception just referred to. At its root it is exclusively motor, but in its course it acquires some sensitive fibres by its anastomoses with the trifacial, through the petrosal branches of the vidian, and probably through the chorda tympani. In passing from the cranium through the petrous temporal bone, it gives off filaments to the tympanum and muscles of the internal ear, and consequently performs important functions in adjusting these to suit the sonorous vibrations.

When this nerve is cut, the whole side of the face is paralysed; the eye remains partially open from loss of power in the orbicular muscle of the lids, and is constantly exposed to irritation from dust and other agents; the sense of hearing is impaired, if the section is made within the cranium; the external ear hangs pendulous; the nostril is no longer dilated at each inspiration, so that breathing takes place in great part by the opposite side, and if both are cut in the horse, which breathes through the nose only, suffocation ensues; the lips on the injured side hang downward, and cannot be used for the prehension of aliments; and, lastly, the aliments masticated collect in pellets inside the cheek, from the inability of the buccinator muscle to bring them between the teeth. The movements of the tongue also become more restricted, and the sense of taste is impaired or lost, not from the filament it supplies to the tongue (chorda tympani) being a nerve of taste, but rather from the want of a perfect adjustment of the organ, which seems necessary to the proper exercise of the sense.

Bernard has found that this nerve presides to a considerable extent over the secretion of saliva. He cut down on the side of the digastricus muscle, and raised the chorda tympani, separating it from the lingual nerve. He placed a tube in the duct of the submaxillary gland, and found that when the nerve was stimulated, saliva flowed abundantly, but ceased quickly on the removal of the stimulus. This phenomenon was repeated as often as the stimulus was applied and withdrawn. The sublingual gland likewise secreted actively when the chorda tympani was stimulated, and stopped with the cessation of the stimulus. The filament from the superior cervical ganglion of the sympathetic, which is connected with the submaxillary gland, has some control over the secretion, since its stimulation led to a greater viscidity of the saliva, and after a time to its complete cessation. Stimulation of the facial nerve within the cavity of the middle ear leads to a free secretion from the parotid gland, though the galvanising of the chorda tympani at its exit from the bone has no such effect.

Glosso-pharyngeal.—The ninth cranial nerve arises from the side of the oblong medulla within which its roots are intimately connected with those adjacent—as the trifacial, facial, vagus, and hypoglossal. It leaves the cranium by the large foramen at its base, and at this point has a ganglionic enlargement. Below this it sends communicating filaments to the facial and spinal accessory. It is distributed to the mucous membrane at the base of the tongue, to the soft palate with its posterior pillars, to the middle ear, and the anterior constrictor muscle of the pharnyx.

Longet and Dr John Reid have shown that this nerve is essentially sensory, and though its stimulation leads to movements in the pharynx and upper part of the face, these, after section of the nerve, can only be induced by stimulating the cranial portion. Some motor power, which it seems to possess toward its periphery, depends on filaments derived from the spinal accessory.

This is, moreover, the nerve of taste, for the root of the tongue, the soft palate and its pillars—for those parts indeed where this sense is most acutely developed.

The glosso-pharyngeal is the principal medium for the conveyance from the pharynx of that impression which gives rise to the reflex act of deglutition. Swallowing does not depend on a reflex act conveyed through this nerve alone, since it may still be induced by a stimulus on the fauces after its section. The unnatural stimulation of this nerve gives rise not to deglutition, but to vomiting, in those animals in which this act can be performed. Tickling of the fauces with a feather is accordingly often employed to effect this object.

Pneumogastric.—This nerve arises by numerous roots from the lower border of the restiform bodies, and leaves the cranium through the same opening as the last. At this opening it has a ganglion, and just below this it communicates by anastomosing filaments with the facial, spinal accessory, hypoglossal, and the inferior branches of the 1*st* and 2*d* cervical nerves. It has been called the *vagus*, from its extensive distribution, which is made to the respiratory tracts from the larynx downward, to the pharynx, œsophagus and stomach, to the heart, to the liver, and other less important organs.

To the larynx, windpipe, pharynx, and that portion of the gullet which is in front of the heart (tracheal portion), it furnishes the pharyngeal, and superior and inferior laryngeal nerves; to the heart, several cardiac twigs; to the bronchial tubes, additional filaments; and to the thoracic portion of the gullet, minute twigs from its terminal branches, which in turn ramify in the stomach, liver, &c.

The functions of the pneumogastric are no less complex than is the distribution; it not only contains motor and sensory fibres in its composition, but likewise acts like the sympathetic upon the stomach and bowels.

The recent experiments of Chauveau have thrown much light on the functions of this nerve in deglutition, and we shall attempt, accordingly, to give a summary of the results at which he arrived.

In horses, cows, sheep, and dogs, branches from the pharyngeal and superior laryngeal bestow motor power on the soft palate, pharynx, and œsophagus, as far as the lower end of the trachea. Movements of deglutition take place in these parts when those nerves themselves, their branches on the gullet, or the pneumogastric above their origin, are stimulated, whilst no movement ensues when the galvanism is applied to the latter below the point where the former are given off. In man and in the rabbit, on the other hand, the motor power of the tracheal portion of the gullet is derived from the inferior laryngeal nerve alone. The inferior laryngeal or recurrent nerve, which is given off by the pneumogastric opposite the base of the heart, and ascends along with the windpipe to the larynx, seems to have no function connected with deglutition in the dog, but a very important one in the case of the horse. In the latter animal, it conveys to the oblong medulla, the impressions made on the mucous coat, and which lead, by a reflex action through the pharyngeal and superior laryngeal nerves, to a vermicular contraction of its muscular coat. Accordingly, it is found that though no stimulation of this nerve can induce contractions in the tracheal part of the gullet, its section on both sides, or that of the pneumogastric nerves above their origin, leads to a paralysed or ataxic condition of this part; so that when a pellet of food passes no contraction ensues. Deglutition can still be effected through the power of the pharyngeal muscles and those in front of the neck. In the dog, section of the recurrent nerves does not in the slightest interfere with the contractions of the œsophagus, thus showing that the sensitive reflex filaments are in this case contained in the pharyngeal and superior laryngeal nerves.

The thoracic portion of the gullet—that between the heart and stomach—is supplied by twigs from the adjacent trunks of the pneumogastric. If the latter, then, or the filaments derived from it, are galvanised in the dead animal, a vermicular contraction of the gullet takes place. Again, if in the living animal the vagi be cut in the neck, and respiration be meanwhile facilitated by performing tracheotomy, the whole gullet is paralysed in the case of the horse; and though the animal may feed greedily, the aliments collect along the whole length of the œsophagus, and can only be passed on slightly when a new pellet is forced in by the contractions of the pharnyx. In the dog, the thoracic portion of the œsophagus is alone paralysed, and deglutition can still be accomplished with tolerable ease.

The pharyngeal branch is the principal motor nerve of the pharynx and palate, and assists as well in giving motor power to the tracheal part of the gullet. The superior laryngeal, too, besides its action on the gullet, is the sensory nerve of the mucous membrane of the larynx, and it is owing to its keen sensibility, that the contact with the latter of a solid body, or irritant gas or liquid, gives rise to violent and uncontrollable fits of coughing. It is the motor nerve to a single laryngeal muscle, the crico-thyroid. The inferior laryngeal nerve, besides conveying to the brain the impression for the reflex action of the tracheal part of the œsophagus, and conferring on the latter its somewhat dull sensibility, has for its principal function the conveying of motor power to the muscles of the larynx. It is distributed to all the muscles that enlarge the glottal orifice; and, accordingly, when cut, the freedom of breathing is interfered with, and during rapid inspiration a sound of a more or less shrill character is heard. The animal in this case becomes a *roarer,* and the disease known as "roaring" frequently depends on a lesion of this nerve. If the nerves are injured on both sides, breathing becomes correspondingly more difficult. This nerve has the further function of modifying the voice, by varying the tension of the vocal cords.

The branches of the pneumogastric furnished to the lungs are the channels through which is conveyed that peculiar impression which leads to the continuance of the respiratory process. It is not, however, the sole agent for conveying this impression, since the non-aërated blood in all parts of the body transmit a similar influence through the various nerves, and respiration continues for a considerable time after the division of both pneumogastrics. When a section of these has been made, there are first symptoms of impending suffocation from the paralysis of the larynx, but these soon pass off, as the desire to respire is in a great measure abolished. The respirations take place slowly and at long intervals, often only three or four per minute, and death takes place in a space of time varying from twenty-four hours to six days. The lungs are throughout in a state of splenization, having a dark purple colour, and a leathery, resistent feeling, being incapable of crepitating, and infiltrated with blood. They sink in water. This seems dependent on the stasis of blood within their substance, and the collapse of the air-cells from deficient inspiration. Inflammatory spots, which sometimes appear, are referable to the irritation caused by foreign bodies which have passed unchecked through the paralysed larynx.

The action of this nerve on the heart is not well understood. After its section the heart's action is usually accelerated; but this probably depends entirely on the excited condition of the animal.

The pneumogastric presides over the movements of the stomach: when it is divided the organ is to a great extent paralysed; and, on the other hand, galvanising its trunk causes rhythmical movements of the stomach. Its section does not interfere with the sensation of hunger. The action of this nerve on the gastric secretion is disputed. Bernard found that its section led to an immediate stoppage of secretion, the previously turgid mucous membrane becoming pale and bloodless; and this condition persisted for days, and any food in the organ underwent decomposition. Others contest this opinion, and believe the cessation of secretion to depend on the shock to the system and the absence of muscular movement, which stimulated the mucous membrane, by bringing it in continual contact with the aliments. Longet, moreover, found that small quantities of food may be digested after section of these nerves.

Spinal Accessory.—The eleventh cranial nerve arises from the oblong medulla, just behind the pneumogastric, and from the lateral aspect of the spinal cord, as far backward as the sixth spinal nerves. It emerges from the cranium with the ninth and tenth, and divides into two branches, one of which joins the pneumogastric, and the other is distributed to the muscles of the neck and shoulder. It is essentially a motor nerve acting on the cervical muscles, and, through its pneumogastric branch, on those of the larynx. Its action on the larynx is to render tense the vocal cords, in order to the production of voice. The fibres of the branch rendered to the pneumogastric would seem to incorporate themselves with those of the recurrent nerve, and with it proceed to the larynx. Its control over the voice is proved by the fact, that section of the branch given to the pneumogastric produces instantaneous and complete aphonia, though the latter nerve be uninjured. Bernard has found that the fibres which preside over phonation belong to the anterior roots of the nerve, being all in front of the first cervical nerve. After division on both sides of the roots derived from the spinal cord, the voice remained perfect as before, whereas, when those in front of the first spinal nerve were cut, the voice became at first hoarse, and as soon as the connection with the oblong medulla was destroyed, became completely lost. The same result followed the division of the anterior roots, though those derived from the cord were left intact. In some cases the subjects were preserved for months, and even for years, during which the condition of aphonia continued. If injured, they opened their jaws as if to cry, but a somewhat hurried expiration was the only result. If the nerve on one side is cut the subject gets hoarse, though not aphonic.

It is remarkable in connection with the control exercised by this nerve over the muscles of the larynx, that when the former is paralysed or divided, the loss of motor power in the latter is associated with inability to close the glottis; whereas, after division of the pneumogastric or recurrent nerves, the absence of motor power in the larynx is associated with a closed condition of the glottis, which the animal cannot obviate. In the former case, respiration is free, but pellets of food fall through the glottis during deglutition, and irritate the air-passages. In the latter, food does not readily enter the air-passages during swallowing, but inspiration is rendered difficult, as is well exemplified in the case of the *roarer*. According to Bernard, therefore, the fibres of the spinal accessory convey to the larynx the influence necessary to the production of vocal sound, which is to some extent incompatible with respiration, while the proper fibres of the pneumogastric, rendered to the laryngeal muscles through the recurrent nerve, preside, on the other hand, over respiration. In this we meet with a substantiation of Sir Charles Bell's opinion, that when an organ receives nerves from different sources, it is not for the purpose of increasing the nervous force, but to convey to it nervous influences of different kinds.

It seems probable that the external branch of the spinal accessory, which is supplied to the levator humeri and trapezius muscles of the neck, has likewise a purpose to perform, for which the cervical motor nerves furnished to the same muscles are not fitted; and Bernard is of opinion that it is in movements incompatible with respiration, as severe straining and the like, that they are had into requisition.

Hypoglossal.—The twelfth cranial nerve arises from the posterior part of the oblong medulla, in a line with the lower roots of the spinal nerves. It arises from a ganglionic mass in the medulla, is intimately connected with the posterior olivary body, and through it with the nerves adjacent. It passes out of the cranium through a special opening at its posterior part, and is entirely distributed to the muscles of the tongue, of which it is the motor nerve. Irritation of its trunk causes convulsive twitching of the tongue, and its section completely paralyses it. It has no sensory fibres at its root, but, like the facial and spinal accessory, acquires some of these from adjacent nerves in its course. It has no connection with the sensibility of the mucous membrane, farther than its power of placing it in a position convenient for the reception of impressions.

CHAPTER XVIII.

DISEASES OF THE NERVOUS SYSTEM.

General remarks.—Rabies canina, or hydrophobia.—Causes.—Geographical distribution; symptoms.—Dumb and barking rabies.—Post-mortem appearances.—Rabies in the horse, ox, sheep, pig, and cat.—Epilepsy; its symptoms.—Dr Brown-Séquard's researches on epilepsy.—Description of convulsions induced artificially.—Treatment of epilepsy.—Catalepsy in the dog; in a wolf; in the horse.—Chorea, or St Vitus's Dance.—Dr Todd's views.—Symptoms.—Treatment.—Tetanus.—Traumatic and idiopathic.—Symptoms.—Nature; treatment.—Diseases of the brain.—Vertigo.—Congestion.—Megrims.—Erroneous views commonly entertained on this subject.—Symptoms.—Prevention.—Encephalitis phrenitis, or inflammation of the brain.—Meningitis, or inflammation of the membranous coverings of the brain.—Difficulty of distinguishing inflammation of the brain from that of its meninges.—Causes and symptoms of encephalitis in cattle.—Encephalitis in the horse.—Treatment.—Apoplexy, or extravasation of blood.—Coma.—Immobility, or sleepy staggers.—Softening.—Induration.—Atrophy.—Hypertrophy.—Dropsy, or hydrocephalus.—Tumours.—Diseases of the spinal cord.—Paralysis.—Hemiplegia.—Paraplegia.—Congestion.—Inflammation.—Softening.—Dropsy.—Louping ill in sheep.—Trembling.—Thorter ill.—Cancer of the spinal cord.—Diseases of the nerves.—Neuritis.—Neuroma.

THERE are several functional and symptomatic diseases of the nervous system in animals which invest the whole subject I have now to consider with special interest, though, as Röll has correctly stated, the list of idiopathic diseases of either the central or peripheral portions of this system is a much shorter one than the list of primary affections implicating any of the other organs of the body. The history of nervous diseases in the lower animals has yet to be written, and I cannot hope to do more than furnish a sketch of the knowledge hitherto acquired on this very important subject.

It may be well to enter, in the first place, on the consideration of a very important group of diseases which implicate the nervous system generally, but which are not usually characterised by any marked organic changes. If the limits of this work permitted, much could be said on the subject of morbid mental conditions in animals. Are horses, oxen, dogs, and other animals ever mad? Are they liable to aberrations of intellect, and to morbid fancies or hallucinations? The ferocity suddenly manifested by animals which, early in life, have been very docile; the extreme irritability of some, and the apparently gross stupidity and listlessness of others, often indicate deviations from the normal state of either instinctive or reasoning faculties. There are singular instances noticed of animals acquiring peculiar morbid tastes, which can only be explained as due to nervous disease, and there can be no doubt that just as we find the greatest diversity in the amount of intelligence possessed by different individuals of the same species, so may we have perversions of instinct or mind similar to those which are manifested by the human idiot or lunatic. The disease commonly termed madness in the lower animals is not of the class included under the general term madness in man. It is altogether a specific contagious malady, which we may at once describe under the usually accepted names—

Rabies Canina, or Hydrophobia.

This disorder occurs in an idiopathic form, in animals of the canine species—viz., the domestic dog, wolf, and fox. It is communicable to all other warm-blooded animals by contagion, being characterised at all times by a train of symptoms which indicate great nervous derangement, though we cannot trace anatomically the changes which occur in the nervous system in this disease. The term Hydrophobia applies only to a symptom of this disease as it manifests itself in man; it signifies a dread of liquid, and, although mad dogs have been called hydrophobic, it is rare to see any symptom of such a condition in the lower animals.

Causes.—Little or nothing is known of the causes which induce rabies, primarily, in a dog or wolf. Our notions of the dog-days bear testimony to the popular belief that excessive heat and prolonged thirst send dogs mad; but scientific men have shown that the disease is as common in winter as in summer, and that the malady is unknown in many parts of the tropics, whereas it is most prevalent over the temperate European continent.

The geographical distribution of rabies would indicate that it is principally due to contagion; and if we only investigate the occurrence of the disease in the United Kingdom, we shall find that the malady prevails most where the chances of communication are greatest. It is occasionally prevalent in England, and especially in the midland and southern counties; it occurs most frequently in Ireland; and it is an extremely rare disease in Scotland. Not a little has been said regarding rabies in dogs in Scotland, but I have never seen a case during eight years, and Professor Christison assures me that for many years all his attempts at securing a rabid dog in Edinburgh, through the police and other likely channels, failed him. From the multitude of curs to be seen in any city in Ireland with bits of wood tied to their necks, under the impression that they can thus be prevented from biting, we might expect a very different amount of rabies to that witnessed in Britain.

A theory has been started to the effect that rabies in the dog commonly originates spontaneously from the restraint put on the animal's sexual desires. M. Leblanc, of Paris, believes this, and recently drew attention to the subject at the Academy of Medicine. On the authority of M. Sace, Leblanc stated, "that in a portion of the course of the Danube, the Christians on the one side of the river have chiefly male dogs, and there rabies is common, while on the Mussulman side, where, as in the East generally, dogs of both sexes are left at liberty, the disease is unknown." Leblanc went on to say, that "fancy and pet dogs, which are kept under most restraint in this respect, and are well fed, are those most liable to the disease. The great preponderance of the disease is shown from his own practice. Among 10,710 dogs entered upon his books, 30 per cent. of the number were bitches, or a little less than a third; but of 159 of this number the subject of rabies, only 25 were females—a mean of 1 female to 14 males." There appears to me to be another explanation to the latter fact —viz., that it is usually dogs that manifest fighting propensities and who are most likely to be bitten, whereas bitches are often not bitten even by a rabid dog. How can Leblanc and his disciples explain the great immunity from rabies in our sporting kennels? Good feeding and restraint in the sexual desires should surely take effect on many a foxhound and pointer during the year, but such a result is never witnessed. A general nondescript epizootic influence has been blamed for outbreaks of rabies, but the most effectual way to check the progress of the disease is to insist on all dogs being muzzled, and such a measure has been carried out with great effect in Berlin, Vienna, Milan, and other important cities. For some years a tax on dogs was imposed in Berlin with a view to diminish the number of roving and homeless animals, but the number of cases of hydrophobia did not diminish until 1854, when muzzling was ordered, and strictly executed upon all dogs not tied up. From the year 1845 to 1853 inclusive, 278 cases of rabies (nearly 28 per annum) were verified at the Berlin Veterinary School; while from 1854 to 1861 inclusive, only 9 cases have occurred, and none of these since 1856.

The virus of rabies is a fixed one, and discharged from the body in the saliva. It is most certainly introduced into the bodies of animals by the rabid creatures who, from natural cunning and ferocity, aim at the most vulnerable points of the human frame or other living thing. Wolves attack men on the face and neck, and the bite of a rabid wolf is thus more commonly followed by the development of the disease than the bite of a rabid dog, which is inflicted through clothes, &c. One great cause of the prevalence of rabies in various parts of the Continent, is the ready communication of the disease through wild animals. In Britain a rabid dog may attack a flock of sheep or fallow deer, but in the French and German forests he meets with victims capable of transmitting the virus *ad infinitum.* These are important considerations in relation to the causes of hydrophobia. According to Tardieu, 55 per cent. of the bites by rabid dogs prove effective in the transmission of the disease. This is very different from Hunter's statement, to the effect that only 5 per cent. of the persons bitten contract hydrophobia. Tardieu says that this is vastly under the truth, and only to be explained by including non-rabid bites.

Symptoms.—Two forms of rabies have been described,—the *dumb* and the *barking* rabies. They are only varieties of the same condition, dependent on peculiarities, so far as the symptoms are concerned, in particular cases.

There are four stages of the disease,—the incubative, the period of invasion, the critical stage, and the stage of decline and death.

The period of incubation varies in a most remarkable manner; and the result of an inquiry into 224 cases proves the appearance of the disease in less than a month in 40, from one to three months in 143, from three to six months in 30, and from six to twelve months in 11 cases. In children it has been as short as fifteen or even thirteen days, and rarely extends beyond twenty-five or thirty days.

The period of invasion is marked by an animal manifesting rather strange habits and desires. It may be more than ordinarily affectionate to its master, or it may begin by showing signs of discontentment. Restlessness, a capricious appetite, and indeed a desire to swallow filth and to lick urine, &c., are noticed. The animal's expression then changes, and is so characteristic, that when once seen it is never again forgotten. There is a peculiar, wild, anxious stare, which persons commonly attribute to some painful condition of the throat, or to a bone, &c. Very commonly ladies present themselves at the continental veterinary colleges, stating that their pet dog has swallowed a bone which has remained in the gullet, and when the professor sees the animal, he at once declares it rabid. In some cases there is dulness, laboured breathing, redness of the conjunctiva, dilatation of the pupil, salivation, and slight increase in the nasal secretion. Dogs which are seized with rabies, after having been bitten, manifest irritation in the region of the bite.

The third stage of rabies is indicated by the animal growing careless regarding the person and things amongst which he has lived. He takes to rove about, to howl piteously, and to bite whenever he can get a chance. The disposition to bite is increased at intervals, and there are paroxysms of apparently great suffering. Any object approached to the animal in this stage is bitten, and it is strange to see how steadily the eyes are kept on any thing moved within sight of a rabid dog. The dread of liquids, or hydrophobia, formerly declared as a symptom of canine rabies, does not exist, though there is difficulty in deglutition, whether of fluids or solids. Every kind of filth is however seized, and in part swallowed. The bark is very peculiar at this stage, and consists rather in a peculiar howl. There is redness and dryness of the visible mucous membranes and intolerance to light, shown by the eyes being kept partially closed.

The animal is then seen to writhe, to suffer from paralysis, its tail dropping between its hind legs, and the pulse is slow and irregular, breathing laboured, and convulsions occur. These fits are first partial and then complete, killing the animal about the fifth or sixth day from the first appearance of symptoms.

The form of dumb rabies is more rapid, and is characterised by paralysis of the lower jaw, discharge of saliva, swelling of the throat, catarrhal symptoms, very rapid emaciation, and early death.

Post-Mortem Appearances.—There are no specific lesions in the bodies of animals that have died of rabies. The principal manifestations are turgid state of the muscles and internal organs, congestion of the brain and spinal cord, determination of blood, and extravasation in the pharynx and stomach. The tongue is often swollen and bitten, and the stomach contains filth of every description.

Rabies in the Horse.—The early symptoms consist in restlessness, dilatation of pupils, and in mares or stallions there is evidence of active sexual excitement. As the disease develops itself, there are cramps, convulsions, and intolerance of light. There is the paroxysmal tendency to bite, difficulty of deglutition, modified voice when the animal attempts to neigh, and partial paralysis of the hind extremities supervene. The animal then suffers from convulsions, cannot rise, and dies about the sixth day.

In cattle and sheep, the symptoms are precisely similar to those in the horse. There is great disposition to grinding of teeth and striking with the horns, though also a tendency to bite.

In pigs, the earliest symptoms consist in severe irritation of the bitten part, which the animal rubs and scratches. There is a peculiarly wild haggard look, rough voice, laboured breathing, and great disposition to bite. The animals tear up the straw, and seize large mouthfuls of it. Paralysis and emaciation speedily supervene, and the animal dies about the third or the fourth day.

In cats, the early symptoms are to a great extent overlooked, from the shyness of these animals. They, however, become very savage, and from their tendency to scratch and bite the exposed parts of the hand and body, they are more dangerous to meet with than mad dogs. The disease ends in death, as in the pig, about the fourth day.

Rabies in man and animals is fatal in all cases. Hot baths and a host of specific remedies have been tried, but invariably with bad success. Like other contagious diseases, it must be prevented by the segregation and slaughter of diseased animals. It is indispensable, when outbreaks of this malady occur, to place restrictions on the liberty of dogs, which should be tied and muzzled. No attempt should be made to treat rabid dogs, though it is also desirable to kill animals suspected of rabies, and which may have bitten human beings or other animals, without keeping them for a while to determine if they are rabid. In Scotland, dogs seized with ordinary apoplectic fits are commonly destroyed as rabid, and the ignorant prejudice still prevails that if a healthy dog bites a human being, and that animal afterwards happens to contract rabies, the human being will fall a victim to the disease.

EPILEPSY.

This is a disease which we have a great difficulty in defining. It occurs in all animals, but it is specially common amongst dogs, and particularly young ones. It is characterised by sudden fits; hence the name ἐπιληψία, a seizure.

Symptoms.—An animal in apparent health, or at all events quite calm and conscious the one moment, is seen to stagger, stare, and begin to champ with its jaws the next. The mouth foams, the muscles of the neck contract, the head is jerked upwards or drawn round to one side, the muscles of the trunk then contract spasmodically, and the animal falls, straining, struggling, and unconscious. Dogs are apt to cry out at first, but are quite dumb and listless during the seizures. The head is jerked violently, and the whole body severely convulsed. Fæces and urine are discharged involuntarily, and the animal breathes with difficulty. The mucous membranes are red and congested, and the heart beats violently. The convulsive phenomena speedily subside and the animal regains its feet, and if loose is apt to run from any one near it, or, in other cases, to fall into a deep sleep. In severe forms of epilepsy, the convulsions recur after, and the animal soon dies. In others, the fits grow weaker and less frequent until they disappear altogether. Each fit may last from a few minutes to about half an hour, though rarely as long as this.

Epilepsy is a disease due to a variety of lesions of the nervous system, and to peculiar conditions of the blood. Its attacks seem to commence often on the surface of the body, or from some special centre within. In man some part is first felt in a state of spasm, or is the seat of an undefined sensation varying in different cases. Such a sensation is termed the *aura epileptica,* and is of course not usually recognised in the lower animals. It is evident, however, from its manifestations, that epilepsy may be either of centric or peripheric origin.

Dr Brown-Séquard published in 1857 some interesting researches on epilepsy, recording specially the results of experiments on animals. He says :—"I have found that the following kinds of injury to the spinal cord are able to produce epilepsy, or at least a disease resembling epilepsy, in animals belonging to different species, but mostly upon guinea-pigs :—

"1*st,* A complete transversal section of a lateral half of this organ.

"2*d,* A transversal section of its two posterior columns, of its posterior cornua of gray matter, and of a part of the lateral columns.

"3*d,* A transversal section of either the posterior columns or the lateral, or the anterior alone.

"4*th,* A complete transversal section of the whole organ.

"*5th*, A simple puncture.

"Of all these injuries, the first, the second, and the fourth seem to have more power to produce epilepsy than the others. The first particularly, *i.e.*, the section of a lateral half of the spinal cord, seems to produce constantly this disease in animals that live longer than three or four weeks after the operation. After a section of either the lateral, the anterior, or the posterior columns alone, epilepsy rarely appears, and it seems that in the cases where it has been produced, there has been a deeper incision than usual, and that part of the gray matter has been attained. In other experiments, few in number, the section of the central gray matter (the white being hardly injured) has been followed by this convulsive disease. I have seen it but rarely after a simple puncture of the cord.

"It is particularly after injuries to the part of the spinal cord which extends from the seventh or eighth dorsal vertebra to the third lumbar, that epilepsy appears.

"Usually this affection begins during the third or fourth week after the injury. In some cases I have seen it beginning during the second week, and even one or two days before. At first the fit consists only in a spasm of the muscles of the face and neck, either on one or the two sides, according to the transversal extent of the injury. One eye or both are forcibly shut, the head is drawn towards one of the shoulders, and the mouth opened by the spasm of some of the muscles of the neck. This spasmodic attack quickly disappears.

"After a few days the fit is more complete, and all parts of the body, which are not paralyzed, have convulsions. According to the seat of the injury, the parts that have convulsions greatly vary. When the lesion is near the last dorsal vertebræ or the first lumbar, and consisting of a section of a lateral half of the spinal cord, convulsions take place everywhere, except only the posterior limb on the side of the injury. If the lesion consists of the section of the two posterior columns and a part of the lateral columns, and of the gray matter, convulsions take place everywhere without exception, but with much more violence in the anterior parts of the body. When the lesion exists at the level of the last dorsal vertebræ, and consists in a transversal section of the two anterior or of the two lateral columns, convulsions are ordinarily limited to the anterior parts of the body; but it is a very interesting fact that they are not always confined to these parts, the two posterior limbs having sometimes very strong tetanic spasms, at the same time that there are clonic convulsions in the anterior limbs. After a transversal section of the central grey matter, or of the whole spinal cord in the dorsal region, convulsions are limited to either the anterior or the posterior parts of the body.

"Convulsions may come either spontaneously, or after certain excitations. The most interesting fact concerning these fits is, that it is possible, and even very easy, to produce them by two modes of irritation. If we take two guinea-pigs, one not having been submitted to any injury of the spinal cord, and the other having had this organ injured, we find, in preventing them from breathing for two minutes, that convulsions come in both; but if we allow them to breathe again, the first one recovers almost at once, while the second continues to have violent convulsions for two or three minutes and sometimes more. There is another mode of giving fits to the animals which have had an injury to the spinal cord. Pinching of the skin in certain parts of the face and neck is always followed by a fit. If the injury to the spinal cord consists only in a transversal section of a lateral half, the side of the face and neck which, when irritated, may produce the fit, is on the side of the injury; *i.e.*, if the lesion is on the right side of the cord, it is the right side of the face and neck which are able to cause convulsions, and *vice versa*. If the two sides of the cord have been injured, the two sides of the face and neck have the faculty of producing fits when they are irritated. No other part of the body but a portion of the face and neck has this faculty. In the face, the parts of the skin animated by the ophthalmic nerve cannot cause the fits; and of the two other branches of the trigeminal nerve, only a few filaments have the property of producing convulsions. Among these filaments, the most powerful, in this respect, seem to be some of those of the suborbitary and of the auriculo-temporalis. A few filaments of the second, and perhaps of the third cervical nerves, have also this property of producing fits. In the face, the following parts may be irritated without inducing a fit:—the nostrils, the lips, the ears, and the skin of the forehead and that of the head. In the neck, there is the same negative result when an irritation is brought upon the parts in the neighbourhood of the median line, either in front or behind. On the contrary, a fit always follows an irritation of some violence when it is made in any part of a zone limited by the four following lines: one uniting the ear to the eye; a second from the eye to the middle of the length of the inferior maxillary bone; a third which unites the inferior extremity of the second line to the angle of the inferior jaw; and a fourth which forms half a circle, and goes from this angle to the ear, and the convexity of which approaches the shoulder."

Dr Brown-Séquard further on adds:—"The following description of these convulsions will show that, if they are not positively epileptic, they are at least epileptiform. When the attack begins, the head is drawn first, and sometimes violently, towards the shoulder, by the contraction of the muscles of the neck, on the side of the irritation; the mouth is drawn open by the contraction of the muscles of the neck, which are inserted upon the lower jaw, and the muscles of the face and eye (particularly the orbicularis) contract violently. All these contractions usually occur simultaneously. Frequently at the same time, or very nearly so, the animal suddenly cries with a peculiar hoarse voice, as if the passage of air were not free through the vocal chords, spasmodically contracted. Then the animal falls, sometimes on the irritated side, sometimes on the other, and then all the muscles of the trunk and limbs that are not paralyzed become the seat of convulsions, alternately clonic and tonic. The head is alternately drawn upon one or the other side. All the muscles of the neck, eyes, and tongue, contract alternately. In the limbs, when the convulsions are clonic, there are alternate contractions in the flexor and the extensor muscles. Respiration takes place irregularly, on account of the convulsions of the respiratory muscles. Almost always there is an expulsion of fæcal matters, and often of urine. Sometimes there is erection of the penis, and even ejaculation of semen."

Epilepsy may certainly be due to injuries of the nervous centres, or the nerves, and it may be due, and often is due, in young animals, to the whole nervous system suffering from defective nutrition, or the circulation through it of a poisoned blood, as in cases of fever, uræmia, jaundice, certain cases of poisoning, &c.

Treatment of Epilepsy.—This consists in treatment at the time of the fits, and general management of the animal with a view to the eradication of the disease. The epileptic seizures have been checked by arresting the transmission of impressions from the surface to the nervous centre. Dr Brown-Séquard alludes to this in the following terms:—"There is a great analogy between the *aura epileptica* in man, and the pain originating in the skin and face of my animals. In them, as well as in man (when there is a real aura), the trunks of the nerves seem not to possess the faculty of producing fits, whereas their ramifications in the skin, or in the muscles, have this power. In my animals, as well as in man, if there is an interruption of nervous transmission between the skin and the nervous centres, fits are no more seen, or at least their number is very much diminished. I have collected many cases of epilepsy with an evident aura epileptica, in which there has been either a diminution of the fits, or more frequently a complete cure, after the interruption of nervous transmission between the starting-point of the aura and the nervous centres. In these cases, the following various means have been employed with complete or partial success, either against the aura epileptica, or against its production:—1*st*, Ligature of a limb or of a finger; 2*d*, Sections of one or many nerves, and amputation of a limb, or of other parts of the body; 3*d*, Elongation of muscles which are the seat of the aura; 4*th*, Cauterization, by various means, of the part of the skin from which the aura originates."

I have found in dogs that the best means whereby to check the violence of a seizure, is to dash cold water on the head, or in severe cases, when the fits recur with violence, at short intervals chloroform may be given.

Schroeder van der Kolk regards epilepsy as usually due to, or associated with, congestion of the upper part of the spinal cord and of the medulla oblongata, and has ascertained that this condition is best overcome by belladonna or its alkaloid atropin, given internally over a period of time. This has been attended with great success in man.

Support by good food and the moderate use of stimulants, are of the greatest service; tonic remedies are used in eradicating the disease, especially the oxide of zinc, oxide of silver, nitrate of silver, sulphate of iron, &c.

CATALEPSY.

"A fit of catalepsy implies a sudden suspension of thought, of sensibility, and of voluntary motion." Dr Watson, who thus defines catalepsy, adds that the mental faculties are in abeyance and the sensibility abolished, as also the functions of voluntary motion; but the limbs are not tied down by spasm; nor agitated by successive contraction and relaxation of their muscles; nor yet left, like portions of dead matter, passively obedient to the laws of gravity: they assume any posture in which they may be placed, and that posture, however absurd, however (to all appearance) inconvenient and fatiguing, they retain, until some new force from without is applied to them, or until the paroxysm is at an end. Catalepsy is by no means a malady restricted to man. As far back as 1686, Lochner described a case in a dog.* Leisering reported a case a few years back which he saw in a wolf in the Berlin Zoological Gardens. The limbs were held in any position in which they were placed. Hering has reported a singular case in a horse, which suddenly stopped if at work, and remained fixed with his fore legs propped out, and staring. The seizures lasted for five or ten minutes. Cataleptic symptoms are seen in a disease peculiar to horses, termed

* See Hering's Pathologie and Therapie, or Misc. Acad. Nat. Cur.

Immobility by the French authors, and which is described in the following pages.

CHOREA—ST VITUS'S DANCE.

A spasmodic twitching of certain muscles, occurring incessantly except when an animal is sleeping, constitutes chorea. Dr Todd has said that it is easier to say what chorea is not, than to describe what its essential nature is. "We may regard it as a disease dependent on a debilitated state of the system, which does not in any way arise from an inflammatory or hyperæmic state of any part of the great nervous centres or of other organs. Indeed, it is impossible to fix upon any particular organ of the body in which anything like structural lesion exists as a constant feature in cases of chorea. The disease is one of functional disturbance rather than of organic change, and this is borne out by the results of *post-mortem* examinations; for almost without exception we fail to detect in those cases of chorea which terminate fatally any morbid alteration which, physiologically, could give rise to the phenomena; and in the great majority of cases, we find all the viscera in a perfectly healthy condition—at least so far as we are enabled to make out with the means at present at our command. The structures which are obviously affected in chorea, are the nerves and muscles. Doubtless a morbid state of both exists; but it seems most probable that the disturbed state of the muscles is excited and maintained by a deranged state of the nerves and nervous centres."

Puppies are more liable to chorea than other animals. It occurs in weakly dogs, and especially such as have been prostrated by a severe attack of distemper. In many cases it is restricted to a constant jerking of the lower jaw; in others there is very marked twitching of the frontal and upper cervical muscles; in a third group of cases one of the fore limbs is affected, and the jerking of one or both fore extremities may be so severe as to interfere with the animal's standing and walking, especially when it first rises from the ground; in a fourth and last group, most of the voluntary muscles are implicated in the disease, so that there is champing of the jaws, jerking back of the head, spasmodic twitchings of the muscles of the back and of the extremities, and the animal affected, unable to rest, or to stand, or move at ease, is speedily exhausted by the disease.

In addition to the twitchings of the muscles, we have evidence in chorea of debility, defective nutrition, and a tendency to wasting and prostration of the vital powers.

The disease has been seen in cattle and horses, but much more rarely than in dogs, and is not often seen in other animals.

Chorea is apt to become chronic, and in course of time to disappear spontaneously. In other cases it persists with great severity, and much to the animal's inconvenience, if not suffering.

Treatment consists in the use of mild purgatives at the commencement, followed by generous diet, and use of cold water dashed daily on the animal's body. Tonic medicines are the most useful, such as the preparations of iron or of silver. The animals must be kept very quiet, but require regular exercise. Nux vomica, and strychnine have been used with success, but they can be dispensed with in the treatment of chorea.

TETANUS—TRISMUS—LOCKED-JAW.

The domestic animals, and particularly horses, are liable to attacks of general, continued, and fatal spasm of the muscles, both voluntary and involuntary, constituting the disease known as locked-jaw or tetanus.

There as two distinct forms of the disorder, differing in origin; the one succeeds the infliction of wounds and other injuries, and is termed *traumatic*; whereas the other is of primary origin or idiopathic. Traumatic tetanus follows surgical operations or accidental wounds which are often very slight. The spasms may supervene shortly after the occurrence of any injury, the time not exceeding fifteen or twenty minutes, though usually they are not observed until the wounds are nearly or quite healed. Predisposing causes such as constitutional tendency, cold weather, low condition, starvation, aid in the development of traumatic tetanus, though it is impossible to induce the disease at will by subjecting animals to influences which are at times sufficient to bring about an attack. Traumatic tetanus supervenes often after docking when the tail is cauterised, or after wounds of the feet or joints. It not unfrequently occurs in severe forms of cynanche or strangles after opening of the abscesses, or when suppuration does not occur freely. A cause of traumatic tetanus is the deposition of dirt in a wound, such as a particle of rust or a portion of steel from the breaking of an instrument. Punctured wounds are more likely to be followed by tetanus than incised ones, and we therefore have the disease after subcutaneous division of tendons or muscles, as in nicking. Traumatic tetanus not unfrequently follows after the occurrence of severe comminuted fractures.

Idiopathic tetanus is due to causes the nature of which is not always obvious. Cold is capable of inducing it, and to this cause I attribute cases such as I have seen of tetanus supervening suddenly when horses are clipped during very cold weather. It is seen in old, worn-out animals exposed to snow-storms and cold winds, and is also said to occur at any age from the influence of excessive heat. The condition of the alimentary canal materially influences the development of tetanus, and it has been known to occur after horses have eaten wheat or wheaten flour. Irritation of the digestive organs is sometimes capable of inducing the disease independently of other causes.

The tetanic spasms are termed tonic from their prolonged character and not being interrupted by relaxations, such as you have in clonic spasms or convulsive contractions. The term tetanus is used to indicate the spasmodic affection implicating the whole muscular apparatus. Sometimes the disease affects the muscles of mastication, and is then called Trismus (τρίζω, strido). Special forms of tetanus have been described according to the symptoms induced by the violent contractions of special groups of muscles. The powerful superior cervical and dorsal muscles occasionally bend the spine backwards. This is called *opisthotonos,* and is occasionally met with in horses and cattle. An interesting case of this description was published in the first volume of the *Edinburgh Veterinary Review.* Mr Maclaren Kitching of Cupar, who reported the case, furnished the following particulars :—

"On July 4, 1854, I was requested to visit a black mare, the property of Mr Reid, late of Cruivie. The history I could glean was, that a day or two before, the ploughman was driving the mare in a cart, and when about two and a-half miles from home, she stood, broke out in a perspiration, and shook all over ; he drove her home, and found her lame in the off fore leg. When seen by me, the mare could not well move the said leg forward ; the pulse was regular ; the muscles of the arm were of less size than on the near side ; the triceps extensor brachii was flaccid, and not half the size of the near one. I considered it a case of lesion of the said muscles ; gave a dose of physic, and ordered her to grass, as I considered that it was a case requiring time and rest. I mentioned that I would look at her in a few days, and see how she was doing in the park. Passing by, and not finding her in the park, I went to the farm, and saw the mare; the pulse was perfectly regular; respiration the same; appetite good; she seemed to have no difficulty in walking; but when taken to the water-trough, she could not get down her head; and upon more minute examination, I found her to be affected with tetanus without lock-jaw. I abstracted blood; gave a smart dose of physic, as her bowels were costive, and applied a blister from the poll all over the spine. This was on the 9th July. Visited her on the 10th; the medicine operating well; blister discharging copiously; gave more opening medicine combined with tinct. opii; the head was drawn more upwards, and the mare was feeding well on grass, bruised corn, and bran mash. 11th and 12th.—Continued to give laxatives, combined with cocculus indicus, and changed alternately with small doses of belladonna. 13th.—Evidently worse; her head much drawn back. I considered it to be a case of what is generally termed in the human subject, opisthotonos. To ease the muscles of the neck and back, the mare placed her fore feet in the manger, and rested her head upon the top of the rack. She never showed any symptoms of stiffness in her legs. On the 14th, applied a blister over her neck. 15th and 16th.—Her pulse increased in frequency, and the mare appeared to be getting worse. On the 18th, she lost the power of her legs. I called in the late Mr Dods of Kirkcaldy in consultation. He considered the treatment appropriate, and advised me to continue it with croton oil, so as to produce liquid evacuations, (she had always a capital appetite, even when down). Mr Dods recommended her to be placed in slings. I did so next day; but she had lost the entire power of her fore legs; and, when in the slings, she could not bear the least weight on them. She had the full power of the hind legs, and I had to let her down. Her head was so much drawn backwards, that when she was turned over to prevent the development of sores on the side she had been lying on for some time, the crown of the head and the posterior part of the quarters were the only parts that pressed upon the ground; and the point of the withers was upwards of 18 inches from the ground. I continued the above treatment till the 25th, when she died. Twenty-four hours afterwards, I intended to make a *post-mortem* examination, but I could not get any one to skin her, or to assist me in any way; so I cut off the fore legs, and examined the axillary plexus of each side, which was highly inflamed, and the nerves leading from them were in a state of inflammation even to their very centre."

When the body is bent forwards, as is often seen in poisoning by strychnine, the condition is called *emprosthotonos.* The term *pleurosthotonos* is applied to lateral tetanus in which the body is curved to one side.

The ordinary symptoms of tetanus are very characteristic. In the earliest stage an animal is seen to grind its teeth and champ with its jaws. There is often a considerable discharge of saliva, and in approaching or otherwise exciting the animal, the muscles of the face and neck are seen to twitch. The breathing is accelerated, nostrils expanded, nose protruded, and head elevated. The pulse is frequent, hard, and incompressible. On looking at the eyes they are found to be spasmodically drawn into the orbit, and the haw, or cartilago nictitans (commonly called "white of the eye"), is seen to protrude over the eyeball. The mouth may at first be opened rather freely, but as the disease advances, the strong masseter muscles prevent the jaw separating any distance. When the tetanic symptoms become general, the position of individual parts is regulated by the action of the more potent groups of muscles. Thus, the elevators of the tail being stronger than the pressors, cause an elevation. The anus is contracted powerfully. The limbs are forcibly extended, and cannot be flexed with freedom, so that the animal stands with obstinately outstretched limbs. The insertions of the levator humeri are distinctly traced, and the superior cervical muscles cause the appearance termed "ewe neck," and which once secured for tetanus the term "stag evil." Mr Percival says that voluntary muscles are those specially involved, but from the first we observe the partially voluntary and involuntary muscles implicated. Deglutition occurs with difficulty. The peristaltic movement of the bowels is stopped, and the urinary bladder firmly contracted. The abdominal muscles are rigid, and the intercostals do not move freely in obedience to the will.

During the tetanic attack the animal's sufferings are evidently intense, and there are periodic exacerbations of great severity, brought on by exposing the animal to the sun's rays, or to the annoyance of noises such as rustling of straw, or to the inspection by people. In the dark, and when an animal is left in perfect quiet, the tetanic rigidity is usually diminished, though convulsive twitchings occur from time to time.

The disease may occur with great intensity; the expression of countenance denotes great irritation and pain, and the animal sinks rapidly. This is acute tetanus. In other cases the malady is of a less severe type, and if, by proper care, the exacerbations are kept in check, it is not unfrequently seen that the spasms diminish in severity, and, if the animal lives over the seventh day, it usually recovers. During the progress of tetanus it is evident that the desire for liquids is considerable, and the appetite not altogether lost. Attempts to eat are attended with aggravations of symptoms, but large quantities of nutritious fluids, such as linseed tea, milk, &c., are drunk if allowed to animals so that they may drink when they choose.

Concerning the pathology of tetanus a great authority, Dr Todd, says,—"We can only draw our conclusions respecting the pathology of the disease from our knowledge of the physiology of the parts concerned. Now, reasoning on this principle, it may be laid down that the phenomena result from an exalted polarity of the centres supplying the parts affected. In the case of traumatic tetanus, the exaltation of the polar state commences in the afferent nerves of the seat of the wound: if the tetanus arise from cold, the exalted polarity commences in the nerves of common sensation distributed to the exposed parts: from the periphery thus irritated the condition is propagated through the nerves to the centres, and the effects on the muscular system show to what portions of the nervous centres the exaltation of the polar force is communicated. This, however, does not afford an adequate explanation of the production of tetanus; for peripheral nerves, and even nervous centres, are often subjected to great irritation without giving rise to tetanus; and it is well known that it is impossible, even by severe mutilations, to produce tetanus in the lower animals: whereas a slight accidental injury (as when a horse picks up a nail) will often excite the disease in its worst form. It would seem that some peculiar state of the system, probably some peculiar condition of the blood, is a necessary precursor of this malady. Hence, no doubt, its greater frequency in warm and unhealthy climates, in overcrowded and badly ventilated military hospitals, and among ill housed, ill clad, and ill fed infants. That tetanus may be produced through the blood is shown by the results of the administration of strychnine which irritate the tetanic symptoms in a very striking manner, so that you may at will develope the general phenomena of tetanus in an animal by giving him strychnine, or injecting it into his blood, but you cannot cause it by external injuries."

The *post-mortem* appearances of tetanus afford us no information of a positive character. Sometimes a particle of dirt is found near an inflamed nerve; in other cases the brain and spinal cord are congested, but there is no constancy in the lesions met with, and we can furnish no facts of moment regarding them.

The treatment of tetanus has been spoken of as a "mortifying subject." The disease is by no means so constantly a fatal one in the lower animals as it is in man, but we are not prepared to attribute the recoveries to anything but the spontaneous efforts of nature. The greatest success has attended leaving animals perfectly quiet in dark loose boxes, with nutritious fluids to drink, and sufficient warm clothing to protect them from cold. Bleeding is objectionable; purgatives of use, but cannot be repeated without unduly exciting the animal; narcotics are often decidedly prejudicial, and the one to be most avoided in the horse is opium.

Mr Horsburgh of Dalkeith, who has reported several cases of recovery after tetanus, says, "Like most of my neighbour practitioners, and for a number of years, I followed the school instructions and recommendations of our veterinary authorities, as published in their works, and, like most others, was equally successful—every case of traumatic tetanus died. I found the everlasting annoyance of balling, blistering, drenching, and clystering, aggravate the spasms to that degree that I had no doubt they hastened death. To save trouble in forcing up the head when the spasmodic action on the muscles of the neck rendered it nearly impossible, I tried, but with no better success, an opening into the œsophagus, by which I could pour liquid medicine into the stomach. I entirely changed my practice. Instead of constantly annoying the poor animal with medicines, I gave at first one large dose of physic—if the patient is seen early in the disease this is practicable—had him wrapt up from head to tail in four or five pairs of blankets wrung out of water about the heat of 200°, left him entirely quiet, locked up in a loose box, and his attendant to keep the key, allowing no person to go near or annoy him, unless in cases where any assistance was absolutely required. Thin sago or flour gruel given, and water, nearly boiling, to be poured along the spine outside the blankets every four hours. Bleeding largely at first, in cases of plethora, is, I think, always recommendable. This is the whole treatment I apply to these cases, and now find that I am generally successful."

Chloroform has been used in tetanus, and so long as animals are kept under its influence they are in a relieved condition; but the spasms come on with great intensity after its effects as an anæsthetic pass off.

Stramonium has been used with success by Buquiet, who steeped the plant in boiling water, and directed the steam, in large quantities, on the animal's body. Infusions of stramonium were injected into the mouth and rectum every hour. The treatment was commenced at seven o'clock in the evening, and in an hour the animal's skin became moist, and at nine o'clock there was considerable perspiration. The treatment was persisted in on the two following days, and the animal recovered.

I have tried cannabis indica, belladonna, hyoscyamus, &c., but with no decided result. The most opposite methods of treatment have proved successful, and a sufficient illustration of this is obtained from the cases of recovery after the shooting off a gun close to an animal's head.

DISEASES OF THE BRAIN.

CEREBRAL CONGESTION—MEGRIMS—VERTIGO.

When any organ becomes congested, the amount of blood in that organ is increased in quantity as well as stagnant in the vessels. It was once asserted that the quantity of blood in the brain could not vary in quantity, and this theory, enunciated first by Monro Secundus, and admitted by Abercrombie, was supported by experiments performed by Dr Kellie, who came to the conclusion,

1st, That in the brains of animals that have died of hæmorrhage, there is no lack of blood, but, on the contrary, very often a state of venous congestion.

2d, That congestion of the cerebral vessels is not met with in those cases in which we should most expect to find it; in persons, for example, who die strangled.

3d, That the quantity of blood in the cerebral vessels is not affected by gravitation; in other words, that it remains the same, whatever may be the posture of the body and the position of the head.

The above conclusions have been demonstrated to be erroneous by Dr Burrows, who has shown that hæmorrhage has a most decided effect in depleting the cerebral blood-vessels, and in reducing the quantity of blood within, as well as upon the outside of the cranium. He has, moreover, proved that "the principle of the subsidence of fluids after death operates on the parts contained within the cranium, as well as upon those situated in the thorax or abdomen."*

Dr Watson says, we fall back "upon another principle whereby some of the difficulty and obscureness which attend certain affections of the brain and nerves may be explained—I mean the principle of varying pressure upon the nervous substance.

"Physiologists say that the cerebral matter is incompressible. This is another of the questionable assumptions implied in the foregoing theory. Upon what grounds the opinion may rest I am ignorant; but whether the brain

* Lectures on the Principles and Practice of Physic by Dr Watson. Vol. i. p. 368.

is compressible or not, whether, that is, it be or be not reducible by pressure into a smaller compass, it is clearly capable of having different degrees of pressure applied to it, and of being pressed out of its ordinary form. We shall see hereafter, that by pressure exercised from within by the distension of what are called the ventricles of the brain, the convolutions on its surface are sometimes flattened, and the natural furrows between them nearly effaced. Pressure there certainly is, in what I shall have to describe to you as hypertrophy of the brain. There must be considerable pressure on the nervous pulp when blood is poured out within it from a ruptured artery in cerebral hæmorrhage. But the phenomena noticeable when a portion of the skull has been removed by the trephine, show very clearly that the encephalon sustains pressure from varying states of the circulation during perfect health. The surface of the brain, seen through the circular opening in the bone, is observed to pulsate, and to pulsate with a twofold motion. With every systole of the heart the surface protrudes a little, and it again subsides with the succeeding diastole. This shows that the tension of the arteries produced by every contraction of the ventricles of the heart, exerts a degree of pressure upon the contents of the cranium. But the brain has also an alternate movement corresponding with the movements of the thorax in breathing, rising with every act of expiration, and sinking with every act of inspiration. Now, during expiration, the blood escapes less freely from the head through the veins, and thus again vascular fulness is found connected with evidence of pressure on the parts within the head."

The lower animals suffer severely at different times from modifications in the amount of blood in the cranium, and greater or less pressure on the brain substance. In the horse there are a variety of forms of staggers or convulsive disorders due to functional or structural disturbance of the encephalon. In the chapter on Impaction of the Stomach in the Horse, at page 186 of the first volume of this work, I have drawn attention to the forms of staggers due to gastric derangement, and have described three kinds. One is characterised by delirium, a second by coma, and a third by interference with the voluntary muscles. The symptoms connected with these forms of stomach staggers are similar to convulsive attacks due to cerebral diseases of various kinds such as I have to notice in the following pages. I wish now to draw special attention to *Megrims*, the staggers of horses at work, and which has been mistaken for epilepsy.

Mr Percivall says, "By *Vertigo*, as synonymous with *Megrims*, I do not mean any simple or single symptom of giddiness which a staggered horse may evince; but I mean an assemblage of vertiginous symptoms which suddenly attack, and as suddenly disappear after the manner of a fit, and to which horses all their lives may be at times subject, and yet never experience what we understand by staggers, *i.e.*, encephalitis, or phrenitis, or even coma. This makes me say megrims is a disease *sui generis*, though of what precise or definite nature, I am not at present prepared to give an opinion." In this paragraph which I quote from the Hippopathology, there are two errors. The one is attributing ordinary staggers to inflammation, and the other is regarding megrims or vertigo as a specific disease. That Mr Percivall, like all other authors who have written on megrims, has known nothing about the disease, is proved not only by his words to the effect that "*the pathology of megrims remains undeveloped*," but by his statement as to the causes of the disease. He says, "high or full condition, hot weather, exertion or agitation of any kind, may be said to be likely to produce a fit in a horse predisposed to megrims, although such causes are not in some cases recognizable. Harness-horses in particular appear subject to the disorder; this may arise from the long continued constraint the bearing rein puts the head to. I knew a horse who had a fit of megrims every time he was put into harness, as if temper seemed to induce it." Any case of vertigo has been called megrims, though the staggering may only be a symptom of tumour in the brain or other organic disease.

I restrict the term megrims, as Mr Charles Hunting of South Hetton does, to a vertiginous affection only seen in animals at work and when driven with a collar. The vertigo never shows itself in the stable, or when the animal is ridden; even in harness it does not occur, if an animal is worked with a breastplate and without collar. In Italy, a horse subject to megrims is said to have the "capo gatto," meaning really as mad as a cat, and it is well known that he is effectually cured by being used on the river side to draw along the rafts of wood floated down the streams to the sea, or even pulling boats up against the current. The fact is, these horses are never worked with collars, and signs of megrims are never seen in them. Some horses have such peculiarly shaped necks as to require a special kind of collar to prevent attacks of megrims, which are invariably due to pressure on the jugular veins. Heat, action, exertion, pulling heavy loads up steep inclines, are of course all causes calculated to aggravate the vertigo, but they cannot alone induce it.

The cases of staggers seen in saddle horses, or which occur at intervals even in the stable, are due invariably to organic lesions, and should not be confounded with that very simple and preventible series of symptoms observed in carriage-horses, from being unable to wear tight or badly fitting collars. True megrims occurs most readily in animals with obstructed jugular veins, from previous attacks of phlebitis, but such obstructions are rare now-a-days in this country.

The symptoms of vertigo or megrims come on suddenly, and often unexpectedly, so that accidents, especially in hilly districts, of a serious nature, often befal the persons driving horses thus attacked. The animal seized, elevates the head, has twitchings of the neck; sometimes the spasms attack the muscles on the one side, or all the superior cervical muscles are contracted, and owing to the peculiarly prominent eyeballs and wild look of the animal upwards, it has been called, when subject to these attacks, a "star gazer." The muscular twitchings of the face, turgid condition of the veins of the head, and dilated nostrils, are also marked, and with a sudden bound the animal falls against any obstruction or into any chasm without perceiving its danger. In fact the pupils are dilated and vision suspended during the next severe period of the paroxysm; the reeling, delirium, or stupor ceases, and vision is suddenly restored on the circulation being re-established. Such attacks have been wrongly attributed to inflammation, phrenitis; and grooms or farriers, not excepting even veterinary surgeons, are ready to jag the mouth in order to draw blood, or to bleed from any accessible artery or vein.

It will be usually found that an animal thus seized is being driven with a tight collar, or though the collar may appear deep enough when the animal holds its head down, it presses on the lower part of the jugular veins as the head is elevated in action, and especially in drawing a load up a hill. The way to relieve is therefore to push the collar forward, and if water be at hand, to pour some on the head.

Horses addicted to megrims have been driven with a peculiar apparatus on the head to contain a damped sponge, but this is obviously useless, as the disease is entirely due to the malformation of the neck and the manner in which the collar rests on it.

ENCEPHALITIS—PHRENITIS, OR INFLAMMATION OF THE BRAIN —MENINGITIS, OR INFLAMMATION OF THE MEMBRANOUS COVERINGS OF THE BRAIN.

Although Mr Percivall and others have devoted distinct chapters to inflammation of the brain and of its coverings, we find in practice that it is impossible to distinguish the one from the other during the life of an animal. They occur principally in the horse and ox, and the morbid changes usually implicate one part of the cranial contents. The most common cause of either meningitis or phrenitis is injury such as concussion or fracture, and as an idiopathic affection occurring independently of injury, I regard phrenitis as almost an unknown disease. If animals are allowed stimulants in excess, however, we may expect congestions, extravasations of blood, and even inflammation of the brain; such a cause rarely operates in inducing such lesions, if I except the singular cases first reported in the *Edinburgh Veterinary Review,* by Mr George Dundas, and which occur in cattle.

Mr Dundas refers to the malady as a form of chorea, but the *post-mortem* appearances satisfactorily indicate that the results of the cerebral irritation are congestions and inflammatory changes. The disease is due to the prevailing practice in different parts of Scotland, of giving "burnt ales" to cows in the neighbourhood of distilleries. The ale is given by steeping straw into it, and the animals will also drink it freely. They often sleep soundly after such a beverage, and sometimes symptoms of intoxication are manifest. The symptoms are as follows:—The head is turned singularly to the side, and is slightly elevated. The pupils are widely dilated, and the eyes have a remarkably wild appearance. On approaching the animals, they wink rapidly and tremble. There is marked heat of head, horns, and ears. When pressed with the finger in the axilla they fall instantly, and when pulled by the head they incline to turn over. The pulse is about 70 or 80 per minute. Mr Robert Morris has informed me that the symptoms of cerebral excitement are very great, and if the animals live on, chronic disease, due to exudations, &c., in the brain become confirmed. One cow, the case of which was reported by Mr Dundas, manifested symptoms of serious illness as the period of calving approached. Symptoms of delirium and interference with the muscular apparatus existed, and the animal had knocked off her horns in falling over in the stall and dashing about. After death all the organs are found healthy except the nervous centres, and both the brain and its membranes are found highly congested. This congestion often extends into the spinal canal, and the pia mater over both the brain and cord is the seat of red spots. The redness is either ramified, or is obviously due to blood extravasation. Clots of blood have been found in the lateral ventricles, and around the spinal marrow in the cervical regions. There is evidently softening of the brain substance as a direct result of this condition.

The violent symptoms usually attributed to phrenitis do not occur in the horse or other animal. In the early or congestive stage there may be delirium and paroxysms of excitement, or general convulsions. Symptoms of intense irritative fever supervene; the eyes are bloodshot; Schneiderian membrane red; mouth hot and dry; pupils contracted; breathing stertorous, and pulse wiry and frequent.

Any noise excites the animal, and the rustling of straw, or touching the surface of the body, indicates an increased sensitiveness to external impressions of various kinds. The symptoms, however, soon change, and indicate the aberration of the cerebral functions. We cannot accept Mr Percivall's description of the disease at this stage. He says:—"The frantic animal will rear both his forelegs into the manger, and in this posture stand, with his head erected, for several minutes perhaps, no person daring to approach the while, lest he should unexpectedly spring up or reel round, and fall upon the intruder. In a word, our patient is '*mad,*' furiously so, in the worst sense of the word, as applied to staggers." Further on, Mr Percivall says:—"As the disease increases, instead of lying quiet as before, in a state of apparent insensibility after a throe, convulsions will follow so quick upon one another, that the patient will be kept in continual struggle, panting and perspiring, and perhaps foaming at the mouth, leading his attendants to believe he is not only phrenitic, but actually *rabid.*" All this does not tally with the most reliable histories of cases of phrenitis especially due to injury, and the diagnosis of which could be relied on. Inflammation of any organ is, as a rule, associated with loss of function; and accordingly, in well-marked encephalitis, after the paroxysmal or congestive stage, there is dulness, listlessness, and loss of consciousness. The animal stands with sunken and outstretched head, and either has difficulty in holding an erect position or lies. A certain degree of vivacity may recur, but it speedily disappears again, and there is decided loss of sensibility, and suspended function of all the organs of special sense. The pulse is apt to be full and throbbing at the submaxillary, and the breathing is loud, and stertorous as in coma. When the animal drinks it sinks its head in the pail, and tries to gulp down a little water. It has no appetite, and the discharge of fæces and urine is very scanty. Prior to death the horse may be seized with convulsions, and knock himself about seriously, or he sinks exhausted and dies.

The duration of the disease varies from forty-eight hours to many days and even weeks. In the chronic form there is partial paralysis, or peculiar modification in the action of certain groups of muscles.

Treatment.—The most valuable remedies in congestions and inflammations of the brain or its membranes are cathartics and cold applications to the head. Clysters are also used, and saline diuretics administered. Narcotics, such as opium, are contraindicated. Blood-letting is more to be recommended; and we find the opening of the temporal artery in favour with some veterinarians. Mr Percivall says:—"When blood can be obtained from the temporal artery, that blood-vessel is to be preferred to the jugular vein. In general, it is advisable to open both temporal arteries. Should, however, even from both of them, the flow of blood be not free and abundant, the jugular vein must be had recourse to, it being absolutely necessary that blood in sufficient quantity should be extracted to produce symptoms of faintness, and it being highly advisable that this should be done as quickly as possible. Supposing the blood can be collected in a blood-can or water-pail—for this cannot on all occasions be accomplished—in general we shall find that from two to three gallons require to flow before this effect is produced, so much depending upon the size, condition, constitution of the horse, and other circumstances. I used to consider the jugular vein to be quite as good a channel as, if not a better than, the temporal artery for blood-letting in affections of the head;

but some striking cases I have had in my own practice have greatly altered my former opinions; and I find I am very much borne out in these altered views by the reports of others. At the same time, I wish it to be understood that arteriotomy is in no case to be confided in unless blood can be obtained from one or both temporal arteries in a full and fast stream. A dribbling or tardy current will avail nothing, and need not be persisted in."

My views with regard to blood-letting in encephalitis are that in the earlier stage it may be of use, but as the disease advances we must rely more on relieving the blood-vessels of the head by the direct application of cold, and perhaps using rubefacients to the extremities and trunk, so as to determine the blood from the head. Setons, blisters, &c., are only of use in chronic forms of the disease.

CEREBRAL APOPLEXY.

An animal, when seized with cerebral apoplexy, suffers from a sudden pressure on the brain, as the result of determination of blood and extravasation. The muscular apparatus is more or less completely paralyzed, but the heart and lungs continue to act. This condition of the system is termed the comatose. In reply to the question, What is coma? Dr Watson says:—"It is that condition in which the functions of animal life are suspended, with the exceptions of the mixed function of respiration; while the functions of organic life, and especially of the circulation, continue in action. There is neither thought, nor the power of voluntary motion, nor sensation, but the pulmonary branches of the par vagum continue to excite, through the medulla oblongata, the involuntary movements of the thorax. When this upper part of the cranio-spinal axis becomes involved in the disease, and its reflex power ceases, the breathing ceases also, and the patient is presently dead."

Under this head we must of course include many of the cases of parturition fever, or dropping after calving in cows, due to overfeeding and to a sudden accumulation of blood in the system on the birth of the young animal, which has largely drained the cow's system, and averted, up to the period of the expulsion from the uterus, a fatal accumulation of blood in the cerebro-spinal system. I have referred at length to this disease under the head Enzootic Disorders; and some of the cases in cattle due to drinking "burnt ale," referred to under Phrenitis, may be pure instances of cerebral apoplexy.

Our knowledge of cerebral apoplexy in the horse is limited. It is not a common disease; and by far the best case of the kind on record was published in the 3d volume of the "Edinburgh Veterinary Review," by Mr Parker of Birmingham, who says:—

"On Thursday, March 7, I was called in to see an aged bay gelding, the property of the Great Western Railway Company, and from the foreman I was able to glean the following history of the horse, up to this date.

"He was bought about five years ago, and was ill for a long time with influenza, but never seriously affected. He was put to work in due course, and beyond being rather bad-tempered, and, as the man said, 'curious in his ways,' there had been nothing to call for any remark till about the 1st of March this year, when he refused his food and became very stupid. This stupidity increased daily till the 6th, when he was sent to Birmingham by train from Leamington, at which station he had been working for two years. He now became paralysed, and was disinclined to move forwards, though he backed readily, and was conscious of any order that was given him. He walked from the railway station to Hockley, where the stables are, a distance of $1\frac{1}{2}$ miles, without assistance, though at any noise he ran back. On seeing him, I found no very acute symptoms present. The pulse was forty-four and natural in force, the eyes half-closed and amaurotic, the sense of seeing *entirely* gone in the near eye, and it was indistinct in the off eye. He was feeding slowly, on my going into the loose box, and could turn round without difficulty—though his movements gave me the idea that the power of volition was but *partial*—both fore and hind limbs were equally affected. The bowels had not acted for twelve hours, so I at once gave seven drachms of aloes-Barb. and ordered clysters to be given every hour, and some thin bran mash the only food to be offered to him. I bled from both facial veins, and applied counter-irritants to the poll and cranium.

"8th. The horse is evidently better, he can see distinctly with both eyes, has purged, and moves with greater freedom, showing now no inclination to run back. He is rather sick from the aloes. The mash to be continued.

"9th. Still improving, the dung pultaceous, his appetite good, and symptoms of viciousness returning, as he begins to look wicked, which I hailed as a return to his normal state.

"11th. To-day I saw him walked out; there were no signs of paralysis, but he was very weak. His appetite not so good, and the sleepy look again apparent. The dung was getting hard too. The poll and temples were stimulated, and an alterative ball given.

"12th. I was nearly kicked out of the stable this morning by my patient; though weak, he tried to the best of his ability. His appetite was very good again, and he seemed to be stronger. He was led out for five minutes.

"13th. No change from yesterday.

"14th. To my surprise I found the animal lying down, quite unconscious, the eyes closed, mouth partly open, no sense of feeling anywhere present, and, in about eight hours from tumbling down, he died without a struggle.

"I thought that the brain had been affected sympathetically and sub-acutely at first—viz., on the 1st of March—and that probably there was a small clot of blood pressing on that organ; and as he improved under treatment, and there were no violent symptoms, I hoped that the clot was becoming absorbed to some slight extent.

"On making a *post-mortem* examination, I found the brain in the state represented,—a large tumour pressing on the upper and posterior extremity of the left hemisphere. Whether the tumour was a partly organised clot I leave to abler hands than mine to determine, as, after showing it to Professor J. S. Gamgee, it was put into a box and sent off at once to Edinburgh. I may, however, venture to state my opinion, that the tumour was not of recent origin, as the brain was absorbed by the long-continued pressure of the mass. I have not disturbed the brain itself at all, so there may be some other pathological curiosity of which I am unaware at present."

"In my opinion, attacks of apoplexy, such as the one above described, occur in the horse most frequently as the result of injury, and the fact that the subject of the above case was vicious would appear to bear out such a supposition. The last case I had was in a mare, to which I was called in the last stage of an attack of colic, and by violently knocking herself about in the stall, effusion of blood had occurred below the crura cerebri, which gave rise to symptoms of coma and death.

"Mr Parker's case is one of old and, probably, relapsing apoplexy, and this opinion I form from the following appearances and microscopical characters. Lying on the posterior lobe of the left hemisphere, I found a solid and nearly spherical tumour, 2·2 inches long and 1·6 inches broad. On raising it, it proved completely detached from the cerebral mass, and divided into two portions, a lesser internal and posterior, and a larger external, the two applied by a flattened surface as if severed by a section.

The upper part of the tumour is covered by a dense white membrane, only partially adherent, and which appears to be a somewhat thickened portion of dura mater. Directly beneath and around the tumour are a number of flattened stratified scales. The separate layers are shiny and brittle, and prove by the microscope to be solidified lymph, without the slightest morphological character. The whole of the thickened portion of dura mater above-mentioned is lined by a dense coating of super-imposed strata of the same solidified fibrin.

A section through the middle of the tumour discloses that it is a solid mass of coagulated blood, undergoing the usual changes of apoplectic effusions. It is of a deep red colour, indicating its comparatively recent origin, though, from the colourless external strata, I should be led to suppose that the animal had suffered from apoplectic effusion at two distinct and distant periods.

The posterior lobe of the brain is evidently, to some extent, atrophied, though the amount of flattening is deceptive, as in all recent apoplexies, and sufficiently explains the irrecoverable cerebral disturbance.

On the whole, the brain appears to have been the seat of some determination of blood, but had a remarkably healthy appearance, with the exception of the two choroid plexuses, which are slightly thickened from a deposit of cholesterine, as commonly found in aged horses."

SLEEPY STAGGERS—IMMOBILITY—COMA.

Mr Percivall says, "The *coma* here intended to be introduced into veterinary nosology, is the *coma somnolentum* of human medicine, which, as near as a disease in man can represent one in a horse, is the sleepy staggers of old writers in farriery."

This malady is far more common abroad than in the United Kingdom, and has here been termed Immobility from the animal's indisposition to move, and it has been regarded as an acute hydrocephalus. Amongst the causes enumerated by authors are heat, obstructions to the jugular veins, mismanagement in feeding, &c. It will be found that breed has much to do with it, and it is rather a coarse kind of carriage-horse that is most liable to the disease. The animal's head is not usually a good one, and narrow across the forehead. The disease attacks middle-aged animals, and very rarely, indeed, either young or old horses.

Symptoms.—A general listlessness in the stable, disposition to be sluggish in harness, especially when kept standing a while without movement, a tendency to deep breathing and slow pulse, are amongst the earliest and most characteristic signs. The pulse is sometimes as low as 24 per minute, the respirations are also slow, the animal is in good condition, and seems to have a decided inclination to accumulate much fat. The organs of digestion are sluggish, and the discharge both of urine and fæces is scanty and rare. The slowness with which the animal feeds, the habit of seizing food between the lips, and then dropping the head in a sleepy fit, are very marked symptoms. When the disease presents itself in an aggravated form, you are perhaps told by the coachman that, whilst standing quietly in harness, on a smack of the whip to wake the horse up, he seemed to lose the power of his legs, and fell. When the disease has advanced thus far, we find in the stable that the animal heeds nothing except a loud sharp sound or the sudden admission of the sun's rays into a dark stable, and then it wakes from a state of drowsiness very suddenly, and may fall. Not unfrequently horses thus affected drop and break their knees. There is a peculiar fierce look and flaccid state of the facial muscles. The limbs are extended, and the animal obstinately stands; indeed, the most curious positions may be given to the limbs, and they then remain as in cases of catalepsy. Thus one fore limb may be crossed over the other, and it is there kept; a hind limb may be pushed far back or forwards, and the same indisposition to move it is seen. The hind limbs are apt to become the seat of twitching and even paralysis. The case assumes a chronic form, and it is rare to observe a fatal result except owing to some complication such as apoplexy, pulmonary congestion, &c. At times there are signs of delirium—paroxysm of spasm and great nervous excitement, but these pass off, and the animal is left dull and listless as before.

After death, accumulations of serum in the cranium, in the lateral ventricles, or in special cysts (Schöne, Tenneker), are occasionally met with. A state of anæmia, and sometimes of softening of portions of the brain, may exist, and tumour of the choroid plexus induce at times symptoms such as those I have just noticed. In acute cases of Immobility, there seems to be accumulation of liquid in the spinal canal as well as in the cranium, and it is in these cases that the hind legs are seriously affected.

Treatment.—This is often hopeless, but moderate and nutritious diet, purgatives, exercise, and rubefacients to the spine and limbs, are the remedies we may expect most direct benefit from. Nux vomica or strychnine and ferruginous preparations are of great value. Belladonna, in small doses daily, continued for some time, seems also to have a beneficial effect. From 3 to 5 grains of *nux vomica* have been given daily for some time to horses with this affection. Hertwig recommends croton oil as a drastic purgative in this disease. Bleeding is injurious. Viborg recommends the tincture of white hellebore. I have seen issues used with advantage, applied along the spine; and setons in the neck have been long in use, but are of questionable advantage.

SOFTENING OF THE BRAIN.

The French word for softening, *ramollissement,* has been applied to that condition of the brain in which its elements lose their firmness and cohesion. Softening is usually a result of inflammation, but it may be due to obstructions to the arteries, a species of arterial plugging or embolism which has been discovered often in the human cerebral vessels, and no doubt occurs sometimes in the lower animals. Softening of the brain substance may be connected with suppuration after an injury, or, as the result of an attack of phrenitis. Softening is usually a disease which attacks a part of the brain, and is therefore attended with symptoms indicating the loss of function of a particular part of the cerebral system. Loss of vision on one side, paralysis of the tongue, lips, and even of the muscles of the larynx, inducing severe roaring, may be its symptoms. The cases of softening due to arterial plugging and atheroma occur usually in old animals. Softening is an incurable disease.

INDURATION OF THE BRAIN.

Occasionally as the result of inflammation, and chiefly towards the surface of the brain, there is exudation and hardening. This condition has been rarely seen, and I have witnessed a form of induration which might be regarded as condensation of the nervous tissue under the influence of gradual pressure, owing to the slow development of a tumour. Induration is not diagnosed during life, and belongs to the incurable conditions.

ATROPHY OF THE BRAIN.

The brain may waste; a portion of it may be absorbed, or the whole mass may diminish in volume. The cases of partial atrophy due to tumour, to the development of parasites, &c., are singular, from the fact that the disease advances far before any symptoms of the atrophy are noticed. The upper part of the cerebral hemisphere may waste away to a great extent, just as portions may be cut off without symptoms of disturbance, but anything like general atrophy is associated with loss of consciousness and paralysis. In man, atrophy of the cerebrum is accompanied by idiotcy, and in the lower animals by aberration of the instinctive faculties, and sometimes by viciousness. The general atrophy may be due to hydrocephalus.

HYPERTROPHY OF THE BRAIN.

We know nothing of hypertrophy of the brain in the lower animals, though the disease has been repeatedly described in the human subject. "When in these cases the skull is sawn through, the upper loose portion of bone starts up as if moved by a spring, and the edges of the bone remain widely apart." Dr Watson says that the hypertrophied and compressed brain is firmer and tougher than natural; it contains but little red blood, and sections of it are seen to be unusually dry and pale.

HYDROCEPHALUS—DROPSY OF THE BRAIN.

The arachnoid, or serous membrane covering the brain, is not unfrequently the seat of an unnatural accumulation of clear watery liquid. This is not uncommonly seen in newly born animals, and especially in calves and puppies. Connected with this chronic cranial dropsy, there is malformation of the cranial bones. Many detached points of ossifications are seen in the broad membrane covering the encephalon ; and if this is pressed upon, the brain is affected and the animal injured, and perhaps destroyed. In the majority of instances the animals die. In adult animals hydrocephalus is rare, except as it occurs in sleepy staggers. Sheep, with sturdy, are said to die of hydrocephalus, or water in the head ; but it is well known that the cyst distended with fluid in this disease is of specific parasitic origin.

The cases of hydrocephalus in newly-born animals are usually, if not always fatal.

TUMOURS IN THE CRANIAL CAVITY.

A variety of products are developed in the cranial cavity with very different degrees of rapidity, and therefore inducing disorders of an acute or chronic character according to the conditions under which they are formed. The growths are either abnormal formations from the inner surface of the cranial bones or in the substance of the brain.

EXOSTOSES, OR BONY TUMOURS.

These are met with most frequently in cattle, and consist in hard, enamel-like products of the inner plate of the scalp, occasionally no larger than a bean, and some occasionally attaining the dimensions of a turkey's egg. These tumours are more or less globular, nodulated, with a distinct pedicle, and convoluted. The eminences or apparent convolutions are due to the manner in which the dura mater binds down the growth as it developes, and is fixed in depressions which are not unlike the furrows of the brain. The small tumours are found attached by pedicles, but the larger ones are usually floating in the cranial cavity, and pressing injuriously against the brain.

Some extraordinary cases have been recorded of growths which have attained the size of an ordinary ox's brain, and which have induced no apparent disorder until the animal's sudden death. One of these products—the largest on record—is in the Milan Museum, and was first described as an ossified brain. It has been the subject of many discussions, and it has been satisfactorily proved to be one of the ordinary bony growths from the inner plate of the cranial bones. The late Professor Alessandrini of Bologna carefully examined many specimens in the fresh condition, and all have been evidently connected at one period or other by a decided bony attachment with the skull-cap.

In the horse, the bony tumours consist in growths of a detinal-like substance, invading usually the temporal bones. They are probably aberrations in the development of dental pulps, just like the tooth products connected so frequently with fistula on the external surface of the temporal bones. These growths in the horse, like the bony cranial tumours of cattle, only induce symptoms when, either from their size or mobility, they press injuriously on the brain. They thus induce paralysis, blindness, and usually fatal disturbance of vital organs, such as checked respiration, &c.

DEPOSITS IN THE MEMBRANES OF THE BRAIN.

In connection with the membraneous coverings of the brain there are occasionally deposits, especially in very young animals, and connected with a tubercular diathesis. This disease has been termed tubercular meningitis, and is by no means so well marked or frequent in the lower animals as in man.

Melanotic deposits and fibrous tumours occasionally occur, but are not usually of such a size in connection with the meninges as to lead to serious symptoms.

CEREBRAL TUMOURS.

In the brain the tumours which most commonly occur in horses are those of the choroid plexuses. These occur rather frequently in lowbred carriage-horses, and usually appear on both plexuses at once, and consist in abnormal accumulations of cholesterine, a non-saponifiable fat which occurs in rectangular scales. This cholesterine, with serum and amyloid or starch-like bodies, is found at first in the hypertrophied villi of the plexuses. In most old horses there is more or less enlargement of these vascular structures, but in some the growths acquire the characters of true cholesteatomatous tumours—that is to say, tumours consisting almost entirely of cholesterine, which is found packed in spherical masses, and these are surrounded by a somewhat dense capsule. The connective tissue in the substance of the tumours is scanty.

These tumours of the choroid plexuses grow slowly, and do not therefore induce severe symptoms until they have perhaps attained the size of a pigeon's egg. I have met with them as large as a hen's egg. They then usually give rise to staggering symptoms, which come on with great severity at intervals. When the fits are not on, the animal may appear quite healthy, fat, and in good working order; but under the influence of generous diet and work, violent exacerbations are brought on; and whether on the road or in the stable, the affected animal becomes excited, raises its head, dashes forward blindly, and is seized with severe trembling. The head and ears are hot, pulse full and bounding, vision imperfect, and appetite suspended. With time the paroxysm is relieved, and the animal resumes its usual look of health. The disease is of course incurable, and is only aggravated by the methods of treatment commonly applied when the fits come on. Bleeding is especially injurious, and rather seems to favour a speedy fatal termination to the case.

HYDATID DISEASE.

Two cystic parasites are met with in the cranial cavity of the domestic quadrupeds. Cattle and sheep suffer from *cœnurus cerebralis,* a hydatid which develops in any part of the brain, and concerning which much has been said under the head Enzootic Disorders.

The second hydatid is the very common *echinococcus,* seen specially in oxen, and developed either in the meninges or in the substance of the brain. This hydatid, like the cœnurus, is due to the animals picking up with their food the ova of one of the tapeworms which infest the dogs' intestine.

DISEASES OF THE SPINE AND ITS COVERINGS.

PARALYSIS.

Loss of motor power and loss of sensibility may occur separately or together, and depend on functional or structural disorder of the nerves, or the centres with which they are connected. In brain disease we often have paralytic symptoms, but the spinal affections I have yet to describe are those in which the loss of power in muscles, or the insensibility of parts, constitute very special and pathognomonic symptoms. Paralysis may affect a part from injury to a single nerve, but more commonly we observe either the hind legs affected, as in paraplegia, or one side of the body, as in hemiplegia, or both sides of the body, whether partially or completely. We thus have the same loss of power varying in degree and extent; and that same absence of motion or sensation may indicate the existence of diseases varying greatly from each other. Paralysis, therefore, is but a symptom of disease, and the usual symptom in affections of the spinal cord and its meninges.

In all cases of disease or injury of the cord, or spinal canal implicating the cord, the paralysis occurs in the parts to which all the nerves are distributed, which originate or are connected with the cord behind the seat of injury or disease. If there be an injury to the sacrum, the tail alone may be paralysed; if the lumbar vertebræ are broken, the paralysis affects the hind quarters. If the cervical portion of the spinal cord is implicated low down, the fore limbs, as well as the hind ones, are deprived of power and sensibility; and if the cord is affected high up, near its point of union with the brain, the phrenic nerves can transmit no more impressions, the respiratory centre is injured, and the animal can no longer breathe.

The various kinds of paralysis differing principally in the extent to which the limbs and trunk are paralysed, are well illustrated by the symptoms which follow the various fractures of the spinal column.

When an animal falls on its head and breaks its neck close up to its attachment with the head, or when an animal is pithed, by dividing with a knife the medulla oblongata or upper part of the cord, there is instant suffocation and complete paralysis of the whole body. Movement and sensibility may be retained for a few seconds in the face, and the heart continues to beat under the influence of the ganglionic system of nerves, but all signs of life soon vanish.

Fracture and displacement of the lower bones of the neck may occur without paralysis, but usually both fore and hind extremities lose their power.

Fractures of the dorsal and lumbar vertebræ occur in horses from violent muscular effort during surgical operations. When the fracture affects the dorsal spines, the displacement is not so great as in fractures of the lumbar region, hence an animal may rise, walk to its stable, and only show signs of paralysis after many hours, and even days, have elapsed. Commonly with lesions in the lumbar region, there is at once irremediable paralysis of the hind quarters.

ACUTE RED SOFTENING OF THE CORD—MYELITIS—SPINITIS—ACUTE PARAPLEGIA.

This disease is somewhat rare, but a number of cases have been recorded in a more or less imperfect manner. During the year 1863 several cases came to my knowledge, but I observed one, in company with my colleagues, which can well serve as a basis for the history of the disorder.

Subject.—A five-year-old mare of medium size, nearly half-bred, and rather fat. Was accustomed to hard work in a heavy van. Had stood in the stable three days; and on December 29, 1863, was taken out in the van for a mile or two. The day was cold, with a drizzly rain almost constantly falling. Nothing was noticed amiss with the animal until taken from the van, about six yards from the stable door. It then became excessively lame in the off hind limb, so that it was with difficulty it was got into the stable.

At 7.30 P.M. my father found it on three legs, with violent muscular tremblings, evidently in great agony, and shrinking from the slightest touch.

At 9 P.M. my father, Mr Law, and myself, visited the patient, and found paralysis of motion in both hind limbs, though sensation seemed to be retained. The animal could rise on its fore limbs, but only partially on the hind, these being bent, with the pasterns resting on the ground. The respiratory movements of both thoracic and abdominal muscles were normal. The hind legs were drawn up again when pulled back by the hand, and were thrown out slightly with the general movements in the frequent struggles of the animal. Pricking the tail with a pin caused its ready movement. The line of the lumbar and sacral spines was regular, and neither they nor the dorsal showed tenderness on being struck. The mare was in violent agony, with the pulse at seventy-two per minute, full, but soft, the skin drenched with perspiration, and the eye abnomally bright, as in colic. The expression of the face was haggard, and the head frequently turned to the flank, as in abdominal pain.

At 10 P.M. I found her in the same condition, excessively restless, and suffering severely. Gave an anodyne draught, which partially relieved the pain.

Examination per ano, detected healthy beating of the posterior aorta, and of both the iliacs on each side, and decided that no retention of urine existed.

By applying the ear over the heart near its base, I detected a rushing sound replacing the second sound of that organ. An hour later, Dr Arthur Gamgee accompanied Mr Law, and examined the heart carefully with the stethoscope.

The sounds were quite normal at the apex, but the second replaced by the beat already mentioned at the base. By pressing the instrument on the carotid, a double murmur was heard with each heart-beat.

The mare was now much easier, and the perspiration less free. A purgative was administered.

December 30th.—Patient much easier, pulse 45, bowels acting normally. Put a mustard poultice over the loins.

December 31st.—Mare much the same as yesterday, fed well, and the only noticeable symptom was the paraplegia. The owner now consented to have it destroyed.

January 2d, 1864.—At 11 A.M. Dr A. Gamgee and Mr Law examined the heart, which had been removed yesterday morning. Water poured into the aorta did not descend into the ventricle. Water poured into the pulmonary artery, flowed gradually into the right ventricle. The valves, notwithstanding, showed no symptom of structural change. The right ventricle seemed slightly dilated, probably from regurgitation of blood.

On laying open the spinal cord, its membranes appeared little altered from health. The cord in the dorsal and anterior half of the lumbar region appeared healthy. In the posterior part of the lumbar region the extremities of the anterior horns were much more vascular than is natural, while two or three inches of the extremity of the cord was quite softened and pulpy, and almost diffluent. Microscopic examination showed soft varicose nerve tubes, globules formed by their disintegration, and numerous exudation corpuscles—the appearances, indeed, which are described as characteristic of acute red softening of nervous matter.

Mr Stirling, Assistant Conservator of the Anatomical Museum of the University of Edinburgh, kindly undertook to harden some of the diseased portions of the cord, and to prepare some tinted sections. Mr Stirling hardened the cord by means of a mixture of alcohol and acetic acid, and attempted to colour the sections of it by means of an ammoniacal solution of carmine.

When a healthy spinal cord is submitted to this process, it is found that the pigment only partially adheres to it. The nerve cells, especially their nuclei, and the central portion of the nerve fibres, alone becoming coloured, the peripheral portion of the fibres (white substance of Schwann) remaining of the purest white. These differences in the absorption of carmine point to a chemical as well as a structural difference in these portions of the healthy cord.

In the diseased cord Mr Stirling observed, and by means of many preparations we have had the opportunity of verifying, that the carmine tinted the intercellular substance, the cells, and the different portions of the nerve fibres indiscriminately. The chemical differences, which in the healthy state exist in the different parts of the cord, appearing, as a result of the diseased action, to have disappeared. It would be interesting to know whether, in other cases of acute red softening, this peculiarity in the carmine reaction has been noticed.

The case narrated above appears to us to be one purely of acute red softening of the substance of the cord, *i.e.*, a softening the result of an acute congested and inflamed condition of the cord—a disease which has been called by some authors, Myelitis. The case differs from the majority of analogous ones in several particulars, especially in the sudden occurrence of paralysis. It is rare to witness this symptom at the outset of the affection. Usually the animal begins to walk stiffly, and to experience difficulty in bending at the loins. There is often evidence of pain in this region, especially when direct pressure is made on the spinous processes of the vertebræ immediately above the seat of disease. After a period varying from two to three days to some weeks, the animal becomes paraplegic, *i.e.*, the posterior extremities become completely paralysed. In the worst cases, the animal is unable to void or retain urine, and fæces voluntarily, and the posterior extremities often mortify.

It is not to be understood that such cases always follow the course indicated. Doubtless in many the stage of congestion is scarcely passed, and the structure of the cord is not involved to any serious extent. Were time allowed, in many of these cases the animal would gradually improve, and might, in the course of time, regain to a considerable extent the lost power. When, however, there is loss of control over the bladder and rectum, the case must be looked upon as so serious as to warrant, in almost every case, the destruction of the animal.

Treatment should, in these cases, be directed particularly to diminishing the congested condition of the cord. In the smaller animals cupping may be had recourse to with advantage. Great attention must be paid to the condition of the bowels, which have a great tendency to become constipated. There are certain remedies which exert besides a useful influence, probably by inducing contraction of the minute vessels of the cord. Of these belladonna and its alkaloid, atropia, and the ergot of rye, are the chief.

The following prescriptions would answer very well for a large dog :—

℞ Atropiæ grj.
Acidi sulphurici dil. mins. ×.
Aquæ font. ℥viij.
Solve.
Liq. 40 drops to be given twice daily.
The dose to be increased after some days.

Or,

℞ Ext. ergotæ liq. (Ph. Britt.) ʒii.

Liq. 5 to 16 drops to be given thrice daily,

Nux vomica and strychnine are unfortunately often used indiscriminately in the treatment of all forms of paralysis. They must on no account be given in the affection now under consideration.

LOUPING ILL, OR HYDRO-RACHITIS IN SHEEP.

This disease is met with in many of the grazing districts in Scotland, prevailing in certain localities, and separated only by some arbitrary line from others immediately adjacent, where the malady is frequently almost entirely unknown. A remarkable instance of this is met with in the counties of Selkirk and Peebles, where, in the farms of the north side of the Tweed, the disease is very destructive in the spring and summer months, while on the south side of the river it is of extremely rare occurrence.

Professor Murray, of Cirencester, who investigated this disease in the summer of 1862, mentions that on the onset of the disease, "the animal falls down and struggles convulsively, paralysis has not yet set in, but the functions of the nervous system are disordered, the limbs are no longer subject to the control of the will, but plunge about convulsively." This is followed by a rapidly advancing paralysis of the limbs affected, which are most commonly the hind. The animal staggers with the fore or hind limbs, or towards the affected side, but soon loses all control over the diseased extremities, and is compelled to maintain a recumbent position. Being unable to move about in search of its food, the animal becomes weak and emaciated, and dies in a period varying from a few days, in the acute cases, to several months in the chronic. Coincidently with the onset of the paralysis, the appetite may be depraved, although it is usually rather voracious, and after death the stomach is often found to contain earthy matters and hair balls. In the advanced stages the urine and fæces are often discharged involuntarily, and in similar circumstances amaurosis and unconsciousness are not uncommon.

In *post-mortem* examinations, Professor Murray invariably met with increase of the cerebro-spinal fluid, while Mr Mathewson never met with this condition, but noticed in some that the cord was paler and softer than natural. The cases seen by the former were, however, more acute, extending only over a few days, while those seen by the latter seem to have extended over several weeks. The discrepancy may thus be partly accounted for—a part of the liquid having become absorbed in the interval. In some lambs killed shortly after the onset of this malady, we have found no great increased vascularity of the membranes covering the cord, and a thicker or more gelatinous condition of the cerebo-spinal fluid.

The causes of this malady are not sufficiently understood. They are doubtless intimately connected with the geological formation of the soil and the consequent modifications of the grasses and water on which the animals subsist. These causes are aggravated by exposure, sudden vicissitudes of heat and cold, and all such influences as reduce the general stamina of the animals. On this subject Mr Mathewson remarks—" It is curious also to notice the influence that cultivation sometimes has on this disease. On those southern exposed farms"—referring to those on the north bank of the Tweed—" I have already instanced that before they were cultivated to the extent they now are, and while mostly lying in rough pasture, the disease, I have been told, was not more common than on the opposite side of the river. It is only since all the low-lying and rich land has been torn up by the plough and improved that it occurs to such a fatal extent. Here I must explain, that since these improvements have been made on the land, and sufficient turnips and artificial grasses raised, the sheep are brought from the hills or unimproved portion of the farm, and folded on turnips during the winter, and are subsequently kept in the young grass fields till after the lambing season. True, a good many lambs may die while in the parks, but the old sheep are seldom affected till they are driven to the hills or to the rough natural posture." On some farms cattle and pigs are affected as well as the sheep, and the pastures can only be safely grazed by horses. Mr Mathewson looks upon it as entirely due to coarse grasses grown on certain soils, adding, that "on some farms that have admitted of being entirely cultivated the disease has almost totally disappeared, lambs only being liable, and that to an inconsiderable extent." On many farms it will attack animals in good condition, but in all cases thin and ill-conditioned animals form the majority of its victims. Want of proper food, cold, and wet, are the chief exciting causes.

Prevention.—Keep the sheep constantly in good condition; allow rock salt in covered troughs as a stomachic; ameliorate the affected land by cultivation and by growing finer qualities of grass, and avoid putting sheep on such pastures as do not admit of improvement.

Treatment.—This is of course very difficult when a large number are affected. Mr Mathewson succeeded in curing three out of five, by supporting the strength with hay, cut grass, and gruel, and by exhibiting for a week diuretic doses of nitre, digitalis, and oil of turpentine, followed by a course of nux vomica.

TREMBLING

Is a somewhat badly defined disease. The term is sometimes applied by shepherds to almost any internal inflammation, the onset of which is characterised by a severe shivering fit. It is sometimes applied to a form of louping ill, when that is attended by marked muscular tremblings.

THORTER ILL.

This is a parasitic disease, in which the hydatid is situated in the cervical portion of the spinal cord, and is attended by more or less paralysis of one or both sides of the body.

HEMIPLEGIA

Is a rare affection in the lower animals, and is commonly dependent on effusion of blood on one side of the brain, or some lesion of one-half of the spinal cord. According to the cause, it may affect one entire half of the body, including the head and even the intercostal muscles, or it may be confined to particular portions of one side of the body, and especially such as derive their nerves from that part of the spinal cord situated behind where the morbid lesion exists.

CANCER OF THE SPINE.

A remarkable case of this description was published in the Veterinarian, 1856, by Mr Hunting, with notes of my own as to the cadaveric lesions. Mr Hunting says :—

"On the 10th of September 1855, I was requested to see a chestnut mare, the property of Mr George Reed, of Seaham Harbour. She had been unwell for ten or twelve days, with cough and sore throat; her neck was likewise very stiff, but her appetite had remained good up to yesterday, when she became tympanitic, and suffered intense pain.

"When I saw my patient, I found that the pulse numbered 68, and was weak. The submaxillary artery appeared full and soft, and the action of the heart feeble. The breathing 59 in the minute, and rather laboured. The conjunctival membranes were very much injected and of a yellowish colour. The mouth was hot and dry. The nostrils were greatly dilated. The ears were cold, legs warm. The fæces were of a healthy character. The respiratory murmur throughout the whole length of the trachea was much louder than in health, and the left lung gave evidence of partial congestion. The cough was thick and heavy, and of a peculiar sound, but not frequent. The larynx and trachea were very painful on pressure. A watery fluid flowed from the eyes, but there was no discharge from the nostrils. The neck was very stiff, so much so that the animal could neither eat nor drink from off the ground, nor move the head in a lateral direction. The parotid glands were much larger and harder than usual. The appetite, however, was but little impaired.

"From these symptoms, I considered it to be a case of ordinary influenza, or distemper, which disease was exceedingly prevalent in the neighbourhood at the time. Acting upon this impression, I treated it as such until the 24th, when my patient was so much better that professional attendance was no longer necessary. The head could now be moved with greater freedom in a lateral direction, and the mare was enabled to eat and drink from the ground. The breathing had become natural both in character and frequency. The pulse 38, and healthy in tone; the appetite good; the animal lively, and capable of taking half an hour's exercise daily.

"On the 6th of October I received a message to say that the mare was not so well. On arriving at the place late in the day, I found her apparently suffering but little pain, the intense agony which the owner had observed in the morning having passed off. The other symptoms they described as also existing were an enormously distended abdomen, frequent groaning, rigid limbs, an occasional lying down but quickly rising again, very heavy breathing, and an anxious expression of the eyes.

"The pulse was 44 in number, and rather weak at the jaw; the sounds of the heart were so feeble that they were scarcely audible on the left side; the breathing was 66 in the minute, but not laboured; the motion of the abdominal muscles was indeed so slight that I was unable to take the number of respirations at the flank; the neck was still a little stiff; the nostrils dilated, and much anxiety of the countenance present. The mucous membranes were healthy in colour; the mouth cool and moist; the surface of the body of a natural temperature; the bowels regular, and the urine of a light colour.

"On the application of pressure to any part of the spinal region rom about the tenth dorsal vertebra to the sacrum, the whole of the voluntary muscles behind became as rigid and hard as in the worst cases of tetanus during the periods of excitement. Very little difference could be detected in the violence of the muscular contractions, whether the pressure was employed directly over the spine, or within twelve inches on either side of it. This tetanic rigidity sometimes occurred when pressure was not applied, and also when the animal was made to back, but then in a much less degree, and lasting for a few minutes only.

"On an examination per rectum, I detected a large tumour on the left side of the spine, having a density, as imparted to the feel, equal to the structure of the liver. It appeared to be about eight or nine inches in diameter, three inches thick in its centre portion, and an inch at its circumference. It was closely connected to the posterior part of the kidney, overlapping the posterior aorta, and extending to the right side of the spine. On pressing the enlargement, evidence of severe suffering was obtained, but the tetanic spasm did not follow, nor was there the slightest indication of pain when the pressure was applied to the inferior portion of the lumbar vertebræ. The pulsation of the posterior aorta between the tumour and the bifurcation of the vessel into the iliac arteries, was scarcely to be felt, and which I attributed to the pressure of the enlarged mass upon the aorta.

"I looked upon the case as one very doubtful of recovery, thinking that I had most likely to deal with the formation of an internal abscess, as a sequela of influenza, and which is not a very uncommon occurrence; but as my patient's appetite was good, the heart's action not much disturbed, and the fæces and urine healthy, I considered treatment justifiable. Counter irritants were therefore applied to the loins, and Pot. Iodidum given internally, with vegetable tonics. Under this treatment the tumour gradually became less in size and much softer in consistence. The rigidity of the muscles was likewise less violent when pressure was applied to the spine.

"On the 24th, a 'charge' was applied to the whole of the lumbar region. Mineral and vegetable tonics were daily given with the iodide of potassium, and exercise was enjoined.

" From this date up to the 18th of November, there was a gradual wasting away of the muscles; the appetite was generally good, the animal eating an average quantity of the most nutritious provender that could be procured.

" During this period the urine became highly impregnated with albumen, but which gradually diminished in quantity, until on the 18th of November, after which time I entirely failed to detect its presence.

" On several occasions during the above period, the peculiar spasmodic contraction of the muscles, the tympanitic state of the abdomen, the anxious and protruding eyes, and the intense suffering, would come on, but only lasted for a short time. These symptoms generally occurred two or three days in succession, and were not again seen for six or eight days.

" On the 18th of November, I found that the tumour was very much smaller, and also soft and flaccid. The pulse and breathing were perfectly natural, both in character and number. The spasmodic contraction of the muscles did not occur, even when pressure was applied to the spine, and the animal looked more cheerful and lively.

" From this date up to the beginning of December the mare slightly improved in condition, and I had more hopes of her ultimate recovery; but on the 6th of December the symptoms again returned, and in as bad a form as before. They continued for several days, and then disappeared.

" On the 23d of December, at 8 o'clock in the evening, she was left apparently no worse. She drank an unusual quantity of water, and ate her food with avidity; but early on the following morning she was found dead and cold.

" *Post-mortem appearances.*—The thoracic viscera, the spleen, and the liver, were all very pale in colour, but otherwise healthy. The left kidney was very much enlarged. The stomach, intestines, bladder, uterus, and right kidney, were likewise healthy; but the pancreas was filled with small tumours, varying in size from a pea to a walnut, which contained a yellowish jelly-like substance. The spinous processes of the lumbar vertebræ were extensively diseased.

" The second, third, and fourth cervical vertebræ were extensively diseased. In the broad, flat, spinous process of the dentata, there existed a circular aperture, extending from side to side, and from the arch to the top of the process at the point of its bifurcation. On the lateral and anterior part of the body on the left side the disease had made nearly equal ravages, extending into the foramen at the base of the odontoid process. Immediately above the transverse process, on the same side, the destruction of bone extended from an inch and a half upwards and backwards, invading a nearly circular portion, and removing a large part of the articulation formed by the left half of the spinous process of the dentata and the anterior articular process of the third vertebra. At the antero-inferior part of the body of the bone the disease had established a complete communication—nearly an inch in diameter—with the spinal canal, but the dura mater was not destroyed.

" In all the affected portions there was a considerable quantity of bony material removed, forming large cavities, which were filled with a reddish-looking mass, and presenting precisely the same appearances as those of the lumbar spine. In the third and fourth vertebræ the lesions were less extensive, but showed the same characteristic appearances."

In a letter addressed by me to Mr Hunting in the month of March 1863, I gave the following description of the morbid appearances:—

" The kidney is greatly enlarged, weighing thirty-six ounces, flabby, of normal colour throughout, and its pelvis contains a large quantity of epithelium in a scanty fluid.

" Connected with the posterior part of the kidney is a portion of aorta, around which the cellular tissue forms circumscribed cysts by its condensation, and is infiltrated with pus. The pus is homogeneous, creamy, strongly charged with corpuscles, whether nucleated or simply granular, and not mixed with heterologous productions. I have failed to determine any relation between the abscesses in question and the lumbar glands ; though, on cutting into the mass at first, a gelatinous infiltration caused me to suspect I had to deal with suppurating lymphatic glands.

" With reference to the portion of spine consisting of five lumbar vertebræ, the bodies of two contiguous ones are broken down and destroyed : they are perforated from side to side, and the cavities formed contain bony spicula, in great part held together by the inferior vertebral ligament, and imbedded in a violet-red pultaceous mass of the consistence of brain substance. The spinous processes of the first two appear healthy ; the second slightly hypertrophied at its base. On the third, which is the one with extreme disease of the body, the bone structure at the base of the spinous process bulges considerably on either side. On cutting into this, on the left, is a clear, semi-transparent, bluish-gray deposit, of gelatinous consistence, with no evidence whatever of inflammatory action around, but clearly malignant in its nature, and surrounded by expanded bones, which has made way for the morbid product. The spine of the fourth vertebra is similarly affected, but to a greater extent. The transverse processes have been equally invaded. The second one presents, on its superior surface, towards its attached end, a circular aperture, with tolerably defined margin, communicating with a cavity filled with malignant deposit, and circumscribed by the expanded layers of the bony process. The last two of the spinous processes are much more diseased, the rarefaction of bone is greater, the destruction more advanced, and a jagged erosion, about an inch long, and more than half an inch in extreme breadth, indicates where the cerebriform deposit has spread its ravages rapidly and with effect. On the right side it is only the transverse process of the last lumbar spine, with the corresponding portions of the sacrum sawn off with it, that give evidence of diseased action. The bone, greatly rarefied and swollen, though looking solid throughout, when cut across is found to contain an irregular deposit of yellowish-grey colour and gelatinous firmness, which has led to a considerable excavation of the bone.

"On cutting through the arches of the spine on the left side, then perpendicularly through the bodies from below, the spinal canal is exposed without being injured, and the progress of the disease can be readily studied. In the centre of the cancellous tissue of the bodies of the last two vertebræ is a cancerous deposit, most extensive in the very last bone. It is seen in the form of perfectly circumscribed masses, which we must attribute to the colloid variety, from its transparency, uniform gelatinous consistency, and scantiness of cells. Not so, however, with the large pulpy masses, infiltrating and destroying almost entirely the second and third lumbar spines; this is distinctly encephaloid, of apparently rapid formation, deeply tinged, of a brownish red in parts, or else of a yellowish or greyish red in others. The bone around, the solidity of which has given way to malignant disease, gives no evidence of inflammatory action, or any reparative process; it has yielded to the encroaching deposit, which has forced two open passages into the spina canal. Here blood has been extravasated outside the dura mater pressing, as well as the carcinomatous mass, on several of the organs of the lumbar nerves ; otherwise the cord itself does not seem to have been much compressed, and is perfectly healthy in structure.

"Histologically, a fact of considerable interest is the almost complete absence of cancer-cells in all the deposit. Some nuclei, granular matter, and detritus, is all I can discover. Whether the cells have not had time to form in the translucid gelatinous deposits, or have been broken up and disintegrated in the encephaloid masses, it is difficult to assert. That, however, the morbid appearances above described can alone be attributed to carcinoma may be inferred from the multiplicity of the deposits. Hearing that there was a rigidity observable at the upper part of the neck, I was glad to see my expectations come true in your note of the 5th inst. ; after having taken the trouble to disinter the skeleton of the mare, you discovered disease in every way similar to that of the lumbar spines affecting the second, third, and fourth cervical vertebræ.

"Cadaveric inspection, moreover, revealed that form of deposit which generally occurs in the shape of circumscribed masses, or of infiltration within bone, viz., colloid disease and medullary cancer ; the latter with effusion of blood, hence its soft consistence and blood-stained, or hæmatoid, appearance. No inflammatory deposit, no suppuration, existed in the osseous texture ; and we must notice the deadly tendency of the growth, there being no attempts to limit it, but infiltrating, invading, destroying, and transforming to its own nature all in its vicinity, perforating the spinal canal, unremittingly progressing to the annihilation of life. These characters alone are sufficient to prove the malignancy of the deposit, however scanty the evidence of the existence of cancer cells."

NEURITIS, or inflammation of a nerve or its sheath, may be said to be unknown in the lower animals, unless as occurring after neurotomy, when the divided end of the nerve has been subjected to some source of irritation.

NEUROMA, or tumour on a nerve, is equally rare, though, after the above named operation, a fusiform enlargement is sometimes met with on the divided end of the metacarpal nerve. It has a fibrous texture. If subject to continued inflammation and pain, the tumour may be removed by excision.

CHAPTER XIX

ON THE FOOT AND THE ART OF SHOEING.*

Horn.—Secreting structures. — Papillæ. — Laminæ.—Horn cells. —Horn fibres.—Growth of human nail and horse's hoof.—On shoeing.—History of the art.—The wall, sole, and frog of a horse's foot.—Bones of the foot.—Peculiarities of the coffin-bone.—Prevailing errors on the subject. —Preparation of the horse's foot for shoeing.—The "rogue pied" or toeing knife.—French system of forging shoes.—Art of shoeing in England.—How to make shoes.—Application of machinery.—Form of nails. —The French method of forging shoes.—English shoeing.—Stamping and fullering shoes.—Comparison between English and French nails.—Oriental method of shoeing.—Comparison between English and French shoeing.—Relative labour in making fullered and stamped shoes.—Fullered shoe sometimes specially advantageous.—On the weight of shoes.—Number of nails. —Position of nail holes.—Toe-pieces. — On fitting the shoe.

HORN.

THE horns, claws, nails, and hoofs of animals are all composed of material similar to hair, and are often spoken of as built up of hairs firmly matted together. The same cell which forms the scaly epithelium, epidermis, and hair, is utilized in building up the horny structures. The special history of the horny appendages of animals consists, therefore, in the description of the form and disposition of the surfaces from which they spring.

* For assistance in the preparation of Chapters XIX. and XX., I am specially indebted to my father, who has prosecuted many inquiries into the physiology and pathology of horses' limbs and feet, and has thereby mastered the difficulties of the art of shoeing.

Whereas hairs have a root imbedded in a follicle, horn springs from papillæ, which stud a surface extended over a bony or fibro-elastic prominence. Thus the papillated tissue, whence spring the horns of cattle, sheep, &c., forms a covering to the processes of the frontal bones, which are pierced by large foramina for the transit of blood-vessels.

In the foot of the horse we observe the skin, at the part where hair and horn meet, thickened and altered in character, constituting the structure called the coronary band, and towards the posterior part of the foot the subcutaneous tissues consist of that vast fibro-cartilaginous cushion, constituting the elastic basis over which the resilient horn of the frog is formed. From the coronary band downwards, permanent folds, laminæ, or podophylla (Clark), are arranged in parallel lines. They are about 600 in number, and like the papillæ, destined for secretion of the agglutinating cells, which form the matrix of horn. As Virchow mentions with regard to the human nail, each lamina corresponds to the

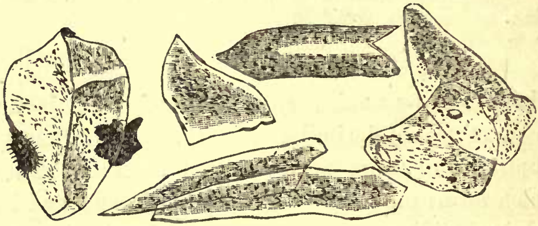


Fig. 216.—(CHAUVEAU).—Different forms of horny scales. The cell to the left is one from the softer and deeper layers, and is charged with two pigment masses, × 300.

single papilla seen on the surface of the skin. The cutaneous surface beneath the os pedis, over the fibro-elastic frog and the lateral cartilages, forms, with the coronary band, an extensive bed of papillæ.

The surface of the horn has a fibrous appearance, and the fibres run in a parallel direction, and in a straight line from the papillæ which form them. Thus the papillæ on the coronary band, frog, and vascular sole, are all directed downwards and forwards.

If a hoof is cut through perpendicularly, it is found that the deeper layers are soft, and the tissue becomes progressively harder from within outwards, so that the surface is firm

Fig. 217.—(CHAUVEAU.)—Longitudinal section of four horn fibres of the wall, taken from the point of union between the white and dark horn. The dark material in the centre of the fibres is composed of opaque spherical cells, which appear dark when seen by transmitted light.

and of a character suited to its functions, viz., for sustaining weight, maintaining a given form, and defending from injury; at the same time, it is endowed with elasticity, one of the essential properties of hoofs.

The so-called horny fibres are funnel-shaped at the point of connection with their respective papillæ. Each fibre has a medulla or pith, composed of soft spherical or polyhedra cells, and of a cortical portion, which has a fibrous appearance, due to elongated fusiform cells, like the cortical portion of the hair. The thickness of the fibres varies; those at the surface of the wall of a horse's hoof are the smallest and

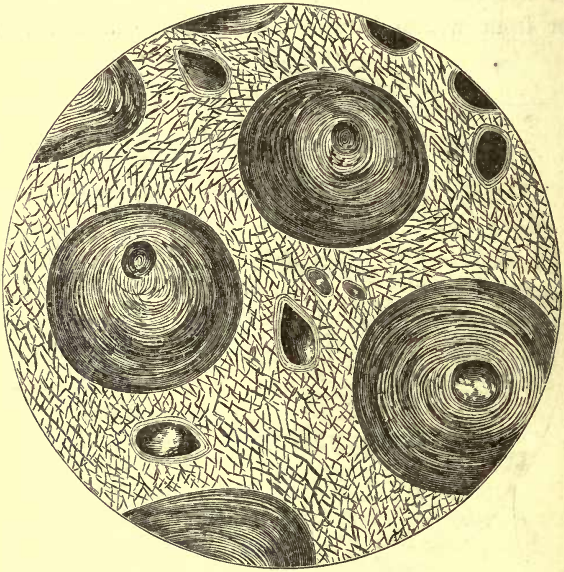


Fig. 218.—(CHAUVEAU.)—Transverse section of several horn fibres of the horse's sole, showing the concentric arrangement of scales around a central medulla; also the superimposed cells constituting the agglutinating material, × 100.

most compact. Between these fibres there is an intermediate substance, best seen on examining a transverse section of horn. Such a section (fig. 218), when examined by transmitted light, affords us a view of the concentric layers of horn-cells surrounding the soft opaque medulla, besides the connecting substance formed by a dense mass of cells similar to those which constitute the fibres, but disposed in an opposite sense, lying flat on each other at right angles with the fibres. This dense bed of cells forms the bond of union between the fibres, which become loose and detached from each other when the horn by accumulation is removed from its proximity to the source of production, and its integral strength is lost.

The fibres, we have said, are formed from the papillæ, but the cells of the material which joins them are produced from the surface between the papillæ and the deeper layers from the surface of the laminæ or podophylla. Thus the horn fibres descend over the laminæ, and are attached to these by cells constantly developed, and which act as the agglutinating material.

The pigment which colours all dark horn is disposed irregularly between the cells of the fibres, as in the case of hair, and has no very regular disposition.

The difference between the horn of different parts of the horse's hoof depends not a little on the relative amount of fibres and inter-fibrous substance. The horn of the wall is tough, and breaks up into fibres as it grows beyond a natural length. This is due to the toughness acquired by the fibres in their lengthy course, and to the crumbling of the cells between them as mentioned above. The horn of the sole is detached in flakes, and this depends on the fact that the fibres are short, do not pass over or into a bed of agglutinating material, and when at a certain distance from the papillæ whence they originate, they break off. Flakes are thus detached from the frog. The growth of horn is unlimited, and in the case of the horse's hoof, we find that if, from the feet being protected by an iron shoe, when injudiciously managed, whether through want of exercise and proper ground to move on, certain parts are allowed to grow beyond the natural depth which would not occur if the animal was free in a state of nature, they imprison other parts between them, and lead to the accumulation of masses of firm unyielding horn, which inflict injury. The unlimited growth of the fibres is beautifully illustrated by cases in which the hoof is not worn down owing to an animal's limb being distorted, and the hoof brought to the ground on its side instead of its normal surface of apposition.

The growth of the wall of a horse's hoof is in every respect similar to the growth of a human nail. We shall quote from Virchow:—"If we consider the nail with respect to its proper firm substance, its compact *body* (Nagelblatt), this only grows from behind, and is pushed forward over the surface of the so-called *bed of the nail* (Nagelbett), but this in its turn also produces a definite quantity of cellular elements, which are to be regarded as the equivalents of an epidermic layer. On making a section through the middle of a nail, we come, most externally, to the layer of nail which has grown from behind, next to the substance which has been secreted by the bed of the nail, then to the rete malpighii, and lastly to the ridges upon which the nail rests.

"Thus the nail lies in a certain measure loose, and can easily move forwards, pushing itself over a moveable substratum, whilst it is kept in place by the ridges with which its bed is beset. When a section is made transversely through a nail, we see, as already mentioned, essentially the same appearance presented as that offered by the skin, only that a long ridge corresponds to every single papilla seen in ordinary sections of the skin; the undermost part of the nail has slight indentations corresponding to these ridges, so that, while gliding along over them, it can execute lateral movements only within certain limits. In this manner, the body of the nail which grows from behind moves forward over a *cushion* of loose epidermic substance in grooves which are provided by the ridges and furrows of the nail. The uppermost part of the nail, if examined when fresh, is composed of so dense a substance that it is scarcely possible to distinguish individual cells in it without applying reagents, and at many points an appearance is presented like that which we see in cartilage. But by treating it with potash, we can convince ourselves that this substance is composed of nothing but epidermis-cells."

As Virchow justly observes:—"From this mode of development, an easily intelligible distinction may be drawn between the different diseases of the nails," and we might add, of the horse's hoof. The causes of false quarter and seedy-toe, the appearances of canker, are most satisfactorily explained. There is only one of these, affording a useful illustration of the manner in which horn is formed, that we shall rest upon. It is the deformity resulting from the diseased condition hitherto called laminitis,—Knollhuf of the Germans,—in which a great enlargement occurs at the toe, believed generally to be due to a descent of the os pedis. The change is gradual. From inflammatory action, a separation occurs between the podophylla (vascular laminæ), and keraphylla (horny laminæ.) As the inflammation subsides, the space, however small, becomes filled up by the cells which usually agglutinate the horny fibres; but as these are detached, they only become more and more elevated, and the space between the horny wall and the os pedis increases. The toe of the latter becomes atrophied, and it is impossible to obtain a restoration of the wall, because the fibres are pushed outwards by the enormous mass of cells found beneath them.

There is a disease of the human nail (Onychogryphosis), in every way similar to the above-mentioned deformity of the horse's hoof. Virchow refers to it as follows:—"When there is a very abundant development of cells in the bed of the nail, the body may be pushed upwards, nay, it sometimes happens that the nail, instead of growing horizontally, shoots perpendicularly upwards, the space underneath being filled with a thick accumulation of the loose cushiony substance."

On Shoeing.

On the high claims to the veterinarian's attention of this department of his calling, little need be urged in this work, since most writers, and almost all able men who have in any way advanced the art of managing horses, have amply set forth the requirement of a rational system of shoeing to be generally carried out in practice.

It is the inconsistency between that which is very generally acknowledged to be an essential requirement, and the indefinite diversities of prevailing customs, which prompts us to take up the matter with becoming earnestness, as the one of all others which interests a large proportion of readers.

History of the Art of Shoeing.

It would be going beyond our limited bounds in this place, to attempt any lengthened historical account of the subject. Still it is believed that nothing tends more to establish knowledge of a science, or an art, than the tracing its past history, each earnest worker thereby fortifying his understanding on the means by which advances have been achieved, the influences which have tended to hinder, and the causes of failure, where such has happened.

Man, unlike every living creature besides, works to-day by the light of past ages, and owes to his fellows, and to future generations, the obligation to use his talents to the utmost in forwarding the cause of truth in every thing he undertakes; whilst the lower animals, having no such mission, act by instinct; the bee of to-day following the same laws as those of his species in all preceding generations.

The history of any subject which extends back for ages, is always difficult to unravel, and when sought to be gone into, is usually lost in remote obscurity; such is pre-eminently the case with the history of horse-shoeing.

The late Mr Bracy Clark applied his classical learning, and great love for the subject, with much earnestness, and after all his researches, believed that horse-shoeing had been in vogue for twelve or thirteen hundred years, and on the credit of some traditional accounts, speaks of its having been brought into Britain with William the Conqueror.

It appears to us that we are totally unable to fix on any date, even approximately, on the origin of shoeing. We have no account whatever of the beginning; unlike the case of the art of printing, we find no name attached as that of the original inventor; and though we are instituting inquiries into an appliance which has enabled man to avail himself of the horse, as a means of advancing civilization, beyond any other power which he could control; and when, in recent times, other powers are made to supply those of the horse to a great extent, that animal is brought into even increased requirement, and, like man himself, does much labour which only living locomotive powers can effectually perform. Notwithstanding all these reasons, there is no epoch to which any two authorities have agreed to assign as that to which the art in question begins to take its date.

We say, then, with Berenger, in his investigations into the history of the horse and horsemanship, that the very absence of any recorded incident whereby a date can be fixed on, is proof of a high antiquity; and, in truth, it must be confessed, that we have no account whatever of the origin of horse-shoeing, but are in total ignorance even of the nation in which the art was first applied, and equally so as to the quarter of the globe in which the ingenuity of man was brought to bear on the subject.

Nor is the negative side of the question more instructive; local accounts must not be taken as full evidence, such as the absence of any account of shoeing horses in the army which Xenophon commanded, or the non-appearance of shoes on the equestrian works of the early sculptors, because the same countries whence these accounts come, admit of horses being used to a great extent at the present day without shoes; therefore, the history of horse-shoeing, as far as it can be made instructive to the many, lies near to our own time; from the latter end of the sixteenth century to the present period may be found all that is necessary to show the state of the art, at the epoch referred to, when Solleysell wrote, proving himself by his work to have been the first and most able of all modern authorities on the subject. The art was, no doubt, well advanced at that time in Spain and Italy, and we believe is referable to a much higher antiquity in the old world, about which we have no early accounts, and yet, looking at the methods of horse-shoeing adopted now amongst eastern nations where no European has had any part in effecting change, evidence is afforded of an innate intelligence.

In all the specimens of shoeing that we have seen, from the remotest countries from which travellers have brought them, however rude the workmanship, a clear intelligence is evinced in adapting means to the requirement.

This subject embraces a wider field for combined labours than may be apparent under its title; to approach proficiency, a clear understanding of the locomotive functions of the horse is required, and if that be acknowledged, the necessary steps must be taken, by going back to the elements of anatomical science. The practice of farriery, viz., that branch of the veterinary art which takes under its charge the art of shoeing and the treatment of lameness —subjects intimately allied and inseparably connected—in which, as a whole, science, artistic skill, and physical activity, are called into requisition, demands the resources of self-denying, able men.

Whilst showing that it is no common smith's work that we are engaged to give an exposition of, it may be readily seen that it is a work for many hands, and does not admit of being equally cultivated to perfection as a whole by all who take it up. Let the same division of labour be encouraged in the art of horse-shoeing as prevails in every other, and something will be done towards arriving at a better general knowledge, and instead of the matter being looked on as everybody's business, whilst no one thinks it incumbent on himself to take the necessary pains to master its details, each man will be induced, it is hoped, to do something in its furtherance, and share in the honours and responsibilities accruing.

The relative share that different workers may take in the cultivation and practice of shoeing is not readily distinguishable in any marked degree, if the hand has need of the head, so does the latter depend on the former.

The physiologist may be supposed the most likely to open up new grounds, whilst the ingenious worker, applying his resources of art, with the help of some correct knowledge on the movements of the foot, will so accommodate means to requirements, that the art will contribute in turn its share to the science.

In the range of knowledge necessary for the prosecution of the art of farriery, a body of disciplined men are required, possessing abilities varied in kind, which can only be found in the many, amongst whom every phase of the subject might be expected to have its adherent.

The whole foot of the horse should be viewed in its proper aspect, embracing structures above the hoof as well as those enveloped by it ; details may advantageously precede general arrangements, in which way the separate parts of the foot should be investigated, they being to the physiologist what the letters of the alphabet are to the scholar—the first steps of the ladder, the parts are learnt separately, and then blended as the understanding puts the knowledge into useful form.

Nature has furnished the horse with hoofs, which are endowed with given degrees of substance, density, toughness, and elastic properties, differing in their different parts, so as to assimilate the functions of the outer with the inner structures. On that animal, more than others, is conferred a double framework to the foot, an inner bony skeleton and an outer encasement of horn, and these mutually act in sustaining and supporting the great exertions which the foot, as the support and lever, undergoes.

Subordinate to the sustaining structures just referred to, those more pliable are brought into their assigned action, viz., the ligaments and cartilages, amongst which may be comprised that immensely powerful structure, the frog, with the intercurrent ligamentous bands which take their attachments from the lateral cartilages, and converge to the centre; this anatomical formation is shown, and the functions described in the *Edinburgh Veterinary Review* for 1861, at page 511, though a single illustration, however well executed from nature, is totally inadequate to do more than aid the text, to indicate how each investigator may succeed in finding out the parts by his own subsequent dissections.

The hoof of the horse may be described according to its formation, in three distinct parts, called respectively the *wall*, *sole*, and *frog*.

Each division of the hoof is composed of horn, differing in texture at different parts, that which enters into the composition of the wall is denser than that of the other divisions, it is of a fibrous nature—the fibres taking a longi-

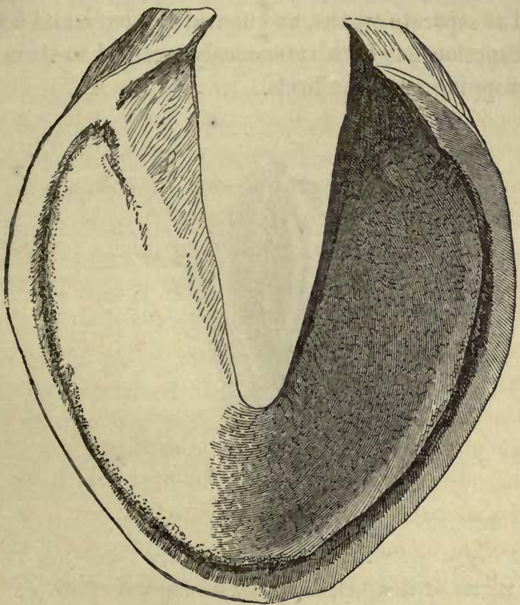


Fig. 219.

tudinal direction from the upper part or coronet downwards, and are endowed with an elasticity and density which admirably fits them to embrace the complex structure, support weight, and resist wear. The density of the horny fibres is greatest, as we have said, as they approach the surface of the wall, the outer layers acting as a cuticular covering to defend the inner from external agencies, snch as a dry atmosphere, excessive moisture, &c., performing, in fact, the same functions as the cuticular covering does to the true skin of all animals over the whole body.

The depth and strength of the wall are greatest at the point or toe. Posteriorly, on each side, it is inflected inwards, so as to form an internal wall. These inflections have been described as separate organs, and named the *bars*, and accordingly, a function has been erroneously ascribed to them, viz., that of propping open the heels.

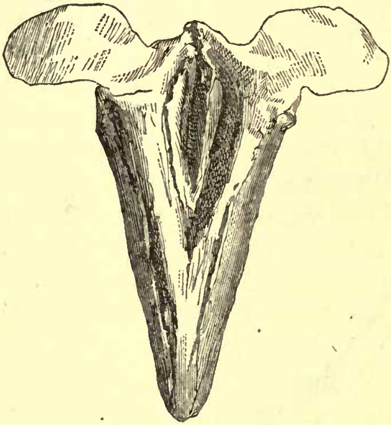


Fig. 220.—Frog of the horse, showing the separation of flakes.

The sole is the next division of the hoof to be noticed, and viewed in connection with the wall, it may be regarded as the arched support of the foot; it is an irregular thick plate of horn, presenting to the ground a more or less concave surface; its outer margin furnishes a broad surface for attachment to the inside of this part of the wall, where it blends with the horn plates.

The frog is a triangle of very elastic horn, filling up a space of corresponding figure in the sole; it extends nearly two-thirds through the centre and bottom surface of the foot. At its anterior part or apex, it consists of one ridge; about one-third of its length from the point, the organ divides into two equal parts, leaving an interspace termed the *cleft*. By this arrangement, provision is made for motion in the posterior parts of the hoof.

The frog is composed of horn of a fine tough texture, more elastic and pliable than the sole; besides, it covers an exquisitely elastic organized structure of its own shape.

Some notice of the bones of the foot may now be taken; on their form, relative position, and connection depends its motion, which in the horse, physiologically considered, begins where the radius terminates in the fore, and the tibia in the hind limbs, that is, the knee and hock and all below enter into the pedal function.

The bones which enter into the construction of the foot should be understood with reference to their particular functions; to the required action of these solid parts, all other structures concerned in the locomotive functions are made subservient.

The bones of the limbs belong to two distinct orders as regards function, one of which, sustaining the weight, are acted on, and are the levers which give velocity, and all motion; the others are formed into projecting pulleys, buttresses, and also become levers in connection with the shafts alluded to in the first order, of which the cannon, pastern, coronary, and pedal bones, constitute those of the foot extremity in both fore and hind limb, and of the latter, there are two pairs, and two single bones in each extremity, viz., the navicular, the two sessamoids, and the two splint bones, with the pisiform in the fore, and the os calcis in the hind limbs; in this classification, the other bones special to the knee and hock are not taken account of

The function of the bones of the last order described is necessary to be understood, inasmuch as it differs from that of the sustainers, and it is only by understanding these in detail that anything can be fully estimated, either of normal action, or of disordered conditions.

The bones which are all placed behind the axis of bearing, constitute the medium by which muscular energy is made to act with great force, but these have little more to do in sustaining the superincumbent weight, than have the trochanters of the femur, the use of which is obvious to all anatomists, viz., that they form projections for uplifting power; taking another example, we may adduce the patella, the great and essential offices of which are most distinct from that of sustaining the superincumbent weight; and just in the same way may the navicular and sessamoid bones be viewed; whilst the splint bones, and those projecting posteriorly of the knee and hock, are so fixed and acted on directly by muscular power, that they constitute additional parts of the shafts, a main function of which is their uplifting action.

The os pedis, or coffin bone, is peculiar in the horse, both in its structure and economy; there is a close analogy between that bone in the horse, and the double formation of the same in the ox, but the resemblance is only partial, each animal being perfect for the uses and situations for which it was designed; the cloven-footed animal moves with astonishing security over granite rocks, where the horse is less adapted to go; this fact is illustrated in the different kinds of goat, deer, and in a lesser degree in the ox. All cloven-footed animals are endowed with remarkable security of foot-hold, but want the elasticity to carry weight, and the graceful movement of the horse, with his ample security over hill and dale, the situations suited to that animal's whole nature, where he finds sustenance for life, and where alone his powers, speed, and endurance are required.

The pedal bone has much of the form of the hoof in its

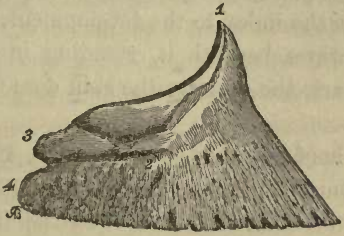


Fig. 221.

exterior aspect; and when the cartilages, with the other structures which attach to the bone, are seen in connection, with the coronary and navicular bones in position, the whole organized structure is similar in its outermost form to that of the hoof.

As has been said, we cannot, if we wish to understand the subject, confine our views to that which is generally treated as the horse's foot, viz., the hoof, and the organs it envelopes, but a larger understanding of the structure of the limbs and the locomotive functions generally is necessary.

The horse's hoof is not to be regarded simply as a covering for the protection from external injuries of other structures, namely, that of the sensitive parts. The hoof has its specially assigned sphere in the whole economy of the foot, and each separate component part must be looked on as an essential constituent of the whole organization. Nature does not make one part so imperfect as to require another to minister to its aid.

The hoof forms an integral part of the foot, and those animals that lack it, though amply protected as they are, cannot sustain weight and undergo the same fatigue on the same soil as those which possess it; and of the animals gifted with hoofs, the horse is superior to them all.

The hoof must be studied in reference to its construction and economy as the index to the development, condition, and health of structures beneath it, standing in relation as it does to these parts the same as the skin does with the structures it covers.

The horse's hoof is commonly regarded as a secondary structure, a something that may be cut away to ascertain the condition of parts under it, not understanding the fact, that when such exploration has been perpetrated, the normal condition of the whole foot is interfered with for many months afterwards. If a medical man examines the limbs of a man, he is thoroughly cognizant of the health or otherwise of the whole structure by the condition of the skin, and so should the veterinary surgeon be with regard to the horse's foot, by taking the hoof especially for his chief guidance; the organs of vision and touch being fully adequate to furnish the mind with data, when to the rest the horse's action is taken into account. When the questions bearing on the above phenomena are satisfactorily solved, it will readily be admitted that the hoof is a most important structure for its own particular part in the whole economy of the foot, and that it must be maintained in its duly proportionate form, with its natural density, whence comes elasticity, and strength to sustain weight, and maintain its required form.

In describing the bones of the horse's foot, whilst limiting our observations according to the scope of this essay, there are only three which come under our notice. These are, first, the coronet bone, the foot or coffin bone, and the navicular bone. By the connection of these, the coffin joint is formed—a joint exquisitely beautiful, and of the first importance in its exactly assigned functions.

The coronary bone forms the medium through which all the weight is exerted, which is conveyed to it by the pastern bone, and which is lastly diffused through the coffin bone.

The action of the coronary bone is most considerable at its lower extremity, where it has a large articulating surface in connection with the coffin and navicular bones; its action in progression is a revolving movement from the posterior on to the anterior surface of its lower condyles.

The coffin bone is the last in the limb, of those in the axis of bearing, through which all power is exerted, and by the mode of connection between it and the hoof, great weight is carried, with velocity unexampled in other animals, and is distributed on to the ground with the most perfect freedom from jar, whilst the inherent strength in the whole foot is prodigious.

On reference to the pedal bone, as shown in the foregoing illustration (Fig. 221), it is seen to resemble, in its leading features, the external form of the hoof; one chief difference being found to consist in the former being fully a fourth shorter than the inner cavity of the latter. When, however, this wonderfully constructed bone is furnished with the cartilages, ligaments, tendinous attachments, and all the influential structures of which it constitutes the centre, the entire concentration of powerfully organized parts, assume the form, and become the counterparts of the hoof.

Though it is not the aim on this occasion to supply a great present want, viz., that of a treatise on the economy of the horse's foot, with ample details on the art of shoeing, it is none the less hoped that, to the extent to which this article goes, little of what is given will be set aside hereafter, or require to be withdrawn.

It is believed that, much as principles are required to be laid down and spread on all that relates to horse-shoeing and the management of horses' feet, that in this place good will be derived by our trying to make the subject plain for popular reading, rather than elaborate. A first move in a right direction, constitutes the extent of our aim in this work.

With reference to the organization of the foot and its functions, so far as these essential details are discussed, it will be sought to make the inner movements apparent from an external view, as most of the phenomena which form links in the chain of facts, the understanding of which is necessary for the establishment of a successful practice of shoeing, may be seen in the way alluded to.

We are of opinion that the ancients drew their conclusions on the movements of the horse from observing his external appearances chiefly, and most of what is best understood on the horse's foot at the present time has been acquired by men who have observed carefully, and at the same time handled the parts contemplated most industriously; thus making the two gates of knowledge which constitute the most effectual channels, the rational means for the attainment of an end.

While contemplating the foot with reference to the adaptation of systematic rules on shoeing, we must take account of the innermost structures, find out the course of bearing as it is transmitted from the longer shafts to the coronary and pedal bones, and how this last disperses the weight over the hoof, and through it to the ground; we find, as is the case from the knee and hock downwards, that at the extreme point the greater solidity exists in front, whilst the structures are all yielding posteriorly; the cartilages on either side commence where the extensor tendon and the branches from the carpo-pedal ligament are inserted into the prominent pyramidal process of the coffin bone; these may then be traced backwards where they are strongly connected to the basilar process, and where much increase of substance is found with more regularity in form; the lateral cartilages have a depth, and from a clear space above the hoof reach to the bottom of it internally, and ligamentous bands attach to the upper margin, and inner surface, which is concave, whilst the outer is everywhere convex; the convoluted form of the whole cartilage on either side includes one-half of the elastic fibrous frog; whilst continuing to be reflected backwards, the upper cartilaginous margin terminates by giving origin to the tendinous bands forming the two ridges of the frog, one on either side of the cleft, immediately anterior to which these bands coalesce and form what is found to be the denser part of the frog, and are seen piercing downwards and forward, to be inserted into the plantar fascia and the anterior concavity of the coffin bone; the position is represented externally by the point of the frog.

We have here traced the cartilages on either side, as they recede from the lateral anterior margin of the coffin bone, attaching to the lower condyles of the coronary bone, protecting the pedal joint, and then continue, the inner framework serving instead of bone, which is discontinued, where the axis of bearing is passed; thus the cartilages, with the hoof, give the form to the foot posteriorly, as the pedal bone fills up the space anteriorly, and by bending round, they become connected with the bands of the frog, which are attached to the centre of the pedal bone inferiorly, forming a double bow. We have passed unnoticed the elastic fibrous bands, which, with interlaying fat-cells together, make up the bulk of the frog, and form the bulbs of the heels. The two lateral halves of the frog, posteriorly, form a double elastic cushion, and are slenderly connected in their posterior centre, represented by the cleft, and are also loosely attached by fibrous bands above, whilst anteriorly the tendinous structures taper, become condensed, and send off attaching bands laterally to the semilunar crest, and a still more considerable one on each side in connection with a slip of the expanded perforans tendon, which are strongly inserted together, into the inner surface of the basilar process, and the pedal cartilage.

Persuaded that no mechanic whose understanding is limited to the handicraft work alone, will ever succeed well in the practice of shoeing horses, and yet, believing from the extent and varied kinds of knowledge required, that few will be able to master more than a special part, and knowing that, probably for years to come, not one horse-shoer in fifty will have the opportunity to learn anything about the foot, (not through want of capacity on the part of farriers to learn, but for reasons, and through the operation of causes not easily defined, but still more difficult to remove), it is through thus seeing facts the more our aim to adopt phrases and modes of exposition such as will be generally intelligible, and still anticipating that which Bracy Clark prognosticated fifty years ago, "when the art has made some advance, improvements will go on faster," the aim now must be to adapt present means of diffusing knowledge on the most urgently required details.

When, however, the most has been done that can be accomplished, to make the veterinary student proficient in the practice of shoeing, and the working farrier intelligent on the structure and functions of the foot, the number of men who may be expected to reach proficiency in the whole, will not be great, the few nevertheless, will be like the little leaven that leavens the whole lump, and in this respect veterinary science and art is not exceptional: the law prevails in all human knowledge. It is very desirable, also, that owners of horses, and men who have charge of them, should possess more correct knowledge on the proper way to manage feet than prevails now, and, as a matter of course, in relative degree as right knowledge becomes established amongst veterinary surgeons as a body, so it will show itself in a more popular form.

It is essentially the provision of veterinary science to enlarge the field of right knowledge on this most important branch in its allotted sphere. And let us try to exclude error, as the only way to advance truth, thence will spring correct ideas, which will radiate. All that is laudable and profitable to the public generally, and to the small body of veterinarians specially, will spring from the banishment of ignorance and prejudice.

In no age in the history of veterinary science have we evidence of such conflicting opinions, and such an unsettled state of knowledge on the economy of the horse's foot and the art of shoeing, as has prevailed in England during the first fifty-five years of the present century. That which was nobody's business, has become every one's province to possess, so that everybody thinks he knows more than others, talks and writes, whilst lame and worthless horses are being multiplied; we may express, as our conviction, however regretable the fact, that this branch of the veterinary art has suffered more within the present century than can reasonably be expected to be redeemed during the remaining part of it.

As this subject has been treated in the different numbers of the *Edinburgh Veterinary Review*, during the past five years, repetition of what has been there produced will not, to any considerable extent, be had recourse to; those who read the *Review* will do well to refer to parts in which the physiology of the foot is described; and in the meantime we will endeavour to advance on our course by new methods of analysis, and exposition of views.

It is found to be true, however paradoxical to the mind, that the art of horse-shoeing, and the prevention and cure of foot diseases, are subjects so allied that no attempt to separate them has effectually done so, because, from the nature of the subjects, the whole must be taken under cognisance together. Physiology and pathology, or the science of healthy action. and a knowledge of diseased states, necessitate one unbroken train of inquiry. Foot disease and lameness, which destroys a larger proportion of horses than any disease to which the animal is subject, besides impairing the working powers of the larger proportion of those which are kept in work, must be investigated along with prevailing customs of shoeing, when it will be found that the one stands related to the other as cause and effect, and the sequence of these will be according to that of the agencies; for instance false modes of shoeing, which, interfering with functions, produce disease; whilst rational application of art may be made the means of restoring functions, when an all-bountiful nature begins to restore the mischief done; hence shoeing is a common cause of temporary pain, and it causes permanent derangement of the foot if the system be not duly amended; whilst the art scientifically applied is capable of conserving horses' feet in their normal state, with some occasional and accidental exceptions, and when good execution is made to follow bad practice, shoeing becomes the restorative means; thus it is a surgical appliance, in the case.

The difficulty experienced in trying to instruct non-professional readers by reference to anatomical details, is perhaps more imaginary than real, though anatomy and physiology cannot be thoroughly gone into locally, and those who advance the knowledge of an organ, or a region, do so usually by concentrating their inquiries on the part specially, after the whole has received the ordinary share of attention. The same argument, however, applies to all knowledge, and if nobody ventured to learn any abstract truths, because opportunity was wanting to go into the whole length and depth of the matter, in such a case the world would be in a miserable state of ignorance. Now the difference between the few scientific men and the many of the world in the knowledge they possess, is one of degree only, and the more exact and extended the knowledge of the latter is, so relatively will these push their pioneers onwards, and furnish recruits to their ranks.

Having, in recently published papers already referred to, treated on the foot of the horse functionally and physiologically, in which way it must be studied and regarded from the knee and hock inclusive, in fore and hind limbs respectively; and having entered at length on some of the most important details of these phenomena, I shall not trespass on the reader's time by inviting him to follow me over the same ground again in this place, but shall limit my observations to the foot as it is popularly recognised by practical horsemen and horse-shoers.

It has been already said that that complex organ, the foot, is endowed, like every part of the animal frame, with its bony structure, and furthermore with an outer supporting one composed of horn, called the hoof. Thus limiting the sphere of inquiry, we cannot lightly pass over these structures and their relations.

On the right understanding of the economy of this two-fold solid construction, greatly depends the capacity for appreciating the functions of the foot.

Other phenomena, of the kind noticed, make up the marvellous combination of pliable structures which are found running in such variously assigned directions, as to confer the greatest possible strength, with the most perfectly adapted resiliency to the whole foot.

The coffin bone is the broad arched structure with which all the yielding parts are connected, and with which all their functions are blended. We may refer to the fact, that the coffin bone is the most important of any one in the skeleton of the horse for the veterinarian to become acquainted with thoroughly, owing to its elaborate construction, and owing to the very important functions with which it is endowed, and through its being more than any other exposed to injuries; yet, strange to say, just as complications prevail, so relatively is the bone little understood.

Much that is bad in the customary practice of shoeing, and equally irrational in the treatment of horses' feet in every way, is due to wrong notions being entertained on the form of the coffin bone, and respecting its most obvious individual and relative functions. More than fifty years ago the description given of the coffin bone by our authorities, was that of a deformed and diseased bone, instead of one of normal condition, and it is very probable, for we have some evidence in the affirmative to show, that one single bone accidentally falling into the hands of a clever writer led to widespread erroneous notions regarding it, which have gone uncorrected; hence, become and continued to be a source of growing misunderstanding on the character of the key structure of the whole foot.

The coffin bone is commonly described as being relieved from the plain line at its front and posterior extremities; nothing, however, is further from the truth than such description, as it is only when the bone has become absorbed in parts, through pressure, which, unfortunately for owners and suffering horses, is a most common occurrence, that the bone assumes the deformity which has been attributed to it as its natural condition.

"In the perfectly natural foot, the *retrossa* are relieved, or raised a little above the general bearing surface of the bone, by which they have a secondary pressure. . . . If we place the perfectly natural coffin bone upon a level flat board, or table, it will be observed to bear primarily on the quarter, and the inside quarter will take a more decided bearing than the outer. . . . The pince, or front of the bone, will also be found to take hardly any sensible bearing, being slightly turned up, and away from the table, obviously in order that it might more conveniently make the rotation which the foot performs on leaving the ground."—(Bracy Clark, pages 136–7.)

The foregoing is a faithful description of a coffin bone far advanced in deformity, amounting to disease; such as may be found every day, where old horses are destroyed; the bone which was selected was capable of being turned to good account, only as a pathological specimen.

It is less surprising to find an enthusiastic inquirer, in 1809, drawing wrong inferences from first impressions, on seeing a solitary phenomenon, than that his rivals and critics should not, from their number, when excited to move, have discovered his errors; but, instead, some attacked the good, and the less correct results of Clark's labours alike, others believed all that he imagined, but none took the right course,—that of separating from the philosopher's produce, the grain from the chaff.

On the false assumption that the form and functions of the coffin bone are such as has been referred to, indefinite hypotheses have arisen as to how the foot should be shod, and shoes of curious forms have been applied in accordance with the views entertained by the authors, amongst whom we have had, in number constantly multiplying during the last fifty years, not only veterinarians and amateurs, but ironmongers, and men possessing all sorts of knowledge but such as belonged to the subject, have been alike persistent in pressing their claims for patronage, in favour of some peculiarly formed piece of iron, and their views on shoeing in general.

That anatomists should not have been able to establish a common accord on the normal features of the coffin bone is strange, and that physiologists should, by placing that bone on a plain surface, try to find out its bearing points, is to ourselves a mystery. The coffin bone has no bearing surfaces; we know of no bone in any animal that has; as adapted to repose on the ground; it is destined for totally different functions, invested, as it is with other structures, and composed of processes, angles, depressing extremities, and margins; by which means the strongest possible hold is given to cartilages, ligaments, and all connecting and attaching tissues; and it would be as logical to look at the skeleton of the horse, and try to discover that the vertebral spine is adapted to bear the pressure of a saddle and the weight of the rider, as to try to learn how the coffin bone can receive and transmit weight otherwise than through its natural means of connection.

Bones are designed for different functions to that which adaptation of their surfaces to bear external pressure would imply. We will reproduce here some observations and illustrations from the *Edinburgh Veterinary Review* for 1863, to show the connection and relative functions of the coffin bone and the hoof. A large share of the functions of the foot is due to the hoof; anteriorly it is such that it does nothing less than sustain the whole weight and force which, through the limb, are exerted on it. As we have shown, in several published papers, the hoof does not bulge, widen, or expand, when exerted on the ground, but the opposite action is going on; the horse's foot is most relaxed or dilated at the instant when the limb is arriving at its full extension, then it is that the more passive structures are being brought to act, and though, as we have shown, there is no such motion going on as was supposed, we can demonstrate the existence of other movements, better defined, and more constantly going on than those supposed to prevail. By the action which follows the alighting of the foot on the ground, pliable structures are drawn upwards while pressure is being exerted downwards as the several bones revolve, and this follows upon the resilient function which results when the foot is implanted, and which goes on through the whole structure during its instant action.

The annexed illustrations represent the arches of the pedal bone, and the sole, of a fore and hind foot. The drawings were executed from transverse sections through the pedal bones, so as to show the arch most distinctly; the section of the whole hoof was made in the same way, transversely from the upper margin of the wall, down throughout its extent, including sole and frog below.

Figs. 222 and 223 show the pedal bone and hoof of a fore foot.

Figs. 224 and 225 show the same parts of the hind foot.

On examining these structures, the somewhat different functions of fore and hind feet become more apparent to us; corresponding with the external character, and what may be observed in the action of the horse. The fore foot sustains most weight, covers a larger surface than the hind, and the arch, both of sole and bone, is scarcely so high in the fore as in the hind foot, whilst its breadth and sustaining power is greater. In the hind, again, as we endeavour to interpret its action, we are aided by observing the structures, which we find corresponding to the more obtuse exterior point, a more considerable concavity of sole and relatively arched form of pedal bone, and that the hind foot is narrower, and more concave—all properties adapting it to embrace a firm hold on the ground.

Fig. 222.

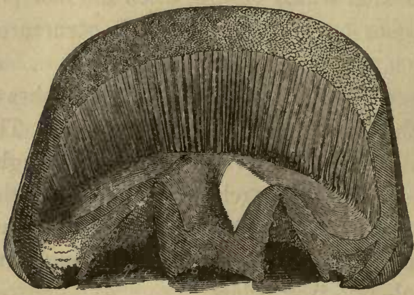


Fig. 223.

Fixed rules, to be laid down for preparing the foot, we have none; and it forms a characteristic feature in all the divisions of labour incident to this art, that we require to work by knowledge and observation, and not by measurement.

If it were possible to reduce the practice of shoeing to exact rule, it would no longer be the difficult art it is, requiring knowledge of various kinds, scientific and mechanical, in order to make up the required system.

In concluding our observations on the necessary steps to be taken in preparing horses' feet for shoeing, or adjusting them when going without shoes, we may state that, to preserve proportionate depth of wall, is about the most impor-

Fig. 224.

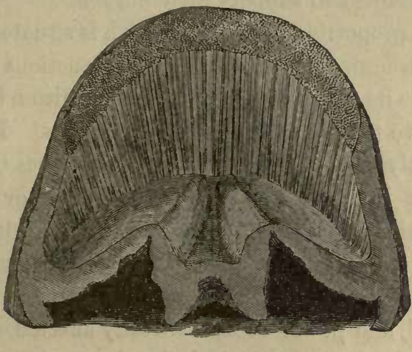


Fig. 225.

tant part, when taken alone, to be attended to and well understood of any in the whole process.

When thoroughly understood, the adjustment of the wall to its duly proportioned depth implies more than at first thought appears; it regulates the geometrical figure of the foot, viz., the due degree of obliquity, breadth, length, and depth of heel, and also confers efficiency to its supporting arches.

It should be understood that the inner capacity of the hoof remains the same, so long as all the organs are maintained in health, it is not affected by the growth of the hoof, all excess of which becomes a store against excessive exertion and consumption, which at irregular intervals is occurring to the horse in his natural state.

The plantar or ground surface of the hoof is endowed with great strength and properties the most effective to resist wear, that is, when horses' feet are preserved and managed as Xenophon directed they should be, viz., kept dry, and accustomed to bear on the hard stones, the texture of the hoof is tough and elastic, yet sufficiently resistant, and its arches are adapted to support their burden.

The large proportion of the hoof which is situated below the organized structure has most important functions to perform, and of course its perfection in form and condition is of importance relative to that of its important offices. If this part be imperfectly developed, as is invariably the case, under bad management in breeding and keeping horses, or if it be reduced by knife and rasp, no amount of iron work can stand in its stead; and, on the other hand, if the hoof is grown to excess, or unequally, and out of proportion, the horse's action, speed, and power become directly affected, even before obvious lameness may necessarily be the result.

The first step in the practice of shoeing to be attended to, is the preparation of the foot. Before removing any part of the hoof, it should be known that the workman is master of his art, and sees at a glance whether any is required to be removed, and, if so, from what part of the hoof. It often happens that a horse comes to us with his foot denuded of its horn, so that there is too little altogether; and yet it may have been so reduced in parts, as to render it necessary that we should give some little adjusting touches; and by removing inequalities, we are often able to give a more extensive and better-balanced bearing surface than previously existed. Thus the word 'adjusting,' or preparing the foot for the shoe, is more applicable than that commonly used, of 'paring out the feet;' indeed, this latter term is thoroughly objectionable, because we never, in the sense implied, pare out the feet at all, the parts detached are not pared away by us, as has been the prevailing custom, and we hold the integrity of the hoof in all its parts to be essential to the foot's health, and to a due performance of its functions; the wall is the chief part we have to act on in the process, which, when defended by an iron shoe, and its consumption is thereby prevented, grows long and deep, and requires reduction to its due proportion at each shoeing, or about every thirty days, even if the horse does not work sufficiently to wear out his shoes in that time.

When it is understood how the feet repose on the ground, and sustain the action exerted on them, the necessity for adapting the shoe in conformity will be apparent. In preparing a foot of which the substance of hoof abounds, there are three points to which attention should be drawn—viz., across the toe, or point, and the posterior extremity on either side. When a horse's foot is much grown up, it becomes what is called long at the toe, and it is at that part more than any other that the instrument is applied for its reduction. At the same time, due proportion is to be given, and the just obliquity of the foot restored or maintained, by adapting the two posterior extremities of the wall to their required depth. Taking the three points above named in order, and for our guide, we carry the rasp over the intervening spaces laterally, which requires to be done nicely—that is, with a clear understanding of requirement and a light touch. One amongst the many prevailing errors in practice consists in rasping and cutting down across the quarters, making the bearing surface of the foot hollow or flat, whereas it should possess a fulness appearing somewhat round, as the eye glances down from heel to toe when the foot is held in the hand, by which depth is preserved across the centre or quarters, and this is in comformity with the foot's natural structure, and with the normal wear of the hoof when unshod, and it is, moreover, found successful in practice.

In the preparation of the foot we meet with extremes in every conceivable form; sometimes the hoof is scarce through previous reduction, at others excessive accumulation of horn is found; and though the sole and frog exfoliate when the foot is in its natural and unshod state, when duly exercised on the ground, and also when properly shod, yet, if we reverse these conditions, the hoof increases in length and depth, and the sole and frog become imprisoned, as the wall grows and tilts over upon itself; in these cases, as a matter of course, the light touches we prescribe will not suffice; still the same rule serves to guide. The depth of the wall being adjusted, unduly thickened sole will be set free, as will also any morbid growth of the horny frog; and these detaching superfluous parts, being incumbrances, must necessarily be removed. The continental workman finds over us an advantage in preparing the foot, by using his buttress—an instrument discarded in England when the drawing-knife was made to replace it. There is an important rule to be observed in preparing the foot, which consists, instead of reducing its depth to excess, as in the ordinary way happens, the foot should be taken forwards on the knee, and the edge filed round the toe; this, however, with some exceptions where there is excess of hoof, will only bear to be done with a fine rasp or file, nor should there be any deep notch cut in the toe, as is usually done, to let up the clip, the entire strength of the wall should be maintained, it being the part which sustains the greatest exertion of any, and forms the fulcrum in all exertion. The continental shoers do this well by using an instrument which the French call the 'rogne-pied,' with which the outer hard edge of the wall is chipped off, when the buttress does the rest, by paring a broad well-adapted surface for the shoe to be adjusted to.

The 'rogne pied,' or toeing-knife as it was called by English farriers, was formerly in common use with the buttress, by our workmen. Its application, however, was frequently carried to excess, the substance of the hoof being thereby too much reduced; excesses in the same way are not unfrequently committed by the less instructed of continental workmen. The intelligent understanding of the shoer can alone afford sufficient guarantee against abuse, whatever be the instruments used or the rules prescribed.

The opposite to the system we are advocating—viz., of cutting and rasping the hoof flat and hollow across the centre, which is followed by the shoe being made in the same form exposes the coffin bone to be jammed on to the shoe, the point of which being fixed by means of nails, the quarters of the foot form the fulcra on which pressure acts, as the two parallel halves of the shoe posteriorly become two arms of a lever—thus we find the coffin bones pressed into deformity, as will be shown when treating on diseases of the foot.

Besides the conflicting notions entertained as to the way horses' feet should be prepared for shoeing, viz.—how a foot with exuberance of horn is to be reduced to form, or in what this latter consists—the now long-established customs render agreement on method difficult, and necessarily a system will be slow of being brought about; the instruments alone now used by us are ill adapted for the work; the drawing-knife and rasp are apt to rob the feet of their strength and substance, the one by scooping out the concavities, and the other by reducing the outer and prominent parts, but neither nor both together are proper for giving a broad, good bearing surface, or for economising labour in the process. A good continental farrier can get feet ready for shoeing in half the time we can, by using proper tools and forethought, with less physical force.

On the mode of forging shoes, their proportionate substance, and the proper form to be given to them, we shall be brief.

With some few exceptions this part of the work could be reduced to *rule*, difference in size, from such as are suitable for the small, up to the largest horses, constituting the only essential variations; substance and cover is required to be different, according to the employment of horses, their breed and weight, and exceptional formation of feet, taking into consideration also the roads on which they work.

If some plan could be devised by which machinery were made to supply the iron in an advanced stage towards being completed into horse-shoes, a public good would thereby result, and we feel quite certain that water and steam power, under the present state of engineering art, can be brought to do at least one-third of the work which is now done by hand in the making of heavy shoes; and without assuming that anything will ever surpass the best hand-work in the process, we believe that the state of the art of farriery would speedily change for the better, both as it would affect the men employed, and in the execution of the work. It would be possible for much of the heavy labour of forging shoes, which is done for less pay than any similar amount of equally important work, to be kept distinct from the art of shoeing, just as nail making or any of the processes through which iron passes, are separate and distinct departments of industry.

With regard to details on the method of making shoes, we can admit of some latitude in the diversity, consistently with good execution of the whole process. We profess to have no special shoe, nor do we ever find ourselves in so remote a place from home that we cannot get a man to make shoes to answer our purpose, which we can adjust to horses' feet in all cases, or direct in ordinary requirements how they should be fitted. It is this last part, coming after the preparation of the foot, which determines the good result of the whole operation. There are, however, some rules to be observed for forging shoes, which, unless they be properly made, we cannot succeed well in fitting, and exceedingly well-forged horse-shoes may also be so badly finished and nailed to the feet, that the end is defeated more or less completely.

The fact is, that in the practice of shoeing we are operating on living structures, and though it is difficult for most people to understand this special phase of the art, the truth does force itself occasionally, though, unfortunately, it is the poor horses that really feel where the shoe pinches; losses to owners through shoeing not following instantaneously on the cause, the extent of the evil consequences is not appreciated.

If a man has arms only to wield the hammer, there is not much care taken about whether he has knowledge and a reflective mind, which alone can insure good execution, on which depends the normal action of the horse, with health and ease to his feet.

The rules to be observed in making shoes are—first, to use good iron, which, if of fine grain and tough fibre, will bend under the hammer, even when cold; and can be fullered and stamped when of a red heat, leaving a clean surface, and if the shoes are well forged, they will maintain their form, and afford protection to the foot when they have become thin through wear.

Whilst every man who knows enough of the art of shoeing to superintend the work, or do it, will appreciate its importance, and the necessity for each part being well done, it is remarkable that of all the authors who have had their peculiar shoe, not one, to our knowledge, has, in any marked degree, improved the art of shoeing. Whether we take, for example, the elder La Fosse, who adopted the short shoe, or tip, or refer to the several different forms which the late Professor Coleman adopted and took out patents for, or recall to memory the names of many men who have also entertained some special notions on shoes of exceptional form, the good which the art of shoeing has derived from these is not to be found; on the contrary, perpetual confusion is kept up, and the whole body of working farriers are placed in the position of an army without a leader. Whilst not a few people recognise the importance of the art, the majority of those who keep horses have no right appreciation on the matter, and the horse-shoer is ordered as if his work was easy to understand. The art of horse-shoeing is in a more unsettled state in England than in any other nation in Europe; and we believe that we are justified in saying that there has been more want of agreement among men on the subject during the present century than at any previous epoch in its history.

There are three requirements of essential importance in shoes as they are forged; as has been said, they must be sound and expertly worked, the iron being of good quality, properly distributed, the nail holes should be of proper form, rightly placed, and the direction given by the stamp should be most accurate.

The question as to the form of nail used is also important, and is intimately connected with the plan of horse-shoe making; the apparently essential difference in the form of nail consists in the variously formed head. The shoes and nails constitute the manufactured material which the artist shoer uses up, and these may be made by expert hands, not necessarily shoers at all; though the workmen fill up their time, when not applying shoes, in making them, still if we could get them equally well made by machinery, it would be a gain in the whole process.

Throughout Great Britain we use two kinds of horse-nails, the old rose-headed pattern, and what is commonly called the countersink; this last kind of nail is of modern introduction, brought into vogue with new ideas on shoeing about sixty or seventy years ago; this nail is entirely confined to the English school; in the whole of Europe, apart from the British Isles, nails of totally different form are used, as we shall hereafter explain, and also by the older Oriental nations.

Writers on the art of farriery have not duly estimated and described how differently formed nails necessarily affect the whole process, and call for modification in the forging of shoes. Those of the old schools are made by the iron being hammered out so that the web presents an almost uniform thickness, which is not more than half that of the outer margin of an English shoe; and they stamp this web of iron with a tool that makes a shallow depression for the nail head. With slight difference, this mode is pursued over the old world, where the art of shoeing no doubt was first applied.

And the practice of shoeing, as carried on by any of the continental nations, will serve to illustrate the views we wish to expose, though the French method, which, above all, merits the name of a well-founded system, as adopted throughout that country, and to a great extent imitated over the world, is that which we shall take most account of, next to the modes in use in our own country.

The French, in forging their shoe, leave the inner margin of the web of their fore shoe (as all people do the hind) as thick as the outer, instead of, like us, working the iron so as to form a thick outer edge, and then to bevel out the inside, making what goes by the name of the seated shoe; our neighbours use a stamp which has a four-sided obtuse point, which forms a perfect countersink, into which the head of their nail fits; the latter being made in a steel dye, exactly corresponding with the nail-hole in the shoe. The French method has advantages which favourably contrast with our custom, inasmuch as the nails can be more accurately applied, from the broad form of the countersink, they have the stronger hold, and less thickness in the web of the shoe is required, and must necessarily be given, by which, and the difference in working the iron of almost uniform thickness, more protection is afforded to the foot, with less weight of iron in the shoe, by from one quarter to a third, than the English shoer uses, and yet, from the mode of adapting the shoe to the foot, the wear is so equal all over, that the lighter shoe will last fully as long as the heavier.

In the process, the first essential difference consists in that of the form of nails used.

We shall not now discuss fully the relative merits of French and English shoes, the object being here to show how incompatible it is to mix systems and adopt parts, or, as some will have it, improve on a plan by imitating an incidental part only.

The comparison between different modes of shoeing will avail more if we go into the description of our own methods, and then refer to the continental systems again.

It is our opinion that the art of shoeing as first adopted in England was of native birth, and not imported; not meaning by this, the origin of shoeing, but that mode of doing the work, which is so different to that pursued by every other people, that whilst ideas may have had other origin, and even shoes may have been brought over, it does not seem that the English shoer learned this mode of working from any continental or Oriental workman. In the first place, in no other country do the shoers hold the horse's foot and work at it at the same time; and though this seems a simple matter, it is characteristic of the national mode, and to change from one plan of work to the other, is found to be an ordeal equivalent to serving a second apprenticeship. An Englishman cannot do his work by another man holding the horse's foot; nor can the workmen in neighbouring countries hold the foot, and prepare it, or nail on the shoe, and finish the work, without the foot being held. Another part of the process truly British is that of fullering the shoe, and this was no doubt at first done for the purpose of marking out by a groove where the nail-holes were to be stamped; hence the creased, or, as we now call it, the fullered shoe of these isles. Nails were also made with the heads to conform to the crease in the shoe; that gave us the old rose-headed nail. which has never been but partially superseded, and will, we predict, hold its place in future time as the best English nail This difference between the Oriental and continental stamping, and the English method of creasing the shoe, led to a thorough divergence of practice. Workmen are clever men; they feel their way as they go, and by creasing the shoe, it would soon be found that the iron must be worked so that a thick outside margin was left—as we say, a thick outer edge—or else the fullering would burst, and there would be insufficient depth for the head of the nail of its peculiar form. This difference from that of the stamping adopted of old, brought about another divergence; for, as with the English stamped shoe, the outer margin must be thick, the shoe would have been excessively heavy and clumsy, if the same substance had been maintained over the web to the inner margin, and, to obviate this inconvenience, the workman drew away the iron from the inside—thinned the web from the outer to the inner margin.

The custom so far established, became more elaborated. Our smiths were able men at forging iron; their shoes in due time were bevelled out, and hammered up more cleanly; and so far as we have been able to learn, this state of things went on improving, and was not materially disturbed until late in the last century. The establishment of veterinary colleges in France, and the success with which our neighbours had long prosecuted the art of shoeing, led some men of our own country to direct attention there for improvement.

Towards the end of the last century, the first English veterinary college having then been recently established at London, the merits of continental shoeing became more than usually canvassed, comparisons were made between the most approved systems which had long been successfully adopted by our neighbours, and the customary practice which prevailed in the United Kingdom.

The most noticeable difference between all foreign horseshoes and those of British make, consisted in the foreign workmen using the stamp only to make their nail-holes, whilst we in England fullered our shoes, formed a crease, or drew a line for guidance, into which the nail-holes were stamped. Wherever we have found the fullered or creased shoe in use on the Continent, as exceptional to the ordinary method, it was and is still distinguished by its being called the English shoe—"Fer Anglais."

It will be, for time to come, regarded by men who devote themselves to the subject, as a most unfortunate circumstance, that changes were brought about in this kingdom at the epoch alluded to, without sufficient knowledge of the matter. Undue importance was attached to incidental parts in the practice, whilst erroneous notions were entertained and promulgated on what the true character of the French system consisted.

The French method of stamping the nail-holes was allowed by Professor Coleman to be worthy of imitation,

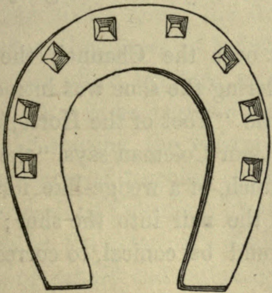


Fig. 226.—Off Fore.

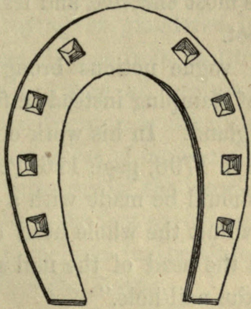


Fig. 227.—Off Hina.

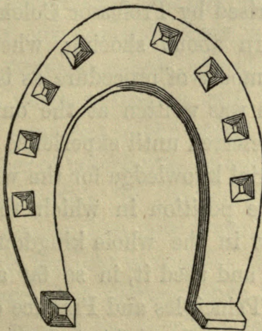


Fig. 228.—Near Hind, with Calkins.

as much preferable to the fine fullering and consequent meagre hold given to the nails by the modes then in use in England. But Mr Coleman erred in forming an opinion on the French shoe, when he presumed to enter on a description of it, without having seen and made himself acquainted with the art of shoeing generally, and of the French system in particular. Mr Coleman said that the French stamped their nail-holes coarsely, whereas a more correct knowledge would have shown that it was eminently a systematic method which they followed, each nail being placed where most effective, and least in danger of causing injury to the foot.

On vague notions brought over the Channel, the custom of stamping instead of fullering the shoe was introduced in England. In his work on the "Foot of the Horse," published in 1798, page 116, Professor Coleman says, "the nail-hole should be made with a punch, of a wedge-like form, so as to admit the whole head of the nail into the shoe;" and "that the head of the nail should be conical, to correspond with the nail-hole."

The above-described mode of forming the nail and nail-hole was extemporised by Professor Coleman when he had everything to learn about shoeing, whether as regarded English or foreign modes of procedure, as is clearly evidenced by his book, which was written at the outset of his career, instead of being deferred until experience had put him in possession of material knowledge for the work.

Yet such was the position in which the sole teacher of veterinary medicine in the whole kingdom was placed, that he had the power, and used it, in so far as the notions represented by his "Principles and Practice of Shoeing" were accepted, and became diffused, his influence being sufficient to cause the adoption of all his suggestions in the army; whilst additionally, or rather primarily, the professorial chair and the practice pursued at the Veterinary College, were enough, in a few years, to make Professor Coleman's stamped shoe, with its concave ground surface, and the free application of the drawing-knife to the sole, to become very general throughout the kingdom.

That Professor Coleman was instrumental in carrying out some important changes has been freely conceded, and by none more cordially than ourselves, his insisting on the necessity of a better system of ventilation of stables, and all places where animals were kept, whether temporarily or constantly, did incalculable good; the destroying of glandered horses, and separating cases of infectious disease from healthy animals, with other hygienic measures, were all praiseworthy, though they in no degree affect the question as it regards his modes of shoeing, the treatment of cases of lameness, or his whole course of teaching on the economy of the horse's foot One and all of Coleman's ideas about the foot were an encumbrance to the veterinary student, such as incapacitated him for going calmly and rationally into the matter.

Effects followed causes. The good parts of Mr Coleman's teaching stood the test of time, and now, when it can be shown that the health of our cavalry horses is greatly improved compared to old times, lameness prevails undiminished, so much so, that we never witness a sale of cast-off military horses that is not composed to the extent of about two-thirds of the whole number of lame horses, mostly preventable cases, and many of them curable by the simple application of a better system of shoeing than now prevails in the service.

The army affords the best means for training men up to the highest standard that distinguishes individuals, but in horse-shoeing the reverse has been the case; it has actually afforded a field in which inexperienced men have tried their hands, set at nought whatever was sound of old, and brought their pernicious schemes to bear their fruits.

Before concluding our remarks on the formation of shoes of various kinds, some farther observations on the nails in use, will perhaps help to make the general subject plain, as the form given to them necessitates modification in the construction of shoes.

Three diverse forms of nails representing the main characteristic properties of those in use throughout Europe

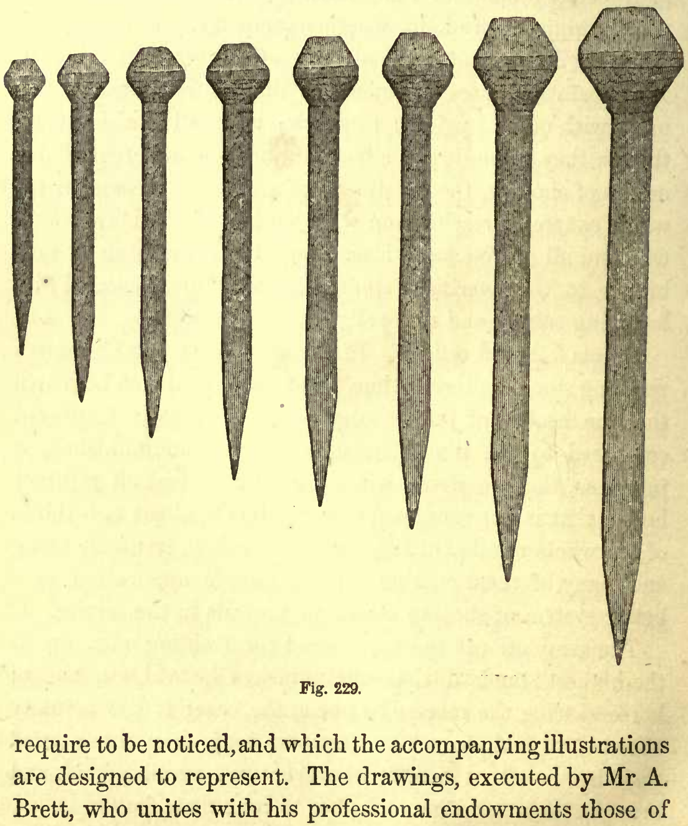


Fig. 229.

require to be noticed, and which the accompanying illustrations are designed to represent. The drawings, executed by Mr A. Brett, who unites with his professional endowments those of a draughtsman of considerable merit, were copied from specimens of the best-made nails of their kinds.

Fig. 229 exhibits an assorted series of French nails obtained from a Paris house, and selected by one of our professional friends of that capital. The eight nails drawn for this illustration include the extreme limits from the smallest to the largest size used in that country, for shoeing very small up to the heavy cart-horse inclusive.

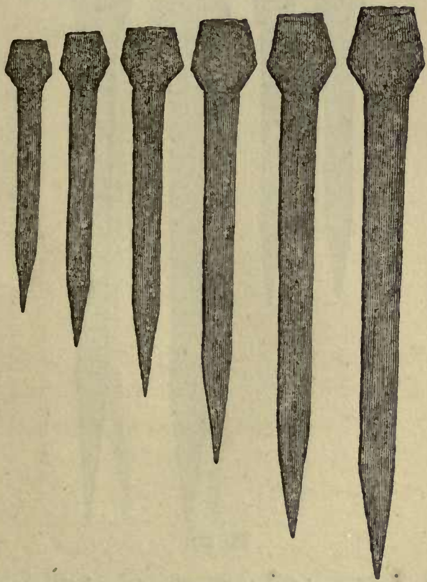


Fig. 230.

Fig. 230 represents a similar series of the old English rose-headed nail, or, as they may not inaptly be called, "the Scotch nails," since it is in the northern division of the kingdom mostly that this pattern of nail has been retained in use to the almost entire exclusion of other forms; whilst in London and over most parts of England and in the army, the wedge-formed nail of Coleman has supplanted the older kind of English nail.

Fig. 231 respresents four nails, *A* and *B* showing these in general use in Scotland, corresponding with the rose-

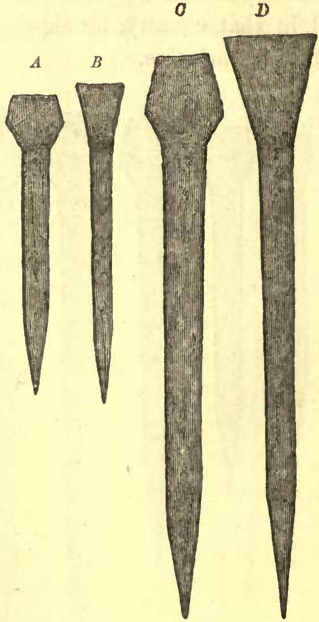


Fig. 231.

headed nail of old as used in England, and the wedge-formed nail extemporised and introduced into practice by Coleman; these are of the small sizes such as are used for shoeing race-horses. *C* and *D* represent the same diverse kinds of nail of large size, such as are in common use for shoeing the heavy draught horses of Edinburgh and Glasgow, and the dray horses of London.

Fig. 232 represents one each of the French, the Scotch, and the English wedge-formed nails, of the large size as used for the heavy draught horses. These three nails are

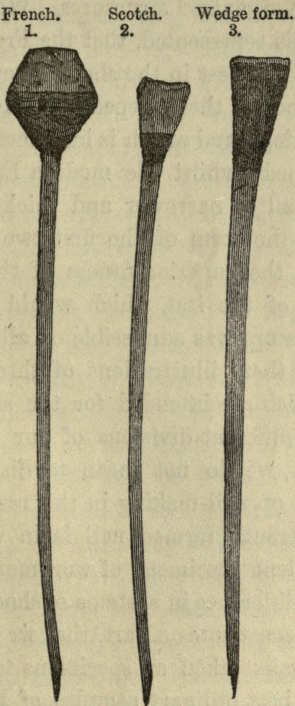


Fig. 232.

pointed, ready to be applied, and are drawn to show their flat or broad aspect; and secondly, edgewise, to show the comparative thickness of the shank, by which combined exposition the strength of the shank may be in a measure estimated, that depending (the quality of iron and workmanship being equal) on the broad even form of the shank from the head to near the point, or the part where the clinch should be formed. A horse-shoe nail should only be of a thickness sufficient to maintain its position when driven. If thick at the neck they press more or less in degree and frequency on the organized structures. We find, by comparing the three nails represented, that the French-made one is the broadest and thinnest in the shank, is evenly drawn from head to point, and in these respects the old English nail, or that which we adopt, and which is in general use in Scotland, is similarly formed; whilst the modern English counter or wedge-formed nail is narrower and thicker in the shank, deviations from the form of the first two described, which essentially mark the superior fitness of these and the fault in the structure of the last, which would do to drive into wood, where pressure was admissible on all sides.

In submitting these illustrations of three different forms of nail, all of which are intended for the same purpose, and are employed in different divisions of our own country and on the Continent, we do not mean to discuss the relative state of the art of nail-making in the respective countries where each differently formed nail is in vogue. All these models are excellent specimens of workmanship and quality of iron; it is the difference in systems of shoeing, of which the form of the nail constitutes a part, that we are reviewing.

The various nails taken as specimens to be drawn from, were all of the best ordinary samples of their kinds; those of French make were procured in Paris, as has been stated, and the rose-headed—the old English nail—now more exclusively used in Scotland than in any other part of the kingdom, and the Scottish makers being inferior to none in making that kind of nail, the specimens were taken indiscriminately from amongst those we use; they are made near Stirling, with one exception, viz., Fig. 231, *A*, which was drawn from a small nail as used for race-horses, selected from those we found in Mr John Scott's forge; and the companion, *B*, is after the spike or wedge form of Coleman, the specimen was obtained at another training establishment, where the narrow, thick tapering nail is preferred to the old sort. The counter-sink or wedge form, from which drawings were taken to compare with the French and Scottish cart-horse nails, were obtained from one of the great London brewery firms, which employs its farriers on the premises, and where the most approved material in vogue is used, and the best workmen are supposed to be employed.

By reference to the figures, it will appear, as examination of the different nails will show, that the French and those in general use throughout Scotland, viz., the old rose-headed nail, bear resemblance, and possess the most essential qualities in common; in breadth of shank they are about equal, the French being somewhat thinner and the more pliable. The essential difference of the two kinds, however, when equally well made, resolves itself into the form of the head, that of the French being solid, filling up a quadrilateral cavity in the shoe, somewhat in the same way as the nail head is let into the tire of a well-made carriage wheel, in which the head of the nail is made to supply the place of the iron removed by the stamp in the case of the shoe, and by the drill in that of the tire. The old English or Scottish nail is made with a flattened head, to adapt it to the crease or fullering, at the same time a fair shoulder is given to these nails by which they are little if at all inferior to the French for holding the shoe, even when the latter is worn thin.

On the counter, or wedge-formed nails, we shall make only a few remarks; as these nails were first extemporised with the English mode of stamping the shoe, and formed a part of that plan; the worth of the nail depends on the merits of the particular shoe, the two forming, as they do parts of a system; both the shoe and nails are bad together; the form of the latter, taken by themselves, is bad as compared with the French and the old British form of nail.

In reference to the modes or systems of shoeing, which were adopted of old in our own and neighbouring countries, we will take a passing notice of that particular system, which, with slight deviations, is in use over the greater extent of the old world, and which is generally called Turkish shoeing. That Oriental method is, to say the least, very old, as is evidenced by the simple fact that we have no account of its origin, though, from an unknown period, and still it is applied over many hundred miles from the north-west of Africa to Egypt and Asia; hence we learn of a common practice of shoeing amongst distant empires, kingdoms, and principalities, and have no doubt, from the similarity of method, the history of which we know so little, that it is much older than any of the European systems in vogue which took rise in southern Europe, modified after these Oriental originals.

According to the testimony of travellers, the horses of the desert, and over a great extent of Asia and Africa, go with freedom and ease with the mode of shoeing which the natives adopt, the good result being due, no doubt, to several influential causes, and not to one only.

No European nation has, as far as we know, ever adopted the Oriental method of shoeing, though their armies have occupied large portions of the eastern nations; that fact alone, however, does not signify much, since we have positive knowledge that, as regards the art of horse-shoeing at least, an army may be stationed in a foreign land for years, and adopt nothing of the practice in use amongst the natives, however well adapted to their purpose or the locality. No better proof can be given than that afforded by reference to the English army and its length of service on the Continent at the beginning of this century; the same with reference to the Austrian army in Italy, where we have witnessed the clumsy ill-adapted shoes used on their horses at Milan, Florence, and Naples, the smooth pavement of which cities requires some special provision in the art, instead of which the same customs are adopted there as for horses on the Tyrol and other mountainous districts where snow and ice are common during many months of the year. In truth, horse-shoeing, as regards its importance, soundness, or the reverse of any system in vogue, escapes the attention the subject merits.

Returning to the Oriental shoe, the plan has all the characteristic appearance of an extemporised method for protecting the horse's hoof from wear, prompted by innate wisdom, in adapting means conformably to the economy of the horse's foot, and the surface of ground on which he moves. Still, from trials which we made of that ancient and extensively adopted mode of shoeing many years ago, they did not in the end persuade us that it could be advantageously applied in Europe. It is true, that these trials were mostly confined, in application, to lame horses, and that at a time when our notions on the functions of the foot, and the effects of shoeing, were very different from what they are now.

It was not until recently that I could thoroughly understand how the Oriental system of shoeing is adapted to the regions over which it is exclusively in use; and I am convinced that no method in vogue in Europe could effectually supply the place of the shoe, so admirably suited to the sandy desert. The shoe from which the illustration (fig. 233) is taken, was presented to me about twenty years ago by an English nobleman who brought it from Egypt. After all that one has heard about the African and Arab shoe, and its relative merits when compared with others, I now see that the explanation why this shoe is the best that can be devised there, and not applicable for common use here, is easy. The thin plate of iron hammered into form, for the most part when the iron is cold, and which is made to cover

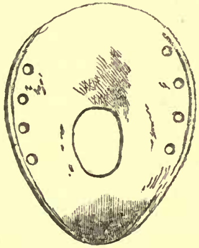


Fig. 233.—Oriental Shoe.

almost the whole of the bottom surface of the foot, is admirably adapted to the movements of the foot; with this the horse treads on the loose shifting sand, and with the shoe finds purchase, whilst any of the shoes in use amongst us would sink into the sand, the horse would slip, and more exertion would be required, and less speed attained.

I look on it that the Arab horse with the customary shoeing adopted in that country, would have the same advantage over another horse shod on our method, as horses would have, in drawing a sledge over the snow-covered plains of Russia, over others drawing a common wheel carriage.

The French method, as the best system established, is, we consider, a rational reduction or adaptation of that just noticed. Our Gallic neighbours of old adopted all that the Arabs did as regards the adjustment of the shoe to the foot, whilst the modern open parallel French shoe, which admits a bearing of the wall of the hoof over its whole circumference, leaving the concave sole and resilient frog free, is preferable, and most adapted to European soil and artificial roads, yet the mode of stamping the shoe, and the leaving the web as thick inside as out, is traceable from the older type of shoe of eastern origin above noticed.

The English shoe, as far as we can trace its character, has

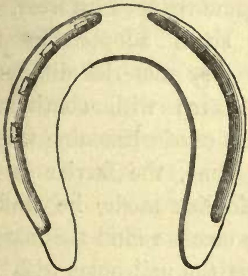


Fig. 234.—Near Fore.

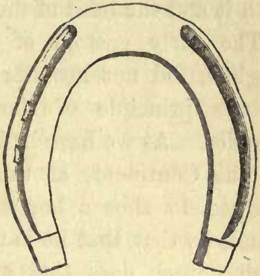


Fig. 235.—Near Hind.

been distinct in its leading features from any others the history of which we know anything about. Our ancestors seem to have been cautious, and before forming the nail holes, they made a groove around the outer circumference of the iron, to mark the line where the nails were to be placed, at given distances apart, in the groove.

It was, no doubt, from the first attempts and by degrees on the part of the English, that the creasing became part of the art of making the shoe; the reason which gave rise to the crease or fullering seems to have been so far lost sight of, that the workman in after-time was esteemed most able, who could make the fullering with the cleanest edge and best form. Fine fullering was in vogue at the end of last century and early part of the present, which led to slanting the stamp and nail inwards, taking slender hold of the hoof, and in order to retain the shoe securely on the foot, the nails were driven high up the wall; that mode was both unsafe and unsubstantial, as also difficult of execution in the application of the shoe.

As has been noticed, our nail-head was flattened conformably to the crease or fullering, sufficient shoulder being given to admit of firm retention of the shoe, when the substance of both it and the head of the nail became reduced by wear.

The early custom of creasing shoes adopted by the English, did not necessarily make very material difference in the principle of shoeing, compared with continental practice. As we have had opportunities of witnessing where, on the Continent, at the present time, the farrier is requested to shoe a horse in the English mode, he understands by that, that he is to make a crease round the margin with a tool, does that, and stamps the nail-holes with his pritchel, instead of with his ordinary stamp, then flattens the head of his usually adopted nails, fits and applies the shoe in his ordinary way, charges extra price, very justly, for the trouble of shoeing English fashion; whilst in all respects the horse is shod according to the ability of the man, in his ordinary way, whether he be a Frenchman, a German, or an Italian. Indeed, in the Austrian army, some years ago, we observed among the officers' horses which were ordered to be shod in the English fashion, that the shoes were fullered, and then stamped with their ordinary quadrilateral stamp, such as we have described as used by the French, they also used their ordinary quadrangular-headed nail—wise practice on the part of the farriers, as it was simply complying with the form, while substantially their own method was carried out unimpaired.

From defects, which distinguished the English mode of shoeing at the latter part of last, and beginning of the present century, which in part consisted in the custom of fullering the shoes on the very margin, the nails took slender hold of the hoof, and from the fact that our neighbours on the Continent never fullered their shoes, but stamped them, and as they were noted for the smallness in the number of their lame horses, as compared with ourselves, the incidental part of stamping was caught up by Coleman, hence the origin of the stamped shoe since then in vogue in England.

Originality, to be practically useful, must result from correct premises, whereas Coleman erred in attributing too much of the fault of shoeing to fine fullering, which admitted of ready correction, without giving up a custom not in the abstract bad, before a better could be established; and in alleging the chief merit of French shoeing to coarse stamping, these errors led the professor, destitute from first to last as he was of knowledge of kind or degree, to fit him for the work required, to extemporise his coarsely stamped shoe and the wedge-formed nail.

Coleman not having crossed that narrow strait of sea which separates England from France, never saw his mistake in attributing coarseness to the stamping of the shoes, such as are made in the good forges of Paris and Lyons; it could have been easily seen, that from the open space which the four-sided stamp gave, the small punch clearing a passage in the centre of the dye for the nail, a command was given to the workman to pitch his nail in a direct line to where he intended it to pass through the wall and make its exit.

The advantage in this form of nail hole over any other, consists in the facility for driving the nail high or low, taking little or much hold according to requirement; thus the French shoes are stamped with admirable system, the inside nail-holes having a fine, and the outer a coarser position, and with the advantages alluded to, which the shape of the stamp gives, the French farrier adjusts his shoe exactly even with the hoof on the inside, and somewhat fuller on the out, and his method gives the means of taking strong and yet safe hold of the wall in every part.

On the contrary, the spurious custom of stamping, which was forced into practice in England, was inconsistent with good and safe shoeing. The radical faults in the plan are two: firstly, the shape of the nail and nail-hole; secondly, the coarse holds given by stamping too far into the web of the shoe.

The Army Shoe as at present adopted.

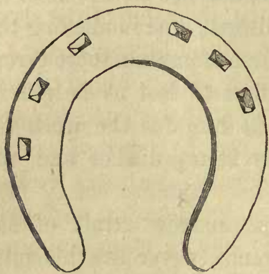


Fig. 236.—Off Fore.

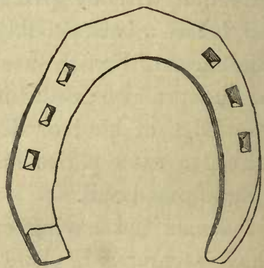


Fig. 237.—Off Hind.

The shape of the nails, as has been noticed, required a thick outer margin to the shoe, in order to bury the long head of the nail, without which precaution it had no hold, but another fault, and as it affected the safety, and became a common cause of lameness to the horses, was the absurd shape given to both nail and nail-hole, which affords no command on the part of the nailer on of the shoe over the direction of the nail. In pointing out faults, the existence of which no man who understands the theory and art of horse-shoeing can deny, we must be understood, as stating what is the tendency, and what the effects of a custom; aware that there are exceptional workmen, who, in making the shoe and holding the stamp, will apply their thoughts, as if they were directing the nail through the hoof, in these cases, care will in a great measure obviate the ill effects; but a custom which requires such care, is full of danger, compared with more simple and rational systems.

There is just one consideration to be given to Coleman's stamped shoe, which gives it a claim in the estimation of workmen before any other, and sympathising as we do for our hardly-wrought and ill-paid farriers, we will give full attention to this part; there is a saving of labour in making this stamped shoe; a saving of many heavy strokes with the sledge-hammer, as compared with the fullering of the shoe, and some saving also as compared with the French method.

The fullering and stamping together of an ordinary-sized carriage horse-shoe requires over rather than under 60 hard strokes with the sledge-hammer, upon the head of a cold tool, whilst to stamp the same shoe with Coleman's wedge-formed stamp, 12 strokes are about the number required; and the French shoe with the obtuse pointed stamp requires about double the last-named number, or 24 strokes. The difference in a day's work of shoe-making, allowing five dozen of shoes for the task, would stand thus:—

Sledge-hammer strokes to the fullered shoes, .	3600
The French method of stamping, . . .	1440
The wedge form or English counter-sink stamp,	720

The above figures show that our men are required, in a single day's work at making shoes, to give 2880 more strokes —five times the number—with the heavy hammer in making fullered shoes, than are required for the stamped shoe, and that in addition and apart from the manifold greater num ber which the whole process of forging the iron requires, and such difference of labour accounts for the silent approval of the otherwise very objectionable mode. Our fullering, as compared with the French stamping, calls for two and a-half times more sledge-hammer blows than their system requires.

In giving a definite opinion as to preference on the special question of fullering or stamping, one is necessarily led to pay some regard to custom, prejudices, and the habits to which workmen in a country have been trained; these points settled, and all things equal, with free choice, we should adopt the French method of stamping for all classes of draught horses, and such as are employed for road work generally; whilst we should use our fullered shoe, as we do with the rose-headed nail, for horses for hunting, training, and, to a great extent, for riding work generally.

Our motives, in the first case, would be economy of workmen's labour, durability of the work, and conservation of the horse's foot.

Our reasons for using the fullered shoe for the class of horses mentioned, are, that we believe it gives firmer foothold on turf or in the hunting field. Moreover, the fullering spreads the iron, and thereby gives circumference with lightness to the shoe. In neither case, however, do we wish to be arbitrary in pressing our suggestions; as in both ways horses may be thoroughly well shod; on the other hand, the English wedge-formed shoe we never use, and vote its abolition, the economy of labour in making it notwithstanding.

On the Weight of Shoes.

Writers have laid down regulations for the weight of shoes for horses of given classes; we can only, however, comply with that custom to a limited extent. In all cases, the size and weight must vary according to the form and action of horses, and the size of their feet, even amongst those of the same class.

Taking our own practice alone, we could show ample latitude in the weight of shoes, beginning with the race-horse plate of three ounces, up to the cart-horse shoe of large size, such as is used for London dray-horses, and the powerful Clydesdales of Edinburgh and Glasgow, in which cases seventy-two ounces of iron is not an uncommon amount composing a single shoe.

Blood-horses require from nine to fifteen ounces of iron to each shoe. And the general run of mixed-bred horses, including all those used in the army service, will require every grade of weight from eight or ten up to thirty-two ounces.

Agricultural horses, throughout England and Scotland, vary much in their stamp. The latter are generally the stronger, and require the greatest weight of iron to shoe them, though those used in the midland counties of England are probably about equal in weight. Shoes for these various descriptions of English and Scotch farm horses of the strongest breeds will average about 45 ounces each. Whilst in Cleveland, and the eastern and southern counties of England, where a coaching-bred or smaller class of cart-horse is used, the shoes will average a fourth less than where such pure-bred cart-horses are employed.

What has been said on the weight of shoes has been more to show the impossibility of giving any fixed rule on the matter, than to attempt to establish one.

In the process of making shoes, the iron should be drawn level, no uneven thickness to be left at the toe or other part. And if the suggestion already made about the kind of nails be observed, no excess of thickness of the outer margin of the shoe will be required; neither will there be need for hollowing out the shoe except to a slight extent; and that, not of necessity for leaving space between the sole of the foot and the shoe, but more for the purpose of lightening the shoe; cover to a moderately proportioned extent being better for the foot than a rigid thick substance of iron. As each separate half of the shoe is made, it is to be fullered and stamped; the outside first, in which we place four nail holes; very coarse holing not advisable, and therefore a clear open fullering, leaving the outer edge of the shoe straight, should be aimed at, and in stamping, the tool should be held upright, and not so as to pitch the nail holes inwards. Holes pitching in are dangerous, as in that case the necks of the nails will press more or less against the *quick.* The inside of the shoe being next forged, is to be fullered and stamped in turn, this should be finer fullered than the outside; the same directions hold good regarding the direction to be given the nail holes. We are supposing a saddle-horse's fore shoe to be in hand, in which the nail holes should be distant two inches and a quarter from the outer heel extremity, and two and a half inches from the inner, and about one inch and an eighth may separate each nail hole on the outside, and one inch and two eighths those on the inside, and an inch and five eighths to two inches. According to the size of shoe may be the space between the outer and inner toe holes. These directions for making a plain fore shoe may be generally adopted, size not altering the case, the number of nails we only alter in the case of very small feet, when six nails will suffice; and we sometimes increase the number to eight for large coach horses. It must, however, be remembered, that with the variation in the size of shoe so are the nails varied from Nos. 4 and 5 to Nos. 10 and 12; thus the number of nails required does not differ much in different sized shoes, the difference in size of nail brings the effect equal in the different cases.

What has been said about working the iron level, the fullering and stamping of the fore will serve for the hind shoe.

In other respects, however, the form and substance of the hind shoe require to be different, the iron is kept square in working it, more substance and less cover is required, the shape of the hind shoe must be like the foot, more pointed and of less breadth. The heels, too, should be turned up, and we prefer to turn up both heels in all cases, instead of leaving the inner heel smooth, or, what is more common and more injurious, left thick; the hind feet, with their strong concave ground aspect and pointed form, act powerfully on the ground in governing the action of the horse.

The custom of applying toe-pieces to the strong draught, as well as cab and some of the carriage horses, is peculiar to Scotland. And, firstly, we will make a few comparative observations between the practice of shoeing the dray-horses in London and that of the heavy cart-horses in Scotland; the weight of iron used is about the same for the four shoes as they are made in London and Scotland, but the iron is differently placed, and so is the bearing capacity for the foot of the horse to stand on. The London cart-horse's hind shoes are left with a thickness of toe at least double the substance of the quarters; the heels are turned up, and when the horse is shod, he stands on a triangle, the three points of bearing being the toe and both heels. Their fore shoe is also devoid of breadth of toe, and is left thick at the heels, but not turned up.

The Scotch shoe, more to the purpose, is forged level and fullered, the heels turned up, and left strong. The toes of the shoes are flattened down and left pointed, to receive the toe piece, which, for town cart-horse work, is four inches long, cut off a bar three-fourths of an inch to seven-eighths square; these weigh twelve to fourteen ounces each; the toe-piece is welded on when the shoes are fitted.

On fitting the shoes the success of the whole operation mainly depends. And having dwelt much on the condition of the foot, and how to prepare it, we shall not have to take up much time here, for though this is a nice operation, yet it only admits of being effectively dealt with by the learner, at the forge. After adjusting the heels of the shoe, either by cutting them level or turning them up, clear out the nail holes, take up a clip at the toe, and put each parallel half of the shoe in the exact form of the foot, and approximate the shoe to the required breadth, then letting the left hand regulate the position of the shoe, the hammer falling by force of the right hand, gives the form and surface, adapted to the foot and ground, which, according to the intelligence of the worker, is required. No placing the shoe on the beak of the anvil, to elevate the toe, should be adopted, the shoe being held by the tongs, near the outer heel, the hammer should pass across it behind the clip, the left hand being meanwhile slightly elevated, and then bringing the hammer down, each limb of the shoe, depressing the left hand as the hammer approaches the heels, gives a full bearing surface across the quarter, which should not be uneven, but exactly such as the normal foot maintains when the unshod horse is free. The shoe is to be always full to the foot, in obedience to the law that the pedestal should possess greater capacity than the column it sustains. We have omitted to say anything about hunting shoes; of late all manner of forms have been given to these; whilst we make slight distinction between the mode of shoeing a horse for training, for hunting, or to be ridden in Rotten Row.

CHAPTER XX.

ON THE DISEASES TO WHICH THE FEET OF HORSES ARE SUBJECT.

Contraction of the foot.—Flat or convex soles.—Thrush, its causes and treatment.—Canker.—Corns, their connection with horny tumours.—Sand-crack.—False-quarter.—Fissure.—Keraphylocele.—Seedy toe.—Over-reach.—Treads.—Pricks by nails or other sharp-pointed bodies.—Quittor.—Founder, acute and chronic.—Navicular disease, or navicular joint lameness.

THERE is no department of the veterinary art which calls for more attention at the present time than that concerning the condition of horses' feet; and, as regards the veterinary surgeon's practice among horses, the art of shoeing has formed, and will form, a most important part of the business of a large proportion of veterinary surgeons practising in large towns; to all of whom the cases of lameness, their character, causes, and remedies, will, if attended to, take up much time and applied skill.

ON CONTRACTION OF THE FOOT.

This is more of an imaginary than a real state. As we said, when treating on healthy structures and action, there is no alternate expansion and contraction going on in the foot, as has been supposed, during ordinary progression; neither is there any antagonism kept up by the hoof, tending to constringe the vascular structures, and these, in turn, resisting that tendency.

Complete harmony of parts and counterparts, both in their form and action, subsists between the hoof and all it encircles, the same as between the outer tunic and subjacent structures of every animal in all its parts. To be plain, the question is reduced to this. When a horse's foot, which was once of normal proportion, has become unnaturally small and deformed, how has the change come about, if not by contraction? Why, by wasting. Like as a man, or any animal which was once fully developed in every part, and when change is brought about by causes, whether from starvation, old age, or otherwise deranged health, wasting ensues and the skin falls in proportionately. Yet, though the general condition of the horse be low, privations, and even old age, exert little appreciable change on the form of the foot of the animal, compared to the more common causes which prevail. It is inconsistent with rational theory, as it certainly is with fact, to entertain the commonly prevailing belief that a clear atmosphere, with the benign influence of the sun's rays, has a tendency to dry up, sear, or otherwise act injuriously on the hoof, which is a living structure, and is supplied from the blood with an abundant secretion for nourishment, and its whole economy. To suppose that a living part should be dried up like as happens with a common board, as has been said (see essay by Professor La Fosse, of Toulouse), is, I submit, giving way to very unphilosophical ideas.

It is the firm belief of the writer, that incalculable harm has been done to our horses, through the entertained groundless notions about contraction of the foot, and again, through imaginary causes inducin that supposed state.

The very strange hypothesis has brought about evil consequences in two ways,—*Firstly*, By treating horses and their feet in a way the reverse of correct; *Secondly*, By being put off their guard, men have neither appreciated nor sought to learn that which is indispensable to the successful management of the animal.

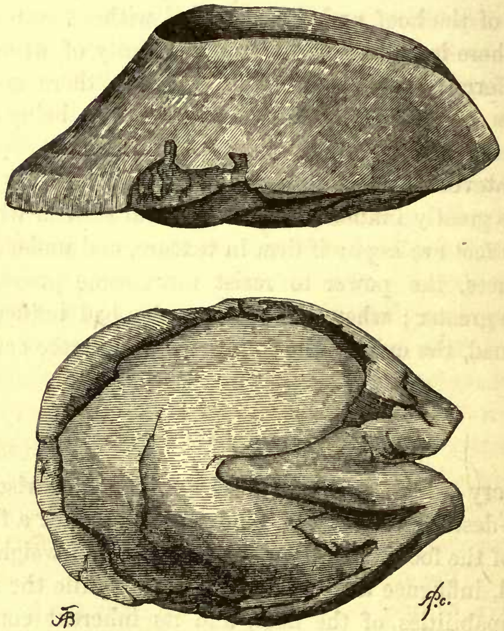
The common agents in the deteriorating process are, excessive moisture to the foot, unduly diminishing the substance of the hoof, and shoes applied without system; and since there is but one right, and an infinity of wrong ways of performing the operation of shoeing, there are many chances to one against this latter part ever being done as required.

Whatever be the relative merits of shoers, the process will be greatly influenced by the general state in which the horse's feet are kept; if firm in texture, and under healthy influences, the power to resist unwelcome pressure will be the greater; when, however, various bad influences are combined, the evil results follow soon and more certainly.

FLAT OR CONVEXED SOLES.

A very similar series of causes, which give rise to the before-described condition, tend also to produce a flattened state of the foot. Breeding, form, action, and weight of the animal, influence the different changes; while the sustaining capabilities of the hoof, and its inherent conservant property of maintaining the symmetrical figure, are dependent on the same hygienic conditions as are required for its first development. All weakening measures tend to alter the physical state of the sole. Softening, paring, and rasping the hoof, want of knowledge, or care, in shoeing, and insufficient exercise, all induce debility, and constitute causes tending to the general bad effect on the whole foot.

By whatever process the sole of the hoof is debilitated, the wall is rendered inefficient for its functions, and either bulges downwards, or collapsing and increase of convexity upwards ensues, accordingly as concomitant influences prevail. Every one who has walked with a soleless shoe, or with the sole soaked by standing in wet until it became



as soft as a sponge, knows that the upper-leather in such cases becomes useless as a means of support to the foot. In the case of the horse, under influences supposed, the pedal bone and all the plantar structures become flattened, as does the hoof, and in conformity with, and by virtue of, natural laws, the most pronounced margins of the bone are removed by absorption, whilst at the same time the energy of locomotive force is proportionately diminished. Having dwelt on the causes, their avoidance will constitute the means of prevention, and an opposite course to such as has been exposed will become the best remedy. A right system of shoeing will be found the best of conservative means, as well as the most effective of curative agents.

Thrush.—This is a diseased condition of the villous membrane covering the fibrous frog; the cleft is the part commonly first affected, and, when neglected, the disease spreads over the whole of the organ to its point and backwards, the horn becoming detached from the bulbs of the heels, and to some extent round the coronet to the quarters. The immediate seat of the disease is the frog; it being a subcuticular affection, and never insinuates beneath the true hoof.

There is no other disease so commonly prevalent in the foot as thrush, and about which there is so much diversity of opinion amongst veterinarians as to the cause; and true it is, which ever view we take, there is always an opposite one, to be entertained and defended almost as strongly, in the belief of any one who has made up his mind differently. Light-formed horses, and even the best bred amongst them, are, under similar conditions, the most commonly affected with thrushes, the hind feet being most liable. Contraction of the hoof has been regarded as the main cause of thrushes. It has been thought that the frog becomes compressed by the narrowing of the hoof. Without further reference to such views, and our grounds of dissent from them, we have only to observe, that this disease is very prevalent amongst horses which are running loose and unshod, and also amongst those where no shoes have ever been applied.

A wet and filthy farm-yard furnishes all those noxious agencies in the greatest abundance which give rise to thrushes, and a general weak state of foot. Reverse these conditions, and keep horses on a firm, well-drained soil, and their hoofs will become almost uniformly excellent physically, as well as firm, elastic, and strong in texture, whilst the arched form of the pedal bone, and the perfection of every fibre in the foot, will be such as to adapt the animal for any work.

Another and common cause of thrush, as it prevails amongst working horses, is justly attributed to impairment of the functions of the foot, through the shoe. When, for instance, the feet, through excess of shortening the toe, and leaving the heels high, are rendered unduly upright, there is a considerable derangement to functions, — one of the common effects being the appearance of thrush.

Treatment.—Remove the causes, and also loose parts of horn from the frog, and put the whole hoof into its normal state, and if the horse is required for work, let him be shod according to rule. Let his stable be dry and clean, with a stone floor; the feet should be washed morning and evening in clean water, and the heels wiped dry at once; and every fourth or fifth day, when the hoofs are dry, a pledget of tow, charged with Barbadoes tar, may be introduced into the clefts of the frogs, and the same pressed into the commissures. If the horse is not required for work, as in the case of young stock, brood mares, &c., let the shoeing be omitted, and all the other things prescribed attended to.

Thrush being, as we have shown, an effect of bad management, in its turn becomes a cause of further derangement in the foot, and therefore no one should consider his horse in a safe and salutary condition with such an offensive state of the frogs as thrushes present; nor is a horse in the possession of his full power with that organ in such a state of ulceration, wasting of the foot being the usual concomitant of diseased frog. In most cases, when all the conditions of the foot have been attended to, healthy action succeeds; in others, such as when horses have been bred on uncongenial ground, it takes a long time to induce the normal functions, and especially so, before the tone of the secreting surfaces can be brought about.

CANKER.

Canker of the foot of the horse is a diseased state of very peculiar character, in which, primarily, the same local structures are affected as in the case of thrush; and it has by some been described as another stage, or one arising out of a neglected and inveterate state of that disease. It is, however, quite distinct, rapidly extending from the frog to the sole, and even the laminated structures become involved in the offensive and rapidly destructive ulceration.

The characteristic symptoms of this disease are so strongly marked, that they can never be mistaken by any one who has seen a case before. Distinguishable from an ordinary thrush, by the frog being large, flattened, and spongy to the feel and appearance, giving off a copious secretion of most offensively-smelling limpid matter, resembling in kind and copiousness that which is seen in the worst cases of grease, to which, in all respects, canker of the foot bears a resemblance so strong, that the two may be called twin diseases, often co-existing, and always common to the same class of low-bred, poor-conditioned horses, such as are ill cared for, and exposed to wet and filthy stabling. Without going so far as to say that any class of horse, under good management, is exempt from this disease, we can most decidedly state that we have never met with a case of canker amongst race-horses, hunters, or in any gentleman's establishment where ordinary average grooming is found; it is a fact too, that well-bred horses—whatever their class, if of good stamina—are seldom the victims of the diseases, canker and grease, even where the common causes are not altogether excluded.

The treatment for canker consists, in the first place, of the removal of all detaching horn from the affected parts, care being taken, at the same time, not to cut deep, so as to cause effusion of blood, which with the non-experienced operator will be liable to happen, through the deceptive appearances of the sprouting fungous surface, which assumes a horny character, whilst it is endowed with considerable vascularity.

Astringent remedies and mild caustics form the proper dressings. We have found nitric acid and tar the best of all; taking about four ounces of the latter, placing it in an iron laddle, and adding one drachm of the acid, and keeping the mixture briskly stirred with a wooden spatula when heat is evolved, the preparation is then to be spread quickly over the exposed surface, the part being cleansed and dried previously. The surface should then be covered with dry tow and bound up; or, in cases where the disease is confined to the frog and part of the sole, a shoe may be tacked on, by which means the dressing can be the better retained, by splinters of wood being placed over the tow.

Different practitioners have their favourite and special dressings for the cure of canker; and good results are attributed to the use of a variety of agents, whilst failure not unfrequently attends all our best efforts and means; in such cases, for instance, as when two feet are very badly affected; or, as we have seen, when all four feet of the horse are equally diseased at the same time, and when it has been impossible to induce him to stand upon the opposite or parallel foot, whilst the one is lifted for the necessary time to be dressed. Nor can casting the horse, for the purpose of dressing the feet, often be made effectual, since the process requires to be repeated every other day, and, at best, will take a long time to produce any permanently good result. Moreover, we believe that there is a constitutional taint in those cases, and experience has taught us that few horses in such condition are likely to pay the cost of their treatment.

CORN.

This is another of the diseases of the connecting structures of the foot in which the hoof participates in the effects.

The prevailing and accepted definition of corn is an erroneous one—viz., that of its being a bruise between the posterior extremity of the coffin-bone above and the hoof below, by which, extravasation of blood is said to ensue. It is nothing of the kind, bruising of the sole does happen in cases of flat-footed horses, while their feet are made still flatter by shoeing and bad management; and in such cases it is possible for the sole to bear on the shoe, fix it at different parts, so as to produce injury to the bone and intervening tissues, when pain and rapidly changing complications follow. In the case assumed above, however, we have not the production of that which has received the name of corn. Corns occur to horses with the best of feet, the common cause being the worst of shoeing. The seat of corn is in the laminated structures at the angles of inflection, or, as may be better understood, the extreme point of the heel. They happen in a similar way under fast exertion that a blister does to our heel under hard marches. The ecchymosis which follows the injury, and which is called the corn, is nothing else than an after effect, due to gravitation of the blood-stained serum which is exuded. The corn is a reality, as its name implies; it consists in a horn tumour, at the angle above indicated. These tumefactions reach to various proportions, from that of enlargement and increased density of the common horn lamina, to their obliteration, and, in the place, an intruding growth of smooth horn, more dense than that of any part of the hoof normally.

The writer first published an account of these horn tumours in 1859–60, when some specimens were presented to the Museum of the Royal College of Veterinary Surgeons of London. The discovery led to further observation, and a more accurate understanding of the whole subject by the author than he had up to that time arrived at.

This effort of nature to fence out and strengthen, as man mutilates and weakens, offers a warning lesson to those who cut and destroy the sole of the hoof: we find that the more it is scooped away, and the external cavity deepened, so, relatively, does the intrusion increase upwards, the tissues and cartilage making way by their becoming absorbed.

These baneful conditions protracted, lead on to further complications, which, indeed, always progress simultaneously when any one source of injury is perpetually in force. The most common form by which the approaching crisis manifests itself in inveterate cases is by suppuration.

This last state seldom arises until after the horse has endured long suffering from corns ; it is not usually until the internal horn tumours are formed that sloughing of the parts, and quittor, are brought on. And this is important to be understood, because a prevailing vicious practice is in vogue, under the pretence of exploring, by cutting away the sole of every lame horse in search for matter, and, as is supposed, to give it vent. Blood only, in the case, is found, and with that the searcher is satisfied; whilst mischief is done, such as takes long to repair, even when the patient gets under better care. The proper treatment for corns is a rightly-applied system of shoeing—for which, consult directions on that subject.

SAND-CRACK.

A sand-crack consists of a fissure of more or less extent in length, which always begins at the coronet, in the quarter of the foot over the cartilage. The crack, usually insignificant in appearance at first, is located in the upper thin margin of the wall; the cuticular band giving way, the wall opens in the direction of its fibres downwards. Union never takes place again, but every hour after the lesion is formed confirms and augments the state of the disorder until remedied; inflammation of the skin is set up, the part is painful, and the lips of the wound gape as the tissues swell. The inner quarter is the most common seat of sand-crack, though it happens to both quarters of the same foot in some instances. This ordinary character of sand-crack happens only to the fore feet.

The causes of sand-crack are more varied than those which produce the last disease considered—corn, the strong and good feet often becoming the seat of that lesion and attendant complications.

In this respect the causes of these lesions are common, in so far that sand-crack, like corns, requires the baneful influence of bad shoeing for its production, with this difference however, that a predisposition almost always prevails with horses in whose feet sand-cracks appear, and occurring in those with weak feet,—such as have been bred where hard or firm sound soil, and liberty to range over it, has been wanting. English horses generally are, of all domesticated breeds, the least subject to sand-crack of any that we know of, either European or Oriental; and this observation holds good, though our horses be taken to distant countries at an early age: the immunity follows on a perfect development of the whole foot with the growth of the horse.

Some notion may be formed of the acute pain which the smallest bursting of the cuticle and hoof at the coronet gives, by those who have been exposed to causes giving rise to cracks at the base of the nail; which, however, it should be remarked, is insignificant, with our hands moving freely, compared to the forced exertion on the ground such as the horse's foot undergoes. A small sand-crack soon acquires larger dimensions, contiguous parts take on inflammation, and swell; the wound gapes, and though no additional splitting of the hoof occurs, the length of the fissure seems increased by the stretching, and is actually increased daily by the growth of the hoof, with no possibility of its reunion. Unrelieved, the case becomes worse, blood issues under exertion, and, as the wound advances, with some partially effective attempts to relieve it; nature, always provident in fencing out extraneous matter, forms a secretion of horn in the bottom of the crack, giving rise to an inner ridge, or, as the French call it a seam; to get rid of which, they remove the wall at the quarter, which is a formidable, tedious, and we believe uncalled-for procedure.

The treatment we adopt consists in placing the part at rest, which, in some cases, calls for giving total rest to the horse for a period of from thirty to fifty days. The most common custom, and one long adopted, is to apply a bar shoe, by which means it is sought to prevent bearing from being imposed on the injured quarter of the foot, which is partially effected by the frog reposing on the shoe, and thus relieving the quarter of some of the burden. The above we have found to be, at best, only a palliation, and not an effectual remedy, and is admissible only with horses used for moderately slow work—for draught.

Of late years, with our more matured experience and system of shoeing, we have been able to give effectual relief by an application to that part of our art, with little or no deviation from our ordinary method or any additional complexity; the feet are, as in other cases, attended to with reference to their general salutary state, and no case has occurred of late where sand-crack has given us any trouble, or which has not healed and the hoof grown down completely sound, commencing from the time we have adopted the proper means.

Giving the horse complete rest, without shoes, when practicable, affords the most simple means of curing him with sand-crack; nothing else being required than treating the feet, as in most cases of lameness we advise. Placing the horse in a loose box, so that he can get free exercise, as has been already repeatedly stated, forms an additional requisite measure for the restoration, and is compatible with the prescribed rest. No binding avails; and all cutting and exploration should be avoided, especially the practice of firing, which is only a source of pain and injury.

False quarter, considered along with sand-crack, may be regarded as an attempted distinction without a difference.

A little confusion of terms is in the case brought into play. In some countries, in Italy for instance, of which the literature on the subject is older than our own, all ordinary sand-cracks are described as quarti-falsi, which implies a condition—viz., when the cracks have become chronic, and the wall exhibits a gaping fissure from the coronet to the bottom, that part of the hoof posteriorly is loose—false, and wants connection in function as well as substance with the front of the foot; and when, from continued or otherwise sustained injury, the secreting structures of the coronet are much destroyed, the absolute breach or great weakness becomes permanent;—hence a permanent sand-crack or false quarter.

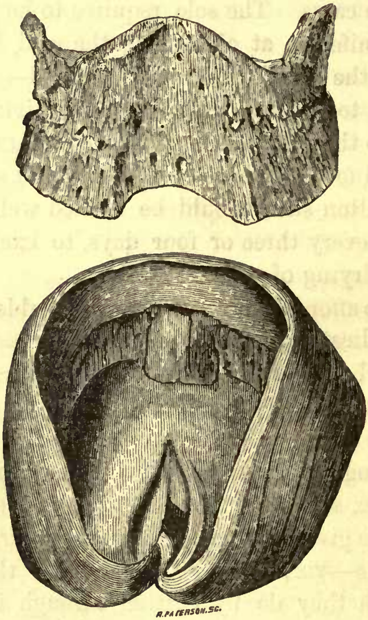
FISSURE IN FRONT OF THE HOOF.

A Fissure in front of the foot, though not called, technically, a sand-crack, is a lesion similar in kind; the difference of situation and in the structures affected change the degree, conditions, and character of the lesion under consideration, which commonly happens to the hind feet of draught horses; it is much less frequently met with than that which happens to the quarter of the fore foot, and is also more formidable in its character, and for resistance of curative measures. As in the case of the first described, there is usually a predisposition — weakness, to which may be enumerated the ordinary influences of severe exertion, position given to the foot, and its capacity altered by shoeing, as the constantly recurring causes. The breach in the horn occurs first at the coronet, taking on the same complications and painful condition as has been described in the analogous case; and, from the fact of the horse having to exert his whole power on the solid front of the foot, it is difficult to afford the required ease and relief under exertion, so that treatment, aided with rest, is absolutely called for in bad cases.

As has been said, faulty position given to the limb by means of the shoe is a common cause, it follows that the correction of the vice must be the first step taken in the treatment, and all that has been said on the proper treatment of the foot and shoeing requires to be brought into use in these cases. The sole requires to be left untouched with the knife (as at all times), the wall left deep anteriorly, and the heels moderately lowered—only, however, to a degree to balance with the front, giving the natural obliquity to the foot. Low, firm calkins are proper in the case of hind feet—absence of moisture, and some ointment, or even mutton suet, should be rubbed well into the wall of the hoof every three or four days, to exclude moisture, and check drying of exposed surfaces.

Failing to afford timely relief in this troublesome affection, other complications arise, the horn seam, as mentioned in the case of lateral sand-crack, is in these cases of a more extended form, and a deep substance of horn is found beneath the fissure at the lower part of the hoof, where a corresponding cavity is formed, by absorption, in the anterior convex surface of the coffin-bone. To this state the French have given the name of *keraphylocele*, and for which they operate—viz., remove the whole of the wall at the front, which they do by cutting through it from top to bottom, at given parts, on the inner and outer side of the toe; detaching it from the sole below they tear off the part, leaving the coffin-bone exposed, with only its membranes to support it. This operation is spoken of with approval, which our own observations have not led us to share in. We manage to cure all ordinary, and such as are believed to be curable cases, in a painless and more simple way;

whilst from the deep-seated ulceration in the bone, the healing process and the formation of a new hoof to a great extent must be a process of time; and we also know the result is uncertain; therefore we merely allude to it, without recommending the formidable operation. The annexed wood-cut shows a case of this diseased state in a fore-foot;



the front of the coffin-bone, and the inner cavity of the hoof, exhibit respectively the deep cavity in the one and the protruding horn tumour in the other structure.

SEEDY TOE

Is the English term for a partial separation of the wall and sole, the vacant space extending more or less up between the wall and the lower margin of the pedal bone. This condition of the foot is dependent on some previous injury, sustained by the organised structures—to the coffin-bone or tissues covering it, implying destruction more or less of the secreting surface at the part. These conditions may be of a temporary character, or, as is more frequently the case, become, to some extent, permanent deformities; when extensive, there is usually some bulging of the wall at the part affected—this occurs most frequently at the outside toe and quarter. There is commonly a want of the arched form or concavity of sole in connection with these conditions, and there is a corresponding flatness by absorption, of the coffin-bone. Horses with these defects are not necessarily lame, although it more frequently happens that they are so, and a want of full energy of action must always be a consequent state in the subject so affected; good shoeing and general care of the feet are the means to be adopted.

OVER-REACH.

This consists of a contused wound over the soft bulbs of the heels, usually on one side only, and is caused by the hind foot, whilst in action, over-reaching the parallel fore one; it usually takes place with young horses, especially before they become accustomed to their work in the hunting field. It is only through some false movement that the horse over-reaches. It happens when galloping in deep ground, or when taking a small leap in his stride; it never occurs in the fair gallop; hence the accident is not often met with in race-horses, either in training or whilst running. The injury sustained in over-reaching is not commonly so great as it at first appears to be. The wound.

though extensive, is superficial; and though the blow has been heavy, from the yielding character of the structures they repel the violence. The cuticle—viz., the soft horn covering—is torn from the true skin and secreting surface, and is detached above, forming a loose pending flap.

Treatment.—In our early days the custom with us was to cut off at once all this detached horn, and then to bind up the wound with tape and tow, wetted with some astringent mixture. In latter years we have adopted a different course, which is found preferable; it consists in taking off the shoes (always advisable when injury is sustained, which gives rise to swelling in the region of the foot), and, placing the foot in a pail of warm water, continuing to foment it for some minutes, at the same time cleansing the wound by removing all particles of foreign matter; we then take an ordinary bandage wrung out of warm water, first laying a pledget of tow over the loose flap and whole wound, and press the bandage round the coronet in the usual way, repeating the same process every 6 to 12 hours. From 48 hours to 3 days is long enough to keep the foot bound up. Bathing it for a few minutes daily, and leaving the wound exposed, is the plan we adopt subsequently, keeping the horse meanwhile in a loose box, and in about six days the bruise passes off, and the dead and detached substance becomes shrivelled and easily distinguishable from sound structures, and may be then cut off, the shoe applied, the hoof rubbed with ointment, and the horse will be fit for exercise or work. It may be asked, why not cut away all detached horn at first? Because we find economy in retaining it; it forms a better protecting medium than any we can substitute for it; moreover, it is always well in the case of wounds, where nothing is to be gained by the opposite course, to let all remain until the line between the living and dead becomes well defined: instance, as a comparison, a bad case of broken knee, where we often find our means of perfect cure frustrated through some one having cut off a piece of loose skin, which in the case, would have filled up its former place, or at least, should have been left untouched, and if possible, restored. The same rule applies to over-reach and all similar wounds.

TREADS.

Treads are accidents which commonly happen to horses during the winter, when the heels of their shoes are turned up and sharpened for frosty weather; they occur to draught-horses almost exclusively. The character of a tread is a wound on the coronet, involving a portion of the skin, and usually more or less injury is done to the coronary band. The locality is the inside or front of the foot.

As it is known, any injury to the root of a finger or toe nail is most painful, and of much consideration, when one of similar extent in another part would be little heeded, so with the foot of the horse. Structures of great importance in the economy of the foot, and yet endowed with little vascularity, are wounded in the case; reparation is slow, and the wounds are very painful; death in most cases occurring to the skin at the part wounded.

The horse should be at once put at rest, and the treatment advised in the case of over-reach pursued. There is this difference, however, between the two modes of injury, that in treads deeper seated structures are wounded, and the solid, instead of yielding parts of the foot, sustain the injury.

In addition to warm-water bathing, a linseed-meal poultice may be applied for the first three days in a case of bad treads; after which, and in all slight cases, the bandage, as already recommended, may be relied on. In bad treads we sometimes find that fourteen days elapse before the wound is clean, and all the slough cast off, which, when effected, the cure is soon completed, by continuing cold-water dressing with moderate bandage pressure, until suppuration ceases, when all coverings may be removed. Irritants should be avoided, though some touches with caustic may be called for in the latter stage. The best in the case we find to be crystalised sulphate of copper, which, from its manageable form and slow solubility, can be applied to the precise spot where granulations are loose and sprouting.

WOUNDS OF THE FOOT BY NAILS AND OTHER SHARP-POINTED BODIES.

The most frequently occurring injuries from these causes are inflicted by the nails in shoeing; the cases of lameness from which are more numerous than is generally known, even by shoers themselves.

It is not the palpable accidents of pricking horses that are of the most frequent occurrence, but the lesser and less obvious effects of proximity of the nails to the organised structures; the hoof being at the same time weakened, pain, more or less acute, results, with a variety of effects depending on other conditions. In all these cases of wounds of the foot, the first thing to be done is to remove the foreign body—let all that offends be cleared away, and no exploration, as a rule, is called for, or advisable. Farriers usually do much injury by cutting and exploring, without any notion of what they are in search of; the pretended remedy is commonly an aggravation of the injury; the hoof being destroyed and the foot deeply wounded, whilst no knowledge is gained, and no possible or expected consequences are prevented, but are often brought on by such a course; therefore we content ourselves with the removal of the cause, and in the majority of cases do no more than have regard to the general health of the foot.

The removal of stubs of wood calls for special dexterity; and the proper after-treatment, when the foreign body has been dislodged, is to apply a linseed-meal poultice, repeating it once in twelve hours, and continuing for three or four days. It sometimes happens, despite all our care, that parts of a stub will be so embedded in the tissues as to evade detection, in which case the suppurative process, which will ensue by the fourth or fifth day under the prescribed measures, will lead to the detection and easy removal of the offending part. When matter is formed, and the wound becomes clear of all extraneous bodies, water-dressings are the best, consisting of pledgets of wet tow laid over the wound, and retained by a bandage.

QUITTOR.

Quittor is perhaps the most painful disease to which the horse is subject. It is another of the disorders that should be prevented; but since it is the nature of our calling to remedy evils that have happened, as well as devise means of prevention, we must prepare to take cases as we find them, and restore the suffering patient in the best possible manner.

As we have, it is believed; done a good deal in the way of prevention, and establishing a right course of treatment of quittor, so far as our practice and teaching has extended; it may be advisable to go into the details of the disease, which happily is not amongst the most frequent of occurrence; and when present, none but a qualified practitioner should attempt to interfere in the complicated state which the foot presents.

The accepted definition of quittor, does not meet the case according to our understanding of the matter; in so far as it is regarded and described as consisting of a discharge of matter from the coronet which has been formed within the cavity of the hoof, caused by some injury, and which so pent up, and finding no means of exit below, burrows its way to the top, sinuses being established for its passage. The above, which gives the common acceptation of what a quittor is supposed to be, is, to say the least, a vague account; but it is more than that—it is incorrect.

We may have any number of cases of matter escaping from the coronet, without the semblance of quittor, according to our views and experience on the subject. And we think it important to be plain on the matter, because right and wrong notions lead to widely different courses of practice, not only where the existence of quittor is agreed on, but under other and less complicated disordered conditions of the foot.

In cases of temporary injury from the shoe, with exertion in addition, to the extent that inflammation resolves into suppuration, the course to which nature points for the escape of the matter is towards the coronet, and not, as has been supposed, to the bottom of the hoof, where, from its non-vascular nature, it would be locked up. Were this fact known, people would not be so ready to cut away the sole of the hoof to the quick, in order to create a depending opening; they only find blood, and do incalculable injury, whilst the real tumefaction is shown by a bulging swelling above the hoof, between which and the skin pus, when formed, escapes. And if the horse be properly taken care of by removal of the shoe, fomenting the foot, and applying a poultice or a wet bandage round the coronet, the swelling will subside, and the horse be rendered sound in the course of three or four days' longer rest. Here we have none of the essentials of quittor, though men often make something very like one, which ends in consequences equally bad through excessive meddling. To those who ask how is matter to get free from within the hoof if we don't cut down upon it? we put another question, Do men suppose that nature left such occurrences unprovided for? no student of Nature's works will entertain such notion.

The fact appears to us to be, that quittor is a state consequent on a deep-seated lesion of the foot, in which the cartilages, or frequently even the coffin-bone, is affected at its posterior extremity indicated by the seat of the disease. Old standing and progressively increasing corns are the common sources of quittor—recent injuries of the kind only superficially affect the connecting surface of the sensitive foot; but in process of time horn tumours press into the structures; when ulceration of bone and cartilage goes on, to remove and make way, mortification more or less of these occur; hence the necessary separation of parts before a cure can be effected; and but for proper treatment these cases go on from bad to worse, so that a spontaneous cure rarely occurs. A quittor is a sign of a complication of long-standing disease in the foot, or of some serious lesion, such as the fracture of some point of the coffin-bone, or an ossified cartilage, all of which pathological conditions we have found; so that in our diagnosis of the actual state and probable result, the nature of the case must be fully taken into account, the name *quittor* going little towards helping to solve the question as to the extent and character of the disease.

Symptoms and Treatment.—We are sometimes consulted on the case of a horse very lame, where we find heat and swelling over one heel and quarter of the foot, for which we prescribe fomentations and poultices, and wait the expected suppurative process, endeavouring by these means to modify its extent; and in almost every case we succeed in limiting it to a slight discharge, and immediate healthy termination; in one case out of many, however, the characters which immediately precede the manifestation of quittor appear. In the latter case, instead of a slight discharge of healthy pus, and subsidence of swelling and pain, we find a limpid secretion, with an angry-looking small orifice, and increasing pain—all indicating that there are conditions within that must be changed. More frequently, when called to a case of quittor, we find this latter stage has already passed, and the disease of some days', weeks', and sometimes of months' standing. Commonly we have one sinus externally, in old standing cases sometimes two, at a distance of an inch or so apart, one about the centre of the quarter and the other backward. Our first step in the case is to inject an active agent, which is especially successful in destroying the spurious growths, whilst it very sparingly affects natural, firm structures. We take the following chemical composition: 1 drachm of bichloride of mercury, rubbed down and dissolved in one ounce of rectified spirit, to which we add ½ drachm of liqui plumbi acetetis. With this mixture, by means of a small elastic gum (we find this the best) syringe, we press it into the sinus, and in case there be two, place the finger on one to prevent escape thereat of the liquid, the object being to press and infiltrate the whole tumefied part. We never probe the part, but send the fluid to do the exploring work; for though we have a tolerably large orifice externally, that being the channel into which an infinity of smaller tubes empty themselves, these afford no calibre for the passage of a probe, which when forced, makes one. Within six hours of the application of our treatment, the swelling of the quarter sensibly diminishes, and the horse is to the same extent relieved; the explanation of which rapid change we submit to be as follows. We have in the case performed something like an amputation; the agent has destroyed the morbid growth, and has isolated the dead from the living; the medicine, after killing, acts chemically on the matter and diminishes its bulk, so as to take off internal pressure, and the swelling subsides; the injection should be repeated twice or thrice, at intervals of twelve to twenty-four hours, in order to penetrate to all parts of the diseased structures. Sometimes we elongate the compound after the second application, by adding equal or twice its weight of spirit; we at this stage wait for the slough separating, which takes from seven to ten days, and watching the case, treat it as the rules of surgery suggest; and when it goes favourably, as is commonly the case, nothing more is required, besides sufficient rest and good care, until the foot is restored and the horse fit for use.

Connected with the slough, in some rare cases, a piece of bone will come away; this was called by the old farriers the quittor bone, and consists of a fractured portion of an ossified cartilage or exfoliation of bone, the cause most probably in the case, of the whole mischief.

No horse should be allowed to work under any pretence, whilst suffering under the extremely painful state of quittor, though we often see poor hard-wrought horses in our streets in such condition, with blood and matter streaking down the hoof; but where words of advice do not avail in these cases, the Act for the Prevention of Cruelty to Animals should be put in force, its tendency being equally conducive to the interest of the owner and humanity to the animal.

FOUNDER, ACUTE AND CHRONIC.

The above terms, and several others, are used at present to express the same condition of the feet of horses and the character of the lameness; the word founder implying, in the case of a horse as in that of a ship, the want of freedom to move.

Fever in the feet is also an old term, used to designate similar cases to the above, neither of which, though somewhat vague, convey the positively erroneous notions of the modern terms, wrongly called scientific, which have been adopted; inflammation of the laminæ, and more recently laminitis, are terms introduced, under the notion that the disease and pain is located in the laminated connecting medium between the wall of the hoof and the organic structures.

We discover a totally different locality to be the original seat of disease, and almost an entirely different train of causes which give rise to it, and, as may be conceived, if our premises be correct, a totally different mode of treatment to be indicated.

The plantar region of the foot being the affected part in all cases which the foregoing terms are meant to indicate, both fore feet of the horse are commonly affected at the same time; sometimes all the feet take on in succession an acute, inflammatory state, arising from being alike exposed to causes, constitutional and mechanical, and the inability of either foot to sustain the exertion destined to be equally distributed over all four. The proximate causes are, exposing the feet to moist soft surfaces, such as on farm-yard manure and wet soil, breeding horses on marshy undrained lands, &c. Bad shoeing and hard work constituting the most common immediate causes, the degree of work which may be borne will depend greatly on the first-named conditions, as a horse may be so bred and treated as not to be able to bear exertion under his own weight.

Treatment of plantar lameness, and the symptomatic fever often accompanying it, consists with us in removal of the shoes in the first instance, adjusting the hoofs, which require to be made level, and not allowed to be high at the heels, the joint of the hoof seldom requires reduction, beyond shortening the spreading thin edge, which is best done with a file, by taking the foot forward on the knee; the sole should be left untouched with the knife. A mild doze of aloes in ball should be given, and clysters at intervals of two hours for the first day, foment the affected feet with warm water, by placing them one at a time in a pail, or in cases where the horse is not able to stand, flannel bandages wrung out of hot water may be applied with similar effect.

The above emollient treatment locally, and attention to diet, which should be spare and regular in its administration, with the aperient measures prescribed, generally effect a radically good change within three or four days. With continued care, the horse being kept on a clean surface, with his hoofs rubbed with appropriate ointment, and properly shod, he will return to work successfully, relatively in a great measure to his previous normal state.

NAVICULAR DISEASE, OR NAVICULAR JOINT LAMENESS.

Ulceration of the navicular bone, which is found present in many cases of long-standing lameness, has, since it was first brought to notice forty-eight years ago, caused a panic amongst the veterinarians of this country, and through exaggerated notions of the cause, prevalence, and character, the horse-owners have been pecuniary losers, our law courts the scene of conflicting evidence often discreditable to our calling, and the result wrong decisions by juries.

Navicular disease is a state that, by proper management of horses and their feet by shoeing, should be prevented. It is not present in more than one case in ten, if so many, where it is pronounced to exist. Nor is the early, or any stage, so hopeless and unamenable to proper treatment as has been supposed; we have attained success, and been gaining evidence of late years, tending to establish the above propositions. We claim merit for the elimination, as far as our practice and teaching has had influence, of the absolutely destructive measures in vogue,—viz., bleeding, setoning, blistering, firing, &c., and instead, attend to those hygienic means for the restoration of the foot which long experience has enabled us to devise, besides the knowledge derived from all available sources, comprising that of writers of past and present times. Shoeing is our sheet anchor, both as the means of conserving the foot and tending to its restoration, whilst primary and collateral conditions are not to be regarded as insignificant, and these have been mostly referred to in the preceding pages.

GLOSSARY.

ADVENTITIOUS. Unnatural, accidental or acquired.

ALKALI—ALCALI. Term for a substance which has properties the reverse of those of an acid, and with which it combines so as to neutralise its activity and form a salt. It has an acrid urinous taste and caustic quality; it changes vegetable dyes to green, renders oil miscible with water, and is distinguished from an earth by its greater solubility.

ALKALINE. Having the properties of an alkali.

ALKALOID. A vegetable alkali.

ALVINE. Belonging to the belly, stomach, and intestines; applied to the fæces or dung.

AMAUROTIC. Pertaining to that blindness which is produced by paralysis of the nerve of sight.

AMORPHOUS. Without any regular form. Shapeless.

ANASARCA. Watery effusion into the cellular tissue. Dropsy of the limbs, &c.

ANASTOMOSE. To communicate with one another; applied to the connection of blood-vessels and nerves by transverse branches.

ANTENÆ. Applied to certain articulated filaments inserted in the heads of the Crustacea and Insecta, and appearing to be devoted to a delicate sense of touch.

ANTIPERISTALTIC. The vermicular contraction of the intestinal tube when that takes place in a direction from behind forwards.

ANTIPHLOGISTIC. Against inflammation. Applied to medicines, plans of diet, &c., which counteract inflammation by depressing the vital powers.

ANTISEPTIC. Counteractive of putrefaction.

AORTA. The great artery which arises from the left side of the heart, and gives origin to all other arteries except the pulmonary.

APHONIA. Loss of voice.

APHTHOUS. Having aphthæ or blisters on the skin or mucous membranes.

APNŒA. Absence of respiration.

APPENDICIS EPIPLOICÆ. Masses of fat attached by pedicles to the folds of peritoneum which support the intestines.

ARTHRITIC. Pertaining to joint diseases.

ATAXIC. Showing irregularity in the functions of the body or in the symptoms of a disease.

ATROPHY. A wasting or emaciation with loss of strength; defect of nutrition.

AURICLE. Ear-like appendage.

AUSCULTATION. Attending to the sounds in the different parts of the body, in order to form a judgment of the condition of these parts.

AUTOPSY. Examination after death.

BIFURCATION. A vessel or nerve bifurcates when it divides into two branches.

BUCCAL MEMBRANE. The lining membrane of the mouth.

BUCCINATOR. The muscle of the cheek.

CACHEXIA. A bad condition or habit of body, known by a depraved or vitiated condition of the solids and fluids.

CADAVERIC. Belonging to a carcass.

CANULA. Name of a tubular instrument, introduced by means of a *stilette* or *trochar* into a cavity or tumour, in order that, on removing the *stilette*, any fluid present may be evacuated through it.

CANTHARIDIS. Spanish flies.

CARCINOMATOUS. Cancerous.

CARDIAC. Pertaining to the heart.

CATALYSIS. Name given to a force or power which decomposes a compound body by mere contact.

CATHARTIC. A purgative.

CEREBRAL. Pertaining to the brain.

CEREBRIFORM. Having an appearance like brain matter; applied to a form of cancer.

CERVICAL. Belonging to the neck.

CHOLOCROME. The colouring matter of bile.

CHYLOPOIETIC. Belonging to the stomach and intestines.

CINERITIOUS. Like ashes. Applied to the outer or cortical substance of the brain.

CŒCUM CAPUT COLI. The point of union of the blind gut with the remainder of the large intestines.

COFFIN-BONE. The last bony segment of the limb, which is enclosed in the hoof.

COMA. A lethargic drowsiness.

COMMISSURE. A jointure. Applied to the corners of the lips, to certain parts in the brain which join one lateral half with the other, and to the hoof, when the frog laterally is connected with the sole.

CONGENITAL. Existing at birth.

CONJUNCTIVA. The mucous membrane of the eyelids, and front of the eye.

CORIACEOUS. Tough, leathery. Applied to leaves.

CORNEA. The clear transparent part on the front of the eye.

CORTICAL. Belonging to the bark of a plant. Applied to the outer layer of the kidney and brain.

CRANIUM. The bony cavity which contains the brain.

CRETACEOUS. Chalky.

CUL-DE-SAC. A blind pouch.

DECUSSATION. Union in the shape of an X or cross. Applied to the crossing of the optic nerves.

DEPILATION. Loss of hair, spontaneously or by art.

DEPURANT. Medicines supposed to be capable of purifying the blood, by removing those constituents which interfere with its purity.

DESQUAMATION. Separation of the scurf-skin in the form of scales.

DEWLAP. The loose hanging skin at the lower part of the ox's neck.

DIAPHORETIC. A medicine which increases the sensible perspiration.

DIAPHRAGM. The muscular partition between the chest and the abdomen.

DIPTEROUS. Having two wings. Applied to insects.

DIVERTICULUM. A blind tube leading out of the course of a longer one.

DORSAL. Belonging to the back.

DUCTUS ARTERIOSUS. A vessel leading from the pulmonary artery to the posterior aorta, and which is obliterated at birth.

DYSCRASIA. A bad habit of body.

ECCHYMOSIS. A livid black or yellow spot, produced by blood effused into the connective tissue.

ECHINOCOCCUS. A bladder worm usually met in the internal organs.

EMBROCATION. A fluid application, to be rubbed on any part of the body.

EMPHYSEMA. A term applied to the presence of air in the areolar tissue, or to diseased enlargement of the ultimate air-cells.

EMPROSTHOTONOS. A variety of tetanus, in which the body is bent forward by the contraction of the muscles.

EMUNCTORY. An organ whose office is to give exit to matters that ought to be excreted.

ENEMATA. Injections. Clysters.

ENTOZOA. Worms that live in the animal body.

ENZOOTIC. Applied to diseases peculiar to a district.

EPIDERMIS. The scurf skin.

EPILEPTIC. Anything relating to epilepsy.

EPIPHYSIS. Part of a bone separated from the shaft in early life, by gristle which afterward changes into bone.

EPITHELIUM. The layer of cells on the surface of mucous and serous membranes.

EXACERBATION. Paroxysm. An increase in the symptoms of a disease.

FAUCES. The gorge. The passage leading from the back part of the mouth to pharynx.

FERRUGINOUS. Chalybeate. Applied to medicines, having iron for their active principle.

FŒTOR. A bad smell.

FORAMEN. An opening; a hole.

FURCULUM. The merrythought. A fork-like bone in the breast of birds.

GANGLIONIC. Relating to ganglia. From the numerous ganglionic enlargements on the sympathetic nerve it has been called the ganglionic system of nerves.

GLOTTIS. The oblong aperture between the vocal cords of the larynx, and through which the air passes to the lungs.

GRANULATIONS. Small reddish, conical flesh-like shoots, that form on the surface of suppurating sores.

HEMIPLEGIA. Paralysis of one side of the body.

HETEROCHRONOUS. At different times.

HYDATID. A cyst containing a clear liquid. A bladder-worm.

HYGIENIC. Relating to those conditions which tend to preserve health.

HYGROSCOPIC. Belonging to the measurement of the dryness or humidity of the atmosphere.

HYPERTROPHY. Enlargement of a part from increased nutrition.

IDIOPATHIC. A primary disease—one not dependent on any other, or on an injury, is so called.

IDIOSYNCRASY. A peculiarity of constitution in which one individual is affected by an agent, which in numerous others produces no effect.

INCUBATION—HATCHING. The time which elapses between the introduction of a morbid principle into the system, and the onset of the disease.

INFERIOR MAXILLARY BONE. The bone of the lower jaw.

INFUSORIA. An order of vermes of the lowest organisation, and found in putrefying liquids.

INGESTA. Substances introduced into the digestive organs.

INTERMAXILLARY SPACE. The interval between the branches of the lower jaw.

IRIS. A membrane stretched across the anterior chamber of the eye, and which gives it its colour; it is pierced in its centre by the pupil.

ISOCHRONOUS. Taking place in the same time, or in equal times.

LACHRYMAL. Belonging to the tears. Applied to parts engaged in the secretion and transmission of the tears.

LAMINÆ. Folds or leaves. Applied to the folds in the third stomach of ruminants, and to the horny and sensitive folds by which the hoof-wall is attached to the deeper seated parts.

LITHONTRIPTIC. A remedy supposed to be capable of dissolving stones in the urinary passages.

LUMBAR. Pertaining to the loins.

LYMPHATICS. A system of vessels, engaged in taking up lymph throughout the body.

MALARIA—MIASMA. Noxious emanations from the earth, especially in marshy districts.

MAMMALIA. That class of animals that suckle their young.

MEDIASTINUM. A membranous space between two layers of pleura, extended from the spine to the upper surface of the breast bone.

MEDULLARY. Relating to the marrow, or analogous to marrow.

MELANOSIS. A disease in which tumours are developed, containing a large amount of black pigment.

METASTASIS. The translation (perhaps more properly an extension) of a disease from one part to another.

MONILIFORM. Having the appearance of a string of beads.

MULTIPOLAR. Having many prolongations.

NARES. The openings of the nose, anterior or posterior.

NIDUS. Nest. Seat.

NUCLEOLUS. A simple granule within a nucleus.

NUCLEUS. The centre of a tumour or morbid concretion. A minute cell within a cell.

OMENTUM. Folds of serous membrane passing from one abdominal organ to another are so called.

OPISTHOTONOS. A species of lockjaw in which the body is bent backwards.

OS PEDIS. The principle bone of the foot.

OVARIAN. Belonging to the ovary.

PAPILLÆ. A name given to small conical, vascular eminences on the surface of the true skin or mucous membranes.

PAPULÆ. Small pointed elevations of the scurf skin with inflamed base.

PARAPLEGIA. Paralysis of the anterior or more commonly the posterior half of the body.

PARASITISM. The condition of a parasite or of an organised body, which lives on another organised body.

PARENCHYMATOUS. Belonging to the texture of a glandular or other organ.

PATHOGNOMONIC. A characteristic symptom of a disease.

PATHOLOGY. Diseased physiology. That branch of medicine whose object is the knowledge of disease.

PEDUNCLE. A flower stalk. Applied to different prolongations or appendices of the brain. The constricted attachment or neck of a tumour.

PERITONEAL CAVITY. The sac of the peritoneum, or lining serous membrane of the abdomen.

PETECHIÆ. Small purple spots which appear on the skin and mucous membranes in the course of certain maladies. They are attended with great prostration.

PHLEBOTOMIST. One who bleeds from the veins.

PHLEGMON. A circumscribed inflammatory swelling, with increased heat and pain, and tending to suppuration.

PLEURAL CAVITY. The sac of the pleura, or lining membrane of the chest and lungs.

PLEUROTHOTONOS. A variety of tetanus in which the body is curved laterally by the stronger contraction of the muscles on one side of the body.

POLARITY. That property which disposes the particles of all kinds of matter to move in a regular and determinate manner when affected by other agents.

POLL. The highest point of the head, marked by a transverse bony ridge.

PROGNOSIS. A judgment formed regarding the future progress and termination of any disease.

PROTEAN. Assuming different shapes.

PULMONARY. Belonging to the lungs.

PYRIFORM. Shaped like a pear.

QUARANTINE. The time during which men or animals, coming from a country where any contagious disease exists, are kept from intercourse with the inhabitants of the country.

RECTUM. The last or straight gut.

RENIFORM. Kidney shaped.

SCHNEIDERIAN MEMBRANE. The mucous membrane lining the nose.

SCOLEX. The ascaris lumbricoides—an intestinal worm.

SENSORIUM. The common centre of sensations.

SEPTUM VENTRICULOSUM. The muscular partition between the two ventricles of the heart.

SEROUS MEMBRANES. A class of delicate membranes, which form closed sacs, met with in the chest, abdomen, and spinal canal.

SIBILANT. Making a hissing or whistling sound.

SINAPISM. A poultice of which mustard forms the basis.

SPHINCTER. A name given to several annular muscles, which constrict or close certain natural openings.

SPORADIC. Diseases which occur in isolated cases, and independently of any contagious or epizootic influence.

STASIS. Stagnation, without any morbid condition of the fluids.

STERNUM. The breast bone.

STHENIC. Strong. Action. Applied to inflammation or fever.

STYPTIC. A substance used to check hæmorrhage.

SUB-ACUTE. Applied to maladies which last from seven to twenty days.

SUPPOSITORY. A solid medicinal agent introduced into the rectum.

SUPPURATION. The formation or secretion of pus or matter.

SUTURE. The line of union of two flat bones.

TAXIS. Term for the operation of replacing by the hand, without using instruments, any parts that have left their natural situations, as in the reduction of hernia, &c.

TERATOLOGY. A treatise on monsters.

THERAPEUTIC. Curative. Therapeutics is that part of medicine the object of which is the treatment of disease.

THORAX. The chest.

THYMUS-GLAND. The sweetbread of the butcher. An organ situated in the anterior part of the chest in the mediastinum, and usually absent in adult life.

Traumatic. Relating to a wound.

Trephine. An instrument for making openings in flat bones. It consists of a circular saw, centre pin and handle, and removes a circular portion of the bony plate.

Trismus. A variety of tetanus affecting only the jaws, and causing their spasmodic closure.

Tubercular. That which relates to tubercles, or that is formed by tubercles. Applied in anatomy to rounded eminences, and in pathological anatomy to a morbid production contained in cysts, or loose in the structure of organs. This matter is at first compact and yellowish; at times calcareous; afterwards pultaceous, semifluid, and curdy.

Tympanum. The drum of the ear.

Typhoid. Resembling typhus fever. Often applied to a fever in which the agminated glands of the intestines are in a morbid condition.

Umbilical Cord. The navel string.

Umbilicated. Depressed on its summit.

Urethra. The channel through which urine is discharged from the bladder.

Varices. Dilatations of veins.

Vena Portæ. A vein which receives the blood from the stomach, intestines, spleen, and pancreas, and breaks up again in the substance of the liver.

Ventricle. Literally a little belly. A name given to various small cavities.

Vertebra. A segment of the back-bone.

Vertigo. Giddiness.

Vesicular. Full of or containing vesicles or cells. Vesicular emphysema is that in which the air-cells are enlarged.

Vibrissæ. The hairs that grow at the entrance of the nostrils and other outlets. In cats the whiskers.

Villi. Small papillary eminences on the surface of mucous membrane, and constituted of blood-vessels, nerves, and absorbents.

Virus. A morbid poison. A principle inappreciable to the senses, which is the agent which transmits infectious diseases.

Viscera. The entrails. Internal organs.

TRAUMATIC. Relating to a wound.

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