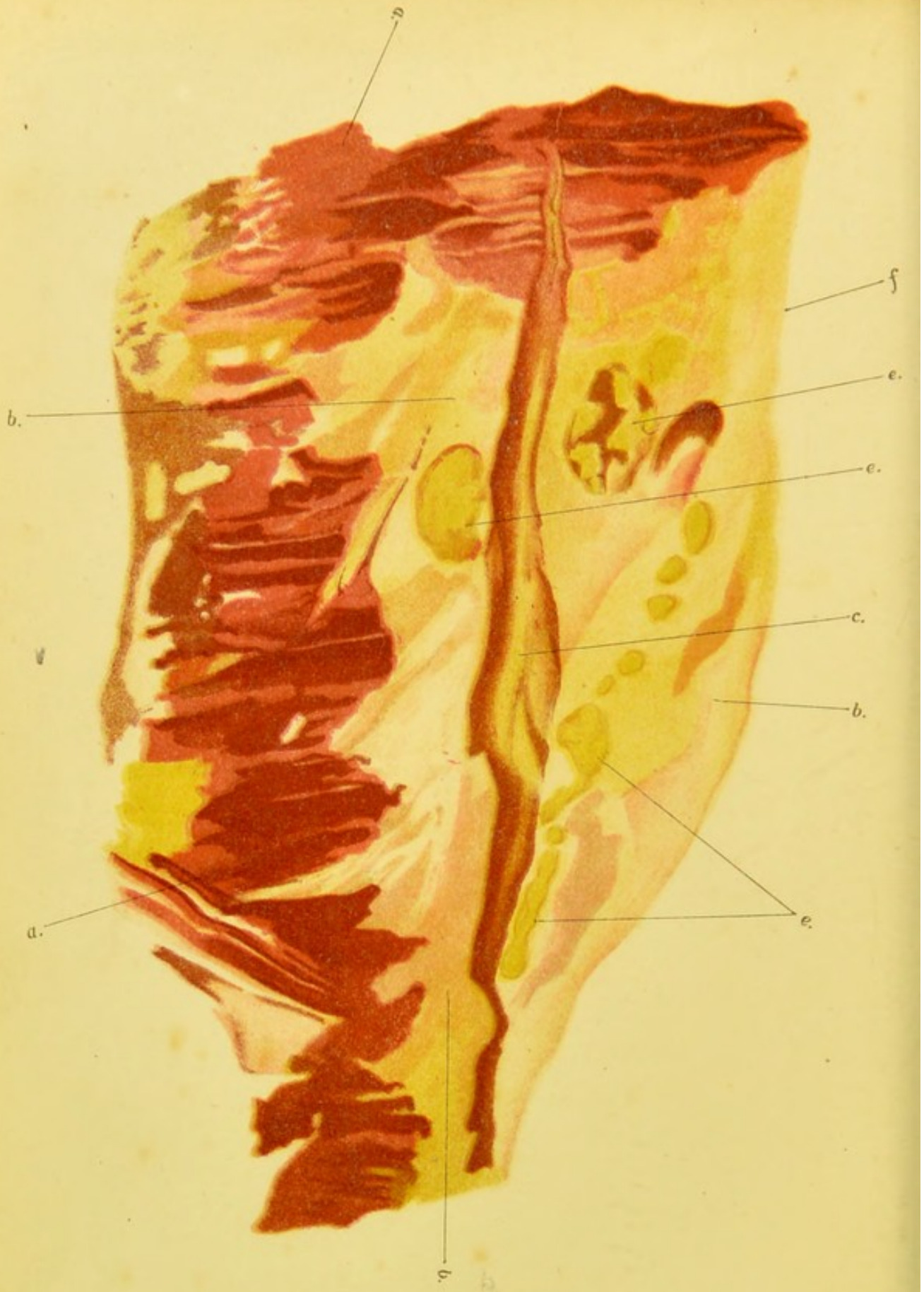
A practical guide to meat inspection / by Thomas Walley.

Bertram Godfray

A PRACTICAL GUIDE TO

MEAT INSPECTION.



Section of costo-sternal muscles and fat, showing groups of supra-sternal lymphatic glands, with tuberculosis—some three inches deep—below pleura.

a. a. Muscle.
b. b. b. Fat.
c. Internal pectoral vein.
e. e. e. Tuberculous glandules.
f. Border attached to sternum.

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BY

THOMAS WALLEY, M.R.C.V.S.,

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WITH FORTY-SEVEN COLOURED ILLUSTRATIONS.

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14, 16, AND 18 CLYDE STREET.

PREFACE.

THE Author of this little work desires to express his thanks to Professor M'Fadyean, for the lucid description given by him of the micro-organisms of Anthrax, Black-Quarter, Tuberculosis, and Actinomycosis; to Dr. Klein for the kind permission, readily granted by him, to use his Plates on the micro-organism of Anthrax, Black-Quarter, and Tuberculosis respectively; to Mr. T. P. Young, M.R.C.V.S., for his assistance in the general preparation of the work, and more particularly in the arrangement of the index.

To the Second Edition has been added several coloured sketches, illustrating the lesions of diseases of an important character, and also others for the purpose of enabling the Inspector to differentiate between the carcases of animals of different sexes, and of distinguishing the exact situations of the most important lymphatic glands of the body.

November 1891.

CONTENTS.

REFERENCE TO ILLUSTRATIONS AT END OF BOOK.

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ERRATA.

Page 115.—For "*Micrococcus* Diphtheria" read *Bacillus* Diphtheria.

Page 163.—This scheme, the author discovers, has not, as yet, been carried into effect.

INTRODUCTORY REMARKS TO FIRST EDITION.

"IN penning the following pages, the Author has undertaken the task rather from a sense of duty than from any claim to superior knowledge on the subject of Sanitation as applied to the consumption of the flesh of animals as human food.

"An experience of over thirty years in his profession, and a long official connection (some sixteen years) with the Edinburgh Abattoirs, have enabled him to gather a large store of information on the subject, which he has embodied in the following pages. It must not be supposed that this is the first occasion on which the Author has dealt with the Inspection of Meat. In 1879 he added an Appendix on the subject to a work entitled *The Four Bovine Scourges*, and long prior to that date he annually dealt with it in his Lectures on Cattle Pathology. In 1884 he had the privilege of moving certain resolutions bearing on the question at a meeting of the National Veterinary Association held in Birmingham; on numerous occasions, since 1879, he has directed public attention to the subject, and in July of 1888 he read a paper on the subject at the Annual Meeting of the Sanitary Association of Scotland in Glasgow.

"It was, in fact, in a large measure due to numerous inquiries for copies of the last-mentioned paper that the Author felt justified in venturing on publishing his opinions on the subject, and he

wishes to observe in this place, that many of the statements hereinafter made must be regarded rather in the light of personal opinions than in that of dogmatic assertions or of scientifically proved facts.

"If, however, the publication of this little work should lead to a more active interest being taken in this subject by those who are responsible for the health of the flesh-eating portion of the community; to the establishing of definite opinions as to what meat is fit for human food and what unfit; and to the adoption of definite legislative measures in connection therewith,—the purpose of the Author will have been served."

INTRODUCTORY REMARKS TO SECOND EDITION.

That a wider interest in the subject exists than was the case at the date of the publication of the First Edition of this work is shown by various circumstances. It is very gratifying, in the first place, to the Author that he has been the recipient of numerous communications from members of his own profession, from Medical Officers of Health, from Lay Inspectors of Meat, and Sanitarians of all shades, congratulating him on the production of *The Guide*; and it is even a more satisfactory circumstance that two officers connected with the Commissariat Department of the army, viz., Colonel Grattan, commanding Army Service Corps, Aldershot, and Captain John Stacpole, Inspector of Rations, consulted him in reference to the preparation and publication of Manuals (which they had in hand) on Meat Inspection, the latter gentleman doing the Author the honour of submitting the proofs of his proposed Manual for revision. To all interested in the welfare of the army it must be a matter of congratulation that the gastronomic tastes of the soldier are so far considered as to warrant the publication of such an

excellent Manual as that prepared by Captain Stacpole,—*A Guide to Meat Inspection for Regimental Officers*,—and a glance at its pages will show that the contemptuous epithet of "sodger's beef" can no longer be applied to the carnal portion of the soldier's rations. The same fact was also strongly impressed on the Author by a perusal of material for a Manual of the same kind written by Colonel Grattan. In addition to these a book on Meat Inspection has also been recently published by Mr. W. Wylde, Chief Inspector of Meat for the City of London; and although none of these works traverse the same ground as that mainly followed in the *Guide to Meat Inspection*, the Author has no hesitation in quoting any remarks from their pages that may be of interest to his readers.

Other grounds for congratulation than those above mentioned are, that the First Edition of this little work has been rapidly absorbed; that a paper read by the Author at a meeting of the Lancashire Veterinary Medical Association held at Liverpool in June 1890, and one read by him at the meeting of the British Medical Association, held at Birmingham in July last, were very favourably received; and that an important resolution, proposed by Dr. Russell of Edinburgh, and seconded by Dr. E. Sergeant, after the reading of the last mentioned paper, to the effect—"That it be remitted to the Parliamentary Bills Committee to approach the Government with a view to obtain the abolition of private and the establishment of public slaughter-houses, with skilled inspection of meat," was favourably received and adopted; and, lastly, that a Royal Commission should have been appointed to take into consideration the question of Tuberculosis.

THE IMPORTANCE OF MEAT INSPECTION.

THE question of Meat Inspection is one of paramount importance to a community whose gastronomic taste is so decidedly animal as is that of the population of Great Britain. And seeing that the flesh of animals bulks so largely in the daily bill of fare, it is only reasonable that some sort of guarantee should be forthcoming that it is not only what it professes to be—*i.e.*, the flesh of the ox, sheep, or pig—but that it is wholesome or nutritious, and that it is also harmless or innocuous.

On no question of social economy is the general public more ignorant than on that of the wholesomeness or otherwise of the flesh they devour, and on that ground alone, low as it is, it is incumbent upon sanitary authorities to guard them against abuse and injury.

A purchaser with a few pence in his pocket, and the cravings of hunger gnawing at his stomach, is not likely to exercise great discrimination in the purchase of the necessaries of life; nor can he afford to pay an expert to teach him what to choose, or what to avoid. He, perforce, buys that which to his uneducated senses is most likely to satisfy the predominant feeling of which he is cognisant—hunger.

That sanitary legislation in this country is far behind that of many Continental countries, must be patent to all who care to study the matter, and that notwithstanding the fact that we are the greatest beef-eating country in the world. At

whose door this dereliction of duty is to be placed I will not stop to consider.*

It is evident that it is due largely to indifference and to apathy on the part of those who are supposed to be the guardians of the public health.

That the inspection of abattoirs, markets, and shops, carried on even in an imperfect manner, is of great public utility, must be apparent to those who are placed in a position in which opportunities are afforded for forming a correct and reliable opinion. Thousands of pounds of flesh meat are by this means annually withdrawn from our markets and shops, and consigned to that fate which is most meet—destruction; and, in addition to this, a wholesome, though not absolutely efficient, check is placed upon the nefarious traffic of the "carrion" or "cagmag" butcher.

If such characters confined their operations merely to the sale of an inferior quality of meat—*i.e.*, meat deficient in fat or wanting in flesh—but little harm would accrue; neither could any serious objection be urged against their trade if they were honest enough to label every piece of meat exposed by them for sale with a description of its character and the source from whence it was derived, or, as of second or third class quality. In that case the purchaser could blame nobody but himself; and if he chose to buy meat labelled "diseased," simply because he obtained it at a low price, the fault would rest with him alone, and the sanitary authorities could no more be held responsible for his act than could the police authorities be held responsible if he elected to commit suicide.

The members of that class of the community most largely

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* As showing the difference in the way meat inspection is managed at Berlin, it may be noted that the staff engaged in the duty at the Central Abattoir comprises over 250 persons, including the director, 19 veterinary surgeons, and 6 assistant veterinary surgeons; while about 15 veterinary surgeons are engaged in the inspection of carcases slaughtered elsewhere and brought into the city (*Journal of Comp. Path.*, June 1890).

affected by the traffic under consideration, not only are not possessed of marked reasoning faculties, but they are usually very confiding (and honestly so), believing that that which seems a spade is really a spade. But how are they to know a spade if it is (metaphorically) reduced to atoms by the teeth of a mincing machine, and further rendered attractive by admixture with a modicum of decent fat and flesh and a large allowance of spice?

Horse-flesh cannot be distinguished from that of the ox when it is so treated, no more than the flesh of the cat or the dog can be distinguished from that of the calf. Nor can the nature of flesh in which, under normal circumstances, the products of disease would be readily detected, be always distinguished even by the expert, when subjected to similar processes.

The business of the "carrion butcher," like that of the "horse-coper," can only be conducted by men possessed of a large share of cunning, and of a profound belief in the gullibility of a large proportion of their fellow-men.

For originality and fertility of resource in fighting against constituted authority, and in devising means for carrying on his nefarious traffic; for the instantaneous coining and uttering of unblushing falsehoods; and for the absolute indifference with which he contemplates the injury likely to be inflicted on his victims, the "carrion butcher" is only equalled, certainly not surpassed, by the "horse-coper," and as in the case of the latter, the cast of his mind makes his work a congenial task. Like Ishmael, his hand is against every man, and he runs the blockade with as much daring and with more cunning than ever was shown by the captain of a Confederate schooner.

A few trusses of hay or bundles of straw, a few useless but innocent looking articles of furniture, serve to hide from the eye of the watchful constable or inspector a sub-stratum of contraband flesh. In some out of the way corner, in a retired part of the country, perhaps in the hollow of a hill, or the gloomy recesses

of a ravine, the horse or the ox is slaughtered by night and its carcase dressed with commendable celerity, and quietly conveyed into the town or city in the early morning, where it is quickly subjected to the mincing and spicing process, or converted into potted-head, saveloy, or polony in some quiet out-of-the-way vault or cellar. The flesh of the unborn calf—the "Staggering Bob" of some Scottish, or the "calf that never heard the nine o'clock bell ring" of some English town—serves admirably, with the aid of parings of ham from the pork shop, and a few pigs' or sheep's tongues, for the manufacture of potted ham, chicken, and veal. The muscles of the horse (the "powed ox" of the Edinburgh "carrion" butcher) give, with the aid of a little saltpetre, a rich florid colour to the tempting saveloy. The blood of the horse, and sometimes the small intestines of the same animal, are convenient and cheap substitutes for the blood and intestines of the pig in the manufacture of "black-pudding." As in the case of rancid or mouldy butter, so with returned or rejected (perhaps putrid) polonies or saveloys, a little manipulation and purification by heat or chemicals quickly convert them into a fresh looking and apparently wholesome article of consumption, which, as it is sold at a low price, is readily purchased by a needy and indiscriminating public.

The pictures here presented are drawn from actual experience. I have been present at the seizure of hundredweights of "returned" polonies, and of salted (pickled) flesh, in a state of semi-putrefaction. I have assisted in the seizure and condemnation of large quantities of sapid horse-flesh, which had undergone the process of "boning;" and of an *olla podrida* of every imaginable organ and tissue of various animals, simmered out of the semblance of recognition in a copper snugly built in the recess of a wall in an underground cellar—which also served as a sleeping apartment for the operator—over the floor of which a miscellaneous collection of stinking stockings and underclothes, with dirty

bed-linen, was strewn, and access to which was only gained by means of a cleverly contrived trap in the shop floor; and I have watched the youth of the lower strata of the population of a large town waiting in expectation at the knacker's yard with innocent looking tin cans for the blood and entrails of the to-be-slaughtered horse.

The traffic in diseased meat is pregnant with serious consequences other than that of direct harm to the consumers. It is one, and the most important, of the means by which the owners of animals are enabled to dispose surreptitiously of their diseased stock; and if the trade of the "blockade runner" were suppressed, the temptation to hide the existence of disease would be reduced to a minimum.

SUBSTITUTION OF THE FLESH OF ANIMALS NOT GENERALLY USED FOR HUMAN FOOD FOR THE FLESH OF THOSE SO USED.

IN this country the choice of the consumer of meat is a very limited one, *i.e.*, if compared with the flesh-eater of other countries.

Amongst the mammalia, the flesh of the ox, the sheep, the deer, the pig, the rabbit, and the hare, respectively, is alone prepared for human food. With such delicacies as the bodies of dogs, cats, and rats, there are few indeed who can claim any conscious acquaintance, and, in a less degree only, the same may be said of the horse. In Mr. Wylde's book a statement is made to the effect that on one occasion a hamper of newly born lambs had been sent to the Leadenhall Market as Ostend rabbits, on another occasion a retriever dog had been sent as a lamb, and on still another, where a jackass had been sent for sale as home- fed deer.

In reference to dogs, cats, and rats, I imagine there are few meat consumers who would knowingly partake of their flesh, or whose gustatory sense would not require to undergo a prolonged course of training in order that such flesh might be rendered palatable; and while sympathising with them in their abhorrence of the use of such flesh, I can scarcely join in the almost universal objection entertained to the use of horse-flesh. There can be little doubt but that large quantities of horse-flesh are, in cities and large towns, substituted for ox beef—identification

being rendered less probable, or more difficult, by submitting it to the process known as "boning," *i.e.*, carefully removing the bone from the flesh. Cases have been known in which army contractors have substituted the flesh of the horse and the mule for that of the ox; and only recently it is within my own knowledge that a horse was slaughtered in the public abattoir of a town not a hundred miles from Edinburgh, and the flesh surreptitiously sold for human food. In like manner, the hind and fore quarters of horses slaughtered in licensed slaughter-houses are frequently disposed of. Seeing that in point of nutritive value, and often in flavour and texture, the flesh of the horse is superior to that of the ox, it is difficult to understand why it has not long since been recognised as a valuable addition to our food supply.

Against the use of horse-flesh as an article of food, there is in the minds of the populace of this country a deep-rooted aversion. How far this aversion is justified or warranted may be a matter for question, but as in the case of other likes and dislikes it may be largely the outcome of an unreasoning and uninformed prejudice, strengthened, perhaps, by the repeated and persistent attempts of "carrion" butchers to palm it off on unsuspecting purchasers as a substitute for ox beef. According to a statement made by Mr. Knowles, M.P., the London Sausage Makers salt the flesh of the horse, and subsequently wash it in order to deprive it of its peculiar taste, and horse-flesh so treated is known amongst the fraternity as "Jack." The same gentleman has also stated that when horse-flesh is exposed for sale the fat is removed, and masses of ox fat are skewered on to the parts from which it has been taken. That the non-consumption of horse-flesh in this country is largely due to prejudice is, I think, proved by the ready sale with which it meets in certain Continental countries — particularly in Epicurean France. Our ignorance, too, as to the best methods of preparing it for culinary purposes, may have something to do with our objections

to its use. Not only prejudice but sentiment also exercises a large share in the national tabooing of horse-flesh as an article of common consumption; and that this is so has been amply proved by my personal experience, and by circumstances which have been brought within my own knowledge. When acting as a prosector in my student days I had occasion, in conjunction with my fellow-prosectors, to dissect the fore limb of a horse whose life had been abruptly terminated by a fracture of one of his legs. After the subject had served the purpose of the lecturer a discussion arose amongst my *confrères* and myself as to the edible qualities of horse-flesh, and especially as to the suitability of a section of the biceps of this particular subject for gastronomic purposes. A steak was carefully cut and conveyed by myself to my apartments, but I only succeeded in persuading one of my fellows to sup with me, and when the table was spread I halved the steak, and handed my friend B. his share of it. After a critical survey of the dainty morsel he succeeded in swallowing one mouthful, but he never swallowed the second, and it ended in my eating his share in addition to my own: it was only "the idea of the thing" that troubled him. A year afterwards two veterinary students occupied the same apartments, a horse-flesh supper was partaken of in the early part of their occupation, and as they were liberally inclined, a tolerably large modicum of the dainty morsel was left over and graciously handed to the domestic for her own use, and it was not until the last day of the session, and consequently the last day of their stay in the house, that the *hippopophagi* revealed the secret, and that they became forcibly aware of the fact that the landlady had shared the feast with the servant by the two performing, in the back garden, a duet well known to those who essay for the first time a voyage by sea. When engaged as a pupil, I one day accompanied my preceptor to the stable of a boating contractor, and there examined a grey horse whose years merged into the

thirties, and who was suffering from a fractured limb. The horse was condemned to be shot, and he was purchased by a company of "carrion" butchers, who conveyed him to the neighbouring town, where his carcase was dressed and prepared in the same manner as is usually practiced in the case of the ox. Subsequently, one or two members of the fraternity expressed, while carousing with their mates in the bar parlour of an inn, a desire for something substantial to eat. They were recommended by those of their companions who were in the secret to go the slaughter-house and cut off some steaks from the hind quarters of O——'s "ox." This they did with alacrity, and after the same had been cooked, with a liberal addition of onions, by an obliging land-lady, they were devoured with great gusto; but the tables were turned when the gourmands were quietly informed, a short time after their feast, that they had been eating steaks cut from the body of "Steamer," the oldest horse on the tow-path.

In marked contrast to these comical experiences are those banquets which have from time to time been given to the more intelligent portion of the community by gentlemen interested in the horse and his uses;* but even in the case of these men of cultured taste their first effort to swallow the dishes prepared by the "horsey" cook have been more remarkable for wry-facedness than for gustatory appreciativeness or relish. Perhaps, after all, the same argument as that which is applicable to diseased or doubtful ox or other flesh may be employed here, *viz.*, why should that which is unpalatable be eaten, when that which is agreeable to the taste can be had for the same, or nearly the same price?

That horse-flesh is largely sold in this country for the purposes of human food is a well established fact, and personally I see no

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* *E.g.*, the banquet given a few years ago by Mr. B. Cartledge, F.R.C.V.S., at Sheffield.

reason why it should not be so sold, providing proper regulat ons are enforced in regard to its exposure for sale, *i.e.*, regulations to guard against the use of the flesh of diseased animals, and for informing intending purchasers that the article offered for sale is horse-flesh. Since these lines were penned an Act of Parliament has been passed, initiated by Mr. Knowles, M.P., which provides:—

"On and after the 29th September 1889 it will be unlawful for any one to *sell*, *offer*, *expose*, *or keep* for sale any horse-flesh for human food elsewhere than in a shop, stall, or place, over or upon which there shall be at all times painted, posted, or placed, in legible characters of not less than four inches in length, and in a conspicuous position, and so as to be visible throughout the whole time, whether by night or day, during which such horse-flesh is being offered for sale, words indicating that horse-flesh is sold there.

"And no one is to supply horse-flesh for human food to any purchaser who has asked to be supplied with some meat other than horse-flesh, or with some compound article of food which is not ordinarily made of horse-flesh. For the purposes of the Act, the term 'horse-flesh' is to include the flesh of asses and mules, and shall mean horse-flesh, cooked or uncooked, alone, or accompanied by, or mixed with any other substance."

The provisions of this Act are, in my view, very inadequate, inasmuch as it does not provide for the slaughtering of the animals under proper supervision and inspection, and in suitable slaughter-houses. The Bill, in fact, does little more than is accomplished by an old regulation in force in Edinburgh in reference to "bull beef."

In order that the substitution of the flesh of animals not generally used for human food for the flesh of those which are so used may be recognised, it is necessary that I should consider:—

The Distinguishing Characteristics of the Flesh of each Animal, and also of some of the more important organs and parts that are used for Human Food.

The Muscular Tissue in the healthy Ox should be of a florid hue in adult animals; being brighter in young animals up to about eighteen months old, and darker in hue after six years of age. In certain positions it should be free from intermixture with fat, in others its connective tissue should be so infiltrated or intermixed with that substance as to give it a distinctly mottled or marbled appearance in section. It should be of a firm or slightly elastic consistence, tolerably dry after being exposed for a short time to the atmosphere, and *rigor mortis* (death stiffening) should be marked—in other words, the carcase should "set" or "firm"; it should possess a pleasant, sweet flavour, and should exhale, when exposed to the action of heat, a savoury odour. *The fat* varies in colour from white to straw colour, and yellow; being whiter in colour usually in young bulls, and in animals fed on corn or grass, than in bullocks or cows, or in animals fed on rich cakes, in which it is sometimes of a tolerably deep yellow, as it is in certain breeds of cattle, *e.g.*, the Jerseys and Guernseys. In cooking, a loss of from 20 to 30 per cent. takes place in the case of yellow fat, consequently (according to Capt. Stacpole) officers charged with the duty of purchasing flesh meat for the army are directed to avoid it when the flesh is markedly yellow. It should be firm, have a suety taste, and a greasy feel; be readily combustible and capable of resisting putrefaction.

The Connective Tissue should glisten on exposure and be tolerably moist, but there should be no draining of water from its meshes. It is most abundant in parts where the skin is loosely attached, *e.g.*, the flanks, under the shoulder, and the abdomen, and at the breast or brisket.

The blood contained in good ox beef should, when roasted,

form rich brown flakes, and—if not overdone—a bright-coloured sanguinolent fluid (coagulating into a jelly when set at rest), should flow out when a section is made through it in a hot state.

The Muscular Tissue of the Horse is much darker in colour than is that of the ox, and it is coarser in texture; in flavour it is, on the whole, superior, but its odour is less pleasant. *The fat* is always of a yellowish colour, and softer than is that of the ox, and it has a rather unpleasant, sickly taste; due probably, to the fact that it contains a large proportion of margarine. After the lapse of a few days—the length of time depending upon the amount of watery vapour in the atmosphere and the condition of the animal when slaughtered—horse-flesh contracts a peculiar sickly odour and a soapy feel, which is familiar to all who have been in the habit of dissecting.

Notwithstanding that the flesh of the horse is superior to that of the ox in nutritive value, it is necessary, from a monetary point of view and in a spirit of fair-trading, that some data should be forthcoming whereby the one may be readily distinguished from the other. In those cases where the bones have been removed the hints above given must be relied upon; but when the operation of "boning" has not been performed, there should be little difficulty in distinguishing between a joint cut from the carcase of an ox and one from that of the horse. The bones of the horse are, relatively, much larger than are those of the ox; they contain more fatty matter, which is of a semi-fluid consistence; the processes usually situated at the extremities (the epiphyses and the apophyses) are better developed, and more numerous, and those bones which are indirectly connected with the skeleton, the "floating bones," as the cap of the stifle (patella), are much more pronounced in form and size. The ulna (or elbow bone) of the ox is much larger than is that of the horse—it articulates in fact with one of the bones of the knee (the cuneiform)—*vice versa*, the corresponding bones of the hind

leg (the fibulæ), as also the splint bones of both fore and hind legs, are usually absent in the ox, or, if present, are rudimentary. The ribs of the ox are fewer in number than in the horse (13 as against 18), but they are much less arched, they are broader and flatter, and their lower extremities form a distinct joint with the cartilages of the ribs, instead of being immovably fixed thereto as in the horse.

The Breast Bone (Sternum) of the Ox.—Between the two first segments there is a distinct joint formed, the detached one being termed the manubrium. In the ox it is flattened below and above; in the horse, from side to side, *i.e.*, keel-shaped. Projecting from the first bone of the sternum of the horse there is a flattened piece of cartilage (the cariniform), absent in the ox, and the cartilage projecting in a backward direction from the last bone (the ensiform) is also much better developed in the former than the latter, in which it is somewhat separated from the bone.

The organs of the horse most largely substituted for the edible organs of the ox, are *the tongue*, *the heart*, *the liver*, and *the kidneys*.

The Tongue of the Horse is broad at its free extremity, while that of the ox is pointed, and in the latter its upper surface is rough (bristly), and there is presented, at about half its length, a distinct prominence or projection. If, as frequently happens, the bone of the tongue (the *os hyoides*) has been left *in situ*, it will be found that while in the ox it is composed of nine segments or parts, there are only five in the horse, that the body of the bone is of an angular shape in the ox, and its spur process is short and conical. The epiglottis (a cartilage frequently left on the tongue) is, in the horse, thinner and more pointed than in the ox.

The Heart of the Ox is more pointed (conical) than is that of the horse, and the fat in the furrows on the external surface

is usually in greater quantity, whiter in colour, and firmer in texture; moreover, in the base of the former there exists a bone (the *os cordis*) which is seldom or ever found in the latter.

The Liver of the Ox and Sheep is made up of one continuous mass or lobe, with one small lobe at its upper and posterior part, while in the horse there are three distinct lobes—the right, left, and middle—with a supernumerary lobe. In the former, a *gall bladder* is attached to the posterior surface; in the latter it is wanting. *The Liver of the Pig* has five lobes, and the lobules are distinctly mapped out on its surface, while in the *Dog* it is made up of two lobes—right and left.

The Kidneys of the Ox and the Calf are lobulated—*i.e.*, separated into lobes or divisions—and elongated; those of the dog, pig, and sheep are simple and oblong in shape; and while the left kidney of the horse is oblong, the right is heart-shaped. *The Kidney of the Pig* is flatter on its surfaces than is that of any other animal.

The Flesh of the Calf is always pale in colour and not very firm in consistence, and the same remark applies to the fat, which resembles tallow. The colour of the flesh will depend largely upon the fact as to whether the animal has or has not been bled (a practice happily now fallen into almost universal disuse) prior to slaughter. In the *newly born or unborn calf*, the flesh has a watery, unpleasant appearance, and the fat resembles tallow which has been macerated for some time in water. It possesses also a distinctive odour. While this flesh is, by some manufacturers, largely substituted for chicken in the manufacture of ham, chicken, and tongue, other substitutions for veal are rarely practised. It is as well, however, to note that the flesh of a large dog has a close resemblance to that of the young calf, and when the head, with the legs, as far up as the knees and hocks, have been removed, the one carcase may be easily mistaken for the other. In the calf, the joints are much larger than in the

dog; and the carcase of the dog always exhales a distinctively *canine odour.*

The Flesh of the Sheep is of a less florid hue than is that of the ox, though in the old ram it is often of a tolerably pronounced colour and very firm; and even as between the flesh of the old ewe or wether and that of the young animal there is a marked contrast in this respect. *The fat* is always very firm (suety) and white in colour, and both flesh and fat exhale a more distinctive odour than that given off from the carcase of the ox. The fat, too, is more evenly distributed over the back and sides of the carcase, and the muscular tissue is seldom found veined with fat

Occasionally, the flesh of the sheep is tainted with the flavour of wool. This, it has been variously explained, is due to the skin being left on the back of the carcase for some time after death; to the carcase being enveloped in the skin; and to the intestines and stomach being allowed to remain for too long a time in the abdomen.

The Flesh of the Goat is, in adult animals, much darker in colour than is that of the sheep, and it is less abundant; but although the fat on the body is small in quantity, there may be equally as much fat on the loins in the former as in the latter. When newly dressed, and when subjected to the action of heat, the flesh of the goat gives off a distinct "goaty" odour, as it has also a "goaty" flavour.

The substitution of the flesh of the goat for that of the sheep, or the kid for that of the lamb, is a matter of much less importance than are some of the substitutions carried out as between other animals.

The Flesh of the Pig is, in young animals, pale in colour, and even in adults it is of a comparatively lighter hue than in either the ox or in the sheep; it is also less firm to the touch, and the *fat* is more unctuous to the feel, and forms a deep, smooth layer all round the kidneys and under the skin of the back

and sides—the latter constituting the "panniculus adiposus" of the comparative anatomist. A slight odour is always detectable, and this becomes very pronounced in *old boars*, as does also the "brawny taste"; both the odour and taste are retained —the former in fact is increased—on cooking. The flesh of the pig is not substituted for that of other animals, but inasmuch as large boars are frequently skinned, and the flesh is of a deep red colour, the carcase, on a superficial view, is not at all unlike that of an old ram. Even if the head is removed, the shortness and thickness of the neck, as compared with that of the sheep, will be sufficient for identification.

In a medico-legal, as well as in a trading point of view, it is also necessary to distinguish between the carcase of a male (whether castrated or entire) and a female animal. In the bull the neck or crest is much more largely developed (bull-necked); the textures of the sternum (brisket) are much coarser, harder, and darker in colour than in the ox or the cow; the contour of the arm muscles is more perfect, and they are better developed; but in the ox they become comparatively fine, if castration has been performed for any length of time. In the bull and in the ox the penis is usually left attached to the left flank, its greater size in the former animal forming a marked contrast with its smaller size in the latter. In some cases the penis of the bull is removed, but the retractor muscles, which to the uninitiated may be readily mistaken for it, and which are smaller, are not removed. The erector muscles of the penis (*i.e.*, those attached to the ischium, and which assist in its erection) are much larger in the bull than they are in the ox. The pelvis of the cow is of large diameter as compared with that of the ox, and the pubic bone is finer.

In the bull and ox there is always a mass of fat in either flank; its shape, in oxen, being regulated by the method of emasculation which has been adopted. If the end of the scrotum has been

cut off, the mass of fat will be much shorter and broader than when a vertical incision has been made into either scrotal sac. Those breeders who desire to see a "plump purse" always remove the end of the scrotum in castration.

The masses of fat in the flanks of the cow, when the udder has been removed, are always irregular and much smaller than in the flanks of the bull or ox, and the large inguinal lymphatic glands are frequently left *in situ*. In the heifer the udder is but slightly developed; it is, in fact, enveloped in fatty tissue, and forms a uniform thick wall on either side of the flank, In order that the various points connected with the differentiation of the sexes and also of the hindquarters of the heifer and the cow may be better understood, sketches of the hindquarter of the ox, the cow, and the heifer have been introduced.

These remarks apply equally to the two sexes in the sheep.

In old sows—more especially in those that have recently borne young—the teats are drawn in between the finger and thumb of the butcher until they become small and shrivelled.

WHAT FLESH MAY BE REGARDED AS MARKETABLE, AND WHAT UNMARKETABLE.

I SUPPOSE all authorities on the subject are agreed that meat which shows no marked departure from the general characteristics presented by the slaughtered carcases of the particular species of animal to which it belongs, should be looked upon as marketable. But there are numerous cases in which a carcase or part of a carcase may show some departure from the healthy standard, in the shape of excess or deficiency of colour, excessive moisture, flaccidity, want of firmness, or deficiency in flesh or fat; or in having some unusual odour, such as may be contracted by the administration of odorous volatile medicines during life, or by the exposure of a carcase to an atmosphere charged with the fumes of volatile agents; and it is in reference to these cases that doubts may be entertained. Unfortunately, a satisfactory solution of this question is rendered more difficult by the fact that there are probably no two individuals, lay or official, who will be found to agree upon particular points; and one individual may look upon an article as not only marketable, but fit for food also, while another individual, having the same amount of knowledge on the question, would unhesitatingly condemn it for both purposes. A carcase, for instance, may present such a marked departure from ordinary characters that, if exposed for sale, the public would immediately cry out and charge the dealer with attempting to sell unwholesome food, whilst all experience has probably shown that there is positively

no danger in its use. I cannot better illustrate this than by directing attention to a very common, I may say an every-day occurrence, viz., that all of us, without the least question or hesitation, enjoy the flesh of certain animals that have met with a violent death, and from whose bodies not a particle of blood has been withdrawn—*e.g.*, game, poultry, &c. But if the carcase of an ox or of a sheep were exposed under similar circumstances few persons would be inclined to purchase it, and fewer still would care to eat it. How can we reconcile this divergence in practice, seeing that if the consumption of the flesh of one animal from whose body the blood has not been withdrawn is harmless, and indeed is nourishing, why should not the flesh of another animal of another species be regarded in the same light? Again, in some districts the flesh of parturient animals is absolutely rejected, while in others it is not only eaten but sold in the market without a second thought being given to its deleterious properties; and the same remark applies to the flesh of newly-born animals, especially to that of calves, yet in neither of these cases can it be shown that any direct harm has arisen from the use of such flesh. Nevertheless, as a matter of sentiment or of taste, the idea of knowingly using such flesh for dietetic purposes would be repulsive to most minds. Doubtless, as I have before pointed out, thousands of pounds of veal from calves which have only lived for a few hours, or have practically never existed at all outside the womb of the mother, are devoured daily by an unsuspecting public in the shape of some enticing commodity; but, I suppose, the old adage, that "what the eye does not see the heart does not grieve," applies here.

It frequently happens that, owing to various physical circumstances, the flesh of an animal presents some marked departure from the normal conditions which renders it repulsive to the eye but which does not interfere with its nutritious or its dietetic value. Such flesh is not, however, marketable, though there can

be no possible objection to allowing the consumption of the same by private individuals if they so choose.

What Meat is Nocuous?

As a general question the above is the gravest of all with which we have to deal in connection with the inspection of meat; nor, indeed, can a definite answer be given to it in all its aspects. And it is in his inability to give such definite answers in every case that the purveyor of meat so often finds his opportunity of tripping up the inspector or the sanitary officer. The latter may have as a guide a vast amount of indirect proof of the unwholesomeness of particular flesh, but there may be wanting a link in the chain of evidence—viz., direct proof of nocuity.

While I shall not attempt to generalise on this question, but shall deal with each abnormal condition of flesh in detail, I may here remark that the more certainly it can be shown that any particular disease from which an animal has suffered is capable of being transmitted from animals to man, or by ingestion from animal to animal, the less hesitation should there be in condemning its flesh for the purposes of human food.

I suppose it will be admitted on all hands that where an animal has been slaughtered while suffering from any of the undermentioned affections, its flesh is absolutely unfitted for human food, as being either nocuous or innutritious. The affections to which I allude are:—mortification of organs or parts, pyæmia, septicæmia, uræmia, erysipelas, anthrax, variola, trichiniasis, glanders or farcy, hydatid disease of the muscles, dropsy, the advanced stages of rabies or swine fever, cattle plague, well-marked cachectic conditions, whether these be cancerous, tuberculous, or otherwise; and also where putrefaction has set

in, and when marked physical changes have taken place as the result of inflammatory or febrile affections or important forms of blood deterioration or degradation. It must be borne in mind that although meat may not be directly nocuous, it may be indirectly harmful by virtue of its being innutritious.

RULES TO BE OBSERVED IN THE INSPECTION OF MEAT.

IN all cases, where such a course is practicable, the internal organs should be examined with the object of detecting the existence of disease. In all public abattoirs there should be a stringent rule established to the effect that the internal organs of every animal, particularly the liver and the lungs, should be put aside for inspection, as the condition of these organs is frequently a valuable aid in arriving at a just estimate of the quality of the flesh.

In those instances where the viscera are not forthcoming, great attention should be paid to the condition of the lymphatic glands, or "kernels" as they are commonly called, as in the condition of these organs do we get the most reliable information respecting the existence of the more important constitutional or blood diseases.

In health, the lymphatic glands are, on section, of a pale greyish-yellow colour, tolerably firm, and somewhat moist; in old animals they frequently become indurated or hardened and at the outer portions pigmented. If these glands are found to be universally enlarged and softened, or if congested or inflamed, or the seat of extravasation of blood, suspicion should be at once aroused that the animal has, during life, suffered from some important form of blood disease, and the inspector should make a more than usually strict examination of the carcase.

The situation of the most accessible of these glands is shown

in our illustrations. They are the *Sternal*; the *Supra-sternal*, very small; the *Dorsal*, alongside the bodies of the ninth and tenth dorsal vertebræ; the *Lumbar*, scattered about the fat, immediately behind the kidneys; the *Sacro-lumbar*, a few; the *Mammary*, at the base or root of the udder of the cow; the *Deep Inguinal or Femoral*, deep in the inside of the thigh; and the *superficial Inguinal*, on the outside of the flank. In young sheep and pigs, a large number of small reddish-coloured glands are scattered about amongst the connective tissue and fat between the kidneys and pelvis; they are known as *hæmo-lymph* glands, and are practically of little importance for the purpose of meat inspection.

The length of time that should be allowed to elapse between the dressing of the carcase and the final inspection will be regulated—

(*a*) *By the condition of the animal when slaughtered.*

(*b*) *By the manner in which the slaughter has been carried out.*

(*c*) *By the state of the surrounding atmosphere.*

(*d*) *By the treatment of the carcase after dressing.*

(*a*) If an animal has been fed on succulent food, such as grass highly surcharged with water, or if it has been allowed large quantities of water immediately prior to slaughter, the carcase will require a much longer period for "firming" than it will if the animal has been fed on solid nitrogenous food and has only been supplied with a limited quantity of water. Again, if the animals have been subjected to great excitement or exertion immediately prior to slaughter (œstrum and parturition in cows produce a similar effect), it will render the carcase more or less flaccid and interfere with "firming."

(*b*) The more effectually an animal is bled, and the greater care used in the drying of the carcase during the dressing process, the more rapidly will it become "firm." On the contrary, if

the bleeding has been imperfectly performed, and a large quantity of greasy water has been employed during the dressing process, the longer will be the time required for "firming."

(*c*) The condition of the atmosphere will frequently make, in point of time, a difference of several hours in the drying process. If the atmosphere is dry, cold, and sharp, the carcase will set much more rapidly than if opposite conditions prevail, and a murky damp atmosphere will frequently arrest the firming process even in the best fed and best dressed carcases. The influence of climate upon flesh is nowhere more strikingly illustrated than in certain parts of Mexico and allied countries, where the carcase becomes dry and firm in a very short space of time.

(*d*) If the carcase is suspended in a dry, lofty, and well ventilated booth, it will quickly become firm ; on the contrary, if the atmosphere of the booth is damp and close, it remains flaccid for a considerable period. Again, if, as frequently happens in the case of animals slaughtered in the country, the carcase is enveloped in sheets and sent long distances in close railway vans, or in the holds of boats, it will be found on arrival at its destination in a very flaccid and moist state. This will be especially the case if thundery weather prevails.

The best situation on board ship for the conveyance of carcases is either between decks, or in passages, such as the alley ways, where there is a constant current of air. In such situations the carcase quickly becomes dry and firm, and retains that condition for a considerable period.

THE PARTS OF THE CARCASE TO WHICH ESPECIAL ATTENTION SHOULD BE DIRECTED, ARE—

Firstly, Those in which there is an abundance of connective tissue, as the flanks, both inside and outside ; the breast, underneath the arms and shoulders, behind and above the fat of the kidneys, along the central portions of the back, and under the

diaphragm (or skirting), as it is in these situations that dropsical lesions are usually located ; moreover, evidence of such disease as tubercle is frequently to be found in some of these situations also.

Secondly, The chest should be carefully examined with the object of detecting whether or not the operation of *stripping of the pleura* has been performed. Stripping of the pleura, *i.e.*, the lining membrane of the chest, is practised for the purpose of removing the traces of pleurisy and of tubercle ; it is also practised for the purpose of removing the unsightly appearance produced by the presence of blood in the chest from what is known as "*over-sticking*," and by the accidental pouring into the chest of matter from the stomachs and intestines.

If the operation has been practised for the latter purpose only, the *underlying tissues* will be found firm and dry and of their normal colour, except that the more ragged portions may be a little stained with blood, or colouring matter of food : if the process has been carried out with the object of doing away with traces of disease, the muscles will be found more or less softened and moist, and altered in colour, and the fat will present a somewhat tallowy aspect. A tyro may be readily deceived by a clever dresser, but no person acquainted with the natural condition of the pleura should be led astray by the operation of stripping. If, in addition to the pleura having been stripped, the whole of the diaphragm (midriff) has been removed, a suspicion may be fairly entertained that it has been done for some special purpose.

Thirdly, The carcase should be quartered, and the condition of the severed muscles carefully noted, not only at the moment of section, but after a lapse of from half an hour to an hour. In no case should the inspector satisfy himself by examining a section of muscle which has been exposed to the air for some time, as the colour always becomes brighter and the surface drier on exposure.

If by the ordinary method of quartering the carcase the inspector

cannot satisfy himself as to the condition of the muscles, he should make one or more deep incisions into the fleshy parts of the carcase, and he should especially note the condition of the tissues in close proximity to bone.

The sense of touch, of sight, of smell and of taste, should be particularly brought into play in the examination of meat intended for human food.

Microscopic examination can only be carried out by experts. In this country, probably owing to the rarity of Trichinosis, it has never been brought into requisition to any extent, but in some parts of Germany, *e.g.*, Berlin, it is carried out systematically, and particularly so in the examination of pork; the method of procedure adopted is, according to a correspondent in the *British Medical Journal* for August 23, 1890, as follows :—

"Small portions of the abdominal and laryngeal muscles, and of the diaphragm and sub-pleural fascia, are removed from the carcase and conveyed to a laboratory, where fine sections of the tissues are cut off with scissors and placed on a piece of plate-glass, about a quarter of an inch thick, 9 inches long, and 2 inches broad.

"The piece of glass is divided by transverse lines into a dozen spaces, in each one of which is placed the piece of flesh intended for examination, and one exactly similar piece of glass is placed over the whole and screwed down tightly, so as to flatten out the tissue. A low power (half an inch) is first used, so as to detect the grosser lesions of tuberculosis and trichinosis : a more searching investigation is carried out in cases where it is thought necessary."

Where the question of age arises, the inspector should pay attention to the condition of the bones and joints. The younger the animal, the softer and more vascular the bones, and the more pronounced will be the ends of bones entering into the formation of joints; *vice versa*, the older the animal, the harder

and the more compact will be the skeleton, and the firmer will be the ends of the bones entering into the structure of joints. Moreover, the quantity of cartilage (gristle) is always greatest in young animals, and the same is true of the connective tissue.

EXAMINATION OF THE CARCASE FOR THE PURPOSE OF DETECTING ABNORMAL CONDITIONS.

IN the consideration of this part of the subject, I shall deal mainly with departures from natural conditions in the matter of colour, odour, and flavour, and with the presence of foreign elements in the flesh.

THE COLOUR.—In this, as in the consideration of all the other characteristics, we must determine whether the alterations we may detect are *general* or *local*—*i.e.*, whether due to a cause which equally affects the whole body and thus renders the flesh all bad alike; or which confines its influence to certain well-marked boundaries, and only destroys the part in which it is actually located. The colour of animal flesh varies from the pale hue of the flesh of the unborn calf, the lamb, and other young animals, to the dark red of the horse, the old boar, working ox, or ram. The muscles in different parts of the body also vary in colour; the psoas muscles (undercut of the sirloin) and the muscles in the inside of the thigh, being paler than elsewhere.

The flesh of many foreign animals is very pallid and the fat white; the latter characteristic is also sometimes seen in home-fed animals, and is often due to the character of the food. But pallor of muscle is seen in all dropsical conditions; in excess of water in the blood (hydræmia), in so-called grass staggers (indigestion of cattle), sometimes in exhaustion, as from over-exertion, and very notably in death from choking—*i.e.*, the impaction of a

foreign body in the œsophagus—in which case the muscles have also a parboiled or macerated appearance.

The pallor of dropsical flesh is due to deficiency in red cells and red-colouring matter in the blood (anæmia), and probably also to the solution of the colouring matter of the muscles, brought about by the excess of water in the inter-muscular connective tissue; but it is impossible to explain the rapid decolorisation of the flesh in indigestion and choking. That the colouring matter of the muscle is rapidly removed is evident, but in what way it is removed is, in the present state of physiological knowledge, a mystery. In both conditions mentioned, serum (often tinged with blood colouring matter) is found in the deeper interspaces of the muscle.

I have seen the muscular parts of the carcase of an ox which, during life, was the picture of health, almost entirely decolorised, and the fibres so friable as to be easily broken up with the thumb nail, or scraped into a pulp with the back of a knife, and yet the internal organs have been perfectly healthy; but I have always found in such cases that there has been a considerable amount of effusion of serum (sometimes blood-tinged) into the deeper parts of the muscles, especially in close proximity to the bone. And seeing that such conditions can only result from grave changes in the blood itself, I have never hesitated to advise condemnation of the flesh.

The most remarkable form of *white flesh* is that which is due to fatty transformation of the muscular elements. When circumscribed to particular areas or to individual muscles or sets of muscles, it may be due to the effects of strain, inducing acute inflammation (myositis); but when affecting large areas, as the whole of the muscles of the loins or back, it can only be referred to some important constitutional condition, or to organic disease of one lung or large parts of both lungs, and, as a consequence thereof, to diminished oxidation.

I have only seen one well-marked example of this change, and that in the carcase of an ox which was slaughtered in London, and in reference to which the opinion of Mr. Edward Coleman, M.R.C.V.S., was sought.

Mr. Hedley, veterinary adviser to the Irish Privy Council, has placed on record a similar instance as occurring in the pig.

In addition to fatty transformation or fatty infiltration, we have *fibroid transformation*, inducing a pale colour of muscle. This change is always local in distribution, and is due to interstitial changes as the result of such chronic inflammatory processes as rheumatism, diseases of joints, and injuries.

Localised changes of this kind should never be accepted as sufficient evidence for the condemnation of the whole carcase, though, unquestionably, the affected parts should be removed and destroyed.

A yellow colour, or tinge, in the fat and tissues is in many animals natural, and is not infrequently due to the food containing a large proportion of margarine and oleine (predominance of stearine gives a white appearance); in other instances it can be traced to certain breeds, and the whole of the progeny of one particular sire may present the peculiarity: otherwise, systemic icterus—even of a moderate degree—is the result of functional or organic disease of the liver, while circumscribed yellowness is due to contact, for several hours, with the gall bladder, or to the effusion of gall from rupture of that organ.

In judging of the importance to be attached to yellowness, we should observe, if possible, whether the colour is confined to one or is common to several animals of the same lot, and an authoritative opinion should never be given from an examination by artificial light, as it is very misleading.

Yellowness, unless very pronounced and associated with other changes in colour, or with important physical changes, or with some grave disease of one or other of the internal organs, scarcely

warrants the condemnation of flesh, as it is due only to the absorption and retention in the system of the colouring matter of the bile, which is in itself comparatively, if not absolutely, innocuous.

A magenta hue is characteristic of general albuminous effusion as the result of the action of a zymotic poison or ferment in the blood, and indicates the existence, in the acute stage, of some zymotic or specific affection, as Zy. p. p., Ec. ep., rinderpest, or tuberculosis. It is most observable in making a fresh section and exposing it for a short time to the action of the atmosphere, and is accompanied by the glaze of albuminous effusion.

A scarlet hue is but seldom seen, and is indicative of carbonic oxide, and sometimes of arsenical poisoning.

Both the foregoing are usually accompanied by textural and other changes sufficiently marked to render the carcase at least unmarketable.

A dark reddish brown or black results from imperfect æration of the blood, and is seen in carbonic acid poisoning, in disease of the lungs, where the area involved is so large as to prevent the access of air, or where mechanical obstruction exists in the air-passages. It is also seen in poisoning by narcotic agents, and particularly by those which, in addition to their action upon the brain, arrest the process of oxidation in the tissues—as alcohols, chloroform, æthers, and turpentine. Modifications of this colour are also seen in inflammatory affections, in high fevers, in apoplexy, in drowning, in suffocation, and in animals which have been imperfectly bled. The latter condition is easily distinguished by the marked infiltration of blood into the most dependent parts, by the back of the carcase being streaked with streams of blood which has escaped from the cut ends of veins, and by the veins and capillaries, especially of the internal organs, being surcharged with blood. *Circumscribed darkness* in colour may be due to hypostatic congestion, from the

carcase having lain on its side or back for some time after slaughter; it may be also the result of *post-mortem* staining, of congestion, inflammation, or extravasation of blood. *Diffused redness* (dyeing) is seen where meat has been subjected to the action of extreme cold and moisture, as in freezing; in blood-poisoning, and as a result of decomposition, and is caused by solution and diffusion of the hæmoglobin or colouring matter of the blood.*

A mahogany hue is a blending of red and yellow, and is due to imperfect decarbonisation of the blood, combined with *icterus* from absorption of bile pigment; it is characteristic of organic disease of the lungs and liver, and is most frequently seen in advanced pleuro-pneumonia and consumption. The flesh in this case is usually dry, though the connective tissue of the flanks may be moist, but notwithstanding this, such flesh is not unwholesome.

Irridescence "Peacock Feather Glint" (*i.e.*, an appearance similar to that produced by reflected light on the scales of a fish, or like that frequently seen on the newly exposed surface of a slice of boiled salt beef, or on decomposing fish), on section is seen under a variety of circumstances, as in blood diseases, prolonged fevers, inflammatory affections, and difficult parturition.

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* A uniformly dark colour of the flesh, even though the carcase may on the whole be firm and dry, must be looked upon with grave suspicion, seeing that it is always due to interference with, or arrest of, oxidation of the blood, and, consequently, is associated with the retention of deleterious matter in the blood and tissues; it is of still greater importance if, as is very largely the case, the flesh on section is soapy to the touch, or pits or yields on the application of pressure.

Circumscribed darkness is not sufficient to necessitate the condemnation of the whole carcase.

Diffused redness, if due to refrigeration, is of no sanitary significance, but care should be taken to determine that the change is due to this cause, as if it results from disease of organs, or from blood depravation, the flesh is, in the fullest sense of the word, unwholesome.

In October last a remarkable case of irridescence was brought under my notice by Dr. G. Wilson of Warwick. The case came under the official cognisance of Dr. J. H. Gramshaw, of Gravesend, who, on inspecting a carcase, found that in the dark or by candle light it was distinctly luminous or phosphorescent, but the phosphoresence was irregularly distributed, the flesh presenting an appearance as if dotted over with innumerable glow-worms. This condition of things can, in my opinion, be only accounted for on the supposition that the animal had received large doses of phosphorus prior to death.

A green hue is indicative of decomposition or gangrene, and is seen in the abdominal parietes when the viscera have been allowed to remain in the abdomen for some time after death. In this situation it may also be due to diffusion of the colouring matter of vegetables, or of medicinal agents, through the coats of the stomach and intestines. In the operation of disembowelling, the intestines and the stomach are sometimes cut, and the contents allowed to flow out over the inner surface of the abdomen, not only discolouring the tissues, but imparting thereto the particular odour of the ingesta.

A yellowish-green hue of the inner surface of the abdomen is often produced by bile which has escaped from the gall bladder, as the result of wounding in the process of removing the liver.

Black discoloration (*pigmentation*) is usually local, and is the result either of previous inflammation, extravasation of blood, or melanosis. *Pigmentation* is natural in certain structures, as in the mucous membrane of the tongue in black and blue-gray coloured cattle, and occasionally in sheep; in the coverings of the brain and of the spinal cord. It is, in itself, harmless.

In judging of colour, age, sex, class of animal, mode of feeding and of treatment prior to slaughter the kind of weather, and the quantity of water used in dressing the carcase, must be taken into consideration. Many medicinal agents—as Epsom salts,

treacle, æthers, turpentine, camphor, &c.—produce a material difference in colour.

ODOUR.—Varies in healthy meat from the vile stink of the old boar or male goat to the scarcely perceptible odour of the young calf or lamb—though that of the first two mentioned animals is modified by castration a few months prior to slaughter, and by partial starvation for a few days.

Abnormal odours are due—*Firstly*, To animals having been fed on vegetables possessing volatile odorous principles — as turnips, alliacious plants, and odoriferous plants in general. The odour of turnips is most striking when an animal has been choked by a piece of the root.

Secondly, To animals having been dosed, prior to slaughter, with volatile medicinal agents, as prussic or carbolic acid, turpentine, tar, creasote, æthers, camphor, chloroform, methyl-alcohol, sulphur, phosphorus, or essential oils.

Thirdly, To putrefaction or mortification, or to contact with decomposing fluids, as pus, blood, urine, &c.

Fourthly, To exposure, immediately after slaughter, to an atmosphere charged with the odour of tobacco, tar, carbolic acid, or paint; in this case the odour is superficial.

Fifthly, To uræmia, to infiltration of urine from the bladder, to escape of medicine from the intestines or stomach, or to fermenting ingesta from the latter; in the first case the odour is general, in the three last localised.

Sixthly, To prepared meats undergoing acid fermentation, or to their having been mixed with aromatic substances or cured with pyroligneous acid or wood smoke.

Odours, as a rule, are most readily distinguished when the animal has been recently slaughtered, and when the flesh is newly incised and breathed upon or artificially heated—with or without moisture; slight odours often disappear as the carcase dries.

MOISTURE.—As has been already indicated, the amount of natural moisture is altered by the condition of the atmosphere—*i.e.*, whether murky and damp, or dry and desiccative; by thorough or careless abstraction of blood, by the condition of the animal prior to slaughter—*i.e.*, as to whether it has been subjected to exertion or not; and by the quantity of water used in the dressing, &c. The moisture of young, especially the unborn, exceeds that of old, and of good-conditioned that of lean animals; while the neck and flanks always contain the greatest amount of moisture, the former from the gravitation of serum from the blood and of water from the carcase.

Abnormal moisture is due — *Firstly, To albuminous effusion*, which is general, and results from the action of enzymes, or of saline or other deleterious matter in the blood; it is temporary, and in some diseases gives place to serous effusion; it varnishes the skin of the hand and produces an *albuminous glaze* on exposed sections of muscle. The best examples of this condition are seen in turnip braxy in sheep.

Secondly, To effusions of lymph, which may be either localised or diffused, the latter resulting from blood depravation or deterioration, the former to inflammatory action, or specific disease—as rheumatism, synovitis, &c.—or to the irritation of blisters, or of skin diseases, or to bruising.

Lymph, in blood-changes, is thrown out between the muscles, sometimes into the muscles themselves, and into cavities, as the chest or abdomen. It may coagulate and form firm glistening layers of membrane-like structure, of a white or pale straw colour, and produce adhesion of organs to each other or to the walls of the cavity in which they are contained; on the other hand, the lymph may be of such poor quality as to be incapable of coagulating, and in this case it lies on the surface of organs or between the tissues in the form of soft masses. Whenever such effusion is extensive, or is found in various parts of the

body, it is certain evidence of the existence during life of some important form of disease, and the carcase should be unhesitatingly condemned.

Thirdly, To effusions of serum—sanguineous or simple—and resulting from blood depravation or deterioration, from the action of ferments, salines, or other agents in the blood, from debilitating diseases, hydræmia (water braxy in sheep), disease of important organs, especially the kidneys; cachexia, thawing after freezing, &c. Effusion of serum may be general or local, the latter frequently being an accompaniment of inflammation, erysipelas, disease of the skin, as scab, and disease of the vessels; while either local or general effusion may be the result of the irritation produced by parasites, and by the lodgment of the bladder-worm (hydatids) in the intermuscular connective tissue.

Pure serum never coagulates; if, however, it is mixed with small quantities of blood an imperfect, jelly-like, coagulum of a pinkish colour may be formed. When due to general or constitutional causes it is thrown out into the deep as well as into the superficial parts of the body, and is more or less universally distributed. The same thing holds good, too, when there is sufficient organic disease of such important organs as the liver, lungs, or kidneys, to bring about a deteriorated condition of the vital fluid; but in some forms of obstructive heart disease the serum is mainly or entirely effused into the chest or into the tissues at the lower part of the throat, neck, and breast, and sometimes between the jaws, constituting in the last mentioned situation *jaw-pocking*, Scot.—*Wattles*, Eng.

In liver and kidney disease the serum is more largely thrown out into the abdomen, and into the tissues of the hind extremities and under the belly. Effusion of serum constitutes *dropsy*, than which there is—if it is at all marked—no more important condition, and no flesh presenting distinct evidence of this state should be passed for human food, more especially if the flesh

is pale, flaccid, and slimy to the touch, and if the blood contained in the veins is watery and pale, and remains fluid.

No amount of exposure will thoroughly dry such flesh, but it does not necessarily undergo decomposition more quickly than does other flesh, and, in fact, it sometimes offers a tolerable resistance to the process of putrefaction.

Flesh which has been subjected to extreme refrigeration has an abnormally damp appearance and a damp and cold feel, and the fat also has a somewhat tallowy appearance; it, however, dries fairly well in good weather, but it frequently undergoes decomposition with much greater rapidity than dropsical flesh. Fluid does not collect in bladders in the connective tissue in the former as it does in the latter condition.

Fourthly, To effusion of blood, which may also be local or general; the former being produced, as a rule, by violence prior to death; by the ravages of migratory parasites, as strongyles; by the violent throes of parturition; or by local disease of the coats of one or more blood-vessels. General effusion is indicative of blood depravation or deterioration with or without disease of the vessels.* Local extravasations (except those into the chest from the knife having penetrated too deeply, or those produced by parasites) are usually superficial and are unaccompanied by any

* There is no graver condition met with in the carcase of an animal than universal or deep blood extravasation. While localised extravasation, due to bruising, affects only the tissues in its immediate vicinity, the flesh in the other part of the carcase being perfectly normal, general extravasation is usually associated with important physical changes more or less over the whole of the body. In anthrax and swine fever, if the animal has been killed early, these associated changes may not be so marked, but in blood-poisoning (septicæmia) the flesh and the connective tissue nearly always present evidence of marked interference with nutrition, and in all cases, and more especially if the lymphatic glands are involved, a careful microscopical examination of the blood should be made, and the tissues cut into deeply in various parts of the body.

In the case of localised extravasation from injury, the damaged parts may be carefully removed, and the remainder of the carcase passed; but if there is evidence of general blood change the whole should be destroyed.

detectable alteration in the blood; while general extravasations are always accompanied by physical or chemical blood changes, are more deeply seated—even in the interior of the bones, under the periosteum, under the membranes in the structure of organs, into the muscular tissue, into the glands, and into the cranial and spinal cavities—and when subjected to the action of fire frequently evolve an unpleasant odour, and do not form the brown savoury flakes seen in roasted healthy blood. The blood, in either case, may be of much the same colour, and may undergo the same changes on exposure to the atmosphere, although in anthrax and blood-poisoning it stains everything with which it comes in contact, is frequently of a crimson or purple hue, or is very black, and forms an imperfect or jelly-like coagulum.

Fifthly, To effusion of urine, which must necessarily be localised in the tissues at the extreme posterior part of the abdomen, around the sheath, and between the thighs, and is due to obstruction at the end of the sheath of the male, to obstruction in the urethral canal, or to wounds in the urethra. It is easily detected by the urinous odour which it imparts to the infiltrated tissues, and unless very circumscribed, the whole of the carcase is unfit for human food.

HEALTHY FIRMNESS, is dependent, to a great extent, upon the same influences as those which regulate moisture. *Abnormal flaccidity* is the result of debility, effusions, exhaustion, lightning, electricity, nervous influences, fevers, inflammatory affections, vegetable poisoning, decomposition, and blood alterations. Flaccid flesh has frequently an adhesive and sometimes a soapy feel, and pits on pressure (doughy); it may be of any colour or odour, fat or lean.

TEXTURE.—*Abnormal texture* varies from the catgut flesh of the patriarchal and hard-worked ox to the tender and easily masticated muscle of the unborn calf. Muscle is frequently very friable, especially where much struggling has taken place prior to

death, where pain has been severe, and in cases of choking. The flesh of the sirloin (undercut of the butcher) is always of finer texture than that of any other part of the body, as are also the muscles inside the thigh.

FLAVOUR.—*Abnormal flavour* is regulated by the same influences and results from the same set of causes as do abnormal odours.

EMPHYSEMA—*i.e.*, the presence of air or gas in the cellular tissue,—may be general or local, the former resulting from blood putrefaction, infiltration of gas from the alimentary canal, or rupture or injury to the lungs, or from blowing by the butcher; the latter from wounds or mortification. The gas in emphysema, resulting from mortification and blood putrefaction, or to absorption from the intestines, has an unpleasant odour. In emphysema resulting from infiltration of air, the tissues are dry and of a whitish colour, and there is an absence of any abnormal odour, neither does it exercise any deleterious influence upon the flesh; but emphysema resulting from mortification or putrefaction renders the flesh not only unmarketable but in a high degree deleterious, as it is associated with infiltration of bloody serum and staining (red, green, purple, or black) of the tissues.

DEATH BY VIOLENCE, &c.

Dislocations, Fractures, Wounds, and Bruises.

IN all severe accidents death may be produced instantaneously by *shock*, or subsequently, and unexpectedly, from inability to rally from the effects of shock. It may be produced instantaneously, or after the lapse of a few minutes to several hours, by *hæmorrhage*, or subsequently, from the debility resulting therefrom.

If from shock, and the operation of bleeding has not been adopted sufficiently early, the condition of the carcase will be the same as in death from shooting or drowning; if from hæmorrhage, the tissues, being drained of their blood, will present no departure from the normal.

The only forms of dislocation likely to produce immediate death are *cervical, dorsal, and lumbar dislocations*, and these only when the displaced bones exert sufficient pressure on the spinal cord as to absolutely annihilate its function, in which case death results; when the pressure is exerted anteriorly to the fourth cervical vertebræ, from paralysis of the diaphragm; or, in any case, from arrest of all the functions by withdrawal of nerve force, or from shock. If the pressure is not sufficient to produce absolute compression of the spine, the animal becomes partially or totally paralysed, and may live for a few days or for many months, and die ultimately from exhaustion or from some intercurrent disease.

In most cases, when animals lie in a recumbent position for a considerable period, the nutrition of the tissues becomes

largely interfered with, or fever becomes marked, or there is considerable bruising of the superficial parts of the body and of the joints, leading to effusion of serum and extravasation of blood into the tissues, and sometimes to the formation of abscesses.

Vertebral Fracture leads to the same results as dislocations.

Dislocation of Joints may render animals helpless, and thus produce the same conditions as those which result from paralysis.

Fracture of the Skull may kill immediately by paralysis of the brain if the blow which has produced it has been of sufficient force; it may kill, secondly, by compression of the brain, inducing coma, or by setting up inflammation of the brain, or of its coverings. In the former case, and if blood is not abstracted, the conditions of the carcase are identical with those produced by sudden death from any cause; in the latter, the conditions already referred to in speaking of inflammation of the brain will be noticed.

Severe Fractures of the Ribs, or of the Pelvis, or of the Bones of the Limbs may also cause death by shock, or in the case of a rib immediate death may result from penetration of the heart, the lungs, the diaphragm, or one of the large blood vessels; but in most cases, death—if the animal is not slaughtered—is produced secondarily by its becoming helpless, by the exhaustion of fever, or by blood-poisoning.

Wounds, if very severe and extensive, may produce death primarily, by shock, or by hæmorrhage and its effects; secondarily, by exhaustion from pain or excessive suppuration, by absorption of toxic materials from the wound, by mortification, or by tetanus.

In all cases of severe injury the tissues around the seat of the injury are more or less infiltrated with blood or serum, or both blood and serum, and, when an external opening exists, with air; and when the nature of the injury has been such as to render slaughter necessary, the attendant circumstances, so far as they

can be ascertained, must be allowed their due weight in arriving at a decision as to the condemnation or otherwise of the carcase.

The rule usually followed, and the one which I myself adopt, is to remove the injured parts, and, if they present no departure from the normal, pass the remaining portions of the carcase.

Trampling.—In the conveyance of animals by rail or sea, especially if not secured, or if improperly penned, large numbers are yearly lost by their being thrown down and trampled upon by the feet of their companions; the effects of the bruising so induced being so important as to render them unable to rise, and in being slaughtered extensive sub-cutaneous extravasation is shown. The actual injury is often aggravated by the animals being deprived of air—*smothered*, as it is usually expressed—and on the carcase being dressed, the combined effects of suffocation and bruising are evidenced. In the holds of improperly ventilated ships there is a large accumulation of foul gases, which not only materially affect the blood and flesh of animals exposed to their influence, but which frequently originate a malignant fever of a catarrhal type.

Strangulation.—This is usually effected by cattle becoming cast in the stalls, or by the head becoming accidentally entangled in ropes or wires, as fences, &c., and if blood is not withdrawn immediately after death, the carcase presents the same appearance as in death by suffocation from any cause, and the flesh is rendered unmarketable, though it is probably no more injurious than is the carcase of a rabbit which has been strangulated by a "gin."

The condition of the carcase will be largely determined by the prolongation, or otherwise, of the strangulating process and the amount of struggling through which the animal has passed with the object of gaining its freedom; and it is obvious that in those

cases where struggling has been severe and the dying process prolonged, there will be a large accumulation of carbonic acid and other deleterious matter in the blood, and the carcase will be rendered nocuous in a greater or lesser degree.

Drowning.—This is an accident to which animals are frequently subjected, and more especially when a cattle ship becomes stranded or wrecked, and the throwing overboard alive of the animals (sheep or cattle) is necessitated. If the animals have succeeded in swimming ashore, but in an exhausted state, and have been at once despatched and the carcases properly dressed, no objection can be urged against the use of the flesh on the score of nocuity. But if death has been caused by drowning, and the body immersed for some considerable time before it is washed ashore, the carcase is not fit to be exposed for sale for human food, as it presents all the characteristics noticed in death by strangulation, and rapidly undergoes decomposition.

Lightning.—The effects of lightning upon animals are identical with those produced by electricity, but in the vast majority of instances the victims are not discovered until a considerable period has elapsed after death has taken place; and inasmuch as *rigor mortis* is usually imperfect or absent, and as the blood remains more or less fluid and of a black colour, the physical conditions of the carcase are somewhat similar to those produced by strangulation. In addition, there will sometimes be found in the tissues under the skin, and in and upon the skin itself, arborescent lines or markings produced by the solution of the colouring matter of the blood.

Seeing that electricity has been successfully employed for the purpose of despatching animals, there need be no hesitation in passing the flesh of those killed by lightning, provided depletion of blood is had recourse to sufficiently early.

It must, however, be borne in mind that gases are quickly disengaged from the carcase when bleeding has not been had

recourse to, and that these gases permeate the tissues, and produce a false *rigor mortis* or apparent stiffening of the limbs and body generally.

Whenever a doubt arises as to the truth of a statement that an animal has been "struck by lightning," the skin or hide should be carefully inspected with the view of detecting the existence or non-existence of *scorching* of the wool or hair.

Fire.—In death by actual burning the extinction of life is usually accompanied by circumstances of such an appalling nature as to exclude the adoption of the necessary measures for dealing with a dead body when it is intended for consumption as food, and frequently the effects of the fire are such as to exclude the idea of using the carcase for this purpose. In cases of moderate burning only, when it is thought advisable to destroy the injured animal, there is nothing to prevent the use of the flesh for food, providing the usual method of procedure is adopted in the preparation of the carcase, and providing life has not been sufficiently prolonged to allow of the production of febrile conditions, or of extensive suppuration. In many cases of death resulting from fire, life is destroyed either by *suffocation* with carbonic acid, or by the inhalation of carbonic oxide.

Carbonic Acid and Carbonic Oxide Poisoning.—In the former case the conditions existing in the carcase will be identical with those produced by strangulation, and the remarks made thereanent will equally apply here; in the latter case the alterations in the blood are of such a grave nature as to render the flesh quite unfit for food. The exact nature of the changes produced by carbonic oxide has not yet been determined, but the combinations of this gas with the oxy-hæmoglobin of the blood are of a permanent nature, and are not influenced by exposure to air, or even by exposure to the direct effects of oxygen, the flesh in every case being of a bright red colour, and the blood presenting a waxy character. Decomposition of the carcase is much less

rapid in carbonic oxide poisoning than it is in poisoning by carbonic acid, in fact the former gas preserves meat (if kept in hermetically closed vessels) for an indefinite period; but it must be remembered that when it is used for this purpose the animals are slaughtered and the carcase prepared in the ordinary way.

Poisoning.—The effects of poisoning, as ordinarily understood, upon the carcases of animals, will be largely regulated by the nature of the poison, *i.e.*, as to whether it is of an inorganic or organic nature.

Inorganic poisons, as a rule, produce local effects only, *e.g.*, inflammation of the mucous membrane of the alimentary canal; consequently, the remarks made in considering the effects of localised inflammation hold good here also.

It is questionable whether any inorganic poison—not even excepting arsenic—is ever absorbed in sufficient quantity to render the flesh of the poisoned animal nocuous, and in all cases where the toxic action has been extreme or prolonged, the changes in the tissues will be sufficiently pronounced to warrant the condemnation of the flesh, without reference to their cause. Of all the inorganic poisons, the effects of phosphorus are the most important, as, owing to the rapid fatty changes it produces in the coats of the vessels, there is universal blood extravasation, and marked changes of a destructive character are produced in the blood itself, which becomes grumous, and the flesh and tissues are found, after death, luminous in the dark,—the luminosity being most pronounced if heat is applied, when also the aliaceous odour of phosphorous is given off.

Organic poisons, acting only as irritants, produce effects exactly analogous to those produced by inorganic poisons; but those of the narcotic class, by virtue of their interfering with brain, spinal, and nerve functions, give rise to conditions identical with those produced by suffocation, and very frequently death is so sudden

that the animal's body is not discovered until the lapse of several hours after life is extinct.

It is a remarkable, but none the less an established fact, that the effect on the body of organic poisons is much more pronounced when the poisonous agent has been ingested in the plant form, than when it has been taken as a preparation, *e.g.*, as a tincture or an infusion; and in the former case, putrefaction of the carcase sets in with much greater rapidity than in the latter. Organic poisons are no more likely to be absorbed in sufficient quantity to produce deleterious effects by ingestion of the flesh than are inorganic, and that this remark has a special application here is shown by the fact that such a deadly agent as curara, when used for the purpose of killing animals for food—as it is by the Indians—is absolutely innocuous to the consumer.

Animal Poisons so rarely gain access to the bodies of animals in this country in sufficient quantity to cause death, that it is scarcely necessary to discuss the matter, especially seeing that such poisons are not reproduced in the blood of those animals that are exposed to their deleterious effects.

Enforced Unnatural Positions.—Ruminants, of all animals, are most susceptible to the injurious effects of unnatural positions, and this is doubtless due to the voluminosity and generally replete condition of the gastric apparatus. While the horse can lie on his back for a considerable period without suffering from material gastric disturbance, a very short time suffices to bring about grave functional derangement in the ox or sheep when either animal is, perforce, placed on its back, and retained for a lengthened period in that position, as so frequently happens in sheep depastured in fields where shallow depressions are numerous. In the majority of instances a sheep rolling on its back (*Rolling Awald*, Scot.) into a hollow is doomed if rescue is not quickly forthcoming. Death in these cases is produced by suffocation as

the result of tympany, brought about by fermentation of the contents of the rumen.

The condition of the carcase in these cases will depend upon the length of time the animal has been in the dorsal position, and upon the abstraction or non-abstraction of blood; usually it presents all the characteristics of the carcase of an animal dying from the effects of tympany, the flesh of the back being particularly discoloured, owing to the gravitation of the blood to this part —*hypostatic congestion.*

Death by Suffocation (Asphyxia) is induced in a great variety of ways, *e.g.*, by mechanical obstruction to the passage of air into the lungs, by pressure exerted on the lungs or the diaphragm, by the deprivation of oxygen, as in carbonic acid poisoning, or in poisoning by any kind of gas; by the introduction of foreign matter, as fluids, medicines, or food, into the bronchial tubes, and by the action of such germs as those of anthrax. In all cases the flesh is very dark in colour, soft, and more or less soapy to the touch; the veins are engorged with dark-coloured, semi-coagulated blood, as are also the vessels of the lungs; and the right heart is usually filled with dark-coloured blood, which forms a soft clot in the ventricle and in the auricle. The flesh rapidly undergoes decomposition, and is, in all cases, unfit for human food.

EFFECTS OF DISEASE OF ORGANS AND TISSUES.

Diseases of Organs.—Brain, Spinal, and Nervous Diseases.

Of the acute diseases of the brain, congestion, inflammation, and apoplexy are the most important; but it cannot be said that any of them—apart from the conditions produced by perverted nerve control, or in the case of inflammation by the attendant fever—lead to the production of changes of a deleterious nature in the flesh of animals suffering from them.

If *coma* is established and life is prolonged for any length of time, oxidation is materially interfered with, and the changes noted under the head of suffocation, &c., are produced.

In *delirium* the muscles may become pale in colour and friable in texture; they may, however, be dark in colour.

Of the less acute affections, dropsy (*hydrocephalus*), staggers, and epilepsy may be briefly noticed. The former is seldom seen as an independent condition in animals whose flesh is used for human food. It may, however, be associated with rickets or other diseases in which there is mal-nutrition of the blood, and it may result from inflammation of the coverings of the brain. In any case it does not of itself lead to changes of any importance in the tissues, except such as result from interference with nutrition; and seeing that inspectors rarely, if ever, examine the brain, its existence is not likely to be detected, consequently if the tissues of such an animal had undergone any marked change the carcase would require to be dealt with according to the conditions presented.

Epilepsy is seen most largely in young pigs, and the remarks made in reference to hydrocephalus apply equally to it. As there is no appreciable brain lesion to be detected on *post-mortem* examination, the existence of epilepsy during life could not even be guessed at after death; and even if oral evidence of its *ante-mortem* existence were forthcoming, it would not in itself justify an inspector in condemning the flesh if it was normal in character.

Of spinal diseases it may also be said that, unless indirectly, no important changes are by them produced. Acute inflammation or congestion of the spine is rarely seen, except in connection with the disease known as *louping-ill* in sheep, and in young lambs subjected to the influences of improper nourishment and inclement weather. In very bad seasons, and in certain districts, particularly in Scotland, hundreds of lambs become the subjects of *louping-ill* and *paralysis*, or *swung-back*, as it is commonly designated. In the neighbourhood of Aberdeen, as I am informed by Dr. Hamilton, the term *supple-back* is applied to cases of caries of the vertebræ in lambs.

Louping-ill in some cases runs a comparatively rapid course, and is associated with great excitement, some fever, and marked interference with all the normal functions. In such cases, the inspector will find evidence of important nutritive changes in the tissues, sufficient in themselves to warrant the condemnation of the flesh.

In the sequential stages of louping-ill, *paralysis* becomes the most important condition, and, as in paralysis from any cause, so here, if the animal is allowed to linger in life for any length of time, nutrition becomes materially interfered with, and the body in consequence thereof becomes emaciated; frequently, too, suppurating sores are formed in the skin, over the most prominent parts of the skeleton, and these aggravate the other conditions.

Tetanus or *lock-jaw* is seen most frequently in sheep, as a result of castration and docking, or from exposure to inclement weather.

The disease, it is now shown, is due to the action of a bacillus, and when it is very acute it brings about changes similar to those produced by excitement and fever from any cause, but to these there is superadded the effects of imperfect oxidation. In sub-acute or chronic cases the resulting changes are mainly those produced by deficient nutrition.

In either case, the inspector—unless he has a foreknowledge of the nature of the malady from which the animal has suffered—must decide as to the fitness or otherwise of the flesh for human food by the conditions presented by the carcase itself.

Thoracic Organs.

The Heart and Pericardium.—The heart is less frequently affected with disease of an idiopathic character than is any other important organ, and the same may be said of specific disease, such as tuberculosis or cancer. It is frequently found enlarged (*hypertrophied*) and dilated, and occasionally wasted (*atrophied*), but in these conditions there is seldom any accompanying disease, or at any rate, disease that can be detected with the unaided eye.

Both under its external and under its internal membranes (*epicardium and endocardium*) extravasation of blood is of frequent, indeed almost of constant, occurrence in such diseases as anthrax, swine fever, and blood-poisoning, but such extravasations are only occasionally seen in the structure of the heart itself. Owing to the penetration of foreign bodies—pins, needles, wire, &c.—from the first or second stomachs through the diaphragm, traumatic inflammation of the pericardium and of the epicardium, as also of the heart muscle, is of very common occurrence in cattle, and as a result of this, inflammation may be of limited extent and of a healthy character, or it may be very much diffused and of a putrefactive character; these differences depending upon the aseptic or septic condition of the penetrating body. In the

former case, the flesh is not materially affected unless a high degree of fever has existed, but in the latter it is frequently of a dark colour, soft and soapy to the touch; moreover, the connective and muscular tissues about the breast and the under surface of the neck are frequently dropsical. In the worst cases the pericardium is found full of putrid pus (*pyo-pericardii*), the heart covered with granulations, the epicardium enormously thickened, and the heart itself enlarged; but notwithstanding these important conditions the flesh is frequently normal—though its condemnation is more than justified when putrefactive processes have been established in the pericardial contents.

A low form of inflammation of the pericardium and epicardium leading to the throwing out of serum (*hydrops pericardii*), or to the formation of lymph, and, as a result, to adhesion, is a very frequent complication in such diseases as swine fever, malignant catarrh, pustular fever, braxy, and septicæmia.

Occasionally the inflammation assumes a more severe form in these cases (as it does also in malignant foot and mouth disease), and pus is quickly formed. If such conditions are found the flesh should be condemned, and especially so if they are associated with similar lesions in other organs or parts of the body.

The Lungs and Pleuræ.—It would be impossible in a work of this kind to notice in detail the various diseases to which the lungs are liable; the most important are extensive emphysema, collapse, congestion, various forms of inflammation, parasitical diseases (as hoose and hydatid disease), abscesses, and tuberculosis.

Neither emphysema nor collapse produce in themselves any important change in the tissues of the body, unless large areas of lung tissue are involved and serum is thrown out into the bronchial tubes, in which cases oxidation is so much interfered with as to establish conditions identical with those described in speaking of suffocation; and the same remark applies equally to congestion, if it is at all extensive. Inflammation *(pneumonia)* varies in

character and extent, and while a limited pneumonia of idiopathic origin produces no appreciable change in the tissues of the body, and does not render the flesh in any sense nocuous, an extensive pneumonia, even of the simplest type, produces important tissue changes, not only by virtue of the effects of the accompanying fever, but by the grave interference with oxidation which it brings about—the changes being a combination of those produced by fever, inflammation, and imperfect oxidation. The most important form of inflammation, from a sanitary point of view, is *septic pneumonia*, which is of very frequent occurrence amongst recently calved cows in the Edinburgh dairies, and it usually arises as a secondary result of septic inflammation of the womb. The extent and the destructive character of the lesions are in many of these cases astounding, and seem—in contemplation—to be utterly incompatible with the maintenance of life. The effects on the tissues are similar to those of septicæmia, and in every case where a putrefactive condition of the lungs exists the carcase should be condemned.

In *hoose*, the inflammation set up by the parasites (*Strongylus filaria* in the sheep, *Strongylus micrurus* in cattle, and *Strongylus paradoxicus* in the pig) may be of very limited extent, and confined to a part of one lung only; or it may be very diffused and complicated with congestion or collapse, and with effusion of serum (which becomes whipped into foam by the passing to and fro of the air) into the bronchial tubes.

In *hydatid disease* of the lungs, the interference with the organ is mainly physical in its character, as the cysts are of slow growth, and in their growth give rise only to a limited inflammation of a very chronic nature. Moreover, owing to the density of the cyst-wall, there is not, nor can there be, any absorption of hydatid fluid, or of inflammatory products. The lungs may be invaded to an enormous extent, and two-thirds or more of the respiratory area functionally annihilated, and yet the carcase be laden with

fat; indeed, this partial annihilation of the respiratory function favours the deposition of fat by diminishing oxidation. Very exceptionally, hydatid cysts soften and originate abscesses, but such are not usually extensive nor are their contents of a septic character.

Pulmonary abscesses may arise independently of similar lesions in any other organ or part of the body; they may, however, have a metastatic or pyæmic origin. In the former case they are produced by inflammation, by death of part of a lung—as in contagious pleuro-pneumonia—with its subsequent encystment and liquefaction or degeneration; by the passage of foreign bodies into the trachea, or through the diaphragm from the stomach; by wounds inflicted from without; by degeneration of extravasated blood, or by degeneration of hydatid cysts; and, much less frequently, by the degeneration of fluke cysts. *Metastatic* abscesses arise as the result of a general pyæmia, and when there is undoubted evidence of their having so originated, the carcase should not be used for human food; but if of local origin and aseptic in character, their presence does not warrant the condemnation of the carcase unless the flesh itself is unhealthy.

Pleurisy is of very common occurrence in all animals; it frequently assumes an epizootic character amongst pigs and sheep, and is a common complication of specific fevers and of blood disorders.

If it is very acute, no matter what its origin, it is associated with so much fever and suffering as to produce changes in the tissues similar to those produced by inflammation of any other structure. In circumscribed and in chronic pleurisy the effects on the tissues are so unimportant as to be scarcely if at all discernible on *post-mortem*, and when the pleura has been stripped off the ribs, an ordinary observer would not be able to say that any disease had existed during life.

If the pleuritic disease is associated with peritonitis or peri-

carditis it points to a septic origin, and such a condition warrants the condemnation of the carcase; the same holds good if the inflammation is of a purulent type.

The effects of tuberculosis on the lungs and pleuræ are dealt with in the chapter on that disease.

Tonsilitis.—"Quinsy."

Inflammation of the Tonsils is most frequently seen in the pig, in which animals these structures are much more perfectly developed than in ruminants.

The disease may occur independently of any other throat affection, but, more largely, it is associated with, and is an extension of, sore-throat. Malignant disease—such as cancer and actinomycosis—is occasionally localised in these structures.

The general effects of the disease on the system do not differ from those produced by acute inflammation in any other organ.

Digestive and Accessory Digestive Organs.

Choking, or the Impaction of Foreign Matter in the Œsophagus.—This accident is of frequent occurrence in cattle, very rare in sheep, is occasionally seen in pigs, and, both directly and indirectly, leads to important tissue changes.

If relief is not afforded for some hours, and nervous excitement is great, the muscular tissue is found after death to present a somewhat parboiled appearance, to be very friable, and to present effusions—often sero-sanguineous in character—into the deeper parts of the carcase; the blood vessels are only half filled with blood, and if the obstructing body has been a piece of turnip, the characteristic odour of the root pervades the whole carcase. It is difficult to assign a reason for the production of these important changes, nor can it be shown that such flesh is nocuous; it is, however, decidedly unmarketable, and should never be exposed

for sale. If, as frequently happens, the accident has led to and been associated with tympany, the changes produced by that condition will be distinctly manifested in the flesh.

Functional Gastric Derangement.—In no animal is the gastric function so easily and so frequently disturbed as it is in the ox, but the changes wrought in the tissues of the body are largely regulated by the complications arising out of such derangement. In those cases in which, owing to indigestion, the first and second stomachs have been impacted with dry solid matter, the changes in the tissues are of much less importance than they are when the indigestion has been associated with fermentation or decomposition of the ingesta, and, as a result thereof, *tympany* has been produced. In impaction by solid matter, the brain and spinal cord are frequently affected in a reflex manner, and symptoms of brain and spinal derangement are marked, causing the animal to lose control over the voluntary muscles; in other words, to become the subject of *stomach staggers*, and the great nervous excitement accompanying this leads to tissue changes of so marked a character as to render the flesh unmarketable. If, as frequently happens, the excitement has been followed by *coma*, the flesh is rendered dangerous, if not actually nocuous. If *tympany* has been produced, and is allowed to continue for some hours before the animal is slaughtered, the mechanical interference with the diaphragm is such as to produce *asphyxia*, and the flesh presents the characteristic changes produced by suffocation from any other cause, and is equally as unwholesome.

In those cases where functional derangement has been prolonged and *gastritis* has been induced, the effects of fever are added to those of indigestion, and the abnormal conditions presented in the flesh are more pronounced.

Intestinal Derangement. — All domestic animals suffer different forms of intestinal derangement, — the ox and the pig more frequently, however, than others. Constipation, mechanical

obstruction, and inflammation, are each in turn met with, and although the two former do not for a time produce much systemic disturbance, and consequently do not lead to the production of material changes in the character of the flesh, they in the long run produce fever, and become complicated with inflammation. Primarily, these disturbances cause interference with the assimilative and nutritive functions; secondarily, disturbance of the function of the liver, and in consequence thereof jaundice and its associated conditions; and owing to chemical changes in the contents of the bowels putrefactive gases are liberated, and probably become absorbed, and exert a very deleterious influence upon the blood. If the animal is slaughtered in the earlier stages of such affections, no important changes are found in the flesh, which is quite wholesome; but if the animal has been allowed to live on, and much medicine has been administered, changes similar to those seen in fever and inflammation are produced in the flesh, and it is rendered unfit for human food.

Inflammation of the Peritoneum.—Peritonitis is produced most largely in cattle by the penetration of foreign bodies from one or other of the stomachs, usually the first or second. In all female animals it may result from extension of inflammation from the womb after parturition, or from the removal of the ovaries in the operation of spaying. This operation is more frequently performed upon young pigs and sows than upon any other female animal. In male animals peritonitis very frequently follows castration, and in any animal it may be produced by the contents of the stomach or bowels finding their way into the abdomen, owing to rupture, or perforation by ulcers; in like manner it is sometimes produced by rupture of the bladder, or perforation of its walls by ulceration, or by worms, thus allowing of the escape of urine. As the inflammatory action set up by the causes mentioned is usually of a septic character, the conditions revealed on *post-mortem* are sufficiently important to enable the inspector

to condemn the carcase as being totally unfit for consumption. In the worst cases of septic peritonitis the odour evolved from the abdomen, when that cavity is opened, is unbearable, the peritoneum is of a green hue, and the cavity contains a large quantity of serum, or serum and pus. If the contents of the stomach, the bowels, or the bladder, have passed into the abdomen, their presence is easily detected.

As both the stomachs and bowels are largely used for dietetic purposes, they should be as carefully inspected as any other part of the animal, and if traces of organic disease are found, they should be unhesitatingly rejected as articles of consumption. The stomachs, when undergoing preparation as *tripe*, are found to *set* very imperfectly if disease has existed; and when cleaned, discoloration or thickening usually attracts the attention of the cleaner to their condition, as they do also to alterations in the intestinal walls.

The Liver.—Functional disorder of this organ usually produces jaundice, but unless it is very pronounced, or is associated with important complications, it does not, as has already been explained, render the flesh nocuous. Organic disease, especially if extensive and of long continuance, generally leads to important tissue changes, such as wasting, discoloration, or dropsy — conditions sufficient in themselves to warrant the condemnation of the flesh— but in the ox and the sheep a large extent of liver structure may be destroyed without interfering in any way with the health of the animal, and consequently without producing any observable change in the flesh. It is, in fact, sometimes astounding to see the splendid condition of the carcase in an animal whose liver has been destroyed by bladder worms, or by the effects of fluke worms (*rot*) to the extent of three-fourths or four-fifths of its entire area. So long as there is sufficient liver structure left to secrete the necessary quantity of bile to carry on the process of digestion, so long will an animal thrive and fatten, and particularly is this true

in the case of the ox. If any marked organic change is discerned in this organ, it should be condemned for the purpose of consumption.

The Pancreas. — This organ, usually known as the *kernel* or *sweetbread*, is freer from disease than any other organ of the body; and I include with this other glands of a similar nature, as the *thymus* (the *chest sweetbread*) and the *salivary glands.*

In the event of the pancreas becoming the subject of extensive organic disease, the interference with digestion and assimilation would be so great as to lead to general emaciation and probably to dropsy.

The Spleen or *Melt* is as little liable to disease as are the foregoing organs, if we except tuberculosis in the pig and the horse, and neither physiologically nor dietetically is it of so much importance; but inasmuch as it is materially affected in such diseases as anthrax and septicæmia, the detection of any departure from a normal condition should lead to a more careful examination of the carcase being made. The abnormal conditions usually observed are enlargement of the organ itself from increase in the quantity of blood contained in its meshes, and a damson or tarry colour of the pulp.

The Kidneys.—Seeing that these organs are so essential to the perfect depuration of the blood, it is of the utmost importance that a careful examination of them should be made in all cases where the flesh presents marked changes in colour, or where effusion into the tissues is extensive, and especially does this apply to the condition known as *water braxy* in sheep, in which the kidneys are often found reduced to a mere pulp, and frequently saturated, as it were, with altered blood. In swine fever, in anthrax, and in septicæmia, these organs are sometimes the seat of extravasation of blood, and thus afford confirmatory evidence of the existence of that disease. In the ox, tuberculosis

of the kidneys is not uncommon, and is easily detected on section.

Extensive disease of these organs is almost certain to lead to the production of *uræmia* or to *dropsy*—conditions noticed elsewhere; but if the disease is confined to a comparatively limited area, there is not usually any important change produced in the nutritive or general character of the flesh.

The Bladder.—In comparison with other organs this viscus is not, primarily, often the seat of disease—most largely it becomes so as the result of the irritation of calculi and obstruction to the outward flow of urine, and of the irritation of drugs, and occasionally, in the cow, from extension of gonorrhœal disease from the vagina.

These influences give rise to inflammation (*cystitis*), and as a result of that process, suppuration, ulceration, and even perforation are established. Occasionally malignant disease (sarcoma or cancer) attacks the bladder, but if the urethra is patent — thus allowing of the outflow of fluids—and if the peritoneum is not involved, diseases of this organ do not produce any systemic contamination. Of course, in cases of acute disease the changes resulting from fever and inflammation generally may be established in the tissues. As elsewhere indicated, absorption of deleterious matter may take place from the bladder where urine or purulent fluids are retained therein. If the bladder has been the seat of extensive disease, the surrounding pelvic tissues will probably be infiltrated with the products of inflammation, and if the disease has been of a malignant character, its effects (as a cachexia) may be observed in the tissues after death.

The Uterus.—The diseases of the womb which are likely to lead to alterations in the flesh are — tuberculosis, inflammation, dropsy, and abscess. Tuberculosis usually occurs in the cow as a secondary, seldom as a primary condition. It may arise as an extension from the abdomen, or the reverse may take place, and

whenever it is found to exist it affords powerful support to the inspector in the condemnation of tuberculous carcases. Acute inflammation is usually seen as a result of parturition, consequently the effects of that process are added to those ordinarily resulting from acute inflammation in any other organ. The most important inflammatory condition is *septic metritis*. It is frequently seen in cows and ewes, and often results from retained clots of blood and decomposing placenta in the former, and from improper management and exposure to adverse influences in the latter. The conditions produced by this form of inflammation are *septicæmia* and *septic inflammation of the lungs*. Dropsy is often secondary to organic disease in other organs, as the kidneys, the liver, lungs, or heart; or it is a part only of a systemic dropsy, consequently the conditions observed in the carcase are those common to dropsy from any cause.

Abscess may be confined to the uterine walls, or may involve the whole organ, *i.e.*, its cavity may, from purulent inflammation, become a huge abscess, containing, in the cow, more than 20 gallons of pus. If the abscess is of limited extent its effects on the carcase are only trifling, but wherever pus accumulates in large quantities, and especially if it undergoes decomposition, it gives rise to tissue changes of so pronounced a character as to warrant condemnation of the flesh without reference to the source of such changes.

The Mammary Gland.—Inasmuch as the udder is not engaged in the performance of any function essential to life, slight or circumscribed changes in this organ do not produce any material effects on the general system, neither indeed does very extensive tissue change, providing it is not due to any acute or malignant disease. Owing to chronic inflammation the udder frequently attains to enormous proportions in the cow and in the ewe, but there is not, as a rule, any interference with the nutrition of the tissues of the body, except such as would be induced by any

other form of parasitical growth, *i.e.*, if its nutritive demands exceed the available supply the body suffers proportionately and becomes emaciated.

In very extensive and acute inflammation of the udder, the fever and suffering are frequently so great as to lead to the production of the changes already noted as resulting from acute inflammation in any organ, and they will be materially aggravated if the inflammation has been of an *erysipelatous* type, or if it has produced mortification.

Tubercular inflammation of this organ is usually of a chronic nature; exceptionally, however, the morbid processes assume an acute character, and terminate in extensive softening and destruction, and inasmuch as tubercular mammitis is usually a secondary process, it affords a certain guide as to the general distribution of the lesions of this disease. The udder of the cow is frequently sold to the proprietors of cook shops, and is by them boiled and retailed to the poorer classes in slices; consequently this organ should be carefully examined in every instance, and unhesitatingly destroyed if the slightest departure from the normal is observed, and more particularly so seeing that its monetary value is small.

The Testicles.—The most important diseases from which these organs suffer are inflammation, in all animals; and in the ox and pig, tuberculosis: the remarks previously made in reference to disease of the mammary gland are equally applicable here.

It is in connection with the operation of castration that the gravest conditions arise, as not only is *septic peritonitis* a frequent sequel thereof in lambs, but also, owing to imprisonment and decomposition of blood, septic inflammation of the scrotum is induced. Local traces of the existence of this condition are usually to be found in the dark colour of the connective tissue of the surrounding parts, into which there is also extensive infiltration of serum, and from which there is sometimes a septic odour given off.

Bone Diseases.

In connection with the Inspection of Meat the only diseases of bone which require to be considered are—inflammation, rickets, and softening of bone.

Inflammation of Bone (Ostitis, affecting the hard structure, Osteo-myelitis, affecting the hard and the soft structures) is only of importance when it is extreme, or when associated with the formation of pus, or with acute destructive processes. Owing to the extreme fever and pain it would, if very acute or prolonged, give rise to changes in the tissues such as are produced by inflammation and fever generally, and if localised in the bones of the limbs, there would probably be added to this the effects of bruising from continued recubation—few people, especially in the country, having sufficient knowledge to prevent this by adopting the necessary precautions against it in the way of proper bedding and of frequently altering the position of the animal—moreover, the tissues around the inflamed bone are usually so much infiltrated with lymph and serum, or so altered by the inflammatory processes as to render their condemnation necessary. In acute inflammation, especially of the softer structures of bone, abscess or diffuse suppuration is frequently produced, and it is one of the most important sources of septicæmia and even pyæmia. In chronic disease of bone the body frequently becomes emaciated, anæmic, and dropsical, and in this case the flesh should be dealt with in accordance with the directions already laid down.

Rickets is seldom seen as a disease of adult life in animals; it affects mainly young pigs, lambs, and calves; is due largely to bad hygienic conditions, and to mal-nutrition from faults existing in the milk of the mother, from innutritious or improper food, from impure water, or from deprivation of light and air; or to mal-assimilation in the bone tissues or cells themselves—it may arise from rheumatism. It is almost invariably associated with

mal-nutrition of the blood, and consequently of the tissues, hence the sufferers become more or less emaciated, and the flesh innutritious, pale, and flaccid (doughy); the carcases of young pigs frequently contracting a peculiar dusky hue. The ribs are sometimes distinctly nodulated or "beaded" in the pig as in the human subject, and occasionally they are fractured; the bones are soft and sometimes deformed, and the ends of the long bones are enlarged and usually redder in colour than normal. While it cannot be shown that there is anything absolutely deleterious in the flesh of such animals, it is innutritious, and consequently unfit for human food.

Softening of Bone—Osteo-Mollities—is a totally different process to the foregoing, and, so far as my experience goes, is due primarily to blood disease rather than to any inherent defects of a nutritive character in the bone tissue. It is seen most largely in young cattle up to two years old, the bones being enlarged, softened, and dark in colour, and there is an enormous increase in the medullary fat, with proportionate decrease in the compact tissue. In one bone I found the proportion of fat to bone tissue was nearly as 2 to 1. Unless the process is very acute, or is associated with marked blood lesions, the muscular tissue is not materially altered in character, nevertheless the carcase of such an animal should certainly not be considered marketable, and even though no proof could be offered of its nocuity it should not be classed as wholesome.

Diseases of the Skin.

There are few diseases of a sporadic nature affecting the skin of those animals whose flesh is used for human food except those having a parasitic origin—as mange in the horse, the ox, and the pig; and scab in the sheep and the goat; and those having a dietetic origin—as eczema.

In addition to mange, the pig and the ox sometimes suffer from the effects of innumerable colonies of lice, those in the former animal being of great size and giving rise to deep inflammation of the skin and of the subcutaneous tissue, while the skin of the sheep is sometimes infested by ticks and keds in very large numbers. The subcutaneous tissues of the ox are the home of parasitic larvæ (*warbles*), and the skin, and sometimes the subcutaneous tissues of the sheep is infested in the summer months with the larvæ (*maggots*) of the blow fly.

Vegetable parasitism (*ringworm*) is seen in the ox and in the horse only.

No matter what the parasite, inflammation of the skin, either circumscribed or diffused, is set up, and this may extend to the underlying tissues, maggots frequently destroying both the skin and the subcutaneous tissues in the sheep; but in no case is any constitutional disease directly set up unless, as sometimes happens with the tick and with flies, the proboscis of blood suckers has become contaminated with the virus of such diseases as anthrax or glanders. When parasitic invasion is extensive, the withdrawal of nutrition and the persistent irritation induced by the parasites may interfere with the growth of an animal, and induce anæmia and emaciation, and even dropsy; and if the inflammation of the skin has extended to the deep tissues, the superficial parts of the carcase may present the same conditions as those which are seen after the application of a blister, viz., redness, with effusion of serum; but if the animal is otherwise healthy, and the flesh has not been rendered innutritious by debility, condemnation of the carcase is not warranted, though in all cases the damaged tissues should be carefully removed.

Skin diseases of dietetic origin occur most largely in the cow and in the pig. In the former they are usually seen in the spring and summer as the result of feeding on luxuriant vegetable matter, such as vetches and alsike clover; and in the latter, as the result

of feeding on unlimited quantities of cabbage, or on impure food. In cattle these skin affections are mostly of an eczematous type, the lesions being localised in the limbs, and in hot summer weather they are aggravated by the irritation of flies. Slaughtering of animals so affected is only practised when the inflammation assumes an unhealthy character, or when pyæmia is established, and in the event of either one or other of these contingencies arising, the effects on the tissues are so pronounced as to constitute in themselves sufficient warrant for the condemnation of the flesh.

Sheep frequently suffer in wet and cold weather from eczema (*wet scald*), but this is purely local in its effects, and is confined to the tissues of the skin itself; in like manner they suffer from eczema of the lips, which, though of local origin, may produce (secondarily) pyæmia.

Foot Diseases.

The most common diseases of the feet to which those domestic animals whose flesh is used for human food are subject, are—in the ox, fouls, rheumatic inflammation of the laminæ, and inflammation of the coronet; in the sheep, foot rot, foot sore, and dew scald. The structural alterations produced by these various diseases are the result of inflammatory action, are purely local, and do not affect the constitution; of course there will be fever in acute laminitis, but cattle, as a rule, are not slaughtered during the inflammatory stage of the disease, consequently no alteration in the nutrition of the tissues can be detected after death. In bad cases of foot rot in sheep, especially in hot weather, and when they have been travelled long distances on hard roads, a certain degree of fever exists, but unless the inflammatory action extends to the deeper structures, or purulent fluids are formed, and produce pyæmia or septicæmia, no deleterious effects on the tissues are produced.

Actinomycosis and tuberculosis are sometimes localised in the tissues around the coronet in cattle, and the remarks made in reference to those diseases generally apply equally here.

In the skin of the coronet and leg of the sheep, a very intractable form of disease, known in Scotland as carbuncle of the coronary band and "Orf," is met with, and, owing to its irritating effects, emaciation to an extreme degree is often produced.

In the pig a form of disease somewhat resembling canker in the foot of the horse is sometimes developed, and the victims become more or less emaciated and anæmic.

Parturition and Diseases connected with it.

It frequently happens in breeding districts that from various causes an animal is unable to give birth, and if its body is in good condition it is slaughtered and its flesh exposed for sale. As already mentioned the question of the consumption of parturient flesh is one about which there is room for difference of opinion, and where the animal has not been allowed to become exhausted, or has been killed at an early stage, it is almost or quite impossible to detect any evidence of the fact that it is a parturient animal, more especially when all the generative organs and the mammæ have been removed. The most suspicious circumstance in connection with these carcases is the extensive removal of all the tissues around the outlet of the pelvis, and in the case of the sow the entire removal of the mammary glands. If the latter are *in situ*, even though the teats may have been removed, some milk may be obtained by pressure, or it may flow over the cut surface on section.

In all cases of difficult or prolonged parturition, and especially where sustained and violent efforts have been made to extract the fœtus, the changes in the flesh resemble to a large extent those

produced by fever, and these changes in themselves warrant the condemnation of the flesh, and particularly if the muscles of the haunch and thighs present evidence of extravasation or effusion.

Of the diseases incidental to parturition the most important are —milk fever, retention of the placenta, and abortion.

In *milk fever*, as in parturition, the changes produced in the flesh will depend upon the length of time allowed to elapse between the advent of the disease and slaughter. If the disease has reached the comatose stage, the conditions produced by that state will be established, and in this case there should be no hesitation in condemning the flesh; but if the animal has been slaughtered immediately on the advent of the symptoms, and it is in good condition, the flesh presents no departure from the normal, nor can the existence of the disease, during life, be determined by any means after the carcase is dressed. *Milk fever* is not in any sense of the word a specific or toxic affection, but is, so far as at present known, purely nervous in its origin, consequently it would be impossible to establish the nocuity of such flesh. Custom regulates to a large extent the method of dealing with this flesh, as in some districts it is universally sold for consumption, while in others it is universally condemned. No matter what the custom in any particular district may be, such flesh should not be used for human food if it presents distinct evidence of nutritive change or of imperfect oxidation.

Retention of the Placenta—Very few animals are killed solely on account of this accident, and if the membranes have not undergone decomposition, their retention does not produce any important effect on the system; but if putrefaction is established, absorption of septic matter may take place, and lead to the same important conditions as those seen in septicæmia or to emaciation.

Abortion.—Abortion as the result of accident does not interfere with the system any more or even as much as does natural

parturition, and practically the remarks already made under that head will apply equally here. If, however, the abortion has been due to a specific cause or to disease of important organs, or is associated with retention of the placenta and putrefaction of the same, septic metritis will result, and the evidence of its deleterious influence on the tissues will usually be sufficiently marked to warrant the condemnation of the flesh.

CONSTITUTIONAL AND BLOOD DISEASES.

Fever.

FEVER, no matter of what type, if it is at all prolonged, produces important changes, not only in the muscular tissues of the body, but also in the tissues of the heart, liver, spleen, and kidneys. The flesh may contract a dark hue, and become very flaccid and even watery, or it may be much paler than normal and very friable. The above changes will be more marked if the fever has been associated with pain and with bodily suffering, or if it is of a low type. As a rule the carcase does not become properly drained of its blood, consequently the small vessels may be very much injected, and the large may contain imperfect and dark-coloured clots. The heart, on section, is usually pale in colour and remarkably friable; it has also, in many instances, an irridescent appearance. The liver and spleen are more or less enlarged or charged with blood, and the structure of the former is unnaturally friable and may be considerably softened. The kidneys, owing to their compact structure, do not usually show any enlargement; they may, however, be very friable in structure, and either dark or pale in colour. The lymphatic glands may, in simple fevers, show no change except that they may be a little enlarged and softened; but in all fevers due to the action of micro-organisms they present marked evidence of inflammation, congestion, or blood extravasation.

Inflammation.—This process is always localised either in one of

the internal organs or in the lining membranes of cavities or organs. If the inflammation is of a non-specific character, is of limited extent, or confined to an unimportant organ, it does not interfere with the nutrition of the body, nor does it produce any marked change in the tissues, consequently the carcase should not be condemned; but if it is very acute or involves an important organ, or is diffused extensively over the serous or mucous membranes, is of a specific character, and leads to important changes such as those already noted, the flesh is rendered unwholesome and should be destroyed. Chronic (interstitial) inflammation neither produces pain nor fever in any marked degree, consequently it is only by its indirect effects, as by interfering with or annihilating the functions of organs that it produces any deleterious effects on the system. All organs the seat of chronic interstitial inflammation become hard, grate against the knife in section, resist the cooking process, and have a sweetish insipid taste.

Suppuration.—Localised and circumscribed suppuration, as the result of a wound or other injury, or as in the formation of limited abscess, either internal or external, does not usually render the flesh unwholesome, and if the whole of the involved organ or part is removed, no objection can be urged against the consumption of such flesh. If, however, the suppuration is very extensive, as in large, open wounds, or in the formation of diffuse or unlimited abscesses, or in diffuse suppuration of the serous or mucous membranes, the nutrition of the body is usually so much interfered with as to render the flesh unfit for human food.

Mortification is not only a result of inflammation, it is frequently produced by interference with the circulation of an organ or part, by severe crushing or bruising, and by the action of chemical agents. It is also seen in the extremities in certain blood diseases, as black quarter, and especially as a result of septic and erysipelatous inflammation. Two forms are recognised, viz.,

the *dry* and the *moist*, and in arriving at a decision as to the effects of mortification this fact must be borne prominently in mind.

In dry mortification (*mumification*), if the patient rallies from the immediate effects of the process which gives rise to it, there is but slight interference with the nutrition of the flesh, but in the moist form the septic products of the process may become absorbed and produce a veritable septicæmia; moreover, the process diffuses itself in tissues contiguous to or in continuity with the organ or tissues in which it originates.

In dry mortification the dead structures are dry, hard, of a reddish brown colour, and leathery in appearance and texture. In moist mortification they are of a black or purple colour, and when decomposition is perfected, green. Bubbles of fœtid gas (sulphuretted hydrogen, &c.) are evolved from the destroyed tissues, which are swamped with fluid of a red colour. The colour is due to the solution and diffusion of the colouring matter of the blood. All the surrounding tissues are infiltrated with serum and lymph, and the small vessels are charged with blood. The blood vessels of the involved tissue are plugged with dark coloured clots of blood, and the whole area swarms with septic organisms.

Pyæmia.—The strict meaning of this term is pus in the blood, but it is not now usually so applied, but is rather used to indicate that multiple abscesses are formed in different parts of the body, and that once having originated they become metastic.

Multiple abscesses may be septic or non-septic (infective or non-infective) in character; they may originate from foci in any structure or organ of the body, and are largely associated with, and due to the formation of, clots (*thrombosis*) in the veins, and to the breaking up of these and the conveying of the *debris* to distant organs, in the vessels of which they become intercalated and produce plugging (*embolism*). The blood clots may be of an

infective or non-infective nature, depending on the presence or absence of micro-organisms, and the general or systemic disturbance is largely regulated by this fact; as in the former case, the effects produced on the system are analogous to those of septicæmia, the boundary walls of the abscesses are intensely hyperæmic, and the abscesses are surrounded by an inflammatory zone; but in non-infective pyæmia such conditions are little marked and unless fever runs high, or the abscesses are very numerous and the process prolonged, the tissues are not materially interfered with; they are, in fact, nearly or quite natural. If the process is prolonged, the animal becomes anæmic and emaciated, and it may be dropsical; the wool of the sheep frequently falls off in the same manner as it does in chronic anæmia.

Pyæmia occurs in all animals, domesticated, semi-domesticated, or wild, but of the first class the sheep is most largely the victim of the process. In these animals it frequently originates from malignant aphtha, from eczema of the lips, and from malignant catarrh; in each case it affects, at the outset, the face, and travels thence to the tissues and lymphatic glands of the throat and neck, finally locating itself in the lungs and in the lymphatic glands of the thorax. In young animals it most largely originates from disease of the umbilical tissues and from joint disease, and most frequently gains an internal localization in the liver.

If the process is a purely local one, is non-infective, and afebrile, the tissues, as already indicated, are not materially altered in character, and condemnation of the carcase is no more warranted than it is in the case of single abscesses; but if it becomes generalised and involves internal organs, or is of an infective character, and the lymphatic glands are diseased, the flesh should be condemned even though it may to outward appearance be healthy.

Evidence of systemic derangement should always be sought for

in the shape of effusions and extravasations, especially into the deeper tissues of the body.

Rheumatism is most largely seen in the pig and the ox, and may occur in animals at any age, though, with the exception of stall-fed cows, which are deprived, during a long period, of exercise, it is more frequently seen in young than in adults or aged animals.

If it affects the joints, as it frequently does in young cattle, and the arthritic disease is associated with degenerative processes, material systemic changes may be produced, and even septicæmia; and though no degenerative processes may be established, there may be systemic effusions and even extravasation in the more acute forms.

In very acute rheumatism, while no deleterious influence can by any possibility be demonstrated as resulting from the use of the flesh, as rheumatic flesh, the effects of fever, and, in some cases, of inflammation, will be observed in the muscular tissues, and the bones may be enlarged and softened. In chronic rheumatism the animal is frequently so emaciated as to render its flesh absolutely innutritious, and sometimes dropsical. In animals in good muscular condition, but suffering from localised joint disease, the tissues all round the joint or joints may become extensively altered by inflammatory changes, rendering the destruction of a leg or part of the leg of a carcase necessary.

Septicæmia (toxicæmia) or a septic condition of the blood (*blood poisoning*) is of very common occurrence in all the domestic animals.

Two forms are recognised, viz. :—

(*a*) Where the products only of the septic processes, which go on so largely in the various tissues and organs of the body, are absorbed into the blood producing *septic intoxication ;* and

(*b*) Where the organisms which induce septic processes also gain access to the general circulation and multiply, there producing *septic infection.*

One or both of these conditions are associated with and are produced by putrefactive wounds, either of the muscular or cellular tissues, or of the internal organs; with mortification of tissues (*sphacelus*), with retention of the placenta, with septic metritis, with navel ill, with septic diseases of the joints and bones, with septic inflammation of the lungs and of the udder, and with septic abscesses.

In sheep, and more particularly in parturient ewes, there are good grounds for believing that a general septicæmia is frequently produced by feeding the animals on improper and decaying or decomposing food, or allowing access to foul water, and that some of the cases of *red braxy* are of this nature.

Rabbits, too, sometimes become the subjects of septicæmia in large numbers.

Septicæmia, by virtue of the depraved condition of the blood which it induces, leads to alterations in the tissues of as grave, and frequently of a more grave character than does even anthrax. The blood seldom coagulates firmly, it is dark in colour, sometimes being tar-like, at others resembling damson pulp, and the walls of the cells becoming disintegrated, allow of the diffusion of its colouring matter, consequently it stains any tissue with which it lies in contact for any considerable time; in the worst cases it is effervescent almost as soon as dissolution takes place, and evolves a sickly or semi-putrid odour; the small blood vessels (capillaries) are charged with blood, and the muscular and cellular tissues are often uniformly stained of a deep red colour—this is particularly marked in the worst forms of so-called *red braxy* in sheep. The carcase and the blood quickly putrefy, and the body rapidly becomes tympanitic after death. The lining membrane of the right side of the heart and of the veins is usually stained of a deep red colour, and there is more or less marked, and generally diffused, effusion of serum and extravasation of blood, the serum being tinged with the colouring matter of the

blood. The blood, in septic infection, swarms with micro-organisms, such as those depicted in our illustrations, and it is extremely virulent, so that a few drops injected into the cellular tissue of a small animal, produces death in a comparatively short space of time.

Of the internal organs, all those of a vascular character, especially the liver, spleen, and kidneys, are usually engorged with blood. The heart is flaccid and contains imperfect coagula of blood of the same character as those found in the systemic veins. The mucous membrane of the stomach (fourth numerically) and of the small bowels is usually found of a dark colour (congested), and there may be extravasation into the structure of the bowels. The lymphatic and mesenteric glands are enlarged, softened, and infiltrated with blood as in anthrax and swine fever. Every part of the carcase is nocuous, and should not be allowed to be used as food either for man or animals.

Uræmia.—(1) This term signifies the absorption of various products from the bladder owing to the retention of the urine therein; this may occur as the result of paralysis of the bladder or spasm of its neck, occlusion of the urethra by thickening as the result of disease of its structure in some part of its course, by obstruction in the lodgment of urinary calculi, clots of blood, or coagula of lymph; in the ox by the formation of carbonate of lime concretions on the hair of the prepuce, and in sheep and cattle fed under cover in dirty houses (as is frequently done on the continent) from ulceration of the prepuce and constriction in the healing process thereof, producing *phymosis*. Concretions on the hair of the prepuce are usually formed when sheep and cattle are feeding on turnips grown with lime salts, and occasionally in summer when lime or bone manure has been used as a top dressing. In cattle, too, fed on unlimited quantities of wheat straw grown on limestone land, calculi form in the bladder and become arrested in the urethra in their passage out with the urine,

and small concretions are frequently arrested in the *vermiform appendage* of the penis of the sheep, the canal of which is of very small diameter.

No matter what may be the cause of retention, the constitutional results are the same, viz., *resorption into the blood of the principles formed in the retained urine by the chemical changes it undergoes and, as a consequence of this absorption, uræmic poisoning.*

In obstruction arising in the prepuce, another important condition is super-added to the retention, viz., intense inflammation of the sheath (*balanitis*) from the constant reflux of urine, which undergoes decomposition, consequently the inflammation is of a septic or putrefactive character and diffuses itself extensively into the connective tissue at the postero-inferior part of the abdomen and the inside of the thighs, producing septic changes, which of themselves render the carcase totally unfit for food. The changes produced in the tissues by the infiltration of urine bear a striking resemblance to erysipelatous lesions, and the parts have a powerfully urinous and ammoniacal odour.

When resorption of urinary products takes place from the bladder, a condition of the tissues of the body closely allied to that resulting from septicæmia is produced, and the flesh is rendered highly nocuous and absolutely unfit for food.

(2) Uræmia results from non-elimination from the blood of urea and other products of combustion, owing to the *non-secretion* or *suppression* of *urine* (*ischuria notha*) as the result of acute or chronic organic disease of the kidneys. Uræmia as a result of acute disease of the kidneys, is of rare occurrence in the domestic animals whose flesh is ordinarily used for human food, but as a consequence of chronic disease of those organs it is very common in the sheep in one of the forms of so-called *water braxy*, under which head it is noticed. In uræmia resulting from acute disease of the kidneys, the general or systemic conditions produced are

closely allied to those seen in septicæmia, and the effects on the tissues are much the same.

In uræmia resulting from chronic disease of the kidneys, the body becomes lean, anæmic, and dropsical, and the flesh is absolutely innutritious and unfit for food.

CACHECTIC CONDITIONS.

Anæmia.

THIS term practically signifies *deprivation of blood*, but manifestly such a condition would be incompatible with the maintenance of life. It is used to indicate that the volume of the blood is materially diminished, but not necessarily altered in quality. The term *oligæmia*, signifying as it does "little blood," would be more appropriate. If the blood is of poor quality, the term *spanæmia* is applicable.

Anæmia is met with in all animals as a result of acute fevers, which primarily exercise a deleterious influence on the nutrition of the blood; in consequence of prolonged and debilitating organic disease, especially of such organs as the liver, pancreas, mesenteric glands, stomach, and bowels, in which digestion and assimilation is materially interfered with; as a result of disease of the lips, mouth, teeth, tongue, and œsophagus, interfering with prehension, mastication, and ingestion; as a result of the ravages of parasites, and in consequence of deficiency of nutritive elements in the food, or the withdrawal of nutrition through the medium of some form of drain on the system, such as an excessive discharge—*e.g.*, diarrhœa or diabetes—or excessive secretion, as in over-suckling. It must not be assumed that in all cases the condition is associated with deficiency in flesh or fat. Ewes, when feeding on swede turnips alone, sometimes die in large numbers in full muscular condition, and the carcases may be

laden with fat; yet the veins may be half empty of blood, and that which is found is of a very poor quality. In these cases life is not sufficiently prolonged to allow of the establishing of a cachexia.

Though anæmia is a cause of dropsy, the two conditions do not necessarily co-exist; very frequently, in fact, the tissues are quite dry after the carcase has been exposed for a short time. Though they may be very pale, soft, and bloodless, the question of the consumption of the flesh of such carcases is to be considered, in the absence of evidence of important disease, rather in the light of the probability of indirect harm accruing from its innutritious quality than in that of nocuity, but under all circumstances it is unmarketable.

Braxy.—This term is applied to certain forms of blood disease in sheep, and is made use of mainly in Scotland or in the counties bordering thereon. It is used in a very indefinite and loose manner, equally as much, in fact, as is the frequently synonymous term *inflammation.*

Three forms of braxy are recognised by shepherds—(*a.*) turnip; (*b.*) wet; (*c.*) red.

(*a*) *Turnip Braxy* is seen when sheep are feeding on an unlimited supply of roots, particularly of swedes. It is essentially a form of mal-nutrition of the blood, and as a consequence, of the walls of the blood vessels, resulting in rapid effusion of serum, charged usually with excess of albumen, into the connective tissue of the body. Its attack is sudden, it is very fatal, and its duration is short—a few hours only. On *post-mortem*, the condition of the tissues is at once detected, and an adhesive feel may be imparted to the skin of the hand when it is passed over it, while the surface of a section rapidly glazes. The effusion is deep-seated and the fluid may be tinged with blood, there may be effusion into cavities, and even extensive congestion of important organs. The muscular tissue and the fat do not present any marked departure from the normal.

From a sanitary point of view, such flesh may not, and probably is not, productive of harm—and in various parts of Scotland thousands of pounds weight are annually consumed after curing and smoking—but though it may be innocuous, it is decidedly unmarketable.

(*b*) *Wet Braxy.*—This term is used in a very extended sense, and practically it includes all dropsical conditions, whether these result from blood disease, as anæmia, from uræmic poisoning, or from organic disease of organs. As in the case of turnip braxy, so here, the flesh of such animals is largely consumed, after being salted and smoked, as "braxy mutton," but the remarks made as to the nutritive and deleterious properties of dropsical flesh apply equally here.

(*c*) *Red Braxy.*—This term is even more indefinite than the preceding, and practically all conditions of the carcase and of the internal organs in which there is marked discoloration are (in Scotland) classified as red braxy. The importance of this fact cannot be over-estimated, as conditions of an entirely harmless nature are confounded with those possessing the gravest attributes. Thus, congestive conditions resulting from a deterioration of the blood simply are classified with lesions produced by that most deadly of all diseases, anthrax, and with those resulting from septicæmia, and not unfrequently with parturient lesions and with the discoloration resulting from fever, inflammation, and imperfect bleeding.

In all parts of Great Britain—more frequently in England and Scotland, perhaps than in Ireland or Wales—sheep die in large numbers as the result of a blood crasis induced by grave faults in dieting, and on *post-mortem* the blood is found to be very dark in colour and imperfectly coagulated, while there is extravasation and effusion (often sero-sanguineous) into the various tissues of the body: and neither by microscopical examination nor by feeding experiments can it be shown that any deleterious element exists in

such flesh, and it is largely consumed as "braxy mutton"; but under no circumstances should it be allowed to pass as marketable food, nor, if the slightest evidence exists of its being from anthrax animals, or from those suffering from septicæmia, should there be any hesitation shown in condemning it as unwholesome and dangerous.

Under circumstances similar to those described as leading to the production of malignant parturient fever, grave and universal changes often take place in the whole mass of blood and in the tissues generally of the sheep, the carcase being universally discoloured, and extravasation and effusion extensive; the body, too, undergoes rapid putrefaction. This is undoubtedly a form of septicæmia—the *hæmatozymosis* of Simonds—and the flesh should be treated as such.

Dysentery—"Bloody Flux"—is a specific inflammation of the large bowels, and is most frequently seen in cattle, sheep, and pigs, rarely in the horse. It is produced by the action of organic irritants, such as decomposing or diseased flesh and fish, in the pig; by contamination (especially by sewage) of pastures or of water, or by the excreta of diseased animals (fouling); by decomposing or fermenting vegetable matter, and by stagnant water. It is sometimes a symptom of a depraved condition of the blood. Dysentery is characterised by extreme fever, and by intestinal symptoms, with profuse diarrhœa at the outset followed rapidly by discharge of bloody fœces, and ultimately by blood. Emaciation proceeds at a very rapid pace. In some cases it merges into a chronic affection, the bowels becoming ulcerated, and the nutrition of the body being so much interfered with as to produce extreme emaciation and debility. On *post-mortem* examination the bowels present all the characteristics of an acute inflammation of the mucous membrane, and frequently the lesion is observed to extend throughout the whole length of the intestinal canal, and especially is

this the case when the disease has been produced by sewage.

In the human subject it has been thought that, in India at least, the malady is due to a specific germ, but there is no evidence of such an influence being exerted in the production of dysentery in animals. Unless animals affected by the disease are killed in the earliest stages, the condition of the tissues is such as to render the flesh unfit for food. It should be unhesitatingly condemned whenever the disease has been marked.

Enteric Fever (*Muco Enteritis*), *Typhoid Fever.*—This affection is seen most largely in the ox and in the pig, it is rare in sheep, but it is occasionally seen in the horse. Its causes are on the whole identical with those which produce dysentery, though in the horse it occurs as an occasional complication of influenza, and in calves and pigs it is induced by the filthy and ill-ventilated condition of the calf-house or the pig-stye. As in the case of dysentery, it may be produced in young animals by grave alterations in the quality of the mother's milk, as also by exposure to cold. It is very fatal, and often kills its victim in a few hours after symptoms of its existence become apparent; frequently, in fact, animals that have been left over-night to all appearance healthy, are found dead the following morning, with all the pathognomonic lesions in the alimentary canal well developed. In some cases it merges into a chronic form of disease, and skin lesions, as papulæ and bullæ, are developed; emaciation is also marked.

This affection has no relation whatever to typhoid fever in man. Its symptoms, when observed, are those of extreme fever, with evidence of gastro-intestinal pain, and fœtid diarrhœa—the discharges being frequently stained with blood. The characteristic *post-mortem* lesions are those peculiar to other low forms of blood disease and of fever, with intense congestion of the mucous membrane of the stomach (the fourth in ruminants), and of the

small bowels: the colour of the membrane frequently resembles that of mahogany. The essential lesion is destruction of the mucous membrane in irregular patches, varying in extent from the dimensions of a hemp seed to many inches in length; the sloughing membrane is thickened, of a peculiar brownish-red colour (resembles badly tanned leather), and is separated from the surrounding tissue by a segregating chasm; the intestinal glands and Peyer's patches are enlarged, congested, and softened; there is sometimes effusion into the peritoneal cavity, with congestion of the peritoneum, the liver, the kidneys, and the lymphatic and mesenteric glands, the latter organs being soft and pulpy in texture and at times engorged with blood. The condition of the flesh is similar to that produced by septic disease, and it is totally unfit for human food.

Joint-Ill.—The term "joint-ill" or "joint-felon" is applied to two very different forms of disease: (1) To *septic arthritis*, resulting from septic inflammation of the navel; (2) To an acute exudative arthritis, in which large quantities of plastic lymph are thrown into the cavity of the joint, leading to permanent stiffening (*anchylosis*) and deformity; or, being followed by rapid softening processes, and producing abscess within, and destruction of, the joint. Both forms occur in young animals deriving their nourishment direct from the mother, are undoubtedly due, in the main, to nutritive defects in the milk, and are frequently associated, especially in the lamb, with some form of blood disease in the dam, such as malignant parturient fever.

In septic joint disease resulting from inflammation of the navel —the co-existence of the latter can be easily shown, as stated in the section on navel-ill—the affection arises within a period of a week or ten days after birth, and runs its course very rapidly, the joint disease being the result of absorption of pyogenic germs from the structures of the navel. In exudative arthritis the symptoms are more largely evidenced at a later period (seven to

twenty-one days) after birth, and are not necessarily, nor indeed commonly, associated with umbilical lesions. In either case, systemic effusions and exudations may be discovered on *post-mortem*, and the flesh is absolutely unfit for dietetic purposes.

Navel-Ill.—This condition, naturally, is seen in recently-born animals only, and more largely in the lamb than in the calf. Its lesions may be confined to the structures of the navel only, constituting *omphalitis*, or may involve the umbilical vein, constituting *omphalo-phlebitis;* in the latter case the lesions may, by continuity, extend to the liver also. The disease has its origin in a depraved state of the mother's blood, or in insanitary surroundings, and prevails extensively in some districts in unfavourable seasons. In healthy animals the umbilical vein becomes plugged with a clot of blood, which, after acting the part of a hæmostatic, is removed by absorption, and the navel aperture becomes rapidly closed by new tissue, and effectually sealed; but if the blood of the dam is depraved, or the surrounding conditions are insanitary, the clot of blood and the lacerated umbilical tissues present splendid media for the development of micro-organisms, and a septic inflammation, or, in some cases, an erysipelatous inflammation is established. This process may be localised in the cellular tissue of the navel, it may extend anteriorly to the fore extremities, or posteriorly to the thighs; or, in the male, to the scrotum; or it may extend along the umbilical vein in a forward direction to the liver, or along the urachus (the tube conveying the urine to the allantoid sac) in a backward direction, to the bladders, and even to the peritoneum. It may kill the sufferer in a period varying from thirty-six hours to several days, or it may induce various forms (usually of a septic character) of joint disease. On *post-mortem* examination systemic effusions and exudations are discovered, and, not infrequently, hepatic multiple abscesses exist.

Apart from the comparatively small value of young animals, the existence of such lesions emphatically warrants the condemnation

of the flesh, and such carcases should be especially sought after by those responsible for the proper conduct of establishments in which potted delicacies are prepared.

Malignant Parturient Fever is a disease which occurs in the ewe only, is a result of a depraved condition of the blood induced by improper management, *e.g.*, feeding on unlimited quantities of turnips grown with an excess of artificial manures, or upon roots in a state of decay and decomposition, or upon the grass of fouled pastures; it is also produced by allowing access to foul water, the gustatory function of parturient animals being frequently depraved. It is the cause of great loss in parturient ewes, at times attacking large numbers in individual flocks; and it is frequently associated with disease of the navel or of the joints in the offspring of affected animals. It occurs within a few hours after parturition, is very fatal, and runs its course very rapidly, usually in a few hours. It is in some cases accompanied by septic inflammation of the udder or of the womb, and on *post-mortem*, the conditions described as resulting from septicæmia are discovered. Inasmuch as local blood lesions are most largely confined to the pelvic tissues, and to the hind quarters, the butcher frequently endeavours to disguise the pre-existence of the disease by removing the former with the knife, or if the muscles of the hind quarters only are the seat of extravasation or effusion, he will expose the fore quarters alone for sale. The remarks as to the unwholesome character of septicæmic flesh apply equally in these cases.

Purpura Hæmorrhagica.—This disease is marked, primarily, by the pouring out of serum, or of blood, or of both, from the vessels into the different structures of the body, mainly into the muscular and intermuscular tissue, and under and into the skin and the mucous membranes; secondarily, by shifting (*metastasis*) of the lesions to such internal organs as the lungs and the bowels, and occasionally to the throat. The affection is most largely seen

in the horse, but it sometimes also affects sheep, cattle, and pigs. It is to all intents and purposes a blood crasis, due, in most instances, to the effects of other diseases, such as fever of a low type; to debility, to impure food, air, or water. On *post-mortem* examination the lesions may be readily confounded with those of anthrax, swine fever, and septicæmia, as the blood infiltrates the tissues of the organs involved, but it is not usual to find the lymphatic glands affected, nor are the specific lesions of swine fever present in the intestines, and no bacilli or other micro-organisms are found on microscopical examination in the blood. The flesh of such animals is not only unmarketable but unwholesome, and should always be condemned.

Red or Black Water.—This term is applied to a blood disease affecting cattle and sheep, solely from the fact that the urine is, in cattle, of a red or blood colour, and that in sheep there is effusion of bloody serum into the abdominal cavity, a condition it may be remarked, sometimes spoken of as *braxy*. Both in sheep and cattle it occurs as a sporadic disease, though in the case of the former a large proportion of an individual flock may die in the space of a few days. It is generally believed that it is due to dietetic causes, *e.g.*, excess of water in the food, and as a result thereof a superabundance of water in the blood (*hydræmia*); it may be due to excess of saline matter in the food, notably, in my opinion, the saline phosphates. It makes its appearance most largely when animals are feeding on turnips or grass, the growth of which has been unduly stimulated by artificial manures or by excess of water. In some districts (especially the eastern counties of England), it occurs very largely shortly after parturition, hence it is frequently attributed to the effects of this natural process. Parturition, however, is only a predisposing cause to its development. On the Continent it is seen in malarial districts and on marshy lands, and is by some attributed to the effects of a miasm, and by others to the influence of micro-

organisms. In this country there is not as yet any positive evidence to show that it is a micro-parasitic disease, nor indeed do its etiological, pathological, or clinical characters warrant such an assumption. The discoloration of the urine in cattle, and of the ascitic fluid in sheep, is due to solution and separation of the colouring matter from the red blood cells, and in cattle the urine also contains albumen, hence the disease is known technically as *hæmoglobinuria*. Exceptionally this condition is established by the action of such poisons as phosphorus, and by the gases liberated in the process of combustion in the burning of cow sheds or other places in which animals are housed. The effects exerted on the tissues and organs in *red water* depend largely on the length of time the animals live; mainly, it may be said, it produces a condition of anæmia, though, owing to the rapidity with which many animals succumb to its effects, the tissues do not contract the marked pallor seen in prolonged anæmia. They are, however, more or less pallid and flaccid, and if the animal has been feeding upon turnips the odour thereof is distinguishable in the flesh. Effusion of serum, sometimes blood tinged, is in many cases detected in the deeper parts of the flesh, which may be jaundiced. The kidneys are sometimes large, pale, and flabby, at other times congested; and the liver is frequently enlarged and congested. The blood is more fluid and paler in colour than normal, and diminished in quantity. If an animal is so ill as to render its slaughter advisable, its flesh is certainly unfit for human food.

Urticaria (*Nettle Rash*) is most frequently seen in the pig, and may attack a large number of swine simultaneously. In the ox, urticaria is not seen. Blain, however, bears a close analogy to it in its causation and course. It is a benign and comparatively transient malady, recovery usually being complete in a few days; it is associated with some fever and general malaise, and may readily be mistaken for swine fever. Its manifestations are mainly

the formation of *purpuric lesions* in the skin, of a circular shape, and circumscribed in extent, diffused more or less over the surface of the body, and due to extravasation of blood into the cutaneous tissues. These symptoms pass off, as a rule, without producing any breach of surface, but there may be secondary eruptions before convalescence is established, and even the formation of pustules; occasionally a little blood is seen at the inner canthus of the eye. The disease is due to mal-nutrition of the blood as the result of faults in dieting, and in many of the cases which have come under my immediate observation, it has been distinctly traceable to the ingestion of a too liberal allowance of cabbage or some similar vegetable matter, or to impure or decomposing animal food. There is no change to be observed in the nutrition of the tissues, and, as a rule, the lesions are superficial; the internal organs are healthy but there may be effusion of small quantities of serum into the chest, the abdomen, or the pericardium. Unless there is distinct evidence of mal-nutrition of the tissues, or extensive local lesions, it is a question whether the flesh of animals affected with this malady should be condemned. Practically, however, the question is scarcely likely to arise, as slaughtering, unless under the influence of panic, is seldom resorted to by the owners of swine; if it is, the inspector of meat is hardly justified in passing the carcase of an animal, in which purpuric lesions are pronounced, as marketable or innocuous, notwithstanding the fact that the flesh may be firm and dry.

Another eruptive affection is sometimes met with in the pig, *viz.*, *Measles.* Here, however, there are no purpuric lesions, but in their place numerous small papulæ, of a red colour, form on the skin, and fade away again in the course of a few days; secondary, and even tertiary, symptoms sometimes occur. The eruption of the papulæ is not accompanied by any marked febrile condition, neither are the normal functions interfered with or the nutrition of the tissues disturbed.

PARASITIC DISEASES.

IN considering these, it is as well that I should point out that internal parasites are arranged in four classes, viz.—

A. Protozoa.—The lowest forms of animal life—*psorosperms.*
B. Cestodes.—Cystic or bladder worms.
C. Trematode.—Flat worms—flukes.
D. Nematode.—Round worms.

The relative positions occupied by the different classes of these organisms in the scale of creation is in accordance with the foregoing arrangement. For the purposes of this work it will only be necessary to notice those parasites which are of importance to the sanitarian, and particularly those that are intertransmissible between man and animals. Attention will also be directed to the effect produced by parasites on the tissues of their dumb hosts, and through them, where ill effects follow the ingestion of such tissues, upon man.

It is, so far, a fortunate circumstance that but few of the parasites of animals, whose flesh is used for food, and those of man are intertransmissible; equally, it is an unfortunate circumstance that of those which possess such attributes their effects render them exceedingly unpleasant companions, and, in one case at least, highly dangerous to health and happiness.

The subject is one anent which a considerable amount of ignorance exists, not only in the lay, but in the professional mind also; and in proof of the latter assertion I may quote an example (one only out of many) of gross ignorance which came under my

personal notice. Several years ago a near relative of my own, residing in one of the midland counties of England, became the subject of hydatid disease of the liver, and the medical man in attendance gravely told my friend "that the disease had been contracted by the drinking water having become fouled by the drainage from the piggeries."

A. Protozoa.—(*a*) *Coccidium Oviforme* (Leuckart).—In the first edition of Davaine's work (1860) on Parasites, these Protozoa are termed "Corps Oviformes," a designation applied to them on account of their resemblance, morphologically, to the eggs of a worm. This resemblance has been noticed by other observers also, but they are now universally recognised as Coccidia.

The following description of these bodies is given in Dr. Hoyle's translation of Leuckart's work on Parasites :—

"Egg-shaped bodies, 0·033 to 0·037 mm. long and 0·015 to 0·002 mm. broad, with thick smooth shells, which have a micropylar opening at one end, usually the narrower. The granular contents are sometimes uniformly distributed throughout the whole interior space, or sometimes, as in the globose forms, collected into a spherical mass (0·017 mm.). In this state the parasites pass from the liver and intestine which they inhabit to the exterior, there to undergo a further development in the moist surroundings. The contents thereupon segregate into four oval spores, which become surrounded with a but slightly firm coat, and form each a single C-shaped curved hyaline rod, the concavity of which is occupied by closely-packed granules."

Speaking of their embryonic condition, Leuckart says—"In their youth these parasites are naked inhabitants of epithelial cells, but afterwards envelop themselves with a firm shell at the close of their period of growth. In this condition, in which they present a puzzling resemblance to the eggs of certain Entozoa, they quit their former resting-place, and generally the former host also, and transform their substance into a larger or smaller

number of spores, each having a granular ball and rod within. The spores themselves have a rather thin wall, and are of a round or elliptical shape."

These organisms are found in many warm-blooded animals (including man), their habitat being, mainly, the intestines, the liver, and the bile-ducts. A species of Coccidia is also found in various organs and parts of the body of the fowl; indeed Leuckart quotes an instance of an epizootic occurring at Pisa in 1872, in which the lesions were localised in the pharynx, larynx, nose, conjunctiva, intestine, and comb, and which was attributed by Silvestrini and Revolta to the action of the Coccidia.

In this country, however, such lesions are usually attributed to the action of tubercle bacilli.

In the first edition of this work, p. 142, I described certain small bodies, which I have frequently found located in the inter-muscular connective tissue of fowls affected with tuberculosis, and which I thought were of a tubercular nature. I confess I have never taken measures for testing the accuracy of my belief, and it is possible that these bodies are of a coccidian rather than of a tuberculous origin. In any case one could scarcely recommend that the bodies of fowls in which these bodies exist should be used for human food. Coccidian disease occurs most largely in the rabbit, and its lesions are usually observed in the liver of this animal; they resemble, in a marked manner, the nodular lesions of tuberculosis, and their existence gives rise to emaciation and anæmia, the abdomen becoming enlarged owing to the increase in the size of the liver.

If, as is generally held, these psorosperms require to escape from the body by way of the intestinal canal in order to pass through certain transitional stages in development, it is obvious that the ingestion of the organs of affected animals by man can be a matter of no importance; nevertheless, as before indicated in speaking of poultry, it would not be a wise procedure to allow

the organs or even the bodies of animals so affected to be used for the purpose of human food.*

(*b*) *Miescher's* vel *Rainey's Tubes.* — These psorosperms were discovered by Miescher in 1843 and by Rainey in 1857, and while being acquainted with them (theoretically) from reading the second edition of Davaine's work, they entirely escaped my mind when preparing the first edition of "*Meat Inspection.*"

In June of last year I received a letter from Dr. J. C. Thresh, Medical Officer of Health for Chelmsford, drawing my attention to some minute saccules (mounted specimens of which were also sent by Dr. Thresh) which he had removed from a piece of ham. At first I was somewhat puzzled as to the nature of the saccules in question, but on showing them to my colleague, Prof. M'Fadyean, he suggested that they were probably Rainey's tubes, and subsequent investigation proved the correctness of this view.

Miescher's tubes are found in the muscular fibres of various animals,—according to Leuckart, in the pig, ox, sheep, and deer; and according to Davaine, in the rat, the horse, and the goat. In addition, Miescher, it is stated in Dr. Hoyle's translation of Leuckart, first discovered them in the mouse, but according to Davaine, they were first noticed by Miescher in the rat. Davaine also states that Rivolta and Silvestrini found them in the pharynx, larynx, and œsophagus of a fowl; but I think it is more than likely that the remarks of these two observers, to which he refers, applied to the coccidia oviformes, not to Miescher's tubes.

As described by Leuckart, the boundary wall of these bodies consists of a somewhat thick and firm cuticle, perforated by numerous pores; inside this capsule are found, embedded in a

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* Mr. Archibald Park, M.R.C.V.S., of Hobart Town, in a letter received from him in December of last year, informs me that in 1884 he found 80 per cent. of the rabbits in Tasmania affected with *coccidian disease*, that he has seen it in young rabbits under fourteen days old, and that Mr. Edward Stanley, F.R.C.V.S.,of Sydney, found it abundantly in N. S. Wales in 1889.

tough somewhat homogeneous matrix, a number of kidney-shaped bodies (0·01 m.), and in the younger tubes betweeen these bodies are numerous round transparent balls. "Probably," says Leuckart, "these balls are immature stages of the kidney-shaped bodies."

While Leuckart states his belief that he, on one occasion, succeeded in infecting a pig by means of ingestion, he points out that, according to Manz these bodies are always destroyed by the digestive juice, and further, that while according to Davaine, Leising, and von Neiderhäusern, they cause in animals difficult respiration, and symptoms allied to paraplegia, *they have never yet been found in man.*

Their importance to the sanitarian lies in the fact that the lesions they give rise to may be readily confounded with other and more important forms of parasitism.

B. Cystic worms, i.e., *Tape Worms and their respective Hydatids.*—Of these we have (*a*) the Tænia Echinococcus of the dog and its hydatid (E. Veterinorum), found in all animals, and in man; (*b*) the T. Cœnurus of the dog and its hydatid (Cœnurus Cerebralis), found in the sheep and the ox, and occasionally in man; (*c*) the T. Marginata of the dog and its hydatid (Cysticercus Tenuicollis), found in the sheep, the ox, and occasionally in other animals also; (*d*) the T. Serrata of the dog and its hydatid (Cysticercus Pisiformis), found in the rabbit; (*e*) the Tænia Solium of man and its hydatid (Cysticercus Cellulosæ), found in the pig; (*f*) the T. Mediocanellata of man and its hydatid (Cysticercus Bovis), found in the ox.

(*a*) The *Echinococcus Veterinorum* is derived from the T. Echinococcus of the dog, and probably from other carnivora also. While the tape worm itself is the smallest and most insignificant of the species, its hydatid is the most universally distributed of all the hydatids, and, from a sanitary point of view at least, it is the most important, though fortunately this remark does not apply to the consumption of flesh.

The hydatid is found mainly in the liver and in the lungs of cattle, more frequently in adults and in the aged than in young animals; and while it is a fact that certain foreign cattle, notably Danish and Icelandic, are more liable to the affection than are our own home breeds, it is equally a fact that the latter are affected in very much greater numbers than is generally supposed. Thus, in the course of my inspections, I frequently find the lungs of from 20 to 30 per cent. of cattle affected; but it must be observed, this applies to aged dairy cows mainly. Horses, sheep, pigs, and other small animals, suffer in a much smaller degree than do cattle. The hydatids may be in the form of simple cysts, containing (apparently) a clear serum; they may assume the form of multiple cysts, *i.e.*, numerous cysts formed in the interior of a primary cyst (*endogenous cysts*), the hydatids being of various sizes; or there may be several cysts developed from the exterior of a primary one (*exogenous cysts*). In the early stages of their formation they contain a limpid fluid, which, if set at rest in a glass vessel, sometimes deposits a fine sediment resembling grains of fine white sand, each one of which will be found on microscopical examination to represent an embryonic tape worm. In the advanced stages of their growth these cysts undergo degeneration and become of a yellow colour and opaque, a large portion of their contents becoming absorbed. In this state they may readily be mistaken for tuberculosis, and it is in order that the reader may be able to distinguish between the two conditions, that a representation of a section through a mass of multilocular cysts in the liver of the ox has been introduced into this work.

The existence of these hydatids in any organ warrants its condemnation as an article of human food, as, although no direct harm could possibly accrue from its consumption by man, the idea of eating such organs is repulsive; and a vast amount of indirect harm may be produced by allowing such organs to be used for feeding dogs, as the tape worm is thereby perpetuated in

the intestines of these animals, and the segments of the worms, passing out with the fœces, may contaminate drinking water and also such uncooked food as salad. While the presence of these hydatids in the structures of important organs does not necessarily produce any deleterious effect on the flesh, their existence in large numbers may—by pressure, and by setting up chronic inflammation—so far interfere with (or even annihilate) the functions of organs, as to bring about marked changes in the flesh; thus, if the liver is largely invaded, jaundice, emaciation, and dropsy (either of the abdomen or the hind legs) may be present; if the lungs, oxidation is interfered with, and the flesh becomes dark and soapy; if the kideys, uræmia, dropsy, &c., may result.

(*b*) *The Cœnurus Cerebralis* or many-headed (*polycephalous*) hydatid is found mainly in the brain and in the spinal canal of the ox and sheep (mostly in young animals), producing "gid," "sturdy," or "staggers" in the former situation, and "thorter ill" in the latter. It is occasionally found in the muscles of animals, and has been discovered in those of man. Its progenitor is the Tænia Cœnurus of the dog. Its effects upon its hosts are not, in the early stage, of sufficient importance to produce material changes in their flesh, but if it is allowed to increase in size and to cause absorption of the brain structure, the host rapidly emaciates, becomes anæmic, exhibits symptoms of brain derangement, and in the end dies from inanition or exhaustion. The sanitary aspect of sturdy is not an important one, as no deleterious effect is directly produced on the flesh; indirectly harm results in advanced cases from the innutritious quality of the flesh. As in the case of the Echinococcus, much might be done to diminish the prevalence of sturdy by adopting the precaution of destroying the bladder worm (bleb) when it is removed from the brain of its host, instead of throwing it, as is now so often done, to dogs, or allowing them to lie about for these animals to pick up and devour, thus perpetuating the tape worm in their own intestines.

(*c*) *The Cysticercus Tenuicollis* — Slender or long-necked hydatid—is found in the abdominal and pelvic cavity of the sheep, the pig, the ox, and the fowl. Its progenitor is the Tænia Marginata of the dog. It is usually found suspended, sometimes in large numbers, in an adventitious (nutrient) membrane to the outside of the abdominal organs, most largely to the omentum and mesentery, presenting the appearance of bladders varying in size from a horse bean to a hen's egg, and containing a transparent fluid. Viewed *in situ*, little can be seen of the hydatid proper, but if the cyst is closely looked at, a white spot or body, about the size of a vetch seed (the head) is seen floating in the fluid contents of the vesicle. If the adventitious cyst is cut through, the hydatid is liberated and falls by virtue of the weight of its contained fluid to the ground. These hydatids are of less importance than are others that are found in the bodies of animals, and being situated on the outside of organs, they do not interfere with them either mechanically or functionally, and even when existing in large numbers, the carcase of the host may be, and usually is, in splendid condition. If emaciation exists, it is due to some other cause. As in the case of the foregoing so here, all such bladders should be carefully removed and effectually destroyed.

(*d*) *The Cysticercus Pisiformis* is found mainly in the abdominal cavity of the rabbit and of the hare, and, in its immature state, in the liver of these animals. It varies in size from a vetch seed to a small filbert nut, is flask-shaped, and shows a greater advance towards the formation of the tape worm than does the hydatid of any other of the Tæniæ. Its progenitor is the Tænia Serrata of the dog. It sometimes exists in such large numbers as to cause emaciation, exhaustion, and death of its host. It is of no sanitary consequence, as it is not likely that the carcase of the rabbit is ever eaten without the abdominal contents being first carefully removed, and further, the tape worm is developed only in the intestines of the dog or other carnivora.

(*e*) *The Cysticercus Cellulosæ* is found inhabiting the inter-muscular connective tissue of the pig, producing the condition known as "*measles.*" It varies in size from a vetch seed to a small horse bean, and exists in enormous numbers in the body of its host. Its progenitor is the Tænia Solium, or solitary tape worm of man. In addition to its being found in the muscles, it is sometimes located in very large numbers in the liver and the spleen, giving that organ, on section, a peculiar mottled and pitted appearance, and rendering it of a more solid consistence than normal. A careful examination of the peculiar greyish spots reveals their cystic character, and when the cysts are removed by the aid of a pin or a needle, a loculus or space is left behind. The condition of the iver is well shown in our illustration, which represents a section of that organ removed from the body of a pig by Mr. A. E. Paley, M.R.C.V.S., Walsall.

While it is a fact that the hydatid is found mainly in the body of the pig, it sometimes finds a habitation in that of other animals, and has even been found to co-exist with the tape worm in man. During life there are but few indications of the existence of this worm in the tissues of its host; the body has a bloated appearance and a soft flabby feel, and if steady but firm pressure is applied, a crackling sensation, produced by bursting of the cysts, is imparted to the fingers of the manipulator. In some cases which came under the notice of Mr. Paley there was cyanotic discoloration of the skin—not unlike that seen in swine fever—with marked difficulty in respiration. The only positive sign to be obtained is in the mouth, in which cavity a row of translucent bead-like tumours may be detected on the inferior and lateral aspect of either side of the tongue, or between it and the lower jaw.

When the flesh of the affected pig is cut up, the section presents a pale flabby appearance, and imparts a slimy feel to the fingers; it is soft and apparently dropsical. The bladder can be readily distinguished on close inspection of the muscles. If the hydatids

have been in existence for a considerable period, their coats will have undergone calcareous degeneration, and in this case a grating sensation is imparted to the knife on section. Measly flesh does not resist putrefaction nor does it take on salt, and it remains more or less pale and flabby after prolonged curing and cooking, but if calcareous degeneration of the cysts has taken place the flesh is usually quite firm, and section reveals the altered cysts as chalky-like masses, which, on section, impart a grating sensation to the hand as the edge of the knife passes through the flesh. These chalky masses are represented, though somewhat imperfectly, in our illustrations, and are frequently met with in hams, both of home and foreign production. While the devouring of such flesh in a raw or semi-cooked condition by man would inevitably produce the solitary tape worm in his intestine, such a result could not possibly take place if the flesh were subjected to the effects of proper cooking, as a temperature of 140° or 150° F. is sufficient to devitalize all forms of hydatids. When calcareous degeneration has taken place no harm can possibly accrue from the consumption of the flesh, nevertheless, it is not pleasant to sit down to breakfast or luncheon with a measly ham as the *piece de resistance* of the meal. That tape worm infection of man from measly pork is of tolerably frequent occurrence is proved by the fact that the Tænia Solium is so often found infesting the human intestines, and this fact is sufficient to warrant the condemnation of all measly flesh.

(*f*) *The Cysticercus Bovis* (*Beef Measle*) has its habitat in the muscles of the ox (mostly in the calf) in the same situation as that occupied by the C. Cellulosa in the pig. It is, however, found to the greatest extent in the muscles of the haunch, and the muscular parieties of the heart. As in the pig, so in the calf, the hydatids are sometimes developed in the mouth. Its progenitor is the Tænia Mediocanellata of man, and it is—owing to the dirty habits of some of the natives—met with much more

frequently in India than elsewhere. The remarks already made in reference to the Cysticercus Cellulosa of the pig, apply, in a sanitary sense, to the beef measle.

Cysticercus Ovis (*Mutton Measle*) is, so far as I know, never met with in Great Britain, nor has it yet been satisfactorily shown from what tape worm it originates.

Tape Worms, by virtue of their inhabiting the intestinal canal only, are of no consequence from a sanitary point of view, inasmuch as in all cases in which gut is used for edible purposes, its loose contents are carefully removed by washing; and even if this were not the case, no harm could accrue if the ova of the worms were ingested by man, seeing that with the exception of the Tænia Echinococcus of the dog, hydatids rarely find a habitat in his system.

FLUKE WORMS.

C. Trematode Worms, i.e. *Flukes.*—Practically, of the Entozöa belonging to this class there is only one of any importance in a sanitary sense, viz., *the Distoma, vel Fasciola, Hepaticum* or *Liver Fluke.* This worm inhabits the bile ducts of the liver of the sheep and the ox, and occasionally the bile ducts of the horse, and gives rise, in sheep, to the well-known disease "*Liver Rot.*" Inasmuch as the Entozöon is universally distributed, rot is found to exist more or less in all parts of the kingdom, but to a much greater extent in damp and swampy districts (except salt marshes) than in others. In wet seasons the disease prevails extensively, and is the cause of a greater monetary loss than any other parasitic disease to which animals are subject.

Rot is, directly, of absolutely no consequence to man, seeing that if portions of a fluke-infected liver were devoured by him no parasitic infection could possibly occur. Indirectly, the disease is of vast importance, not only on account of the great monetary

loss which it annually entails upon the nation, but also from the immense and incalculable diminution of our food supply which results from its ravages.

The most important effect produced in the liver by the fluke worm is the initiation of extensive organic disease, which, by annihilating the function of the organ, leads to emaciation and exhaustion of the host, whose tissues become dropsical and innutritious. If no important tissue changes exist, the flesh is absolutely innocuous, otherwise the rules already laid down in reference to jaundice, leanness, and dropsy, apply, without direct reference to the condition of the liver itself. In all cases the liver and the contents of the intestines should be destroyed, not only on account of the structural alterations which may exist in the former, but in order that the ova of the worm shall be destroyed also.

D. Nematode or *Round Worms.*—With the exception of the Trichina Spiralis, none of the worms in this class are of any importance from a sanitary point of view, nor are they as a rule met with in any of the structures or organs of animals. In large numbers, however, they may so far interfere with digestion and nutrition as to bring about emaciation and dropsy in the host, and thus render the flesh unfit for food. Round worms, or their embryos, are seldom met with in the tissues of those mammalia whose flesh is ordinarily used for human food, but while this is so, such worms are occasionally met with in the tissues of fishes: and seeing that the life history of many of the parasites in this class is at present a sealed book, it is possible that this fact may be of much greater sanitary importance than is a consideration of the general question. The vast majority of the worms of this species inhabit the alimentary canal of their hosts, and in those cases where the intestines are used in the manufacture of sausages, polonies, &c., the processes to which the gut is subjected are usually sufficient to ensure the removal or

destruction of the parasites, their ova, or embryos; nevertheless it occasionally happens that, owing to sufficient care in this direction not having been observed, entozoa may be left adhering to the mucous membrane of the gut, and it certainly is not a pleasant thing to find a specimen of a strongylus or of a whip worm (*Trichocephalus*) clinging to the inner surface of the skin of a sausage which one is intent upon devouring for breakfast.

The Trichina Spiralis, notwithstanding its minute size, is the entozoa that is most dreaded by sanitarians, and in certain continental countries, *e.g.*, Germany—and in some of the States of North America—it is the one most eagerly sought after by meat inspectors. The fact that it has its habitat in the flesh of swine alone materially limits the area over which inspectors have to make their search; but inasmuch as its presence cannot be detected by the naked eye alone, it follows that the examination of such flesh, to be effectual, can only be undertaken by experts.

The Trichina Spiralis is a minute round worm of hair-like dimensions, and is found lodged within the muscular fasciculi, in lemon-shaped cysts, in which it lies coiled upon itself in a spiral manner. When fully developed its extreme length does not exceed one-eighth of an inch, and for its detection a very strong lens or a low power of the microscope is required. As already observed, the trichinæ find their habitat in the structure of the muscle of the pig, and it is calculated by Dr. Sutton that a cubic inch of flesh may contain 100,000 parasites. The cyst wall is composed partly of organic (membranous) and partly of inorganic (calcareous) matter; the presence of the latter protects the parasite against the effects of such destructive agents as salt, and to a limited extent against heat, cold, smoke, and similar influences. In reference to the effects of salt on this parasite, it may be useful to quote the results of experiments carried on by M. Fourment. In April 1881, this observer took a piece of trichinised American pork, and after embedding it in fine salt placed it in a flask which

he sealed hermetically; in April 1882 the pork was well washed and administered to mice, and living trichinæ were subsequently discovered on *post mortem* examination in their intestines.

M. Fourment believes that the cyst-wall of the trichinæ does not become sufficiently calcified to protect the parasites from the effects of salt until a period of twelve months has elapsed after encystment. The trichinæ are found to the greatest extent in the voluntary muscles, and, up to a comparatively recent date, most observers were of opinion that the adipose tissue was free from them. In 1882, Chatin (*Lancet*, 23rd September 1882) demonstrated the presence of trichinæ in the fat of the body of the pig in large numbers; but he further demonstrated a most important fact in connection therewith, viz., that when animals were fed on such fat they did not, as a rule, become trichinized. If a portion of trichinized flesh is ingested by man, the trichinæ, by the combined action of the gastric juice and of pepsin, become liberated, and in the course of a few days they originate a new brood, the members of which pass through the wall of the intestines and find their way into the voluntary muscles, penetrating even as far as the tips of the fingers. The condition produced by the parasites is known technically as *trichinosis* or *trichiniasis*. Each female trichina gives birth to a brood varying in number from several hundreds to a thousand or more, and it is calculated that the parasite may retain its vitality in the encysted state for a period of fifteen or twenty years. Looking at the vast importance of this question, it is necessary that the sanitary inspector should be ever on the alert for such flesh, and submit it, if its true condition is suspected, to examination by an expert. The parasites may be detected by means of a very simple process; but I think I cannot do better than introduce in this place extracts from an article by Mr. George W. Morehouse on the examination of trichinized flesh, which appeared in the *Veterinarian* of July 1879.

In microscopical research Mr. Morehouse says, "that it is

undeniable that microscopists waste a good deal of valuable time by the use of higher powers than are necessary, and by imperfect preparation of objects for examination. In nothing is this more forcibly illustrated than in the examination of pork for trichinæ. For this purpose it is customary to use powers of 75 diameters and upwards (seldom as low as 50), and the meat is not always made sufficiently transparent for ready detection of parasites. A power of 25 diameters, obtained with a good 2 inch objective and 2 inch ocular, is amply sufficient. With the 2 inch we have greater depth of focus, the object is still shown with great clearness, and most important of all, we are able to do as much searching in one hour, as it would take about nine hours to accomplish with a ⅔ inch objective."

As to preparing pork for present, rapid, and accurate observation, he has found the following method to work well: "Cut thin longitudinal sections from the extremities of muscles, and from other favourite localities where the worms, in migrating, stop in great abundance, and place the sections in a watch glass, covering them with acetic acid. In a few minutes the tissues will be transparent enough to enable one to see the letters through the specimen when the watch glass is placed on a printed page. Drain off the acid, add water, and examine; or wash and transfer to a glass slip (large, with large cover for a number of sections at once) either in water or glycerine, and cover. For permanent preservation, while the sections are still in glycerine, press them for several days between plates of glass, and mount at leisure in pure glycerine. When thus prepared the parasites remain coloured more highly than the surrounding muscular fibres, and readily attract the eye. They are so plain, that none, when brought into the field of view, can escape instant detection. The process is simple, takes but little time, and is inexpensive."

DISEASES ASSUMED (OR PROVED) TO BE DUE TO THE ACTION OF MICRO-PARASITES.

1. Anthracoid Diseases.

(1.) Black Quarter.—*Striking*, *Blood Striking*, *Black Spauld* (Scot.).

THIS malady, which is classed amongst the anthracoid diseases, is seen in the ox and in the sheep, and usually in young animals only; occasionally, however, adults fall victims to its destructive influence. Formerly it was attributed to dietetic influences; but while these undoubtedly play a great part in its production, there is required a second element for its production, viz., a bacillus, which is found abundantly in the fluids of the local lesions, but has only rarely been demonstrated in the blood, though an indirect proof that it does reside in that fluid is afforded in the fact that if some of the fluid from the diseased tissues is injected into the circulation of a healthy animal, and an injury sufficiently severe to produce extravasation of blood into the tissues in any part of the body is inflicted, the characteristic local lesions quickly develop at the seat of the injury. In cattle the lesions are usually localized in the limbs,—hence the terms "*Black Quarter*," "*Quarter Ill*," "*Black Leg*," "*Leg Ill*,"—occasionally in the neck and on the sides or back, but in sheep they are frequently more diffused. Death results in a very few hours after the appearance of the symptoms, and if the animal lives for a sufficient length of time, mortification of the affected parts ensue, and gases are liberated which produce marked emphysema. On *post-mortem*

examination the tissues of the affected part present to the eye the characteristics of sphacelus, infiltration of blood, or of bloody serum, being very extensive and very deep. The blood itself is dark in colour, but its condition will depend upon the length of time the animal has lived and upon the method of death; if it has been slaughtered in the early stages, the blood does not show any marked departure from the normal; but if it has been allowed to live for some hours, and if no blood has been abstracted from the veins, it is very dark in colour and of a tarry consistence. The local lesions of this disease must be carefully distinguished from those which result from a blow or other injury—*vide* extravasation. In marked cases there is systemic effusion and discoloration of tissue, with congestion, or even extravasation, into the tissues of the more vascular internal organs. In those cases in which the animal has been in good condition, and has been properly slaughtered and bled before the disease is far advanced, the unaffected parts of the carcase are usually healthy in colour, and dry and firm; and if separated from the diseased parts even an expert could not possibly affirm that the animal of whose body they had formed a part had been the subject of such a grave disease.

The sanitary aspect of this question is very important, as the lesions of the disease may be confounded with those of anthrax. To my personal knowledge the unaffected parts of the carcase are largely consumed as human food, and so far as I have seen are never productive of harm to the consumer; neither am I aware that there are any instances on record of transmission of the disease to man; nevertheless, an inspector of meat would scarcely be justified in passing such a carcase as marketable or wholesome, if he had undoubted evidence of the nature of the disease from which the animal had suffered, and more especially if there had existed important lesions in the internal organs, or if the blood presented evidence of marked nutritive changes.

(2.) ANTHRAX.—*Charbon* (Fr.), *Milzbrand* (Ger.), *Cumberland Disease* (Australia), "*Loodianah*" *Disease* (India), *Horse Sickness* (Cape).—The term Anthrax is derived from the Greek, and signifies "a live coal." Its synonyms are *Splenic Apoplexy* and *Anthrax Fever*. *Malignant Pustule*, and *Wool Sorters' Disease* in man owe their origin to accidental inoculation with the virus of this malady. The affection is most largely seen in cattle and sheep, sometimes in the pig, the dog, and the horse, but few animals are proof against inoculative contagion. It is the most deadly disease to which the animal body is heir, and it runs its course with greater rapidity than does any other disease with which we are acquainted, death frequently resulting, in cattle, within the space of one or two hours after animals have been observed to be, to all outward appearance, in a perfect state of health. Its rapid course is only equalled by its malignity, few animals, especially cattle, recovering from its destructive influence.

Anthrax owes its origin to the influence of a micro-organism, viz., to a fission fungus, known as the *bacillus anthracis*, which is capable of multiplying in favourable pabulæ with great rapidity. This fungus is found mainly in the blood; but it is a remarkable fact, and one of great importance in a sanitary sense, that it never arrives at maturity in the system (blood) of animals, or, in other words, that it never in this situation forms spores, consequently the flesh (and its contained blood) is less virulent than it would otherwise be, as the spores resist the effects of destructive agents to a much greater degree than do the bacilli themselves, a temperature of 212° F. devitalizing the latter in the space of a few seconds, while steam at 100° C. only kills the spores after exposure for five minutes (Koch). In view of the fact that spores are not formed in the blood of animals, we do not require to consider them in relation to the consumption of anthrax flesh as an article of human food; but we must not overlook

the influence of *Ptomaines*, which are probably produced in greater abundance in this than they are in any other disease.

The deleterious influence of the anthrax bacillus is much less marked in the case of the sheep than in that of the ox, the former animal frequently living for some days, and recovery is not uncommon. The *post-mortem* lesions are also of a less pronounced character, as a rule, in the sheep, although instances not unfrequently occur in which the lesions are universally distributed over the body, giving the muscular tissue a dark red colour and constituting one form of *Red Braxy*. While the affection is much more certainly transmitted by inoculative contagion than by any other means; it is frequently transmitted by ingestion: thus, pigs, dogs, and even ducks, frequently contract anthrax by devouring the offal, flesh, and blood of animals that have succumbed to the effects of the malady. On the other hand, it has been shown that some of the secretions of infected animals are innocuous — lambs sucking upon anthrax-stricken ewes with impunity, but succumbing to the malady when such milk is injected under the skin—and according to Koch, sheep may be fed on unlimited quantities of bacilli with impunity; not so, however, with spores.

The lesions of anthrax are universally distributed in the tissues and organs of affected animals. The blood is viscid in consistence, but it coagulates only imperfectly. It is of a peculiar damson-like hue, and sometimes tarry in character; it distinctly stains white linen or the skin of the hand, owing to the breaking up of the red cells, and to solution of their colouring matter. Bacilli are usually found in it in greater or less abundance by microscopical examination, though instances are sometimes met with in which they cannot be so demonstrated. The blood stains the lining membrane of the veins, it emits in some animals a peculiar sickly odour — a fact to which my attention was first directed by my colleague,

Professor M'Fadyean,—and it rapidly undergoes decomposition. The muscular system may not, in the early stages, present any marked change if the body has been drained of its blood, but in the advanced stages of the disease it is dark in colour, more or less flaccid, and often of a soapy feel. There is usually some extravasation of blood into the muscles and into the inter-muscular connective tissue, or effusion of bloody serum, the latter being frequently found in close proximity to the bones; and effusion of serum into the various cavities of the body may be detected. The more vascular organs—as the liver, kidneys, and spleen—are all more or less engorged, though in some cases this fact is not patent to the unaided vision. In many instances the spleen is greatly increased in size, and its pulp is soft and dark in colour, and when removed by scraping has a grumous appearance; while in the most extreme cases its capsule may be found ruptured, thus allowing of the outflow of blood into the abdominal cavity. Sub-endocardial extravasation is common, as is also intestinal congestion and extravasation, the bowels sometimes containing large quantities of altered blood which bears a strong resemblance to semi-fluid black currant jelly. The lungs are often congested and sometimes apoplectic. In the horse and in the pig, the lesions are more frequently localised in the region of the throat than they are in other animals. The most important naked eye lesion is that which is very largely and very commonly found in the lymphatic and mesenteric glands, these organs presenting conditions allied to those seen in septicæmia and in swine fever, and between which it is sometimes difficult to differentiate without the aid of the microscope, or without having recourse to experiment.

In considering the question of the use of anthrax flesh as an article of human food, the extreme virulence of the disease, the great number of bacilli usually present in the blood, and the readiness with which it is transmitted from animals to man, must be borne in mind. In ordinary circumstances the bacilli would retain

their vitality in the blood and tissues for many days, in fact until decomposition has been established, and it has been shown that even when putrid decomposition is going on they may retain vitality for a period of from five to eight days. Absolute drying quickly kills the bacilli, but such a condition is never attained in the flesh of animals prepared for human food. It has been shown that a temperature of 212° effectually destroys the bacilli; but here, again, parts may escape, as in the cooking of a large joint, either by boiling or roasting, the deeper parts of the tissues are frequently never exposed to the influence of such a temperature. Salt is very deadly to all fungi, but no person can ensure that every joint of meat shall be effectually salted, and as bearing upon this point, an observation recorded by Peuch may be quoted. Peuch states that the juice from the muscle of a ham which had been salted (but imperfectly covered) for fourteen days, but in which there was no putrefactive odour, was virulent when introduced into the tissues of rabbits and guinea pigs, as was also a cultivation obtained from the juice of the muscle. The ingestion of the flesh of animals affected with anthrax by man is, to say the least of it, highly dangerous; and various instances are on record in which large numbers of persons have lost their lives by the use of such flesh, either as the result of a general or systemic infection, or as the result of an intestinal mycosis. Some authorities hold that infection could not take place through the medium of ingestion in these cases unless some breach of surface exists in the mucous membrane of the alimentary canal, but allowing that this is so, is it right to expose any human being to the risk of contracting a deadly malady for a mere monetary consideration? No matter what condition the carcase of an animal may present, or however firm and good it may appear, it should be unhesitatingly condemned and destroyed if indubitable evidence of the existence of anthrax is forthcoming; and not only the carcase but every organ and tissue of the body

should be effectually destroyed, as should also the skin or the hide. Fortunately the legislature has decreed that such destruction shall be carried out, so that it is not left an open question to be decided as the opinion of individual inspectors or sanitary officers may dictate.

(3.) *Blain or Stinge.*—This affection is considered here simply because little is known as to its true nature, and because its lesions are in some respects similar to those of anthrax. Blain is peculiar to the ox, and is marked by sudden swelling of the head, neck, and throat, and by the development of several large vesicles on the tongue, which organ is also swollen. In the cow the lesions are also developed in the vulva and vagina. The symptoms of the disease make their appearance very suddenly, and, as a rule, pass off again in the course of a few hours without producing permanent damage or endangering life; inasmuch, however, as the symptoms are sometimes very alarming, the owners of cattle in good condition prefer to slaughter the animals rather than run the risk of a total loss.

As already indicated, the nature of the affection is not well understood, further than that it is undoubtedly due to derangement of the blood, brought on probably by faults in dieting, especially by the allowance of large quantities of succulent vegetable matter, by the imbibition of an inordinate quantity of cold water when the body is heated, and by exposure to cold, particularly east and north-east winds. On *post-mortem* examination, effusion of serum and lymph is found in the tissues of the affected parts, and in the worst cases extravasation of blood also. While there is no evidence that the flesh of animals suffering from the malady is nocuous, it is distinctly unmarketable, and unless the blood has been freely drawn, dark in colour.

2. Zymotic Diseases.

Diphtheria and Croup.—While these affections are by some pathologists looked upon as distinct from each other, there are other pathologists who hold that the lesions are practically identical in nature, and that the differences in manifestation are due to differences in the histological character of the tissues in which they are developed. In man, the lesions of croup are usually developed in the mucous membrane of the larynx, in the upper part of the trachea, and contiguous parts; while those of diphtheria are localized in the mucous membrane of the pharynx and the fauces. This distinction, however, does not hold good in cattle, at any rate in adults, as in every case in which I have seen diphtheritic lesions in these animals they have been confined mainly to the larynx and the trachea.

Since it has become fashionable to charge the cow with being the progenitor of many of the ills to which man is heir, there has been added to her other delinquencies that of being the disseminator of diphtheria, and that too through the medium of her milk. So far as my experience extends—now upwards of thirty-five years—I have never seen a case of diphtheria, either in cattle or in any other domestic animal, in which it has had a spontaneous or primary origin in the system of the victim; and instead of the cow, the pig, or the fowl acting as sources of infection in outbursts of this malady, I have always had fairly conclusive evidence that the infection had been derived from a human source. Thus, a few years ago, when diphtheria was rife in the Stewarty, two examples of infection of cows and pigs from affected persons came under the observation of Mr. Campbell, F.R.C.V.S., of Kirkcudbright, the pigs having contracted the disease by the ingestion of materials which had been used for the purpose of poulticing the throats of the affected persons.

I have said that according to some medical practitioners the lesions of the disease are sometimes developed in the udder of the cow. If a person in attendance upon cows during the prevalence of the malady required to introduce a syphon or other instrument into the teats of the cow, and that instrument had been contaminated with diphtheritic matter, one can understand that the infection might readily be conveyed to the udder, otherwise the conveyance of the infection—in the face of the perfect closure of the teats by their sphincters—to the mucous membrane of the galactopherous channels is, to say the least of it, a very improbable contingency. It would be just as reasonable to say that the infection of gonorrhœa could be conveyed to the urethral passages of man without the intervention of contaminated catheters or similar instruments. Personally, I have yet to see my first case of diphtheritic mammitis in any domestic animal, though I do not deny that it may occur. In the same way medical writers have endeavoured to prove that diphtheria frequently has its origin in poultry, and have cited as proof thereof the lesions of tuberculosis which are so commonly developed in the mouth and throat; but I have often said, and I have no hesitation in repeating it here, that I have never seen spontaneous diphtheria in poultry, and I question very much if it ever so arises. Sometimes croupous and diphtheritic products are met with in the air passages or in the alimentary canal of the pig in swine fever, in the ox in cattle plague, and in the sheep in variola; and independent croupous inflammation occurs in these situations in young cattle, and in the throat of the pig and of the horse. Of the specific nature of these maladies, or at any rate of the specific nature of diphtheria, no doubt can be entertained, and while there are yet some who doubt whether the *micrococcus diphtheritica* is the actual cause of the malady, or is only a constant concomitant thereof, no pathologist at the present day will venture to question that it is a most virulently infective disease.

The effects of diphtheria on the general system are too pronounced, and its virulent properties too intense, to allow of any question being raised as to the wisdom, or even the absolute necessity, of condemning the flesh of any animal which has been the subject of the disease; but these remarks scarcely apply in so high a degree to croup, in which form of inflammation the accompanying fever is much less in degree, and the effects on the general system are not so pronounced.

Erysipelas has been, for long, recognised as one of the maladies to which animals are prone. It is occasionally met with in every one of the domestic animals, but with the exception of the dog it is questionable whether it ever arises as a primary affection. In so-called navel ill of young animals, as a complication of castration and of parturition in every animal, and occasionally as a mammary lesion in the cow and the ewe, the lesion is tolerably familiar to the veterinary practitioner, but in most of these cases a predisposing cause exists in the form of depravation or degradation of the vital fluids, or of lowered systemic vitality. Undoubtedly, as in the human subject, erysipelas is conveyed to, and becomes virulent in, healthy wounds, through the medium of contaminated instruments, through the skin of the hands, the nails of the surgeon or the attendant, and by sponges and other materials used in the dressing of wounds.

Independently of any pre-existing depravity of the blood, the effects of erysipelas upon the system are so pronounced as to render the flesh of its victims totally unfit for human food, and additional justification for its condemnation is furnished in the fact that it is of a distinctly specific nature, its causal entity being a micrococcus—the *M. erysipelatosus*.

The local lesions of the malady are characterised by great thickening of the skin and subcutaneous tissues of the affected parts; by a brawny appearance of the skin, which is best seen in the pig and in the sheep; by œdematous infiltration of the

tissues; by the peculiar glistening aspect presented on section thereof; and, most importantly, by the presence of the micrococci in the tissues of the spreading zone of the inflammation.

Influenza.—As in man so in animals, there are several distinctive forms of continued fevers, though with many it is a common practice to group them under the one term—influenza. The primary types of influenza fever are:—(*a*) the *Catarrhal;* (*b*) the *Bilious* or *Yellow Fever;* (*c*) the *Effusive*—"*Pink Eye*"—and while each type is frequently seen in its distinctive form, it is a matter of every-day experience to find the various characteristics of each type intermixed. Influenza is peculiar to the horse. I have only seen one instance of transmission to cattle, and that in the case of the effusive form. We have no absolutely positive evidence of transmission of any of the forms of the disease to man, but I have on several occasions been strongly under the impression that I have contracted the malady from affected horses. In the first form, the symptoms and cause are identical with that of catarrhal fever (already described), with a great tendency to lung complications; in the second, there is in the majority of cases absence of catarrhal symptoms, but marked evidence of jaundice with extreme fever, and a tendency to derangement of the bowels and to serious lung complications, *e.g.*, pneumonia and pleurisy; in the third form, the prominent lesion is rapid effusion into the connective tissue of the limbs, into the eyelids, and frequently into the cornea—these parts becoming infiltrated with serum to an enormous degree—and, under adverse influences, metastasis of the lesions to the bowels, the lungs, and the throat.

The systemic effects produced by influenza are, on the whole, similar to those of other excessively febrile conditions—with universal jaundice in the case of the bilious form, and infiltration (more or less general) of the connective tissue of the body, and effusion into internal cavities. The small vessels (capillaries) of the tissues, too, are markedly engorged with blood.

Two subsidiary or secondary forms of influenza are occasionally met with, viz., *Muco Enteritis* (*Typhoid Influenza*), and *Cerebro-Spinal Meningitis*. The former gives rise to enteric lesions and to alterations in the tissues similar to those produced by the muco-enteritis produced by other causes, coupled with the changes produced by fever; in the latter, the tissue changes are not so marked. The flesh of an animal which has been the subject of any form of influenza of a sufficiently severe type to necessitate slaughter, presents such marked departures from normal conditions as to at once attract notice, and in themselves these afford ample warrant for the condemnation of the flesh.

Malignant Catarrh and *Malignant Catarrhal Fever*.—The first of these terms is applied to that condition in which an ordinary attack of catarrh (owing to the action of pyogenic organisms) assumes malignant characters and tends to destroy life. It is seen most largely in the sheep and the pig, and occasionally in cattle, and its virulence is traceable to the existence of bad sanitary conditions, and to exposure to cold and wet when an animal is labouring under an attack of common cold. In this way, many hill sheep become the victims of the malady. In addition to the ordinary phenomena of cold, there is, frequently, ulceration of the mucous membrane of the nasal cavities, and of the skin of the nostrils, and also sore throat and laryngitis, followed by ulceration of the involved parts. Unless fever is extreme or the blood becomes poisoned, recovery is the rule, but a *localised pyæmia*, involving the face, the head, and the throat, and extending to the lungs, frequently arises as a sequel. To such cases the remarks made under the head of pyæmia apply. If the acute lesions become so aggravated as to necessitate slaughter, the systemic conditions presented on autopsy will be similar to these seen in acute inflammatory affections generally, associated with those of blood depravation.

Malignant Catarrhal Fever is most largely seen in cattle and

sheep that have been subjected to the prolonged influence of a foul atmosphere, *e.g.*, in transit by sea in the holds of ships, when the raging of a storm has necessitated the battening down of the hatches; or where sewage gas is allowed to escape into the houses in which animals are confined. The symptoms do not usually make their appearance until a space of about forty-eight hours after the exposure has elapsed. There is marked fever with catarrhal symptoms, followed by great prostration; the mucous membrane of the nostrils becomes ulcerated, the mouth fœtid, and even the breath exhales a sickly odour, profuse diarrhœa sets in, the discharges having a sickly fœtid odour. In addition, there is often a cough, and the lungs frequently become emphysematous or congested. The animal may die in a comatose state. If the animal is killed in the early stages of the malady, there may not be any evidence of the existence of a grave disorder, and condemnation of the flesh is scarcely justified; but if the disease has been advanced, the usual evidence of the existence of an important form of fever will be found in the blood and tissues on *post-mortem* examination, and the carcase should be unhesitatingly condemned. Stomach and bowel lesions, in the form of patchy congestion, inflammation and ulceration, may exist.

Pleuro-Pneumonia.—This disease, which is peculiar to the ox, is a contagious inflammation of the lungs and pleuræ, due to a specific organism which has not yet been satisfactorily isolated or demonstrated, though certain pathologists claim that this has been accomplished. In considering the disease in relation to public health, it is of the highest importance to remember that it has never been transmitted, either spontaneously or experimentally, to any other than bovine animals, nor indeed has the disease been propagated between individuals of the latter species by any experimental methods yet devised. True typical lesions are readily produced by the inoculation of lymph from the lungs into the subcutaneous connective tissue in any part of the body,

and the lesions so produced are identical in their general character with the lung lesions of the disease, but in no case has it been transmitted by inoculation, or even by intra-venous injection, as a pulmonary affection. That the malady possesses the attributes of, and in some respects comports itself as, a specific fever, is a fact that cannot be gainsaid, but notwithstanding this, it is equally a truth that in its course and in its effects it presents differences of a very marked character from any of the usual attributes of such diseases.

Statements have been made by some pathologists to the effect that in certain forms of pneumonia in man, organisms identical with those present in the tissues of the lung in pleuro-pneumonia exist; but these statements in no way prove the identity of the latter with any similar affection of the lungs of man, and all the clinical evidence at our disposal negatives the transmission of the disease from the ox to man as a pulmonary affection, though isolated instances have occurred in which a local lesion, identical with that seen in the tissues of the former after inoculation, has been produced by accidental inoculation with the pleuro-pneumonic lymph on the tissues of the latter.

Though pleuro-pneumonia is a specific fever, it is a remarkable fact that the effects exerted on the nutrition of the flesh are, in most cases, infinitesimal as compared with those produced by other fevers of a similar type, or even by marked febrile conditions of a non-specific origin; and it is still more remarkable that the effects of the disease are localised in the lungs alone, and even in these organs the lesion is a limiting one. In the early stages, and frequently in the advanced stages, no changes can be detected in the carcase to indicate the *ante-mortem* existence of such an important affection—the carcase sets firmly, the flesh is normal in colour, resistance, and taste, there is no abnormal odour, and even the most experienced expert would be puzzled, either by a macroscopic or a micro-

scopic examination, to detect any marked change in its characters; but when a large area of lung tissue is destroyed, and when pleurisy has been extensive and is associated with effusion into the chest, the *post-mortem* changes are important and pronounced. In the former case the flesh is of a very dark colour, more or less soapy to the feel and moist, and—the connective tissue being icteric—the carcase is of a distinctly *mahogany hue;* in the latter case the carcase is more or less dropsical, and if the animal is killed (or dies) early, a section of flesh presents a bright reddish *magenta* colour, and has an *albuminous glaze*, both these conditions being most observable in the muscles of the chest and in the diaphragm. In very advanced cases, and in those in which there is a great amount of thoracic effusion (*hydrothorax*), there is frequently systemic dropsy which is most marked about the inferior part of the chest and the neck; and the knowledge of this fact led to the application of the term "wet goat" in such cases by the fleshers of Edinburgh.

In reference to the method of dealing with the carcases of animals affected with pleuro-pneumonia, the universal rule is to pass them as marketable and innocuous if they present no departure from natural conditions—the affected portions of the pleuræ being removed by stripping, and in bad cases, the portion of the fore quarter contiguous to the pleuritic lesion, or even the whole of the quarter, being retained. That such a procedure is at first sight indefensible, few sanitarians will deny; but it would be impossible to bring forward evidence, either as the result of actual experience, or as the result of analogy or induction, to show that the flesh in these cases is in any way injurious to the health of man, and the wholesale condemnation of such flesh would involve the country in a very heavy pecuniary loss. If, however, the flesh is physically altered, the existence of such lesions in the lungs and pleuræ as those which characterise this malady, would be of value to the inspector in determining in

favour of its condemnation. Another point to be dealt with in connection with the sanitary aspect of this question, is the effect of inoculation on the carcase. This question is only of importance in those cases in which the inoculative lesion — by extension from the tail—involves the tissues of the haunch, of the pelvis, or of the sub-lumbar region, and in consequence of which it is deemed necessary to slaughter the animal. As in the natural form of the malady, so also in the local inoculative lesions, fever exists, but to a much less degree in the latter than in the former—the temperature seldom exceeding 104° F.—and even in the worst cases, the flesh in the uninvolved parts of the body presents no departure from the normal. If the lesion involves the tissues about the root of the tail only, the flesh may be passed for human food, but if it has extended to the pelvic tissues or to the muscles of the haunch, or if, as the result of bruising, lesions are developed in other parts of the body, the carcase should unhesitatingly be condemned. The inoculative lesion, it may be observed, is identical in its general characters with the lung lesion —the connective tissue being charged with serum and lymph, the blood vessels plugged with thrombii and the interstitial tissue infiltrated with lymph.

Rabies.—Like anthrax, this disease is transmissible to man and to all domestic animals by inoculation and by contagion, through the medium of saliva, and, according to some authorities, by the blood and juices of affected animals. Although no definite organism has as yet been isolated from the blood or from any of the tissues of the body of a rabid animal, there can be no doubt in the minds of scientific men that a specific organism exists and is the cause of the malady. Its method of propagation, its clinical character, its pathological lesions, all go to prove that this is the case.

If an animal is killed in the early stages of the disease, no physical change can be detected in the blood or in the flesh, and

in the absence of any proof as to the cause of death, such flesh would be unquestionably passed for consumption, nor, so far as I know, could any proof be adduced that it possessed noxious properties. But notwithstanding this fact, I am emphatically of the opinion that the flesh of an animal that has suffered from rabies should not, knowingly, be passed as fit for human food, though I am quite aware that a contrary opinion has been expressed by one of my confrères. In the advanced stages of the disease, the flesh and blood become materially altered in their nutrition, and the changes so produced are in themselves sufficient to demand that the former should be condemned. The flesh presents the characteristics common to the flesh of all fever-stricken animals, and the blood has often a peculiar grumous appearance and coagulates imperfectly.

3. Specific Eruptive Fevers.

Cattle Plague—Rinderpest.—Although it may be confidently hoped that the herds of this country may never again, under ordinary circumstances, be subjected to the ravages of this fell malady, it is as well to glance briefly at its sanitary aspect. Rinderpest belongs to the class of specific eruptive fevers, and it is undoubtedly due to a specific organism. The organism of Rinderpest is, according to Klebs and Semmer, a micrococcus, found abundantly in the blood and lymphatic glands of infected animals, and with cultivations of which the disease has been induced, by inoculation, both in the calf and in the sheep.

Rinderpest is essentially a bovine malady, and though propagable to ovines, its virulence is in them materially diminished. Not the slightest particle of evidence of its transmissibility to man has ever been obtained, but the effects produced by the malady on the systems of its victims are so pronounced as to render the carcase unfit for human food. The characteristic lesions of cattle

plague are essentially of an aphthous type, and are localised in the skin and in the mucous membrane of the alimentary canal—their existence in the latter structure being constant and pathognomonic. The constitution is gravely affected, fever running very high; the bowels become markedly relaxed in the advanced stages, the discharges sometimes being dysenteric, and always emitting a peculiarly distinctive odour of a sickly nature. The blood, if withdrawn in the acute stage, coagulates imperfectly or not at all; the lungs become emphysematous, and thus oxidation is checked; non-assimilation of nutrient matter leads rapidly to mal-nutrition and consumption of the tissues, and, prior to death, an odour characteristic of the disease is exhaled from the skin, and is given off with the expired air from the lungs. After death the blood in the veins is found materially altered in its physical characters. It is of a peculiar purplish colour, the red corpuscles more or less shrivelled or crenated, and their colouring matter is frequently dissolved out, and is held in solution in the blood plasma. The blood may or may not coagulate, this phenomenon being regulated by the length of time that the malady has been in existence, and by its virulence. The flesh in the advanced stages presents either a magenta hue, and has an albuminous glaze, or it is of a reddish-yellow (mahogany) colour, or is very dark. It is more or less flaccid and moist. In the earliest stages no material change is observable in the carcase, but notwithstanding this, the majority of experts are unanimous in condemning such flesh as an article of human food; and here again, as in the case of rabies and anthrax, the legislature has, fortunately and rightly, decreed its absolute destruction.

Eczema Epizootica—Foot and Mouth Disease. — This disease, while it is generally looked upon as indigenous in the ox, affects more or less all the domesticated animals whose flesh is ordinarily used for human food, and occasionally the horse also. That it is due to a micro-organism is proved by its nature and its course,

and by its clinical and pathological characters; but this organism has not yet been satisfactorily demonstrated, although Klein has described the existence of a micrococcus in the fluid taken from the vesicular lesions of sheep. That the virus pervades the whole system is shown by the fact that the characteristic lesions develop more or less over the cutaneous surface (particularly in the pig), and in the mucous membrane of the alimentary canal, on that of the sheath, the vagina, the udder, and, occasionally, the bronchial tubes.

The virulence of the disease varies materially in different epizootics in different animals, and in different seasons; thus, in some outbreaks, a large percentage of animals die either from the effects of the fever or from the effects of the local lesions. In the vast proportion of cases the fever which accompanies its evolution is of so benign a character as to interfere but very slightly with the nutrition of the blood or of the flesh. But every now and again—especially when the sufferers are exposed to such adverse influences as cold, or cold and wet, to exhaustion, or to bad sanitary conditions—it assumes malignant characters, and its lesions partake of the nature of those produced by septic infection; there is induced, in fact, a veritable septicæmia. During the prevalence of an epizootic of this disease thousands of animals, while labouring under its effects, are slaughtered, and their flesh used for human food; and this, perforce, for so rapidly does it spread, and so short is its incubative period, that animals purchased in an apparently healthy state one day, may be affected with the malady in the course of two or three days subsequently; and if the consumption of the flesh of all animals which had suffered from the malady were prohibited, fasting—so far as fresh meat is concerned—would become compulsory.

So far as I am aware there is no instance on record of the transmission of the disease to man through the medium of the flesh of affected animals, and there are comparatively few

instances of such transmission through the medium of the milk —next to the saliva, the most powerfully viruliferous of all the secretions of the body. While the virus of foot and mouth disease is capable of retaining its vitality under favourable conditions for comparatively long periods, it is readily rendered impotent by antiseptics, and by such influences as heat, even in a moderate degree. In ordinary cases the general physical condition of the carcase of an animal which has suffered from foot and mouth disease, differs in no respect from that of one which has been slaughtered in perfect health; the muscular tissue is firm, of a normally florid hue, sweet and dry; nor is there any noticeable change in the blood, the fat, or the connective tissue.

In cases of a malignant type the conditions presented are allied to those described as existing in the carcases of animals which, during life, have suffered from the effects of septicæmia; and in such cases the flesh should be unhesitatingly condemned as an article of human food, as it should when, from severe foot lesions, fever runs high, and the muscles, in consequence thereof, present the characteristics of the flesh of animals which have been subjected to its influence.

In reference to the use of the affected parts as articles of human food, no difference of opinion need exist; if the feet, the tongue, or the udder, are the seat of local lesions, they should be destroyed, and the same applies to the tripe; but I cannot agree with those who condemn *in toto* the head, the heart, and similar organs. Granted that there are about the head numerous secretory glands, whose products become more or less contaminated with the virus, the situation of these glands is well known, and their removal is easy, and if the tissues of such organs as the heart are nocuous, then also is the flesh of the body generally.

Pustular Fever in Cows and Ewes.—I have adopted this term to designate a form of disease in cows and ewes which has

been variously described—in the cow, as cow pox and Hendon disease—and which I myself, until recently, have described as varioloid. In ewes, the term *Malignant Aphtha* has been universally applied to a malady analogous in many particulars to that which occurs in cows, and I have coupled these affections in the two animals simply because of the close analogy which, in certain important points, they present to each other. In milch cows—young and middle-aged alike—an eruptive disease makes its appearance, usually within a short time after parturition. The lesions of the malady are localised in the skin of the udder and the teats, and in many respects closely resemble those of variola, the important divergencies in character lying in the absence of the characteristic vesicle and scab of variola in the former affection, and also in the fact that the fluids taken from the local lesions do not produce variola when inoculated in calves, but on the contrary, give rise to a locally destructive process of an ulcerative type, and to a septic inflammatory process in the mucous membrane of the nasal chambers, as also to certain lesions, such as congestion, in important internal organs.

These facts were abundantly brought out in the experiments carried out in the college during the summer of 1889 by Professor M'Fadyean, and the course of which I had the opportunity of observing. In one or two of the cows some febrile excitement existed, and pulmonary and cardiac derangement ensued, though not to an extent sufficient to produce fatal results. I embraced the first opportunity of satisfying myself of the innocuous nature of the disease so far as cohabitation and the imbibition of the milk from the patient, directly or indirectly, by calves, was concerned, and further, that the milk produced no ill effects when ingested in an uncooked state by pigs. Its innocuous nature was also abundantly proved in reference to the consumption of the milk by man. While it is not a probable contingency, it is just within the range of possibility that owners of fat cows suffering from the effects of this

malady, may occasionally be tempted to slaughter them rather than run the risk of suffering an absolute loss. In the event of such a contingency arising, an inspector, even though he was aware that the animal had suffered from the disease, would scarcely, in the present state of our knowledge, be justified in condemning the carcase, unless evidence of organic disease in important organs existed, or unless the tissues presented evidence of the existence in the system of a high degree of fever.

As affecting ewes, this disease is much more virulent and destructive, not only to the ewes themselves, but also to their offspring. The lesions of the disease are first observed in the skin of the udder, and, at the outset, do not differ materially from those of foot and mouth disease in the cow; but as the disease progresses the malignant nature of the malady is made apparent by the ulcerative processes which are set up, and by the fact that wherever the ulcers come in contact with the skin of contiguous parts, as the thigh and the abdomen, a similar condition is established; and by the further fact that the udder, or parts of it, is very apt to become gangrenous. The constitutional conditions are also graver, fever running very high, wasting of the body going on rapidly, and the bowels becoming materially deranged, as evidenced by diarrhœa, the discharges of which have a fœtid odour. On *post-mortem* examination effusion of serum into the different serous cavities is marked, and the more important internal organs are either congested or are the seat of acute inflammation of a suppurative type, and suppurative pleurisy is also sometimes observed; the blood is of a dark colour, and the flesh presents the changes characteristic of such maladies. The disease is highly contagious as between individual ewes, and it is infective to the lambs, these little animals contracting it by sucking the affected mothers. In lambs, the lesions are localised primarily in the mucous membrane of the lips, from which the destructive process extends, both by continuity and contiguity, to the skin of

the lips and of the nostrils, with the result that in due course the little victims become unable to graze or to suck, and an unhealthy diarrhœa is established. Fever runs high, and, unless the disease is checked in its inception, death invariably results. On *post-mortem*, lesions identical with those seen in the body of the ewes are revealed. Inoculation with the discharges of the sores from the udders of the ewes, and the lips and nostrils of the lambs, reproduces the malady in all its virulence in other (male or female) sheep and lambs.

Looking at the malignant nature of the malady, the important character of its lesions, and its marked systemic effects, no hesitation as to the necessity of condemning the flesh of such animals as an article of consumption need be entertained by an inspector.

Strangles (*Pyogenic Fever*).—This affection is peculiar to horses, and although it has been transmitted to cattle, there is only one instance with which I am acquainted of its supposed transmission to man, and that was in a case which came under the observation of Mr. Constable, M.R.C.V.S., of Inchture. The disease is characterised by a fever, more or less marked, but in benign or ordinary cases, seldom excessive; by a catarrhal discharge from the nostrils; and (*essentially*) by the formation of one or more abscesses, containing pus, in the intermaxillary space or in the region of the throat. If it runs an irregular course, or if the animals affected by it are subjected to adverse influences, the fever becomes exaggerated, abscesses form in various parts of the body or in the internal organs—principally in the lungs—and a veritable pyæmia, and sometimes a septicæmia, becomes established. The disease, long believed to be due to the action of a micro-organism, has been shown by Schültz to be produced by a globular bacterium—a *streptothrix*. In the regular form of the disease death seldom takes place, nor is there even threatened death except in those cases in which abscesses form in close proximity to the larynx, and, by pressure, produce suffoca-

tion; or in which an abscess bursts into the fauces or pharynx and the pus finds its way into the trachea and asphyxiates the patient. The *post-mortem* lesions are those of fever, with those of pyæmia or septicæmia. If these conditions have been established, and if evidence of their existence is forthcoming, the flesh should be condemned.

Variolous Diseases.—Without stopping to discuss the question as to the unity or otherwise of variolous disease in the different domestic animals, it may be here stated simply that each species suffers from variola or pox—thus we have Variola Equina in the horse; V. Vaccinia in the cow; V. Ovina in the sheep; and V. Suillus in the pig; while, very exceptionally in this country, poultry are attacked by it. In all animals there are, up to a certain point, common clinical phenomena; constitutionally, there is fever, more or less marked, but always highest in the sheep and lowest in the ox, though, with the exception of the sheep, it is benign in character; in this animal it is excessive in the papular and pustular, and sometimes in the ulcerative, stage—in the two latter it is even of a putrefactive type. Locally, the skin of the affected parts is at first red, thickened, and hot—roseolous stage; this is followed by the formation of round, red, and comparatively circumscribed elevations or tumours—papular stage; this again, by the formation of bladders or vesicles containing a limpid fluid —vesicular stage; next to this, pus is formed on the site of the vesicles—pustular stage; and this is succeeded by the formation of a sore, upon which is again formed a scab or crust, constituting the ulcerative and crustaceous stage of some authors; finally the the crust falls off, and with desiccation and exuviation, convalescence is established.

In the horse, the lesions are localised on the lips, on the mucous membrane of the mouth, on the skin of the coronets and lower parts of the legs, and occasionally on the skin over the surface of the body; in the cow, they are mainly localised on

the skin of the udder and teats, sometimes on the skin of the lower parts of the legs; in the ox, on the skin of the scrotum; and in the sheep they are usually localised, at the outset, on the skin covering the inside of the thighs and the arms, but they may subsequently extend more or less over the whole surface of the body; while in the pig they are localised on the snout and the skin of the udder.

The disease, as already indicated, is in all animals, except the sheep, of a benign character. In the sheep it is malignant, and destroys large numbers of animals; and practically it is in reference to this animal only that the question of consumption of flesh arises. As in the cow death seldom or ever ensues in uncomplicated cases, and as it generally confines its attacks to milch animals, there is nothing to be gained by slaughtering them for the purpose of food. In the sheep the constitutional changes are of such a grave character as to render the flesh totally unfit for edible purposes; the blood, the organs, the tissues, and the lymph glands, except in the mildest cases, present all the changes peculiar to septicæmia, and even if these changes did not render the flesh nocuous, it would be decidedly unmarketable.

Swine Fever.—This malady—unfortunately so prevalent in this country at the present time—occupies a prominent place from a sanitary point of view. As an eruptive fever it produces a marked effect upon the constitution, and in the advanced stages these changes are so pronounced as to attract the attention even of ordinary persons. During life the disease is frequently marked by the formation of patches of congestion in the skin, particularly of the ears, lower parts of the limbs, and underneath surface of the abdomen, giving to the parts a dark blue or livid colour; in other cases red or dark red patches are formed, as the result of extravasation of blood, and if the animal survives for a sufficient length of time, or recovers,

the skin covering the hæmorrhagic areas may die, and be cast off as a slough.

Independently of these lesions, papulæ, pustulæ, and even vesicles, may form on the skin over the surface of the body; but there are numerous cases in which no lesions of any kind exist. The internal lesions are numerous and diversified in character. In the early stages, neither the systemic nor the local lesions are, as a rule, of importance; the blood, the flesh, and the tissues of the organs present no departures from the normal; the carcase sets firmly, and of the natural colour, neither does it evolve any unnatural odour; but in the advanced stages, the flesh usually becomes flaccid in consistence, of a pale hue, and sometimes dropsical; while in some cases it possesses a distinctive and sickly odour, which is, however, always most pronounced in the bowels and their contents.

Hæmorrhagic lesions may be found in the skin, in the sub-cutaneous tissue, in the intermuscular connective tissue, and even in the tissue of the muscles themselves. The cutaneous hæmorrhages are always most observable after the skin has been scalded and scraped, and they can be distinguished from those resulting from bruises and blows, by the shape of the patches, and by the depth of the lesion. In many cases in which no hæmorrhagic lesions are detected in the skin, or in the parts of the carcase exposed to view, they will be found to exist in the tissues underneath the shoulder blade, and this should always be detached from the trunk if a suspicion is entertained that the disease has existed. Blood extravasations are also found on the inner lining of the heart—*endocardium*—under the capsule of the kidneys, or into the structure of these organs, and, more importantly, in the lymphatic glands. In the early stages, the lymph glands may appear to be simply congested, but as the malady advances, they become more or less infiltrated with blood; in most cases the distribution of the hæmorrhage is partial, and

when a section is made of the gland, it presents a mottled appearance, not much unlike that seen on section of a "Queen" strawberry. Exceptionally, the glands become so much infiltrated with blood as to render them absolutely black, and the same remark applies to the kidneys. This condition of the lymph glands, with the endocardial extravasation, often serves as evidence of the existence of the disease when none other is forthcoming, but it must be borne in mind that in young pigs a large number of hæmo-lymph glands are found distributed amongst the sub-lumbar tissues and fat. The blood is not, in ordinary cases, materially altered in its character, but whenever the disease has been in existence for some time, or the lungs are extensively involved, it contracts a dark hue, and is sometimes even tarry; while, in the more asthenic cases, and in those in which convalescence is imperfect, or the bowel lesions are extensive, it is of a pale hue, and watery in consistence. Effusion into the abdominal and thoracic cavity, and even into the pericardial sac, is most largely seen in animals in poor condition, or when the disease has been prolonged, and the same remark applies to the exudation of lymph.

Diffuse inflammation of the mucous membrane of the bowels —more particularly the small—is most largely seen in young pigs, and not infrequently it assumes a diphtheritic character. The characteristic bowel lesions are found mainly in the large intestines, and almost always around the ileo-cœcal valve. In the lungs, specific lesions in the majority of cases—but not in all, as is affirmed by some authorities—exist; these lesions in the earliest stages are of an effusive type, but in the later, distinctly inflammatory, and in some cases the lesions resemble, to a large extent, those characteristic of pleuro-pneumonia in the ox.

From this brief description of the pathognomonic lesions of swine fever, it must be obvious to all that in the advanced stages the flesh of animals suffering from it is unfit for human food; but inasmuch as the disease is not transmissible to man,

and as the nutrition of the blood and of the flesh is not interfered with in the early stages, it may be a question as to whether it should be condemned or not; if, however, any material change in the blood or in the flesh is discernible, or if muscular or cellular extravasation exists, or if the lymphatic glands are hæmorrhagic, no scientific man should be found ready to defend the practice of using the flesh for human food. The bowels of pigs suffering from swine fever are often used as skins for sausages and similar delicacies, and on one occasion I had placed before me for breakfast some sausages in which the odour of swine fever was so palpable to my olfactory nerves as not only to disgust me, from a gastronomic point of view, but also to partially act as an emetic. It should be noted here, that very frequently a miliary rash of a red colour is observed to exist on the skin of the carcases of pigs after dressing. It is commonly known as *measles*, and is not associated with any of those grave lesions mentioned above as being characteristic of *Swine Fever*.

4. Infective Granulomata.

Actinomycosis is a pathological condition produced by the irritation of the ray fungus (*Actinomycis*) which, up to a comparatively recent date was thought to belong to the Hyphomycetes or Mould Fungi. Recently, however, doubts have arisen as to the correctness of this view, and my colleague, Professor M'Fadyean, has satisfactorily demonstrated the fact that it really belongs to the fission fungi (as shown in our illustrations). Although this disease has existed for a considerable period in certain animals in this country, it is only a few years since its true nature was understood. The animal most largely affected by it is the ox, in which it is primarily (in the majority of cases) localised in the tongue; and in castrated oxen, occasionally in the spermatic cord, pro-

ducing here one form of scirrhous cord. Owing to the fact that the disease sometimes extends from the tongue to adjacent or contiguous structures—even to the bones of the jaw and face—it has always been looked upon as of a malignant nature, by some as cancerous, by others as sarcomatous; hence the terms *cancer of the tongue* and *osteo-sarcoma* by which it was, until recently, designated; and further, owing to the fact that the structure of the tongue became very hard, it has been long known to the Germans as *wooden tongue*, and, on account of the enlargement of the jaw, it is in America termed "*lumpy jaw.*" While the affection has been recognised most frequently in the ox, there can be little doubt but that many of the diseases marked by new formations in the tissues and organs of the body of the horse and of the pig, owe their origin to the pathogenetic action of this fungus, and the same remarks apply probably to the sheep.

The malady affects man, and is in him known as *Actinomycosis Hominis*, and while it has been transmitted by inoculation from man to the calf (Crookshank), so far as I am aware, there is no direct evidence of the transmission of the disease from animals to man. Nor indeed is such a contingency ever likely to arise, seeing that the vitality of the spores of the hyphomycetes is much inferior to those of other pathogenetic fungi, and that the changes produced by it in the organs attacked are so marked as to attract the immediate attention of even ordinary persons; and what is of more importance, the lesions of the disease are seldom localised, except in the pig, in the muscular tissue of the body. There may, however, be lesions in the muscles immediately contiguous to, or connected with, affected organs. The spores of the disease are supposed to gain access to the structure of the tongue and other organs by the medium of a break of surface, such as a wound, an abrasion, or a crack, and after so gaining access rapid development of the fungus goes on, while multiplication and dissemination of the spores take place. The irritation set up by the fungus

leads to the production of a condition analogous to that seen in tuberculosis, viz., to a diffuse and chronic (interstitial) inflammation of the tissue of the organ, with the formation of nodules or granulations almost identical in morphological characters with those of tuberculosis. They are, however, larger than the miliary nodules of the latter disease, and do not, like them, tend to aggregate or coalesce, and consequently do not lead to the formation of such extensive lesions; and while calcification goes on in the centre of the nodule (constituting its core), caseation is much less pronounced. During life, the lesions are best observed in the tongue, which becomes enlarged and excessively hard, and loses its tactile and gustatory functions.

The disease usually commences on the free surface (dorsum) of the organ, and after a time flattened nodules, about one-fifth of an inch in length and one-eighth in width, are formed under and within the mucous membrane. The epithelial covering of the membrane softens and gives way, and is removed by friction in eating, leaving raw or abraded patches. Dribbling of saliva is very marked, too, at this stage. As has already been indicated, the glossal disease may invade the lips, the cheeks, and even the muscles and bones of the jaws and face, producing material changes in these parts, such as destruction of the cancellated portion of the bone, and opening up (rarefaction) of the compact tissue; softening of the new growth goes on with the formation of imperfect abscesses, the contents of which may be evacuated through cloacæ in the bone, and finally, by sinuses, through the soft tissues and the skin. The evacuation of this softened matter is followed by healing and the formation of a cicatrix, hence the scars so frequently seen on the face and cheeks of affected animals. The internal organs may become invaded, primarily, through the medium of the various mucous membranes; but the theory has been promulgated that a localised lesion may become, by virtue of the infectivity of the disease, systemically disseminated.

Whether this is so or not is a matter of very little importance so far as our present purpose is concerned. In pigs, according to Johne, the actinomyces is frequently found in the tonsilar cavities, which may or may not have become the seat of any pathological change. Although certain organs, such as the tongue, may be largely involved, there is not much accompanying fever or interference with the normal functions, or with the nutrition of the blood, and any systemic changes that arise are due mainly to annihilation of the functions of the tongue, or of the particular organ involved, and as a result of this a state of poverty is induced. Seeing that the disease is rarely of a systemic nature, and that there is an absence of fever, the nutritive changes induced in the muscles are so slight as to do away, in the great majority of cases, with the question of nocuity of the flesh; but notwithstanding this, if there is any evidence of mal-nutrition of the blood or of the flesh, the carcase should be condemned for human food, and in every instance the affected organ or organs should be effectually destroyed. In the United States destruction of the whole carcase is carried out if the disease is at all extensive.

Glanders and Farcy.—If it were not for the fact that horse-flesh is sometimes used as an article of consumption, or rather, is largely sold as such under the guise of ox beef, the question of glanders need not have claimed attention in connection with the subject at present under consideration.

Essentially an equine affection, this fearful and intractable malady—equalled in this respect by syphilis alone — is readily propagated by inoculative contagion (and, according to some authorities, by infection) to the human subject, though there is no case on record in this country, so far as I am aware, in which it has been so conveyed by ingestion of the flesh of diseased animals. This may be probably due to the fact that horse-flesh is so seldom used as an article of food, and, consequently, if such transmission had at any time occurred, it might easily have been

overlooked. For a very long period proprietors of menageries have entertained an overwhelming dread of the effects of horse-flesh on the carnivora in their establishments, and that, too, on account of their belief that glanders is transmitted by the uncooked flesh of infected animals to such of their beasts as may be fed on it; and they invariably make a searching inquiry into the antecedents of the animal whose carcase they may purchase for feeding purposes.

Fortunately, glanders does not arise as an indigenous affection in cattle, neither can it be transmitted to bovines, though a statement has recently been made to the effect that sheep do not possess immunity from the disease.

Personally, I have never met with a single instance of disease in cattle that I could in any way identify as of glanderous origin, and I am quite satisfied that the cases which have from time to time been placed on record were cases either of pyæmia, or, more probably, of malignant catarrh.

In Guadaloupe, the term glanders is applied to a disease affecting cattle; but M. Nocard, of the Alford Veterinary School, has shown that the malady so styled has no pathogenic relationship with glanders of the horse.

Glanders and farcy are one and the same disease, the local manifestations of their existence in the system alone presenting distinctive characters; the former having its lesions mainly localised in the respiratory tract, the latter mainly in the cutaneous and sub-cutaneous structures and in the superficial lymphatics. It is due to a specific organism—a bacillus—which seems to find a favourable pabulum for its development mainly in the tissues and juices of the equine species. It is to the pathogenic effects of this organism that the local lesions of glanders and farcy are due. In the acute form of the disease febrile conditions are pronounced, there is usually a profuse catarrhal discharge from the nostrils, diffluent ulceration of the

lining membrane of the nasal chambers—the ulcers, as shown in the illustrations, having a very angry appearance—enlargement of the sub-maxillary lymphatic glands, and, occasionally, specific inflammation and rapid degeneration of the glands of the groin (inguinal) with the adjacent muscular tissues, constituting *glanders tumour*. In the internal organs, the lesions are localised in the lungs, and consist of consolidation, congestion, effusion, and the formation of the characteristic miliary tubercles and abscesses, distributed mainly in a racemose manner.

In *chronic glanders*, the characteristic symptoms are an agglutinous discharge from one nostril, with slight enlargement and hardening of the sub-maxillary lymphatic gland on the same side; a pale (anæmic) or bluish (cyanotic) colour of the mucous membrane of the nose, with the development of glanders ulcers thereon; the latter being most largely found on that part of the membrane covering the septum of the nose. The affected animal may be in splendid condition, and, if there is no fever, the muscular tissue may present after death, no appreciable departure from the normal; on the contrary, the animal may be more or less emaciated, and the carcase, as a result, deficient in flesh which may be pale in colour, or even dropsical. The lungs, in the large majority of cases, are studded with the miliary nodules of the disease; but they are not always distinguishable from other nodular formations by visular examination, even by experts.

Farcy may be *acute* or *chronic*. The former is characterised by a markedly febrile condition of the system, and by rapid swelling of one or more limbs, which may be only the forerunner of the pathognomonic lesions of the disease, viz., the so-called *farcy buds*—nodular swellings about the size of a cherry formed along the course of the lymphatics, which burst and discharge a yellowish-coloured, synovia-like fluid, the eruption being followed by an angry-looking sore, the fluid discharge from which possesses specific characters. Chronic farcy is usually afebrile, and here

also there is swelling of one or more limbs, but the tumefaction is much less inflammatory than it is in the acute form. The lymphatic vessels too become swollen, and nodular swellings (*farcy buttons*) form at intervals along their course, which, like those of acute farcy, undergo softening, discharge a glairy fluid, and form a specific sore. These lesions may be distributed, more or less, over the surface of the body, particularly on the sides of the neck, the withers, and the back.

As in glanders, so in farcy, the animal may be in splendid condition; on the other hand, it may be anæmic and emaciated, and its tissues may be dropsical. The local lesions of farcy may be readily mistaken for those of pyæmia or *vice vêrsa*.

Scheduled as a contagious disease, legislative provision is made by the Privy Council for the effectual destruction of the carcase, hide, &c., of all horses suffering from glanders or farcy; but in the large cities many cases undoubtedly occur of which the authorities have no cognizance, and large numbers of animals are yearly smuggled away and slaughtered surreptitiously and the flesh used for the food of cats and dogs, and there is nothing to prevent its being used for human food also. Energetic inspection of all stables, in places where the disease is known to exist, should be carried out, and the law strictly enforced, in order that there may not be the slightest possibility of such a repulsive and intractable malady being conveyed to the human subject, either by contagion from the live animal, or by ingestion of its flesh.

TUBERCULOSIS.*

THE question of consumption of, not only the flesh of animals, but the milk of cows suffering from this disease, is of the gravest importance, especially seeing that it does not confine its attacks to animals, but affects the human subject also; and in order that some estimate of the possible effects of the flesh and milk of such animals upon the human frame may be formed, it is necessary that a few words should be devoted to the consideration of the nature and progress of the disease itself.

The term tuberculosis applies only to a diseased condition, in which growths resembling little *knots* or *kernels* are formed within, or upon, the different organs of the body. These little knots are technically termed "tubercles." At one time it was thought that they were the products of ordinary inflammatory action in the organs of those persons or animals who had inherited a scrofulous or consumptive tendency from their parents; but while it is a fact, and a very important one too, that such hereditary tendency is a powerful factor in its production, the healthiest man or animal may become the victim of the malady.

Of the domestic animals in this country, cattle, pigs, and poultry are pre-eminently the hosts of this disease; but it has

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* The greater part of the matter referring to this subject is from papers read by the Author at Meetings of the Medico-Chirurgical Society of Edinburgh, and the Sanitary Association of Scotland.

now been definitely shown, by Professor M'Fadyean, that the malady occurs also, with tolerable frequency, in the horse. Sheep and goats are rarely, if ever, spontaneously affected, though the disease can be readily transmitted to every living creature (and it has been stated by Villemin to plants also) by inoculation with particles of the so-called tubercles.

Up to the time of Koch's discovery of the bacillus, the actual nature of the disease was unknown, but many of those who had studied the question had long before that date arrived at the conclusion that it was due to a germ or virus. In 1872 I publicly expressed (at a veterinary meeting held in Glasgow) the conviction that the disease was of a specific nature, and was capable of being propagated from animals to man.

The first evidence of its true nature was obtained by the carrying out of a large number of experiments by the well-known pathologist Villemin, and during the last fifteen years hundreds of animals of various species have been sacrificed by experimentalists, with the object of determining the actual nature of the malady. Not only the tubercular products themselves, but various secretions—such as milk, urine, and saliva, the blood, and the juice of the flesh—have been introduced into the system of animals by inoculation, by injection into the veins, and by introducing matter into the stomach by the process of feeding. Further, it has been found that the inhalation (or taking in by the breath) of dried particles of tuberculous matter, or of dried discharges from the lungs of consumptive animals or of man, is sufficient to propagate the disease.

As has already been observed, it was not until the date of Koch's memorable discovery of the bacillus that the true nature of this disease was known. Koch, a German pathologist, after a very patient examination, discovered in tuberculous matter a microscopic organism of a vegetable nature. This fungus belongs to the class of *fission fungi—i.e.*, it has the power of multiplying

by division,—and from its elongated staff-like shape, it is known technically as a *bacillus*. Some idea of its minute size may be gained from the fact that it requires a magnifying power of 600 degrees to render it visible to the eye. Moreover, a careful process of staining by aniline dyes has to be carried out, in order to distinguish it from other organisms of a similar character.

This minute fungus not only multiplies by fission, but by spores also, and these spores are of infinitely greater importance than are the bacilli themselves, inasmuch as, like the seeds of a plant as compared with the plant itself, they withstand the effects of a far greater amount of adverse influences; and it has been shown by Pasteur that, at a temperature of 212° F., milk containing spores requires to be boiled for a considerable period in order to render it harmless.

It is necessary that this fact should be kept in mind in reference to the question as to the harmlessness or otherwise of tuberculous meat and milk.

Not only do the spores of this fungus withstand the effects of boiling, but they resist the action of long drying and of freezing, and also of strong solutions of salt; and it is believed that they are capable of retaining their vitality and their power of propagation and reproduction for a very long period outside the living body. Thus it is believed, and in fact distinctly proved, that the dried spittle of a consumptive man, and the discharges from the nose of a consumptive cow, adhering to woodwork and similar substances, may be the means of contaminating healthy persons or animals, respectively, long after they have been so deposited.

"*Experimental Researches on the Virulence of Tubercular Matter* (*Lancet*, 30th June 1888).—In inquiring into the origin of epidemics, it is felt how necessary it is to recognise the channels of diffusion, and the vital resistance of the infectious

microbes. The germ of glanders possesses but little vitality; dessication kills it; putrefaction shortens its life; and the chances of infection, when not immediate, diminish and rapidly disappear as time proceeds. The germ of tuberculosis, on the contrary, realises a collection of conditions eminently favourable for more remote infection, for it survives the majority of microbes usually associated with it. Neither drying nor putrefying appear to destroy it, whilst both processes often allow of its being distributed through air or water.

"MM. Cadeac and Malet (*Lyons Medicale*, No. 25) have sought to discover the time required to destroy the germs of tuberculosis in dessicated, putrefied, or frozen matter. The experiments prove that tubercular matter dried and pulverised may preserve its virulence, since 102 days after its preparation it was capable of transmitting tuberculosis. Schill and Fischer maintain that tubercular matter only loses its virulence after six months. Pietro asserts that well dried sputa may remain infective for nine or ten months, if maintained at a mean temperature of 25° C.; but it appears probable to MM. Cadeac and Malet that the virulence does not persist after thirty or forty days, unless special care is taken to preserve it. M. Galtier has found tubercular matter to be virulent after fifteen days, one month, and thirty-eight days of dessication.

"These somewhat conflicting results are sufficient, however, to show the desirability of completely destroying all the tubercular matter ejected from patients, and is also an argument in favour of cremation. MM. Cadeac and Malet find that the virulence is maintained for 150 days in pieces of tubercular lung, exposed during winter and spring to the atmosphere. When dried pieces have a considerable volume, the virulence lasts longer than when the matter exists as fine dust. It is probable that the rapid disappearance of virulence in the fine dust, is due to the action of the oxygen of the atmosphere, which is enabled to come into

direct contact with all the tubercular molecules. As to the influence of putrefaction, 167 days appeared to be the limit of tubercular virulence in tubercle allowed to putrefy by itself. About 120 days was the duration of virulence when the tubercle was allowed to decompose in water. Tubercular liquids exposed to the air, and to various external conditions, more rapidly lose their virulence than tubercular solids. In other words, putrefaction exercises its destroying effects much more rapidly when the putrescible mass is of but little volume. The duration of the preservation of virulence in hard and compact tissues, like the tubercular lungs of ruminants, is also proportional to the size of the organ submitted to putrefaction. It is the same to a certain degree for tubercular matter submitted to the process of dessication. In the numerous experiments from which the above conclusions were arrived at, the pieces of tubercular lung were kept at a temperature from one degree to eight degrees below zero, in such a fashion that the matters remained frozen sometimes for more than a week. Yet virulence was maintained for 76 and 120 days."

At an International Congress on Tuberculosis, held at Paris, the following statements were made on this subject:—

MM. Chantemesse and Vidal—"That bacilli and spores retained vitality in Seine water (sterilised) for 50 days, at a temperature of 8° to 12° C., and for 70 days if kept in perfect repose."

M. Galtier—"That tubercle fragments, placed in running water, retained vitality for 15 days, at a temperature of 6° to 15° C."

M. Cadeac—"That bacilli and spores retained vitality for six or seven weeks in running water, and for 120 days in water in a state of repose."

The methods by which bacilli or their spores are most likely to gain access to the living body are—(1) by inhalation (breathing) of contaminated air; and (2) by ingestion (swallowing of any fluid or

solid matter containing tubercular products, and it has been shown distinctly that these products need not contain a single bacillus in order to render them infective. And this is easily accounted for by the fact, that though no matured bacilli may be present, there may be thousands of spores which, when sown on favourable ground, develop in the course of time into matured bacilli.

When bacilli or their spores are taken into the interior of the body, they adhere to the inner lining (the mucous membrane) of the different organs, and may there undergo further development and multiplication. As a proof of this, it may be mentioned that when calves are fed on milk from cows suffering from tubercular disease of the udder, or milk with which is mixed tuberculous matter, the disease is found developed along the membrane of the mouth, throat, and bowels.* At the same time there can be no doubt but that millions of these bacilli are rendered harmless by the juices of the stomach, or are swept out of the bowels before they can gain lodgment.

Strauss and Wurtz, assert that exposure for a period of *six hours* to gastric juice is required in order to destroy the bacilli.

Many of these organisms pass from the mucous surface, or inner lining of the bowels and lungs, into the surrounding tissues, and are carried thence by the lymphatic vessels to the different groups of lymphatic glands, which are found scattered here and there along the course of the lymphatic vessels, and through which the vessels pass. That this process goes on to a very large extent, is shown by the fact that the glands situated in the abdomen and the chest are often found to be extensively affected, without there being any trace of the disease in any

* Cornil states that a single drop of a liquid culture of bacilli placed in the pharynx of a guinea-pig, produces, in fifteen days, distinct macroscopical tuberculous lesions in the mucous membrane, along the whole length of the alimentary canal.

of the organs of the body; and it is highly probable that, so long as these glands retain the bacilli and their spores, so long does the general system remain unaffected. This, however, is mere speculation, and in any case there comes a time — in most instances at least—when the bacilli and their spores escape from the meshes of these glands, and are conveyed by the outgoing lymphatic vessels into the blood stream, thereby contaminating the whole system.

Next to the lymphatic glands, the delicate lining (serous membrane) of the abdomen and the chest is most largely affected.

Of the internal organs, the lungs, the liver, the kidneys, and the brain, are most frequently found to be the seat of tuberculosis; and it is a curious fact that the substance of the heart and the sweetbreads are rarely, if ever, affected primarily, and only very exceptionally are they involved in secondary tubercular lesions. The melt (spleen) in cattle seems to enjoy a far greater immunity from the disease than does the same organ in man, in the pig, and in the horse; but as in children, so in young animals, the covering of the brain is frequently affected. The generative organs, both male and female, are very often found diseased; and this accounts, to a large extent, for the hereditary transmission of tubercle.

The udder of the cow, unfortunately, is also frequently affected with the disease, and many of the so-called cases of "garget" or "weed" (*mammitis*) in that organ, are nothing more or less than cases of tuberculous inflammation.

The bacilli produce their effects on the tissues by acting like any other irritant matter—i.e., by setting up a circumscribed inflammatory process, which results in the formation of minute centres of new tissue. This new tissue, however, owing to the want of permanent blood-vessels, does not become organized; and, indeed, in place of going on to form a permanent tissue, it goes

through a backward or retrograde process, and becomes converted into a material resembling cheese (*caseous matter*) of a very soft consistence, and into a gritty substance known as *calcareous matter*.

The primary tubercular centres are no larger than millet seeds, and from this fact they are termed *miliary tubercles*. But owing to the amount of inflammation of the tissue in which they are produced, they become aggregated together and form immense masses or tumours, and these masses may either remain hard and firm or may undergo a general softening, and produce tubercular abscesses or "gatherings."

From the peculiar arrangement of the small tubercles, and of the growths resulting from their aggregation, various terms have been used to designate the different forms of tubercular growths. Thus, from their fancied resemblance to that fruit, they are termed in many parts of the United Kingdom "*grapes*," and in other parts (from the supposition that they resemble those berries) they are called "*angle berries*." Not only in this country, but in Continental countries also, are they designated according to their resemblance to different well known objects. Thus the Germans speak of this disease as "*duck-weed disease*," and as "*pearl disease*" (Perlsucht), while the French speak of it as "*potato disease*" (Pommelière) the latter term more particularly applying to the larger tubercular masses. In this country, the enlarged glands are spoken of as "*clyers*" or "*kernels*."

It is of the highest importance to note that not only the little millet seed-like bodies, but also every other form of tubercular product, contains either bacilli or their spores, or both bacilli and spores; but while this is so, it is equally important to note that it is from the softer products that the great danger of a general contamination of the system arises.

In reference to the flesh of infected cattle, actual tubercular

growths are seldom found in the structure of muscle (or at least are not sufficiently large to be visible to the naked eye) unassociated with disease of some adjacent organ, such as a joint or a bone; but, notwithstanding this fact, there is abundant evidence to show that the juice of the flesh of tuberculous animals contains the germs of the disease, and amongst those who first pointed out this was Toussaint, a veterinary teacher at Lyons, who reproduced the disease by inoculation with juice pressed out of the centre of an underdone steak from the body of a tuberculous animal; and, in like manner, the late Professor Bouley transmitted tubercle to a pig by inoculation with meat juice from one of the thigh muscles of a cow.

The course run by tuberculosis in birds, and the character of its macroscopical lesions differs, in some respects at least, very widely from that just described in mammals. It is a curious fact that the Palmipedes are rarely, if ever, affected with the disease, and it is equally as curious that turkeys and guinea fowl are seldom its victims.

The poultry yard, the pigeon loft, the pheasantry, and the aviary (so far as canaries, at least, are concerned), are decimated of their occupants to an enormous extent by this fell malady throughout the whole of the country; and Dr. Bland Sutton has shown that while grain-eating birds are the most frequently attacked—probably, he thinks, from the contamination of the grain by the fœces and other products of infected birds,—birds of prey also occasionally fall victims to the malady.

The affection in poultry is commonly known as "*croup*" or "*roup*," and, scientifically, it has both in this country and on the Continent been described as "*gregarinosis*," and as "*diphtheria*." In my first lectures on the subject in 1871-2, I described it as "*diphtheritic aphtha*," and during the past few years, human and veterinary pathologists have variously described it as a diphtheritic and as an aphthous affection.

The discovery of the bacilli of tuberculosis has served to dissipate these contradictory theories, and to establish the fact that, with few exceptions, these variously designated affections are one, and that tuberculosis.

The process, in the majority of cases, commences in the mucous membrane of the mouth, the nostrils, or the eye, and extends from the mouth to the throat and the crop, thence to the proventriculus, and after that the bowels, the mesentery, and the liver,—the gizzard is rarely affected; from the nostrils it extends to the throat and lungs—the windpipe usually escaping the infection. In some cases the comb, the wattles, the ball of the foot, and the skin of the breast, are affected, localisation in the breast being probably due to the irritation of the perch, and in the feet to dirt or to wounds inflicted by pieces of glass or other sharp objects. The spleen—unlike that of the ox—is frequently affected, the kidneys and the testicles occasionally, the heart never. The conjunctival lesion sometimes extends to and destroys the eyeball, and, very exceptionally, it extends through the foramina of the skull to the brain. In the mouth, nostrils, and conjunctivæ, the lesions have a croupous, and sometimes a diphtheritic, character; yellow-coloured strata of a lymphoid exudate being deposited on the surface of the membrane, forming a tolerably firm mass which clings to the superficial mucosa, and when forcibly removed, leaves a bleeding surface. In the lungs, the lesion is of the character of a croupous exudate, and in some cases the whole of the lung structure in one lobe becomes replaced by such exudate, which forms a beautiful cast of the lobe. In the walls of the crop, of the proventriculus, and of the intestines, the lesion is nodular, the nodules varying in size from a small pin's head to two ounces or more in weight, and the intestinal surface is frequently ulcerated; sometimes a stratified exudate is thrown out on the surface of the intestinal mucous membrane, forming a cylindrical cast of its lumen, which is occasionally occluded

thereby. In the mesentery, the lesions are always nodular, as they are in the liver and in the spleen; these organs are frequently so much invaded by the new growths, as to suffer annihilation as functional organs, and the tubercles can be washed out of the liver, which becomes soft, with ease. The condition of the liver is shown in our illustrations. In the comb, wattles, and feet, and under the skin of the breast, the lesion is stratified.

Tuberculosis in the Rabbit.—The lesions in this animal are confined mainly to the liver, but are also seen in other organs. The liver, as in poultry, becomes of an enormous size, soft and friable, and studded thickly throughout its structure with miliary tubercles. As a rule, the victims are emaciated and "pot-bellied," and there is little fat about the interior of the carcase; consequently, in the great majority of cases, it is not exposed for sale as for human food. I have never seen the lesions of tuberculosis in the muscles of the rabbit, though the cysts of the Coccidia may be readily mistaken therefor.

The effects of tubercle on the systems of its hosts depends—1. Upon the rapidity with which the disease runs its course; 2. Upon the extent of the disease; 3. Upon the importance of the organs involved; 4. Upon the localisation of the lesions—*i.e.*, whether in the interior of the organs or on their exterior; 5. Upon the amount of the inflammatory action accompanying the formation of the tubercles; 6. Upon the subsequent changes—*i.e.*, as to whether the tuberculous masses become hard or soft; and 7. Upon the constitution of individual animals—*i.e.*, as to their capability or otherwise of withstanding the effects of disease. If the disease runs its course slowly, there may be no injurious effect exercised upon the body, nor will there be any visible sign of its existence, so far as the general aspect of the animal is concerned; but if the disease runs its course quickly, fever, often very high, is established, and the body rapidly wastes. In like manner, the localisation of the disease on the external surface of organs, is

never associated with so much general disturbance as that produced by its localisation in the interior of organs; and enormous masses of so-called "grapes" or "angle berries" (from a half cwt. to one cwt.) may be found in connection with the lining of the abdomen, or of the chest, without the animal evincing any external evidence of their existence. Again, if the tuberculous products undergo rapid softening, the disease is spread more readily through the system, and the whole body becomes rapidly contaminated.

The effects of these growths, so long as they remain hard, may be likened to the effects of a parasite—*i.e.*, they demand a supply of nutrition, and so long as the animal is capable of supplying this in excess of its own wants, so long will it not only preserve its condition, but will actually thrive. The same remark holds good when the tuberculous formations become hard and gritty, or, in technical language, *obsolete*.

In the case of such organs as the lungs, liver, kidneys, and brain, the disturbance produced by the pressure of large masses of tubercle is sufficient to interfere with their function, and thus lead to important interference with such normal processes of life as digestion, the purification of the blood, and the generating of nerve force.

From these remarks it will be seen that, under certain circumstances, animals may become extensively diseased, and yet no suspicion of the fact may be aroused in the minds of the owners of, or the attendants upon, such animals. On the contrary, a very limited amount of disease may give rise to such marked disturbance, as to at once show that there is something materially wrong.

A photograph of the abdominal and thoracic surface of the carcase of one of the fattest cows I have ever seen is introduced in our illustrations, as are also drawings (coloured and uncoloured) of sections of different organs affected with the disease.

The question of the use of the flesh and of the milk of tuberculous animals for human food must now be considered. It must not

for a moment be assumed that the present is the first period in the history of this disease in which this question has received attention; we have it on the authority of Lydtin, Fleming, and Van Hertsen, that there existed in the Mosaic laws strict legislative rules as to the condemnation of the flesh of an animal, or any portion of an animal, affected with this disease, at least at certain stages of the disease; and there can be no question that the laws embodied in the "Mischna" (the oldest part of the Talmud), distinctly referred to the prohibition of the use of such flesh. From this time onwards, various ordinances have been instituted with the object of checking the use of consumptive flesh, especially in France and the German States, and even in such countries as Spain, Italy, and Switzerland; and severe punishment has at different times been inflicted on butchers and others who have wilfully sold such flesh for consumption.

It is curious to observe how, during the past centuries, as now, there have been men of note ready to come forward and prove, by themselves devouring the flesh of tainted animals, that such flesh is necessarily harmless; forgetting that what may be meat to one is to another rank poison. Thus, in the 17th century, a doctor of medicine and philosophy not only consumed a large quantity of flesh, but also drank a quantity of broth made from tuberculous nodules, and publicly drank the broth in the market place of the town in which he resided in order to show the people the harmlessness of such matter.

Some time ago a most striking example of the effects of consuming the flesh of a tuberculous animal was brought to light by a French physician in the case of a young woman who rapidly became consumptive as the result of devouring the imperfectly cooked bodies of tuberculous fowls.

That a certain amount of relation exists between the death-rate of man and animals respectively from consumption, and that this relation is materially affected by the use of tuberculous flesh for

human food, is afforded in a chart issued by the authorities of the Grand Duchy of Baden, in the year 1881, and published in Lydtin, Fleming, and Van Hertsen's paper. The chart applies to no less than 52 towns, and shows that where tuberculosis is prevalent among cattle, it is equally prevalent amongst the human population, and is particularly prevalent in those towns in which the number of low-class butchers is greatest. One remarkable exemption to this is found in the town of Wertheim, but it is significantly pointed out that from this town large quantities of sausages, made from flesh of inferior quality, are annually exported.

That the flesh of tuberculous animals, and even the tuberculous organs of animals, may be consumed with impunity when properly cooked, cannot be denied, but in how many instances, it may be asked, is such flesh eaten without being properly cooked?

When the facts already stated as to the power of resistance to heat of the spores of the tubercle bacilli are borne in mind, it will be plain to all observant persons that, in the ordinary process of cooking, especially in the cooking of large joints, there may be ounces of flesh devoured by human beings that are never subjected to a sufficient amount of heat to destroy these spores. Take for example the cooking of a beef-steak, or of a large roast of beef. How many people are there who prefer that it shall be *under-done?* and consequently, in how many instances must the flesh and internal organs of animals be eaten in the interior of which numbers of bacilli and their spores retain their vitality?

It is well known that many people have a great partiality for ox kidneys and for liver—especially the livers of poultry—and that ignorant persons are not always particular in reference to the existence or non-existence of such apparently harmless things as small yellow spots or blebs (tubercular nodules); and I have on several occasions had such organs submitted to me for examina-

tion that had been sold for human food. But the amount of danger arising from this source is very small indeed as compared with that which exists in the consumption of sausages and such like delicacies prepared from the flesh of tuberculous animals; and as a proof that such flesh is used for this purpose, I have only to direct attention to some of the prosecutions that have been instituted against the manufacturers of such articles, and in which I, as well as others, have detected tubercle nodules in large numbers in the material prepared for this purpose.

It is all very well to assert that sausages are cooked before they are eaten; but, again, it may be asked, in how many instances is the centre of a sausage devoured in a comparatively raw state? The poorer classes, too, have doled out to them in slices the livers of cattle and the cooked udders of cows, and who shall say that any steps are taken by the vendors of such edibles for the purpose of ascertaining whether they are or are not the subjects of tuberculosis. Of even more importance than the foregoing is the fact that lymphatic glands are more often affected by the disease than any other organs of the body, and that large numbers of these glands, or "kernels," as they are called, are situated in the deep portions of the flesh, and are by many looked upon as a delicacy.

As an example of the way in which tubercular lymphatic glands are sometimes overlooked in the examination of carcases, I may direct attention to a case which occurred in Edinburgh some time ago. A carcase had been seized by the inspectors in one of the meat markets and removed to the sanatorium at the abattoir. The owner of the carcase, which was in prime condition, disputed the action of the inspectors, and called in several experts to examine the carcase on his behalf. After the conclusion of their examination I myself made a second inspection, for the purpose of obtaining other evidence of the existence of the disease than that which I had gathered on the occasion of my first examination,

and, on cutting through the sterno-costal muscles, I came across a chain of tubercular glands at a depth of about $2\frac{3}{4}$ inches from the surface. This section has been represented in one of the illustrations to this work, and a glance at the situation of the affected glands will show the improbability of their being subjected, during the ordinary process of cooking, to a degree of heat sufficient to destroy the contained bacilli or their spores.

The last question to be considered in reference to tuberculous flesh is, as to how far it may be safe or expedient to use such flesh or organs for human food? While there may be some difference of opinion as to the flesh, none can exist in reference to the organs, they should be unhesitatingly condemned; and particularly in view of the fact that, in whatever way the disease may be contracted, or through whatever channel the bacilli may gain access to the system, they must necessarily find a lodgment in the lungs, the stomach, the intestines, or the liver: and assuming for a moment that they gain access to the blood, they are bound in the ordinary course of circulation to pass through the vessels of the organs mentioned, and in doing so may be arrested in the capillaries of these organs.

The point which has received most consideration in connection with the consumption of flesh is, as to where the line (if any) shall be drawn—*i.e.*, whether the carcase of an animal which only shows evidence of the existence of tubercles of the serous lining of the abdomen and chest, may be with safety passed after the lining has been removed by "stripping?"

If it could be shown beyond the possibility of a doubt that, under these circumstances, no contamination of the muscle itself or of the lymphatic glands had taken place, and if every particle of the tuberculous lining were removed, such carcases might be used as human food with impunity. But evidence as to the non-existence of bacilli in the flesh could only be gained by careful and prolonged microscopic examination, and in some instances

the examiner would fail to find them, seeing that the microbes might be present only in the form of spores; and inasmuch as the process of staining required to render the bacilli visible is a delicate and elaborate one, it is evident that the adoption of such a system of examination in all cases is impracticable. Nor can the test of inoculation of animals with the juice of the flesh—seeing that the disease requires a considerable time to develop—be brought into requisition; and even if this were not the case such a test would be prohibited by the provisions of the Vivisection Act. In like manner, the carrying out of feeding experiments with the object of deciding as to the nocuity or otherwise of tubercular flesh would be impracticable as a sanitary measure, on account of the time required for the development of the lesions.

It may be argued that there is no direct proof of the transmission of tubercle from animals to man by the consumption of flesh; such proof, it need scarcely be said, cannot for manifest reasons be obtained, but the mass of indirect proof in favour of such supposition is enormous, and if our arguments against the use of such flesh are based only upon analogies and deductions, they are sufficient to warrant us, in view of the great gravity of the question, in prohibiting the sale of tuberculous flesh for human consumption. As bearing upon the nocuity of such flesh, the following extracts from a paper read by M. Arloing, Director of the Lyons Veterinary College, at the late International Congress held in Paris, and translated by Professor M'Fadyean in the *Journal of Comparative Pathology and Therapeutics*, are of extreme interest:—

"*Nocuity of Tuberculous Flesh.*—Let us at the outset prove very clearly the nocuity of the flesh coming from tuberculous animals. That has been demonstrated by two varieties of experiment—(1) The ingestion of the flesh of tuberculous animals, having all the appearances of healthy flesh; (2) The inoculation of the juice extracted from such flesh.

"Of the first kind we shall content ourselves with citing a few. Those of Gerlach and of Johne are the most important. Out of 35 animals fed by Johne with the raw flesh from animals attacked with tuberculosis, 8, or 22·5 per cent., became tuberculous; and of 46 subjects fed in the same manner by Gerlach, 13·1 per cent. contracted the disease.

"M. Peuch caused two young pigs to consume 5 kilogrammes of raw flesh, without bone, in ten days. At the end of two and three months these animals presented discrete glandular tuberculosis.

"M. Nocard caused eleven cats to be fed for from two to four days with a certain quantity of flesh from tuberculous animals without result; but these negative experiments cannot destroy the preceding.

"Thus the passage of suspected flesh into the digestive tube can communicate tuberculosis. Moreover MM. Straus and A. Wurtz have shown in some experiments, *in vitro*, that the virulence of Koch's bacilli is with difficulty destroyed by the gastric juice.

"The cooking to which food is submitted can diminish the danger, but it is impossible to rely on that for the destruction of the virulence. In fact, to obtain this result all the virulent particles would require to be heated to over 70° C. for half an hour. But in practice this temperature is not always uniformly attained and maintained throughout the whole thickness of the masses of flesh submitted to the cooking. Let us add, to complete the information on the rôle that may be attributed to cooking, that in 62 experiments in which Johne administered notoriously tuberculous flesh, after having submitted it to cooking in boiling water for ten to fifteen minutes, 35·5 per cent. of the animals were infected.

"Experiments by inoculation of the juice of meat, in which one, so to speak, compels the virus to enter the organism, may appear to some persons a little artificial.

"The results, however, which they furnish are less alarming than those of the experiments in which the suspected flesh has been introduced naturally into the digestive passages. Sometimes, indeed, the results are most reassuring. Thus M. Nocard has obtained only a single example of infection in 21 series of inoculations made with the juice of the flesh of 21 cows seized in the abattoirs. But it must not be forgotten that the virulent bacilli are distributed with great irregularity in the muscular mass, that they are rare there, and that consequently they may pretty often be absent from the small volume of juice which serves for the inoculation of an animal.* To appreciate the virulence of the juice of the flesh by inoculation, it is therefore necessary, as in statistics, to examine as many experiments as possible.

"At the late Congress for the study of Tuberculosis, the experiments of MM. Nocard, Chauveau, and Arloing, Galtier, Peuch, and Vessière, were cited. These experiments give a total of 47 attempts, 9 of which were followed by tuberculisation.

"For these 47 attempts there were employed 137 animals, 13 of which became tuberculous, giving a proportion of 9·4 per cent. for infection by inoculation; while by taking the mean of the experiments by Gerlach and Johne by natural ingestion, one arrives at the ratio of 17·8 per cent.

"The two series of experiments converge, then, towards the same demonstration — the nocuity of the flesh of tuberculous animals; and they indicate, further, the fact, especially serious from our point of view, that contagion by the digestive passages operates with an alarming frequency.

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* Woodhead produced tuberculosis by injecting into the peritoneal cavity of two rabbits the raw juice expressed from the intercostal muscles of a tuberculous cow, after all tuberculous pleura had been carefully "stripped;" but he found that the juice taken from the muscle of the thigh, and injected into two other rabbits, produced no results.

"Calculation gives us an idea of the number of bacilli contained in the mass of muscle of a tuberculous ox.

"Let us start from the experiments mentioned above, and suppose that the bacilli are uniformly distributed in the muscles of a tuberculous animal. Let us admit also that the 137 animals inoculated may have each 1 centimetre cube of juice. In the 137 centimetre cubes there were at least 13 bacilli, or for 1 centimetre cube $\frac{13}{137} = 0{\cdot}094$. We have assured ourselves that 100 grammes of flesh give under the press 30 centimetre cubes of juice. Consequently 100 grammes of flesh will include $0{\cdot}094 \times 30 = 2$ bacilli ·820. A kilogramme will contain 28 bacilli. If an ox of medium size furnishes 280 kilogrammes of flesh net, its carcase will contain $28 \times 280 = 7840$ bacilli. This number is not insignificant.

"M. Nocard has endeavoured to discover how long the bacilli wandering in the muscular tissue may conserve their virulence. Having inoculated six rabbits, two and a half months old, with 1 centimetre cube of a culture of tubercle bacilli (non-sporulating), he killed the first at the end of two days, and the others at intervals of twenty-four hours. From each rabbit he removed the mass of the longissimus dorsi muscle, divided it finely, and submitted it to the action of the press in order to express the juice. A centimetre cube of this juice was inoculated into the auricular vein of a parallel series of test rabbits. The rabbits inoculated with the juice of the flesh of the three first rabbits died tuberculous; the three others were never affected.

"M. Nocard concludes that the flesh of a tuberculous animal can offer some danger during the four or five days after death, but that after that interval—that is to say, before the sixth day—the bacilli are destroyed in the muscular tissue.

"This research, interesting from the scientific point of view, is hardly reassuring from the point of view of practice. In the first place, it is generally within five days after slaughter that the

flesh is retailed among the consumers, and within even a shorter period in summer. Again, the muscular tissue may very well destroy non-sporulating bacilli, but does it destroy also the spores, such as are often present in the bacilli of tubercular organs? The question may be put and almost answered negatively, for otherwise one could not comprehend the development of some examples of tuberculosis of the muscles which science has recorded.

"Several persons have inquired whether the flesh of animals that present some tubercular lesions, and at the same time are in a thriving condition as regards fatness, are really dangerous. Our friend, M. Baillet of Bordeaux, has insisted that these animals enjoy a sanitary immunity.

"M. Van Hertsen believes that such a tolerance would be followed by fatal consequences, for it is not in subjects of good appearance that the lesions are most discrete; he has seen in these animals the co-existence of pulmonary phthisis and mesenteric phthisis of a very advanced degree.

"MM. Veyssière and Humbert are not content with theoretical considerations; they inoculated two rabbits with 1 centimetre cube of juice of flesh from a cow *in very good condition;* both animals became tuberculous. Consequently the bacilli of fat subjects would be no less dangerous than those of lean subjects.

"It may be added that the flesh of fat subjects would have less chance of being sterilised by cooking, for that is what the consumer eats underdone (*saiguantes*) in preference to the lean meat.

"To sum up, the flesh of all tuberculous cattle, lean or fat, may conceal the germ of phthisis."

I have frequently examined the carcases of cattle that have been subjected to the "stripping" process — and with which no fault could be found so far as the appearance of the carcase was concerned — and discovered masses of tubercles in situations

that would usually have escaped detection in such superficial examinations as that to which meat is subjected by the ordinary inspector. Thus I have found tubercle in the deep lymphatic glands of carcases after they had been passed as being fit for human food, and I have seen advanced and extensive tubercular lesions in the bones of apparently perfectly healthy joints of meat, when these have been cut through for sale or for cooking purposes, and such an instance is depicted in the breast bone (sternum) of a young ox in our illustrations; and in reference to the flesh in those cases, we usually find that the muscles of the hind quarters, and also of the back (as exposed when the carcase is "ribbed") are dark in colour, soft in consistence, and soapy to the feel, while those of the hind quarters frequently present an irridescent appearance on section.

If those who advocate the sale of such carcases were prepared to place on every piece of beef sold, a ticket declaring that it was part of a consumptive animal, then those who chose to purchase it would have no ground for complaint, as they would be personally responsible for any ill effects arising from it. But it is only a reasonable question to ask, Is it fair to the public to expose such meat for sale without giving any indication of its character, and to charge the same price as that which is obtained for sound flesh?

I am quite well aware that a great hardship is inflicted upon butchers by the condemnation of the carcases of tuberculous animals which have been purchased at a fair market price on the faith that they were sound, but this question is for the consideration of the purchaser and seller only; it has nothing to do with the general public. In very many instances the seller is in the position of middleman, and he may suffer a large indirect loss; but here, again, the question is one between him and the consignee. Further, the consignor may be only the feeder of the animal, and the disease may have been in existence at the time of the purchase from the breeder and rearer; and it is to the

breeder, in the first place, that we must largely look for protection against the dangers arising from this repulsive and fearful malady. For several years past I have been in the habit of pointing out to butchers who have complained to me of the losses they have suffered in connection with the condemnation of the carcases of animals bought by them in a condition of apparent health, that they had the remedy in their own hands, and I have tendered the advice that they should decline to purchase any animal except with a proviso to the effect that the carcase (after slaughter) passes the inspector of meat. This advice was at one time acted upon by the butchers of Paisley; and the Aberdeen Association of butchers decided in April 1890 to hold the salesmen responsible for the loss in the event of the carcase of an animal purchased from them being condemned on account of tuberculosis, while only recently a scheme of insurance has been drawn up by the Edinburgh Butchers' Association of a very simple character. By this agreement the three parties interested bear each a proportion of the loss, the seller paying 3d., the auctioneer 1d., and the purchaser 3d. for each bullock sold, and in the event of the carcase being condemned the purchaser receives three-fourths of its value. The question of *compensation* can scarcely be considered here. Personally I am in favour of such being given, but only under certain conditions, and after careful consideration of the circumstances of each individual case.

In the *Four Bovine Scourges*, a book published by myself in 1879, the following remarks may be found under the head *Jurisprudence*:—"It should be borne in mind that if an animal is sold 'healthy,' 'all right,' or 'correct,' and tuberculous symptoms show themselves subsequently, the vendor is liable to the vendee for all contingent loss if it can be distinctly demonstrated that the tuberculous lesions were in existence at the time of sale." Here it may be noted that according to several recent decisions it is necessary to prove that the seller of a warranted

animal possessed a knowledge of the existence of disease prior to its sale. Again, at p. 166, under the head of *Prevention of Tubercle*, the following propositions are formulated :—

"1. All flesh and offal of infected animals, especially in the advanced stages of the disease, should be destroyed by fire or otherwise.

"2. All suspected animals should be carefully isolated until special signs of the disease have become developed.

"3. All actually affected animals should be destroyed.

"4. All contaminated food, litter, &c., should be disinfected or burnt.

"5. All infected houses should be disinfected.

"6. No animal whose history is tainted, even in the slightest degree, or in whose system there exists the least suspicion of tubercle, should be used for breeding purposes.

"7. The system of feeding and general management of our high class stocks should be regulated on a more rational and conservative basis than that on which it at present rests."

On p. 167 the following paragraph occurs :—"The subject of tuberculosis is one more for the consideration of individuals than of the State; nevertheless, if the former refuse to recognise the necessity for taking vigorous and prompt defensive measures against the common foe, the latter may yet require to see what can be effected by legislation."

At the Paris Congress of 1888 a resolution was passed (there being only three dissentients) in favour of the total seizure and destruction of all flesh derived from tuberculous animals, whatever the extent of the specific lesions found in such animals.

Since the holding of the Paris Congress of 1888, the following decree has been promulgated in France :—

"The flesh of tubercular animals shall be excluded from consumption—(1.) If the lesions are generalised—that is to say, not confined exclusively to the visceral organs and their lymphatic

glands; (2.) If the lesions, although localised, have invaded the greater part of an organ, or are manifested by an eruption on the walls of the chest or abdominal cavity."

Again, the Departmental Committee appointed by the Lord President of the Council in April 1888 to inquire into the subject of tuberculosis, expressed the opinion "that although bacilli may be found but rarely in the flesh, still the chance of their being present either there or in the blood is too probable to ever allow the flesh of a tubercular animal being used for food under any circumstances either for man or the lower animals."

On the occasion of the second sitting of the International Congress held at Paris on the 2nd September 1889, the following important resolution was (with four dissentients only) adopted:—

"There is reason to prevent the consumption, by men or animals, of the flesh of tubercular animals—mammals or birds—whatever the degree of tuberculosis, or whatever the apparent quality of the meat."

The importance of the foregoing resolutions, and the conclusions arrived at by the Departmental Committee, resulting as they did after a prolonged and careful consideration of the views of those best versed in the subject, cannot be over-estimated, and they must strengthen very materially the hands of all those who are anxious to see eliminated from the public bill of fare materials that are not only dangerous, but absolutely harmful to the human constitution. It must be within the knowledge of all sanitarians that there is at present sitting a Royal Commission on this question, and the hope may be allowed that some satisfactory conclusion in connection with it will be arrived at.

The seizure and removal of tuberculous cows from byres, and the prosecution of those who sell milk therefrom, is on quite as unsatisfactory a footing as is the seizure of diseased live animals in open market; and of this fact a striking proof was some time

ago afforded in the case of a prosecution, initiated by the Paisley sanitary authorities.

Infection by Milk.—The question of the infection of tuberculosis being conveyed by milk is of even greater importance than is infection by flesh; for the twofold reason that the former is largely consumed by infants, and is imbibed, generally, in an uncooked state. Moreover, the cream, the butter-milk, and butter from such milk, as has been shown by Professor Bang, of Copenhagen, and others, is as infective, if not more so, as milk itself.

Long before Koch's discovery of the tubercle bacillus, it had been accidentally and experimentally demonstrated that milk was infective by ingestion to calves and other young animals, and there is a mass of evidence—certainly to a large extent indirect—in favour of the view that it is by this vehicle that the germs of the disease are conveyed from the cow to the human subject. In 1872 I lost a child in Edinburgh under circumstances which allowed but of one explanation, viz., that he had contracted mesenteric tuberculosis through the medium of milk.

In a paper read at the meeting of the National Veterinary Association held in London in 1883, the late Mr. Cox, of the Army Veterinary Department, related the particulars of a case which inevitably led to the same conclusion, as did also Mr. Hopkins, F.R.C.V.S., of Manchester. Dr. Fleming has also referred to a similar case as occurring in the child of a surgeon in the United States, and a short time ago a case of mesenteric tuberculosis by the imbibition of milk occurred in the child of a well known veterinary officer of the Privy Council. At a meeting of the Edinburgh Medico-Chirurgical Society held in Edinburgh on the 15th February 1888, Dr. Woodhead referred (during the discussion following the reading of my paper on tuberculosis) to some undoubted cases of transmission to man and the pig by the medium of milk. To these instances a large number of

others might be added, but these are sufficient for our present purpose.

The danger of contamination by milk will be better appreciated when it is known that the tubercle bacillus can be readily detected, not only in the lactiferous product of animals in whose udders tubercular lesions exist, but occasionally also in that product when the gland to all appearance is perfectly healthy. And this danger will be still more appreciated when the fact is borne in mind, as pointed out by Bang, that such milk is not deprived of its infectivity by ingestion after exposure to a less degree of heat than 65° C. is reached.

REFRIGERATED, FROZEN, SALTED, PRESERVED, AND TINNED MEATS AND FISH.

REFRIGERATED MEAT is brought to this country mainly from the United States of America, the heat being extracted from the carcase immediately after slaughter, and the flesh being subsequently kept at a temperature of from 36° to 40° F. Owing to the diffusion of the colouring matter of the blood through the tissues, refrigerated meat has usually a pink colour; the flesh is somewhat insipid in flavour, and the fat has a tallowy taste. It undergoes decomposition with tolerable rapidity, and the tissues of the flank are, as a rule, very moist.

In Frozen Meat—which is most largely brought from New Zealand and Australia—the preliminary process of extracting the heat is not usually put in practice; it is very hard, requires many hours to thaw, and when thawed becomes of a darker colour (again owing to the diffusion of the blood colouring matter through the tissues) and moist.

Salted or Pickled Meat.—The process of salting meat is so well known that a description of it is scarcely required here. It is, however, necessary to observe that, while in the main it is carried out by subjecting flesh to the action of salt—with or without saltpetre—in its ordinary condition, or by macerating it in a strong (often a saturated) solution (*brine*) of these ingredients, it is sometimes effected in a much more rapid manner by means of *irrigation*, *i.e.*, by forcing or injecting brine into the flesh by the aid of a syringe constructed for the purpose.

In some districts "*Sweet Pickling*" is more largely practised, *i.e.*, molasses or common sugar, or an admixture of these, is mixed with the saline materials, while in other cases spice is added to the substances used for pickling—the last process is carried out more largely in the preparation of *pressed* beef than in the preservation of *corned* beef or other flesh.

Flesh or Fish intended for preservation by either of the above mentioned methods should be carefully dressed, perfectly healthy, and quite fresh, and, where practicable, should be subjected to the operation of "*boning*," or if not boned means should be taken to ensure that the preservative material is brought into contact with the bones. The flesh of diseased animals, or the flesh of animals that have been subjected to great excitement or to over-exertion, is not fit for preservation. The flesh of pigs, the subjects of measles, will not absorb salt or any other preservative material.

Evidence of imperfect preservation can, in some cases, be obtained by a superficial examination only, but in others it is necessary to make deep incisions, especially into parts contiguous to bone, before such evidence is obtainable. Thus it will frequently be found that imperfectly preserved materials, particularly pig's feet, bacon, &c., have a slimy aspect and are slimy to the touch, and while in this condition they are not so dangerous to health as when putrefaction has set in, they are, nevertheless, totally unfit for human food. In cases where there is evolved from the cut surface a putrefactive or sulphurous odour, the flesh should unhesitatingly be condemned.

Looking at the immense trade carried on in such preparations as preserved and tinned meats, it is, in my opinion, of the utmost importance that a stricter watch than is now exercised should be kept on such edibles, and I do not think it is going too far to insist that those responsible for the health of the community should be empowered, nay, instructed, to examine samples of

every consignment of such articles before they are admitted to our food markets; and further, I am of opinion that equally strict watch should be kept on home-made articles of this class.

As I have before indicated, prepared meats offer a ready means of using up animal flesh of doubtful character, but more than this, owing to imperfect preparation and preservation, chemical products of a poisonous nature are frequently developed in them. This fact has been known to chemists for a considerable period, Liebig having described these poisons in sausages more than thirty years ago as being of the nature of acids; they have been largely looked upon as of a fungoid (mould) nature, and while certain mould fungi (penicillium and aspergillus) undoubtedly possess pathogenic properties, poisoning by such is not very likely to occur in face of the palpable presence of mould in the articles to be consumed. In 1880 a case of wholesale poisoning by beef and ham sandwiches occurred at Welbeck, the prominent symptoms were those of a grave intestinal lesion, in fact they were of a distinctly choleraic type. Again, in 1881, a somewhat similar occurrence took place at Nottingham, the medium in this case being baked pork. In both these instances a spore-bearing bacillus, which has been figured by Klein in his "Micro-Organisms and Diseases," and by the aid of feeding experiments, and by inoculation in dogs, cats, and other animals, positive proof was obtained that those organisms were the active agents in the production of the malady from which the consumers of the edibles in question suffered. But while the nature of these outbreaks was so satisfactorily demonstrated, numbers of similar instances occur in which no such organisms have been discovered, and in these poisoning is attributed to the presence of a series of poisons identical in character with the alkaloids obtained from plants, and known as *Ptomaines*.

Ptomaines are produced during the process of putrefaction in vegetable and animal matters, and possess different properties

according to the source from which they are derived; thus, in some cases, tetanic symptoms are produced by them, in others conditions allied to scarlatina, and in others again, choleraic symptoms. It is now recognised that these principles are the products of micro-organisms.

Seeing that the subject of *Ptomaines* is one of such great importance, I have felt myself justified in transcribing the following extracts from lectures (The Croonian) recently delivered by Dr. Lauder Brunton, and published in the *British Medical Journal* for June 15th and 22nd 1889:—

"*Ptomaines, &c.*—For a good while the microbes were looked upon as directly causing disease by affecting the tissues of the patient, but now, since chemical investigation has been applied to the processes of disease and the products of putrefaction and fermentation, we are beginning to look upon many of the symptoms which occur in consequence of the action of microbes as being due not to their direct action upon the tissues, but to their indirect action in forming poisons; to regard, in fact, the symptoms they produce as bearing a similar relation to the microbes as the symptoms of intoxication do to the yeast plant. This plant, when introduced into the body, does not produce intoxication. It is the alcoholic products of its action upon saccharine fluids which make a man drunk.

"*Panum's Researches.*—In 1856, Panum demonstrated that the poison which occurs in putrefying meat is a chemical substance and not a living organism, although it may be formed by organisms, for he was able to boil it for eleven hours, and then to dry it completely at boiling heat without destroying its poisonous properties. He showed that the symptoms produced by the putrid poison were different from those produced by various ammoniacal salts—leucine and tyrosine—which he administered to the animals for the purpose of comparison. He was uncertain whether the poison acted like an alkaloid, such as strychnine,

directly upon the nervous system, or whether it acted upon the blood, causing decomposition in it, and leading to the production of substances which poison the nerve centres. At all events, he felt sure that it did not act like an ordinary ferment, such as pepsin or ptyalin, for it was not destroyed like them by prolonged boiling.

"*Selmi's Researches.*—In 1870, Selmi brought prominently forward the chemical nature of the poisonous products which resulted from the decomposition of albuminous matters by microbes. He concluded that their actions might resemble those of the vegetable alkaloids, but he did not separate or identify any individual substance, although he gave the whole class the name of ptomaines.

"*Cholera and Muscarine Poisoning.*—In 1873 I read a paper before the British Association at Bradford, in which I pointed out the striking resemblance which exists between the symptoms of cholera and those of poisoning by muscarine; and I suggested atropine as a possible remedy in cases of cholera, on account of its remarkable power to antagonise muscarine; I came to no conclusion regarding the exact nature of the cholera poison, nor did I distinguish between microbes or actual alkaloids which might be present in it.

"*Bacteriology and Chemistry.*—Since that time the researches of Koch, and the methods he has introduced, have given an enormous impetus to the study of bacteriology; and the isolation by Nencke of a definite ptomaine, and the discovery of many more by Brieger, has put the chemistry of putrefaction on an entirely new basis.

"*The Relation of Microbes to Disease.*—In discussing the relation of microbes to disease, we may consider, first, the microbes themselves outside the body, and the poisons they may produce; secondly, the microbes themselves, and the poisons they may form in the intestinal canal; and, thirdly, the action of microbes or their products when actually circulating in the blood or present

in the tissues. It is, of course, a question not only of great theoretical interest, but one likely to be of great practical importance—Do the microbes break up the albuminous substances or hydro-carbons which they attack by means of their actual protoplasmic structure, or do they, like the higher animals, secrete organic ferments or enzymes, by means of which the disintegration is actually carried on?

"*Mode in which Microbes attack Protoplasm.*—It is evident that if the decomposition of albumen, starch, or fat, for example, is due to the actual protoplasm of the living microbes, it will at once cease if these microbes be killed, but if it is dependent on a ferment which is secreted by the microbes, it may continue to a certain, though limited, extent after they have been destroyed, just as the pepsin which is secreted by the stomach of a pig may carry on digestion after the pig itself has been killed. This question was investigated by Kühne in 1877. He came to the conclusion that the fermentative action of bacteria was not the same as that of the pancreas, and he did not succeed in isolating any ferment by extracting bacteria with water or glycerine, as he would have done on treating a pancreas.

"*Microbes and Ferments.*—The probability that microbes formed ferments seemed so great, however, that I thought it worth while to take up the question again. The difficulty of such a research, and the time required to make the necessary experiments, completely prevented me from attempting to do it alone, but I have been so fortunate as to secure the co-operation of Dr. Alan Macfadyen, whose skill in experimenting has enabled us to get some positive and interesting results.

"The object of the inquiry was to ascertain whether (1) microbes act upon the soil upon which they grow by means of a ferment; and (2) whether such a ferment can be isolated and its action shown apart from the microbes which produce it, in the same way that the ferments of the stomach and pancreas

can be separated from the cells by which they are originally secreted. The results of the inquiry show that bacteria liquefy gelatine by means of an enzyme which can be isolated, and which will continue to act after the microbes have been destroyed. Like the ferments of the pancreas, this enzyme acts most readily in alkaline solutions. Bacteria seem to have the power of adapting themselves to the soil on which they grow, and of manufacturing a ferment suitable to their needs, for the same bacilli, when grown in starch paste instead of on gelatine or in beef-tea, produced a different ferment, which would convert starch into sugar, but would not act upon gelatine.

"After we had been occupied with this research for several months we learned that similar results had been obtained by Bitter, who has found that Koch's cholera bacillus produces in meat peptone a peptonising ferment which is quite distinct from the bacillus itself, and continues active after the bacillus itself is destroyed, and similar results have also been obtained by Sternberg. This ferment resembled pancreatin rather than pepsin by acting more vigorously in alkaline than in acid solutions. We have not seen the original work of Bitter and Sternberg, and know it only from a brief abstract.* The difficulty of such investigation is so great that, however carefully the experiments may have been made, there is always a natural hesitation to accept the results of any observers till they have been confirmed by others. At the same time I believe that the results are substantially correct; and one point that comes out in the experiments is that the microbes themselves may be destroyed by a temperature which does not destroy the activity of the ferment which they have formed.

"*Relation of the Ferments formed by Microbes to poisoning by*

* *Ptomaines and Leucomaines.* By Victor C. Vaughan and Frederick G. Novy. Philadelphia, Lea Bros. and Co. 1888. P. 96.

Meat.—The practical application of these results in regard to the prevention of disease is that they seem to show that meat which has become tainted by the presence of putrefactive microbes may possibly be cooked sufficiently to destroy the microbes themselves, while the ferments they have formed continued to decompose the meat, and gave rise to poisonous substances. We can thus see how a cold beefsteak pie, or other cold meat, may become poisonous and produce serious symptoms, although the same food may have been eaten with impunity immediately after being cooked; for during the process of slowly cooling, poisons may have been formed in the meat, although there may have been none in it immediately after it had been removed from the oven, and any microbes present were likely to have been killed by the cooking. The frequency with which meat very slightly tainted must be eaten in summer, and the common rule of not eating game at all until it is somewhat "high," as it is termed, makes one rather wonder why poisoning by ptomaines formed in such meat and game does not occur more frequently, although I believe that it occurs, in a slight degree, more frequently than people are generally willing to allow.

"*Explanation of the Danger of Diseased Meat.* — Some very interesting experiments by Bocklisch may perhaps explain this rarity of ptomaine poisoning. In experimenting with pure cultivations of the *vibrio proteus*, better known as 'Finkler's bacillus,' he found that it did not seem to produce any poisonous substances, although it occurs in the dejecta of patients who have been suffering from sporadic cholera, and is supposed to cause the disease. It occurred to him, however, that it is never present in the human intestine as a pure cultivation, and that possibly the presence of another bacillus along with it might cause the formation of the poisonous products in sporadic cholera. He therefore mixed some other putrefactive bacteria with it, and

found that the mixed bacilli formed the highly poisonous substance methyl-guanidine.

"In the same way, it seemed not unlikely that cases of acute poisoning by meat or game may be due to the accidental presence of more than one kind of bacillus, leading to the formation of specially poisonous products. More especially is this likely to be the case if one of them is a pathogenic microbe, which has already produced disease in the beast or bird yielding the meat, and a certain amount of decomposition of its tissues before its death.

"*Practical Bearings of our knowledge of Ptomaines.*

"*High Game.*—The practical outcome of the facts I have just brought before you is, that there may be very great danger indeed of poisoning by alkaloidal substances formed in meat by its decomposition. Yet we know that while tainted beef is strongly objected to, high venison is looked upon as a delicacy, and the experiments of Bocklisch indicate that very probably the presence of two kinds of bacteria may be the cause of poisons being formed.

"*Tainted Meat.*—Tracing the question a step further, we ask: How are the two kinds of microbes likely to be present? And the simplest explanation is that the dangerous meat may have been got from a diseased animal, and the microbes present in its tissues may, by combining their action with that of ordinary putrefactive bacilli, have caused the formation of the deadly poisons. If this should be found to be the fact, it will clearly explain the necessity of avoiding, as unfit for use, the flesh of animals suffering even from the very earliest stage of acute disease.

"*Action of Microbes in the Intestine.*—Having considered the relation between disease and microbes living outside the body, we now come to discuss their action when they are taken into the

intestinal canal, or applied to some absorbing surface such as that of a wound.

"*Microbes in the Intestine.*—Bacteria abound in the intestine even in health, and some have thought that they might even aid the digestive juices in breaking up the food. It is quite likely that they aid in breaking up the food, but whether they do so with any advantage to the organism may be somewhat questionable. They tend to split up the products of pancreatic digestion further than the pancreatic ferment would, and one of the substances to which they give rise is indol. This body has an antiseptic action, and belongs to the aromatic series, members of which, as I shall afterwards have to show, have a very marked action upon the liver. In the intestine it becomes converted into indican, which is absorbed and excreted in the urine.

"*Poisons formed during Digestion.*—The presence of bacteria is not necessary for the production of poisonous alkaloids in the intestine, for fibrin digested with pepsin yields a substance to which its discoverer, Brieger, has given the name of peptotoxine. This substance belongs to the aromatic series, and I shall have again to refer to it when speaking of the action of drugs upon the liver. It causes drowsiness and feebleness, and may possibly be the cause of these symptoms in some cases of indigestion, but it causes no diarrhœa.

"Diarrhœa is, however, one of the most prominent symptoms produced by neurine, choline, and muscarine. Two other alkaloids — mydaleine, and another not yet named — which Brieger isolated from putrefying livers and spleens, have a still more powerful purgative action, producing almost continuous and fatal diarrhœa.

"In all probability much of the diarrhœa which occurs, especially in children, after the use of milk, is due to the formation of tyrotoxicon, or other more or less poisonous products, by decomposition of the milk in the intestine itself.

One of the most fruitful sources of diarrhœa in children is certainly the use of feeding bottles with long tubes, which are generally imperfectly cleaned, so that even when the milk is put quite fresh into the bottle, it becomes inoculated with bacteria before it reaches the child's stomach, where the temperature is just right for their rapid multiplication and the decomposition of the milk. The difference between the chances of a child fed at the breast and in this way is enormous, for in the former case the milk flows free from germs directly into the child's mouth, and the risk of bacterial inoculation is greatly dimished.

"Indeed, Andeer finds that in cows there is an antiseptic substance, resorcin, present in the udder, as if for the purpose of rendering the milk not only aseptic but antiseptic.

"The possibility of contamination in the child's mouth itself suggests the advisability for careful supervision in regard to the cleanliness of things put into it, even though it only be the mother's fingers or a teething ring.

"There can be, I think, little doubt that choleraic diarrhœa, Asiatic cholera, and typhoid fever, are all due to microbes, although bacteriologists may not have definitely settled the nature of the microbe in each case. In choleraic diarrhœa and cholera it is probable that the microbe acts to a great extent indirectly upon the organism, by simply producing poisons in the intestine."

It must be borne in mind that in some cases poisonous properties are imparted to tinned meats by the action of their juices upon the metals in which they are encased, and further, that the poison of sausages, black puddings, saveloys, and similar delicacies may reside, not in their substance, but in their envelopes, and I am given to understand that a mineral poison is sometimes used in the preparation of the latter. In the case of black puddings, another and a greater danger may arise, *viz.*, the

possibility that the animal from which the blood has been obtained has been the subject of anthrax or septicæmia.

Obviously, the most reasonable advice to give in reference to such foods is that they should be carefully examined before they are eaten, and that they should, so far as is practicable, be subjected to a thorough process of cooking. According to Captain Stacpole much may be learned as to the condition of the contents of a tin by the state of the tin itself. "If the meat has been improperly tinned, or if the slightest aperture exists in the tin or the solder, the contents will almost certainly be in a state of putrefaction, and as a result of this process gas will be disengaged, and this will give rise to a hollow or drum-like sound when the tin is struck with a solid body, in place of its being non-resonant."

"A hollow sound will also be produced if the tin has been imperfectly filled, but in this case the lid is generally depressed in the centre owing to the pressure of the atmosphere."

In reference to fish, I have been long acquainted with the fact, and have been in the habit for many years of impressing it on the members of my class, that in dogs, especially at seaside resorts, *septic forms of poisoning* and choleraic conditions were more frequently produced by the devouring of partially putrefied fish than by any other kind of animal matter. I am strongly and distinctly of opinion that all fish in which evidence of putrefactive change exists should be unhesitatingly condemned for the purposes of human food.

LEGISLATION IN REFERENCE TO THE CONSUMPTION OF ANIMAL FLESH, FISH, &c.

IN dealing with this part of my subject I shall, in the first place, make a few remarks in reference to the officials appointed to carry out the duties of inspectors.

In the *Four Bovine Scourges*, 1879, p. 202, I ask the question —"Is the inspection of meat in proper hands?" and in answer thereto I say:—"In the great majority of instances, inspectors of meat are chosen from butchers, farmers, or those employed officially, in some other capacity, about slaughter-houses, any doubt that may exist as to the sanitary or insanitary condition of meat being usually referred to the medical officer of health for solution; and while I am free to confess that many inspectors (who know nothing whatever of disease) attain, in the course of time, to a vast amount of practical knowledge and sound tact, there are very many who are absolutely ignorant of the rules necessary to guide them in their work, or of the evil effects of unhealthy flesh. Medical men, too—some of whom, be it said to their honour, do not dabble in matters which they do not comprehend—are ill qualified to judge of the fitness or unfitness of animal flesh for human consumption, as they are, in the very great majority of instances, totally unacquainted with the characters of animal diseases and the effects of any particular malady upon the tissues of the body. Veterinary surgeons, as they are trained, or should be trained, at the present day, are, in my opinion, the proper consulters as to the condition of flesh from animals that

have suffered from any pronounced form of disease." I have frequently, since that time, directed public attention to the anomalous conditions under which the inspection of meat is carried out in this country. Thus, at a meeting of the Royal Scottish Veterinary Society held in Edinburgh in March 1888, I said in the course of my inaugural address as President of the Society, and again in a paper on the Inspection of Meat, read before the members of the Sanitary Association of Scotland, held in Glasgow, in June 1888, that, "In the vast majority of instances, the system of inspection and condemnation of meat, and of milk too, for that matter, is a bad one, inasmuch as it is largely entrusted to individuals who have had no special training to fit them for the office they have to perform, and who have no knowledge of the nature of disease or of its effects upon animals, or through them upon man. Lay inspectors are of the greatest possible use, and their services cannot be dispensed with, but their functions should be more those of detectives than of experts; and I am quite satisfied that a greater measure of justice would be meted out to all parties concerned if lay inspectors of abattoirs and markets were instructed to seize and retain the carcases and organs of all diseased animals that may come under their notice and submit them to the inspection of a competent Sanitary Board, whose decision as to the disposal thereof should be final. The composition of this Sanitary Board should, in all equity and reasonableness, be the medical officer of health, the veterinary officer, and the senior inspector of markets or slaughter-houses."

The opinions expressed in the above quotations are those I still hold. Medical officers of health exercise an important function in relation to the physical well-being of the community, but I am afraid some of them entertain too high an opinion of their fitness to carry out, unaided, duties, the fulfilment of which appertains as strongly, and in some senses more strongly, to veterinary practitioners, and that not only in reference to flesh but also in

reference to live animals. A striking proof of this was afforded a few years ago by the action of the medical officer of health in one of our northern cities. This gentlemen not only considered that he was the proper person to carry out the ordinary duties of his office, but that he was alone fitted to act as an inspector of dairies and of the markets and the abattoir, and he even went so far as to publicly declare that veterinary surgeons knew nothing of such matters. Happily, there are few members of the sister profession to be found who are ready to endorse such opinions. I am quite prepared to acknowledge that cases every now and again arise in which the medical man is right, the veterinary surgeon wrong, and it is always a source of great pain to me when such antagonisms arise. Seeing that the primary aim of the members of both professions is to conserve the health of the animal and of the human population, it is surely not too much to ask that they should work in unison in order to accomplish the desired end, hence the proposal made above in reference to the appointment of Sanitary Boards so far as the condemnation or otherwise of animal flesh is concerned.

In an "Act to amend the Nuisances Removal Act for England with respect to the seizure of Diseased and Unwholesome Meat," which Act was subsequently extended to Ireland, is the following clause:—"The medical officer of health or inspector of nuisances may at all reasonable times inspect and examine any animal . . . exposed for sale, or deposited in any place for the purpose of sale, or of preparation for sale, and intended for the food of man . . . . and in case any such animal . . . . appear to him to be diseased, or unsound, or unwholesome, or unfit for the food of man, it shall be lawful for such medical officer of health, or . . . . in order to have the same dealt with by a Justice, inspector of nuisances, to seize, take, and carry away the same; and if it shall appear to the Justice that any such animal . . . . is diseased, or unsound, or unwholesome, or

unfit for the food of man, he shall order the same to be destroyed," &c. &c. A suggestion was recently made by the medical officer of health to the city of Edinburgh (Dr. Littlejohn) that the provisions of the above Act should be extended to Scotland, and when my opinion was asked as to the advisability or otherwise of adopting this suggestion, I made enquiries in reference to the working of this clause in three of the largest cities in England, viz., Liverpool, Birmingham, and Newcastle-on-Tyne, and I found that the power so given was never exercised, and that, too, for the obvious reason that the officers in question did not feel themselves competent, nor was it a part of their duty to exercise such a function ; and it must be further obvious to all unbiassed minds that such a procedure would lead to no end of litigation and contention. A striking commentary on the absurdity of this proposition was afforded at the meeting of the British Medical Association held in Glasgow in July of last year, when in the course of a discussion carried on in the section of Public Health, on "*The Communicable Diseases of Man and Animals and their relationships*," I ventured to ask from those present if they considered that medical officers of health and inspectors of nuisances were the proper persons to exercise such a function ; the answer was an emphatic "no" from nearly all those present, the President, Dr. Littlejohn, being more emphatic than any other member of the section. In many of the large towns and cities of England and Scotland the ordinary inspectors of markets and abattoirs, and sanitary inspectors, are instructed by the Municipal Authorities to submit all questions as to the unwholesomeness or otherwise of flesh, &c., to the veterinary officer for inspection, and if it is thought necessary, to the medical officer of health, and with this proceeding I cordially concur. In a very few instances veterinary surgeons are appointed as superintendents of slaughter-houses, and recently the Edinburgh authorities have appointed two veterinary surgeons as sub-inspectors of markets, and I hope this

enlightened and progressive action on their part will be followed in due course by the adoption of still more decided steps in the same direction all over the country. It is gratifying, too, to find that some of the leading medical journals have recently advocated the adoption of similar measures.

The Inspection of Live Animals exposed for sale for the purposes of human food is on a very unsatisfactory footing in this country. I have persistently directed attention to this matter for years past, but hitherto my efforts have not been rewarded. Every year thousands of animals—cattle, sheep, and pigs—obviously diseased, are exposed in public marts and markets for sale for human food, and no person possesses the power (in Scotland, at least) to prevent them being sold for this purpose; and, as has already been shown, the powers possessed by medical officers of health and inspectors of nuisances in England are not exercised. The Contagious Diseases (Animals) Act gives veterinary inspectors power to seize all animals which they have reason to believe are affected with contagious disease, but in such cases the local authorities are bound to give compensation if on *post-mortem examination* no such disease is found to exist. In the same way, no animal can be removed from a byre except under similar conditions; and, as shown in the article on *Tuberculosis*, this is the gravest blot on our legislative efforts in reference to the transmission of disease from animals to man. Veterinary inspectors should be invested with the power of seizing all live animals that are obviously unfit for human food, whether as the result of disease or poverty, and in the absence of the veterinary inspector, other officials, as market inspectors or police officers, should be empowered to take charge of, and detain such animals, pending his arrival. By the Rules and Regulations of the Edinburgh Slaughter-houses, the superintendent is charged with the duty of isolating any animal which is brought in apparently diseased, until it can be inspected by competent judges. Such a rule is of

greater importance as applying to markets and fairs, than to slaughter-houses, as in the latter case, animals are seldom allowed to leave the premises alive, and, consequently, an opportunity is afforded the officials of detecting disease on *post-mortem* examination; but in the former case, no person can ever prophesy what may be the ultimate destination of such animals when bought, as they usually are, by unscrupulous dealers or butchers.

It may be urged, and it has been so urged, that in the event of such power as is above indicated being exercised, the consignors or exposers of such animals should receive compensation therefor, seeing that compensation is given for animals suffering from contagious disease; but there is no force in this argument, as the suppression of contagious diseases is a national question, and the sufferer is, as a rule, in no way responsible for their introduction into his flocks or herds. But sporadic diseases are frequently the result of mismanagement and neglect, and in any case, when the owner of an animal, whose carcase may be reasonably considered fit for food, allows that animal—as is done in thousands instances—to linger on for weeks and months until, either as the result of the processes of disease, or as the result of wasting, its flesh becomes absolutely unfit for all edible purposes, he deserves to suffer any loss that may accrue from his reprehensible conduct.

Not only should power be given to inspectors to seize animals exposed in markets and other places, they should have full power to seize all cows that may be found obviously affected with disease in byres, or to effectually isolate them until health is restored. There are many forms of disease in which lactation is not arrested, but in which the quality of the milk is impaired, or in which it becomes absolutely nocuous, especially when consumed, as is largely the case, in an uncooked state; and from my own knowledge, I am prepared to state that milk from sick animals is not always thrown away by the dairyman, unless it has undergone

such important changes as to manifestly contaminate any other milk with which it may be mixed.

The Seizure and Condemnation of Diseased Carcases or Diseased Meat in Markets or Shops or in Slaughter-houses is a wide question, and one demanding the fullest consideration; and in order that any steps that may be taken in this direction may be effectual in protecting the public against the injurious influences of such flesh, certain preliminary steps are necessary in reference to the reporting of cases of disease, and the abolition of all private slaughter-houses. I have for years urged, and have been successful in several instances in getting public bodies to pass a resolution to the effect that all private slaughter-houses, except those that are licensed in country districts, should be abolished; and that a properly qualified inspector should be attached to all abattoirs, or be appointed to every rural district in the kingdom. In London an attempt is now being made by the authorities to effect the changes above recommended.

I have also expressed the opinion, and have here to reiterate it more strongly than ever before, that all owners of cattle should be compelled to report every case of disease or of death to properly constituted authorities. The same rule could scarcely be applied to sheep, seeing that the deaths in these animals are sometimes very numerous; but in all cases where the owners of slaughtered animals intend that the carcases thereof shall be consumed by the members of their own families, or shall be disposed of to their neighbours for consumption inspection by some competent person should be carried out; and in the event of the owners of such carcases not being desirous of so disposing of them, but rather to forward them to some neighbouring city or town for sale, they should be compelled to consign them to the public abattoir, or to *a receiving house* established for the purpose, there to be submitted to inspection; and failing compliance with such a regulation, they should be prosecuted with the utmost rigour of the law. It may

be said that such a procedure would involve municipalities in heavy expenses; but it is questionable whether the fat, bones, and manure, if the matter is properly managed, would not only cover any expenses that might be incurred in so dealing with carcases, but would leave a tolerable margin for profit; and even if this were not the case, a small fee could be demanded for every carcase so consigned. Amongst the rules in force at the Musselburgh slaughter-house there is one which provides for the inspection of any doubtful animal or carcase of an animal (in reference to which a declaration is made that it is intended for human food) by a veterinary surgeon, to be employed at the instance of the party who claims the animal or carcase; or in case the owner refuses to employ a veterinary surgeon the superintendent is empowered to do so. In the former event a fee of five shillings to the veterinary surgeon is fixed, which fee is paid by the owner if the carcase is condemned, and by the authorities if it is passed; but in the latter event, a prosecution follows the condemnation of the animal or the carcase, as being unfit for human food.

If the veterinary surgeons were officially connected with all slaughter-houses—whether as superintendents or as inspectors—such a rule as that just quoted would not be required.

In reference to the legislative powers conferred upon sanitary authorities and others for the purpose of enabling them to deal with the matter of Meat Inspection, I find that while there are general legislative powers applicable to England and Ireland and to Scotland, separately and respectively, individual municipalities have succeeded, at different times, in obtaining the insertion of special clauses bearing on the subject in Local Acts.

Thus Clauses 116, 117, 118 of the Public Health (England) Act, 1875, run as follows :—

"116. Any medical officer or inspector of nuisances may, at all reasonable times, inspect and examine any animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, flour, or

milk, exposed for sale, or deposited in any place for the purpose of sale, or of preparation for sale, and intended for the food of man, the proof that the same was not exposed or deposited for any such purpose, or was not intended for the food of man, resting with the party charged; and if any such animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, flour, or milk, appears to such medical officer or inspector to be diseased, or unsound, or unwholesome, or unfit for the food of man, he may seize and carry away the same himself, or by an assistant, in order to have the same dealt with by Justice.

"117. If it appears to the Justice that any animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, flour, or milk, so seized is diseased, or unsound, or unwholesome, or unfit for the food of man, he shall condemn the same, and order it to be destroyed, or so disposed of as to prevent it from being exposed for sale or used for the food of man; and the person to whom the same belongs, or did belong at the time of exposure for sale, or in whose possession, or on whose premises the same was found, shall be liable to a penalty not exceeding £20 for every animal, carcase, or fish, or piece of meat, flesh, or fish, or any poultry or game, or for the parcel of fruit, vegetables, corn, bread, or flour, or for the milk so condemned, or, at the discretion of the Justice, without the infliction of a fine, to imprisonment for a term of not more than three months.

"The Justice who, under this section, is empowered to convict the offender, may be either the Justice who may have ordered the article to be disposed of or destroyed, or any other Justice having jurisdiction in the place.

"118. Any person who in any manner prevents any medical officer of health or inspector of nuisances from entering any premises and inspecting any animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, flour, or milk, exposed or deposited for the purpose of sale, or of preparation for

sale, and intended for the food of man, or who obstructs or impedes any such medical officer or inspector, or his assistant, when carrying into execution the provisions of this Act, shall be liable to a penalty not exceeding £5."

But seeing that this Act does not enable the authorities to deal with articles *after sale*, the Newcastle-upon-Tyne Municipal Authorities—as I am informed by Dr. Henry Armstrong, medical officer of health—obtained the insertion of the following clause, as a remedy to this defect, in the Newcastle-upon-Tyne Improvement Act, 1882 :—

"SECTION 35. Section 117 (Power of Justice to order destruction of unsound meat, &c.) of 'The Public Health Act, 1875,' shall extend and apply to every diseased, unsound, or unwholesome article of food, sold or exposed for sale, or deposited in any place for the purpose of sale, or of preparation for sale, whether such article be or be not seized and carried away, to be dealt with by any Justice, or ordered by any Justice to be destroyed or disposed of, as mentioned in such section: Provided that the Justice before whom any complaint with respect to such article of food is made be satisfied, on the evidence laid before him, that such article of food was diseased, or unsound, or unwholesome, or unfit for the food of man."

In Scotland the question of unsound meat is dealt with under the Police and Improvement (Scotland) Act, 1862, 25 and 26 Vict. cap. 101, sect. 272; but in Edinburgh it is most largely dealt with, so far as markets, shops, and other similar places in which meat is exposed for sale, under "The Edinburgh Municipal and Police Act, 1879," the following clauses of which refer to the subject :—

4. *Diseased Meat.*

"CLAUSE 259. Every keeper, owner, or occupier of any market, shop, stall, or other place for the sale of butcher meat,

fish, or other provisions, and every cowfeeder who shall not, at all hours during the day and night, allow the inspector of markets or any constable access to such places for the due performance of his duties, shall be liable to a penalty not exceeding forty shillings.

"260. The inspector of markets, or any constable, shall be entitled to search any place in which there is reason to believe that the carcase of any animal which shall have been smothered, or shall have died of disease, is concealed, and if found, to seize the same; and the person guilty of such concealment shall be liable to a penalty not exceeding five pounds, or imprisonment for a period not exceeding twenty days, and the judge of police shall order such carcase to be destroyed or otherwise disposed of.

"261. Every person who shall sell, or expose to sale, or have in his possession, as or for human food, the carcase or any part of the carcase of any animal which shall appear to have died of or been killed in consequence of disease, or any butcher meat, fish, poultry, or other article of provision, of an unsound or unwholesome description, or in a state unfit or unsuitable for human food, shall be liable to a penalty not exceeding twenty pounds, and the articles shall be forfeited and disposed of as the judge of police shall direct; and every person who shall sell, or expose to sale, or have in his possession for the purpose of sale, as or for human food, any blown, stuffed, or pricked veal, lamb, or butcher meat, and every person who shall sell or expose to sale any bull beef without having the words 'bull beef' exhibited on a board in roman letters of at least three inches in length and of a proportionate breadth, over the stall or place in which it shall be exposed to sale, shall be liable to a penalty not exceeding five pounds, and the articles shall be forfeited and disposed of as the judge of police shall direct."

It will be observed that in clause 261 a regulation exists as to the sale of "bull beef" similar to that which is now in existence in reference to the sale of horse flesh.

In reference to blown veal, I may observe that in March 1890 the carcases of about thirty Dutch calves were landed at Leith, they were subsequently conveyed to the Edinburgh city abattoir; the authorities, acting on the regulation referring to blown veal, declined to allow the carcases to be sold within the precincts of the city, but permitted the consignee to send them elsewhere for sale. That harm could arise from the consumption of such carcases is very improbable, but the regulation is salutary and necessary, as it is not pleasant (to say the least of it) to have the breath of the slaughterers permeating the tissues of a carcase intended for human food.

In 1882, the Dundee authorities obtained powers to enable them to deal with the *original sellers of unsound meat, &c.*

Copy of Section 260 of the Dundee Police and Improvement Consolidation Act, 1882.

"260. Where any person is convicted by any Magistrate of the offence of selling or exposing for sale, or of having or keeping in any premises used for sale, any unsound or diseased animal or diseased meat, or any animal or meat unfit for the food of man, and intended for such food, it shall also be lawful for the Procurator-Fiscal to proceed against the original seller of such animal or meat as if he were an offender, art and part, with the convicted person, and as if he had committed such offence within the burgh; provided that such animal or meat were unsound, or diseased, or unfit for the food of man at the time of the sale thereof by such original seller to the convicted person, and the purchase by the convicted person, or by anyone on his behalf, from such original seller, wheresover made

or carried out, shall be taken and held to be a sale by such original seller of the animal or meat in question within the burgh, in premises kept and used for the sale of animals or meat; and the penalty and punishment provided by this Act against the person convicted shall also be applicable to, and be leviable and recoverable from, such original seller; and all the powers, authorities, jurisdictions, and forms of procedure given and provided by this Act against the convicted person shall be applicable to the prosecution, trial, and punishment of such original seller." The above-quoted regulation is an admirable one, but it would be enhanced in value if consignors were dealt with as well as sellers.

For the purposes of dealing with unsound or unwholesome meat in the slaughter-houses in Edinburgh, the following form a part of the Rules and Regulations in force thereat:—

"SECTION 8. And be it enacted, That if any person shall have in his booth or in his possession, in any place within the said slaughter-houses, the carcase, or any part of the carcase, of any animal which, in the opinion of two competent judges, shall have died of disease, or which, in the opinion of two competent judges, shall be unwholesome, unsound, or unmarketable, such person shall be liable in a penalty not exceeding twenty pounds; and if any person shall have in his booth, or in his possession in any place within the said slaughter-houses, any blown * or stuffed † veal, lamb, or other butchers' meat, such person shall be liable in a penalty not exceeding five pounds, and all such carcases and others shall be forfeited and disposed of as the Magistrates shall direct.

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* *i.e.*, Blown up with air in order to give it a white colour and to hide defects in condition.

† *i.e.*, Any veal or lamb upon which or to which masses of fat from other animals has been affixed for the purpose of giving lean flesh the appearance of being in good condition.

"SECTION 9. And be it enacted, That it shall be the duty of the superintendent of the said slaughter-houses, to be appointed by the Magistrates and Council, to see that the regulations for the said slaughter-houses are duly observed, and to search for and *seize all carcases*, or parts of carcases, or any animals which shall have died, or *appear to have died of disease, or to be of an unwholesome, unsound, or unmarketable, description;* as also all veal, lamb, or other butchers' meat, blown or stuffed, or apparently blown or stuffed, wherever the same can be found within said slaughter-houses, and to convey the same before the said Magistrates, to be disposed of as they shall direct, for which seizure this Act shall be his warrant; and for this purpose it shall be lawful to the said superintendent at all times, with or without assistants, to enter into and inspect the booths and other places within said slaughter-houses."

It will be observed that in all cases in the foregoing regulations the round-about process of appealing to Magistrates, Justices, or other administrators of the law, for the purpose of securing the condemnation and destruction of the articles seized, has to be gone through, and in order to obviate the delay, trouble, and expense connected with such proceedings, a very simple rule is in existence in Edinburgh, and is usually adhered to by all the parties concerned, by which the owner of a condemned carcase, or part of a carcase, consents to the same being forfeited, and signs a formal declaration to that effect; if however (which seldom happens), he refuses to do so, the ordinary course of bringing the matter before the constituted judges for settlement is followed, and it is always open to the owner of such carcase, or part of a carcase, to challenge the competency of the *two competent judges* referred to in Section 8, as above quoted.

In some slaughter-houses there exists a rule to the effect "That public jobbers — *i.e.*, those employed and licensed by

the authorities — are bound to report every case of disease to the superintendent." This rule, however, does not apply in the case of private jobbers (slaughter men)—*i.e.*, those employed by butchers themselves. I need scarcely observe that this is an invidious distinction, and one pregnant of wrong-doing in the way of concealment.

In the matter of the general management of slaughter-houses, I have only to point out here that the strictest cleanliness in the dressing of carcases should be enforced, and especially in reference to the hands, clothes, and instruments and appliances used by the operators, and that the system of emptying the contents of the digestive organs on the floor of the houses, and allowing the material to lie there for some time in close proximity to the still warm carcases, should be entirely abolished. Furthermore, the strictest cleanliness in the matter of the hands and clothes of those who have the conveyance of carcases from place to place, and of the wrappers, baskets, hampers, boxes, or vehicles in which they are so conveyed, should be observed.

The following sections in the Edinburgh Municipal and Police (Amendment) Act, 1891, dealing with diseased cows in byres are of great importance, and no apology is needed for giving them a place here :—

"26. Every person who, in any manner, prevents any inspector, officer or other person duly authorised or appointed by the magistrates and council, or any constable from entering any market, shop, stall, depôt, or other premises, at all hours during the day and night, and inspecting any carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, flour, milk, butter, eggs, or other article exposed or deposited for the purpose of sale, or of preparation for sale, and intended for human consumption, or who obstructs or impedes such inspector, officer or person or

constable in the due performance of his duties, shall be liable to a penalty not exceeding five pounds.

"27. The medical officer of health, or any duly qualified veterinary surgeon who may be appointed for that purpose by the magistrates and council, may, from time to time, within reasonable hours, enter any byre or cowshed within the city or wherever situated, if the milk produced therein is being sent for sale within the city, and may inspect and examine any cow kept therein for the supply of milk, in order to determine whether such cow suffers from any disease which might render the use of the said milk dangerous or injurious to health.

"28. Every owner of any cow kept within the city for the supply of milk, or wherever kept if the milk is being sent for sale within the city, and every person in charge of the same, shall render such reasonable assistance to the medical officer of health, or to any such veterinary surgeon who may be appointed as aforesaid, for the purpose of inspection and examination, as may be required by them, and any person refusing such assistance or obstructing the inspection shall be liable in a penalty not exceeding five pounds, and such penalty may be sued for and recovered by the prosecutor before the sheriff of the county in which such person is domiciled.

"29. Every dairyman or keeper of a byre or cowshed, whose milk is sold within the city, who, after intimation has been made to him by the magistrates and council, or by the medical officer of health, or by any person on behalf of the magistrates and council, that any cow in his possession kept for the supply of milk for human consumption suffers from tuberculosis, or any disease which might render the use of such milk for human consumption dangerous or injurious to health, shall retain such cow in his possession, shall, unless the contrary be proved, be presumed to have sold the milk produced by such cow for human consumption, and shall be liable in a penalty not exceeding five pounds, and such penalty may be sued

for and recovered before the sheriff of the county in which such person is domiciled, at the instance of the prosecutor.

"30. Every person who knowingly sells, or suffers to be sold or used for human consumption within the city, the milk of any cow which is suffering from tuberculosis, or any disease which might render the use of such milk dangerous or injurious to health, shall be liable to a penalty not exceeding ten pounds for each offence, and in any case where the person liable to a penalty under this section is not resident within the city such penalty may be sued for and recovered before the sheriff of the county at the instance of the prosecutor."

DESCRIPTION OF FIGURES ON PLATES.

FIG. 14.—*The Bacillus Anthracis.*—The bacillus of anthrax, as it occurs in the blood, presents itself as a straight immobile rod or cylinder with square cut ends. The dimensions of the single rods are not uniform, but their average length may be stated as about 3 to 6 μ) the diameter of a red blood corpuscle of the ox is about 8 μ) and their breadth is about 1 μ. The rods are frequently joined end to end to form chains. In the circulating blood these chains seldom number more than three or four elements, but in the capillaries of some organs, such as the lung and kidney, the bacilli are frequently united to form long interwoven threads. The bacillary form is the only one under which the anthrax organism presents itself in the blood during life, or within the intact blood vessels of an animal recently dead. In appropriate nutritive media freely exposed to the air (oxygen), and maintained at a suitable temperature, the bacilli grow out into long wavy filaments, in which at intervals clear refractile spores subsequently make their appearance. By the dissolution of such a filament the spores are set free, and these, under suitable conditions of medium and temperature, give rise to a new generation of bacilli.

For purposes of diagnosis a droplet of blood (from the fresh spleen if that is available) should be spread in a thin layer on a cover-glass. If the spleen is not available, the droplet should be taken from one of the systemic veins. In many cases the immediate examination of the cover-glass preparation, without

previous staining, suffices to bring into view the characteristic bacilli, which appear at short hyaline cylinders between the blood corpuscles. Any modern microscope magnifying 300 times will suffice for this examination. To stain the bacilli the cover-glass preparation ought to be allowed to dry in the air, and then passed (film upwards) slowly through the flame of a spirit lamp or Bunsen gas burner three times. The film is then to be treated with a few drops of Loeffler's solution of methyl blue, which is made as follows:—

Solution of caustic potash (1 in 10,000) 3 parts;
Concentrated alcoholic solution of methyl blue 1 part.

After five minutes standing the cover-glass must be dipped once or twice in a dilute solution of acetic acid (a drop to a watch-glassful of distilled water), then rinsed in distilled water, dried, and mounted in Canada balsam dissolved in xylol or benzol. By this method the bacillli are stained deep blue, while the nuclei of white blood corpuscles and other animal cells are stained light blue.

FIG. 15.—*The Bacillus of Black Quarter.*—The organism of black quarter, like that of anthrax, has a rod-like form, but it differs from the latter in several notable respects. In the first place its habitat is the muscular fibres and connective tissue of the well-known emphysematous swellings. The bacilli are either absent from the blood during life, or present so sparingly as to escape microscopic observation. The individual rods are mobile, shorter but thicker than those of anthrax, and rounded at the ends. One of the extremities frequently contains a refractile spore and is somewhat thicker than the other, thus giving to the entire organism a club-like outline. For practical purposes of meat inspection the characters of the bacillus are of little or no importance, but where search is made for them an incision ought to be made into the centre of the "tumour," and a cover-glass should be rubbed on the freshly cut surface of the muscle. This ought

then to be treated with Loeffler's solution of methl blue in the manner above described in speaking of the anthrax bacillus.

FIG. 16.—*The Actinomyces.*—The actinomyces, as it is most commonly found in the lesions in cattle, is aggregated to form minute granules distinctly visible to the naked eye. Each of these granules is composed in the main of club-shaped elements, which are radially disposed with their narrow ends towards the centre of the granule, and their broad ends outwards. The surface of the intact granules has thus, when magnified, an appearance comparable to that of a mulberry or the heart of a daisy. Frequently no other formed elements than these clubs can be made out in the granules, but sometimes the centre of the mass is composed of intricately interwoven delicate filaments, some of which are continuous with the narrow end of a club. Other elements like cocci are sometimes dispersed through this *mycelium.*

For purposes of diagnosis, a scraping from the cut surface of the suspected tumour, or a small quantity of pus, ought to be spread in the usual way on a cover-glass. When dry it may be stained with a drop or two of picro-carmine, the superfluous stain being removed by means of blotting-paper. The cover-glass ought then to be mounted with a drop of Farrant's solution or glycerine, and examined in the first place with a low power (× 60). The actinomyces granules, if present, will be seen distinctly from their canary-yellow colour, the nuclei of the pus or other animal cells being stained pink (carmine). The individual granules vary greatly in size and outline, and even with this power the granular character of their surface and edges (caused by the free ends of the club-like elements) may be discernible. A single colony will show this very distinctly when examined under a power of 300 diameters.

FIG. 17.—*The Bacillus Tuberculosis.*—The germ of tubercle is a slender rod from 2 to 5 μ long. The single rods are frequently slightly curved, and when stained and highly magnified many of

them are distinctly granular in appearance, and have a finely sinuous or beaded edge. Sometimes the stained bacilli exhibit in their substance clear unstained points, which are considered to be spores. The commonest mode of grouping of the bacilli is in small bundles like a faggot of sticks, and more than two rods are seldom or never found joined end to end.

For diagnostic purposes the suspected material (scraping, pus, mucus, &c.) ought to be spread in a thin layer on a cover-glass in the usual manner. When dry, pass the cover-glass three times (film upwards) through the flame of a spirit lamp or Bunsen gas burner. Pour a little of the following stain (Ziehl-Neelsen) into a watch glass and warm it slightly over a flame :—

Fuchsin, 1 part (by weight);

Absolute alcohol, 10 parts;

5 per cent. solution of carbolic acid, in water, 100 parts.

Float the cover-glass, face downwards, on the stain for ten minutes. At the end of that time remove the cover-glass with forceps, and then immerse it, moving it about, for half a minute in a 25 per cent. watery solution of sulphuric acid. Wash thoroughly in water, dry, mount in Canada balsam, and examine with a power of 400 diameters. The tubercle bacilli will be seen deeply stained red, while all other organisms that may be present in the film will be unstained and invisible.

FIG. 1.—Bronchial (Mediastinal) Lymphatic Gland of Cow, transverse section, showing Acute Inflammation as the result of contagious Pleuro-pneumonia.

a. a. Softened Structure of Gland.
b. b. Inflamed Connective Tissue.
c. c. Dark lines showing pigmentation.

FIG. 2.—Section of Lymphatic Gland in Swine Fever, showing its congested state in the earlier stages.

G. 4.—Interior of Left Ventricle of Heart, showing blood avasation in Swine Fever.

FIG. 3.—A piece of flesh from the Hind Quarters of a Cow killed during the act of parturition, showing the dark colour and irridescent appearance so frequently seen in congestive blood diseases, inflammation, and fever.

Fig. 5.—Section through Muscle of Pig (Swine Fever), showing extravasation of blood into the Muscle, Connective Tissue, and Fat.

Fig. 9.—Cysticercus Cellulosæ in the flesh of Pig—after Küchenmeister.

Fig. 10.—Small Sections of Boiled Ham, showing calcareous transformation of Cysticerci.

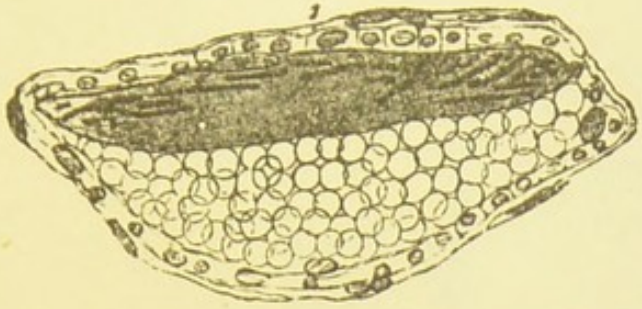


FIG. 6.—From a Section through the Small Intestine of a Mouse dead of Septicæmia.

The figure represents a section through a small vein in the submucous tissue, filled with blood. At 1, there is a homogenous substance, and in it numerous bacilli, but these bacilli are much larger than the bacilli of Koch's septicæmia in the mouse.

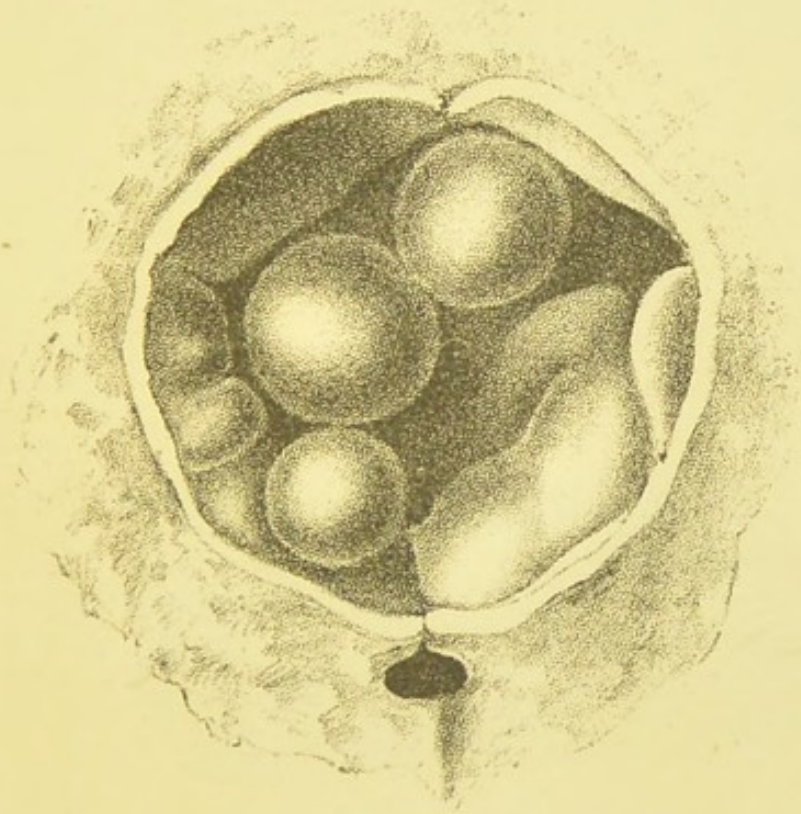


FIG. 7.—Section through a Hydatid (daughter and granddaughter) Cyst in the Liver of a Cow, showing endogenous development of Hydatid Cysts.

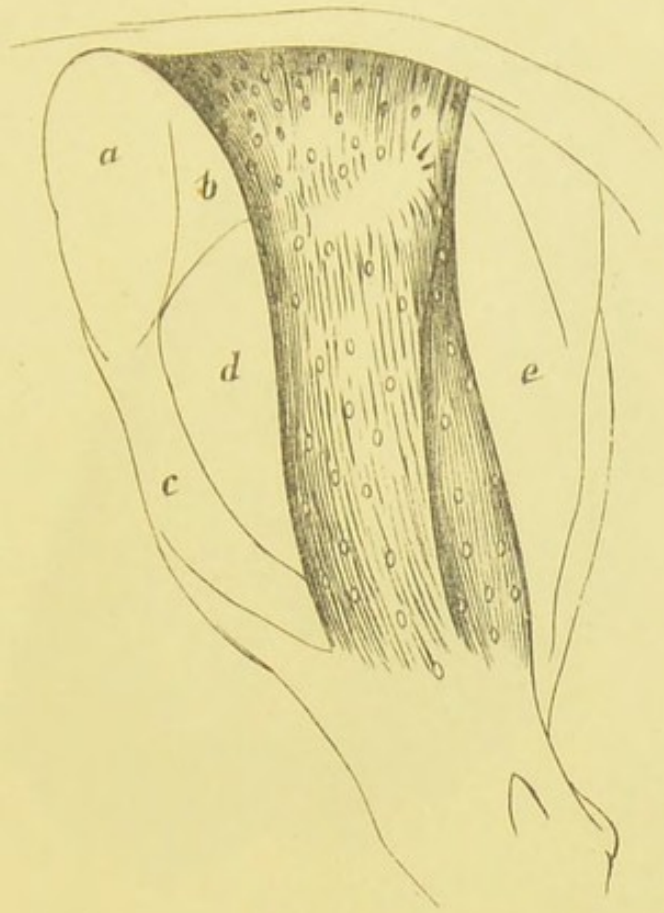


FIG. 11.—Muscles of Hind Quarter of Calf, showing Bladders of Cysticercus Bovis—after Cobbold.

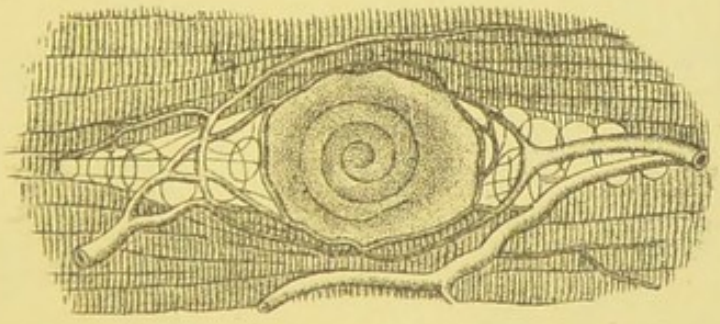


FIG. 12.—Trichina Spiralis coiled up in its capsule within the muscle—after Küchenmeister.

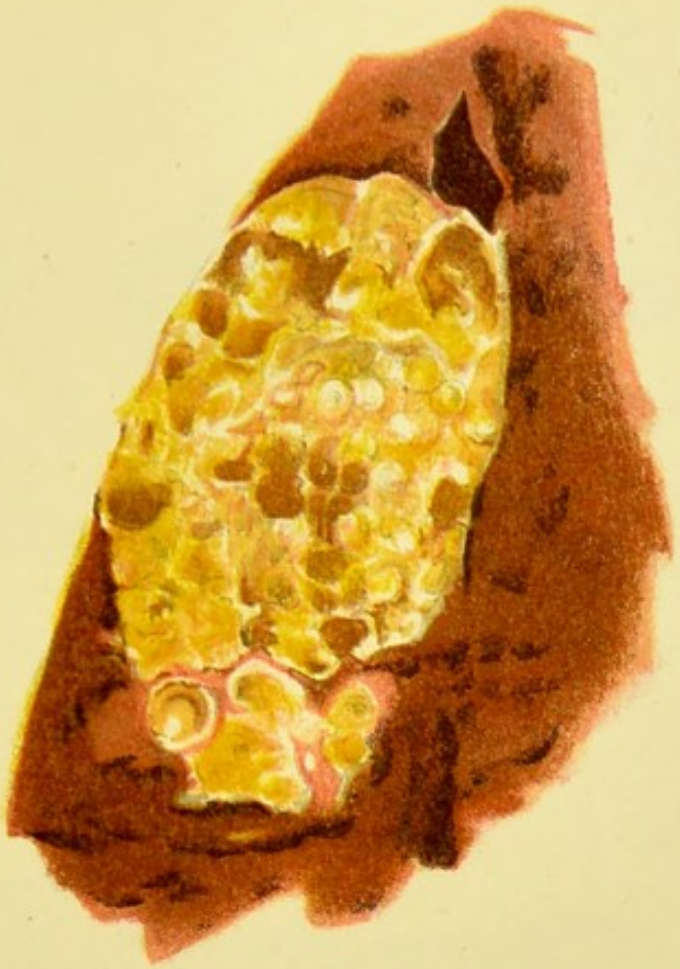


FIG. 8.—Section through Multilocular Hydatid Cyst, Liver of Cow.

The circular masses and whiter portions representing small cysts intact or lacerated. The yellow masses representing septæ which have undergone calcareous changes.

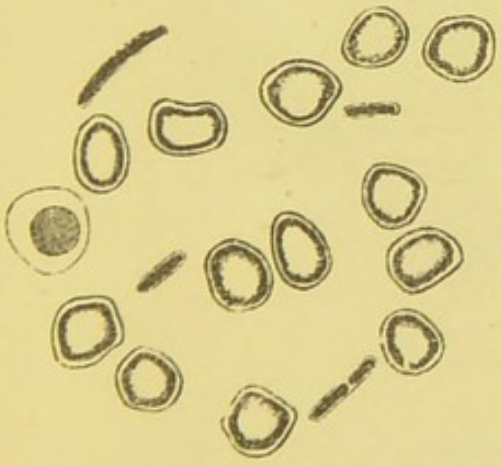


FIG. 13.—Blood of a Guinea-Pig dead of Symptomatic Anthrax.

Blood-corpuscles, and between them several Bacilli.

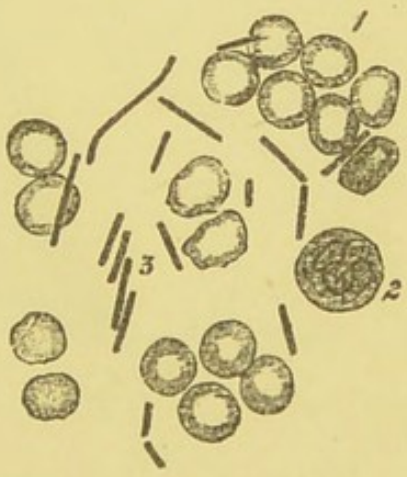
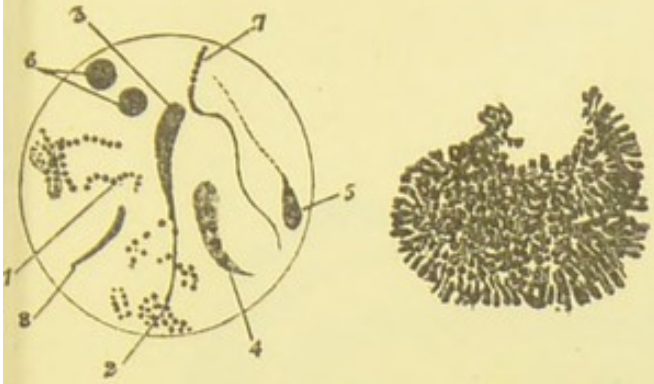


FIG. 14.—Heart's Blood of a Mouse dead of Anthrax.

1. Blood discs.
2. White blood-corpuscle.
3. Bacilli anthracis.



15.—Actinomycosis organism. *See* Professor M'Fadyean's Description, p. 195.

Fig. 16.—From a Preparation of Caseous Matter from Pulmonary Deposits in Bovine Tuberculosis, showing Tuberculosis.

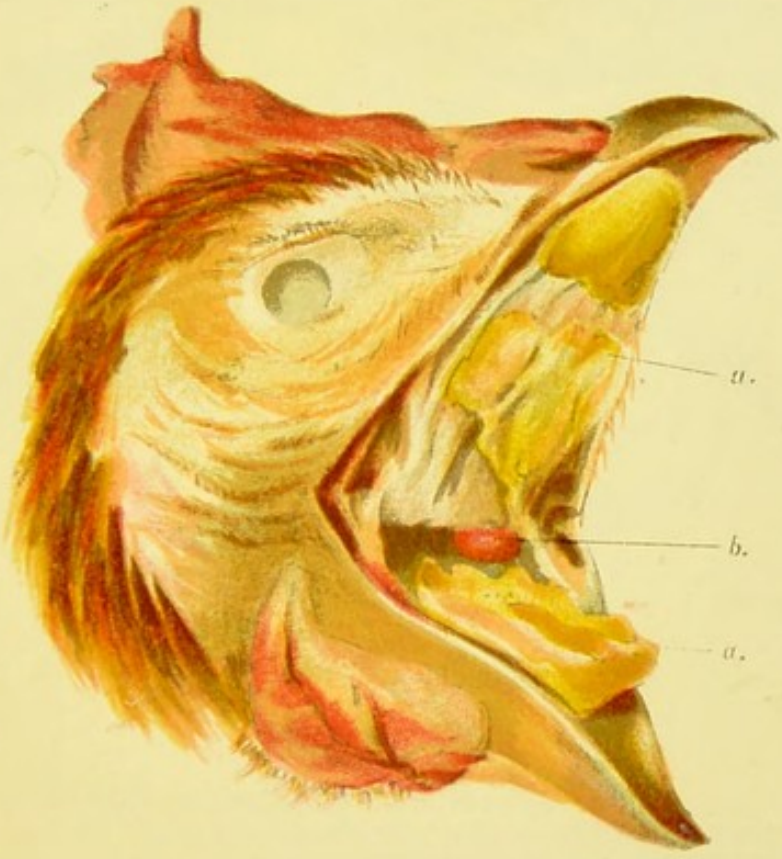


Fig. 17.—Head of Hen, with mouth open, showing—

a. a. Tubercular deposit on palate and dorsal surface at base of tongue.

b. Acute tubercular ulcer of palate.

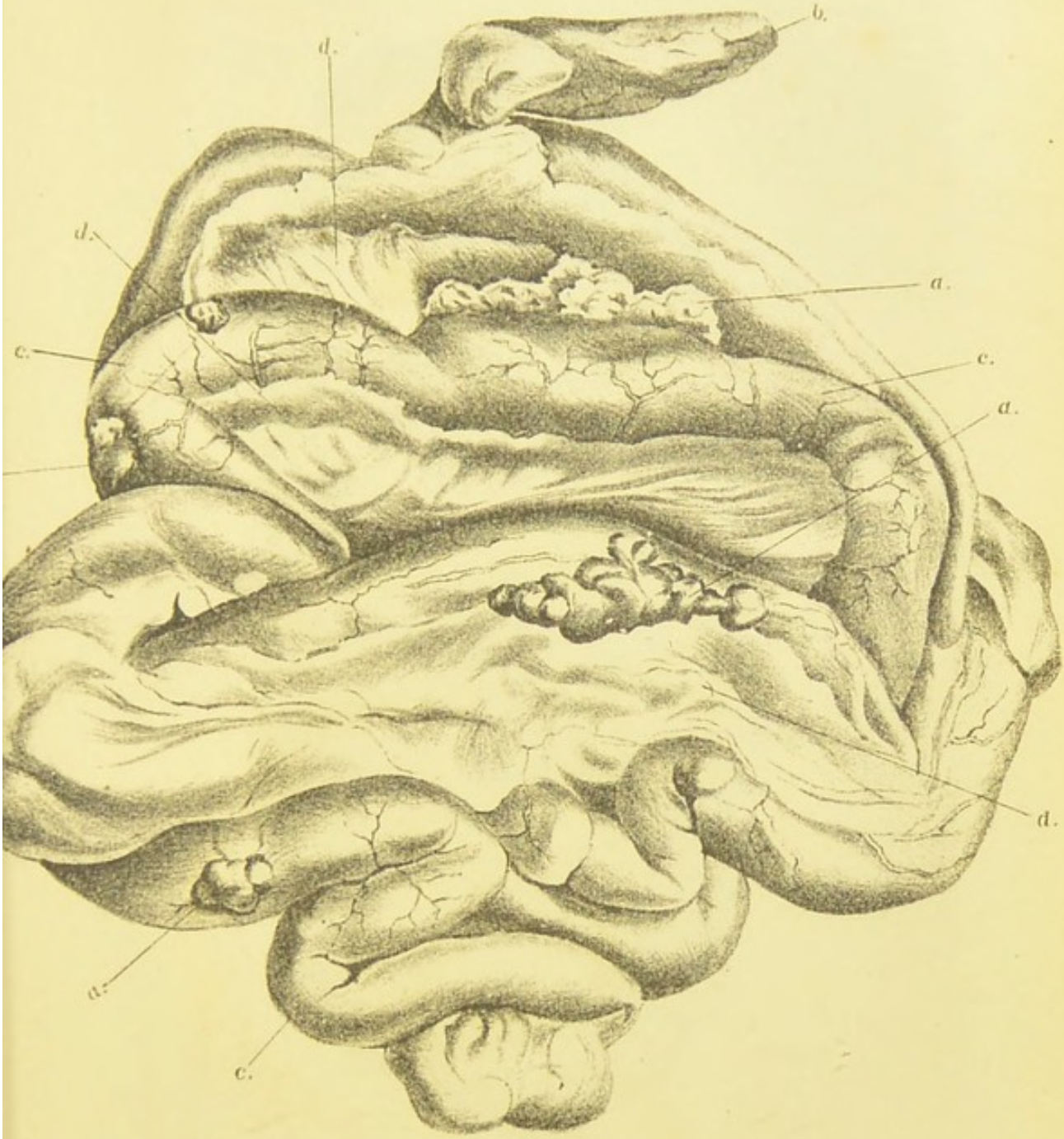


Fig. 18.—Coils of Intestines of a Hen, showing—

a. a. a. a. Sessile tubercular nodules in the Intestinal Walls.
b. A large pedunculated Tubercular Nodule.
c. c. c. Intestines.
d. d. d. Mesentery and Mesenteric Fat.

FIG. 19.—External Surface of a Lobe of the Liver of a Hen, showing (yellow masses) universal Tuberculosis.

a. Distended and enlarged Capillaries of its Capsule.

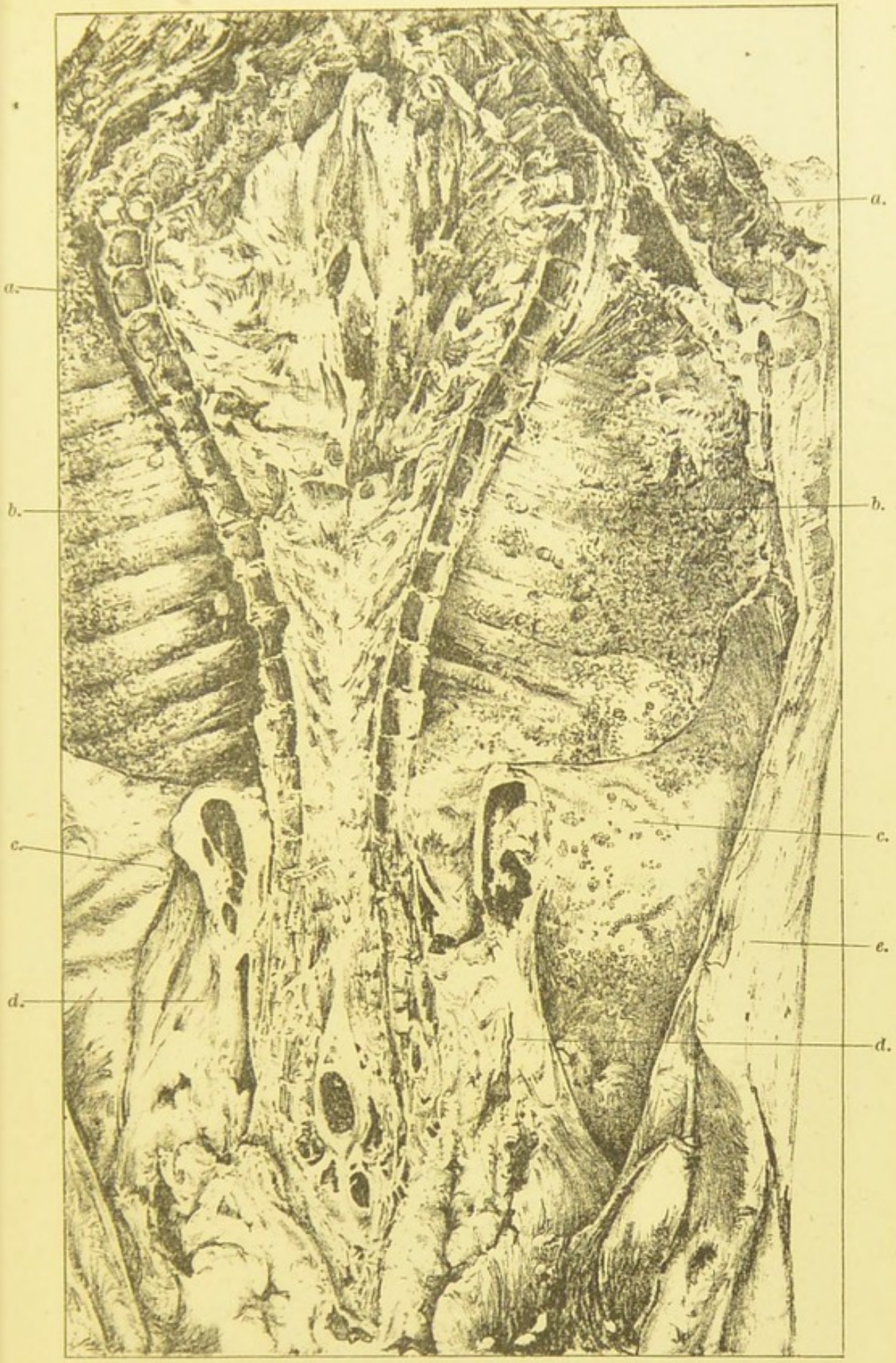


FIG. 20.—Photograph of Abdominal and Thoracic surface of the Carcase of a Cow, showing diffuse Nodular Tuberculosis of the Pleura and Peritoneum.

a. a. Section through Dorsal Vertebræ.
b. b. Thoracic Pleuræ. The dark spots representing the Tuberculous Nodules.
c. c. Peritoneum with Tubercular Nodules.
d. d. Kidney Fat.
e. Flank.

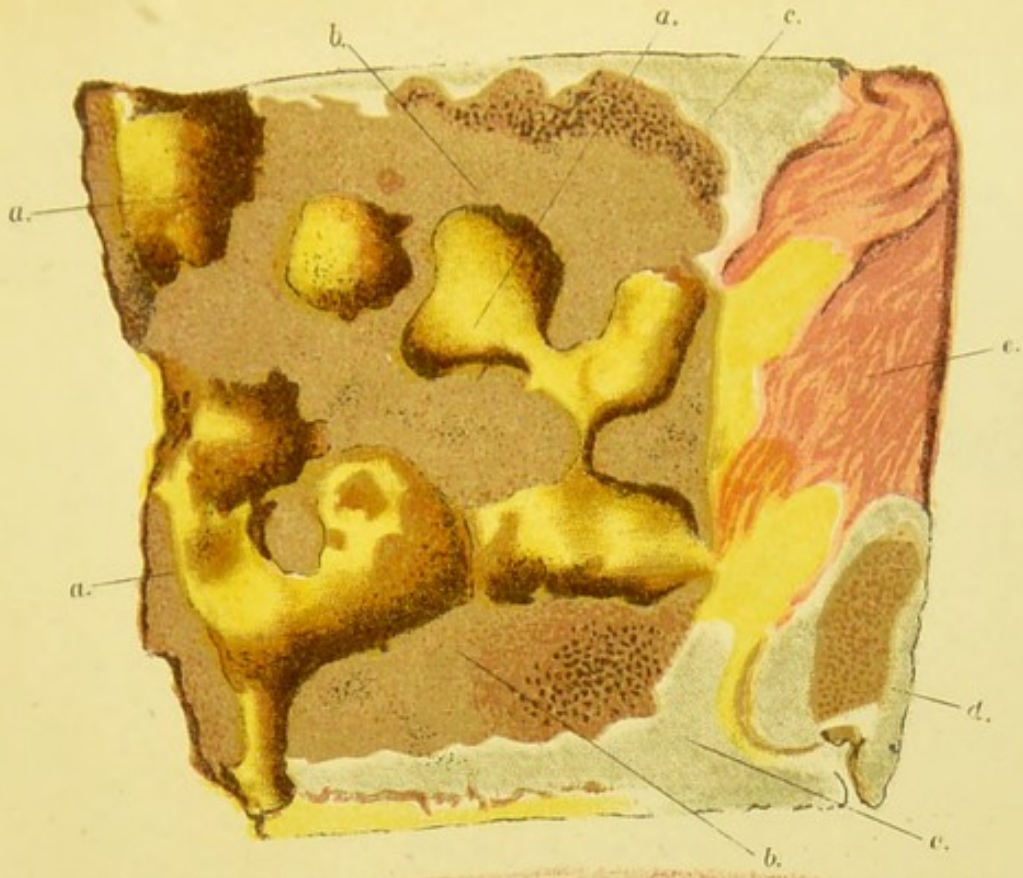


FIG. 21.—Section of Sternum of Ox, showing Tubercular Masses in the Structure of the Bone.

a. a. a. Tubercular Masses.
b. b. Bone.
c. c. Cartilage.
d. Section through a Costal Cartilage.
e. Muscle.

FIG. 22.—Miliary Tubercle of Pleura.

Piece of lung—external view—with the grape-like masses of Miliary Tubercle connected together by fibrinous bands.

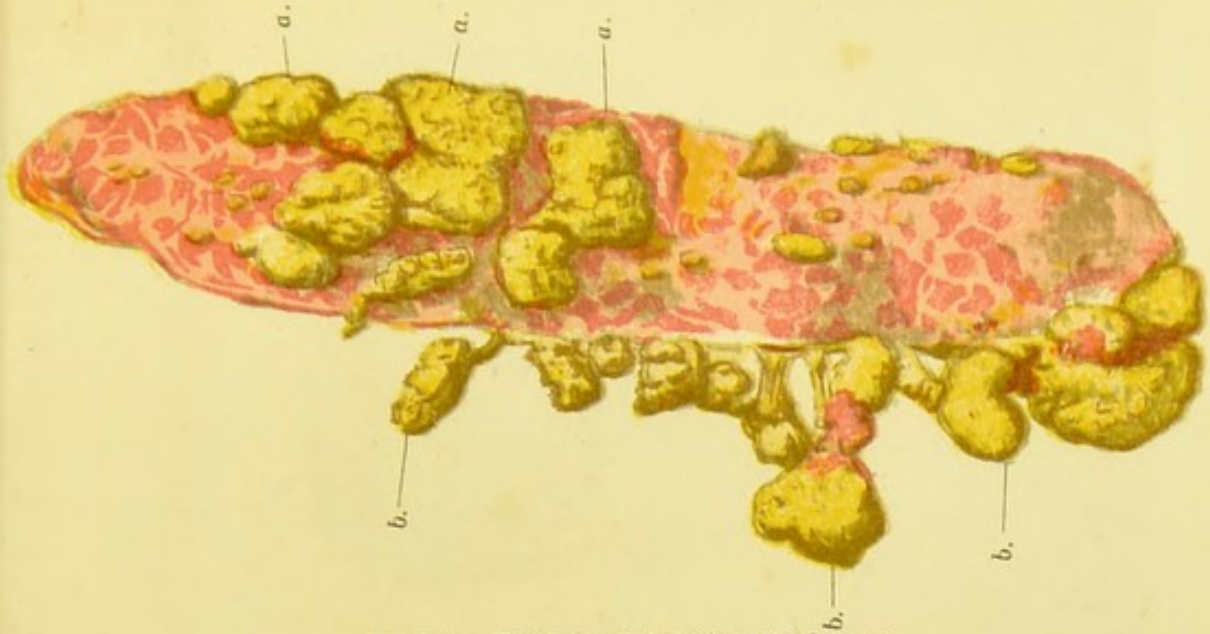


FIG. 23.—Portion of Inferior Border of Lung of Cow, showing—

a. a. a. Sessile Masses on the surface of the Pleura.

b. b. b. Pedunculated Masses growing from the Pleura at the extreme border—Dr. Crichton's festoons.

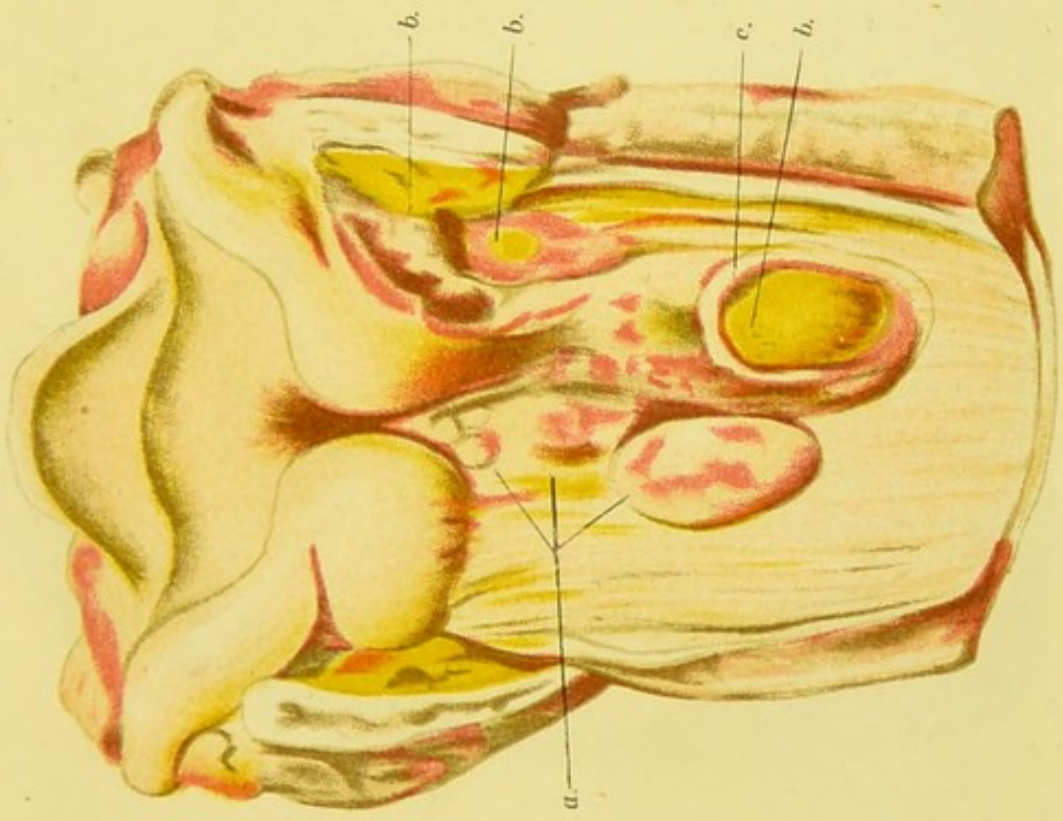


FIG. 24.—Larynx of Cow (Tubercle) laid open, showing—

a. Elevation of Mucous Membrane by subjacent Tuberculous Nodules.

b b. b. Masses of Yellow Tubercle exposed by ulceration and absorption of the Mucous Membrane.

c. Edge of Ulcer after irruption of Tubercle—intensely Hyperæmic.

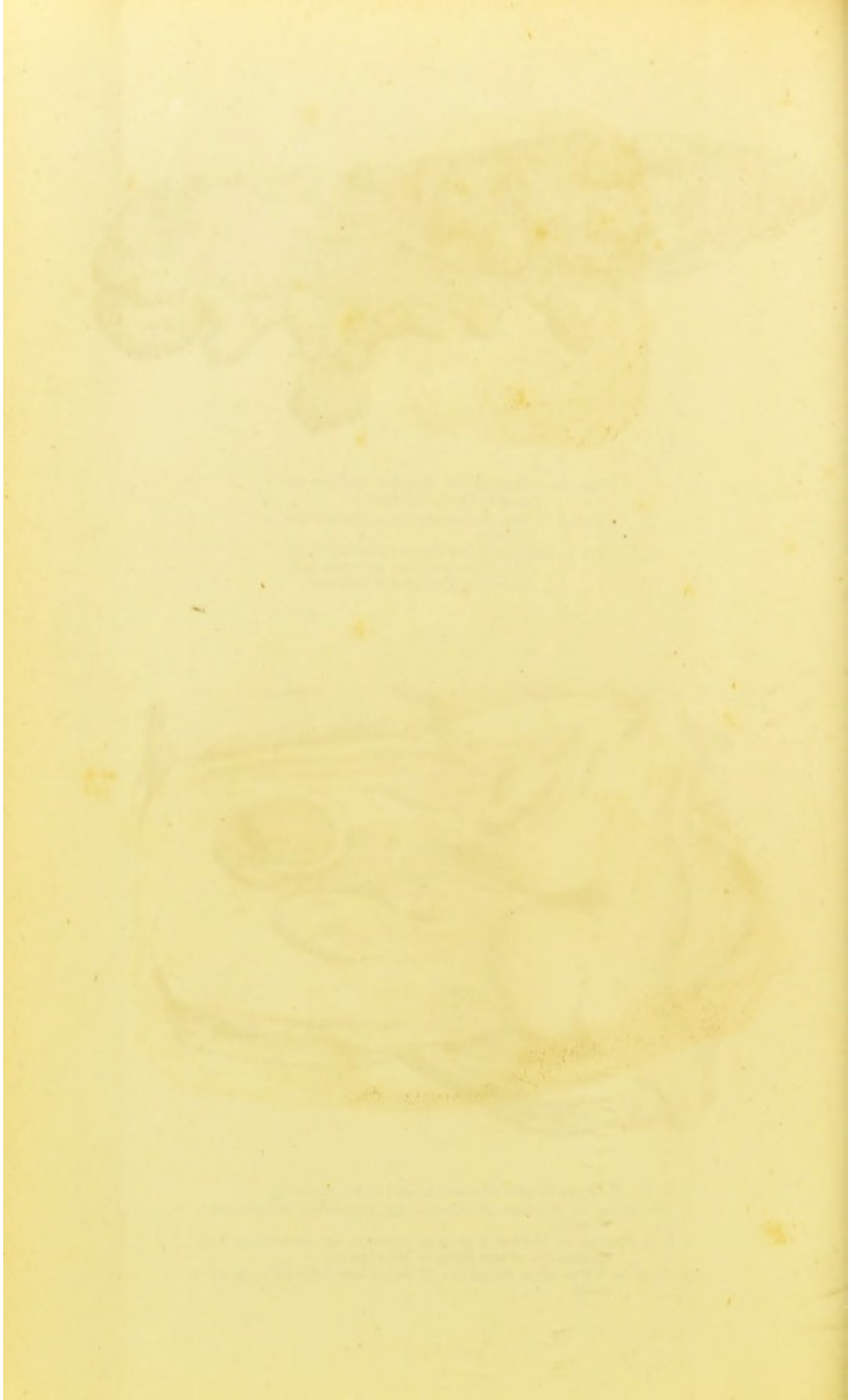


FIG. 25.—Lymphatic Gland (Bronchial) of Cow, laid open to show the deposition of caseous and calcareous Tubercle in its interior—mainly at its hilum—with detached smaller masses.

FIG. 26.—Section of Lung of Ox, with tubercle in various stages.

a. a. a. Small masses of Tubercle.
b. b. b. Large masses of yellow Tubercle, caseation.
c. A large mass commencing to liquefy and break down in the centre, with the condensed areolar tissue forming the so-called cyst or wall, *d*.

The light-blue portion at *e* represents condensed and hyperplastic connective tissue, and the lines *f*, interlobular connective tissue; *g g*, parenchyma, or lung-substance.

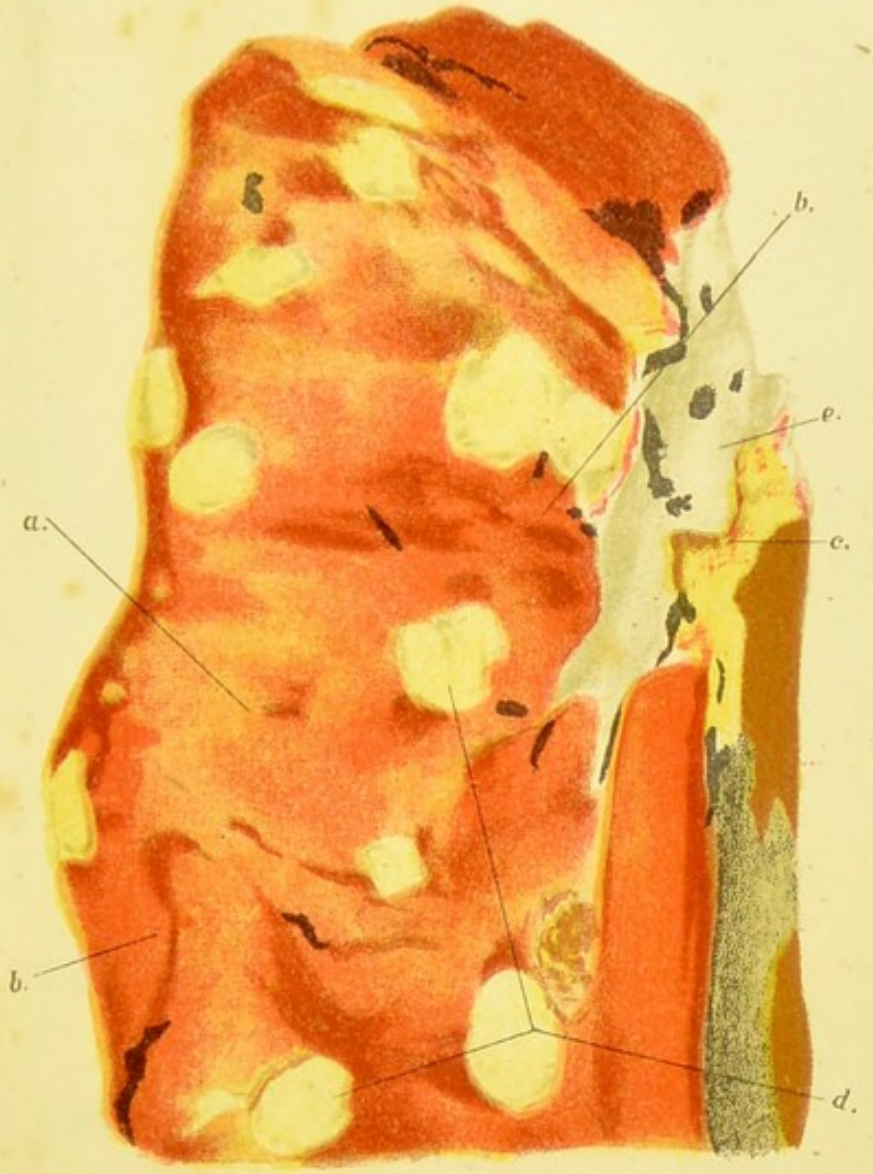


FIG. 27.—Section of Liver (Cow), with circumscribed and diffused Tubercle.

a. a. Liver substance of an orange-yellow colour,—frequently characteristic of tuberculous liver in the ox.

b. b. Two spots of a red colour, as the result of recent Tubercular Inflammation.

c. A mass of diffused Tubercle deposited on the coats of the portal vein, *e*; with masses of circumscribed caseous Tubercle, *d*.

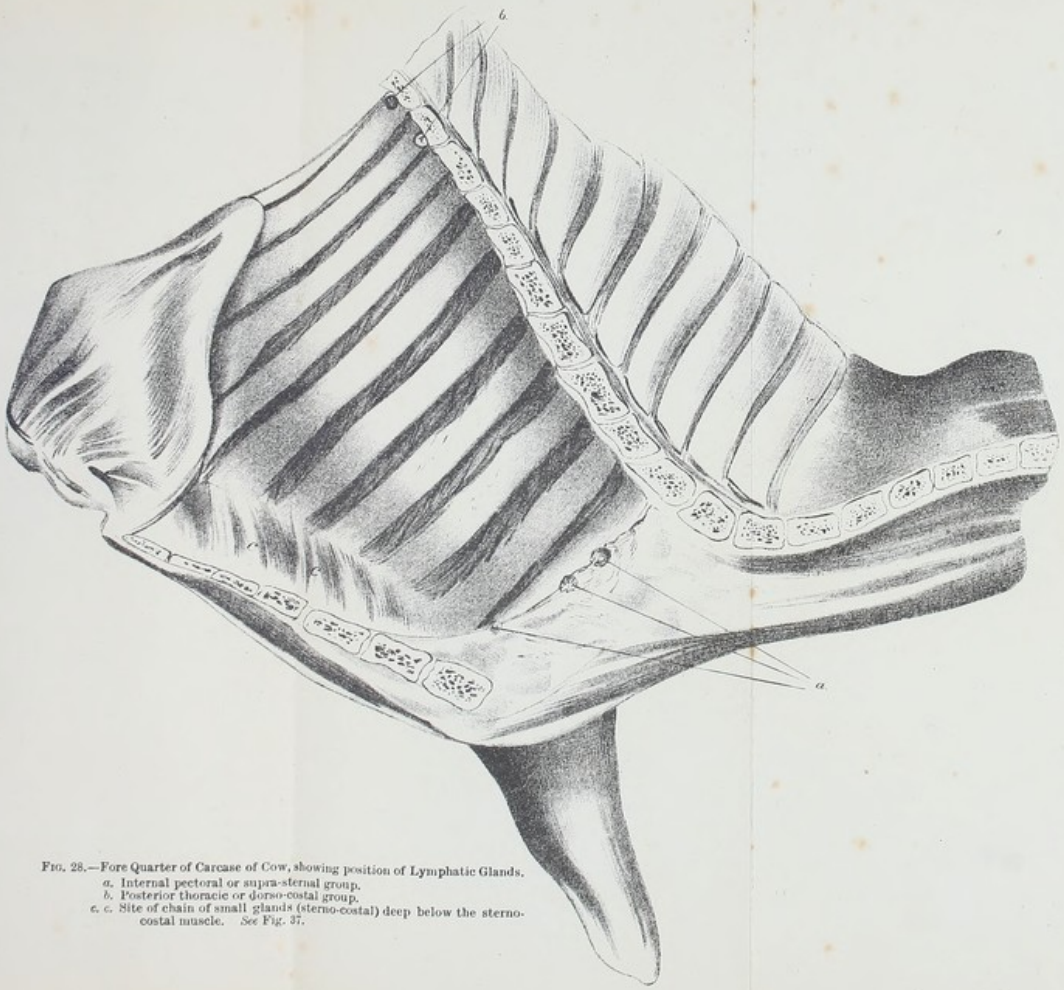


FIG. 28.—Fore Quarter of Carcase of Cow, showing position of Lymphatic Glands.
a. Internal pectoral or supra-sternal group.
b. Posterior thoracic or dorso-costal group.
c. c. Site of chain of small glands (sterno-costal) deep below the sterno-costal muscle. *See* Fig. 37.

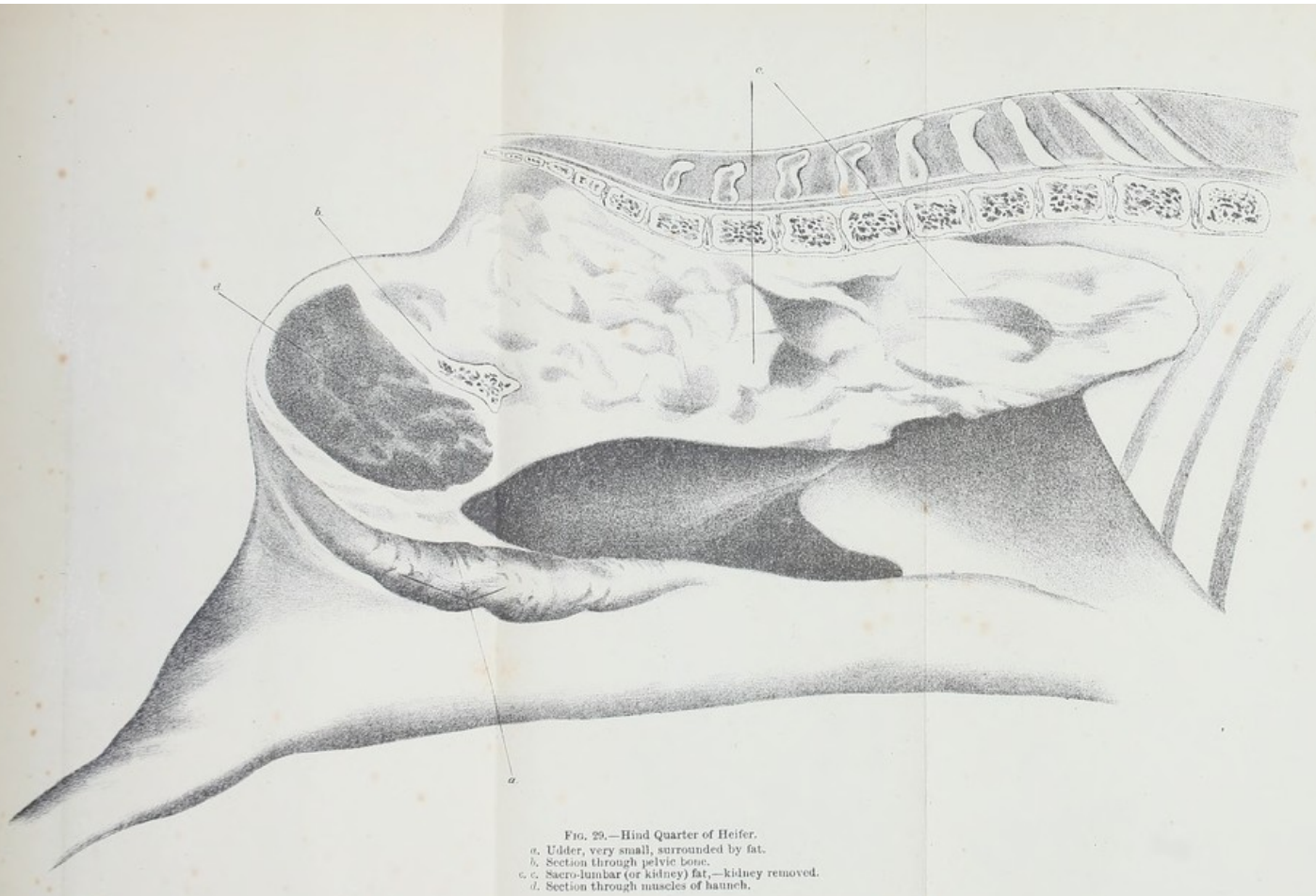


Fig. 29.—Hind Quarter of Heifer.

a. Udder, very small, surrounded by fat.
b. Section through pelvic bone.
c. *c*. Sacro-lumbar (or kidney) fat,—kidney removed.
d. Section through muscles of haunch.

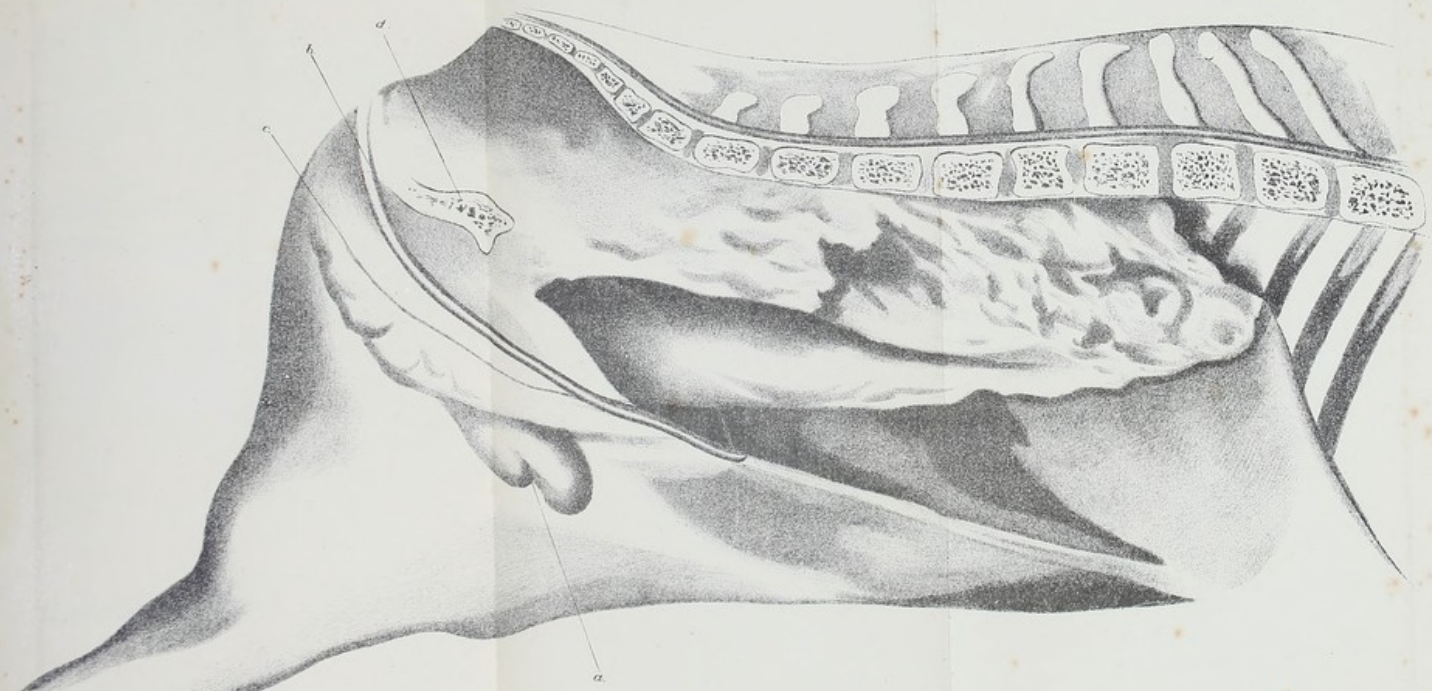


FIG. 30.—Hind Quarter of Bullock.

a. Scrotal fat.
b. Penis.
c. Retractor muscle of Penis.
d. Pelvic bone.

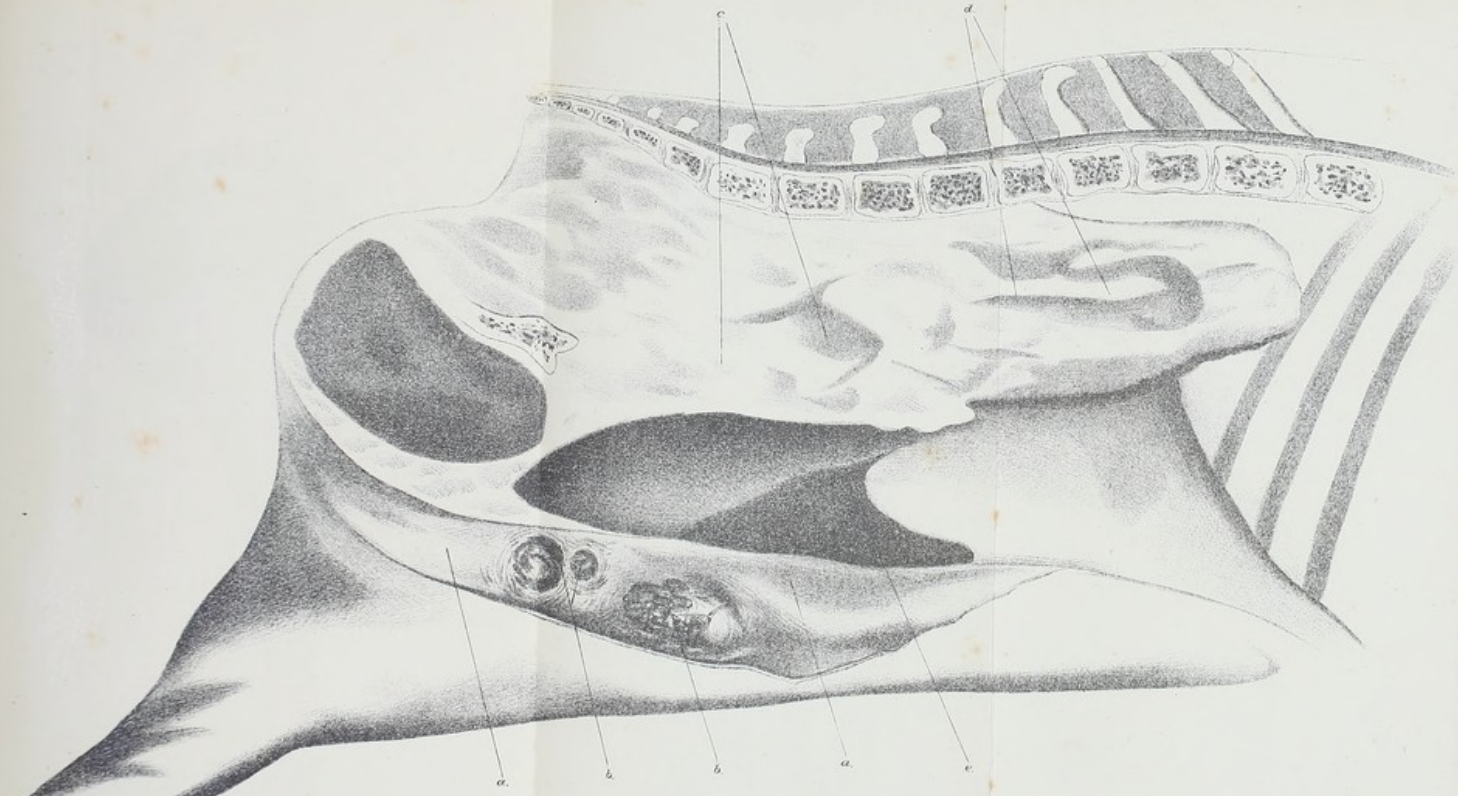


FIG. 31.—Hind Quarter of Cow.

a. a. Site of udder,—removed.
b. b. Deep inguinal or mammary lymphatic glands.
c. Site of sacro-lumbar group of glands.
d. Site of lumbar (kidney) group of glands.
e. Spot opposite to which (on the outside of the flank) the superficial flank group of glands are situated.

FIG. 32.—Small excavated ulcers (in group) of glanders—inner surface of anterio and upper part of nostril—with congestion of the mucous membrane.

Fig. 33.—Section of Lung of Young Pig.
Tuberculosis, with intense congestion.

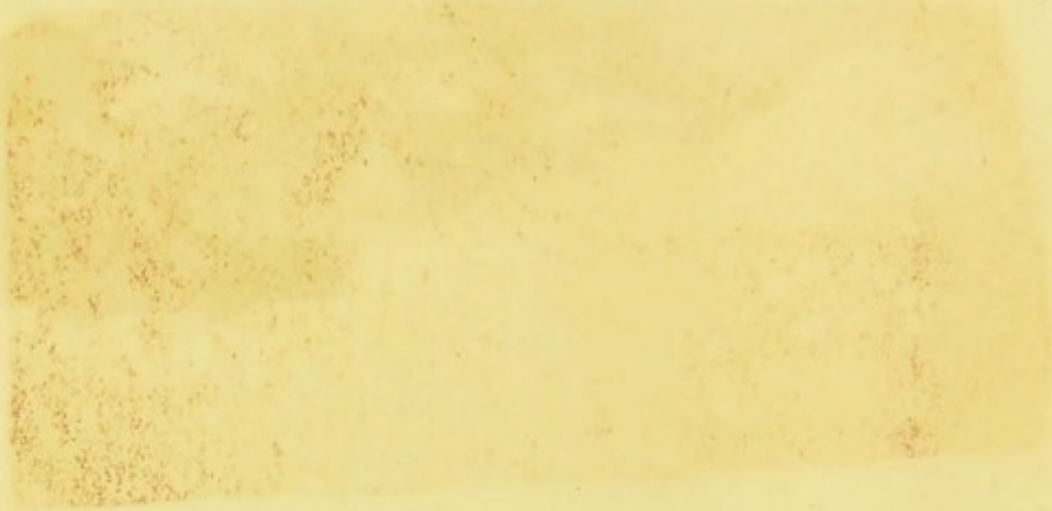


FIG. 34.—Section of Liver of Pig three months old, showing characteristic appearance of the lesions of Cysticercus Cellulosæ.

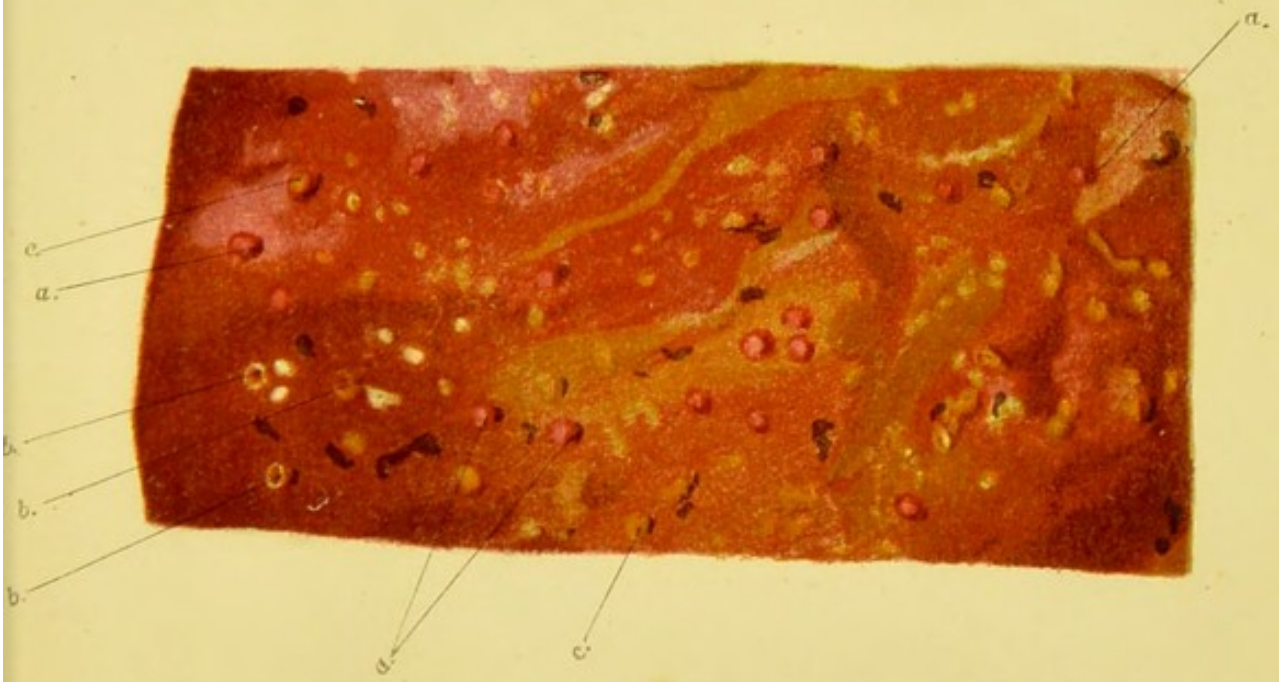
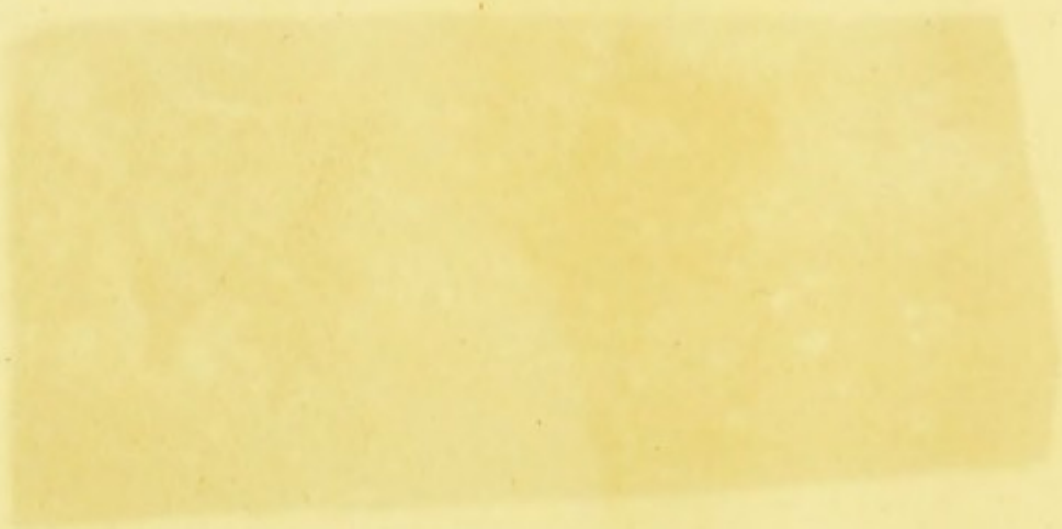


FIG. 35.—Surface of Section of the Liver of a Pig three months old, showing lesions produced by Cysticercus Cellulosæ.

a. a. a. Hæmorrhagic and vascular nodules on the surface of the liver.
b. b. b. Cavities of evacuated cysts.
c. c. Cysts before evacuation.



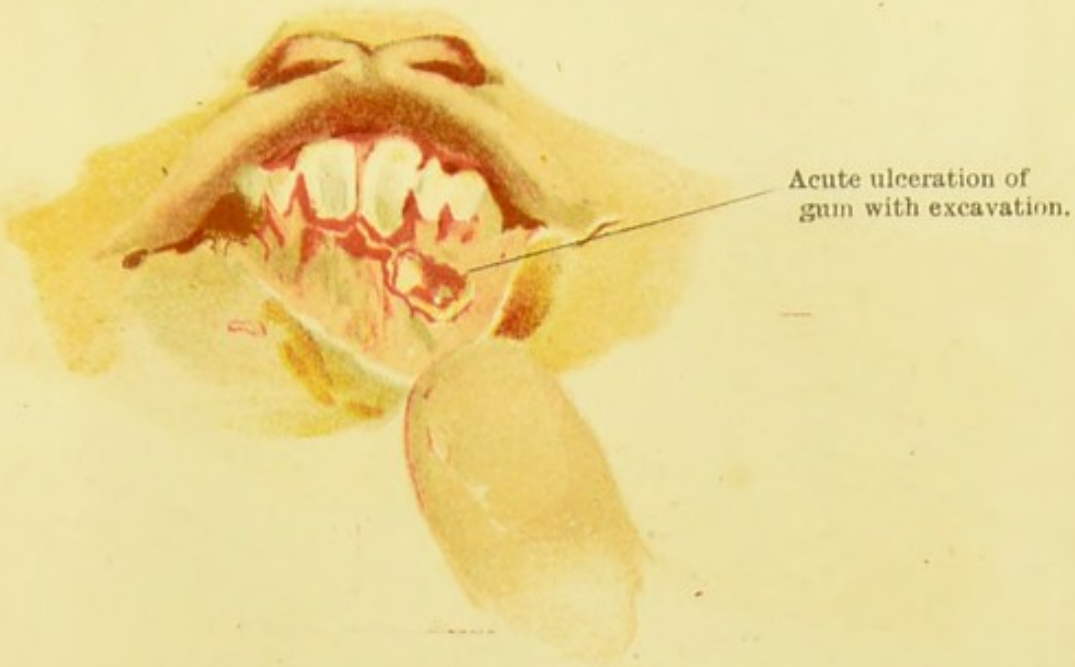


FIG. 36.—Lamb—Infection from Udder of Ewe. Malignant Aphtha, *vel* Pustular Fever. Acute ulceration of gum with excavation.

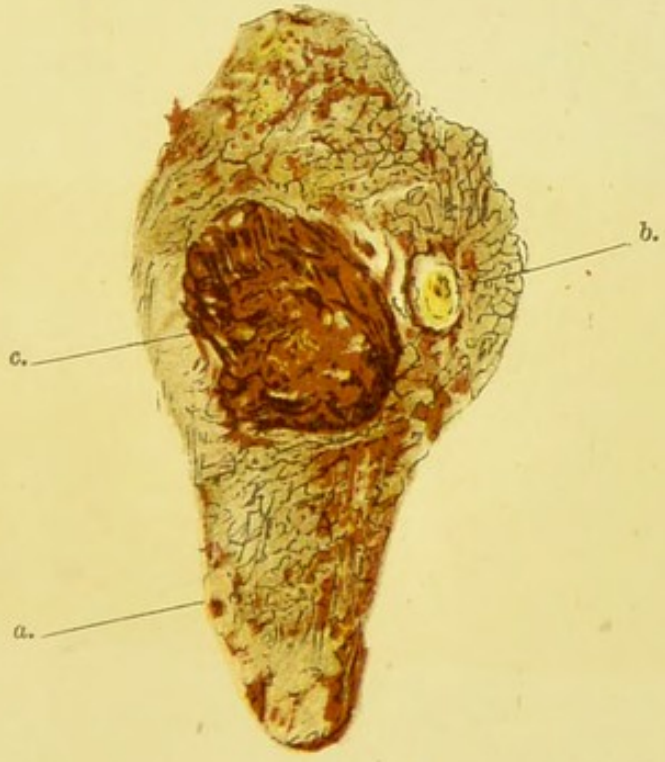


FIG. 43.—Teat of Ewe—Malignant Aphtha, *vel* Pustular Fever.

c. Crust. *a.* Papule. *b.* Pustule.

Fig. 38.—Section of Tongue of Ox—Actinomycosis.

a. a. a. Patches of surface of organ denuded of mucous membrane.
b. b. Papillæ.
c. c. Nodular new growths, somewhat flattened on surface, and raised above surrounding level.

FIG. 39.—(1.) Section of a fold of third Stomach. Septic (malignant) Catarrh, from exposure to foul air in the hold of a ship, showing universal or diffuse extravasation into the structure of the fold.

FIG. 40.—(2.) Section of fourth Stomach of Cow, showing congestion and ulceration of mucous membrane as result of Septic Catarrhal Fever.

FIG. 41.—External surface of Ear of Pig, showing characteristic passive stasis and extravasation in Swine Fever.

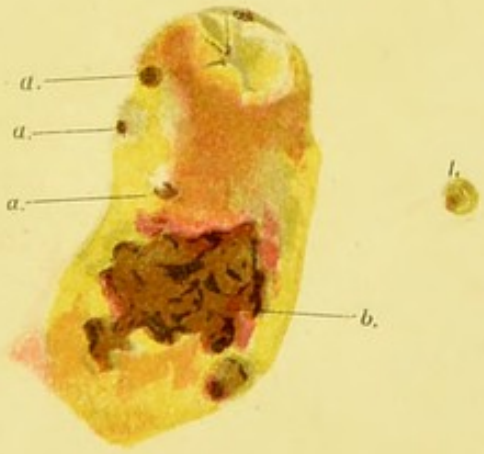


FIG. 46.—Ileo-coecal Valve of Young Pig, showing several plugged follicles, *a. a. a.*, and one discrete superficial ulcer at base, *b.*
1. A detached plug.

FIG. 42.—Section of Small Intestine (laid open) of a Cow, the subject of acute Miliary Pulmonary Tuberculosis, and Extensive Mesenteric Tuberculosis. Showing diffuse and intense mucositis, with flakes of altered lymph, *a. a. a.*; and intra-mural tuberculosis, the yellow masses *b. b. b. b. b.*, representing tubercular nodules in the intestinal walls

FIG. 45.—Lamb—Infection from Udder of Ewe. Malignant Aphtha, *vel* Pustular Fever.

a. Large crust on skin of nostrils.
b. Ulceration of gums, with mass of fibrinous exudation.

FIG. 47. *Ulcers on mucous surface of large Intestine of Pig* (Enteric Fever of Pig).

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