INTRODUCTION

This book forms part of a series that has been designed to provide a study aid for students undertaking Red Meat Inspection and other courses where knowledge of bovine meat inspection is required such as those for Environmental Health Officers, Veterinary degree students and Official Veterinarians. It is hoped that it may also provide information in a 'user friendly' format for abattoir owners and producers as to the nature of rejections recorded by inspectors.

This second edition has been augmented by more photographs and the addition of less common conditions and parasites that may be encountered in post mortem inspection.

Wherever possible, photographs illustrating anatomical features and conditions have been included, the latter generally depicting severe examples of conditions. This is a conscious decision, arrived at after giving numerous lectures on meat inspection where I learnt that no two people would describe something the same way.

The section covering anatomy and physiology does not go into great detail; numerous other texts fulfil this function. The order that the bodily systems are introduced should not be construed as an order of importance. The section covering diseases loosely follows the format of name, synonym, aetiology, pathogenesis, clinical lesions, gross lesions and judgement as to the fitness for human consumption. The diseases are listed in alphabetical order for ease of reference.

The Affections of Specific Parts and Conditions Encountered at Post-Mortem Inspection in Abattoirs is hoped to provide a useful tool for day-to-day inspection decisions in the abattoir environment.

AUTHOR DISCLAIMER

I must add that the judgements as to the fitness for human consumption given in this book are my own views, gained through experience and consultation with others.

A Grist

ACKNOWLEDGEMENTS

Thanks to William (Bill) Boxall for his friendship, encouragement and persuading me to train as a Meat inspector.

In writing this book, as with the others in the red meat series, I relied heavily on the experience and knowledge of Dave Barrah. I count myself fortunate to not only have been taught by him, but for his unselfish friendship and infectious enthusiasm for meat inspection; thank you for everything you have done for me, I only hope that imitation during lectures can be considered as part repayment for your efforts.

Thanks and appreciation are especially due to Chris Drury for allowing me to photograph in his abattoir, the slaughtermen and inspectors at F.Drurys and Sons Ltd, Tockenham, Wiltshire, including Ian Flynn, Mick Webb, Tony Kelly, Robert Weeks, Jerry McKinnon, Roy Pettifer, Nathan Morgan, Chris Law, Andrew Elderkin and Nigel Moore.

Meat Hygiene Inspectors and Official Veterinarians who provided samples, photographs and material for this volume include my wife Grace, Julian Ponting, Sue Hopkins, Manuel Sarnargo MRCVS, Tim Udall OBE BVSc CertVPM(MH) MRCVS and Eric Harvey.

As ever, my wife Grace has been a tower of strength and tolerance, checking and editing each book, sourcing samples for photography and teaching, and keeping me supplied with copious quantities of coffee. As always my children Elizabeth, George and Henry deserve gratitude, for their constant support and enthusiasm, but mostly for no longer enquiring as to the contents of specimen jars.

My colleagues at the University of Bristol School of Clinical Veterinary Science deserve thanks for their support and encouragement, especially Ali Weaver, Steve Wotton MBE MSc HND and Christine Rowlings.

As with all the other books produced, Sarah Keeling of Context Products has been patience personified, this being the sixth book and the sixth time I have overrun deadlines by a considerable margin. Thank you for your professionalism and perseverance.

DEDICATION

I have always held the opinion, during my time as a Meat Hygiene Inspector, abattoir manager, and lecturer that the food that I inspect should be fit for my own children to eat. If you would not feed it to your children, you should not expect the consumer to feed it to theirs.

To that end I dedicate this to my wife Grace and my children George, Elizabeth, Henry and Harriette.

In memory of my Grandfather, Ronald Maryan. Forever in our thoughts.

1

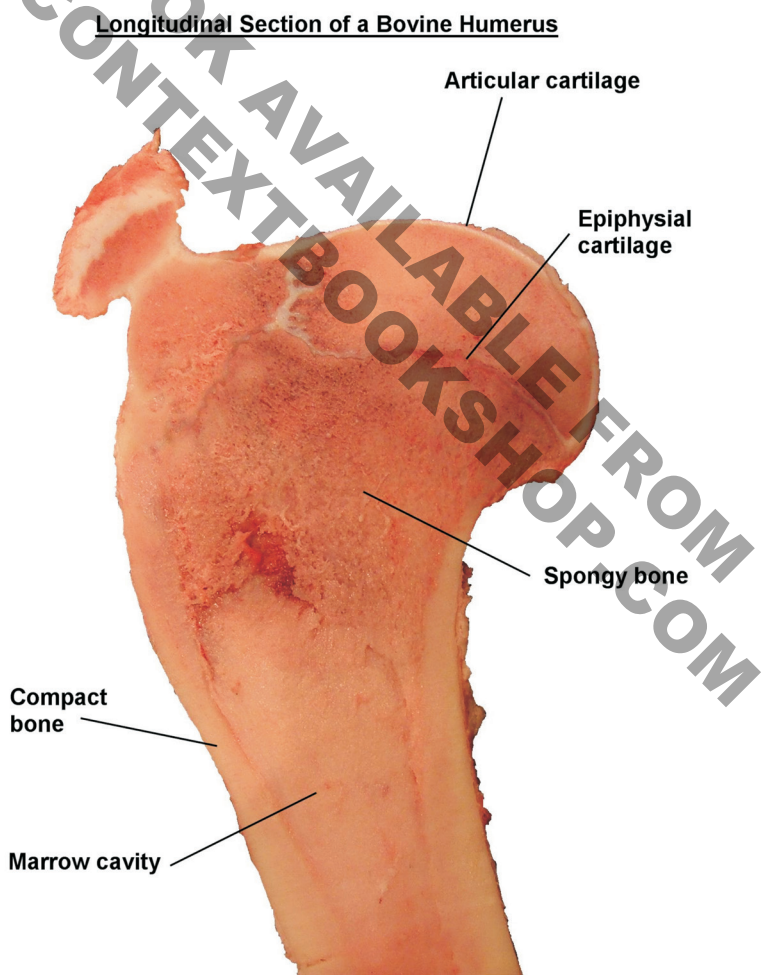
ANATOMY/ PHYSIOLOGY

SKELETAL SYSTEM

INTRODUCTION

The skeletal system, the bones, provides structure, protection and a means of locomotion. Muscles are attached to the bones by ligaments or tendons and move the animal by contracting around a pivot or joint. In this section the basic structure, position and function of the bones is described. For this purpose the bones of the skeleton are divided into the skull, the axial skeleton and the appendicular skeleton (forelegs and hindlegs).

THE STRUCTURE OF BONES



2

DISEASES OF CATTLE

INTRODUCTION

The survival of an animal depends on the symbiotic function of all the bodily systems. Disease can be considered to be an abnormality in the structure or function of these systems, and even an inability of the animal to perform as expected in relation to its peers. The traditional concept of disease is that there is a causal factor that produces recognisable macroscopic and microscopic lesions that can lead to identification of the causal factor. In this section infectious diseases are considered, including those due to viral, bacterial and fungal pathogens, be they of communicable origin (passed from one animal to another) or commensal organisms (organisms that form part of the normal microflora associated with the animal).

The role of the Meat Inspector is to determine whether the carcass or part carcass is fit for human consumption, given the macroscopic evidence of lesions presented.

Of greatest importance are zoonotic diseases, those that are naturally transmissible between vertebrate animals and man, such as anthrax, brucellosis.

ROUTES OF INFECTION

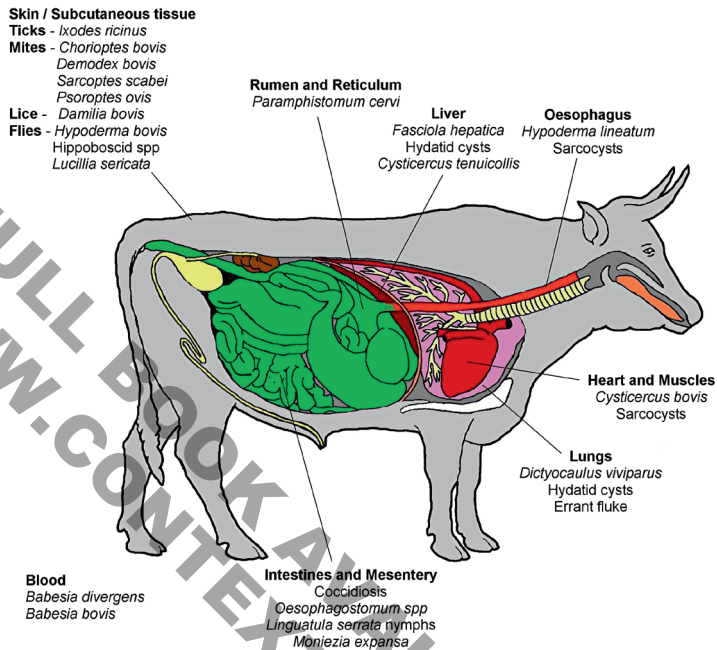
There are five routes by which infectious organisms gain entry into the host animal, these being:

- **Inhalation** – The causative agents are drawn into the body during the act of inspiration. Tuberculosis lesions usually have primary foci within the lung tissue.
- **Ingestion** – Infection and subsequent spread is achieved by entry of the infectious agent via the digestive tract, initial lesions in this tract are usually followed by transference of the infection to the liver via the hepatic portal blood circulation. Examples include endoparasites such as liver fluke and the larval stages of *Echinococcus granulosus*
- **Inoculation** – Penetration of the physical barrier to infection, provided by the skin and mucous membranes, allows entry of micro organisms, either through exposure of subcutaneous tissue to environmental contamination, or by the injection of these agents that may be present on or in the object penetrating the barrier as occurs in wounds and insect bites. Examples include the tick-transmitted infection of red water fever.
- **Congenital** – Vertical transmission from the dam to the offspring, if this infection occurs before the foetus has developed its own immune system (before third trimester) any infectious organism can be included in the phase where recognition of 'self' occurs so that any infection may not be countered as it is not recognised as foreign material.
- **Sexual** – Infection can be passed during copulation. Brucellosis and other forms of infectious abortion are known to be transmitted in this manner.

3

PARASITES OF CATTLE

PARASITES OF CATTLE



PARASITISM

Parasites can be defined as plants or animals that live on or within another living organism at whose expense they gain some advantage whilst giving nothing in return. The host/parasite association can be complicated. The type of parasite encountered ranges from viruses (intracellular parasites) that can only reproduce in a living cell, to protozoa (single celled organisms) to intestinal worms and insects. Although they are parasitic, viruses are generally treated as a separate group, and we will only be considering some parasites that are internal (endoparasites) and external (ectoparasites) that can affect cattle.

Parasites may have a direct or indirect lifecycle. A direct lifecycle means that the parasite can only complete the lifecycle by parasitizing the host.

ENDOPARASITES

HOST / PARASITE RELATIONSHIP

The lifecycles of parasites vary, but endoparasites undergo a three-step association with the host animal. Firstly, the parasite must infect the host via the intestines, respiratory system or the skin. Secondly the individual parasite must be maintained

4

NEOPLASIA

TUMOURS

INTRODUCTION

The term tumour literally applies to any abnormal swelling, but nowadays it tends to refer exclusively to neoplasms, which are abnormal new growth of tissue, in which cell multiplication is uncontrolled and progressive in addition to serving no purpose and growing faster than normal tissue. This growth is due to genetic alteration or damage causing uncontrolled multiplication of these cells. These neoplastic formations are classified as being either benign or malignant; the gross appearance of neoplasia is variable being dependent on their origin and type.

CARCINOGENS

A carcinogen is any agent that promotes a disruption of cellular DNA causing uncontrolled multiplication and formation of neoplasia. These agents can be varied and include chemicals, viruses and radiation – for example ultraviolet rays and radioactive material.

ANGIOGENESIS

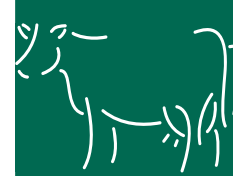
Both malignant and benign tumours are served by increased blood vascularisation, all tumours requiring nutrients to continue growth. In the case of the rapidly growing malignant tumours the blood vessels tend to be thin and poorly formed and prone to rupture creating the appearance of haemorrhagic areas within the tumour. The ability of neoplastic cells to chemically stimulate the formation of new branches of blood capillaries from existing vessels is termed **angiogenesis**.

Fibro-papillomas in the oesophageal groove of the reticulum. Although benign, their presence can interfere with the process of rumination and lead to conditions such as bloat

5

CONDITIONS ENCOUNTERED AT BOVINE POST MORTEM INSPECTION

(NON PARASITIC)



ABNORMAL ODOURS

Any abnormal odour in meat intensifies on heating, a fact utilised as a confirmatory test for uraemia, but this odour in addition to indicating possible conditions also renders the meat unmarketable and hence carcasses and offal affected by abnormal odour / taste are rejected. The cause of an abnormal odour in cattle can be due to feed, medication or metabolic disorder.

Feed – "You are what you eat" is especially true in cattle, those slaughtered during the first week of being transferred to a turnip diet produce meat with a very distinct turnip odour. Cattle that have access to wild onions, leeks and garlic, as well as running the risk of toxin poisoning, will produce meat with a strong odour of these. Other foodstuffs that can cause abnormal odours include factory waste containing strong aromatic compounds such as orange rind.

Medication – Drugs or tonics administered before slaughter that include aromatic compounds such as aniseed, turpentine, linseed oil etc can taint the meat of that animal. The presence of medicinal odours, as well as rendering the carcass unfit for human consumption, may also prompt the taking of samples for laboratory analysis to ensure that relevant drug withdrawal periods have been met.

Metabolic disorder – cattle can be affected by acetonaemia, or ketosis, when fevered or after giving birth or late in their pregnancy. It is generally accepted that this is due to ketones produced when body fat is broken down to produce energy. These ketones are reabsorbed into the blood circulation and then into the body tissue. The carcass smells strongly of 'nail varnish', a smell that becomes more pronounced when the tissue is heated.

Carcasses with an abnormal odour or taste are rejected as unfit for human consumption

ABSCESSES

An abscess is a collection of pus surrounded by fibrous tissue; it is part of the body's defence mechanism normally triggered by the presence of pus -forming bacteria. This fibrous tissue is a normal healthy reaction and consists of newly formed connective tissue and blood vessels. Pus may consist of dead or dying bacteria, dead tissue cells that formerly occupied the area, dead or dying white blood cells, debris and a certain amount of fluid exuded from the blood vessels in the vicinity. Various bacterial species are associated with abscess formation including *Corynebacterium pyogenes*, *Streptococcus spp*, *Staphylococcus spp* and

6

AIDE MEMOIRE - ANATOMY

Vertebral Column

- 7 cervical vertebrae
- 13 thoracic vertebrae
- 6 lumbar vertebrae
- 5 sacral vertebrae
- 18-20 coccygeal vertebrae

Foreleg

- Scapula
- Humerus
- Radius
- Ulna
- Carpus
- Metacarpus
- Phalanges

Hind Leg

- Femur
- Patella
- Tibia
- Fibula
- Tarsus
- Metatarsus
- Phalanges
- Head of femur articulates with acetabulum of pelvis

Pelvis

- 3 bones, ilium, ischium and pubis.
- Top of cavity formed by sacral vertebrae
- Paired pubis joined by pubic symphysis

7

DISEASE AND CAUSATIVE ORGANISM

DISEASE	CAUSE	TYPE
Actinobacillosis (Wooden Tongue)	*Actinobacillus ligniersi*	Bacterial
Actinomycosis (Lumpy jaw, Ray Fungus)	*Actinomyces bovis*	Bacterial
Anthrax (Woolsorters' Disease, Splenic fever, Charbon, Malignant pustule)	*Bacillus anthracis*	Bacterial
Babesiosis (Red Water Fever, Haemosporidiosis, Piroplasmosis)	*Babesia bovis* *Babesia divergens*	Protozoal
Black Disease (Infectious necrotic hepatitis)	*Clostridium novyi*	Bacterial
Blackleg	*Clostridium chauvoei*	Bacterial
Bluetongue (Sore muzzle disease)	Orbivirus	Viral
Bovine Herpes Mammillitis (Ulcerative mammillitis, Bovine Herpesvirus II)	Herpesvirus (BHV-2)	Viral
Bovine Malignant Catarrh (Malignant Catarrhal Fever)	Herpesvirus	Viral
Bovine Spongiform Encephalopathy (BSE, Mad Cow Disease)	Prion Protein	Prion
Bovine tapeworm	*Moniezia expansa*	Parasitic
Bovine Virus Diarrhoea (BVD, Mucosal disease)	BVD virus, Pestivirus	Viral
Brucellosis (Contagious abortion, Bang's disease, Undulant fever)	*Brucella abortus*	Bacterial
Calf Diphtheria (Oral necrobacillosis, necrotic stomatitis)	*Fusobacterium necrophorum*	Bacterial
Canine tongue worm	*Linguatula serrata*	Parasitic
Coccidiosis	*Eimeria bovis*	Protozoal

8

AFFECTIONS OF SPECIFIC PARTS

This section gives details of visible lesions and possible diagnosis; it is only intended as a guide

N.B. Neoplasia can affect all parts

BONES

LESION	POSSIBLE DIAGNOSIS
Inflammation of	Osteitis
Purulent inflammation of	Osteomyelitis
Brown pigmentation	Osteohaematochromatosis
Callus formation	Resolving fracture, Lymphosarcoma, osteosarcoma
Softening, swelling and curvature	Rickets (vitamin D deficiency)
Tubercles (most common in vertebrae)	Tuberculosis

Resolving rib fracture – callous formed by bone deposition

HEAD

LESION	POSSIBLE DIAGNOSIS
Bones	
Brownish red discolouration	Osteohaematochromatosis
Swelling of mandible/ other bones	Actinomycosis, osteomyelitis, trauma, tumour, non-specific infection
Buccal cavity	
Inflammation of	Stomatitis
Crater like erosions of nose, mouth	Malignant catarrhal fever
Diphtheric foul smelling membrane	Calf diphtheria
Erosion of cheek papillae	Trauma, Malignant catarrhal fever, Bluetongue
Erosion of mucous membrane	Bovine Virus Diarrhoea, Foot and mouth, Bluetongue

9

INDEX

INDEX

A

B