

ANDREW WILSON

# Practical Meat Inspection

FOURTH EDITION



Blackwell Scientific  
Publications

# Practical Meat Inspection

ANDREW WILSON

MRCVS, DVSM

Examiner in Meat Inspection for  
The Royal Society of Health

FOURTH EDITION

BLACKWELL SCIENTIFIC PUBLICATIONS

OXFORD LONDON EDINBURGH  
BOSTON PALO ALTO MELBOURNE

© 1968, 1975, 1980, 1985 by  
Blackwell Scientific Publications  
Editorial offices:  
Osney Mead, Oxford, OX2 OEL  
8 John Street, London, WC1N 2ES  
23 Ainslie Place, Edinburgh, EH3 6AJ  
52 Beacon Street, Boston  
Massachusetts 02108, USA  
667 Lytton Avenue, Palo Alto  
California 94301, USA  
107 Barry Street, Carlton  
Victoria 3053, Australia

All rights reserved. No part of this  
publication may be reproduced, stored  
in a retrieval system, or transmitted,  
in any form or by any means,  
electronic, mechanical, photocopying,  
recording or otherwise  
without the prior permission of  
the copyright owner

First published 1968  
Second edition 1975  
Third edition 1980  
Fourth edition 1985

Set by Downdell Ltd  
Oxford, and printed and bound  
in Great Britain by  
Billing & Sons Limited, Worcester.

#### DISTRIBUTORS

##### USA

Blackwell Mosby Book Distributors  
11830 Westline Industrial Drive  
St Louis, Missouri 63141

##### Canada

Blackwell Mosby Book Distributors  
120 Melford Drive, Scarborough  
Ontario M1B 2X4

##### Australia

Blackwell Scientific Publications  
(Australia) Pty Ltd  
107 Barry Street  
Carlton, Victoria 3053

##### British Library

Cataloguing in Publication Data

##### Wilson, Andrew, 1913-

Practical meat inspection.—4th ed.

1. Meat inspection

I. Title

664'.907 TS1975

ISBN 0-632-01449-0

# Practical Meat Inspection

## Preface to Fourth Edition

The contents have been brought up to date and a few new line drawings added to help particularly with the identification of bones. Appropriate judgements have been placed at the end of each text of diseased conditions. I hope these will be a help to readers.

Again the veterinary surgeons, environmental health officers and authorized meat inspectors of the City of Birmingham Environmental Department have been very helpful, especially Mr Donald J. Knight with the section on bacon.

I would like to thank them for their help, and my son, William G. Wilson, for his advice and encouragement.

Andrew Wilson

## Preface to First Edition

This book is based on a course of lectures on meat inspection, and is intended for all those interested in the practical aspects of the subject, particularly veterinary students, trainee public health inspectors and trainee meat inspectors. While the sections dealing with physiology and anatomy have been deliberately made somewhat elementary they do provide all the information required by meat inspectors, while veterinary students, and to a lesser degree, public health inspectors, learn these subjects as a separate part of their course.

I have tried to deal comprehensively with meat inspection, but it must be stressed that it is essentially a practical subject which cannot be learned from books alone. I have, however, designed both text and illustrations to emphasise all the important facts which students should remember, excluding all irrelevant material.

It is most important that students should familiarise themselves with normal tissues so that when something abnormal turns up it can be recognised.

In writing this book I have had much helpful criticism from colleagues in Birmingham; in particular from Mr George E. Bousfield, MAPHI, I am most grateful for his help. I also wish to thank Mr Jack Baker, FRSH, for the section on preservation by heat, and Mr Donald J. Knight, meat inspector, for the section on bacon curing and meat products.

# Contents

Preface to Fourth Edition	vii
Preface to First Edition	viii
1 Cells and Tissues	1

## SYSTEMS OF THE BODY

2 Skeletal System	9
3 Muscular System	22
4 Circulatory System	23
5 Lymphatic System	31
6 Respiratory System	43
7 Digestive System	49
8 Urogenital System	63
9 Nervous System	71
10 Endocrine System	75
11 The Slaughter of Animals	78
12 Sex Characteristics and Estimation of Age	86
13 Abnormal and General Pathology	95
14 Judgement and Specific Diseases	112
15 Parasites and Parasitic Diseases	131
16 Affections of Specific Parts and Tumours	163
17 Butchers' Joints	190

18	Diseases of Rabbits	194
19	Meat Preservation and Meat Products	198
20	Food Poisoning from Meat Products	224

## POULTRY

21	Slaughter and Dressing of Poultry	229
22	Anatomy of Fowl	235
23	Diseases of Poultry	252
24	Legislation and Colloquial Terms	271
	Index	275



# Chapter 1

## Cells and Tissues

Physiology is the study of animal body activities, e.g. respiration, digestion and muscular movement.

All living things are composed of cells the form of which can be seen microscopically. The simplest form of life is composed of only one cell, e.g. the amoeba. Most animals however are made of a great number of cells.

Each tissue has its own particular type of cell, e.g. muscle cells differ in size and shape from those of the liver. Basically each cell has the same structure.

A cell has a *cell membrane* containing the *protoplasm*. The protoplasm consists of a *nucleus* surrounded by the *cytoplasm*. The red blood cells of mammals are unusual in having no nuclei.

The cytoplasm contains many living inclusions:

- (i) *Mitochondria*. These are found in most abundance in situations where there is great activity, e.g. in the muscles. They are concerned with the conversion of *adenosine diphosphate* (ADP) to the *triphosphate* (ATP) for energy purposes.
- (ii) *Ribosomes* are the site of protein synthesis.
- (iii) *Golgi bodies* are concerned in the production of enzymes and hormones.
- (iv) *Lysozymes* break down food particles.

The cytoplasm also contains non-living inclusions such as fat and glycogen.

The cell nucleus contains *nucleoplasm* consisting mainly of DNA (De-oxyribose nucleic acid). The nucleus contains the *chromosomes* which are constructed mainly of DNA. Separating the nucleus and the cytoplasm is a perforated *nuclear membrane*. Inside the nucleus is the *nucleolus* which consists mainly of RNA (*Ribose nucleic acid*).

Living things have various activities:

- 1 Assimilation of food and oxygen to produce energy necessary for their existence
- 2 Excretion of waste products
- 3 Growth
- 4 Reproduction

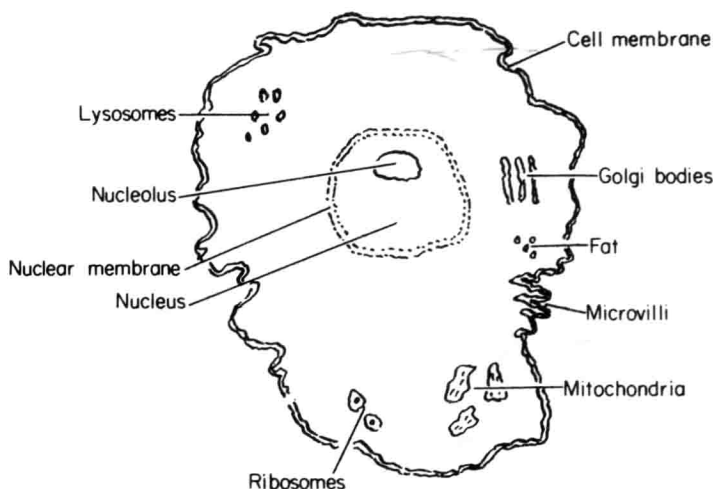


Fig. 1.1. Cell.

Cells are constantly dying and being replaced by new cells, e.g. the red blood corpuscle cycle is about 14 days.

## TISSUES

The animal body is composed of tissues. The main tissues are: epithelial; connective; muscular; blood; lymphatic; and nervous.

### EPITHELIAL TISSUES

These cover the free surfaces of the body. There are various types:

(a) *Stratified epithelium* is many cells thick and covers the anterior surface of the cornea and forms the epidermis of the skin, the superficial cells of which are dead, flattened and scale-like, whereas the deeper cells are polyhedral and columnar in shape.

(b) *Transitional epithelium* is a type of stratified epithelium which has only three or four layers of cells. Most of the urinary tract has this type of epithelium.

(c) *Pavement epithelium* covers the unexposed parts of the body, e.g. the pleural and peritoneal cavities, and the blood and lymph vessels.

(d) *Columnar epithelium* is a more active type of epithelium and is found lining the stomach of intestines.

(e) *Ciliated epithelium* is found in the lungs and trachea, in the Fallopian tubes, uterus and efferent tubes and ducts of the testes.

#### CONNECTIVE TISSUES

Connective tissues as the name implies connect the various cells of other tissues and organs and their function is largely mechanical. They include the following tissues: (a) areolar, (b) elastic, (c) lymphatic or reticular, (d) adipose, (e) fibrous, (f) cartilaginous, and (g) bony.

(a) *Areolar tissue* is composed of white and elastic fibres forming meshworks which enclose spaces or *areolae*, e.g. *subcutaneous tissue*.

(b) *Elastic tissue* is composed of yellow elastic fibres. It is found in the walls of blood vessels, the lungs and most characteristically in the *ligamentum nuchae*.

(c) *Lymphatic* or *reticular tissue* is composed of networks of collagenous fibres enclosing *lymph*.

(d) *Adipose tissue* or *fat* is composed of a network in which are embedded *fat cells*.

The chief constituents of animal fat are *stearin*, *olein* and *palmitin*. The body fat comes partly from fat in the diet and is in part manufactured, within the body, from carbohydrates and sometimes proteins in the diet.

The fat is soft during life but quickly hardens after death. This is due to the fall in temperature and not to *rigor mortis*. Fat is found under the skin, the *subcutaneous fat* or *panniculus adiposus*, and collects around the heart and particularly around the kidneys. It is also found in the pleura, peritoneum and mesentery and in small quantities in the tissues of most organs. Fat provides a store of energy for the body. Being a poor conductor of heat it prevents loss of body heat. In well-fed animals it is found between the muscle fibres and is called *marbling*.

Unlike ruminants, horses and pigs tend to deposit fat unchanged. Fat varies in consistency, colour and distribution. Some animals have white fat and some yellow due to the presence of *carotene*. In some the fat is firm, in others soft. In chronic diseases the fat may not set and remains soft. The colour may vary not only with the species but also with the age and breed of the animal.

In old cows the fat is yellow. The Channel Island breeds of cattle have a yellow fat although young calves of those breeds have white fat. The colour may also vary with the feeding, e.g. a grass diet

Table 1.1 Characteristics of fat.

Animal	Colour	Consistency
Calf	White or greyish white	Soft and gelatinous
Heifer and bullock	White or yellowish white	Firm and smooth
Cow	Yellow	Fairly firm and ragged
Bull	White or yellowish white	Firm (sparse)
Sheep and goat	Very white	Very firm and crisp
Pig	White	Fairly firm and greasy
Horse	Yellowish white	Soft and greasy

with high levels of carotene gives a yellow fat compared to the white fat in Barley beef.

The consistency of fat varies according to the amounts of *stearin*, *olein* and *palmitin* in it. A high stearin content gives a firm consistency, whilst a high olein content gives an oily consistency. A good knowledge of the different kinds of fat is very helpful in identifying the source of specimens.

(e) *Fibrous tissue* is composed almost entirely of white fibres. It is found in ligaments, tendons, fasciae and in the serous membranes.

(f) *Cartilaginous tissue*, (cartilage) commonly known as gristle, is a specialized dense connective tissue. It forms most of the temporary skeleton of the mammalian embryo and persists in the adult, e.g. at the joint surfaces, in the respiratory passages, in the ears, and as the costal cartilages of the ribs. The commonest and most characteristic form of cartilage is known as *hyaline cartilage* because of its glassy translucent appearance. Cartilage in some areas e.g. at the pelvic symphysis and at the dorsal extremities of the spines of the first five or six thoracic vertebrae, gradually ossifies with age. It is therefore helpful in deciding upon the age of an animal.

(g) *Bony tissue*—bone is a connective tissue which is impregnated with salts of lime, chiefly phosphate, these salts constituting about two-thirds the weight of the bone.

Bony tissue is either *compact* or *spongy*. Compact bone is white, dense and almost like ivory. Spongy bone consists of delicate bony plates and spicules which run in various directions and intercross. The spaces between the plates are called *marrow spaces* and are filled with *marrow*. Externally, bones are covered, except at the joints, by a vascular, fibrous membrane, the *periosteum*.

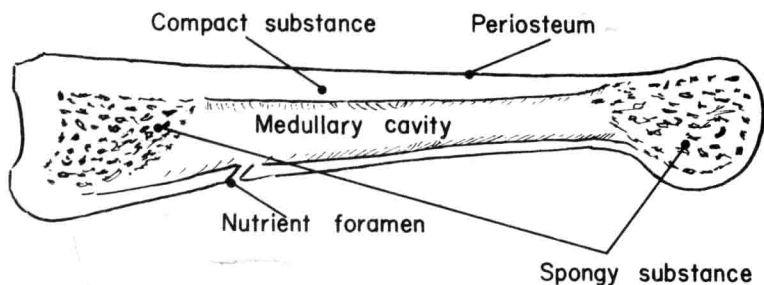


Fig. 1.2. Long bone.

The bones are commonly divided into four classes:

- 1 Long bones—typically elongated cylindrical form with enlarged extremities, e.g. femur.
- 2 Flat bones—bones of the skull.
- 3 Short bones—e.g. those of carpus and tarsus, with somewhat similar dimensions in length, breadth and thickness. They diminish friction or change directions of tendons.
- 4 Irregular bones—bones of irregular shape, e.g. vertebrae.

#### MARROW

There are two distinct varieties of marrow—the red marrow and the yellow marrow.

1 The red marrow occupies the spaces in the spongy bone; it is highly vascular and thus maintains the nutrition of the spongy bone. It is in these situations that the red blood corpuscles are formed.

2 The yellow marrow fills the medullary cavity of long bones and consists chiefly of fat cells with numerous blood vessels.

*N B* In young animals there is only red marrow, i.e. as the animal ages the proportion of red to yellow decreases.

Short descriptions of the muscular and lymphatic tissues are given in the relevant chapters.



## Systems of the Body

For ease of description the systems of the body have been divided into nine systems: skeletal, muscular, circulatory, lymphatic, respiratory, digestive, urogenital, nervous and endocrine.





## Chapter 2

# Skeletal System

The skeletal system consists of a framework composed of the bones of the body.

They are joined together in their natural positions by ligaments and joints. The softer tissues of the body are built on this framework and the organs are enclosed and partly protected by it.

### 1 The skull and lower jaw

The skull forms the cranium. The upper jaw is attached to the skull and contains the upper teeth. The lower jaw or mandible, carrying the lower teeth, is a separate bone joined to the skull by means of ligaments. The skull articulates with the first cervical vertebra, the atlas, by a ball and socket joint.

### 2 The vertebral column

The vertebral column, spine or backbone, consists of many vertebrae which form a long fairly flexible chain extending from the head to the tail. The vertebrae are divided into groups named according to their position:

- (a) Cervical or neck vertebrae.
- (b) Dorsal or Thoracic vertebrae are those of the back with which the ribs articulate.
- (c) Lumbar vertebrae, situated in the region of the loin.
- (d) Sacral vertebrae in the pelvic region. These are generally fused together to form the sacrum and articulate with the pelvic bones to form the pelvis.
- (e) Coccygeal or tail vertebrae.

The vertebral formulae for the various animals are shown in Table 2.1.

It will be noted that they all have seven cervical vertebrae. Even the giraffe with its very long neck has only the same number.

The spinal cord passes through the vertebral foramen of each vertebra down to about the third sacral vertebra. Between the