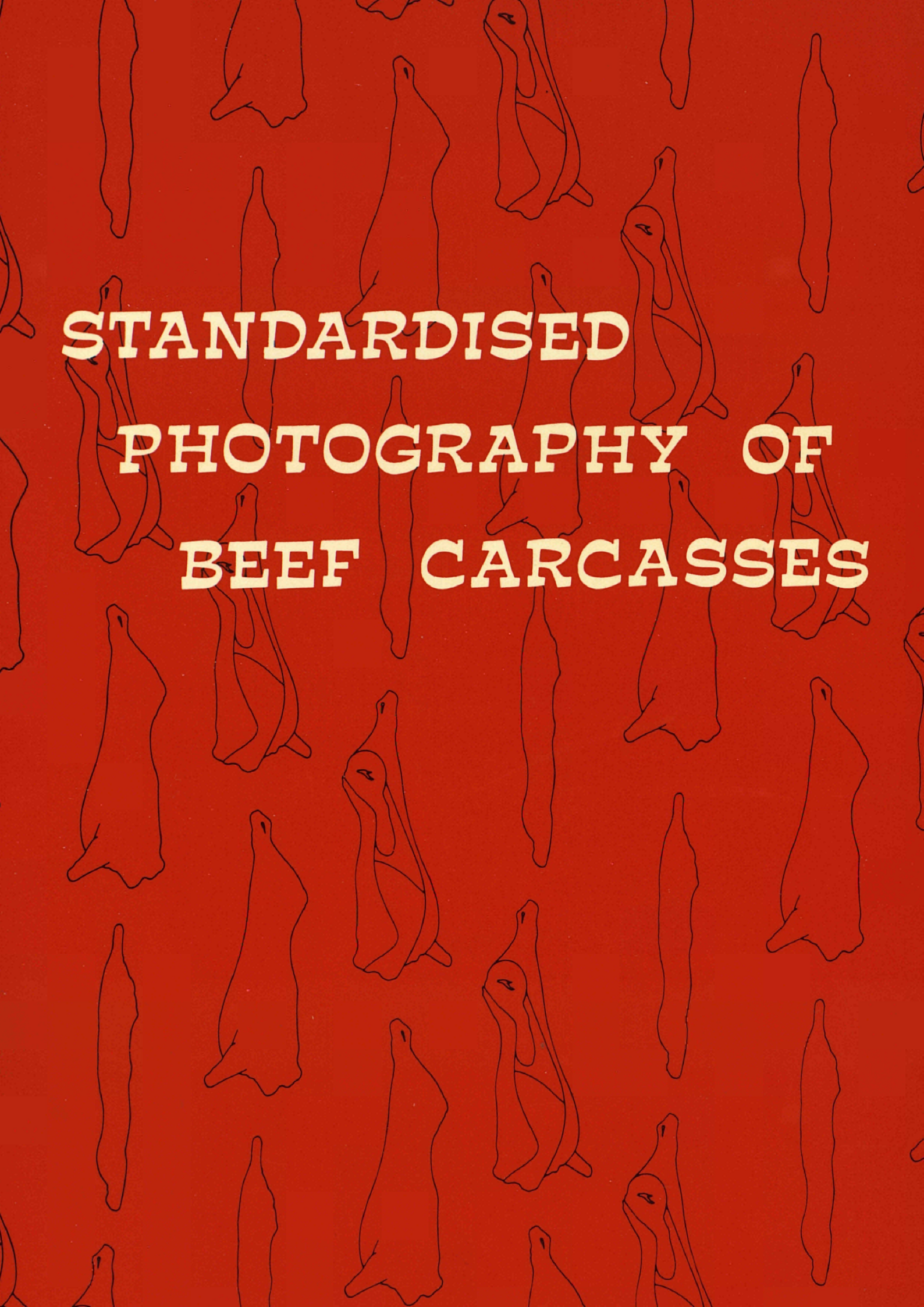

STANDARDISED PHOTOGRAPHY OF BEEF CARCASSES

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of
BEEF CARCASSES

by

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Preface

As part of the work on classification of carcasses of experimental beef cattle produced at research institutes within EEC countries it is proposed to make considerable use of standardised photographs. The plan is that the carcasses will not only be assessed by trained staff at each institute but they will also be photographed and the photographs circulated to a panel of experts for independent assessments. The objective of this is to try to maintain a uniform standard of classification at all the collaborating institutes. However, experience at the Meat Research Institute over a number of years indicates that assessment from photographs can be influenced with respect to both fatness and conformation by the quality of the photographs and, indeed, poor quality photographs can be positively misleading. Mr. B.S. Speight, Principal Photographer, at the Meat Research Institute has therefore compiled this guide to standardised photography of beef carcasses in the hope that it will assist research workers, who may be rather inexperienced in photography, to avoid the more serious pitfalls in carcass photography and to produce standardised photographs of adequate quality.

R.W. Pomeroy

Contents

Introduction

The well known saying 'a camera does not lie' is often met with scepticism. It is, nevertheless, perfectly true that the camera records precisely what it sees during the time of exposure and any abnormal or unusual results are the fault of the operator, not the camera. A typical example is in photographing a tall building; when we look up at the building our eyes see the structure exactly as the camera sees it but our brain tells us that its walls are vertical. However, the camera can only record what it sees and since the vertical sides seem to converge towards the top, the building appears to fall backwards in the photograph. Another example, often seen in holiday snapshots, is the enormous size of feet and long legs of someone sitting in a deck chair. Most errors can be avoided by careful consideration of the position of the camera relative to the subject.

It is obvious, therefore, if photography is to play a useful role in any scientific discipline it must be used correctly and carefully. The art of technical photography is in the use of materials and techniques which produce factual records, i.e. sharp images with a full range of tones which are free from distortion and artistic embellishment. It must be remembered that the higher the quality the more information the photograph will contain.

The need for standardisation

Professionals and a number of good amateurs are capable of producing quality photographs of animal carcasses which individually would be perfectly satisfactory; but in international collaborative investigations standardisation in technique is essential in order to achieve uniform quality. Unless standardisation is accepted, variations in photographic quality could very easily be attributed wrongly to variations in carcass quality. For example, in a set of colour transparencies used for the E.A.A.P. Beef Fatness Classification, the originals were produced jointly by Dr. E. Kallweit, Institut fur Tierzucht und Tierverhalten der Fal Mariensee, Germany and Dr. R.W. Pomeroy, Meat Research Institute, Langford, England. The same make and type of film was used by both Institutes, but because of film batch differences and/or processing variations in the two countries, the transparencies from Germany had a slight blue cast while those produced in England were slightly yellow. In order to avoid any confusion arising during use, it was necessary to reproduce a more uniform set by removing some of the predominant overtones. But when this had been done, one of the transparencies, i.e. carcasses, appeared to be out of order because removal of the small amount of yellow from the image gave the visual impression of a carcass with less fat cover than its position in the set indicated. It is essential therefore, that if accurate assessments are to be made from photographic images their quality must be consistent throughout.

Plate 1 is an example which illustrates the importance of uniform quality. The first photograph (a) is of poor quality due to lack of definition and excessive contrast. The enlargement was derived from an 'instant' type of picture. Photograph (b) is typical of the quality produced by amateur photographers; some amateurs could, of course, improve on this quality but many would be worse. (c) is an example of poor contrast, where both fat and muscle areas are degraded. The effect produced in (d) is the result of unbalanced lighting; as one side of the carcass is in shadow it is difficult to assess the fat cover accurately. (e) suffers from distortion, which is evident from the elongated and narrow hindquarter and pronounced forequarter. The final photograph shows the quality for which one should aim; it has reasonable contrast with sufficient detail in the fat areas and it is evenly lit and free from distortion.

This hypothetical set of 'fatness' standards could have been compiled from photographs taken at different institutes and it is obvious that difficulty would arise in use because of the wide variation in photographic quality. Each photograph might have been satisfactory for use by the individual institutes which produced it and, provided their other photographs were of similar quality, they could all have been used for comparison purposes. However, in international collaborative work the photographic quality must be consistent throughout. The recommendations and illustrations contained in this booklet indicate how many of the possible defects can be avoided.

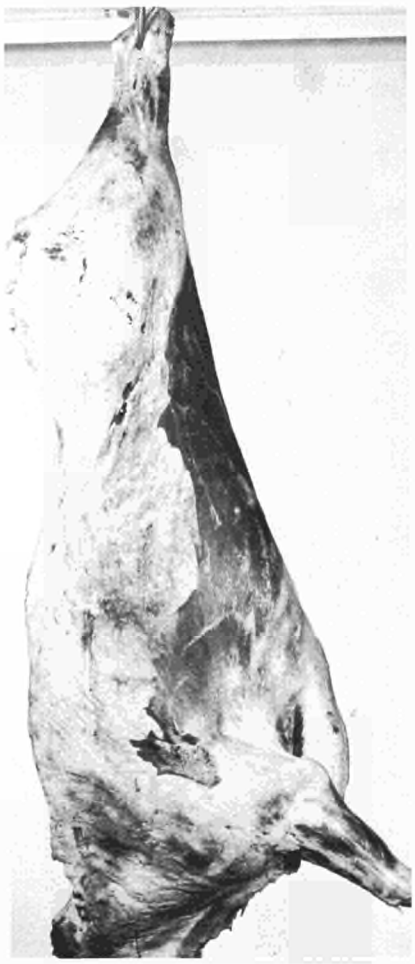
Plate 1

a

b

c

d



e

f

Position of carcass

The carcass or side of beef should be suspended by the achilles tendon, ideally on a swivel hook so that the various views can be taken without moving the camera. For the lateral and medial views, the side should be aligned with its sagittal (dorso/ventral) plane at 90^{0} to the lens axis, and for the dorsal and ventral views, the sagittal plane and lens axis should be parallel. A reference scale, e.g. a metre rule, and the carcass identification, should be hung adjacent to and in the same plane as the carcass if measurements are to be taken from the photograph. A 'grey scale', consisting of three areas of grey of different density, as well as black and white, should also be attached to the scale to give the printer a standard reference for density and contrast. This is particularly valuable if commercial processing laboratories are to be employed. Similarly, colour references should be included for colour photography and, provided these are printed to a standard, any variations in the colours in the photograph must then be due to variations in the original carcasses.

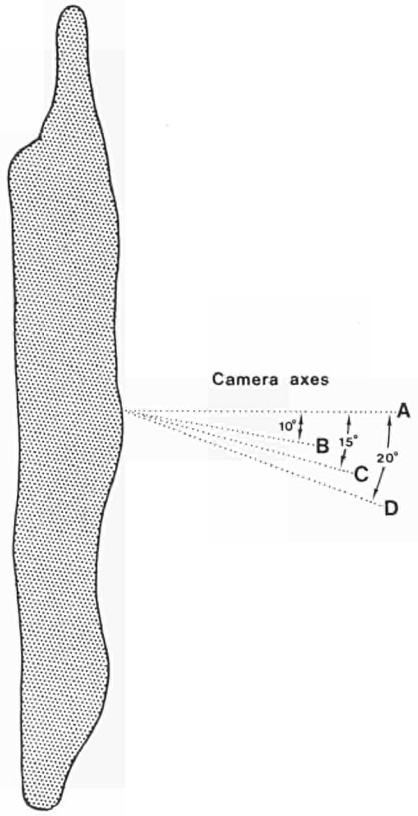
The camera

Of the many types of camera available, single lens reflex models are the most useful for scientific work because the image produced on the viewing screen is exactly the same as that which will appear on the negative. Cameras of this type, using roll films and giving negatives of the order of 6 cm x 6 cm, are particularly suitable for carcass photography as they produce images of adequate dimensions whilst remaining convenient to handle. Technical cameras are capable of producing higher quality negatives but are less suitable because they are cumbersome in use and must be reloaded for each photograph. Miniature cameras using 35 mm film have the advantage of greater film capacity but this is offset by the small negatives they produce; also the subtle tone differences in the fat areas are difficult to reproduce in print due to the loss of definition resulting from the high degree of enlargement required. Such miniature cameras are, however, ideal for the direct production of transparencies for projection.

Position of camera

Ideally, the camera should be mounted on a stand or tripod so that it can be positioned (or repositioned) accurately for each photograph. It is vitally important to position the camera correctly to avoid distortion of the image. This is achieved by ensuring that the film plane is parallel to the plane of the carcass. In most cases this means that the camera must be held horizontally with the lens axis level with the mid-point of the carcass, which is about the 13th thoracic vertebra, (see Plate 2, position A). When the lens axis is not horizontal, a distorted image will be produced if the camera is tilted upwards to the mid-point (position B). Distortion is further increased if the camera is held at waist level (position C), e.g. a reflex camera without a pentaprism viewfinder.

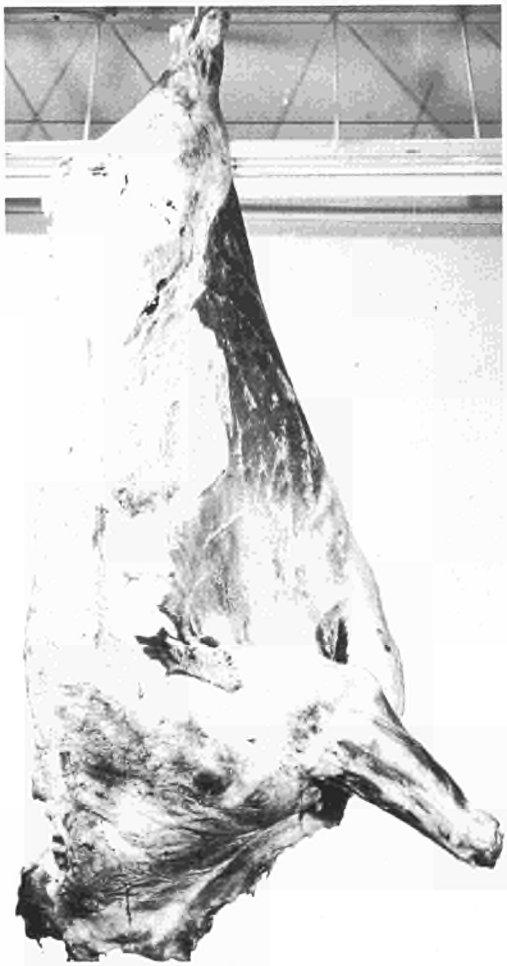
Plate 2



position A

position B

position C



position D

Lenses

It is always desirable to fill the negative with the subject and the longest focal length lens should be used which will accomplish this in the space available. The normal focus or standard lens for the camera is usually adequate and does not require an unduly long camera-to-subject distance. Such a lens has a focal length approximately equal to the diagonal dimension of the negative it produces, e.g. the standard lens for a 35 mm camera giving full frame negatives has a focal length of about 50 mm, compared with 80 mm for a camera producing 6 cm^2 negatives.

Use of shorter focal length lenses is not recommended, even where space is limited, as distorted images can result from the proximity of the camera to the carcass, especially if the film and carcass planes are not parallel (Plate 2, position D). The grotesque shape of the distorted carcass makes such a photograph useless. Even when the lens axis is horizontal these lenses can produce 'marginal distortion', i.e. the image is progressively distorted towards the edge of the picture because, as the film plane is flat, the off-axial rays meet the film plane at an increasingly oblique angle. This effect is not apparent to the eye because the image falls on the concave surface of the retina.

Lighting

A number of lighting arrangements for beef carcass photography have been explored at M.R.I. and the system which has given the most satisfactory and consistent results over the whole fatness range utilizes multiple electronic flash heads. Figure 1 is a plan of the recommended lay-out showing the light outputs of each flash head and the relative positions of carcass, camera and lights. With monochrome photography the ring flash, i.e. an annular flash tube surrounding the camera lens, is used to give general illumination and to lighten the shadows created by the oblique lighting of the two flashes which are necessary to show the rough surface of the subcutaneous fat.

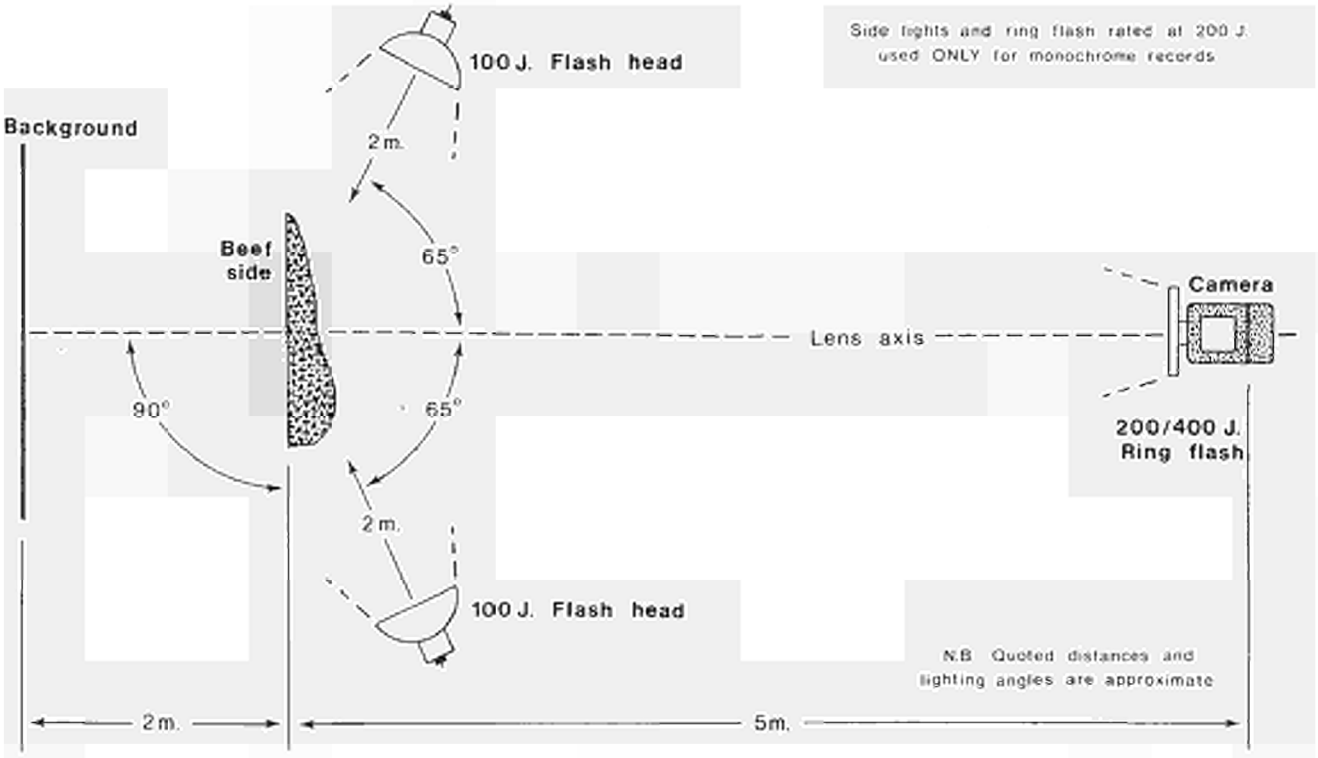


Figure 1

The height of the head illuminating the dorsal aspect of the carcass is level with the pelvic region while the other, illuminating the dorsal aspect, is level with the shoulder region. The lighting arrangement for colour photography uses only the ring flash: the oblique lighting from the side heads is not necessary because variations in the colour of the subcutaneous fat layer are sufficient to depict the rough surface and give an indication of its depth.

With the introduction of 'umbrella flash', it may not be possible to obtain suitable studio electronic flash equipment with ring flash heads. An alternative procedure is shown in Figure 2.

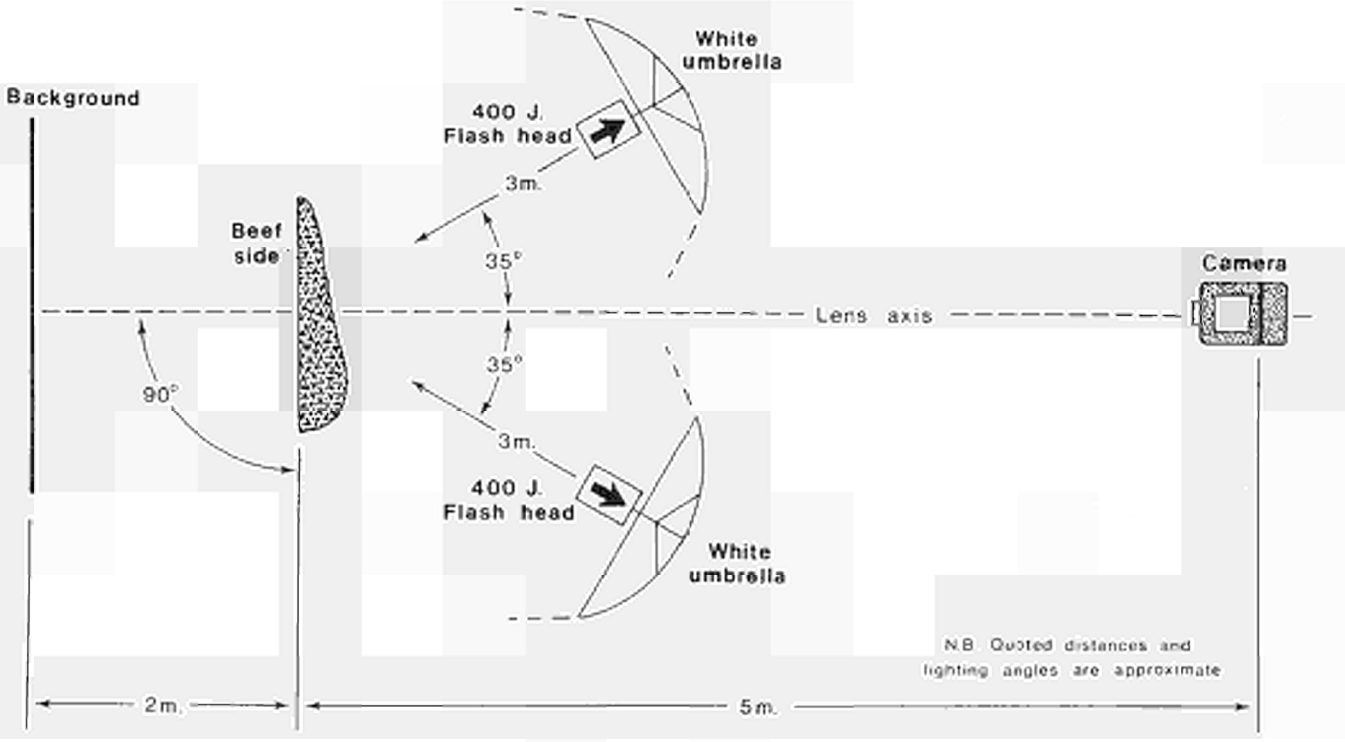


Figure 2

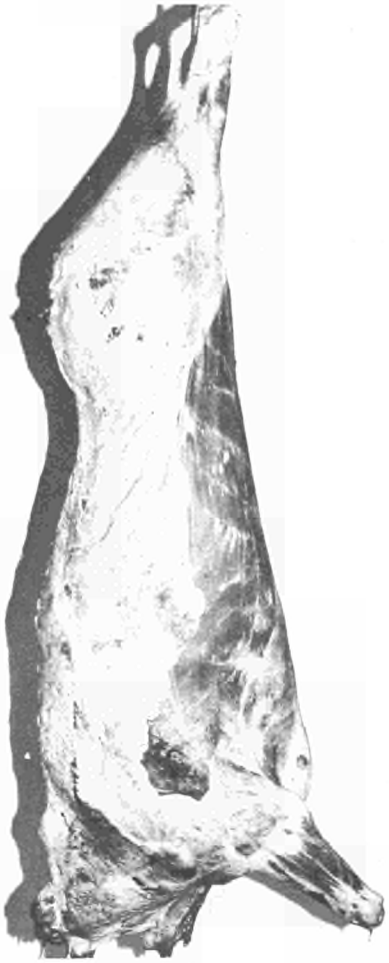
Unlike the direct lighting of the ring flash method, the flash heads are directed away from the carcass into the concave surface of an umbrella, thus giving indirect or reflected light. A matt white-finished umbrella is preferable to the aluminised type as it produces a more diffused source of illumination. Alternatively, diffused light can also be produced by fitting a diffuser cap over the flash tube, but in this case the flash head is directed towards the carcass. Either form of diffused lighting is as acceptable as the ring flash method and, in cases where the carcass/background distance is restricted, it is preferable because the disturbing shadows cast on the background are avoided.

Electronic flash is a convenient source of illumination with a number of advantages over other forms of lighting. The light produced tends to be soft which is ideal for recording the detail of the fat areas. It is cheaper than expendable flash-bulbs, and daylight sensitised colour film materials can be used without the need of colour conversion filters. It also has the advantage of not raising the temperature of the carcass by radiation as occurs with tungsten or quartz-iodine flood-lighting.

Many inexperienced photographers prefer to use a single flash mounted on the camera for convenience, but this gives flat lighting which, together with the softness of the light, can produce negatives of poor contrast. As conventional flash equipment cannot possibly be situated on the lens axis, objectionable shadows are cast on the background.

Plate 3

a



b

c

d

e

f

Plate 3

g

SINGLE FLASH

a. mounted above lens axis

b. " right of lens axis

c. " left of lens axis

UNBALANCED MULTIPLE FLASH

d. excessive frontal lighting

e. " light from the right

f. " " " " left

g. correctly illuminated carcass using multiple flash heads

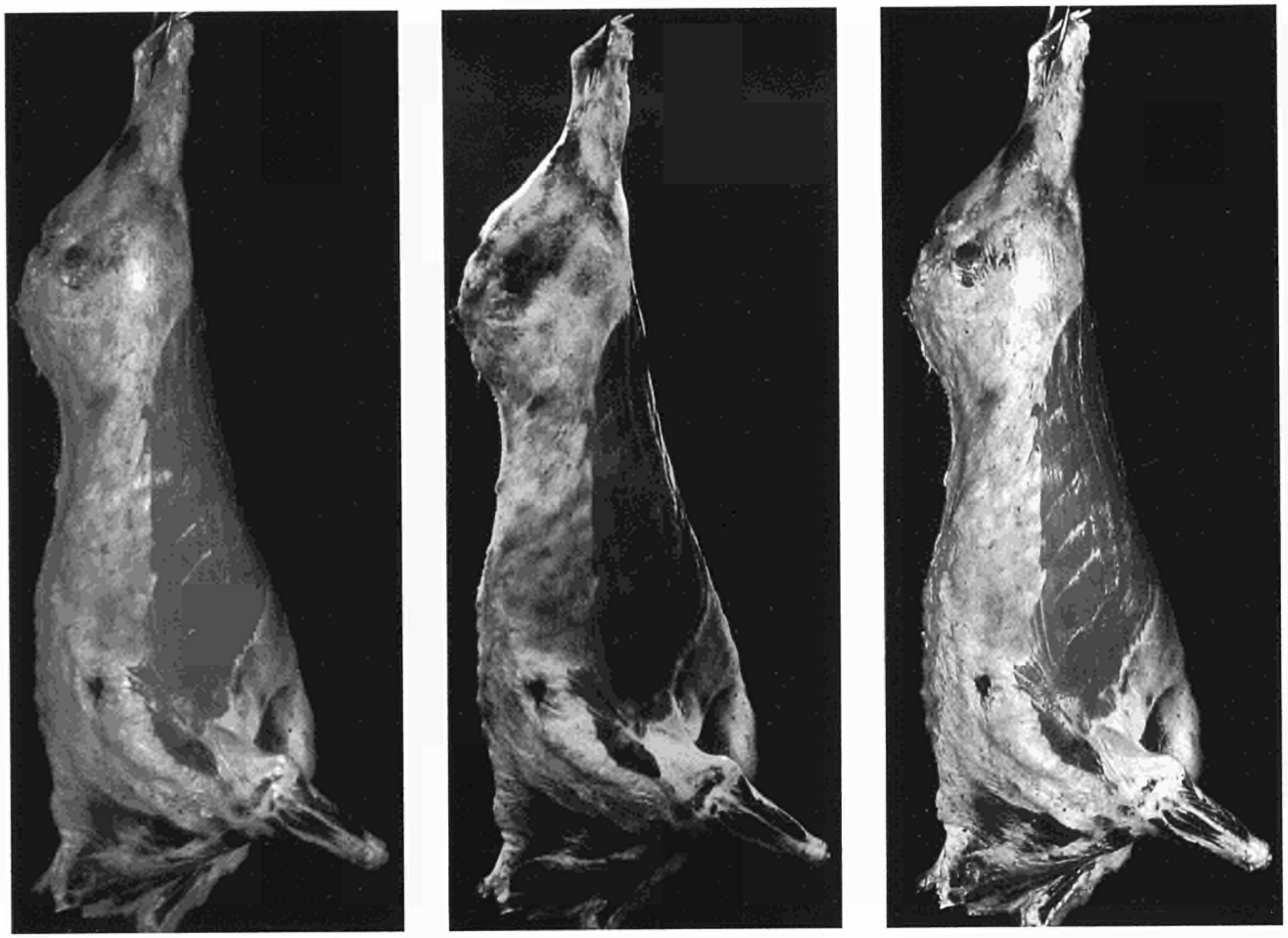
Plate 3 illustrates the three effects produced when a single flash is mounted on the camera, either above or on one side of the lens axis. Unbalanced multiple flash and a correctly illuminated carcass are also shown for comparison.

With colour materials, especially those which produce transparencies, it is essential to use light of the appropriate quality, i.e. a film sensitised to 5600^{o}K (daylight) may be exposed with daylight, electronic flash or blue coated flashbulbs. If tungsten light is used with such a film, it is necessary to

use a conversion filter over the lens to avoid distorted colours. The effect obtained when such a filter is not used is illustrated in Plate 4(a). A mixture of different quality lights should never be used in colour photography, as it is impossible to correct for each type simultaneously during printing. For example, if daylight from a window were used to illuminate one side of a carcass and tungsten light was used from the other side as a fill-in, the correct colours would be produced on one side only, depending upon the film or conversion filters used.

Fluorescent tubes should not be used to illuminate subjects for colour photography because of the unbalanced nature of the spectrum emitted. They are available in a variety of types, each emitting light of different quality. These tubes are a development of the mercury vapour lamp and have a phosphor coating which fluoresces when excited by rays from the vapour. The phosphors emit a continuous background spectrum but the high energy spectral bands of mercury are also emitted. Many tubes are given colour temperatures ranging from 3000-6500^{o}K but these are only approximate and for photographic purposes are almost meaningless. Plate 4(b) illustrates the effect produced when such a source is used to illuminate a carcass. A correctly exposed colour photograph, Plate 4(c), is included for comparison.

Plate 4



a *b* *c*

Film sensitised to 5,600°K (daylight)

Exposed to:

a. Tungsten light (3,200°K)

b. Fluorescent light (nominal 3,500°K)

c. Electronic flash (5,600°K)

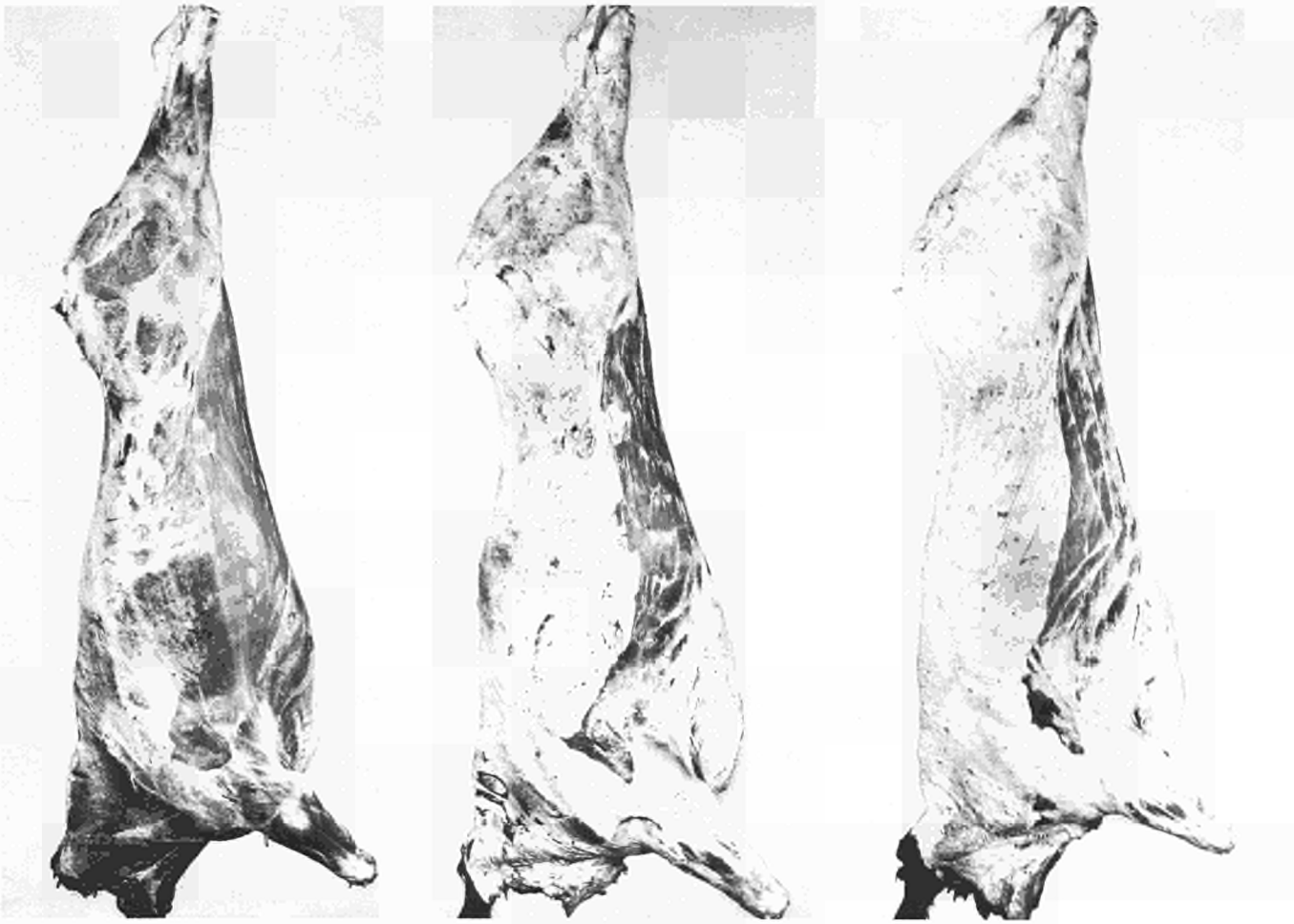
Synchronisation of flash

It is necessary with all high intensity illumination of short duration to ensure the camera shutter is fully open when the flash occurs. Most cameras nowadays are synchronised for flash and are usually designated by XM, or sometimes XF settings (the V setting on XMV shutters is for delayed action). With these cameras the X setting should be used for electronic flash so that the circuit is closed and the flash triggered when the shutter is fully open; if M or F settings are used, the flash is fired too early. On cameras of more recent manufacture, particularly those employing focal plane shutters, the symbol  indicates the fastest shutter speed that can be used with electronic flash. Between lens shutters offer greater flexibility where ambient light is troublesome because a faster shutter speed can be used to reduce the effect of such light without affecting the exposure from the flash.

Colour -v- monochrome

The decision to use either monochrome or colour materials for the production of standards on an international scale has yet to be made. Each material has its advantages as well as disadvantages. Some institutes favour the use of colour transparencies and whilst these are ideal for discussions and training programmes held in lecture theatres, they can be difficult to use in slaughterhouses. Viewing conditions for coloured images are almost as exacting as the requirements for exposure. Colour films which produce transparencies are manufactured to reproduce the correct colours as closely as possible when they are viewed by means of a projector. All colours appear distorted when transparencies are viewed by light of a quality different to that of a projector lamp. When colour prints are required, the quality of the light under which they are to be viewed should be known at the time of printing because their colour balance can be adjusted to appear correct to one type of light only, e.g. daylight or tungsten light. Another difficulty with colour materials is in colour matching because film batch differences and/or slight processing variations can have a significant effect upon the resulting colours. The useful life of coloured images, produced by the chromogenic method tends to be limited, particularly if true colour is important, because all colours will fade eventually to some extent. Assuming that the films have been correctly processed, the degree of fading is dependent upon the frequency

Plate 5

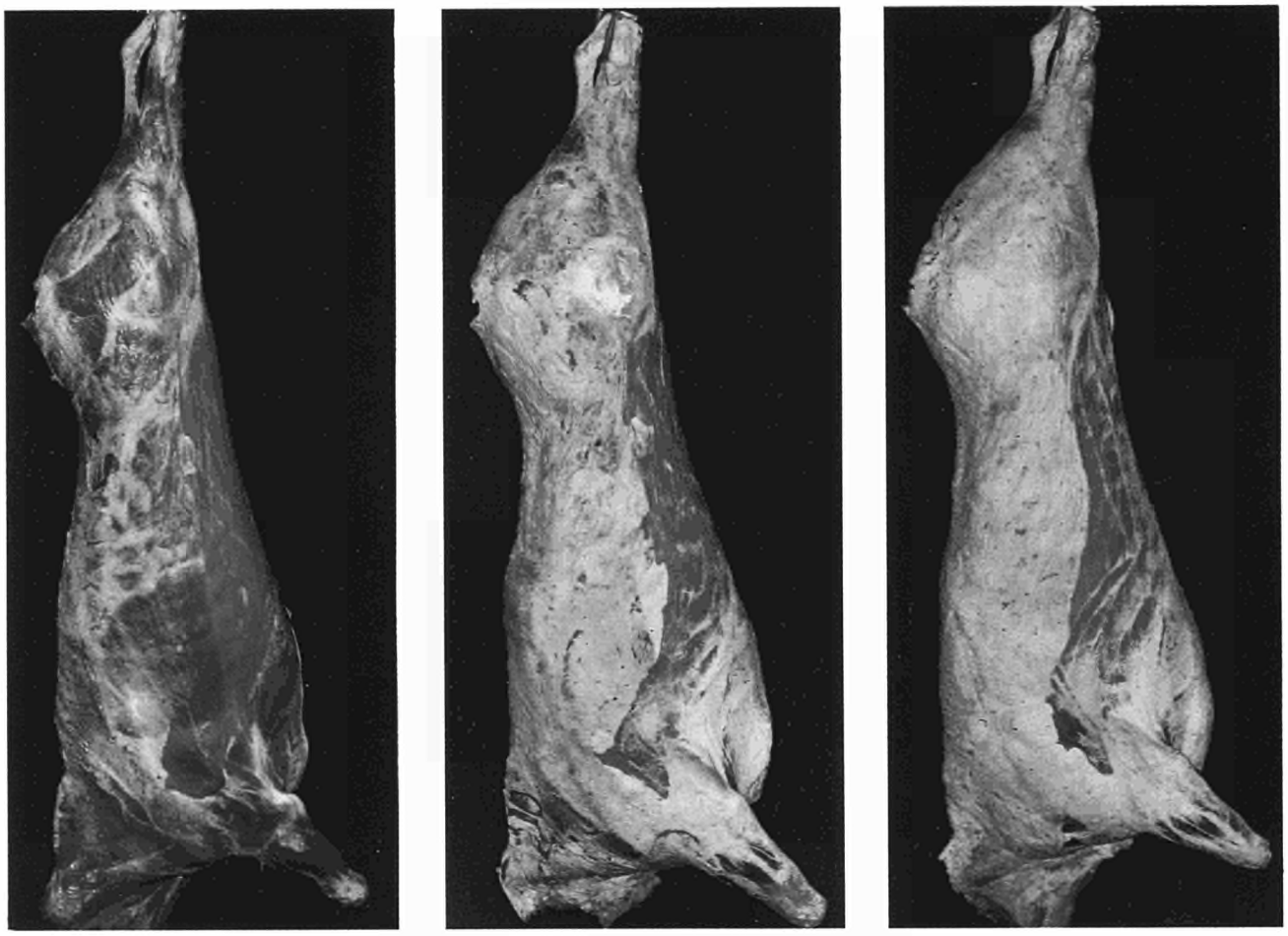


Monochrome

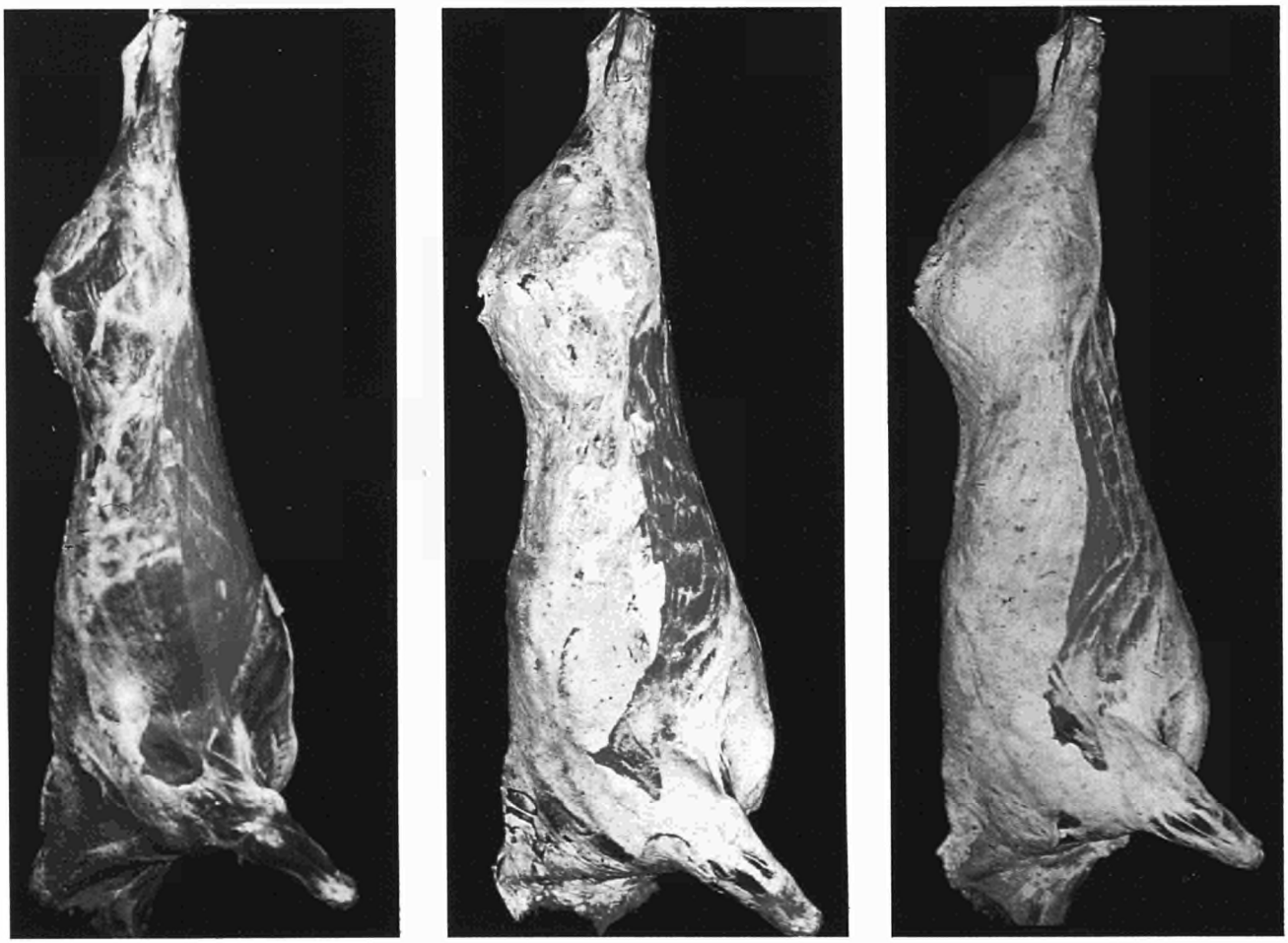
and conditions of use, as well as storage; the average life is about two years.

Plate 5 shows three carcasses each photographed on monochrome, colour negative/positive and colour reversal materials. The highly saturated colours of the prints produced by the silver dye-bleach process from transparencies is due in part to the high contrast inherent of all reversal materials which is necessary for their designed purpose of projection.

Plate 5

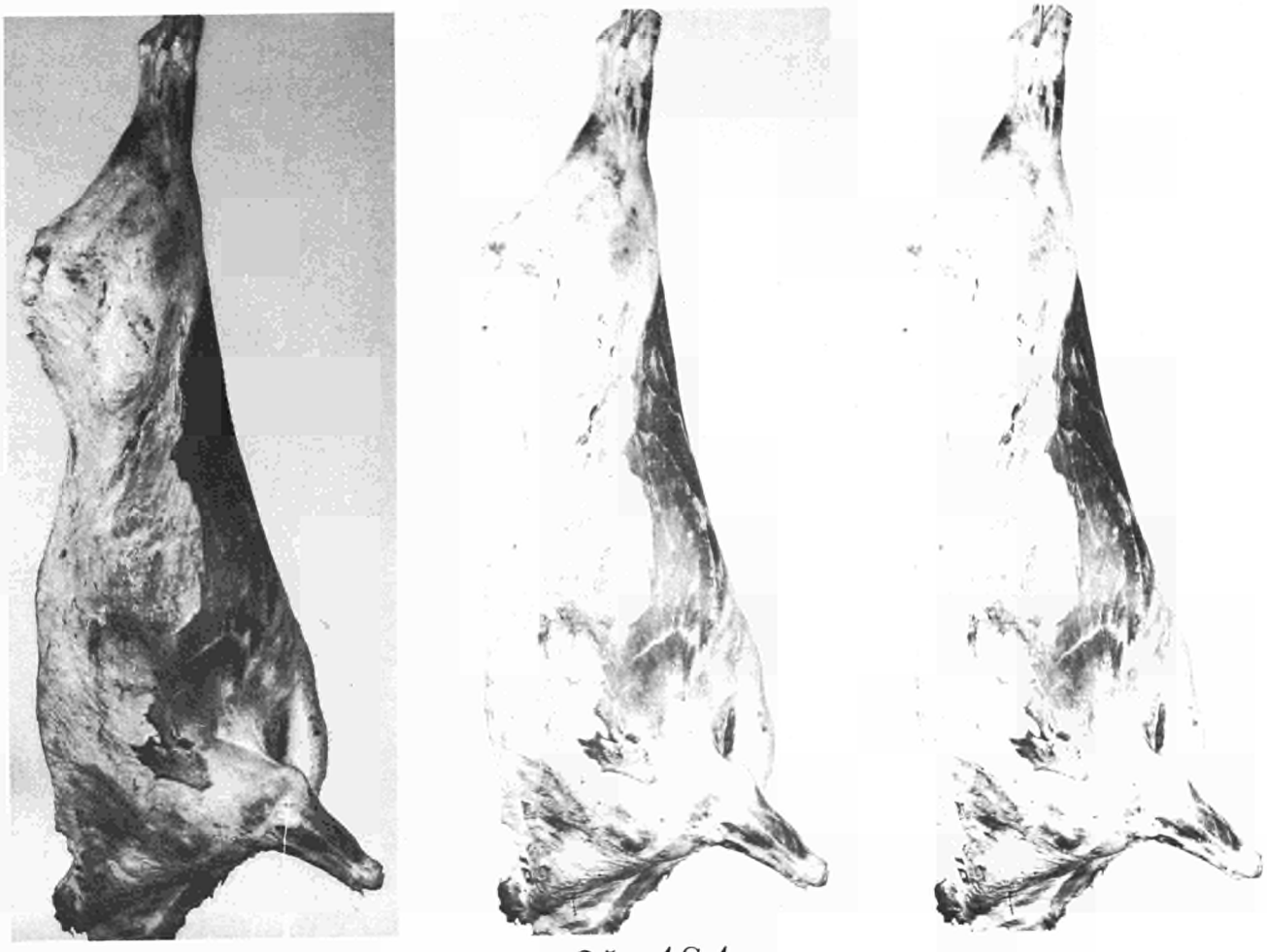


Colour: negative/positive

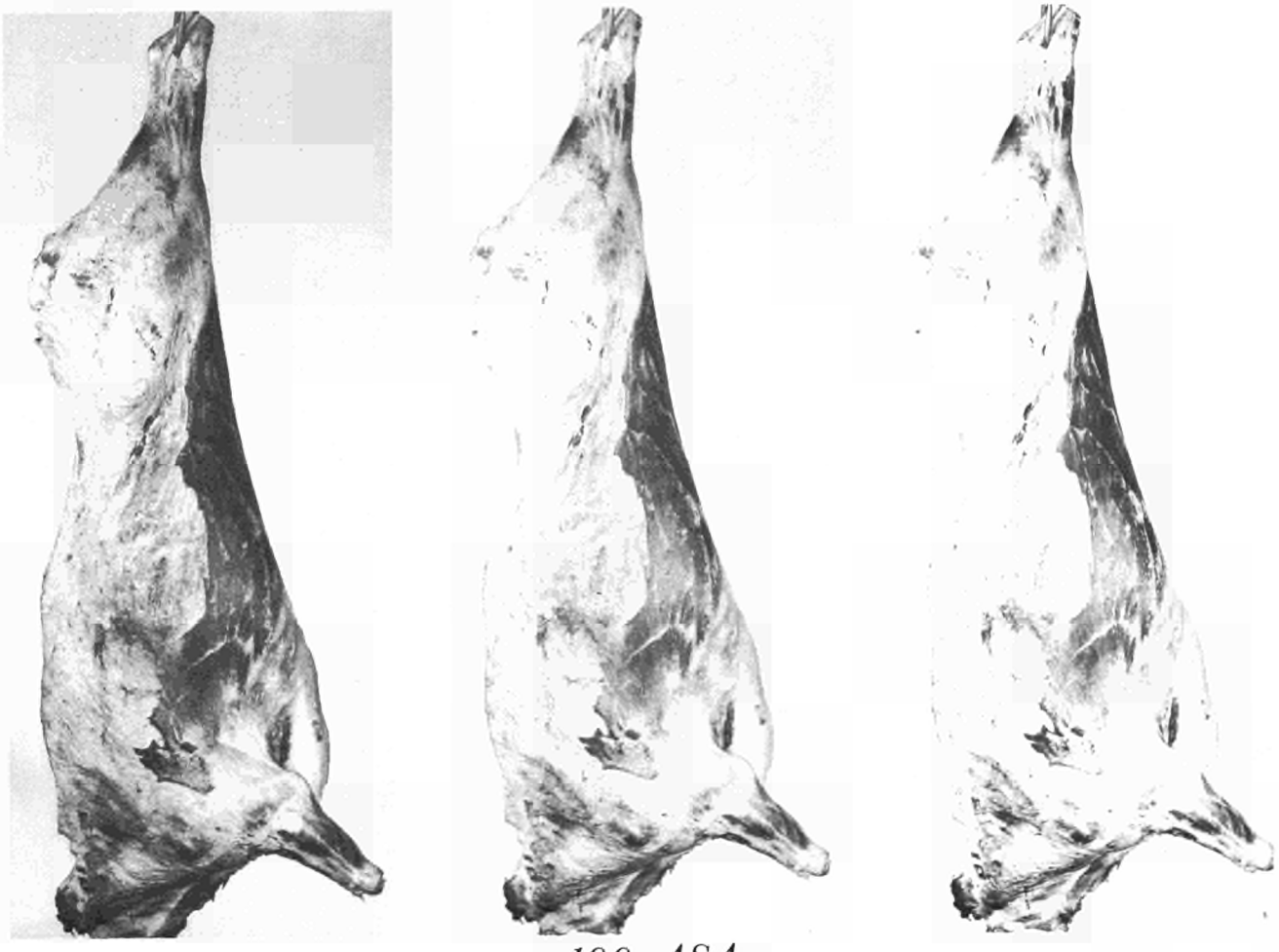


Colour: reversal (diapositive)

Plate 6

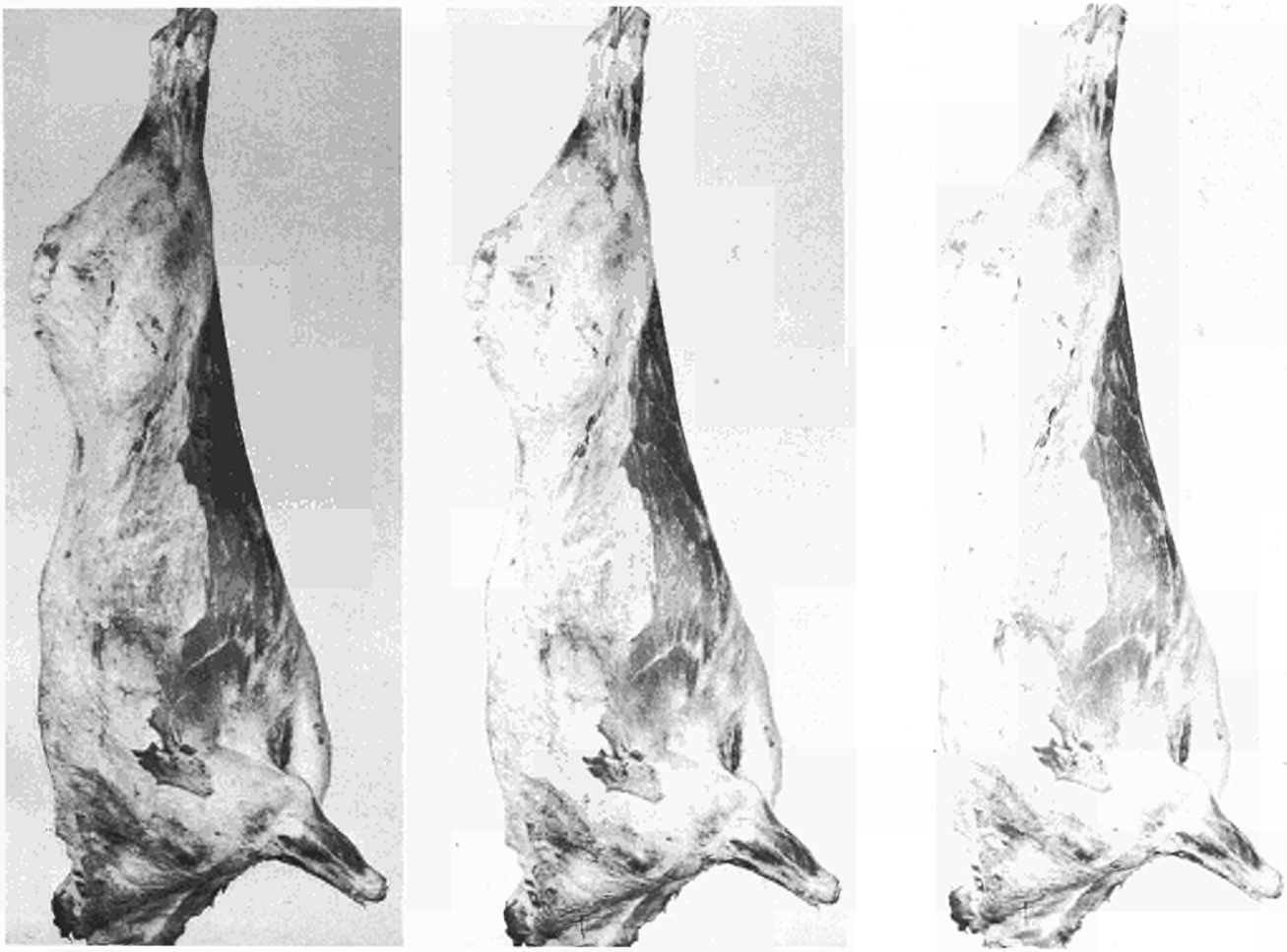


25 ASA



100 ASA

Plate 6



400 ASA

Where true colour reproduction is not required, it is far more economical and easier to maintain consistent quality by using monochrome materials. Although results in monochrome are not as attractive as in colour, experience in this country has shown that with practice they can be used very satisfactorily.

The appearance of a carcass photographed in monochrome can be greatly influenced by the type, but not necessarily the make, of film used. Plate 6 shows photographs taken on three types of panchromatic film at different exposures, i.e. 25%, 100% and 400% of correct exposure. The principal difference of the films is

their speed rating i.e. 25 ASA (15 DIN), 100 ASA (21 DIN) and 400 ASA (27 DIN) but the character of their images also differs. Generally speaking, as film speed increases the contrast of the image decreases. Linked with these two variables is the exposure latitude, which is the range of exposures which will yield an acceptable negative. The relationship between these factors is that the faster the film, the lower is the contrast, but the greater is the latitude. It follows that a film of slow speed and high contrast has a small latitude which necessitates greater precision in determining the correct exposure. Conversely, a faster film with lower contrast and considerably extended latitude would appear to be ideal especially for inexperienced photographers. Unfortunately, however, although contrast could be improved by extended development or the use of a contrasty developer, the grainy structure of the image would increase which could result in loss of fine detail. It is therefore preferable to use a film of lower speed to obtain the necessary contrast directly which will adequately record fine detail.

The background

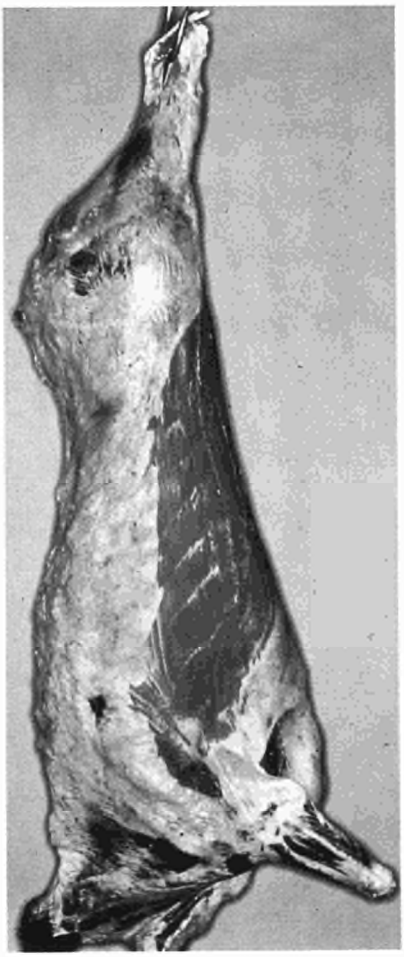
Consideration must be given to the background against which carcasses are photographed. The effect of what may be encountered in a commercial slaughterhouse is illustrated in Plate 7(a). The carcasses hanging behind the side being photographed produce a confused picture and make it extremely difficult to assess the quality of the subject. A plain background shows the edge of the carcass much more clearly and helps to reduce distraction by the rest of the picture. With monochrome materials, a white background produces the best results when the recommended lighting arrangement is used. Although such a background is reproduced in the print as grey, it is sufficiently pale to allow areas of fat on the periphery of the carcass to be distinguished easily, as shown in Plate 7(b). Less light is reflected towards the camera from the edges of a carcass because of its curvature, therefore these are reproduced slightly darker and give a sharp outline which is particularly useful for measurement purposes. This advantage is lost when a black background is used, (Plate 7(c)) because the darker edges together with cutaneous trunci tend to merge into the background which gives the impression of a slimmer carcass. When such monochrome prints are used to produce fatness standards it has been found that cutting around the carcass and mounting on a buff coloured card adds impact to the photograph.

a

b

c

d



e

f

When colour film materials are used the colour of the background will depend upon the intended purpose of the photograph. If true colour representation is required a neutral grey (Plate 7(e)) is the only background which should be used, ideally with about 30% reflectance. The use of a neutral background does not influence the appearance of the colours of the carcass. A black background, although adopted by a number of institutes as the standard for colour records because of its durability and ease of matching in different countries, tends to increase the apparent saturation of colours in the carcass. Conversely, a white background gives the impression of desaturated colours. For aesthetic appeal a pale blue background gives the most attractive picture.

Developing and printing

Development is one of the many variables which govern the quality of negatives. To obtain uniform results this stage should be kept as consistent as possible, although small adjustments can be made to compensate for irregularities in technique, i.e. use of a suitable developer to minimise the effect of known under/over exposure, or to adjust contrast of the negative. The developer used at M.R.I. is of the metol-hydroquinone-borax type which gives images of fine grain and adequate contrast, and maintains maximum emulsion speed. With some other fine grain developers the film may require an increase in exposure to compensate for their low energy. High acutance developers have also been used with success and these produce maximum definition by increasing edge sharpness through adjacency effects, i.e. at the boundary of two different densities a microscopically thin dark line is produced at the edge of the darker area and a thin light line is produced at the edge of the paler area, thus giving the effect of increased sharpness. Slight adjustment in the speed rating of the film was found to be necessary, i.e. from 125 ASA (22^{o} DIN) normal setting to 200 ASA (24^{o} DIN), as this type of developer increases the sensitivity of the material.

The compensation method of development, i.e. higher dilution with extended development is recommended as this will retain maximum detail in both fat and muscle areas. Developers which have been diluted for the method above should only be used once,

then discarded. In this way, fresh developer is used each time, thus eliminating the need for any further compensation in development time to achieve uniform results.

Processing of colour materials, especially in negative-positive work, should be left to experienced photographers with all the necessary facilities and equipment, i.e. a completely darkened room, a good quality enlarger with provision to accept colour printing filters and a processing unit which is able to maintain the temperature of all solutions and washing water to within $\pm$ 0.2^{o}C. Reversal materials can be processed in spiral tanks, but temperature control and chemical cleanliness are of the utmost importance if consistent results are to be produced.

If photographic records are required for measurement purposes it is more economical to use monochrome materials. More accurate measurements will be obtained from projected negatives as this avoids errors arising through stretching of the paper during processing, although the new PE or RC (resin coated) papers are much more dimensionally stable than conventional bromide paper. If negatives are used for projection, particular care should be taken in their handling especially if prints are likely to be required at a later date.

Conclusions

A good photograph will be defined differently by different people, but the purpose of this booklet is to provide the basis for the production of factual records of consistent quality for use in international collaborative work. The recommendations are summarised as follows:

1. Take all photographs at the same distance from the carcass.
2. Keep the camera axis horizontal and level with the 13th thoracic vertebra.
3. Keep the plane of the surface to be photographed perpendicular to the lens axis.
4. Use only the normal focus i.e. standard lens for the camera; short focus, wide angle lenses can cause distortion of the image.
5. Use the same even-lighting arrangements every time.
6. Always use the same uniform background.
7. Include a scale in the same plane as the carcass.
8. Always use the same film (film/developer combination in monochrome).
9. Expose correctly.

Suitable equipment and materials

Standardisation of technique is far more important in achieving consistent and comparable results than the make of equipment or materials employed. However, as a guide to Institutes about to embark on carcass photography, the equipment and materials used at the Meat Research Institute are given below together with alternatives of similar type.

Cameras

The camera used for all negative materials is a Hasselblad 500C fitted with the 80 mm lens and produces 6 cm^2 negatives. Other cameras of this type include, Bronica S2a and ET-CL, Kowa-Six, Pentacon-Six, Rollei SL66 and SLX, Zenith 80, Mamiya RB67 and the Pentax 6 x 7; the latter two cameras produce ten 6 x 7 cm negatives on the standard 120 roll film. Colour transparencies are taken with a Leicaflex SL camera fitted with a 50 mm lens. Other equally suitable single lens reflex miniature cameras are too numerous to mention, but satisfactory results can be achieved with most.

Flash equipment

The electronic flash equipment used for this work was a Courtenay Majorette Mk III with a total output of 400j. Unfortunately this model has been discontinued and currently very few modern studio flash units utilise ringflash because of design

problems. Balcar equipment, however, incorporates a separate power-pack and has an adaptor which produces a similar lighting effect to that of the annular flash tube. Ringflash heads are not usually available for the smaller portable units, although Hasselblad manufacture one which can be used with either the Metz or Braun power-packs. Caution must be exercised if portable units are to be used because of their limited light output: whilst such units may be satisfactory for monochrome records, they may not have sufficient output for the slower colour reversal materials.

The alternative equipment used for 'umbrella flash' consisted of two Bowen's Monolite 400 heads fitted with 1m diameter white umbrellas. Each flash head contains its own power pack: one is triggered directly by the camera shutter while the other is fired simultaneously by signal from a monitoring photocell.

Films

The film used for monochrome records is Ilford FP4 which has a panchromatic, medium speed, fine grain emulsion. Films with similar characteristics include Kodak Plus-X and Agfa-Gevaert Agfapan 100. The colour negative film used originally was Agfacolor CNS, but the recently introduced finer grain and higher colour fidelity Agfacolor 80S Professional film is now preferred. Agfacolor CT18 and Agfachrome 50S Professional are used for production of colour transparencies although there are a number of suitable alternatives, but it must be remembered that

each type of reversal film has its own colour characteristics. Only daylight sensitised films should be used with electronic flash.

Processing

Development of monochrome negatives has been covered in the text; the alternatives to Kodak D76 (metol-hydroquinone-borax) developer include Ilford IDII (whose formula is identical to D.76) and Gevaert G.206. All colour materials must be processed in the solutions designed for them and are not generally interchangeable.

Printing Materials

Monochrome prints are made on Kodak Veribrom papers, but any other manufacturers bromide paper could be used, although it may be necessary to use a different contrast grade. Ektaprint 37RC, now replaced by Ektacolor 74RC, is used for colour prints from negatives, but Agfacolour MCN 310 papers would also produce satisfactory results. The material chosen for production of colour prints from transparencies is Cibachrome CCP-A 182E, as contrast control is much easier compared to the professional product CCP-D 182. Prints or large transparencies for back-illuminated displays produced by this silver dye-bleach process have a far greater life expectancy than the conventional chromogenic materials.

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