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From the Department of Anatomy, Veterinary College of Norway, Oslo.

A TECHNIQUE FOR THE DESCRIPTION OF PROJECTIONS OF INTERNAL ORGANS ONTO THE EXPOSED SURFACE OF ANIMALS

By

Rolf H. Engebretsen

ENGEBRETSEN, ROLF H.: *A technique for the description of projections of internal organs onto the exposed surface of animals.* Acta vet. scand. 1975, *16*, 307—314. — The need for exact knowledge of the projections of internal organs onto the surface of animals is emphasized, for clinical veterinary medicine as well as for hunting purposes. A method is described for outlining the projections of dissected anatomical structures onto the exposed surface, on a photograph of the undisturbed animal in a natural standing position.

topographic anatomy; photograpic technique.

Topographic anatomy is an important part of applied anatomy in veterinary medicine. Exact knowledge concerning the projections of internal organs onto the external surface of an animal is of use in clinical examination (inspection, palpation, etc.). Slaughter and hunting are other fields in which topography is of importance. It is obvious that anatomical knowledge is of great importance for successful and humane killing of the bigger game animals. The hunter is obliged to orientate visually at some distance and it is therefore necessary for him to bear an image of the particular species he is hunting in his mind, and thus where to hit vital centres by his shot. Quoting *Hofmann & Scholz* (1968), "The first and uppermost rule for a hunter, irrespective of his motive, must be to kill the animal painlessly and quickly." With this in mind, "Vital centres" must be parts of the animal body which preferably must be hit by the shot, rapidly rendering the animal into an unconscious condition and causing its rapid death.

Hofmann & Scholz have given descriptions of projections of vital centres onto the surface of several game animals. Their technique has been to reconstruct drawings from series of photographs recorded stepwise, following a layer by layer dissection of animals. The animals were first fixed in toto in a natural standing position. When describing anatomy for hunting purposes, it is important to provide information which can be used by the hunter. The animal must be observed as naturally as possible and therefore accurate photography of the animal indicating projections of vital centres on the undisturbed surface would be helpful in orientating the hunter (*Hofmann & Scholz* — plate 1 and 2). In the present paper a method based upon photographic recording was developed and reindeer (Rangifer Tarandus. Lin. 1758) used as objects.

MATERIALS AND METHODS

Reindeer were obtained from a herd of tame reindeer. The animals were deeply anaesthetized and sacrificed by bleeding through an opened carotid artery. Mounting and injecting the animal in a natural standing position was performed according to *Paulli* (1909) and the same method was used by *Hofmann* (1966), after some improvements, for the study of wild African game animals. Approx. 10 l of formalin was injected into an adult reindeer. The concentration of formaldehyde was somewhat lower (6—7 %) than the usually recommended 10 %. In order to obtain steady fixation, the injected animal was stored in a cooled room for one week before dissection was started.

The animal was placed centrally in a large room so it could be observed at some distance and from different angles of vision.

Layer by layer, the animal was carefully dissected. Starting with the animal intact, photorecordings were performed step by step as important structures were exposed. The recordings were taken against a white background. Occasionally, dissected structures had to be painted in order to secure clear outlines of structures to be recorded.

An optic axis and centre had to be established for reference when looking at or photorecording the animal. It was necessary to determine the centre as close as possible to the middle of the silhouetted image of the animal when seen from the observation point. For hunting purposes, major interest is directed towards the head and body of the animal. Therefore it was deemed necessary to establish the optic centre in the middle of the silhouetted image of these parts. In the establishment of the plain lateral projection, the centre fell midway between the nostril and the tip of the tail, and midway between the upper and lower outlines of the body. (When observing from oblique angles, the centre is more difficult to determine as it has to be adjusted by sighting from the actual point of observation). It is important that this centre should always be in the optic axis when photorecording, when enlarging prints and when outlining projections onto the picture of the undisturbed animal by means of a photographic enlarger.

For plain lateral projection, the method can be described as follows: At a distance of 4 m parallel to the median plane of the animal, a wooden panel was erected. A hole (4 cm — diameter) was cut through the panel in a position such that the axis through the centre of the hole passed through the optic centre of the animal perpendicular to the median plane. When recording, the camera was always adjusted with the lens protruding through the hole and the optic axis directed towards the optic centre in the animal. In this way it was possible to secure a constant point for observation and a constant recording axis.

In order to be able to co-ordinate films and prints recorded at different steps of dissection, it was necessary to establish a few constant landmarks on the object. Black or white marks in metal, cardboard or painted on directly, were placed at certain parts of the animal where they could easily be observed.

The following equipment was used: Camera — Hasselblad 500 C; lens — Zeiss Planar 80 mm F 1:2.8; two light bulbs — Philips "Photolita" 500 W for illumination at oblique angles from behind; film — Ilford FP 4; positive film — Ilford fine grain positive film; print paper — Agfa RRS 1.

A primary picture of the intact animal was printed on photographic paper (18×24 cm) without glazing (see discussion).

In addition, all recordings were copied on positive film (scale 1:1).

A photographic enlarger was used to outline the projections of the dissected relevant structures onto the primary picture. This procedure was carried out by placing the primary picture on the printing table and the positive film image projected on it. By adjusting the two images, landmarks on the positive as well as primary picture were brought into co-incidence. Outlines were then subsequently marked by Indian ink, adhesive marking lines etc.

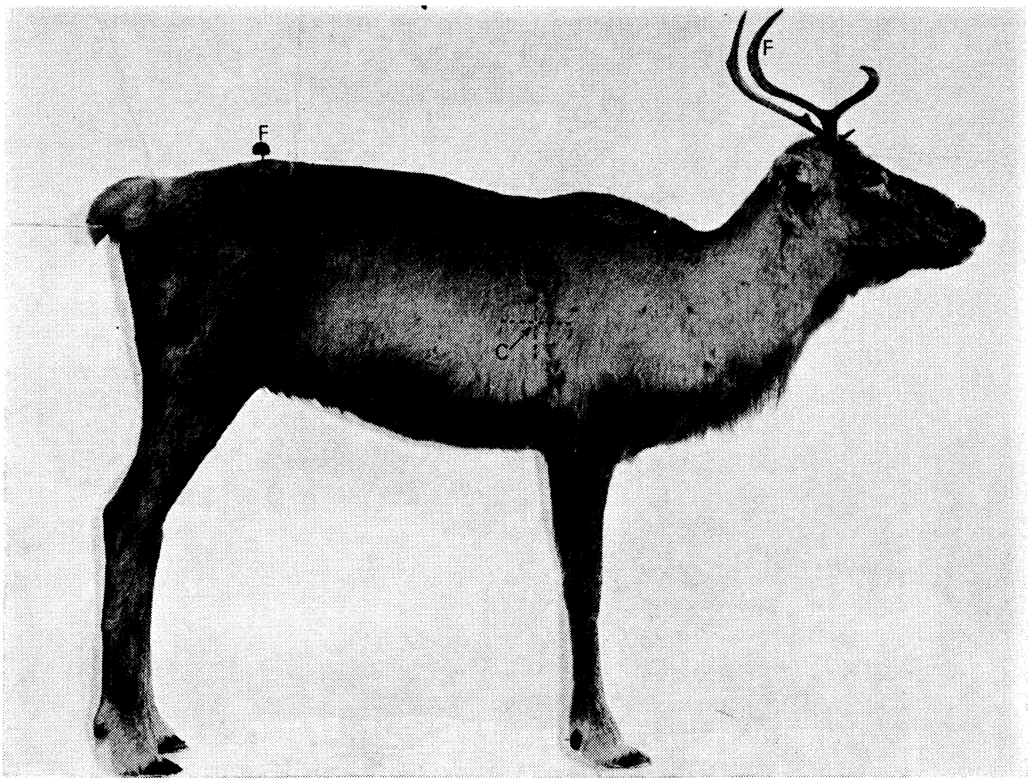

Figure 1. Reindeer (adult ♀ — untouched surface). After intravascular fixation in standing position.
C = optic centre, F = landmarks for co-ordination of photorecordings.

RESULTS

Figs. 1, 2 and 3 show an example of results obtained by applying the technique described above. The plain lateral projections of heart, cranial and caudal vena cava in the thorax of a reindeer are outlined on the surface of the right side of the animal.

From Fig. 4, it is obvious that the technique incorporates a small degree of deviation from the geometric plain lateral projection. The extent of this error is analysed and as examples, deviations of projections of definite points in two structures situated in the median plane of the animal are calculated. Observations were carried out at a distance of 4 m. In calculating the deviation, it was necessary to know the horizontal distance from the specific point to the optic axis, as well as the distance

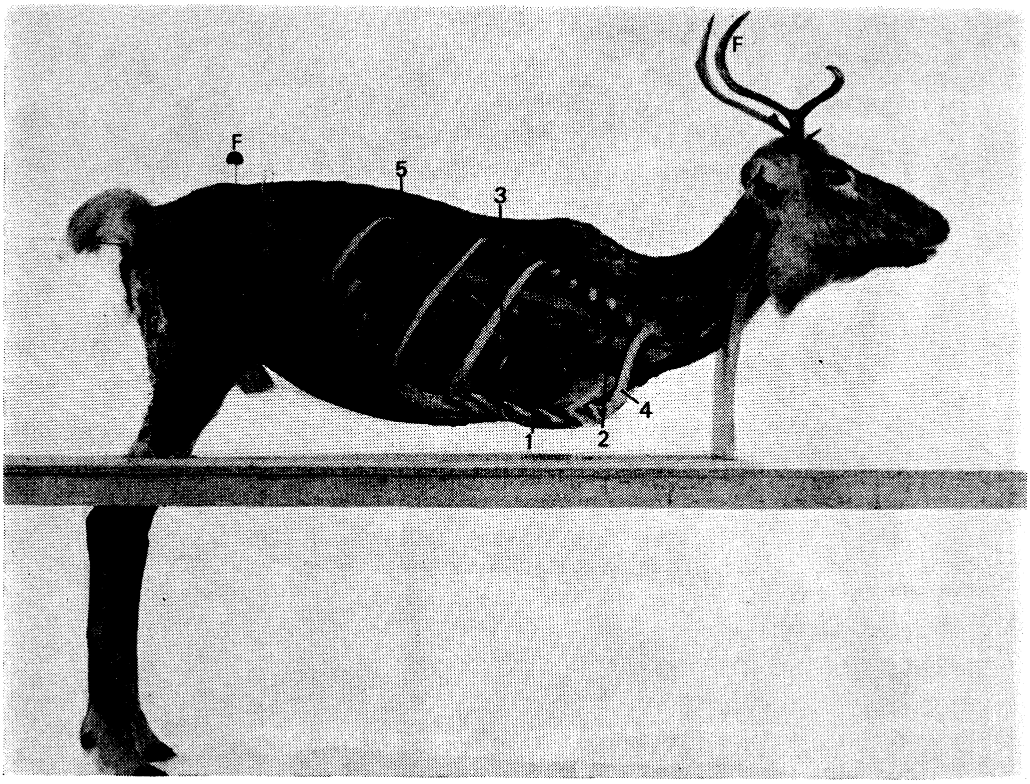

Figure 2. Reindeer (same as Fig. 1). Right thoracic wall and right lung removed. Heart, large vessels and organs in the mediastinum are prepared for photorecording.

1 = heart, 2 = cranial vena cava, 3 = caudal vena cava, 4 = first rib, 5 = diaphragm.

from the point to the projection surface (example 1: 52—7.5 cm, example 2: 23.5—11.5 cm). The total length of the animal was 145 cm and the deviation is expressed in cm relative to the natural size of the animal.

Example 1: Projection of nasal border of brain is displaced caudally 1 cm (Fig. 4).

Example 2: Projection of nasal end of cranial vena cava (in thoracic inlet) is displaced caudally 0.7 cm (Fig. 4).

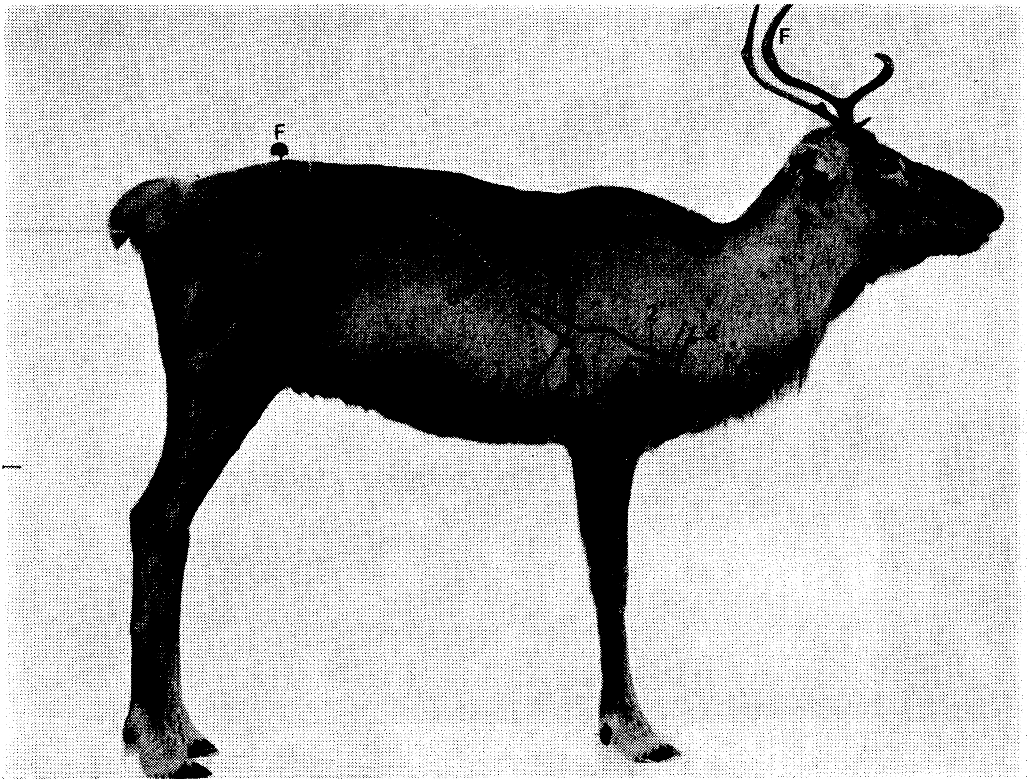

Figure 3. Reindeer (same as Figs. 1 and 2). Projections of heart, cranial and caudal vena cava in the thorax, are outlined on the surface of the right side of the animal.
1 = projection of heart, 2 = projection of cranial vena cava,
3 = projection of caudal vena cava, 4 = projection of first rib,
5 = projection of cranial border of diaphragmatic cupola.

DISCUSSION

A method involving so many different steps contains various potential errors. In this connection, a relevant question is whether a dead animal fixed in toto by injection into the vascular system, reproduces the correct topographic anatomy of a living animal? It is difficult to answer this question, but anatomists are in general agreement that fixed topography is close to the natural state. It must be emphasized, however, that effective fixation of tissues and stable mechanical fixation of the animal are essential in order to obtain correct projections when using the technique described.

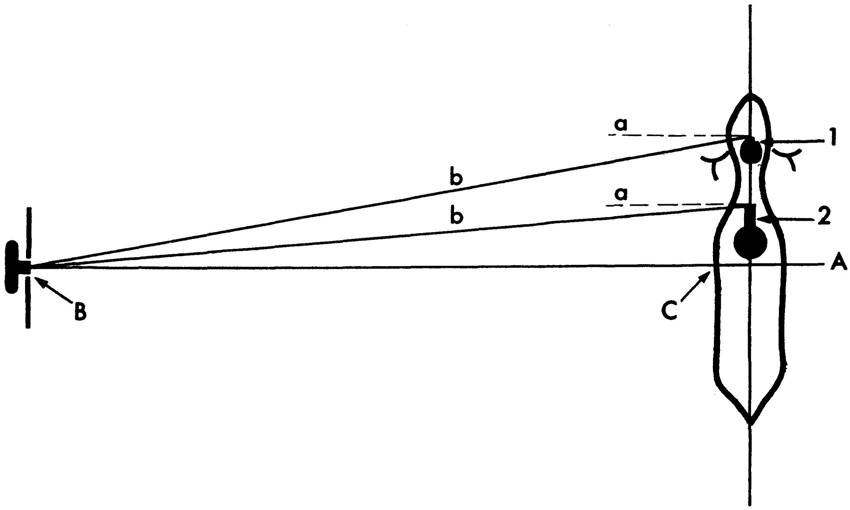

Figure 4. Diagram indicating the deviation which occurs when close photorecording is used for the description of plain lateral projections of internal organs.
1 = brain, 2 = cranial vena cava, A = optic axis, B = camera, C = optic centre, a = optic beams by observation at long distance, b = optic beams by close observation.

It is impossible to simulate field hunting conditions when working confined in a room. When in the field, observations are made at a distance, which for analytical purposes may be regarded as infinite. (The optic beams from the object are close to parallel to the optic axis). In the laboratory, the much shorter distance for observation involves a small deviation from the geometric lateral projection (Fig. 4). When observing close to the optic centre, the deviation is slight, but increases somewhat towards the peripheral parts of the animal. If, however, recording is carried out at a reasonable distance, the results of the observations will hardly involve errors of practical importance when such pictures are used in simulating the visual impressions of a hunter observing an animal at a distance. The deviations calculated in the two examples are small and will hardly be misleading to a hunter. The most accurate results will be obtained when the animal is recorded at a long distance by means of a telephoto lens.

It is essential that uniform quality of film, print paper etc. is used. Most important, however, is the fact that glazing a print in a glazing machine may disturb the relative proportions of the size of structures. This is caused by the fact that when a wet print is dried and glazed on a drum, it will be stretched. Therefore it is important to use the photographic enlarger to check that the structures in the dried photo to be used for the mapping of projections, correspond exactly to the image obtained by superimposing the corresponding film upon the photograph. To prevent errors of this kind, it is recommended that prints are dried, and not glazed, or the copies may be printed on Agfa-Gevaert Opal film.

In this paper, the method has been described as an observation of the animal at a right angle from the side (plain lateral projection). The technique may, however, be easily adapted for all other angles of vision that may be relevant to a hunter.

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REFERENCES

Hofmann, R.: Field and laboratory methods for research into the anatomy of East African game animals. E. Afr. Wildl. J. 1966, *4*, 115—138.

Hofmann, R. & P. Scholz: Applied topographic-anatomical studies of East African game ruminants. E. Afr. Wildl. J. 1968, *6*, 107—123.

Paulli, S.: Formolinjektion zur Demonstration des Situs viscerum bei den Haussäugetieren. (Formolinfection for demonstration of situs viscerum in domestic mammals). Anat. Anz. 1909, *34*, 369—375.

SAMMENDRAG

En teknikk for beskrivelse av projeksjoner av indre organer på den synlige overflate av dyr.

Behovet for eksakte kunnskaper om projeksjoner av indre organer på overflaten hos dyr er presisert, så vel for klinisk arbeid i veterinærmedisin som for jaktformål.

En metode er beskrevet for avgrensing av projeksjoner av dissekerte anatomiske strukturer på den synlige overflate, i fotografiet av det intakte dyr i naturlig stående stilling.

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Reprints may be requested from: Rolf H. Engebretsen, Department of Anatomy, Veterinary College of Norway, Postbox 8146, Oslo Dep., Oslo 1, Norway.