started, for instance, by the macerating or irritating effects of such organisms on the adjacent tissues.

TREATMENT.

This deals only shortly with the surgical aspect since the material available was too restricted to try drugs and other modes of therapy. Surgical removal of the tumour was performed in the following cases 14772, 7256A B, C, D, E, F, and G. 17294 and 17299. It proved entirely successful in so far as can be ascertained at this stage. The operation itself is very simple on account of the superficial attachment and usually non-infiltrative nature of these tumours. Most of the above cases were done under field conditions, with a local anaesthetic. An injection of 1/10th - 1/2th grain of cocaine and adrenalin, into the subcutaneous tissue near or under the growth, was found to answer the purpose very well. The tumour and neighbouring skin was in the first place washed with soap, warm water and disinfectant, dried and painted over with tincture of iodine. The tumour could then very easily be dissected out, especially when of the stalked variety, by following and enucleating the firm connective tissue stroma from the subcutis. In one case of the ulcer type, which penetrated deeply into the vulva lip and involved the mucosa (7256B), it was necessary to cut fairly deeply, in order to remove the whole pigmented tissue. The mucosa was then sutured to the skin. In all these cases the tumours were either near the anus or vulva. The tumour removed from 17299 was situated on the ear. Here of course the ear itself was amputated just proximal to the tumour and a few sutures placed at the edge to approximate the skin over the cartilage. In another case (7256.) the tumour was attached over quite a large area of skin over the neck, resulting after the operation in a fairly wide, though shallow wound. In all these cases after

attending to haemostasis, bleeding being fairly profuse in some e.g. 7256B, a few interrupted sutures were placed in position to bring the skin edges together. After-treatment consisted in cleaning and dusting with iodoform a few times. The 7256 series running in the veld, were never again attended to. The whole group made a rapid and uneventful recovery. As a matter of interest, the case of Goat 14770 may be mentioned here, as it practically is equivalent to surgical removal. Here the maggots which swarmed in the tumour ate their way right down onto the base of the very slender stalk in such a way that the tumour and its occupant fell off. The small wound on the stalk stump, healed up soon afterwards and there has been no recurrences.

The seven cases done in the field, i.e. 7256 series, were not seen again by the writer, but the owner stated in his last communication that all had recovered from the operation, and were to all outward appearances healthy.

Two of these, however, subsequently died from causes unassociated with cancer. Of those which were kept under observation No. 14772 was killed 25 months after operation on account of poverty and old age. It had no outwardly visible recurrences. Subsequent microscopic examination of the perineal skin, shows small foci of epithelial growth which seem to be the beginnings of tumours. The skin also showed distinct atrophy and degeneration. Nos. 14770, 17299 and 17294 are still alive and well 19, 14, and 2 months respectively after removal of the tumours.

From these few cases it would seem that these skin tumours in Angora goats respond fairly well to surgical treatment. Experience in this respect is, however, limited, and more work in this line has to be done. ~~together with a~~ Close observation of the treated cases afterwards under various conditions is necessary before definite conclusions can be drawn. It is for instance, not known what ~~the~~ effects ~~of~~ breeding

would have on such animals. Mention is made in the literature, Gans (1928), that the basal cell carcinoma and even the squamous cell carcinoma in man do not easily recur once removed.

In most cases of skin cancer in the goat, therefore, surgical treatment is indicated, provided metastasis has not obviously taken place. The chances of success in the earlier stages are naturally greater and the operation is quite simple on account of the superficial nature of the growths. Where the presence of metastases is suspected, it may be advisable (on purely theoretical grounds) to remove the supramammary lymphatic glands as well, i.e. if the tumour is at the perineum. These glands, it appears, become involved in metastasis before any other invasion takes place e.g. (17293 and 17298). Under the present circumstances of Angora Goat farming in this country, it is doubtful whether curative measures, unless such could be performed by the farmer himself, would be of any practicable value. Except in rare cases, the individual value of goats is not great enough, and the services of a Veterinarian too difficult to obtain to render surgical treatment a practical solution.

The best course to follow at this stage is to encourage the present policy of culling all affected animals, as early as possible. Most farmers do this already, and attribute to it the decrease in incidence of cancer in recent years. There would not be any great difficulty in generalising this practice. Should the belief that the disease is transmissible, or even that it is due to inherited predisposition, be founded, then such a course would, for obvious reasons, be the proper one to adopt.

Finally, such a procedure also commends itself from a purely hygienic and humanitarian point of view.

As nothing is known regarding the etiology of the condition, little can be said about prevention. It is

probable, however, that timely surgical treatment of fractured horns and other injuries might avert some at least of the tumours which develop in those situations.

IV DISCUSSION.

Literature. The literature relating to skin tumours in the domestic animal covers a surprisingly small field. Fairly comprehensible histological, as well as macroscopical descriptions of a few types of skin and skin gland neoplasms are given by Joest and by Kitt in their standard works on Animal Pathology. Apart from these, occasional outstanding cases have been recorded by various writers, but little has apparently been done in attempting to study them thoroughly.

Kitt states that in the dog, adenomata of the sebaceous glands, and especially of the circumanal glands are fairly frequent. The skin glands of the ear are also sometimes affected. Their size reaches that of a hazel nut or even that of a small apple. The skin over these tumours is rarely ulcerated. The circumanal adenoma shows no lumen in its structure, no secretion is present, and there is no outlet. Skin carcinomata he states, are to be noted in dogs, cats, and horses to a greater extent than in other animals. The predilection seat of development is at or near the junction of the epidermis and mucous membranes, e.g. lips in the horse, dog and cat, anus in the dog. (In this connection it is interesting to note that in this country, cancroids of the nictitating membrane in horses are sometimes met with. Carcinoma of the eyelid in bovines also occurs with relative frequency.)

Frohner describes an "Ulcus carcinomatodes circumanale" in the dog, as a lumpy, slow-growing, tumour, soft to firm in consistence. Its ulcerated surface is covered with slimy, stinking secretion, which macerates the neighbouring skin and sets up an inflammation. The base of the

tumour is continuous with the skin. Anal carcinomata of this type, he states, are as a rule benign.

According to Joest, skin carcinomata of domestic animals are not rare. In the horse they are mostly to be found at the prepuce, tail and vulva, (the latter from the clitoris). In cats at the lips. In cattle Joest and Niederman describe two cases of vulva carcinoma. Maine, Trotter and many others, also mention carcinoma of the vulva in cattle, usually of the typical cancroid type. Joest also describes a "glandular" or basal cell type of carcinoma which may originate from the skin glands or their ducts. These he states are very rare in animals. Histologically they consist of solid, winding, branching garland-like strands of epithelium. The arrangement of these is very irregular, they are devoid of a lumen, so that they can not easily be mistaken for an adenoma. The epithelium is composed of many layers and closely packed in sparce connective tissue. On account of the similarity of these cells to those of the basal layer of the epidermis, Krompecher called them basal cell carcinoma or Basaliomes. He states that one rarely finds in sections evidence of continuity between the epidermis and tumour cells. Ricker and Schwalbe quoted by Joest derive the basal cell carcinoma from the epithelium of the skin glands.

Joest further gives a short account of adenomata of sebaceous and sweat glands in dogs. The former is characterised by the presence of much branched sebaceous gland lobes. The centre of each sac consists of the usual fat laden cells The periphery is lined by layers of darker cubical epithelial cells, which are difficult to distinguish from epidermal or follicular basal cells. These tumours apparently may affect any part of the skin. The sweat gland adenoma described, has such a typically glandular structure that it need not be taken into account here for the purpose of comparison.

In Australia, according to Dodd(1923) sheep often suffer from cancer of the ear. This, it is believed, is ~~one~~ due to long standing chronic irritation, the results of ear marking.

Beatti, likewise believes that skin cancer in Argentinian sheep is caused by the repeated injury from the thorny bushes amongst which the sheep have to graze in the Pampas.

The cancers aluded to by the last two workers are presumably cancroids. In South Africa such tumours have also been observed at this Institute. One case was a large squamous cell carcinoma of the forehead, the other of the ear. Lubarsch and Ostertag, give more or less similar statistics regarding skin tumours in animals.

With regard to melanotic epithelial tumours in domestic animals, the following have been recorded. Taylor and Schlotthauer, describe melano-epithelioma in three young swine. Melanoma ~~in pigs~~ were also observed in pigs by Schöpperl, in cattle by Adams, by Schindelka, in dogs by Schindelka. Newlett in India mentions newgrowths on the base of the horns of cattle. These go under the name of "Horn core disease" and in Stockman's opinion are of the nature of epitheliomata.

Remarkably enough ~~nowhere is~~ the goat is not mentioned in connection with skin tumours. It is fully relised that the above does not include all that has been written on skin cancer in animals. It merely represents the literature which the writer was in a position to consult in the local library.

The most interesting and useful information was obtained from some of the standard text books on human tumours and skin diseases.

Borst points out that in one and the same carcinoma of the skin, one must be prepared to see various stages of

epithelium differentiation. This peculiarity is often shown by basal cell carcinomata. These non-keratinising epithelial tumours are characterised by more or less undifferentiated epithelial cells having polygonal, round, elongated or spindle shapes. He considers the 'rodent ulcer' of man, a special type of this carcinoma, slow growing, more restricted to the superficial tissues, and in which calcification can often be seen. He states also that he saw a pigmented flat cell carcinoma in the form of a pigmented naevus. This consisted of polygonal cells often arranged in strings or strands, but without showing any tendency to keratinisation. He could not establish any connection with the epidermis, and therefore, did not feel justified in terming it a melano-carcinoma. An alternative was to call it an endothelioma.

A point of considerable interest is raised by McCallum in connection with basal cell carcinoma. He states that the malignant epitheliomata may present a different histological alteration of any or all the cells of the epidermis. Their malignancy, therefore, need not merely be the effect of their being derived from a somewhat more differentiated layer of the same cells. Krompecher regards these tumours as growths derived from the lowermost, or basal layer of the epidermis, for which reason they show no tendency to keratinisation or horn pearl formation. Indeed, he is willing to ascribe certain tumours to the cylindrical or germinal layer, others to the cuboidal or rete layers and the highly malignant epitheliomata to the more superficial or spiny layer.

Oertel gives a brief but very concise description of Krompecher's skin cancer. These little differentiated epidermal cell tumours according to him, may also grow in infiltrating fashions. They maintain a much more delicate arborescent manner of growth in the form of thin, delicate

cell branches and cell columns, with club shapes or pointed extensions. The cells themselves are also finer, more delicate in appearance, often elongated, even fibrillar or spindle shaped (sarcomatous), so that some regard these tumours as endotheliomata. These growths generally arise in the cutis not in the epidermis, i.e. from the skin appendages such as the hair follicles etc. They then grown upwards, under, or into the epidermis which ~~is~~ then becomes eroded and collapses over the advancing tumour. These cancers ulcerate relatively early, and possess hard, indurated surfaces. Cancroid pearls or any tendency to keratinisation of cells are absent, but occasional combination with cancroid tumours are observed. The surgeons refer to these growths as "Rodent ulcers". They are locally destructive but have little tendency to generalise by metastasis.

As regards their situation Boyd states that they do not occur at the junction of skin and mucous membrane, but on parts such as the face, cheek, nose, eyelids or ear. One may infer that the uncovered parts of skin, well supplied with non-follicular sebaceous glands, are particularly susceptible.

Gaus attributes to this type of tumour a derivation from nasvus-like structures. His detailed description agrees on the whole with what has already been mentioned. One point of particular interest is his statement that 5% of cases are combinations of the basal cell and spinous cell types. He maintains that the absence of keratinisation is not an absolute characteristic of the basal cell carcinoma. Some of these do show a tendency to horn formation, which is probably consistent with the degree of cell differentiation of that particular tumour. It has been observed that after X ray therapy, baso-cellular carcinoma have sometimes given rise to metastases in the regional lymphatic glands. These metastases proved to be of the hornifying squamous

cell type. He, however, draws attention to the fact that atypical giant cells with numerous nuclei and mitoses, or various other degenerative processes are not as a rule seen in a basal cell carcinoma.

For the sake of comparison, one might also consider the acuminate condylomata of man. Gans describes these as types of cauliflower, wart-like growths, usually of the external genitalia. They are at first single, but soon increase to large numbers, when certain peculiar conditions of moisture, maceration etc., favour their development (anal, genital, and mouth regions). Their situation as well as their much branched structure, render them particularly favourable for the growth of all sorts of microorganisms. The widening of blood vessels and lymph spaces also facilitates the oozing out of exudate which, together with secretions, forms a suitable pabulum for such organisms.

The bacteria and spirilles which are easily demonstrable in the foul smelling secretion, cannot be regarded as causative agents. These growths are believed to originate from the spinose layer of the epidermis. They are, however, different from ordinary warts or papillomata in that there is no thickening, nor keratinisation of the epidermal covering. It is thought that condylomata result from the acti of a virus.

Apart therefore, from a certain outward resemblance there is no reason to think that the tumours in Angora goats are in any way related or similar to the acuminate condylomata of man.

MORPHOLOGY AND PIGMENTATION.

Turning now to the tumours of Angora goats in the sixteen cases studied, there is undoubted evidence that they are of epidermal origin. In spite of their varied situations and certain other points of difference, they give the impression of belonging to the same group or at most to two

allied groups of epithelial tumours. On the one hand the undifferentiated, uniform, epithelial cell tumour the Basal cell carcinoma, and on the other the branching strands or solid masses of spinose or squamous cells with pearl nest formation, i.e. the Spinous cell carcinoma or cancroid. Between these two extremes are cases showing a combination of the two types side by side in the same tumour, and others in which the state of differentiation of the cells seems in a transitory stage between the two types. Even amongst the simple basal cell carcinoma, there are differences in appearances, both clinically and histologically. All have this in common, however, that they are composed of undifferentiated cells such as are seen in the lower layers of the epidermis. These cells may be round, polygonal, dendritic, elongated or spindle shaped. Only one type, however, is usually seen in any one tumour, so that the parenchyma has always a very uniform appearance. The arrangement of the cells differs also in different tumours. In some the cells are closely packed together with very little stroma, as in a sarcoma. In others a loose network is formed with the cells apparently well spaced out. In others again the cells show a more or less distinct arrangement into rows or strings, sometimes branching out in arborescent fashion, folded to simulate crypts or tubules, interwoven giving a lace-like appearance or fused to form solid strands.

Two out of the eight baso-cellular carcinomata, i.e. 17296 and 17297 showed extensive metastases, although there was definitely no sign of keratinisation. The tumour cells in these cases showed numerous mitosis, a significant difference from the remaining non-metastasising types of baso-cellular carcinomata. It is interesting to note also that Miescher mentions the frequent absence of mitosis in melanomata. He also states that the metastases from skin melanomata show the same characteristics as the primary growth. In cases 17296

and 17297 the metastases examined showed very little or no pigmentation, as compared to the mother tumour. Is it perhaps due to the protection of these parts from light that the cells are not stimulated to pigment formation? It seems that the younger tumours of this type, i.e. those still of small size and known to have recently developed, e.g. 7256A, 7256D, have usually the most undifferentiated and uniform structure. The older and larger tumours tend to malignancy and cancroid formation, e.g. 17293, 17298, 17296, 17297. In fact in some cases of the combined basal and spinous cell carcinoma, the latter part developed secondary to the former e.g. 14771.

It is also possible and even probable that those tumours diagnosed as spino-cellular carcinoma e.g. 17293, 17298 and 7256F, started as baso-cellular carcinomata. The spinous-cell part may have developed later, and then overgrown the original basal cell tumour completely.

The combined forms are those in which both basal and spinous cells types are present side by side, e.g. 14771, 14773, 21957. The two types do not blend but are usually sharply demarcated from each other, and further even when the basal cell part is pigmented, the spinous cell portion just next to it remains free of pigment, e.g. 14771 and 7256C.

The mixed or transition forms, that are mentioned above, represent a type such as 17294 in which there seems to be a blending or transition between the basal cell and the keratinising squamous cell. One might almost suggest in seeing this and other similar tumours, that by a process of evolution or differentiation the basal cells are gradually changing their ordinary appearance and acquiring the power of keratinisation. Such changes in type are not unknown in other forms of neoplasms, e.g. adenoma to carcinoma.

The question of melanin pigmentation in these tumours is a very interesting one. Some of the growths are

totally devoid of pigment while others show various grades of pigmentation. Macroscopically the intensity of pigmentation is reflected by the colour, which may vary through uniform or mottled shades of grey, to pitch black. In section the concentration of melanin also varies widely. In some tumours only a few isolated epithelial cells contain granules of melanin. In others practically every cell shows the presence of fine granules diffusely scattered in the cytoplasms. In some cases the pigment may be confined to cells in one part of the tumour only. As a rule pigment is most evident in those parts of the tumour which adjoin or run into the epidermis. That is to say, in those parts in which the cells of the basal layer show ~~the~~ a peculiar "loosening or "shelling out" process into the tumour tissue.

It has already been pointed out that the normal skin of Angora goats in the less hairy parts, such as the perineum and ears, may either be unpigmented (pink to the naked eye) or uniformly pigmented (tan or light brown to the naked eye). In addition, black or greyish black, patches or maculae are very often present in these regions, See fig. 44. These might be compared to the pigmented naevi of man.

A great deal of work has been done on the development of melanomata from such naevi. The "Abtropfungsprozess" of Unna and "Ségregation" of Darier, quoted by Miescher, are views on this which seem firmly established and have been supported by many other workers. The principle involved is briefly a loosening of "nests" of germinal cells from the basal layer of the naevus. These cell-nests then sink down and multiply in the corium or subcutis, thus giving rise to a melanoma. Miescher believes that there exist types of non-pigmented naevi, from which the non-pigmented epitheliomata are probably derived. The question arises, therefore, what is the difference between a basal cell carcinoma and a melanoma or melano-carcinoma?