

### III. Tumours of the thyroid gland \*

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*The epithelial tumours of the thyroid are divided into benign, malignant, and C-cell categories. The malignant tumours are described under the following names: follicular carcinoma, solid and solid-follicular carcinoma, papillary carcinoma, squamous cell carcinoma, and anaplastic carcinoma. The malignant mesenchymal tumours are described as fibrosarcoma, osteosarcoma, and chondrosarcoma. There are also coexistent tumours and carcinosarcomas.*

This classification is based on studies of approximately 400 tumours of the thyroid gland in dogs, 14 in cats, 13 in horses, 9 in cattle, and 2 in sheep, as well as on the literature. Only morphological characteristics have been considered, as clinical data on domestic animals are almost completely lacking and prognostic conclusions are difficult to draw.

In general there seem to be no important interspecies differences, but the numbers of cases examined, in species other than the dog, were too small to enable definite conclusions to be drawn. The explanatory notes include mention of special

features seen in certain species. The classification includes heart-base tumours of thyroidal origin in dogs, although they are not treated as a separate entity in the classification table. In certain cases (solid tumours), they can be clearly distinguished from chemodectomas at identical sites only by electronmicroscopy or thin sections (sustentacular cells, size of granules). There are apparently geographical differences in incidence. Tumours of ectopic thyroid tissue are more common in regions where goitre is endemic. Owing to a lack of material, tumours of the parathyroid are not included.

The material for this classification was provided by the departments of veterinary pathology of the Universities of Munich, Giessen, Zurich, Cambridge, London, Glasgow, and Connecticut; the Armed Forces Institute of Pathology, Washington, D.C.; and the Cancer Institute of the Netherlands.

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#### HISTOLOGICAL CLASSIFICATION AND NOMENCLATURE OF TUMOURS OF THE THYROID GLAND

##### I. EPITHELIAL TUMOURS

###### A. BENIGN

1. Follicular adenoma
2. Other

###### B. MALIGNANT

1. Follicular carcinoma ("malignant adenoma")
2. Solid and solid-follicular carcinoma  
variant: solid oxyphilic (eosinophilic carcinoma)
3. Papillary carcinoma
4. Squamous cell carcinoma
5. Anaplastic (undifferentiated) carcinoma

###### C. C-CELL CARCINOMA

##### II. MESENCHYMAL TUMOURS

###### A. BENIGN

###### B. MALIGNANT

1. Fibrosarcoma
2. Osteosarcoma
3. Chondrosarcoma
4. Other sarcomas

##### III. EPITHELIAL-MESENCHYMAL TUMOURS

###### A. BENIGN

###### B. MALIGNANT

1. Coexistent
2. Carcinosarcoma

##### IV. SECONDARY TUMOURS

##### V. UNCLASSIFIED TUMOURS

##### VI. TUMOUR-LIKE LESIONS

## DESCRIPTION OF TUMOURS

## I. EPITHELIAL TUMOURS

Unilateral and bilateral epithelial thyroid gland tumours occur with about the same frequency. There is no significant difference in prevalence between the sexes. The average age of tumour-bearing dogs is about 10 years.

A. *Benign*

1. *Follicular adenoma* (Fig. 1). The typical characteristics of these tumours, which may be multiple or solitary, are as follows: encapsulation by connective tissue, compression of the adjacent gland tissue, pattern mainly microfollicular but also solid cords (4–10 cells in width), uniform cell picture, and variations in colloid content. Regressive changes are frequent.

2. *Other*. Follicular adenomas with variable amounts of papillary structures have been called "papillary adenomas" (Fig. 2). The possibility of a benign variant of parafollicular cell tumour (C-cell adenoma) in animals is still to be clarified; C-cell adenomas occur mostly in cattle and are derived from the ultimobranchial body.

B. *Malignant*

The solid and solid-follicular carcinomas show a different degree of follicle formation within the cords. In a sense, this classification is arbitrary, since the elements may well vary within the same tumour. Differences in malignancy between the degrees of differentiation do not appear to exist. Most of the carcinomas in dogs fall into this group and tumours with a predominantly solid pattern are the most common. The subtype—solid oxyphilic carcinoma—occurs only in dogs and is very rare.

The majority of tumours metastasize *via* the haematogenous route. Primarily affected are the lungs. In contrast to human thyroid tumours, primary metastases in regional lymph nodes are rare. Papillary carcinomas are the most common tumours in man. The same appears to be true for the cat, but in dogs this type is extremely rare.

1. *Follicular carcinoma* ("malignant adenoma") (Fig. 3). A nearly complete follicular differentiation is characteristic, but focal mixtures of papilliferous and tubular areas may be seen. The breadth of cords varies and therefore also the content of stroma. The microfollicular pattern may be uniform or follicles

may vary considerably in size. The cells are cuboidal or cylindrical and the content of colloid varies. These tumours often show local invasiveness into blood vessels and into the capsule.

2. *Solid and solid-follicular carcinoma* (Fig. 4–7). The basic structure is a solid cord of cells with the formation of follicles varying in the size of follicles and in the amount of colloid. The width of the cords varies considerably from 1 to 50 or more cells, and therefore also the quantity of stroma. Focal tubular formations are sometimes seen and rarely papilliferous growths within follicles. Tumour cells are not uniform and different cell types are intermingled (oxyphilic cells, clear cells), but a cell type with pale, eosinophilic cytoplasm is predominant. As a rule nuclear size varies little and both nuclear and cellular pleomorphism are rather infrequent. The invasion of blood vessels and of the tumour capsule is common. Regressive changes are frequently seen. A variant that may occur is *solid oxyphilic (eosinophilic) carcinoma*. These are solid carcinomas in which the oxyphilic cell type is predominant.

3. *Papillary carcinoma* (Fig. 8). These tumours have been reported in the literature but are assumed to be rare in dogs. They appear to be the most common type in cats. Papillary structures dominate, with fibrovascular stalks supporting epithelial cells. Follicle formation is almost always present.

4. *Squamous cell carcinoma*. This does not differ from squamous cell carcinoma in any other location. The cells show intercellular bridges and/or form keratin. Very rarely there is focal squamous cell metaplasia within solid and solid-follicular carcinomas.

5. *Anaplastic (undifferentiated) carcinoma* (Fig. 9). The pattern of growth is predominantly solid; there is much pleomorphism of the tumour cells—giant cells, spindle cells, and small cells occur. It is not certain whether these cells originate from thyroid epithelial cells.

C. *C-cell carcinoma* (Fig. 10)

In the dog, the pattern of growth varies. More or less solid cells resembling plasma cells seem to be predominant. The most important feature is a hyaline, amyloid-containing stroma. The tumour cells are derived from the C-cells (argyrophilic and/or argen-

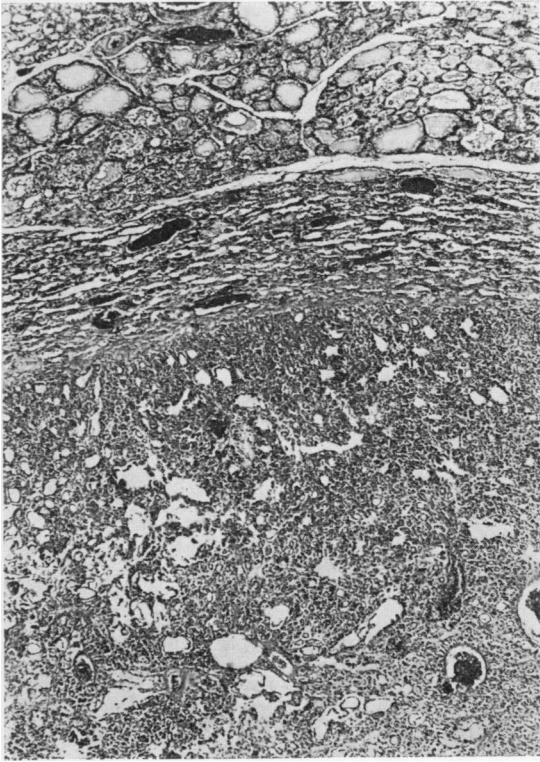


Fig. 1. Follicular adenoma (dog).



Fig. 2. Papillary adenoma (dog).

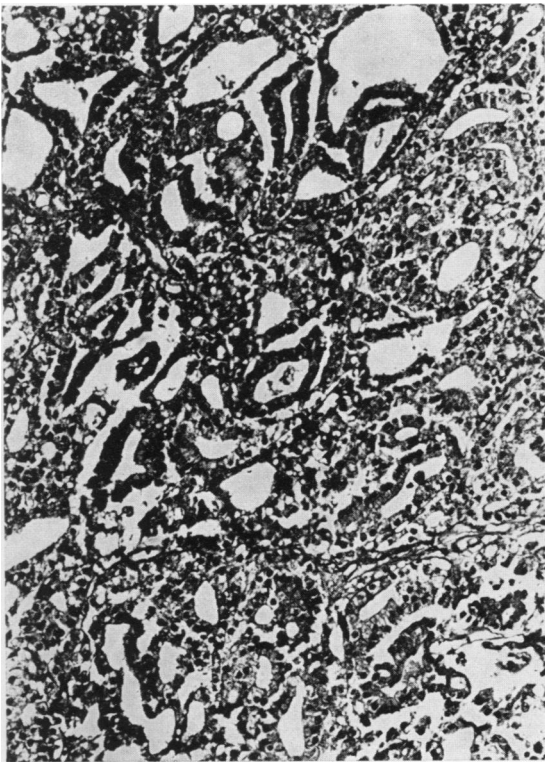


Fig. 3. Follicular carcinoma (dog).

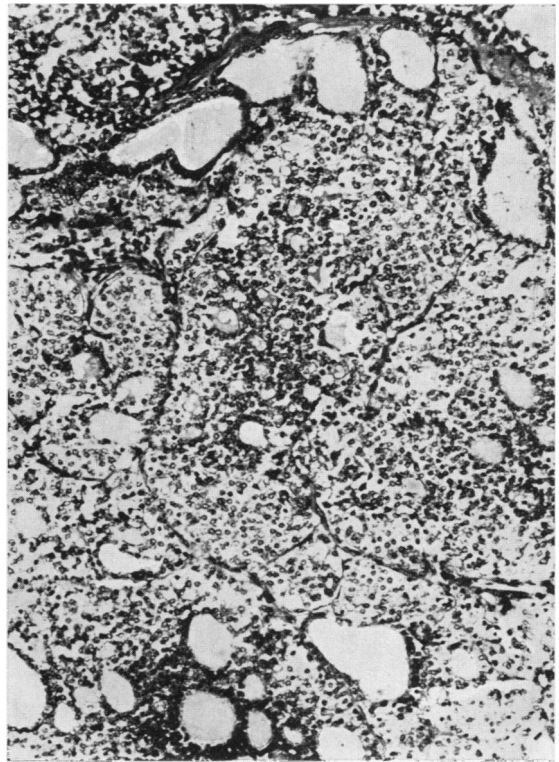


Fig. 4. Solid-follicular carcinoma (dog).

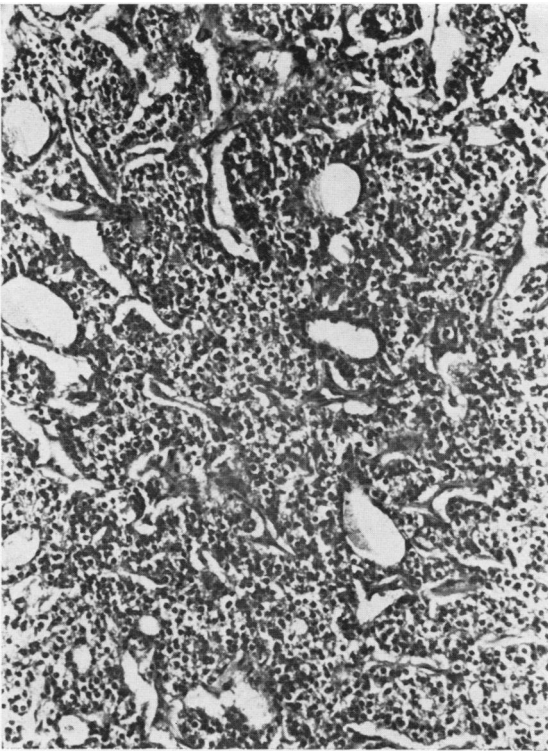


Fig. 5. Solid-follicular carcinoma (horse).

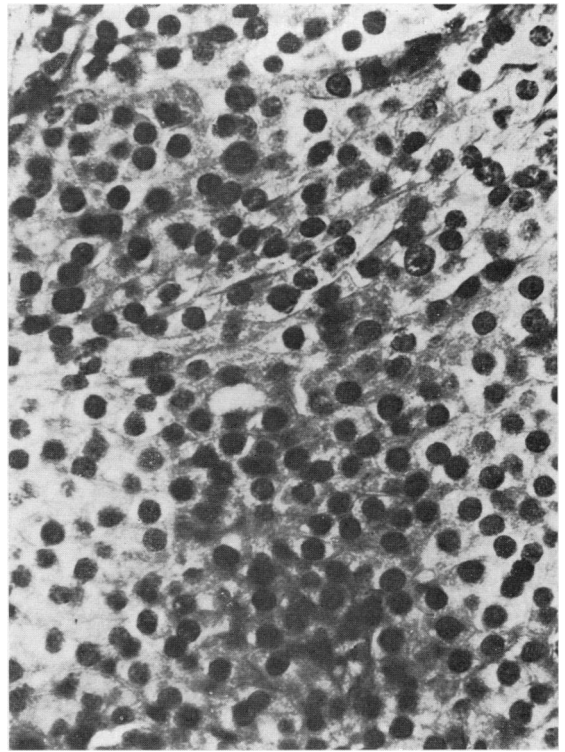


Fig. 6. Solid-follicular carcinoma, solid part (dog).

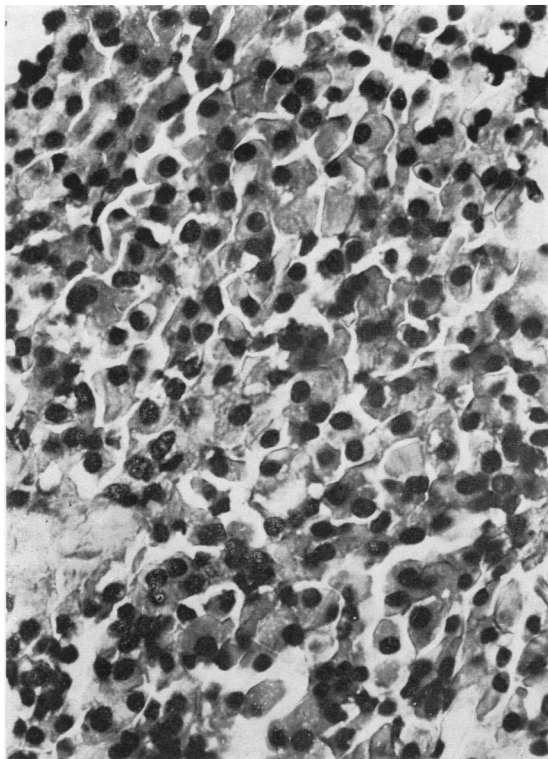


Fig. 7. Solid oxyphilic carcinoma (dog).



Fig. 8. Papillary carcinoma (cat).

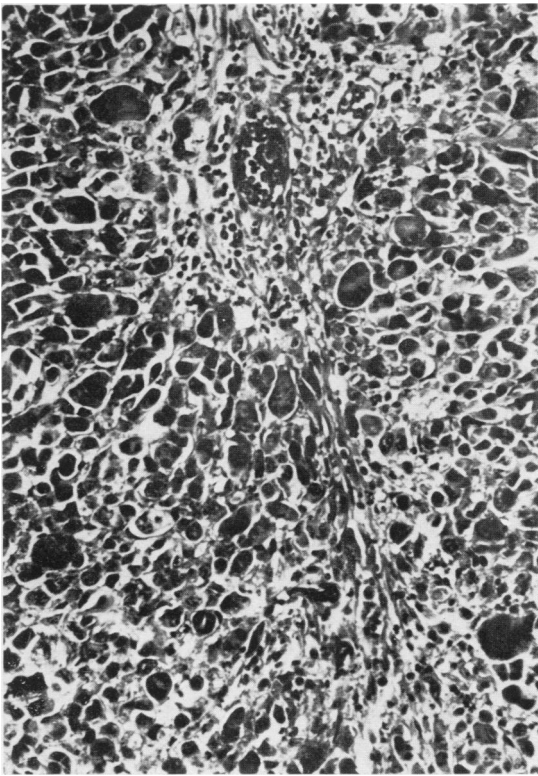


Fig. 9. Anaplastic (undifferentiated) carcinoma (dog).

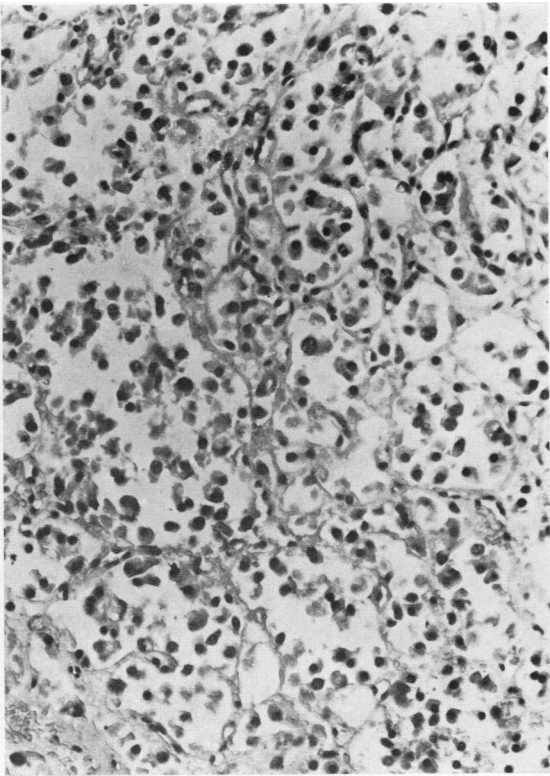


Fig. 10. C-cell carcinoma (dog).

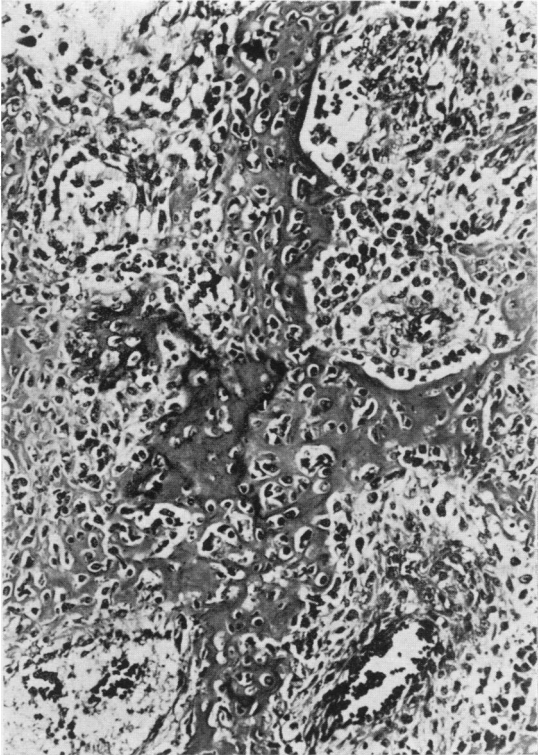


Fig. 11. Osteosarcoma (dog).

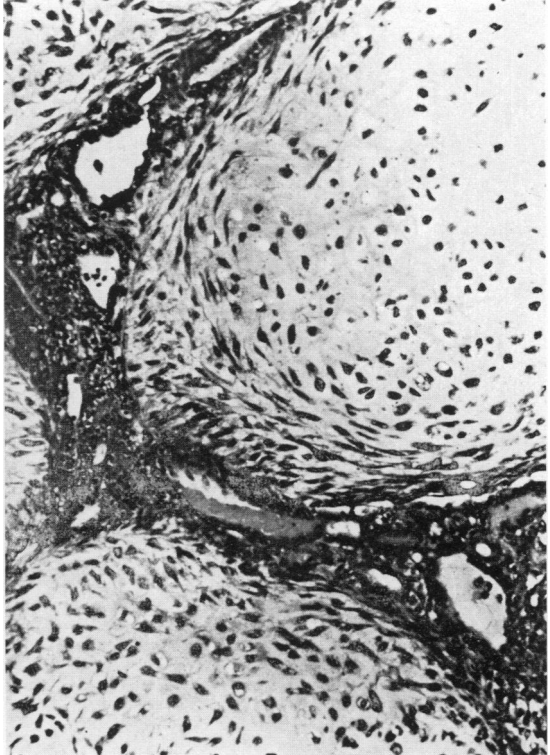


Fig. 12. Chondrosarcoma (dog).

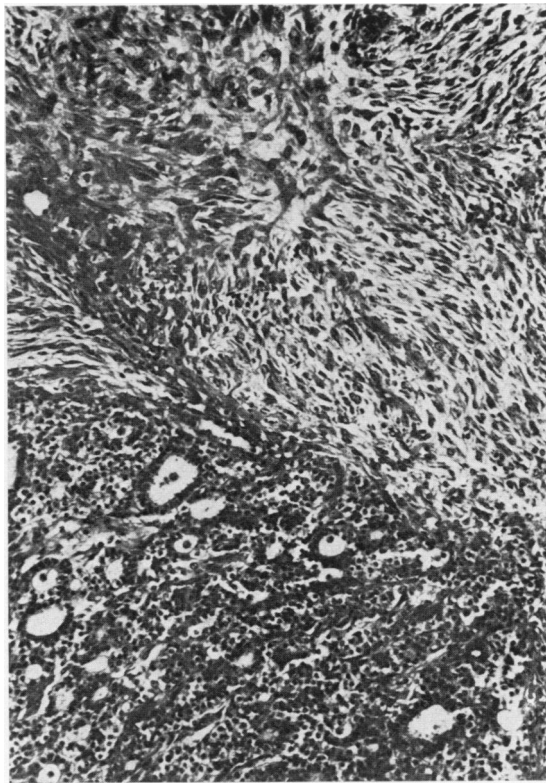


Fig. 13. Malignant epithelial–mesenchymal tumour, coexistent type (dog).

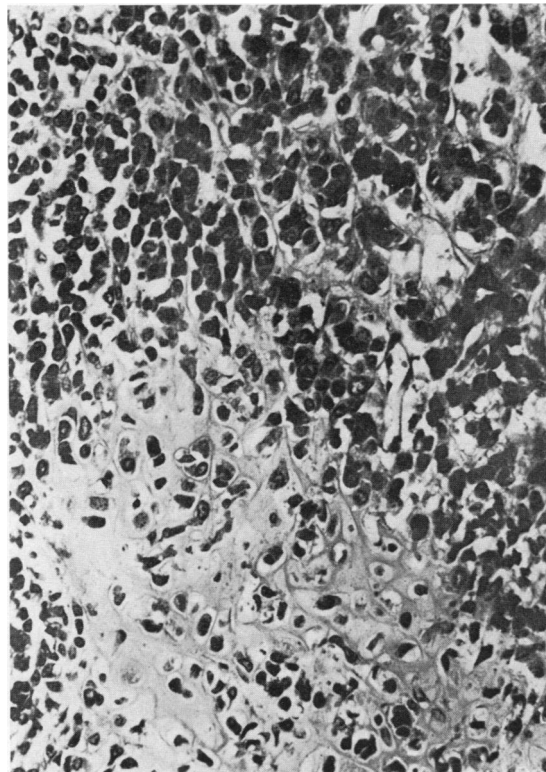


Fig. 14. Carcinosarcoma (dog).

taffin granules). Whether there are C-cell carcinomas without amyloid in dogs is uncertain.

In the case of ultimobranchial carcinoma in cattle, there is a solid pattern of growth. The neoplastic cells, which are either separated by strands of fibrous connective tissue or arranged into small colloid-containing follicles, are cuboidal to polyhedral with a slightly eosinophilic cytoplasm. There is very little amyloid, in rare cases only—mainly in old bulls.

## II. MESENCHYMAL TUMOURS

Mesenchymal tumours of the thyroid gland were seen only in dogs.

### A. Benign

There are a few references in the literature to benign mesenchymal thyroid gland tumours in dogs, e.g., osteochondromas, but detailed descriptions are lacking. Further investigations are necessary before it can be said with certainty whether benign mesenchymal tumours occur.

### B. Malignant

Sarcomas that form an intercellular substance (osteosarcomas, chondrosarcomas) are more common in dogs than are purely cellular sarcomas. There is no sex or breed predisposition and the average age of those affected with sarcoma does not differ from that recorded for the carcinomas. Sarcomas appear to be relatively more common in dogs than in human beings.

1. *Fibrosarcoma*. Spindle-shaped tumour cells form a varying amount of collagenous fibrils.

2. *Osteosarcoma* (Fig. 11). These are sarcomas with osteoplastic activity. They form osteoid and/or immature bone trabeculae that are partly mineralized. Cartilage may be present.

3. *Chondrosarcoma* (Fig. 12). These tumours are sarcomas with more or less well-differentiated chondroid or cartilaginous foci among the pure cellular areas.

4. *Other sarcomas*. The following terms have been used to describe the different types. *Pure cellular sarcoma*: malignant tumours without intercellular substance. The cells are pleomorphic, round, and spindle-shaped. *Myxosarcoma*: tumour cells forming a mucinous intercellular substance. *Combined sarcoma*: combinations of chondrosarcoma and osteosarcoma are very frequent; they should be categorized

as osteosarcoma. Other combinations of tissues also occur, e.g., fibrous, vascular, or myxomatous.

## III. EPITHELIAL-MESENCHYMAL TUMOURS

Mixed epithelial-mesenchymal tumours of the thyroid glands have been seen only in dogs. There is no sex or breed predisposition. The average age of the host does not differ from that recorded for other thyroid tumours.

### A. Benign

The existence of this type of benign mixed tumour in the thyroid gland has not yet been proved in the dog and there are no reports of its occurrence in other species.

### B. Malignant

In many cases we were able to investigate metastases and found that often both the tissue elements were present in metastatic deposits, either combined in one focus or in separate foci. Mixed tumours also metastasize predominantly *via* the haematogenous route. Carcinomas are less common than coexistent tumours.

1. *Coexistent* (Fig. 13). These tumours are composed of carcinomatous and sarcomatous elements, which are sharply divided. Potentially, all types of mesenchymal and epithelial tumour may be combined in this way.

2. *Carcinosarcoma* (Fig. 14). The different carcinomatous and sarcomatous elements are closely integrated.

## IV. SECONDARY TUMOURS

Metastases rarely simulate primary neoplasms; secondary tumours of primary tonsillar carcinomas (squamous cell carcinoma) are of some significance in dogs.

## V. UNCLASSIFIED TUMOURS

These include primary benign or malignant tumours that cannot be placed in any of the categories described above.

## VI. TUMOUR-LIKE LESIONS

Each stage of a goitrous process can simulate tumours, but *adenomatous (nodular) goitres* are of particular significance in dogs and horses. Whereas uniformity of structure, distinct encapsulation, and compression of adjacent tissue are characteristics of

follicular adenomas, such features may sometimes also be found in nodules of adenomatous goitre, and differentiation of the two entities may be impossible. *Cystic lesions* are most commonly degenerated foci in adenomatous goitre or follicular adenoma. *Ectopic thyroid tissue* has been found in animals,

particularly in dogs, from the base of the tongue to the thoracic cavity, but the most important site is the heart-base region. *Chronic thyroiditis* is a rare condition in animals. An autoimmune thyroiditis in dogs does occur, but without marked swelling of the gland.

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