

## Chapter 9

# The Skin

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### Disorders of Development

Developmental disorders are often but not always congenital. They may or may not be hereditary.

#### **Epitheliogenesis imperfecta**

The epithelium is absent over some areas of the body leaving naked dermis. Distinct edges of epithelium give way to raw weeping areas. Limbs are most commonly affected. Large areas become infected and traumatised and affected animals should be euthanased. Small lesions may resolve. Lesions may also affect the feet and oral cavity. The condition is congenital and inherited as an autosomal recessive disease. It occurs in many breeds of cattle and sheep.

#### **Collagen dysplasia**

This covers a complex group of autosomal recessive disorders of collagen with various names including dermatosparaxis and cutis elastica. The skin is extraordinarily fragile and hyperextensive. Clinical signs vary in severity. Oedema may or may not be present. A rare recessive genetic disease in several breeds of cattle including the Charolais, Hereford, Simmental and Belgian Blue. It has also been seen in Border Leicester, Finnish, Romney, White Dorper and Southdown sheep with a milder form in Merinos. The thin skin wears and tears easily. Oral lesions may develop during suckling. Curiously, slow healing is not a feature. Scarring can be prominent in some cases.

#### **Epidermolysis bullosa**

A complex of inherited defects of the skin in several breeds including the South Suffolk and Dorset. In cattle it has been seen in several breeds but most notably as familial acantholysis in Aberdeen Angus calves in New Zealand. The epidermis is easily traumatised and responds to injury by forming bullae and separating from the dermis beneath. Lesions may occur anywhere but are most common on the mouth and over limb joints. Secondary infections develop quickly and are fatal.

#### **Ichthyosis**

A group of cutaneous conditions in cattle resembling fish scales - with varying severity and anatomical patterns. The congenital condition may be so severe that calves may be aborted or die soon after birth. Less severe cases remain alive but are usually euthanased for welfare or aesthetic reasons. Calves are born with thick horny scaly skin which forms folds and fissures along the wrinkle lines of the skin. The fissures may become ulcerated. Partial or complete alopecia may accompany the

condition. Small ear pinnae may be present. It has been seen in Holstein Friesians, Norwegian Red Polls and Brown Swiss.

#### **Lethal Trait A46**

An inherited defect of lymphocyte maturation has been reported in a range of European cattle breeds and in beef Shorthorn calves in the USA. Calves are normal at birth. Clinical signs include poor growth rate, scales and thick crusts around the head and legs with exanthema and hair loss. Signs begin at 1 - 2 months and most calves die by 4 months unless treated. The parakeratotic disease appears to be an autosomal recessive zinc deficiency. Oral zinc therapy will return most calves to normal in a few weeks but must be continued throughout life. Lymphocyte numbers and function are reduced whilst the calf is in a zinc deficient state and there is reversible atrophy of the lymphoid organs and tissues throughout the body.

#### **Hypotrichosis**

Hypotrichosis (partial or complete absence of hair) is a rare series of conditions of the hair follicle in most breeds of sheep and cattle and most other species. Congenital hypotrichosis is often hereditary and may be accompanied by other defects, some of which are lethal. Clinically the severity varies. It can also be caused by zinc deficiency, iodine deficiency and by a genetic condition of the thyroid in Merino sheep associated with thick wrinkled skin. Hair or wool may be fine and brittle or curly. Delayed onset alopecias also occur. Symmetrical alopecia is inherited as a single autosomal recessive character in a number of breeds of cattle. Calves appear normal at birth but lose hair at 1 to 6 months of age in extensive symmetrical patterns. There is no irritation. Calves are normal except for completely bald areas of skin.

#### **Curly Coat**

A short woolly hair coat syndrome has been seen in polled and horned Herefords in Australia. The coat changes are often a marker for lethal cardiomyopathy. See cardiovascular system.

#### **Hair Pigment Alterations**

A number of disorders occur which result in a change, often a dilution, in coat colour. Sometimes this is accompanied by partial or complete alopecia. The conditions are often heritable and have sometimes become the basis for a "new" breed. Occasionally the changes are restricted to the pigmented parts of the skin. Less desirable variations may be accompanied by seborrhea (excessive secretion from sebaceous glands) and or folliculitis.

#### **Hypertrichosis**

Occurs in neonatal calves and lambs following maternal hyperthermia. There is an autosomal dominant hypertrichosis in Holstein Friesian cattle. In sheep an abnormally hairy fleece may be due to a mutant gene or Border disease virus. Maternal pestivirus infection ( Border disease) in early to mid pregnancy produces some lambs which are small and hairy (hypertrichosis). A smaller proportion shake (hypomyelogenesis).

Pestivirus infection in a flock may be recognised by a combination of dry ewes, abortions and the birth of a variable proportion of small stunted lambs. Diagnosis is confirmed by detection of antibody in precolostral lamb sera. Coloured breeds may show a patch of hyperpigmentation in addition to a hairy coat. The coat appears more primitive with an increase in the percentage of medullated fibres. Ewes infected during pregnancy will be immune to reinfection and should be retained in the flock. Maidens and ewes of unknown status should be mixed with the infected flock whilst non pregnant in order to seroconvert and avoid future foetal infection. This condition is common in New Zealand but not in Australia.

#### **Wattles in Sheep**

Skin covered, pendulous structures hanging from the mandible have been noted in Merino, Dorset Down and Karakul sheep. They are similar to those normally seen in goats and are up to 6 cm long with a cartilaginous core. They are reported to be inherited by a single dominant gene.

### **Deficiency Disorders**

#### **Copper deficiency**

Primary or secondary copper deficiency in adult sheep produces steely straight wool fibres due to defective keratinisation. In addition, the fleece of coloured sheep shows bands of lighter coloured wool. Each band representing a period where lack of a copper containing enzyme has prevented the conversion of tyrosine to melanin. Signs of copper deficiency in growing sheep include anaemia, scours, osteoporosis, poor growth and ataxia (swayback). Affected cattle develop light "spectacles" of hair around the eyes and coat colour lightens. Black coats become rusty brown and deep red coats become orange.

#### **Vit E Responsive Dermatitis**

Seen in adult and juvenile goats on a selenium deficient diet. Muscular dystrophy may also be present. They develop generalised seborrhea and periorbital alopecia. Hair becomes dull and brittle. Alopecia in calves fed milk substitutes may also be partly due to Vitamin E and Vitamin C deficiency.

#### **Cobalt Deficiency**

Cobalt deficiency causes poor growth rate and wasting in sheep and cattle. The wool and hair grow poorly and become more fragile.

#### **Zinc Deficiency**

Zinc responsive dermatoses occur uncommonly in goats, sheep and cattle. Goats show illthrift, alopecia, and parakeratotic scaly skin. Decreased fertility may occur. In cattle experimental deficiency produces scaly skin, partial alopecia, and fissures and exudation on the limbs, perineum and around the mouth and eyes. Experimental Zn deficiency in sheep causes thin, straight wool which is easily plucked. Wool eating and

excessive salivation are common. Crusts and scales develop around the eyes, nose, over joints, coronary bands and scrotum. The normal ringed structure of the horns is lost and horns may fall off. Abnormal hoof growth and lameness may occur.

## **Toxicological Disorders**

### **Selenium Toxicosis**

Selenium toxicosis has been reported in cattle and sheep. It is usually due to the ingestion of Se containing plants but occasionally it is due to accidental chemical overdose. Selenium accumulating plants in Australia associated with poisoning are *Morinda reticulata* (mapoon) on the Cape York Peninsula and *Neptunia amplexicaulis* (selenium weed) on the seleniferous soils of the Richmond - Hughenden area of north western Qld. Most poisonings have been restricted to horses although sudden death has occurred in sheep. Cattle are more tolerant than sheep. However in the USA chronic poisoning in ruminants occurs with partial or general alopecia, swelling of the coronary bands, deformities and separation of hooves and severe lameness.

### **Mimosine toxicosis**

A tropical and subtropical leguminous tree (*Leucaena leucocephala*) which is used as a protein feed source can be toxic in excessive quantities. The tree contains the toxin mimosine. Clinical signs of toxicity include symmetrical alopecia and occasional nervous signs, goitre, infertility and illthrift in cattle and sheep. Goats are more resistant. Habituation of the rumen microflora to degrade mimosine over time. Depilation in sheep can be marked.

### **Ergotism**

The ergot of *Claviceps spp* develops in the seed heads of a range of grasses and cereal grains. It is particularly common on ryegrasses. Hyperthermia and nervous signs are common but dry gangrene of extremities occurs only occasionally in cattle and is rarely seen in sheep. Swelling of the coronary bands and lameness may be the first sign followed later by ischaemic necrosis leading to cold insensitive feet with gangrenous changes to the soft tissues of 1 or more feet and sometimes the tip of the tail and or ears.

### **Fescue toxicity**

Fescue foot is a disease of cattle which causes gangrene of the skin and hooves. It is very similar to ergotism. It has not been reported in sheep.

## **Immune-Mediated Dermatoses**

### **Urticaria**

Transient, circumscribed oedematous flat topped swellings of the skin are occasionally seen in ruminants, particularly cattle. They may or may not be pruritic. Drugs, foods, inhaled and contact allergens, stings and

infectious agents have all been incriminated. The response is usually a type 1 hypersensitivity reaction. Erythema multiforme has been reported in cattle with an acute onset of symmetrical non pruritic erythematous papules and vesicles. As the lesions spread out the centres clear. The predisposing factors are drugs and infections. Severe cases may extend to full thickness epidermal necrosis. High producing dairy cows, especially Jerseys and Guernseys, can become sensitised to their own milk protein. The urticaria is part of a more generalised hypersensitivity condition.

### **Atopy**

Atopy is conspicuous by its absence in ruminants although there is one report of a presumptive inherited condition in Suffolk sheep. Clinical signs were a recurrent seasonal pruritic condition affecting the face, ears, perineum and lower abdomen.

### **Culicoides Hypersensitivity**

Seasonal hypersensitivity is well known in horses but it has also been reported as causing a pruritic dermatitis of the non woolly exposed areas in sheep.

## **Viral Diseases**

### **Pox virus Infections of Sheep**

#### **Orf Virus**

Orf virus infection has several synonyms including scabby mouth, contagious ecthyma and contagious pustular dermatitis. It is caused by a *parapox virus* which affects sheep and goats and occasionally man.

It is a common infection of sheep of all ages in Australasia but is most common in lambs 3-6 months old. Minor lesions are present in one or two sheep in most flocks. The disease becomes important when severe lesions occur in a significant number of sheep. The infection can occur at any time of the year, but is more common in dry conditions. Housed sheep appear to be at special risk. The virus is thought to enter the skin through wounds from thistles, grass seeds, burrs and crop stubble.

Erythematous patches up to 5cm in diameter progress to papules, pustules and ulcers with persistent scab formation. Scabs dry off in 3 to 4 weeks. Lesions are most common on the lips, muzzle, tongue and teats. They can also occur on the genitalia, tongue, coronet and interdigital cleft. The latter sites are important when foot and mouth disease is considered. Secondary infection leading to cellulitis, mastitis, etc can significantly increase the severity of the disease. Residual small horny papillomatous growths are occasionally found. Bodyweight loss can be severe and fatalities do occur in sucking lambs.

The clinical diagnosis can be confirmed by demonstration of virus in scabs by electromicroscopy. Differential diagnoses include

photosensitisation, dermatophilosis and staphylococcosis. The virus persists in the environment and endemic farms and areas become known to the experienced veterinarian.

Orf infection occurs in farmers and abattoir workers. In most cases a 'cigarette burn' lesion appears on the hand and remains for 3-6 weeks. It is a raised reddened painful lesion. Crust formation is not prominent.

### **Sheep Pox and Goat Pox**

Sheep pox and goat pox are closely related diseases. They are the most serious of pox diseases of livestock and may cause heavy production losses and mortalities. They are exotic to Australia but Australia's sheep and goat populations are highly susceptible. Viruses are spread by the respiratory route. Infected animals shed virus in all secretions and in scabs. The virus is very resistant in the environment. In a susceptible flock mortalities may reach 50% but approach 100% in young animals. Goat pox is often a milder infection with a mortality rate of around 5%. Clinical signs include a rapid onset of fever, excessive salivation and nasal and ocular discharge and reluctance to move. Lesions appear within a few days and may occur anywhere on the skin and mucous membranes of the respiratory, gastrointestinal and reproductive tracts. The typical pox cycle of erythema, papule, vesicle, pustule and scab is followed over a period of 5-6 weeks.

### **Pox virus Infections of Cattle**

#### **Pseudo cowpox**

A common mild infection of the teats of dairy cows with occasional lesions on the udder and perineum. Secondary bacterial infection of the dark circular or horseshoe scabby lesions is common. Infection of humans causes "milker's nodule". The virus is closely related to bovine papular stomatitis virus.

#### **Bovine Papular Stomatitis**

BPS is a common cause of ulcerating lesions in the oral cavity of young cattle but produces occasional pox-like lesions on the lips and muzzle and on the teats of cows with affected calves. It can also cause "milker's nodule".

#### **Cow pox**

Cow pox virus affects a very wide range of species including humans. Therefore the term is a misnomer. The most important reservoir is in small wild mammals. Infections in ruminants including cattle occur only rarely and produce pox-like lesions on teats and udder.

#### **Lumpy Skin Disease**

The capripox virus which causes lumpy skin disease in cattle is a close relative of the virus which causes sheep and goat pox. They appear to be host adapted strains of the same virus. Lumpy skin disease is NOT found in Australia. It is endemic in Africa. It affects cattle and buffalo and is

transmitted by biting insects and close contact. Fever, systemic illness, lymphadenopathy and ventral oedema accompany the multiple skin lesions. Abortions may be noted. Morbidity and mortality vary widely and inapparent infections occur. The number of lesions vary with the severity of the disease. Skin nodules 0.5 to 7 cm in diameter make a sudden appearance anywhere on the body. They are flat topped, firm, raised intradermal swellings surrounded by a zone of hyperaemia.

Most nodules become necrotic, begin separate from the surrounding skin within a day or two and eventually form a cone of dead material which leaves a raw crater when dislodged. Secondary infection and abscessation of these lesions is common and can lead to metastatic infections. Healing takes months and leaves scars rendering hides worthless. Chronic debility is common.

### **Pseudo Lumpy Skin Disease**

This disease causes a more benign infection but is similar enough to Lumpy skin disease to cause diagnostic confusion. It is present in Australia. It is caused by bovine herpes virus 2, the cause of ulcerative mammillitis. Similar skin lesions to LSD erupt suddenly after a mild fever. The nodules only involve the more superficial skin layers and resolve as skin scabs within 3 weeks. Deep necrotic lesions are not seen.

### **Bovine Ulcerative Mammillitis**

BUM is caused by bovine herpes virus 2 and is a localised form of infection seen sporadically in Australia. Inapparent infections are common. Transmission requires teat trauma. Transmission is via milking machines, biting flies and teat abrasions. Lesions occur on the teats with occasional lesions on the udder, perineum, and also on the muzzle, lips, chin and oral mucosa of sucking calves. Teats develop painful 1-2 cm plaques with a necrotic centre which slough to leave a ragged ulcer. Some cases show widespread coalescing lesions. Most lesions heal without scar formation.

### **Foot and Mouth Disease**

FMD is caused by a picornavirus. It is a highly contagious vesicular disease of cattle, sheep, goats, deer, buffalo, pigs and a range of wild animals. Australia had several minor outbreaks in the early years of the colonies, the last being in Victoria in 1872. It is spread principally via the respiratory route. Cattle and pigs are the most severely affected. Persistent infection after lesion healing is common. The incubation period is 2-14 days.

In cattle fever is followed by depression, inappetence and cessation of milk production. Vesicles form at one or more of the following sites within a day or so on the tongue, lips, gums, dental pad, interdigital skin, coronary bands, bulbs of heels and teats. Hyperaemic foci quickly progress to vesicles 1-2 cm in diameter which may coalesce. They contain clear fluid and are contained within blanched epithelium. They rupture within 24 hrs and leave raw, painful ulcers with ragged edges. Salivation, inappetence, lip smacking, lameness and secondary mastitis

are followed by rapid loss of body condition. Mortality in adults is usually <5%, but up to 50% in young calves which may die without gross lesions.

FMD is a much milder infection in sheep and goats. Vesicles are difficult to detect. Lameness may be the only sign but differentiation from other foot conditions is particularly difficult.

## Bacterial Diseases

### Abscesses

Focal pyogenic infections occur in many subcutaneous sites in sheep and cattle. They are included here because many originate from a skin lesion. Others develop subcutaneously and open onto the skin.

Grass seed abscesses occur mainly in sheep and fibre goats. They can be found anywhere on the animal but are frequently found on or under the mandible. A mixture of opportunist bacteria are involved.

Injection abscesses are found in any site where a dirty needle has been placed. *Corynebacterium pyogenes* is the most common bacterium found in these sites. They are common when vaccination procedures are carried out on wet sheep and cattle. Some vaccines, particularly the oil based footrot and campylobacter vaccines produce large sterile pyogenic local reactions, most of which open onto the skin.

Rams suffer scrotal abscesses, presumably from local abrasions.

Caseous lymphadenitis caused by *Corynebacterium pseudotuberculosis* (*C. ovis*) causes lymph node abscesses with sinus formation to the skin of sheep. In severe cases, multiple subcutaneous abscesses are seen.

*Actinobacillus lignieresii* enters through abrasions in the oral cavity and skin to cause fibrous lesions with caseous centres on the lips and subcutaneous tissues of the head and lower limbs of sheep and cattle. *Mycobacterium spp* can cause pyogranulomatous skin nodules.

### Dermatophilosis

Dermatophilosis has several synonyms: mycotic dermatitis, lumpy wool, rain scald and cutaneous streptothricosis. It is a common bacterial disease of sheep, cattle and horses which causes a marked exudative dermatitis on wet macerated skin.

*Dermatophilus congolensis* is a filamentous gram positive bacterium present on the skin of many sheep and cattle. Under persistently wet conditions, particularly if the temperatures are mild to warm, the normal waxy layer of the epidermis is broken down. Other contributing factors include shearing, dipping, jetting, sweating, flystrike and dermatitis. External parasites may act as mechanical vectors. The disease must be



differentiated from other causes of dermatitis including photosensitivity, orf, pseudomonas and footrot.

The 'lumpy wool' form of the disease is common in sheep. Infection causes profuse exudative dermatitis with scab formation, firstly over the ulcerated skin and later up into the wool. Scabs tend to be thick and have pointed tips. The condition can be painful and makes shearing extremely difficult. Lesions can occur anywhere on the skin but are most common along the backline. Flystrike is a common and important secondary problem.

Dermatophilosis can also cause dermatitis and thin scab formation on the dorsal midline or on the face, ears and lower legs. In severe lesions the hair may be buried in coalescing crusts. Infection of the lower limb skin of lambs and weaners in Australia leads to a condition called strawberry footrot. The name comes from the strawberry-like shallow ulcers left after crusts are dislodged.

Dermatophilosis may be a mixed infection with *Staphylococci*, *Fusobacterium necrophorum* and sometimes *Bacteriodes nodosus*. Diagnosis is confirmed by identifications of the bacteria in smears from scabs and ulcers and response to treatment with parenteral penicillin and dipping with antibacterial solutions such as 0.5% zinc sulphate.

Dermatophilosis can debilitate cattle and sheep and facilitate secondary infection. Deaths in debilitated cattle occur.

### **Staphylococcal pyoderma**

A patchy dermatitis with scab formation occurs on the head and sometimes the legs of sheep, goats and cattle. Lesions are found on the skin along the nose and around the eyes. Ulceration and inflammation may be severe, deep seated and persistent. The lesion may progress to a chronic granuloma surrounded by a zone of alopecia before healing, leaving bare scarred skin.

The condition is common but is not a prominent or well-recognised syndrome. Only some strains of *Staphylococcus aureus* cause the disease. Staphylococcal folliculitis and furunculosis also occurs, particularly on the tail, perineum, scrotum and face, but generally heals uneventfully.

### **Pseudomonas dermatitis**

Another poorly recognised dermatitis of sheep and occasionally cattle is caused by the bacterium *Pseudomonas aeruginosa*. In addition to causing wool pigmentation some strains of this organism colonise persistently wet skin and create focal ulceration along the backline. Ulcers may become deep seated and the characteristic smelly greenish pus of *Pseudomonas* infection is present. Scab formation is variable. Fine and coarse wool breeds have been affected, most within 8 weeks of shearing. Recovery is very prolonged and in a few cases extends to lesions subcutaneous cellulitis, myositis and septicæmia.

## Fungal Diseases

### Ringworm

Ringworm is a rare condition in sheep and goats. *Trichophyton spp.* and *Microsporum canis* cause circular patches of alopecia - usually on the head. The lesions are usually multiple, show a greyish light crust and persist for 1-3 months. Diagnosis is confirmed by identification of spores and mycelia in skin scrapings.

Ringworm is very common in cattle. *Trichophyton verrucosum* is the most frequent isolate. Prevalence is highest in young cattle either housed or in large groups. Most lesions are on the head (particularly the periocular region) and neck. They can be extensive in poor animals. Individual lesions are very thick grey crusts roughly circular 2-6 cm diameter. They may persist for several months.

## Photobiological Disorders

### Sunburn

Sunburn is a common problem in white skinned goats and in sheep post-shearing. It is rare in cattle. It can occur with as little as two clear sunny days exposure at all times of the year in northern Australia and in all but the winter months in southern Australia. Erythema followed by exudation, necrosis and sloughing of the skin is seen. Lesions are most severe along the neck, back and around the perineum. The udder of lactating goats can also be affected. Acute lesions can lead on to dermatophilosis, flystrike and suppuration. Chronic lesions may lead to keratoses, cutaneous horns and squamous cell carcinoma.

### Keratoses, cutaneous horns

Keratoses are raised scurfy areas which enlarge and eventually go through cycles of trauma and ulceration. They are equivalent to the 'sunspots' of man induced by solar irradiation damage. Common sites are the ears and other woolless areas of the sheep, with similar sites plus the udder in white skinned goats. The unpigmented eyelids, including the third eyelid and sclera of the eye of cattle are predilection sites in cattle. When sheep are radically tailed and mulesed the dorsum of the tail, vulva and perineum become affected. Keratotic lesions take several years to become obvious and some progress to squamous carcinoma.

Cutaneous horns are dry hard hyperkeratotic columns which are thought to originate from solar damage and/or chronic trauma from ear tag irritation. The sites of the lesions are similar to those of keratoses and both conditions are often found together. The prognosis is also similar ie trauma, ulceration, secondary infection, myiasis and neoplastic transformation. The involvement of papilloma viruses in the pathogenesis of both lesions is common.

### Photosensitivity dermatitis

Photosensitivity diseases in sheep, goats and cattle are recognised by erythema, oedema and pruritis of affected skin followed by traumatising, oozing, scab formation, necrosis and sloughing. The major sites are ears, eyelids, face, muzzle, teats and udder. The ears swell and droop. Jaundice may be present.

Primary photosensitisation is caused by the ingestion of a photodynamic substance or its precursor. Primary photosensitivity may be caused by St John's Wort (*Hypericum perforatum*), buck wheat (*Fagopyrum spp.*), perennial ryegrass (*Lolium perenne*), burr trefoil (*Medicago denticulata*), *Brassica spp.*, *Erodium spp.* and *Trifolium spp.*

Secondary photosensitisation is caused by accumulation of phyloerythrin in the peripheral circulation. Phyloerythrin is a product of chlorophyll metabolism which is normally excreted in the bile. Liver dysfunction or obstructive jaundice results in its accumulation in the bloodstream and skin. Plants producing secondary (hepatogenous) photosensitisation in sheep include:

- Ragwort (*Senecio jacobea*)
- Lantana (*Lantana camara*)
- Heliotrope (*Heliotropium europaeum*)
- Blue-green algae (*Anacystis spp.*)
- Blue lupins (*Lupinus angustifolius*)
- Palisade grass (*Brachiaria brizantha*)
- Coolah grass (*Panicum coloratum*)
- Native millet (*P. decompositum*)
- Hairy panic grass (*P. effusum*)
- Brown millet (*P. miliaceum*)
- Sweet grass (*P. laevifolium*)
- Guinea grass (*P. maximum*)
- Pepper grass (*P. whitei*)
- Caltrops (*Tribulus terrestris*)
- Verbena (*Verbena officinalis*)

Secondary photosensitivity is also caused by a fungus named *Pithomyces chartarum* which grows in wet autumn weather on improved pastures in the southern states of Australia and in New Zealand. Severity of the lesions is dose dependent. The skin lesions are accompanied by liver pathology, usually an acute hepatitis.

In addition photosensitivity of unknown pathogenesis occurs from ingestion of:

- Oats (*Avena sativa*)
- Barley (*Hordeum vulgare*)
- Barley grass (*H. leposinum*)
- Wheat (*Triticum aestivum*)
- Sudan grass (*Sorghum sudanensis*)
- Perennial ryegrass (*Lolium perenne*)
- Black medic (*Medicago lupulina*)
- Lucerne (*M. sativa*)
- Woolly burr medic (*M. minima*)
- Burr medic (*M. polymorpha var vulgaris*)
- Vetch (*Vicia sativa*)
- Japanese millet (*Echinochloa frumetacea*)
- Pennywort (*Hydrocotyle sp*)
- Paddy melon (*Cucumis myriocarpus*)
- ---- (*C. trigonus*)
- Ulcardo melon (*C. melo*)
- Wild watermelon (*Citrullis colocynthis*)
- Camel melon (*C. lanatus*)
- Squirting cucumber (*Echballium elaterium*)
- Windmill grass (*Chloris truncata*)

The conditions under which the above plants cause photosensitisation are poorly understood, In some cases, it is a simple dose/response relationship, in some it is confined to specific stages of growth and in others, it may reflect toxic fungi growing on the plants. Recovery of animals on removal from affected pastures and provision of shade assists in confirming the diagnosis. Dermatophilosis and flystrike are both important secondary problems.

A rare inherited defect in phyloerythrin excretion has been reported in Corriedale and Southdown sheep.

## Neoplastic Disorders

### Cysts

There are several types of benign cysts of the skin of cattle, sheep and goats. Some cysts are congenital and inherited, some are spontaneous developmental abnormalities whilst others are acquired after blockages of dermal glands, wounds or penetrating foreign bodies.

They are usually spherical, firm painless structures lined by epithelium and containing a variety of material. Some may leak mucoid contents onto the skin.

Epidermoid cysts contain skin only; dermoid cysts contain matted hair and inspissated sebaceous material. Other cysts may contain pus and a penetrating grass seed.

### **Papillomatosis**

Papillomatous lesions induced by papilloma virus are very common in cattle, less common in goats and uncommon in sheep. Cattle may have either slim epithelial papillomas on the teats or in the upper alimentary tract or bulkier fibropapillomas on the skin of the head and neck, lower abdomen, penis, teats, udder and upper alimentary tract. In situ lesions can occur in the urinary bladder.

In goats epithelial papillomas occur on the face, teats and udder with fibropapillomas on the skin and udder - particularly in unpigmented areas.

In sheep small epithelial frond papillomas containing papilloma virus have been found on the lower limbs and muzzle of a small number of animals in Australian flocks. Lesions persist for a relatively short time (1-2 weeks). Secondary infection is rare and progression to squamous cell carcinoma has not been demonstrated.

### **Squamous cell carcinoma**

Genetic and environmental factors interact in the formation of squamous cell carcinoma (SCC) in cattle. This tumor is extremely common in Australia on the unpigmented eye and eyelids of many breeds including Herefords and Holstein Friesians. Sunlight is the most important carcinogenic stimulus but bovine papilloma virus infection may also play a role. Skin pigmentation is highly protective for tumor development. The appearance of SCC depends on whether or not it arises from a precancerous skin lesion. It may be a firm, white dermal mass with indistinct borders and variable degrees of infiltration and ulceration; or it may be a raised papilliform or acanthomatous lesion.

Ocular precursor lesions are usually single or multiple hyperplastic keratotic plaques or epithelial papillomas. Not all lesions progress to SCC within the economic lifespan of cattle. SCC is most common in cattle over 5 years of age. Predilection sites are the third eyelid, the lateral canthus and the corneoscleral junction of the eye. SCC may be infiltrative or proliferative. The masses are fleshy and the surface may be granulated, haemorrhagic or ulcerated. All tumors are locally invasive and metastasis to the parotid lymph node is common. More distant metastases are uncommon. Some SCC become flyblown and others suffer bacterial infection and produce a foul odour. Affected animals become debilitated. Occasionally SCC will be found on the vulva, udder, penis and perineum.

In sheep squamous cell carcinoma affects the non-woolly areas of skin and arises from transformation of keratoses and cutaneous horns. The most common site is the dorsal surface of the ear with the muzzle and eyelid being occasionally affected. In flocks which have been short tailed

and/or radically mulesed, lesions are common on the dorsum of the tail, vulva and perineum.

Prevalence rates in adult sheep often exceed 1% in the drier areas of Western Australia and Queensland. Prevalence rates in older sheep (over 5 years) may exceed 5% per annum. Mulesed flocks may have even higher rates.

Cancers grow slowly with bouts of traumatising, ulceration, flystrike and secondary infection being common. Some lesions are proliferative and form irregular nodules of tumour tissue. Others are predominantly erosive. Without surgical intervention, squamous cell carcinomas continue to enlarge and erode surrounding tissues. Loss of half or more of an ear is common. Metastases to the local lymph node occur in approximately 10% of cases.

Marked discomfort leads to anorexia, debilitation and death from a combination of stress, flystrike and secondary septicaemia.

The prevalence rate can be lowered by providing ample shade, keeping the average age of the flock at 5 years or younger, and reducing or eliminating the amount of skin removed during mulesing. Other factors include leaving three coccygeal vertebrae and some woolly skin on the dorsum when tailing and keeping ear tags and marks to a minimum.

SCC is a relatively common tumour of older white skinned goats in Australia. It occurs on the udder and vulva and occasionally at other sites. Saanen breeders successfully introduced "orange" pigmented strains into Australia which greatly reduced the prevalence of SCC. A peculiar form of SCC develops in castrated male cattle in India. It originates in the horn core, eventually destroying it and extending to adjacent sinuses and bone.

### **Melanomas**

Pigmented melanomas are sometimes seen in young sheep goats and cattle. They are more common in dark skinned breeds. Angoras have a higher prevalence than other goat breeds. Primary lesions are firm black, brown or grey irregular masses of 20-60 mm in diameter with a shiny cut surface, usually located along the backline. In contrast to the benign nature of most cattle lesions, sheep and goat melanomas are rapidly invasive. Metastases are common.

### **Other Neoplasms**

A range of other neoplasms occur in the skin at much lower prevalence rates than SCC. They include haemangioma, haemangiosarcoma, lymphoma, mastocytoma and basal cell carcinoma

## Ectoparasites

Flystrike and lice (together with internal parasites and footrot) are the most important disease of sheep in Australia. They are a significant source of economic loss (wool, pelts, bodyweight) and mortality (flystrike). They are of much less importance in goats and sheep.

### Flies

Flystrike (myiasis) is most frequent during warm moist conditions when faecal contamination, fleece rot or skin wounds attract blow flies. Primary fly larvae led by the green blowfly (*Lucilia cuprina*) infest the skin of living sheep. They are followed by the larvae of so called secondary blowflies which cannot initiate attack but infest existing lesions and extend them. There are three major sites. Head strike is most common in rams as a sequel to fighting wounds. Although important in individual animals its prevalence rate is usually low.

The second site for flystrike is around the perineum and prepuce. Urine and faecal staining predispose these areas to strike. Once the most important type of flystrike, it can now be adequately controlled by the application of good managerial techniques. They include correct tail docking, mulesing, crutching in the early stages of the fly season, internal parasite control (to reduce diarrhoea) and, if necessary, jetting or dipping. Therefore, in well managed sheep populations breech and pizzle strike usually have low prevalence rates.

The third site is body strike which is usually a sequel to fleece rot although dermatophilosis and other skin conditions also predispose to flystrike. It is now the most important type of lesion as its prevention is the most difficult. Prevalence rates and case mortality rates can reach epidemic proportions in favourable circumstances. Susceptibility of an animal to fleece rot and body strike has been associated with certain fleece characteristics. Prevalence of the disease varies with the season and degree of susceptibility of the sheep population.

The gross appearance of the lesion may be masked by the fleece and the first signs are often toxæmic debilitated or dead sheep. On inspection of the affected site, early lesions show patches of wool bathed in a wet brown exudate with an offensive smell. The area feels hot and the skin is reddened and oozing serum. Foci of white maggots 10-20 mm in length hatch out from fly ova within 24 hours, ingest the inflammatory exudate and grow rapidly. Necrosis from the proteolytic enzymes secreted by primary fly larvae extend the lesion and attract the even more destructive secondary blowflies.

Moist putrefactive changes, irregular ulceration and pruritis characterise the extensive lesion and quickly lead to shock and toxæmia. Deaths within one week of infestation are common. Healing lesions show wool loss, superficially dry scabs and underlying ulceration.

### **Screw Worm Fly**

The screw worm fly (*Chrysomia bezziana*) attacks fresh wounds in a wide range of animals including ruminants. It is common in Asia including New Guinea. Whilst not in Australia yet, climate, host range and management practices (castration, branding, ear tagging) would allow its establishment. Australia has a monitoring program in northern Australia with fly traps and sentinel animals. The flies lay larvae in fresh wounds. Wet umbilical cords and abraided vulvas post calving are also targets. Larvae invade the edges of the wounds enlarging them and producing deep wounds with foul smelling brown exudate. Prevalence rates can be minimised by releasing sterile male flies and conducting management procedures causing wounding in the cooler months.

### **Buffalo Fly**

These small blood sucking flies of cattle and buffalo (*Haematobia exigua*) cause serious nuisance to cattle, interfering with grazing and reducing production. It is common in northern Australia and has gradually moved into northern NSW in recent years. Its bites cause intense pruritis resulting in rubbing and raw weepy areas around the withers, shoulders, flanks and eyes. Simulid and stable flies also cause serious fly worry to cattle in more temperate areas.

### **Ked**

Sheep ked (*Melophagus ovinus*) is a blood sucking wingless fly about 7 mm long. Light infestations cause few problems but heavy infestations lead to severe skin irritation and self mutilation. The importance of the condition has declined in recent years with the widespread use of more effective insecticides. It is now a threatened species and is rarely seen! Affected sheep have a ragged fleece from biting and rubbing and the wool may have a musty odour and brown stain from the adult insects' excreta. Anaemia is an occasional problem, particularly in lambs. Diagnosis is by visual identification of the insect.

### **Mites**

*Chorioptes bovis* is a cause of minor hyperkeratotic mange problems in cattle and goats at the backline, base of the tail, lower limbs, scrotum and muzzle. However chorioptic mange on the lower legs of sheep and scrotal mange in rams can become an important problem. Whilst widespread in Australia, its importance is limited to the scrotal condition in rams. Extensive dermatitis, serum exudation and scab formation causes inflammatory changes which raise the scrotal temperature and cause sperm degeneration. Infertility may be partial or complete but usually returns to normal 2 to 4 months after the condition is controlled by topical acaricides. Small lesions cause few problems. Microscopic examination of the exudate and superficial skin scrapings will show oval shaped mites.

*Demodex spp* are species specific mites which infest hair follicles of all species of domestic animals. Demodectic mange is a minor nodular mange problem on the shoulders, neck, dewlap and muzzle of cattle.



Mange in goats has a similar distribution but a slightly higher clinical importance. Demodectic mange is rare in sheep.

Trombidiform mites are mites which primarily attack grain. They infest animals accidentally and usually cause a dermatitis around the face. In sheep they sometimes attach to the skin of the caudal pastern. Erythematous papules with tiny orange mites on their surface burst and ulcerate. Lesions later dry up and a scab is formed. Pruritis is intense and the sheep bite affected areas. Secondary infection and flystrike are common.

Sarcoptic mange is a sporadic problem in goats, sheep and cattle. In goats and cattle it is usually found on the head but may become generalised. In sheep it infests the haired areas of the lips, nostrils, ears and occasionally the lower legs. Thick scales and crusts are formed. Pruritis and self trauma are common. Some individual animals display hypersensitivity reactions to the mites. It occurs most frequently in poorly managed, debilitated animals.

Itchmite (*Psorergates ovis*) is a cause of pruritis and self inflicted trauma in sheep throughout Australia. It and its relatives can also cause serious mange problems in cattle and goats. The pruritis appears to be a hypersensitivity reaction as fleece derangement is present in only a proportion of infested sheep. Other suggestive signs include the presence of scurf, thickened skin and occasionally, yellow discolouration of the fleece. Biting and tubbing are most severe along a line between the elbow and hip. Differential diagnosis should include lice, ked and grass seeds. Transmission from infested ewes to their lambs is an important method of spread. Itchmite is very susceptible to the ivermectin group of chemicals and has been largely eradicated from sheep in Australia.

### **Ticks**

Cattle tick is an important problem in northern Australia. Tick worry and tick paralysis from *Boophilus microplus* are a significant cost to the cattle industry in losses and preventive measures. Tick paralysis will not be considered here and tick worry will be confined to the gross skin lesions. Skin irritation leads to interruption of grazing, growth and production. Some animals may show self trauma, alopecia and fissured skin. Hypersensitivity to tick products can occur. Scarring leads to downgrading of hides at slaughter. Extensive tick infestation is obvious with several hundred ticks attached to various parts of the body. However light infestations may be confined to the perineum, neck or ears. Other tick species infest cattle in Australia but do not normally cause extensive skin disease.

Ticks are not an important ectoparasite of sheep in Australia but a 3 host tick (*Haemaphysalis longicornis*) is found on sheep in the northern half of the North Island of New Zealand. It does not act as a vector for other disease in sheep and its importance is restricted to pelt damage and occasional weight loss and anaemia.

## Lice

Louse infestations (pediculosis) are common in sheep, goats and cattle throughout the world. Species specific biting and sucking lice occur in all 3 species. They are particularly important in sheep in Australia where the income from wool is more important than from sheep meat. The economic importance of ovine pediculosis lies in the high prevalence and severity of fleece damage.

*Bovicola ovis* is the most common and most important louse of sheep. It occurs throughout Australia and is present in the majority of sheep flocks. It becomes important when poor management practices allow louse populations to dramatically increase.

*B. ovis* is a small light grey insect up to 1.8 mm long with a broad reddish head. Females lay eggs which attach near the base of wool fibres and the life cycle is completed in approximately one month. Numbers are lowest in shorn sheep in summer and build up through autumn and winter to a peak in spring. The summer decline in numbers is related to the inability of lice to survive high skin temperatures and exposure at shearing which causes dessication. Generally, at least 4 to 5 months are required from time of initial infestation to levels which produce significant pruritis.

Transmission is by direct contact between sheep. Feeding by biting the cornified layers of the skin causes pruritis and self trauma. The sheep disturbs its fleece by rubbing and biting. Initially, the fleece has a ragged hairy appearance which extends to irregular areas of wool loss, particularly along the shoulder, side and flank. Heavily affected sheep show illthrift and some become debilitated. Diagnosis is confirmed by observing lice on the skin. Inspections should be made by parting the fleece in several places over the neck, withers, shoulder and side. Good light and experience are needed as the lice congregate in colonies and move quickly away from bright light. The level of infestation will vary amongst individuals in a flock and light infestations can be easily overlooked.

*Linognathus pedalis* is a sucking louse approx. 2 mm long with a hairy abdomen. It mostly occurs in the hairy rather than the woolly areas of the sheep ie lower legs, but can extend to the scrotum and belly wool. *L. pedalis* can survive on pasture for 2-3 weeks. Light infestations cause no clinical signs but heavy build ups in the late winter and spring can cause stamping and biting of the affected parts. Most problems occur in rams, young lambs and housed sheep.

*Linognathus ovillus* is the face louse. It occurs in all east coast states of Australia but causes few clinical problems. It is the largest of the sheep lice with a head twice as long as it is wide. Infestations are found at the hair/wool junction on the head.

In goats the sucking louse (*Linognathus stenopsis*) is more pathogenic than the biting lice (*Bovicola* spp). The hair coat of fibre goats may be seriously deranged from rubbing and biting.

In cattle infestations are common, particularly in colder months and on poor, illthrift or overcrowded animals. There is usually little effect on most animals. Sucking and biting species may both be present. Pruritis is a feature but self trauma is uncommon, however damage to trees and fences from rubbing can be considerable. Some lice are widely distributed on the body, others cluster. The head and neck are the most commonly affected sites. Scurf and variable alopecia may be seen.

## Wool Disorders

### Wool break

A localised weakness in the tensile strength of the wool fibre is a common fault in sheep fleeces. It is also referred to as tenderness. Growth checks related to levels of nutrition, pregnancy, lactation and disease are thought to be the cause of tenderness. There is also a seasonal (photo-periodic) effect on wool growth rate being slowest in winter.

A decrease in the diameter of the wool fibre is the most common reason for wool break although some fibres are structurally weak as in copper deficiency. In addition, some fibres stop growing and are shed into the staple, thus making the strength of the staple dependent on fewer fibres. Masses of tangled shed fibres in the fleece are referred to as cots.

### Fleece rot

Persistently wet skin encourages skin maceration, proliferation of bacteria and a superficial exudative dermatitis called fleece rot. *Pseudomonas seruginosa* is the bacterium associated with most cases of fleece rot. Other predisposing factors include high humidity in the fleece, long wool, high wax and low suint content and open fleece structure with shaggy staple tips.

Most cases occur in the warm wet periods of the year and therefore the frequency of fleece rot is highest in high rainfall areas. The prevalence and severity of the condition varies widely. It is diagnosed by observation of dirty greyish green or greyish yellow band across the wool staple, particularly along the backline. Wool fibre damage does not occur so that the term is misleading. The discolouration can be removed by scouring. Severe cases show matting and marked discolouration. Fleece rot can be differentiated from dermatophilosis by the latter's heavy characteristic scab formation however, mixed infections do occur.

In sheep affected by fleece rot, cutaneous hotspots of serum exudation and *Pseudomonas* proliferation attract *Lucilia cuprina* the primary sheep blowfly and body flystrike is a common sequel.

Small framed fine wool Merinos are said to possess a high degree of natural resistance to fleece rot and body strike. This type of sheep predominates in high rainfall areas.

Genetic predisposition and resistance to fleece rot have been documented and programs to select resistant sheep appear worthwhile.

### **Fleece pigmentation**

The conditions mentioned for development of fleece rot (above) may also produce fleece pigmentation. Pigmentation by *Pseudomonas aeruginosa* can produce bands of green, grey-green, brown and occasionally blue and pink discolourations. The pigment is scourable.

Diffuse yellow scourable pigmentation may be due to ectoparasitism or an heritable pigmentation of skin gland secretions.

Diffuse yellow or apricot unscurable pigments are found in the ventral body areas and are caused by high suint levels exposed to prolonged warm wet conditions.

Black non-scurable discolouration of the staple tip can occur under wet conditions due to the fungus *Peyronella glomerata*. It does not penetrate deeply but the damaged wool tip is lost during the scouring process.

A range of pink, blue and purple fleece discolourations without a known cause have been described but are uncommon.

### **Grass seed infestation**

The majority of sheep in Australia have grass seeds from some grass species accumulate in the eyes, ears, gums, interdigital clefts, anus and external genitalia of sheep. Others accumulate in the wool and penetrate the skin. Woolly faced sheep and lambs and young sheep (which have thin skin) are particularly severely affected. Major offenders are Barley grass (*Hordeum leporinum*), Spear grasses, (*Stipa spp.*, *Heteropogon spp.*, *Aristida spp.*), Storksbill and Crowsfoot (*Erodium spp.*).

Lesions include conjunctivitis and blindness, mouth and ear impaction and injuries, lameness, puncture wounds and tracts throughout the woolly skin. Resultant reluctance to graze, ill thrift and secondary infection are important, the latter particularly after dipping. Grass seed puncture wounds predispose to other conditions including orf, caseous lymphadenitis, tetanus, malignant oedema, erysipelas, footrot and flystrike. Grass seed infestation causes major economic and welfare problems. Downgrading of wool, pelts and carcasses cause losses of many millions of dollars to the Australian sheep industry.