Disease of The Integument

Skin

- The skin is the largest organ in the body and has haired and hairless portions.
- It consists of epidermis, dermis, subcutis, and adnexa (hair follicles and sebaceous, sweat, and other glands).
- The histologic structure varies greatly by anatomic site and among different species of animals.

Histology of The Skin

Epidermis

- Str. corneum
- Str. lucidum
- Str. granulosum
- Str. spinosum
- Str. basale

Dermis

- Str. papillare
- Str. reticulare

Subcutis

Adnexa

- Sebaceous glands(Gll. Sebase)
- Hair Follicles
- Sweat glands (Gll. Sudorifere) (*apocrine and eccrine)*

DERMATOHISTOPATHOLOGY

- ***Hyperkeratosis*** **(*Orthokeratotic – Parakeratotic*)**
- **Dyskeratosis**
- **Hypergranulosis - Hypogranulosis**
- **Hyperplasia (*Acanthosis*) - Hypoplasia**
- **Acantholysis**
- **Spongiosis (intercellular edema)**
- **Exocytosis**
- **Pustules**
- **Crusts-Vesicles-Bullae**
- **Hypopigmentation - Hyperpigmentation**

DERMATOHISTOPATHOLOGY

- **Hyperkeratosis** refers to ***increased thickness of the stratum corneum.*** It can be either **orthokeratotic** (without nuclei), or **parakeratotic** (nuclei retained).

- ***Diffuse parakeratotic hyperkeratosis*** can be seen in *many chronic dermatoses, especially zinc-responsive dermatosis, dermatophilosis, superficial necrolytic dermatitis,* and *thallotoxicosis.*

- ***Diffuse orthokeratotic hyperkeratosis*** is seen in many conditions, including *hypersensitivities, endocrinopathies, nutritional deficiencies, development disorders, and seconder seborrhea.*

DERMATOHISTOPATHOLOGY

- **Hyperplasia** is the increase in the thickness of the non-cornifiying epidermis due to increased in the number of cells.
- **Hypoplasia** ; is the reduction in the thickness of the non-cornifiying epidermis due to decreased in the number of cells.
- **Atrophy** is the reduction in the thickness of the non-cornifiying epidermis due to decrement in the size of the cells.

DERMATOHISTOPATHOLOGY

☑ **Hypergranulosis** and Hypogranulosis indicates *increased and decreased thickness of the stratum granulosum*.

❑ **Dyskeratosis** is *premature or abnormal keratinization of individual keratinocytes* in the epidermis or follicular epithelium.

DERMATOHISTOPATHOLOGY

- **Acanthosis;** is diffuse epidermal hyperplasia especially hyperplasia of stratum spinosum.
- **Acantholysis** refers to a *loss of cohesion between individual keratinocytes* resulting from a breakdown of the intercellular bridges (desmosomes).

DERMATOHISTOPATHOLOGY

- **Acantholysis** can result in epidermal clefts, vesicles and bullae.
- Acantholysis can result from proteolytic enzymes released by neutrophils or eosinophils in an inflammatory process.
- In cattles, familial development defects, neoplastic changes like squamous cell carcinoma, and actinic keratosis and diskeratoms.

DERMATOHISTOPATHOLOGY

- **Hypopigmentation** refers to *decreased melanin in the epidermis.*
  - It may be associated with congenital or acquired idiopathic defects in melanization (leukoderma, vitiligo), toxic effects of certain chemicals on melanocytes, inflammatory disorders, hormonal disorders, and dermatoses featuring hydropic degeneration of basal cells (e.g., lupus erythematosus).
- **Exocytosis** *is the migration of inflammatory cells and/or erythrocytes through the intercellular spaces of the epidermis*

DERMATOHISTOPATHOLOGY

- **Intracellular edema** of the epidermis is characterized by increased size, cytoplasmic pallor, and, sometimes, displacement of the nucleus to the periphery of the affected cell.

- *Intracellular edema is a common feature of any acute or subacute inflammatory dermatosis.*

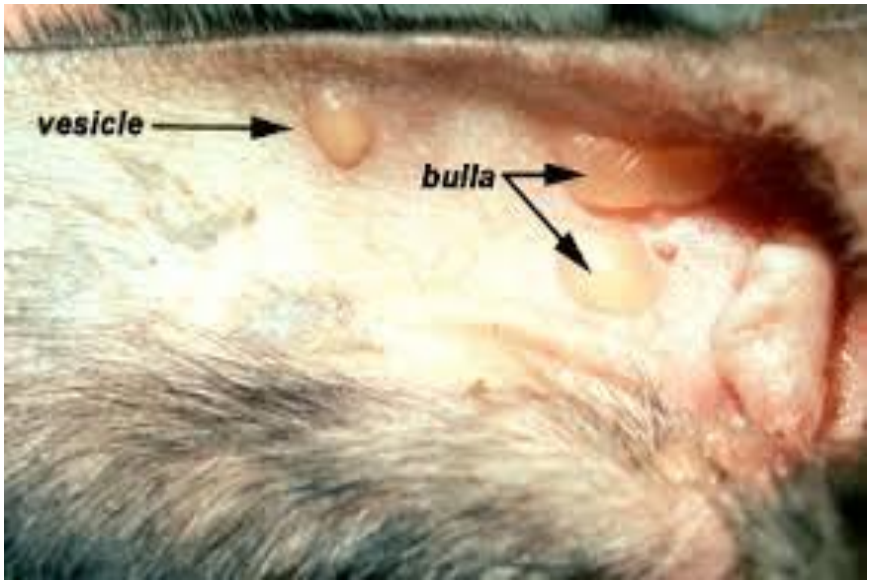
  - **Vacuolar degeneration**
  - **Hydropic degeneration**

DERMATOHISTOPATHOLOGY

- **Spongiosis (intercellular edema)** of the epidermis is characterized by widening of the intercellular spaces with accentuation of the intercellular bridges, giving the epidermis a "spongy" appearance.
- Severe intercellular edema may lead to rupture of the intercellular bridges and the formation of *intraepidermal vesicles* .
- Intercellular edema is a common feature of acute or subacute inflammatory dermatoses.

DERMATOHISTOPATHOLOGY

- **Vesicle** is a *fluid filled blister less than 1 cm in diameter* in, or immediately below, the epidermis. They may be *subcorneal, suprabasilar, or subepidermal*. When these lesions contain large numbers of inflammatory cells, they may be referred to as **vesicopustules.**



DERMATOHISTOPATHOLOGY

- **Bullae** are *collections of fluid* within or below the epidermis greater than 1 cm in diameter.
- They may be caused by severe intercellular or intracellular edema, ballooning degeneration, acantholysis, hydropic degeneration of basal cells, subepidermal edema or other factors resulting in dermoepidermal separation such as the autoantibodies in bullous pemphigoid.

DERMATOHISTOPATHOLOGY

- **Pustules** filled with inflammatory cells, usually neutrophils or eosinophils.

- **Crusts** are consolidated, desiccated surface masses composed of various combinations of keratin, serum, cellular debris and often microorganisms.

Pattern analysis

- *Perivascular dermatitis*
- Interface Dermatitis
- Vasculitis
- *Nodular and diffuse dermatitis*
- *Intraepidermal vesicular and pustular dermatitis*
- *Subepidermal vesicular and pustular dermatitis*
- *Perifolliculitis, folliculitis, and furunculosis*
- *Fibrosing dermatitis*
- Panniculitis
- *Atrophic dermatosis*

Perifolliculitis, Folliculitis, and Furunculosis

- ***Folliculitis*** is inflammation of the hair follicle.
- ***Perifolliculitis*** means accumulation of inflammatory cells around a hair follicle.
- ***Furunculosis*** is occurs when the hair follicle ruptures releasing the contents into the dermis. It is a deeper infection of the hair follicle.
- These pathological findings are continuing of each other. Also, they can exist in the same case.

CONGENITAL AND HEREDITARY DISEASES OF SKIN

- ✶ Epitheliogenesis imperfecta
- ✶ Ichthyosis
  - # Ichthyosis fetalis
  - # Ichthyosis congenita
- ✶ Hereditary zinc deficiency
- ✶ Hereditary connective tissue disorders
- ✶ Congenital hypotrichosis
- ✶ Hypotrichosis associated with pigmentary Alterations
- ✶ Hypertrichosis
- ✶ Epidermolysis bullosa
- ✶ Canine dermatomyositis
- ✶ Canine inherited epidermal acanthotysis
- ✶ Dermatosis vegetans
- ✶ Dermoid cyst
- ✶ Cutaneous mucinosis of Chinese Shar-Pei dogs

Epitheliogenesis imperfecta

- Epitheliogenesis imperfecta (Aplasia Cutis)(EI) *is a congenital condition in which localized or widespread areas of the squamous epithelium of the skin and mucous membranes* ***are absent***.
- It is rarely observed in calves, piglets, foals, lambs, dogs and kittens.
- Lesions consist of sharply demarcated, variably sized defects in the epidermis or mucosa, resulting in exposure of a glistening, red, moist, hairless dermis, or oral or esophageal submucosa.

Epitheliogenesis imperfecta

- Hooves, nails and pinnae may be absent or poorly developed; teeth may be malformed.
- Fetuses with extensive lesions are generally born dead.
- Affected animals born live may die in early postnatal life because of infection or septicemia.
- In all species, *histologic lesions are an abrupt absence of epithelium and a lack of adnexal structures in the dermis or rare rudimentary hair follicles devoid of apocrine and sebaceous glands.*

Ichthyosis

- This term reflects the resemblance of skin to fish scales.
- *Ichthyosis is a heterogeneous group of disorders of cornification that are all characterized by hyperkeratosis and accumulations of scales*.
- Especially in cattle, dogs, pigs, chickens, laboratory mice, and lama.
- In cattle there are two basic forms: ichthyosis fetalis and ichthyosis congenita.

Ichthyosis

- In ichthyosis fetalis: Affected calves are stillborn or die shortly after birth. The skin is hairless and covered by thick scales divided into plates by deep fissures that represent normal cleavage planes of the skin.

Ichthyosis

- **Ichthyosis congenita** is a less severe form and affected calves live more.

Seborrhea Diseases of The Skin

- ***Seborrhea*** *is a term used to describe a broad range of conditions ranging from dry flaky skin to severe oily or scaling, crusty lesions with alopecia.*
- Seborrhea literally means "abnormal flow of sebum" however, the major clinical abnormality in seborrheic skin diseases is *altered keratinization*.

Seborrhea Diseases of The Skin

- Current terminology favors the use of the term *cornification defect* to cover all hyperkeratotic conditions from ichthyosis to flaky skin.
- The seborrheas can be divided into *primary idiopathic seborrhea* or *secondary seborrhea* where there is an underlying primary dermatosis.

Seborrhea Diseases of The Skin

The majority of seborrheic skin diseases are secondary.

- Causes:

❖ hormonal imbalances (especially hypothyroidism, hyperadrenocorticism and sex hormone imbalances),

❖ ectoparasitism (especially cheyletiellosis, pediculosis and demodicosis),

❖ endoparasitism,

❖ dermatophytosis,

❖ Hypersensitivities (inhalant, dietary, drug),

❖ abnormal lipid metabolism (malabsorption, liver or pancreatic disease, diabetes mellitus),

Seborrhea Diseases of The Skin

Causes:

- dietary deficiencies (fatty acids, protein, vitamin A, zinc),
- chronic catabolic states,
- environmental factors (especially hot, dry conditions),
- autoimmune disease (systemic lupus erythematosus, pemphigus foliaceus), and
- neoplasia (epitheliotropic lymphoma and internal malignancy).

- Seborrheic skin disease is reported most commonly in the dog, but also occurs in horses, cats, goats, sheep, cattle, rodents, and primates.

Seborrhea Diseases of The Skin

- **Clinically,** seborrheic skin disease is often separated into **three morphologic types:**
- **Seborrhea sicca** is characterized by dry skin with focal or diffuse flaking and accumulations of white-to-gray nonadherent scales.
- **Seborrhea oleosa** is characterized by focal or diffuse scaling associated with excessive lipid production that produces yellowish to brownish material that adheres to the skin and hair.
- **Seborrheic dermatitis** is characterized by scaling and greasiness with gross evidence of local or diffuse inflammation.

DISORDERS OF PIGMENTATION

- **Hyperpigmentation** (Melanoderma -melanotrichia)
  - ***Canine acanthosis nigricans***
- **Hypopigmentation** (*Leukoderma and leukotrichia)*
  - **Piebaldism and Albinism**
- **Vitiligo** ("blemish," vitiligo is a melanocytopenic hypomelanosis of humans and animals, which is characterized by gradually expanding pale macules that are often symmetrical or segmental in distribution.)

PHYSICOCHEMICAL DISEASES OF SKIN

Physical injury to skin

- Mechanical, frictional, and traumatic injury
  - Calluses
  - Hygroma
  - Decubitus ulcers
  - Intertrigo
- Cold injury
- Thermal (heat) injury

Thermal (heat) injury

- Heat may be applied to the skin in a variety of forms and, depending on duration and intensity, will produce *mild to severe necrotizing lesions*.
- *Dry heat causes desiccation and carbonization, whereas moist heat causes "boiling" or coagulation.*

Thermal (heat) injury

- Thermal injury in domestic animals may be caused by hot liquids, steam, heating pads, hair dryers, drying cages, hot metals such as wood stoves or car engines, fires, friction from rope "scalds," electrical burns from chewing electrical wires, improperly grounded electrocautery units, or lightning strikes.

Thermal (heat) injury

Burns

- **Burns** are classified into four degrees according to depth of injury.
- **First-degree burns** *involve only the epidermis. The* heated areas are erythematous and edematous as a result of vascular reaction in the dermis, but vesicles do not form.

- ***In* second-degree burns,** *the epidermis and part of the dermis are damaged. The* cytoplasm of the epithelial cells is hypereosinophilic, and the nuclei are shrunken or karyorrhexic.

Vesicles and bullae form in the epidermis, often at the dermoepidermal junction. The bullae contain serum, granular debris, and leukocytes.

- *In* **third-degree burns,** *the destructive effect of the heat extends full thickness through the epidermis and dermis,* causing coagulation necrosis of connective tissues, blood vessels and adnexa. Permanent scarring with loss of adnexa results.
- **Fourth-degree burns** *are similar in character to those of third degree but penetrate below the dermis to and beyond the subcutaneous fascia;* their local consequences depend on what lies underneath. Heat in surface tissue is conducted to deeper tissues via the blood and lymph.

PHYSICOCHEMICAL DISEASES OF SKIN

Chemical injury to skin

- ***Primary irritant contact dermatitis***
- ***Thallotoxicosis-*** *Thallium poisoning*
- ***Arsenic toxicosis***
- ***Mercury toxicosis***
- ***Cutaneous iodism***
- ***Selenium toxicosis***
- ***Organochlorine and organobromine toxicoses***
- ***Mimosine toxicosis***
- ***Gangrenous ergotism and fescue toxicosis***
- ***Tricothecene toxicoses***
- ***Vetch toxicosis ond vetch-like diseases***

Thallotoxicosis

- The heavy metal thallium is a potent toxin with pharmacological actions similar to lead and mercury.
- *It occurs chiefly in dogs,* less often in cats, sheep, cattle and pigs.
- The LDB0 for the dog is 10-15 mg/kg, and the toxin is cumulative.
- Absorption occurs rapidly from the gastrointestinal and respiratory tracts and skin.
- The toxin is disseminated widely in the body and is persistent, being very slowly excreted in bile and urine.

Thallotoxicosis

- The clinical effects depend on the dose and rapidity of administration.
- The *cutaneous lesions* develop 7-10 days after ingestion of thallium and principally affect frictional areas.
- The pattern of skin involvement in cats and dogs is characteristic, beginning at the commissures of the lips or nasal cleft, occasionally on the ear margins and expanding over the face and head.

Thallotoxicosis

- The mucous membranes are characteristically "brick-red" and may be ulcerated.
- The lesions are *marked erythema, scaling, alopecia, exudation, and crusting.*
- The paws often become very swollen.

ACTINIC DISEASES OF SKIN

- The radiant energy of the sun includes components that are potentially harmful to mammalian skin. This radiation is known as **actinic radiation,** and its acute effect is the well- known *sunburn* reaction.
- **Photosensitization** is essentially an *exacerbated form of sunburn,* caused by the activation ofphotodynamic chemicals in the skin by radiation of an appropriate wavelength.
- Chemical substances can be exogenous or endogenous and can reach to skin in a variety of ways .

ACTINIC DISEASES OF SKIN

- *Most of the direct photobiologic reactions in the skin are induced by high energy light in the ultraviolet radiation* ***UVB*** *range (290-320 nm).*
- **Wavelength causing damege is** below 290 nm **(UV-C).**

☼ Longer wavelengths of 320-400 nm constitute **UV-A** and (unless they are photodynamic agents) are the <u>least harmful</u> form of ultraviolet radiation.

ACTINIC DISEASES OF SKIN

- The skin is normally protected against the harmful effects of ultraviolet radiation, by such as the hair follicle, Str. Corneum and melanin.
- *Urocanic acid* (a metabolite of filaggrin) is a major *ultraviolet-absorbing* component of the stratum *corneum*.
- Melanin absorbs UV radiation, prevents it from spreading, minimizes the harmful by catching free radicals.

ACTINIC DISEASES OF SKIN

PHOTOSENSITIZATION

- A localized photodynamic agent increases the sensitivity of the skin to actinic radiation.
- The photodynamic agent usually reaches the skin via the systemic circulation, although percutaneous absorption of some photodynamic agents can cause local contact photosensitization.
- The agent may originate externally, or it may be an endogenous substance that has accumulated to an abnormal degree as a result of metabolic dysfunction.

ACTINIC DISEASES OF SKIN

PHOTOSENSITIZATION

- **The 3 categories of photosensitization are classified according to the source of the agents.**
- **In type I (primary) photosensitization, (exogenous sources),**
- **Type II photosensitization (inability to synthesis endogenous pigment),**
- **Type III photosensitization (hepatogenous photosensitization)(accumulation of phylloerythrin).**

Type I (Primer) photosensitization,

- ***Plants*** are the most common cause of primary photosensitization; hence herbivores are most commonly affected.

➠ St. John's wort **(Hypericum perforatum)(**horses, cattle, sheep and goats- h*ypericism*)**,**

➠ Buckwheat **(Fagopyrum spp.)(**sheep, pigs, cattle, goats, and horses- f*agopyrism*)**,**

➠ Spring parsley (Cymopterus watsoni), bishop's weed (Ammi majus) and Dutchman's breeches (Thamnosma texana)(cattle, sheep,white chickens, and ducks- furocoumarin= *psoralens*)**.**

➠ Phenothiazine photosensitization (*calves, sheep, swine, bird*.)

Type II Photosensitization (due to defective pigment synthesis),

- Photosensitization due to *endogenous pigment accumulation* is the result of a congenital enzyme deficiency causing abnormal heme synthesis with the resultant blood and tissue accumulation of photodynamic agents such as *uroporphyrin I, coproporphyrin I and protoporphyrin III.*
- In cattle, human and siamese cats are seen.

Type III (Hepatogenous) photosensitization,

- *The most common form of photosensitization in domestic animals occurs in conjunction with primary hepatocellular damage or, less commonly, bile duct obstruction and is due to impaired capacity of the liver to excrete the potent photodynamic agent,* **phylloerythrin**
- Phylloerythrin is a chlorophyll catabolite formed by microbial action in the intestinal tract and transported to the liver via the portal circulation.
- Hepatocytes assimilate the phylloerythrin and excrete it into the bile.

- One of the earliest signs of liver cell damage is a reduced ability to transport and excrete phylloerythrin.
- Mild renal tubular damage caused by some toxins may further inhibit the excretion of phylloerythrin.
- The circulating phylloerythrin accumulates in tissues including the skin.
- *Photodermatitis occurs provided the animal is on a chlorophyllrich diet and is exposed to sufficient solar radiation of the appropriate wavelength.*

- Toxic plants and mycotoxins account for most cases of hepatogenous photosensitization.
- A few of the many plants implicated in hepatotoxic photosensitization include lantana *(Lantana camara),* bog asphodel *(Narthecium ossifragum), Tribulus terrestris, Agave lecheguilla, Nolina texana, Cymadothea trifolii-infested* clover, *Trifolium hybridum* ("alsike clover poisoning"), and *Panicum* spp. grasses such as kleingrass *(Panicum coloratura).*

ACTINIC DISEASES OF SKIN

PHOTOSENSITIZATION

- The **gross lesions** are similar for all forms of photosensitization.
- They occur on those areas of the body most exposed to sunlight and which lack protective fleece, hair coat or skin pigmentation.

- *The initial reaction in photosensitization is erythema, followed by edema*.
- Vesicles or bullae may develop. There is marked exudation and extensive necrosis.
- Affected skin becomes dry and sloughs in desiccated sheets.
- There is swelling of the eyelids and excessive lacrimation.

- **Histologic lesions** mirror the gross lesions with *coagulative necrosis of the epidermis* and possibly the follicular epithelium, adnexal glands, and superficial dermis.
- Subepidermal clefts or vesicles form and the *dermis is edematous*.
- Endothelial cells and deep dermal vessels are often swollen or necrotic.
- Fibrinoid degeneration of vessel walls and thrombosis may be present.
- Initially, inflammation is sparse but soon the lesions are infiltrated by neutrophils. Secondary bacterial colonization is common.

NUTRITIONAL DISEASES OF SKIN

- Protein-calorie deficiency
- Fatty acid deficiency
- Hypovitaminoses and vitamin-responsive dermatoses
- Mineral deficiency
- *Canine zinc-responsive dermatoses*
- Zinc deficiency in ruminants

ENDOCRINE DISEASES OF SKIN

- Hypothyroidism
- Hyperadrenocorticism
- Hyperestrogenism
- Hyposomatotropism and hypersomatotropism
- Alopecia X
- Canine recurrent flank alopecia

IMMUNE-MEDIATED DERMATOSES

- Hypersensitivity dermatoses,
- Autoimmune dermatoses,
- Other immune-mediated dermatoses.

IMMUNE-MEDIATED DERMATOSES
(Hypersensitivity dermatoses)

- ***Urticaria and angioedema***
- ***Atopic dermatitis***
- ***Food hypersensitivity (allergy)***
- ***Allergic contact dermatitis***
- ***Insect hypersensitivity***
  - **Flea-bite hypersensitivity**
  - **Culicoides hypersensitivity**
- ***Hormonol hypersensitivity***
- ***Intestinal parasite hypersensitivity***

IMMUNE-MEDIATED DERMATOSES
(Hypersensitivity dermatoses)

- There are four basic types of hypersensitivity, which are either single or combined in the pathogenesis of allergic dermatoses.
- Type 1 immediate (atopic or anaphylactic) hypersensitivity reaction
- Type 2 hypersensitivity (cytotoxic hypersensitivity)
- Type 3 (immune complex) hypersensitivity,
- Type 4 (cell-mediated) hypersensitivity.

IMMUNE-MEDIATED DERMATOSES

- Hypersensitivity dermatoses,
- Autoimmune dermatoses,
- Other immune-mediated dermatoses.

IMMUNE-MEDIATED DERMATOSES
(Autoimmune dermatoses)

- **Pemphigus**
  - Pemphigus Vulgaris
  - Pemphigus Vegetans
  - Pemphigus Foliaceus
  - Pemphigus Erythematosus
- **Bullous pemphigoid**
- **Lupus Erythematosus**
  - Systemic Lupus Erythematosus (SLE)
  - Discoid Lupus Erythematosus (DLE)

IMMUNE-MEDIATED DERMATOSES (Autoimmune dermatoses)

Pemphigus

- **Pemphigus** refers to *a group of autoimmune skin diseases characterized clinically by pustules, vesicles, bullae, erosions and ulcers and histologically by loss of adhesion between cells (acantholysis).*

- Autoantibodies directed against antigens within various stratified squamous epithelia, including skin, mucocutaneous junctions, oral mucosa, esophagus, and vagina, develop and can be detected via immunologic assays.

IMMUNE-MEDIATED DERMATOSES
(Autoimmune dermatoses)

- Different types of pemphigus are recognized based on the level at which acantholysis occurs within the epidermis, and the clinical and immunological findings.

✶ **Pemphigus Vulgaris** (It is the most severe form. It is rarely seen in dogs and cats. It is especially seen in inguinal and axillary skin.)

✶ **Pemphigus Vegetans**

(It is quite rare. Only known in dogs.

✶ **Pemphigus Foliaceus** (It is seen in the superficial layers of the epidermis. It is the most common form of pemphigus in dogs, cats, horses and goats. The lesions in dogs and cats begin first through the nose and spread around the eyes, ears, neck and ventral abdomen.)

✶ **Pemphigus Erythematosus** (in Dogs and cats have been reported.

IMMUNE-MEDIATED DERMATOSES
(Autoimmune dermatoses)

☯ Bullous pemphigoid

- **Bullous pemphigoid** is *a chronic, autoimmune skin disease characterized clinically by vesicles, bullae and ulcers, and histologically by subepidermal vesicles /bullae containing eosinophils or other leukocytes*.
- Bullous pemphigoid occurs in *dogs, cats, pigs, and horses*, with no apparent age or sex predilection. *Collies* appear predisposed.

IMMUNE-MEDIATED DERMATOSES (Autoimmune dermatoses)

Lupus erythematosus

Systemic lupus erythematosus (SLE)

- Canine (Collies, Shetland Sheepdogs, German Shepherd Dogs) and feline (Siamese, Persian, and Himalayan) SLE occurs without clear age or sex predilections.
- **Polyarthritis, fever of unknown origin, anemia, thrombocytopenia, stomatitis, glomerulonephritis, and dermatitis are the most common manifestations.** Polymyositis, lymphedema, and neurological signs may also be present.
- Dermatological signs occur in 1/3 of affected dogs and cats.

IMMUNE-MEDIATED DERMATOSES
(Autoimmune dermatoses)

☯ Lupus erythematosus

✸ Systemic lupus erythematosus (SLE)

- Skin lesions tend to occur in areas exposed to sunlight such as the face, ears, nose, lips, and sparsely haired, lightly pigmented, thin skin of other body regions. Footpads may be hyperkeratotic or ulcerated. Nail beds may be involved.
- Gross skin lesions are extremely variable, from a mucocutaneous, ulcerative dermatitis resembling pemphigus vulgaris and bullous pemphigoid to erythema, scaling and alopecia of little specificity.

IMMUNE-MEDIATED DERMATOSES
(Autoimmune dermatoses)

Lupus Erythematosus

Discoid Lupus Erythematosus (DLE)

- DLE is described most commonly in the *dog* **(Collies, Shetland Sheepdogs, Siberian Huskies, and German Shepherds)** , and rarely in *horses and cats* **.**
- *Sunlight aggravate the lesions,* which typically affect the nasal planum in dogs and cats, and the face and neck in horses.
- In the dog, perioral, periocular, and pinnal skin may also be affected. The lesions include erythema, depigmentation, scaling, crusting, alopecia and occasionally ulceration.

IMMUNE-MEDIATED DERMATOSES

(Other immune-mediated dermatoses)

- ☆ Drug eruptions
- ☆ *Cryopathies*
- ☆ *Erythema multiforme*
- ☆ *Graft-versus-host disease*
- ☆ Toxic epidermal necrolysis
- ☆ Vasculitis,
- ☆ *Plasma cell pododermatitis*
- ☆ Rabies vaccine-induced vasculitis and alopecia in dogs,
- ☆ Linear IgA Dermatosis
- ☆ *Canine uveodermatologic syndrome (Vogt-Koyanagi-Harada (VKH) syndrome)*
- ☆ *Alopecia areata*
- ☆ *Cutaneous amyloidosis*

VIRAL DISEASES OF SKIN

- Cutaneous lesions occur in the course of a number of viral diseases in domestic animals.
- Viruses may induce skin lesions upon *local infection,* but the intact integument is resistant to viral penetration; injection via an arthropod bite or introduction through a cutaneous wound is a prerequisite for infection.

VIRAL DISEASES OF SKIN

- Pantropic viruses, such as *Canine distemper virus* and *Classical swine fever virus,* may cause cutaneous lesions; but *most viruses causing cutaneous lesions are epitheliotropic.*
- Some epitheliotropic viruses, in particular the Poxviridae, have a predilection for the epithelium of the skin.

Poxviral infections

The Poxviridae share group-specific nucleoprotein antigens. Animal poxviruses are in the subfamily Chordopoxvirinae.

- *Orthopoxvirus- Camelpox virus, Cowpox virus, Ectromelia virus* (mousepox virus), *Monkeypox virus, Vaccinia virus* (buffalopox virus, rabbitpox virus).
- ***Parapoxvirus*** - *Bovine papular stomatitis virus, Orfvirus* (contagious pustular dermatitis virus, contagious ecthyma virus), *Parapox virus of red deer, Pseudocowpox virus* (milker's nodule virus).
- *Avipoxvirus- Fowlpox virus, Pigeon-pox virus,* and many other avianpoxviruses.
- ***Capripoxvirus-*** *Goatpox virus, Lumpy skin disease virus, Sheeppox virus.*
- *Suipoxvirus- Swinepox virus.*

Poxviral infections

MACROSCOPIC POXVIRUS LESIONS

Pox lesions have a typical developmental sequence!!!

- Erythematous macules, is red scaly plaques with indistinct edge
- Papule a circumscribed, solid elevation of skin with no visible fluid, varying in area from a pinhead to 1 cm
- Vesicle (The vesicular stage is well developed in some pox infections, such as sheeppox, and is transient or non-existent in others, such as contagious pustular dermatitis) ,
- Pustule (Vesicles develop into umbilicated pustules with a depressed center and a raised, often erythematous border. This lesion is the so-called "pock'.),
- Crust (This crust may become very thick, as in lesions of contagious pustular dermatitis 2-4 mm. But it is thin in sheeppox).

Lesions heal and often leave a residual scar!!!

Poxviral infections

- ***Histologically,***
- Pox lesions begin as epidermal cytoplasmic swelling and vacuolation, usually first affecting the cells of the outer stratum spinosum.
- There is evidence, from experimental studies with the virus of contagious pustular dermatitis, that post-injury proliferating keratinocytes are the target for viral replication.
- Rupture of the damaged keratinocytes produces multiloculated vesicles, so-called *reticular degeneration*.

Poxviral infections

- The early dermal lesions include edema, vascular dilation, a perivascular mononuclear cell infiltrate and a variable neutrophilic infiltrate.
- Neutrophils migrate into the epidermis and aggregate in vesicles to form microabscesses.
- Large intraepidermal pustules may form and sometimes extend into the superficial dermis.

Poxviral infections

- There is usually marked epithelial hyperplasia and sometimes pseudocarcinomatous hyperplasia of the adjacent epithelium.
- This contributes to the raised border of the umbilicated pustule.
- Rupture of the pustule produces an inflammatory crust, often colonized on its surface by bacteria.

Poxviral infections

- Poxvirus lesions often contain *characteristic intracytoplasmic inclusion bodies*. These are single or multiple and of varying size and duration.
- The more prominent inclusions are designated *type A.*
- They are eosinophilic, reflecting their high protein content, and weakly Feulgen-positive.

Parapoxviral infections

- **Contagious pustular dermatitis**

  (Orf, Ecthyma Contagiousum)

- **Ulcerative dermatosis of sheep**

- **Pseudocowpox**

- **Bovine papular stomatitis.**

Contagious pustular dermatitis (Orf, Ecthyma Contagiousum)

- Contagious pustular dermatitis is a poxviral disease of *sheep and goats*, with incidental infections occurring in humans, camels, cows, and many wild ruminants, and very rarely dogs.
- The disease is caused by orf*virus, a Parapoxvirus*.
- Synonyms for contagious pustular dermatitis include contagious ecthyma, orf, infectious labial dermatitis, soremouth, and scabby mouth.

- The economic significance of contagious pustular dermatitis results chiefly from loss of condition, since affected animals neither suckle nor graze.
- Morbidity in a susceptible population may reach 90%, but mortality rarely exceeds 1% unless secondary infection intervenes, or unless the animals are immunosuppressed or stressed in which case mortality can be high.
- Cellulitis may complicate pedal lesions, mastitis may complicate mammary lesions, and necrotizing stomatitis and aspiration pneumonia may complicate oral lesions.

- Contagious pustular dermatitis affects sheep and goats of all breeds. *It is predominantly a disease of lambs and kids.*
- Infection is established through cutaneous abrasions, particularly those associated with dry and prickly pasture or forage.
- Clinically affected lambs may transmit the virus to the udder of the ewe.
- The virus is hardy and probably persists in a dry environment indefinitely in crust material shed from affected animals.

- *Gross lesions usually commence at the commissures of the lips and spread around the lip margins to the muzzle.*
- Primary lesions sometimes occur on the face about the eyes. In severe cases, lesions may develop on the gingiva, dental pad, palate and tongue.
- The buccal lesions are raised, red or gray foci with a surrounding zone of hyperemia.
- Very rarely, lesions extend to the esophagus, rumen and omasum in the lower alimentary canal, causing ulcerative gastroenteritis, and in lungs and heart.

Contagious pustular dermatitis (Orf, Ecthyma Contagiousum)

- Lesions of the mammary gland affect the teats and adjacent skin of the udder.
- Lesions on the limbs are less common and tend to involve the coronet, interdigital cleft, and bulb of the heels.
- *The lesions develop through the typical pox phases but are much more proliferative!!!*
- The vesicular stage is transient and pustules are flat rather than umbilicated.

Ecthyma Contagiousum

- The most significant feature of the gross lesion is the layer of thick brown-gray crust that may be elevated 2-4 mm above the skin surface.
- Depending on the degree of secondary infection, regression is usually complete by 4 weeks.
- Papillomatous growths, resulting from continued epidermal proliferation, sometimes occur.

Ecthyma Contagiousum

- ***The microscopic lesions;*** *of contagious pustular dermatitis are characterized*
- *by vacuolation and swelling of keratinocytes in the stratum spinosum,*
- *reticular degeneration,*
- *marked epidermal proliferation,*
- *intraepidermal microabscesses,*
- *and accumulation of scale-crust.*
- Basophilic intracytoplasmic inclusion bodies are reported as early as 31 hr post-infection and the inclusion bodies persist for 3-4 days.

Ecthyma Contagiousum

- Dermal lesions include superficial edema, marked capillary dilation, and mononuclear cell infiltration.
- A thick layer of scale-crust is built up, composed of ortho- and parakeratotic hyperkeratosis, proteinaceous fluid, degenerating neutrophils, cellular debris and bacterial colonies.
- The subsequent microscopic appearance of the lesions depends on the degree of secondary bacterial infection.

Capripoxviral Diseases

- ***Sheeppox***
- *Goatpox*
- **Lumpy-Skin Disease of Cattle**

Sheeppox

- *Sheeppox is the most serious of the pox diseases of domestic animals.*
- It exists in Africa, Asia, and the Middle East. The disease is exotic to the Americas, Australia, and New Zealand.
- Eradication measures eliminated the disease from Britain in the mid-19th century but have only recently been successful in Eastern European countries.

Sheeppox

- *Sheeppox causes extensive economic loss;*

❖Through high mortality,

❖reduced meat, milk or wool yields,

❖commercial inhibitions from quarantine requirements,

❖and the cost of disease prevention programs.

Sheeppox

- Transmission of infection is by direct contact with diseased sheep or indirect contact via contaminated environment.
- Fine-wooled Merino sheep are particularly sensitive.
- Sheeppox occurs in all ages of sheep with high morbidity, and mortality as high as 50%; but the disease is most severe in lambs, with mortality reaching 80-100%.

✵ Sheeppox virus is resistant to desiccation and remains viable for up to 2 months on wool or 6 months in dried crust.

Sheeppox

- Sheeppox is a systemic disease.
- Infection is usually by the respiratory route but may occur through skin abrasions.
- The incubation period is 4-7 days and is followed by a leukocyte-associated viremia. The virus localizes in many organs including the skin where the virus concentration is highest 10-14 days postinfection.

Sheeppox

- The initial clinical signs are fever, lacrimation, drooling, serous nasal discharge, and hyperesthesia.
- Skin lesions, which develop 1-2 days later, have a predilection for the sparsely wooled areas and typically involve eyelids, cheeks, nostrils, vulva, udder, scrotum, prepuce, ventral surface of the tail, and medial thigh.

Sheeppox

- **The macroscopic lesions** follow the typical pattern for pox infections.
- *Sheeppox lesions have a prominent vesicular stage .*
- The vesicles are umbilicated and, being multilocular, yield only a small amount of fluid if punctured.
- The pustule stage is characterized by the formation of a thin crust.

Sheeppox

- Highly susceptible animals often develop hemorrhagic papules early in the course of the disease and, later, ulcerative lesions in the gastrointestinal and respiratory tracts.
- Approximately one-third of animals develop multiple pulmonary lesions that *comprise foci of pulmonary consolidation.*

Reddish to whitish nodules in the lungs.

Sheeppox

- The kidneys have multifocal, circular, fleshy nodules throughout the renal cortices.

Sheeppox

- Healing of the skin lesions is slow, taking up to 6 weeks and a scar may remain.
- In the milder form of the disease, seen in endemic areas, the full range of pox lesions does not develop. Instead, epidermal proliferation produces papules covered by scale-crust, which heal with desquamation in a few days. Such lesions often occur on the ventral surface of the tail.

Sheeppox

- *Sheeppox lesions have the typical epithelial changes for the group,*

✓ *including marked vacuolar degeneration of stratum spinosum keratinocytes,*

✓ *microvesiculation,*

✓ *eosinophilic intracytoplasmic inclusion* **(Guarnieri)** *bodies,*

✓ *and epidermal hyperplasia.*

- *The* lesions affect both surface epithelium and that of the hair follicles.

Sheeppox

- The initial dermal lesions, corresponding to the macroscopic erythematous macule, are marked edema, hyperemia and neutrophilic exocytosis.
- During the papular stage, large numbers of mononuclear cells accumulate in the increasingly edematous dermis.
- These cells, first described by Borrel, are called "cellules claveleuses" or *"sheeppox cells"* and are characteristic of the disease.

Sheeppox

- The vacuolated cytoplasm contains single, occasionally multiple, *eosinophilic intracytoplasmic inclusion bodies*.
- Sheeppox cells are **virus-infected monocytes, macrophages and fibroblasts, but not endothelial cells.**

Sheeppox

- *The pulmonary lesions* are *proliferative alveolitis and bronchiolitis with focal areas of caseous necrosis*.
- Alveolar septal cells contain intracytoplasmic inclusion bodies.
- Additional histologic lesions, characterized by the accumulation of sheeppox cells, may involve heart, kidney, liver, adrenals, thyroid and pancreas.

Lumpy-Skin Disease

- Lumpy skin disease, caused by Lumpy skin disease virus of the Capripoxvirus genus, is a disease of cattle, buffalo, and occasionally other wild species of hoofstock, characterized by the eruption of multiple, well-circumscribed skin nodules, accompanied by fever, ventral edema, and generalized lymphadenopathy.
- Lumpy-skin disease is found throughout the African continent and Madagascar.
- Cattle of all ages, sex and breeds are affected.
- The disease occurs in epidemics. Epidemics tend to follow periods of prolonged rainfall, which favor population increases in vector species.
- Infection is transmitted mechanically by a variety of **biting insects.**

Lumpy-Skin Disease

- The morbidity is extremely variable.
- *Mortality is usually low;* around 1%.
- Economic losses are due to debilitation, loss of milk and meat production, damage to hides, and reproductive wastage due to ever-associated abortions and temporary sterility in bulls.

✵ The natural incubation period of lumpy-skin disease is 2-4 weeks.

Lumpy-Skin Disease

- **Clinically;** in severely affected animals, the development of large numbers of cutaneous lesions over most of the body is preceded by fever, marked weight loss, profuse drooling, oculonasal discharge, ventral edema and generalized lymphadenopathy.
- In the mild disease, there may be few isolated nodules and no prodromal fever.

Lumpy-Skin Disease

- *The cutaneous lesions are firm, circumscribed, flat-topped nodules 0.5-5.0 cm in diameter.*
- They may coalesce. The nodules have a creamy-gray color on cut section and involve the full width of the cutis, extending into the subcutis and occasionally adjacent muscles.
- Nodules affecting the scrotum, perineum, udder, vulva, glans penis, eyelids and conjunctiva are usually flatter, and in non-pigmented tissue are surrounded by a zone of intense hyperemia.

Lumpy-Skin Disease

- *Typically, nodules undergo central necrosis and sequestration.*
- But some may resolve rapidly and completely, and others may fail to separate but, instead, become indurated and persist as hard intradermal lumps for many months.
- Sequestration is preceded by central necrosis in the nodule and occurs rapidly.

Lumpy-Skin Disease

- When the sequestrum is removed, a deep ulcer remains which is slowly filled with granulation tissue.
- *Secondary bacterial infections* develop in the necrotic cores of the nodules and contribute very significantly to the seriousness of the disease.
- Large craterous ulcers develop which lead to lymphangitis and lymphadenitis.
- Local extension of lesions causes blindness, tenosynovitis, arthritis or mastitis.