364th Chinese Society of Veterinary Pathology

Veterinary systematic pathology

張皓凱(DVM, PhD candidate, Vet pathologist)

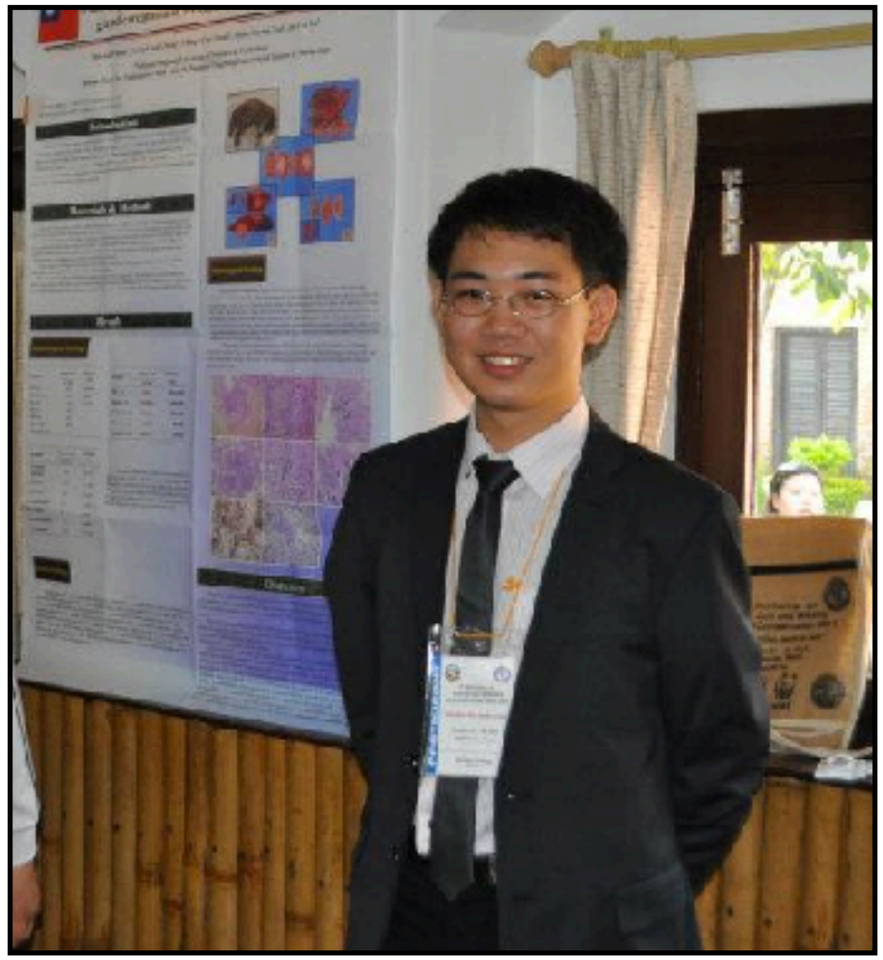
2018.09.07

Outline

- Resume
- Introduction: what is systematic pathology
- Study efficiently for the test of veterinary pathologist
- Integument system - for example
- Conclusion

Resume

- 張皓凱 Hao-Kai Chang
  - 2013年 屏東科技大學獸醫系 學士
  - 2017年 中興大學獸醫病理生物學研究所 博士候選人
  - 2017年 中華民國獸醫病理學會 獸醫病理專科獸醫師
  - 學經歷
    - 2010 - 2013：屏東科技大學獸醫病理研究室
    - 2012、2013年：亞洲野生動物醫學研討會(ASZWM)—尼泊爾、泰國
    - 2015年：亞洲獸醫病理學會會議(ASVP)—菲律賓
    - 2016年：日本山口大學交流
    - 中華民國獸醫病理學會、比較病理學會會員，歷年學會發表病例約50例以上



What is Pathology ?

- Pathos = disease; logos = study

  - ☑ a significant component of the "causal study of disease" wikipedia

Subdivisions of basic pathology

- General pathology

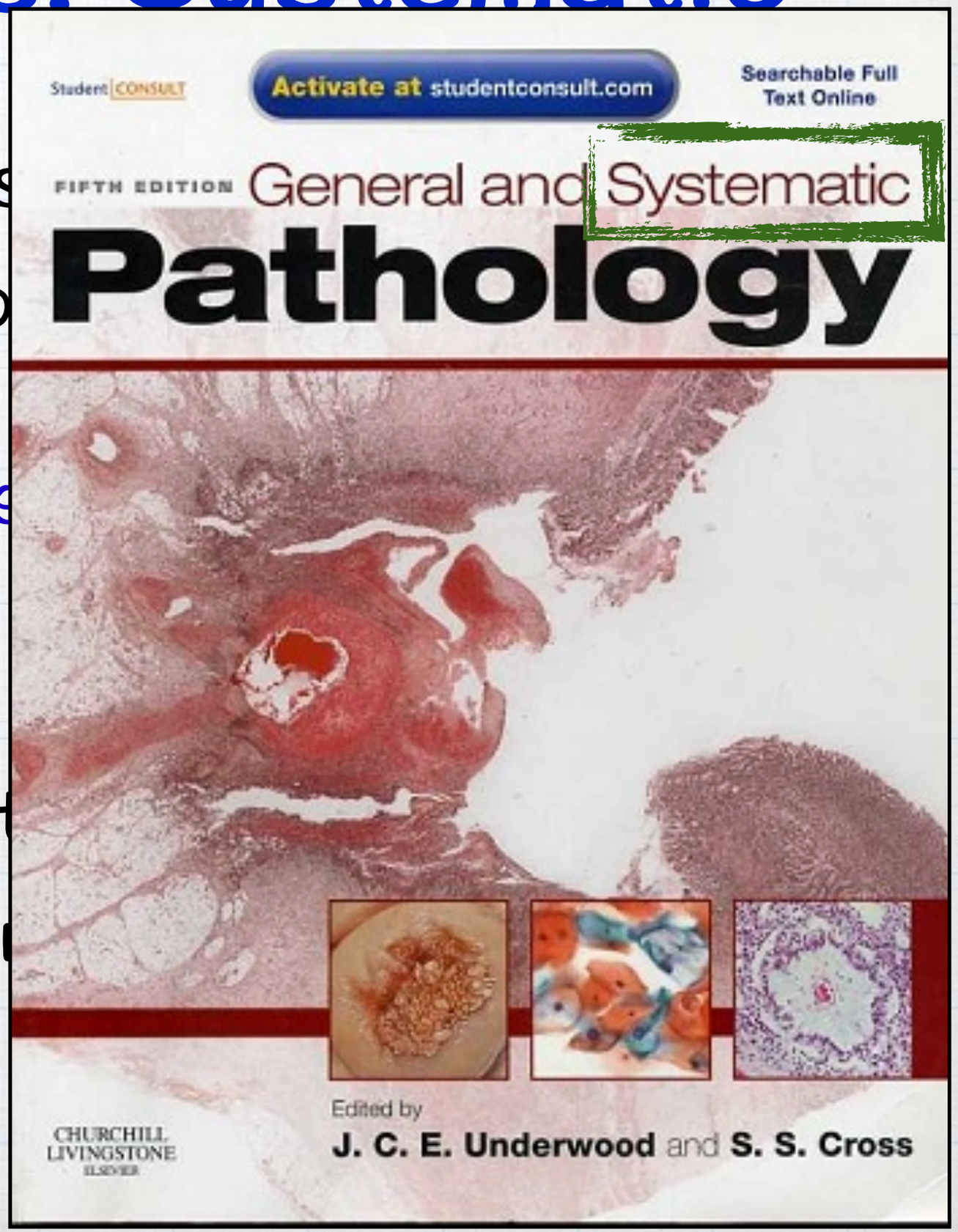
  - reactions of cells and tissues to abnormal stimuli

- **Systematic pathology**

  - alternations in specialized organs and tissues that are responsible for disorders that involves these organs

Systemic v.s. Sustematic

- **Systemic**: describes
  an entire process o
  - e.g., systemic infe
- **Systematic**: refers
  carried out in a met
  manner, like a recor
  investigation



SECTION I General Pathology

SECTION II Pathology of Organ Systems

Subdivisions of Pathology

- Systematic pathology

  - ☑ alternations in specialized organs and tissues that are responsible for disorders that involves these organs

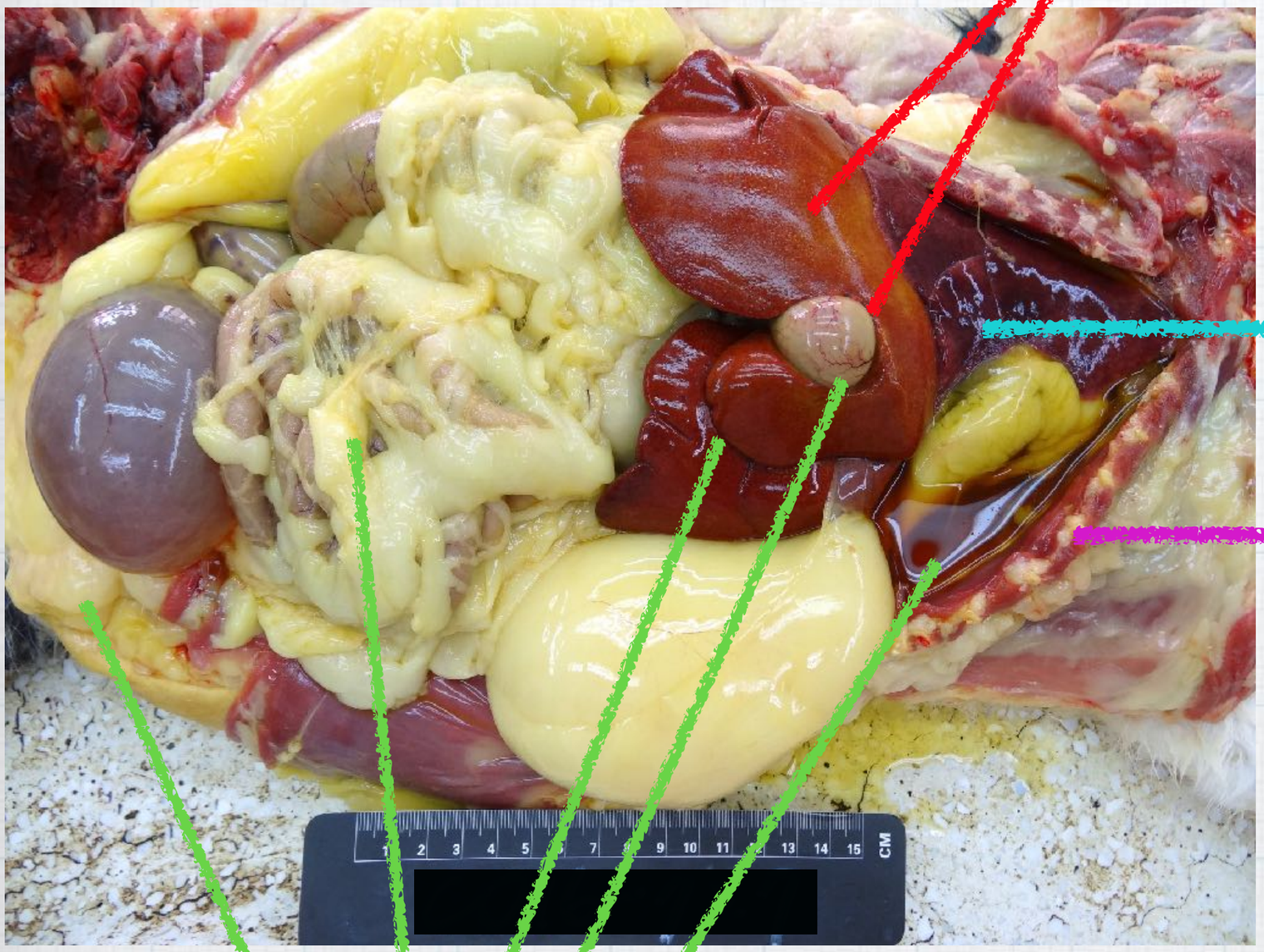
    - clinical manifestation
    - morphological changes
    - diagnosis
    - etiology
    - pathogenesis

https://slideplayer.com/slide/8899026/#

A case for example


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
CM

hepatobillary system ?



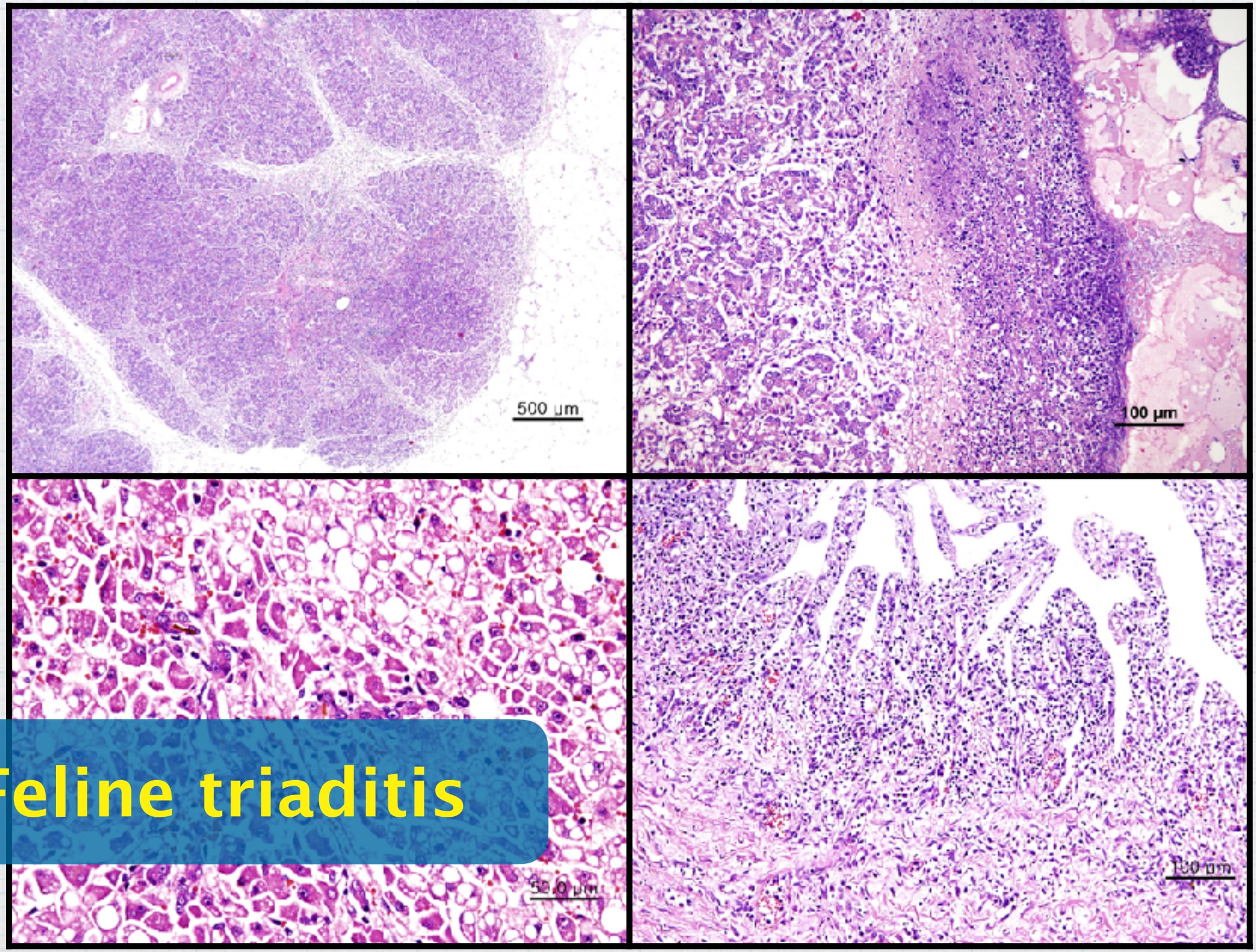
respiratory system ?

skeleton system ?
endocrine system ?

hepatobillary system ?
circulatory system ?
BM, and lymphoid system ?

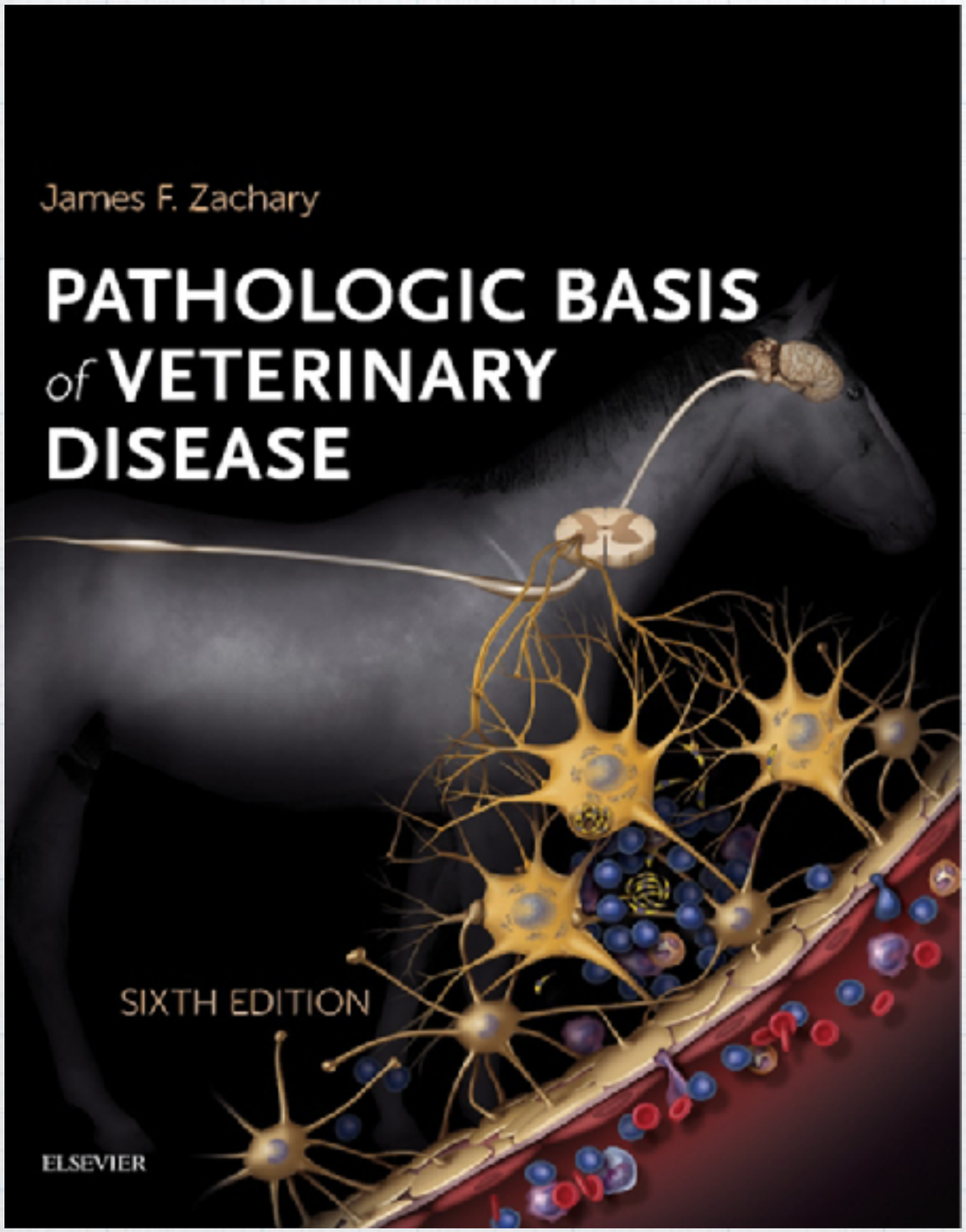
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

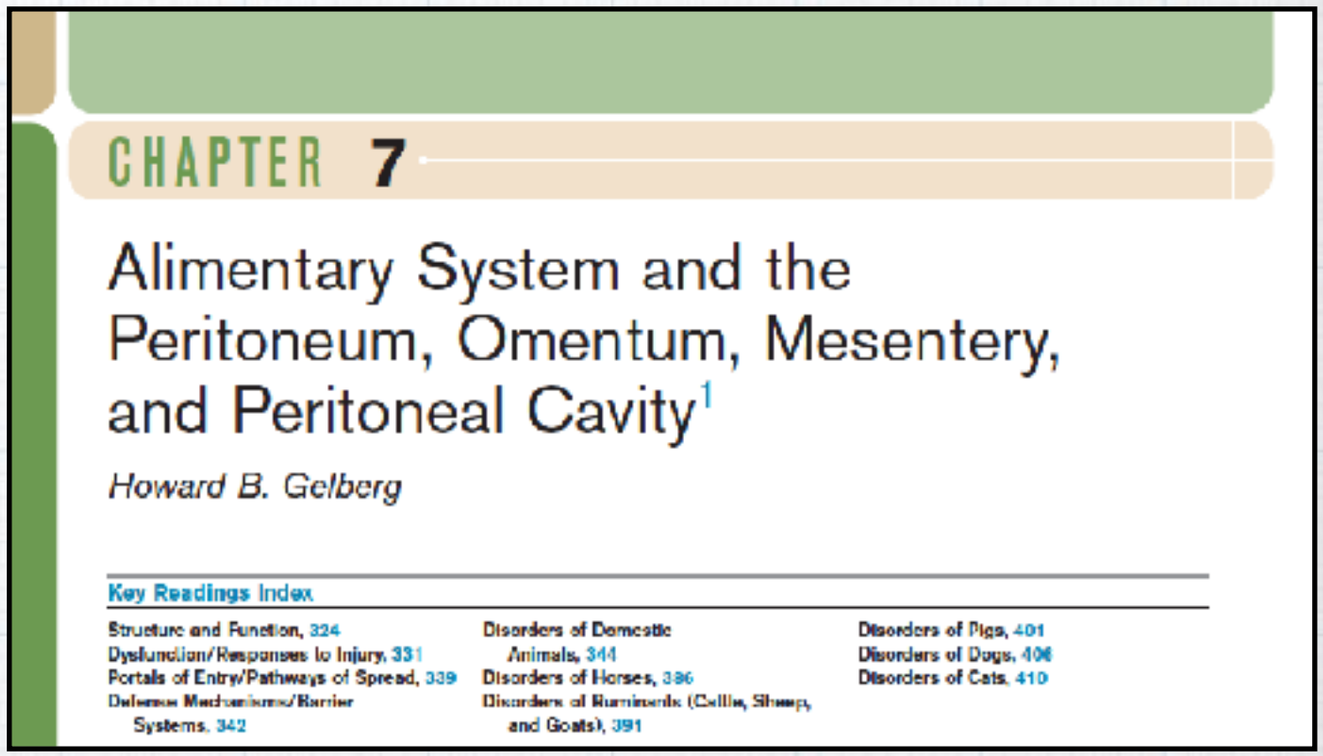
Histopathology



Feline triaditis

Study efficiently





CHAPTER 7

Alimentary System and the Peritoneum, Omentum, Mesentery, and Peritoneal Cavity[1]

Howard B. Gelberg

Key Readings Index

Pathologic basis of veterinary disease, 6th

Systematic pathology

- Normal structures and functions of the organs
- Gross morphological changes of the organs
- Histopathological changes of the organs
- Classification of the organs diseases
  - ☑ congenital, **infectious**, environmental
  - ☑ etc…
- Pathogenesis of the diseases

The function of the alimentary system as a whole is to take ingested feedstuffs, grind them and mix them with a variety of secretions from the oral cavity, stomach, pancreas, liver, and intestines (digestion), and then to absorb the constituent nutrients into the bloodstream and lacteals. Undigested ingesta, effete neutrophils, fresh (hematochezia) or digested (melena) blood, and excess secretions are passed from the body into the alimentary lumen and thus become a component of the feces. The quality and quantity of the feces and clinical signs, such as regurgitation and vomiting, are often early indicators of alimentary dysfunction.

Oral Cavity

The physiologically normal oral mucosa is smooth, shiny, and pink. It is composed of variably keratinizing, stratified squamous epithelium (mucous membranes). In animals in which the oral mucosa is heavily pigmented (melanosis), assessment of circulatory function (capillary refill time) and color as an indicator of red blood cell concentration (packed cell volume) can be difficult. In these cases, examination of conjunctiva and rectal and urogenital mucosa can be substituted. The oral cavity is where ingested materials are masticated; mixed with digestive enzymes, such as those in saliva; and passed on through the oropharynx to the esophagus.

Teeth

Teeth provide mechanical advantage for prehension, tearing, and/or mastication of food. Among domestic animals there are differences in the growth pattern and numbers of teeth. Hypsodont teeth, such as in the horse, continue to grow throughout life, and appropriate leveling of the occlusive surfaces (floating) may be a necessary procedure to prevent malocclusion and sharp edges that can lacerate the adjacent buccal mucosa and interfere with appropriate mastication as the horse ages. Brachydont teeth, such as in carnivores, do not continue to grow after they are fully erupted. Most species of mammals have deciduous teeth that are replaced near maturity by permanent teeth. In many species the approximate age of the animal may be determined by eruption date and examination of wear patterns and shape of the teeth.

Molar teeth in general are designed for grinding feedstuffs, whereas incisors in ruminants (mandibular only) are for cropping forage. Canine teeth are designed for tearing flesh. Brachydont teeth consist of a crown, which is the portion above the gingiva; the neck, which is slightly constricted; and, just below the gingiva, the roots, which are embedded in the bony socket (alveolus) of the jaw. Enamel covers the crown, cementum covers the roots, and both cover the dentin. Besides carnivores, the incisor (lower) teeth of ruminants and porcine teeth, except the canines of the boar, are brachydont.

Hypsodont teeth have an elongated body, but the neck and roots may form later in life. Cementum covers the tooth, and enamel is beneath the cementum. Beneath the enamel is the dentin. The cementum and enamel invaginate into the dentin, forming the infundibula. Enamel crests result from normal wear, with enamel being the hardest of the layers. The cheek teeth of ruminants, tusks of boars, and the teeth of horses are hypsodont.

In simple-toothed animals, such as carnivores, the tooth root is not covered by enamel. Receding gingiva therefore expose the dentin, resulting in pain and invasion by bacteria. Domestic animal species seldom get caries, although buildup of plaque can result in gingival infections, osteolysis, and tooth loss.

Tonsils

The palatine tonsils are pharyngeal lymphoid structures covered by stratified squamous epithelium. Their function is uncertain, although it is likely they serve in lymphocyte production and antibody formation (see Chapters 5 and 13). In carnivores they are found in crypts or recesses at the dorsolateral aspect of the caudal oropharynx. In pigs they are flat and recognized by tiny pores in the surface epithelium of the caudal soft palate. Horses, ruminants, and pigs have lingual tonsils in addition to palatine tonsils.

Salivary Glands

Salivary glands are found in a variety of locations in the head and neck regions and vary in number and location from species to species. They arise from oral ectoderm. In all species the major salivary glands include the parotid, mandibular, and sublingual. Carnivores have a zygomatic gland as well. Minor salivary glands include buccal, labial, lingual, palatine, and others similarly named by location.

Most salivary glands are discrete aggregates of compound tubuloalveolar tissue. Saliva is a mixture of serous and mucoid secretions. Saliva lubricates the mouth and esophagus and moistens ingesta. Saliva also dissolves water-soluble components of food so the taste buds can function. The mucus in saliva binds to masticated food and creates a bolus that is more easily swallowed. Salivary mucus also coats the epithelium of the mouth, preventing mechanical damage to the tissue. Saliva, through its flushing action, reduces bacterial populations. Saliva contains a lysozyme that lyses bacteria. Carbohydrate digestion begins in the oral cavity as a result of the presence of α-amylase, which changes starch into maltose. There are very small quantities of this enzyme in carnivores and cattle. Saliva also is an effective buffer, especially in ruminants, whose forestomachs have no glands. In carnivores, evaporation of saliva is a major mechanism of thermoregulation.

Tongue

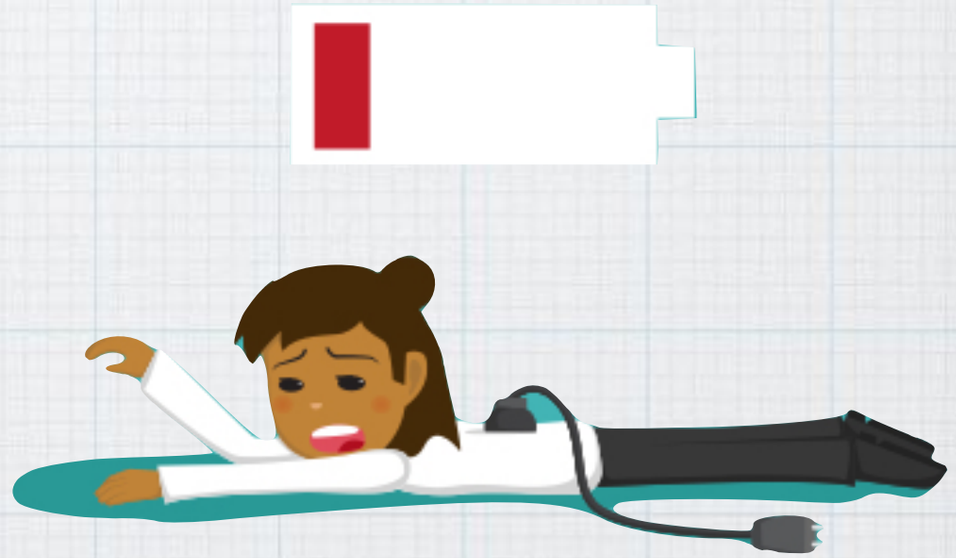
The tongue is a muscular organ covered by stratified epithelium and is functionally connected to the esophagus via the epiglottis. It is necessary for prehension, mastication, and swallowing of feedstuffs and water. The epithelial covering of the tongue is stratified squamous with various degrees of keratinization dorsally, but ventrally the epithelium is not keratinized and the tongue attaches to the floor of the oral cavity by a frenulum. Keratinized papillae are most prominent in ruminants and cats. There are various types of papillae, some with secondary lamellae. Vallate papillae, for example, are on the dorsal surface of the tongue near its origin and are flat structures completely surrounded by a cleft. Some surface macroscopic papillae contain taste buds. The tongue is a highly vascular (functioning in heat loss in many animals, especially carnivores that have no sweat glands) and sensitive organ containing a variety of serous and mucus glands and sensory cells (taste buds). The muscular part of the tongue is striated in randomly arranged bundles. A cordlike structure enclosed in dense collagen extending lengthwise near the ventral central surface of the tongue of carnivores is called the lyssa. Porcine and equine tongues have a similar structure. The lyssa appears to be a structure without a function. Historically the lyssa was removed as "prevention" for rabies. Lyssa bodies are synonymous with Negri bodies, and rabies used to be called lyssa. Adipose tissue becomes more abundant in the caudal part of the tongue in most species.

Esophagus

Under normal circumstances the esophageal lumen is a potential space. The wall collapses when the esophagus is not transporting ingesta. The esophagus extends from the aboral end of the oropharynx, passes through the mediastinum and the diaphragmatic hiatus, and ends at the stomach. The esophagus is lined by nonkeratinizing stratified squamous epithelium in carnivores and is keratinized in

There are too many words in the text.

It is impossible to study all.



Pathologic basis of veterinary disease, 6th

Although some differences exist, the stomachs of the simple-stomached animals and the abomasum of ruminants (third compartment of New World camelids) are very similar in structure and function. A fundus and body make up the cranial portion, lined by numerous spiral folds and produce acid and pepsin. The distal portion, the pyloric part, is lined by epithelium with mucus-secreting glands and G cells that produce gastrin. Stomachs have an indigenous flora. Most of these organisms cannot be cultured by traditional methods. CS of New World camelids is more tubular than the abomasum, with more peristalsis-like rather than mixing motility. The first two thirds of CS is homeostatic with a pH of approximately 5.5. At the caudal flexure the mucosa thickens to 7 to 10 mm and the pH is around 2.0. The final portion surrounding the true pylorus has an alkaline pH.

Intestine

The intestines might be thought of as a tube within the body cavity that carries material (ingesta/digesta) through the body. The overall anatomic and histologic organization of this digestive tube is illustrated in Figure 7-2. By the action of enzymes, microbial flora, and added secretions from the liver and pancreas, ingesta are broken down, nutrients are absorbed into the body, and waste products are excreted. To perform these functions the intestinal tract has a very large surface area, which is accomplished by the following three means.

1. The intestine is coiled in the abdomen.
2. Numerous intestinal folds contain villi that notably increase the number of cells contacting the ingesta (Fig. 7-3, *A* and *B*).
3. Each enterocyte has a microvillous border, further increasing the surface area available for digestive and absorptive processes (see Fig. 7-3, *C*).

Herbivores have larger intestines than carnivores or omnivores and need a homeostatic vat, either the rumen or cecum, to digest cellulose. Within the smooth muscle layers and villi are the nerve network of the enteric nervous system.

The intestinal mucosa is composed of three layers—a single cell thick layer of epithelial cells lining the intestinal lumen

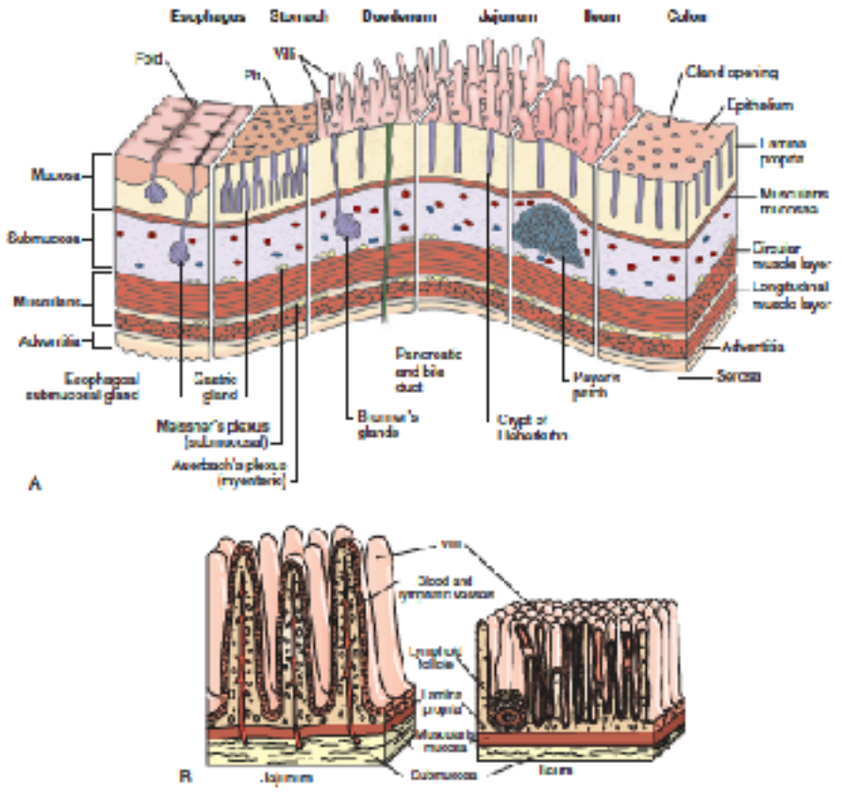


Figure 7-2 **Anatomic and Histologic Organization of the Digestive Tube.** A, Entire digestive tube. B, Higher magnification of the jejunum and ileum.

Figures are good tools to learn pathology

Pathologic basis of veterinary disease, 6th

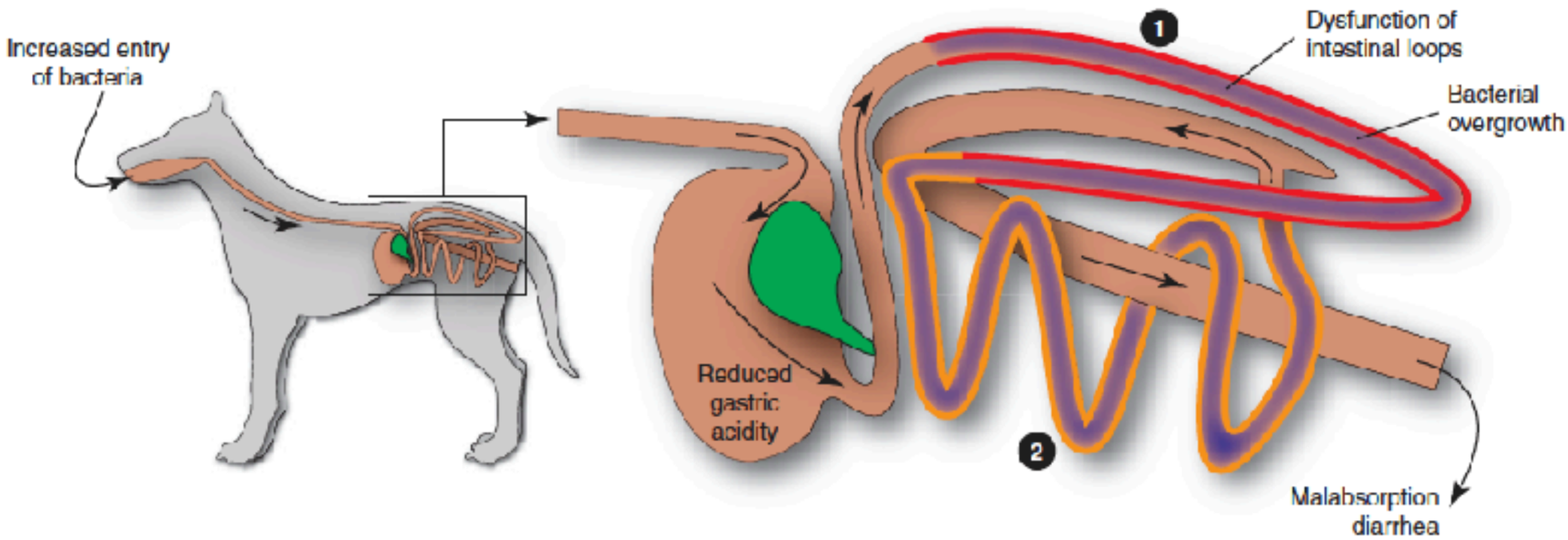


Figure 7-9 **Mechanism of How Intestinal Bacterial Overgrowth Causes Malabsorption and Diarrhea.** *1*, Bacterial overgrowth results from a combination of increased ingestion of bacteria, dysfunction of intestinal loops, and reduced clearance of bacteria. These processes result in excessive multiplication of bacteria and thus bacterial overgrowth in the intestines. *2*, Malabsorption and diarrhea occur as a result of bacterial overgrowth leading to bile salt deficiencies, excessive bacterial toxins, and overconsumption of resources by bacteria. (Co… State University; and Dr. J.F. Zachary, College of Veterinary Medicine, University of Illinois.)

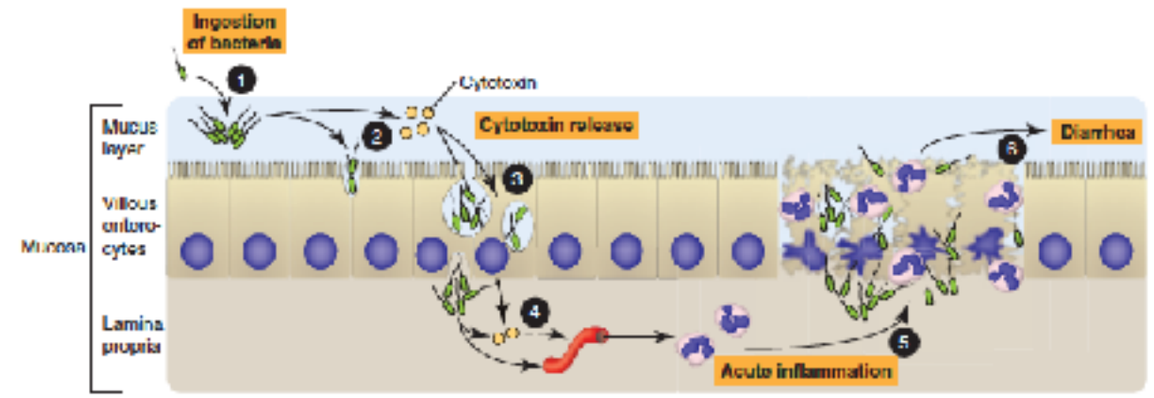


Figure 7-11 **Mechanism of Invasive and Cytotoxin-Mediated Bacterial Inflammation.** *1*, Colonization of the mucosa. *2*, Local production of cytotoxins and invasion of the mucosa by bacteria. *3*, Bacteria replicate in large numbers and spread to adjacent epithelial cells. *4*, Bacterial cytotoxins are released and injure adjacent mucosal endothelial cells and cause acute inflammation. *5*, Acute inflammation results in necrosis of the mucosa. *6*, Mucosal necrosis and bacterial toxins cause diarrhea. (Courtesy Dr. H. Gelberg, College of Veterinary Medicine, Oregon State University; and Dr. J.F. Zachary, College of Veterinary Medicine, University of Illinois.)

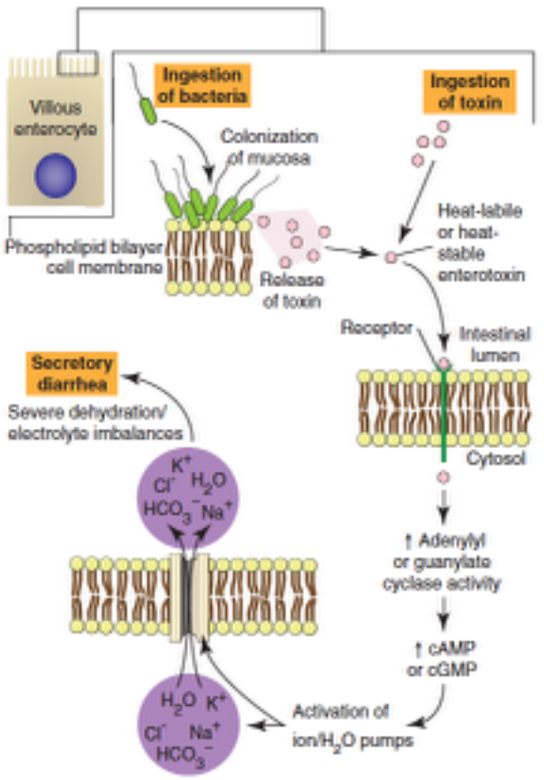


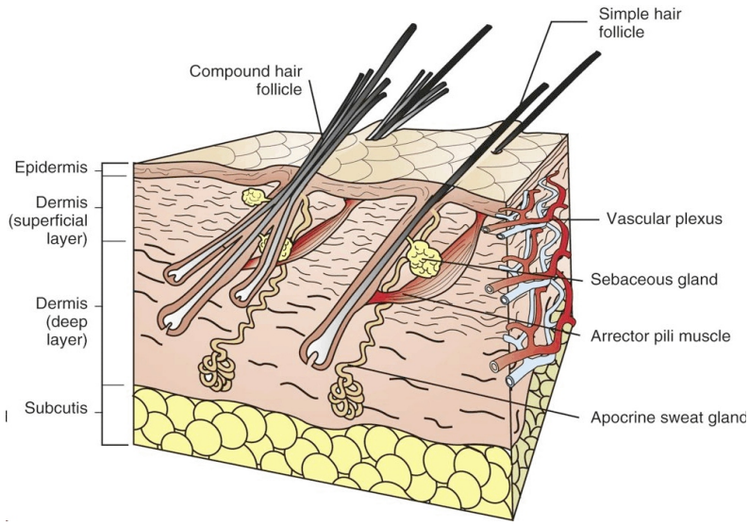
Figure 7-10 **Mechanism of Action for Enterotoxin-Mediated Bacterial Diarrhea.** *cAMP*, Cyclic adenosine monophosphate; *cGMP*, cyclic guanosine monophosphate. (Courtesy Dr. H. Gelberg, College of Veterinary Medicine, Oregon State University; and Dr. J.F. Zachary, College of Veterinary Medicine, University of Illinois.)

PATHOLOGY OF THE INTEGUMENTARY SYSTEM

Paul Hanna DVM, MSc, DACVP

Systemic Pathology I (VPM 2210) **Fall 2017**

References: http://people.upei.ca/hanna
Pathologic Basis of Veterinary Disease, Zachary, 6th edition, 2017, Chapter 17
Pathology of Domestic Animals, Maxie, 6th edition, 2016, vol 1, Chapter 6



Source: Textbook of Veterinary Histology, 3rd ed, 1987

NORMAL STRUCTURE AND FUNCTION (background information only)

- the skin is the largest organ of the body and consists of the following components:
  ① **Epidermis**
  - is composed of several cell types, ie keratinocytes, melanocytes, Langerhans cells, Merkel cells.

  ② **Adnexa** (appendages of the skin)
  - hair, glands (sebaceous, apocrine, eccrine; also circumanal, tail, anal), claws / nails and hooves.

  ③ **Dermis**
  - consists of **fibers** (collagen, reticulin, elastin), **ground substance** (glycosaminoglycans, proteoglycans), **cells** (fibroblasts, mast cells, histiocytes, smooth muscle), **vessels** (blood, lymph), **nerves**.

  ④ **Hypodermis** (subcutis)
  - consists of **lipocytes** (panniculus adiposus, digital cushion), **fibers** (collagen, elastin), **vessels**, **nerves**.
- epidermis is continuously renewed (~22 days in dogs); keratinocytes arising from stem cells in the basal layer differentiate as they move through the spinous, granular & corneum layers and are then shed from the surface.
- **keratinocytes** are tightly bonded to each another by spot-like adhesion structures called desmosomes; the cell adhesion molecules desomogleins & desmocolins are the transmembrane components of desmosome.
  - the basal keratinocytes are adhered to the underlying basal lamina (basement membrane zone) by hemidesmomes; the basal lamina is attached to the underlying dermis by anchoring fibrils.
  - the thickness of the stratum spinosum is inversely proportional to the thickness of the hair coat; ie very thin epidermis in dogs and cats, thicker in horses and cattle and thickest in pigs and humans.
- **melanocytes** are typically scattered throughout the basal layer of the epidermis (& hair bulbs) where they inject melanin pigment granules into keratinocytes (& hair) to provide coloration and protection against UV-light.
- **Langerhans (dendritic) cells** are antigen processing & presenting cells scattered throughout the epidermis.
- **Merkel (tactile) cells** have both mechanoreceptor and neuroendocrine functions.

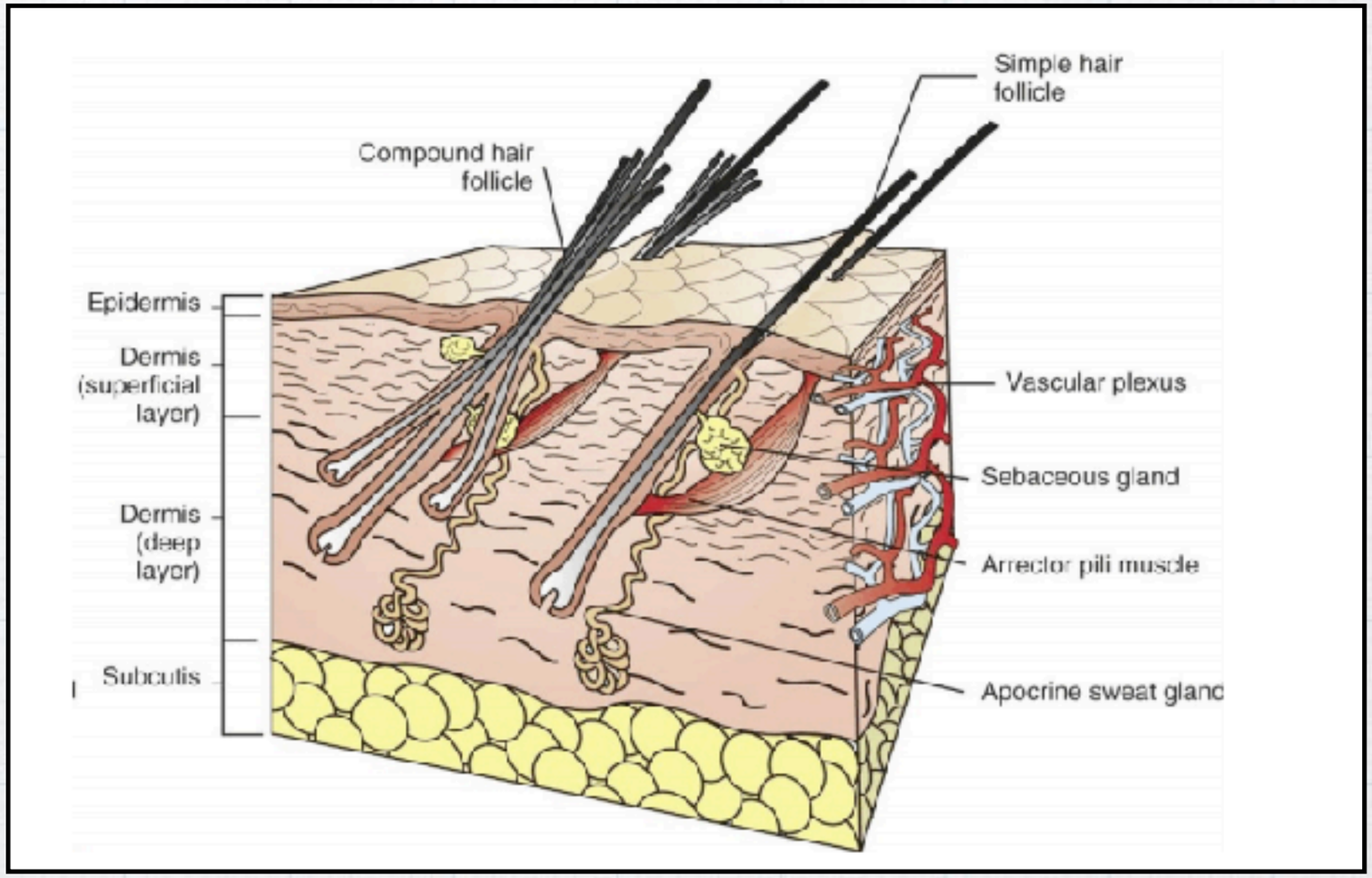
You can obtained some of the informations that has been compiled easily.

Integument system

- for example

Normal structures and functions

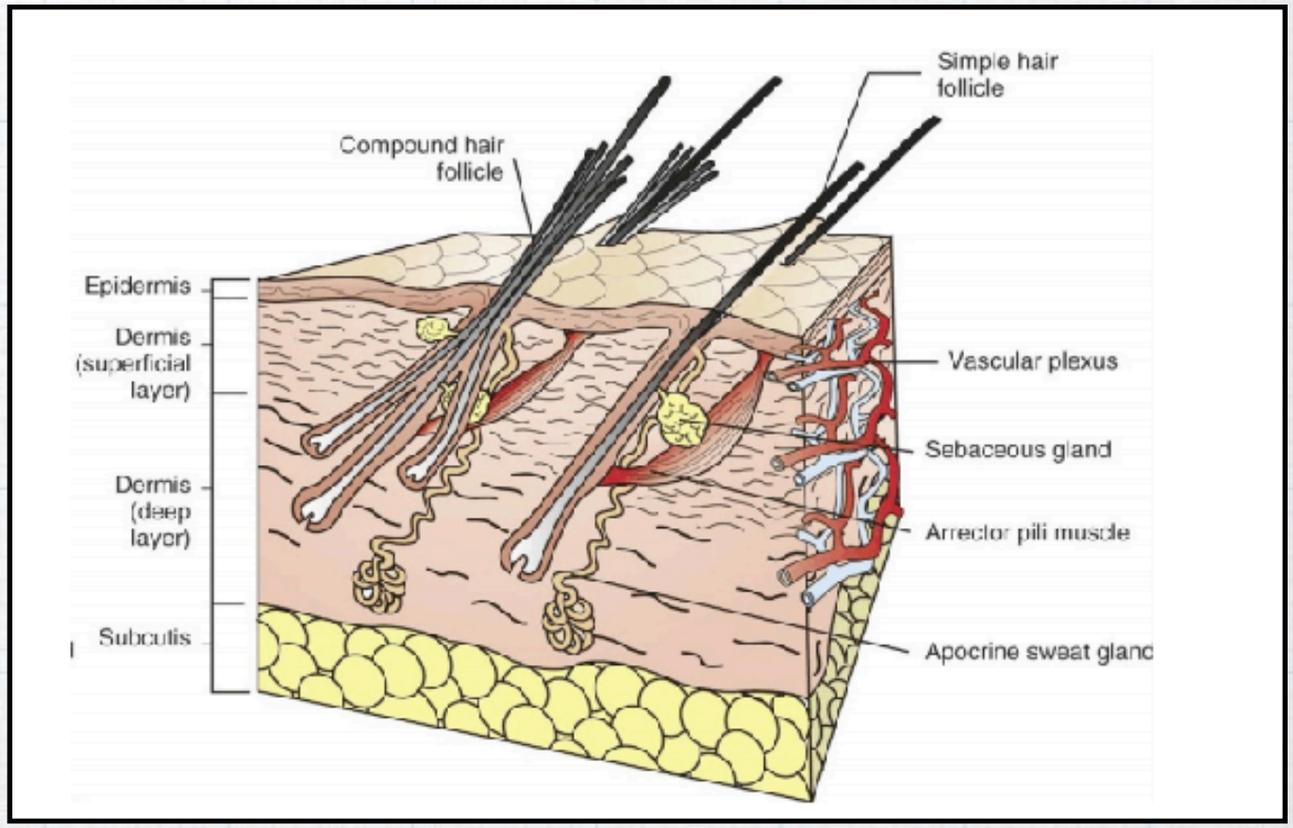
- Epidermis
- Adnexa
- Dermis
- Hypodermis



The largest organ of the animals' body

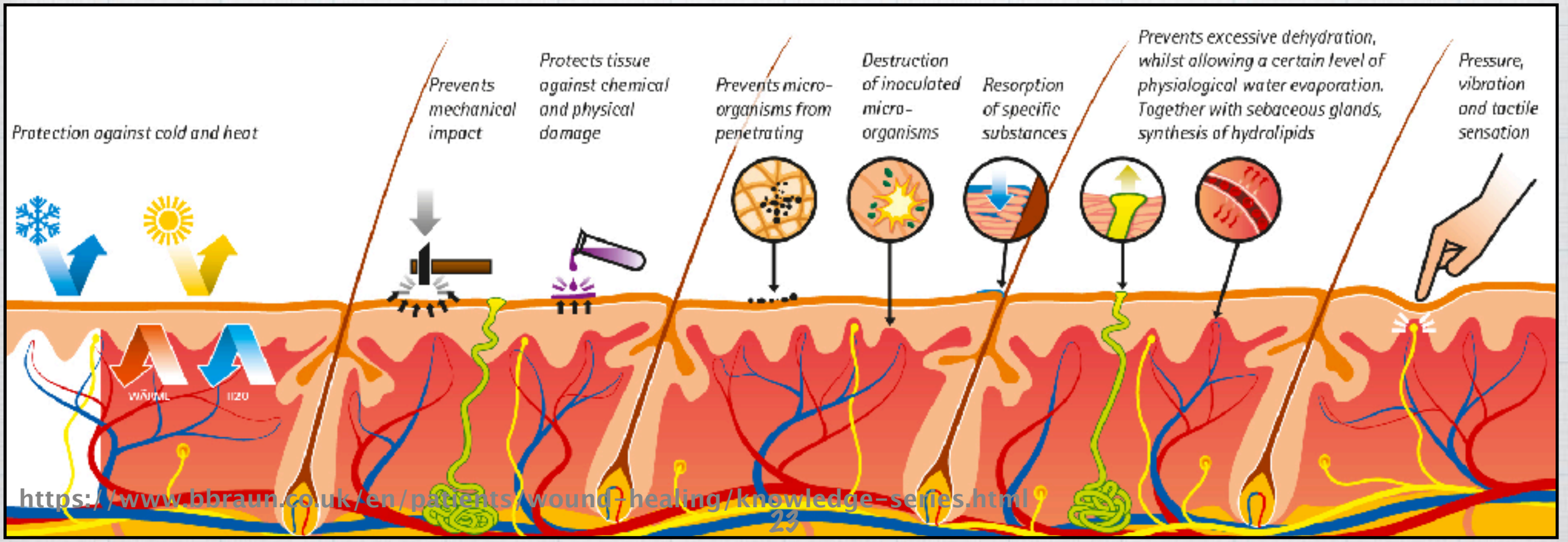
Normal structures and functions

- Epidermis
  - ☑ keratinocytes, melanocytes, Langerhans cells, Merkel cells
- Adnexa
  - ☑ hair, glands, claws, nails,
- Dermis
  - ☑ fibers, fibrocyte, vessels, nerves
- Hypodermis
  - ☑ lipocytes, fibers, vessels



General functions of the integument system

- Barrier, and protection
- Sensory perception
- Temperature and blood pressure regulation



https://www.bbraun.co.uk/en/patients/wound-healing/knowledge-series.html

Table 17-4 Differential Diagnoses of Selected Patterns That Can Be Recognized Clinically and Histologically

PATTERN						
Pustules Crusts (epidermal)	Vesicles Bullae (epidermal to subepidermal)	Necrosis or ulceration (epidermal)	Scaling or other hyperkeratotic lesions* (epidermal)	Nodules ± draining sinuses (dermal and pannicular)	Alopecia (adnexal)	Hypopigmentation or depigmentation (epidermal)
DISORDERS						
Superficial bacterial infection Pemphigus foliaceus and panepidermal pustular pemphigus Dermatophilosis Exudative epidermitis Subcorneal pustular dermatosis Pawpads* Pemphigus foliaceus Superficial necrolytic dermatitis Lupus erythematosus	Pemphigus vulgaris Paraneoplastic pemphigus Lupus erythematosus Dermatomyositis Subepidermal bullous dermatoses Drug reactions Chemical and thermal burns Photosensitization Viral diseases	Vasculitis/ infarction Chemical and thermal burns Superficial necrolytic dermatitis Erythema multiforme Stevens-Johnson syndrome Toxic epidermal necrolysis Ergot/fescue grass toxicity Frostbite Feline indolent ulcer Feline ulcerative dermatitis syndrome Vesicular cutaneous lupus erythematosus Self-trauma Epitheliogenesis imperfecta	Primary seborrhea Ichthyosis Zinc-responsive dermatosis Sebaceous adenitis Ear margin seborrhea Vitamin A responsive dermatosis Feline exfoliative dermatitis with and without thymoma Callus Cutaneous horn Solar (actinic) dermatosis	Masses caused by deep infections with bacteria, fungi, algae, *Pythium*, migratory parasites (e.g., abscesses, actinomycosis, feline leprosy, mycetoma, blastomycosis, pythiosis, habronemiasis) "Sterile" nodular inflammation (e.g., foreign body reactions, histiocytosis, sterile pyogranuloma, xanthoma, venomous bites, injection site reactions, eosinophilic granulomas) Panniculitis/ steatitis Neoplasms	Folliculitis: infectious/ noninfectious Postinflammatory and posttraumatic Endocrine alopecia Cyclic, idiopathic and seasonal alopecias Telogen effluvium Anagen effluvium Prolonged alopecia postclipping Follicular dysplasia Congenital alopecia and hypotrichosis Feline psychogenic alopecia Poor nutrition with protein deficiency Feline pancreatic paraneoplastic alopecia	Vitiligo Uveodermatologic syndrome Lupus erythematosus Copper deficiency Alopecia areata (healing stage) Inherited disorders (Chédiak-Higashi syndrome, Maltese and other coat color dilutions) Waardenburg-like syndrome Piebaldism Albinism Cyclic hematopoiesis Contact with rubber

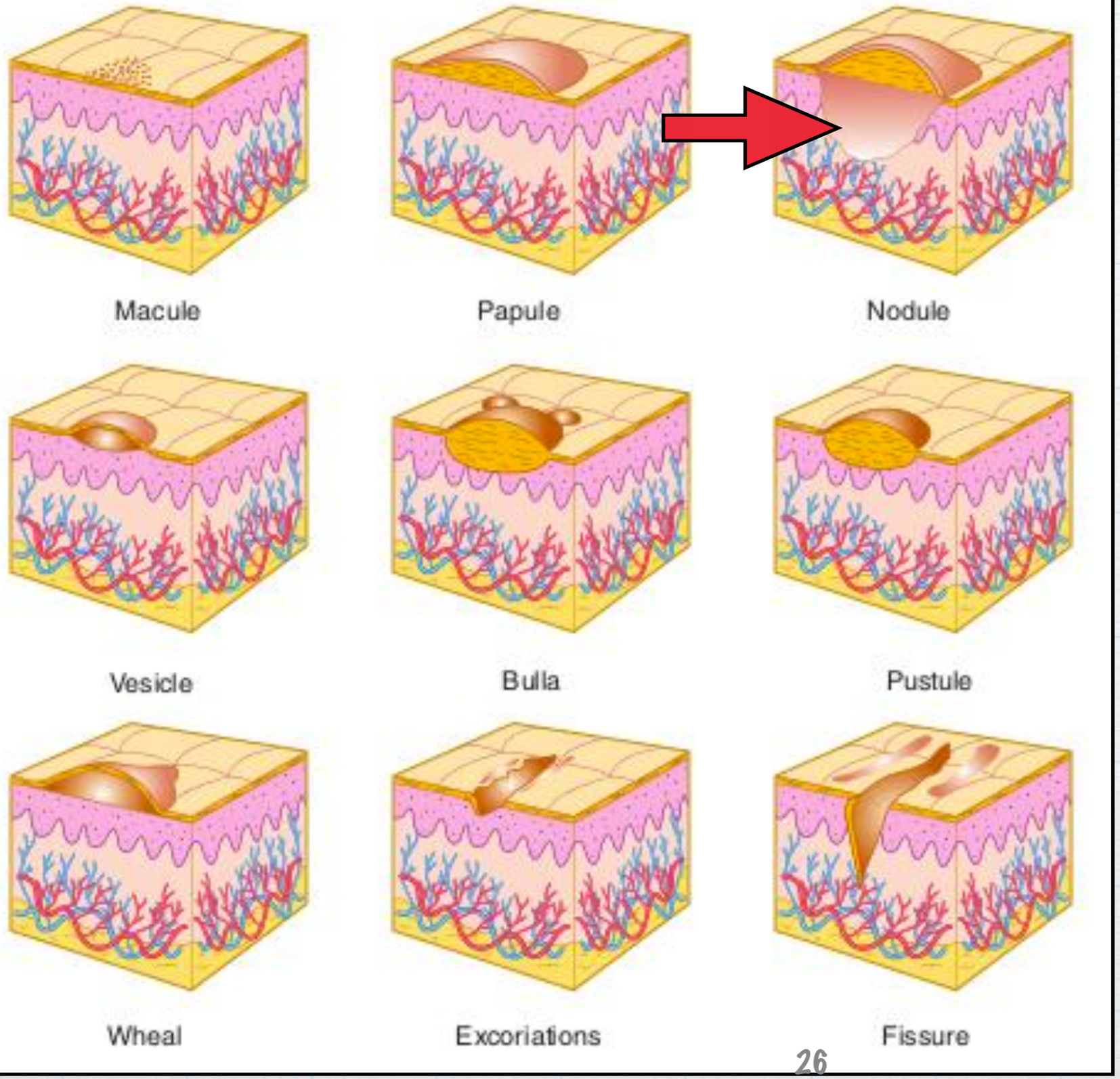
Pathologic basis of veterinary disease, 6th

Gross morphology of the skin lesions

Indian Association of Dermatologists, Venereologists and Leprologists

Primary Lesions	Secondary Lesions	Special Lesions
▪ Macule ▪ Papule ▪ Nodule ▪ Plaque ▪ Vesicle ▪ Bulla ▪ Pustule ▪ Cyst	▪ Scales ▪ Crust ▪ Erosion ▪ Ulcer ▪ Excoriation ▪ Fissure ▪ Sinus ▪ Scar ▪ Lichenification ▪ Atrophy	▪ Erythema/Purpura ▪ Wheal ▪ Burrow ▪ Comedone ▪ Milium ▪ Telangiectasia ▪ Sclerosis ▪ Poikiloderma ▪ Target lesions

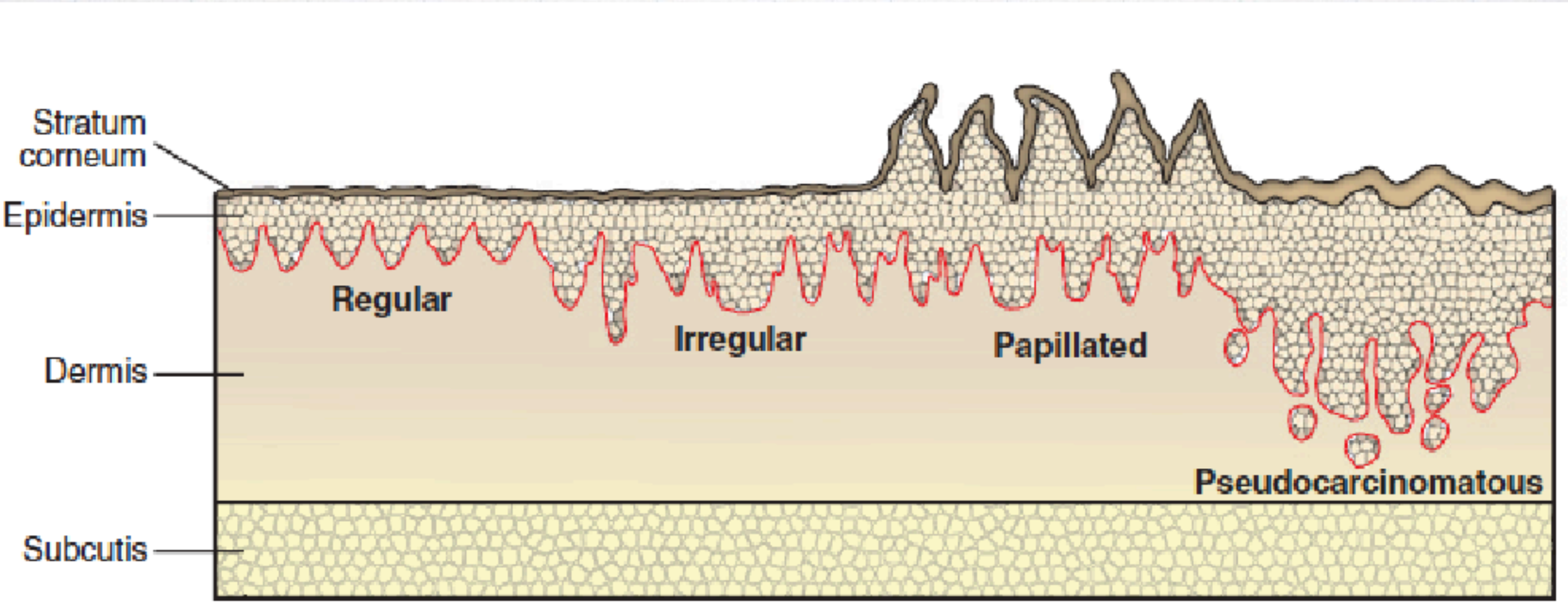
Gross morphology of the skin lesions



- **Macule** - flat, < 1cm
- **Patch** - flat, > 1cm
- **Papule** - solid elevation, < 1cm
- **Plaque** - elevation, > 1 cm
- **Vesicles** - elevation with clear fluid
- **Bullae** - containing serous or sero-purulent fluid, > 1cm

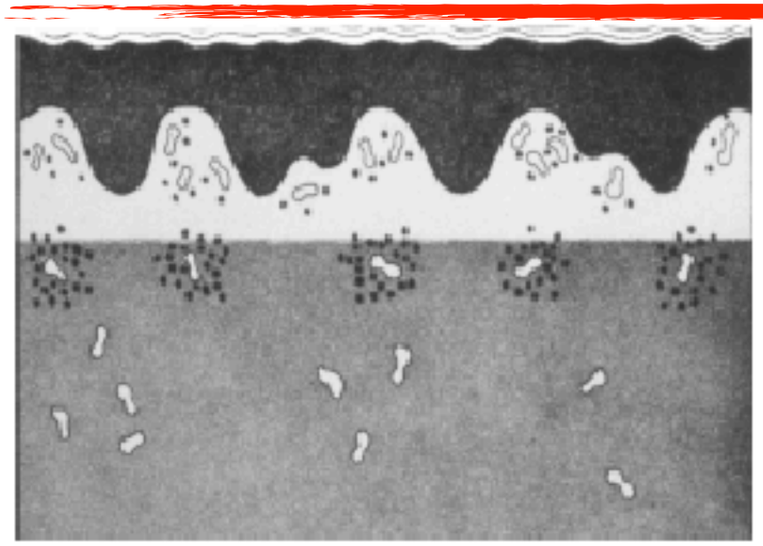
http://nehwalr.blogspot.com/2014/08/guide-discoloration-types-of-skin.html

Patterns of epidermal hyperplasia

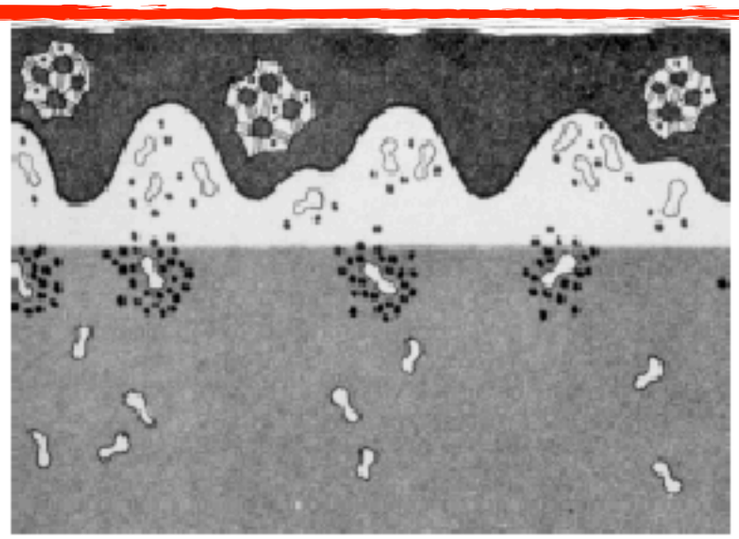


Pathologic basis of veterinary disease, 6th

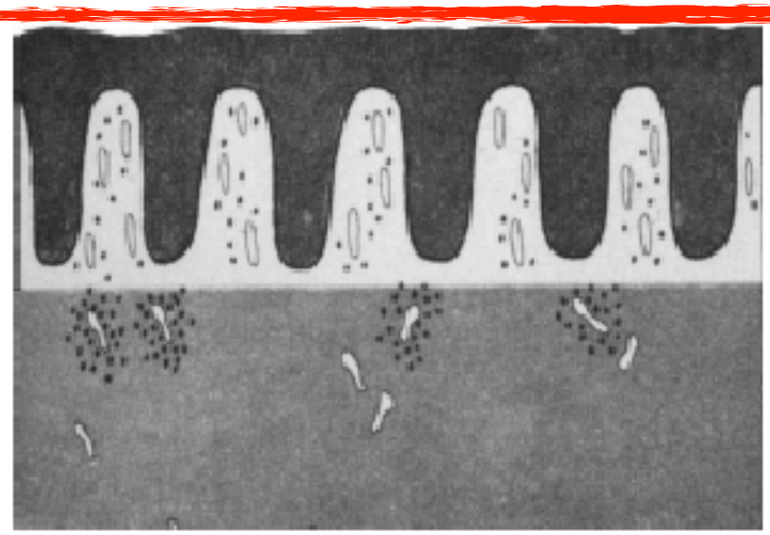
Histopathological patterns of dermal inflammation



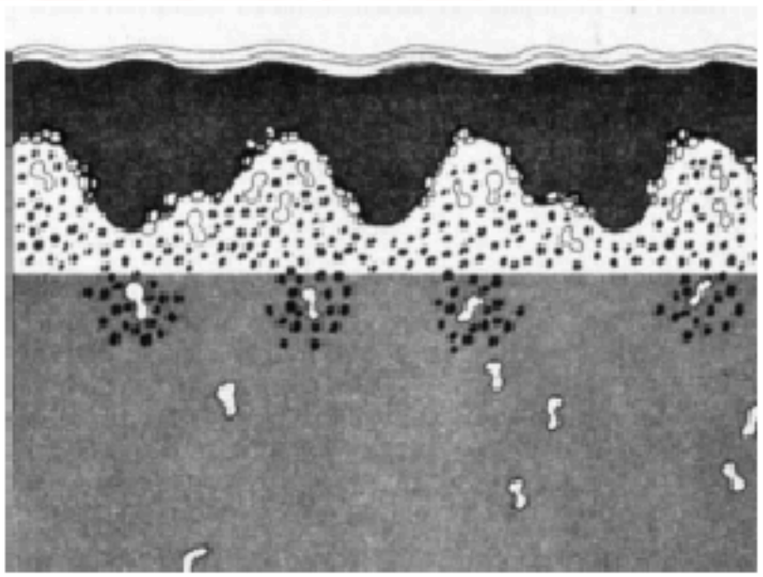
Superficial perivascular dermatitis



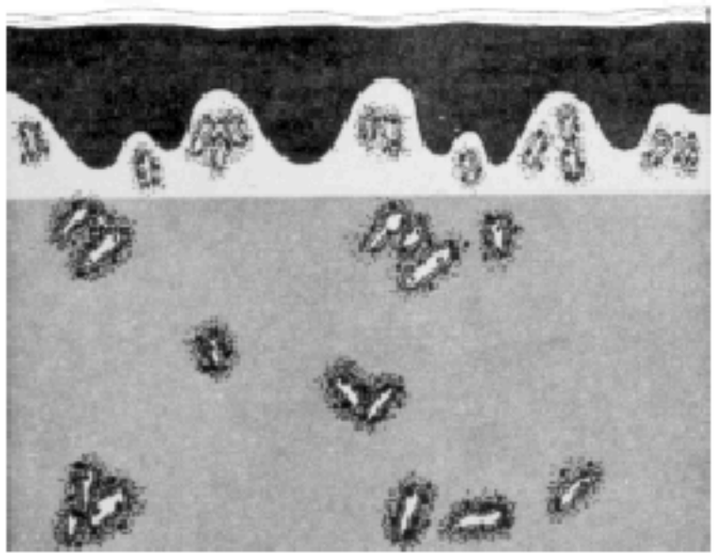
Spongiotic perivascular dermatitis



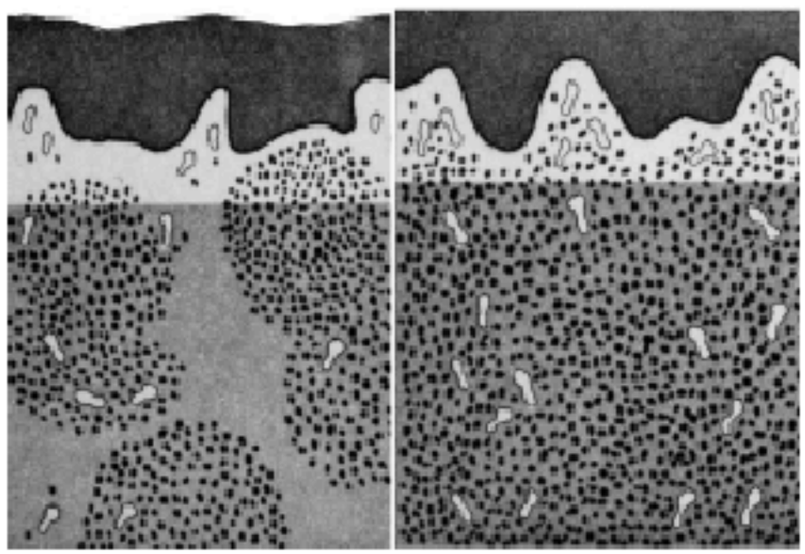
Hyperplastic perivascular dermatitis



Interface dermatitis with hydropic degeneration and lichenoid infiltrate



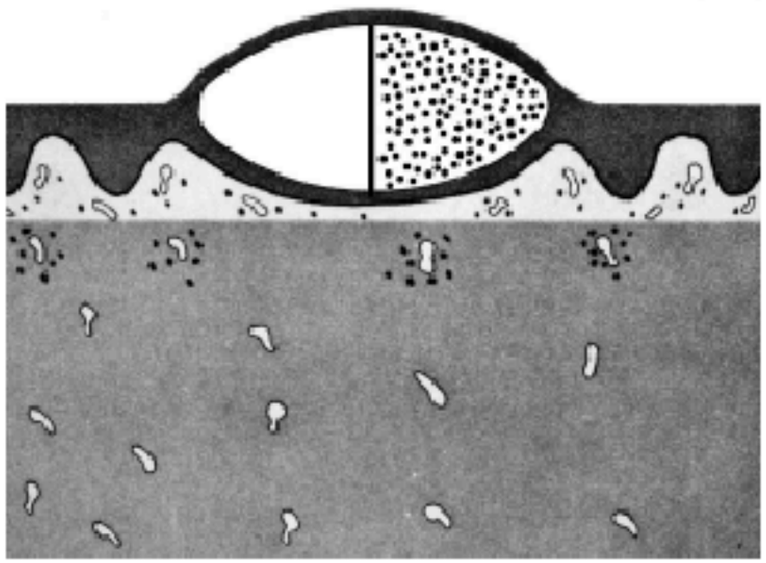
Vasculitis



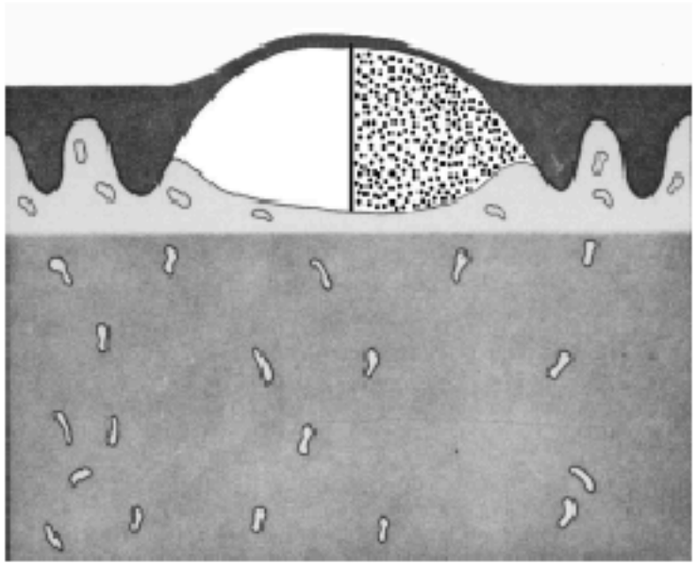
Nodular dermatitis

Diffuse dermatitis

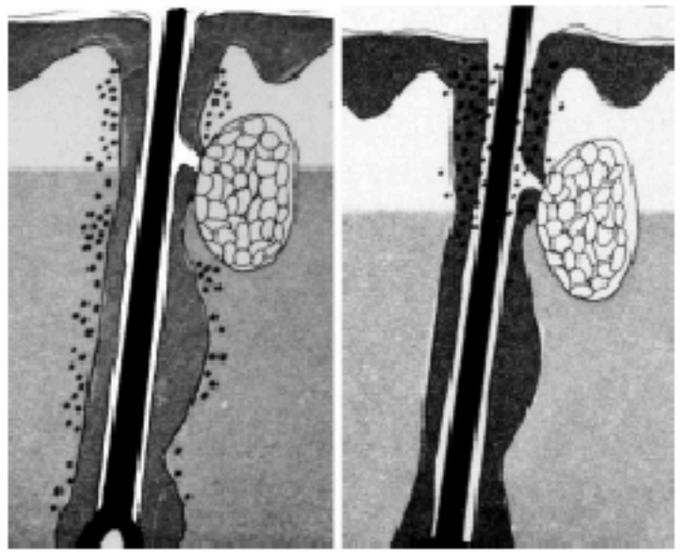
Histopathological patterns of dermal inflammation



Intraepidermal vesicular and pustular dermatitis

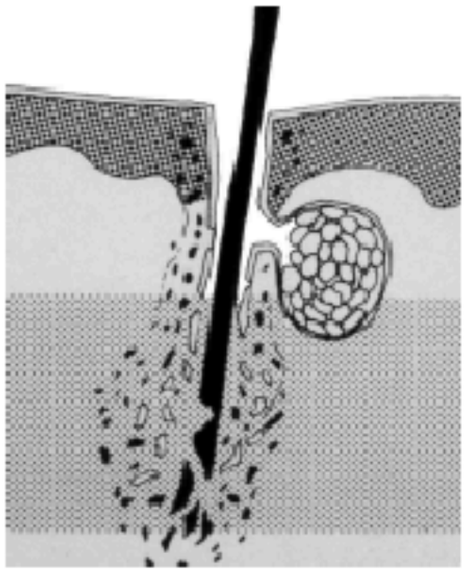


Subepidermal vesicular and pustular dermatitis

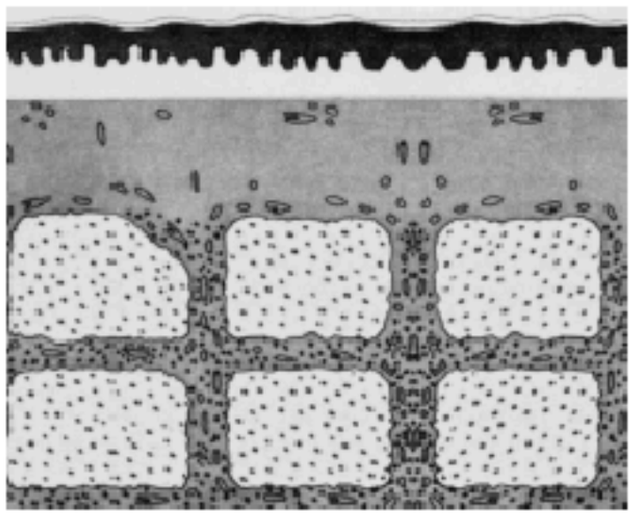


Perifollicul itis

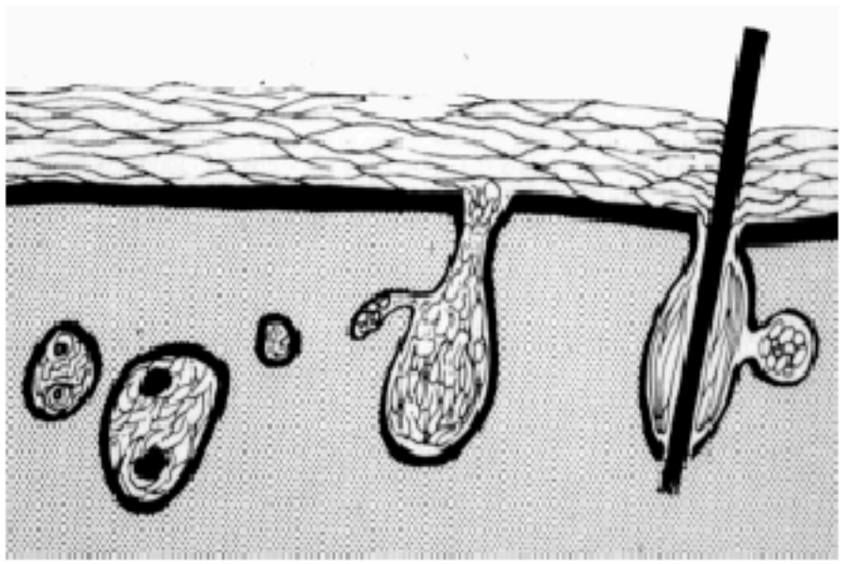
Folliculitis



Furunculosis



Panni culitis



Atrophi c dermato sis

Subtype of the skin disease

- Congenital and hereditary
- Environmental induced
- Immune-mediated
- Nutritional
- Endocrine
- Infectious
  - ☑ Viral
  - ☑ Bacterial
  - ☑ Mycotic
  - ☑ Parasitic
- Miscellaneous
- Neoplastic

Congenital and hereditary skin disease

- **Congenital hypotrichosis:**
  - in all domestic animals, most common in calves
  - can be hereditary or acquired
    - acquired: intrauterine BVD infection, iodine deficiency, goiter, adenohypophyseal hypoplasia
- Hereditary Collagen Dysplasia: requir
  microscopic examination
- Epidermolysis bullosa: rarely seen in

Environmental induced skin disease

- Actinic (sun) injury
  - ☑ Sunburn or solar dermatosis
  - ☑ Photosensitization
    - **type I**, exogenous origin of photodynamic agents
    - type II, endogenous heme pigment, ie porphyrias
    - **type III**, **hepatogenous type**, failure to move phylloerythrin
    - type IV, unknown pathogenesis

Viral skin disease

- Papilloma and Pox viridae
- *Poxviridae*
  - ☑ Sheep pox, chicken pox, swine pox…
  - ☑ contagious pustular dermatitis, Orf (parapox)
- *Papillomaviridae*
  - ☑ caused papilloma, very common in domestic animals
  - ☑ canine, bovine, equine papillomavirus

Systemic viral infection with skin involvement

- Epitheliotropic viruses:
  - ☑ Poxvirus
  - ☑ Vesicular viruses
    - Foot and mouth disease (FMD), vesicular stomatitis (VS), vesicular exanthema (VE), swine vesicular disease (SVD)
  - ☑ Bovine viral diarrhea (BVD)/ malignant catarrhal fever (MCF)
    - skin ulceration
  - ☑ Porcine dermatitis and nephropathy syndrome, PDNS

Bacterial skin disease

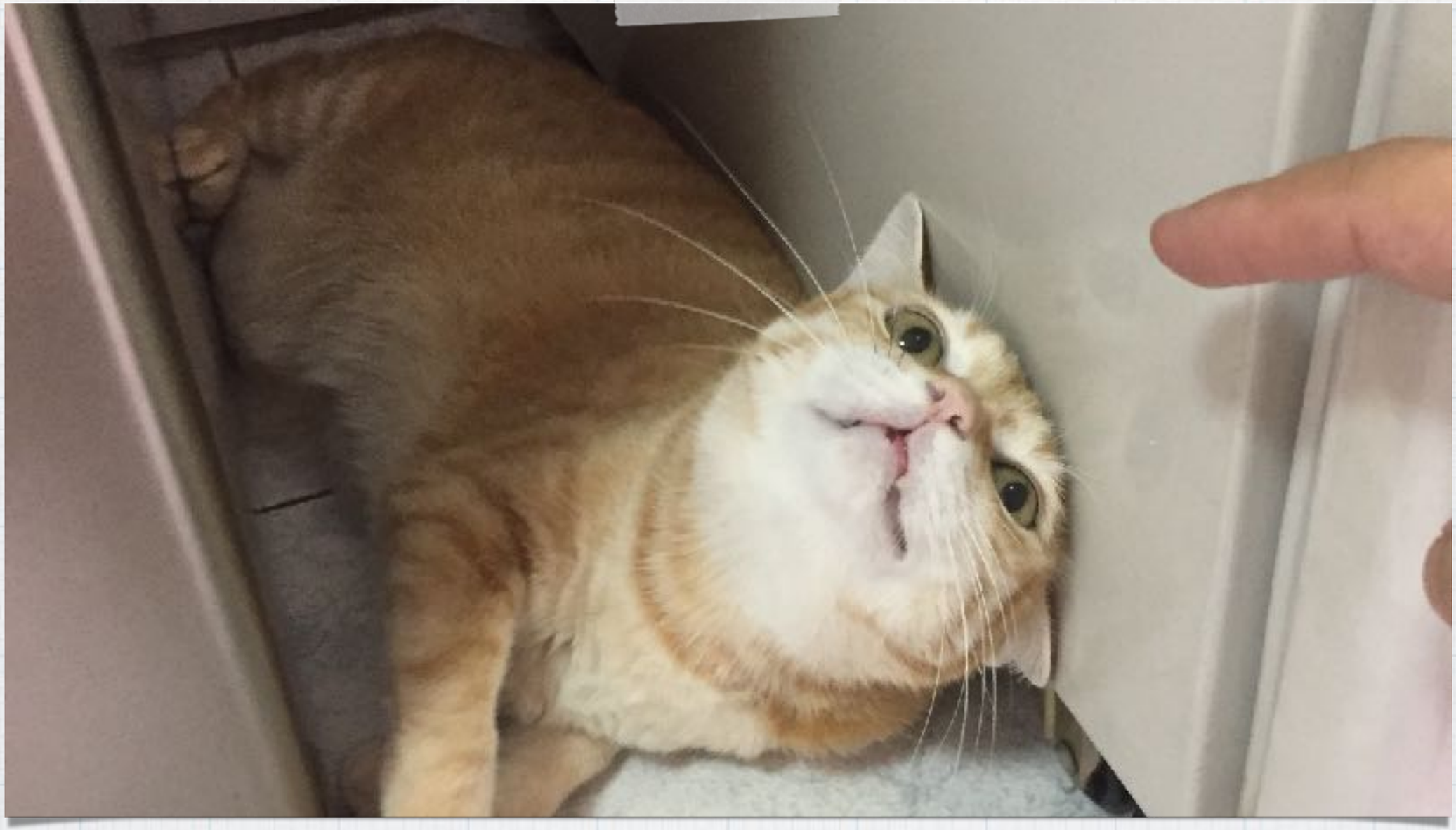
- Etiopathogenesis
  - ☑ healthy skin is resistant to infection by pathogenic bacteria
  - ☑ **factors assisting bacterial proliferation**
    - moisture and dirt
    - altered cornification
      - endocrine, seborrhea…
    - physical damage
- Compared to other species, bacterial skin disease is **more common in dog**

Immune-mediated skin disease

- **Hypersensitivity**, most are type I or type IV
- **Autoimmune**, ie pemphigus, discoid lupus erythematosus
- Others
  - iatrogenic, i.e. erythema multiform, toxic epidermal necrolysis
  - cutaneous amyloidosis
  - eosinophilic complex in cat

Conclusion

- "Definition" of the proper nouns is the most important
- "Normal physiology functions" of the system and organs
- "Figures" and "tables" are much more important than the text
  - ☑ Pathologic basis of veterinary disease, 6th
- "Diseases", especially the farm animals
  - ☑ questions of the previous exams
    - pathology, infectious diseases



Thanks for your attention

Question ?