A. Study Guide

STUDY GUIDE
FOR ACVD CERTIFYING EXAMINATION
Updated April 2011
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INTRODUCTION

The ACVD certifying examination is designed to test the candidate’s broad and specific knowledge of the skin and skin disorders (subcellular, cellular, microscopic, macroscopic, structural, physiologic, pathogenetic, and clinical). It covers all aspects of dermatology, as well as aspects of general internal medicine, immunology, endocrinology, pathology, pharmacology, clinical pathology, parasitology, oncology, microbiology etc., particularly as they may relate to the skin and skin disease.

Although much of our knowledge of skin structure, function, physiology, and pathology is derived from human medicine, the examination will cover all species including small animals, large animals, exotics, laboratory animals, fish, birds and humans. Skin diseases in any species may be examined in detail. Skin diseases of humans for which there are no animal equivalents or that bear no characteristics that are of comparative interest in veterinary dermatology are only of peripheral interest.

This study guide will help you understand the extent and depth of knowledge that may be expected of residents and examination candidates. It should not be viewed as all encompassing and there may be some questions on the examination from topics not covered in this guide.

STRUCTURE AND FUNCTION

The candidate should be familiar with the biology and function of the cells and extracellular support matrix in the epidermis, dermis and subcutis. This includes the vasculature, lymphatics, innervation and nutrition to these structures.

A. Epidermis:

1. Learn each of the resident cells (these include keratinocytes, Langerhans cells, melanocytes, and Merkel cells) found in the epidermis: their origin, the characteristics of each in terms of appearance and staining characteristics on light microscopy and electron microscopy, immunocytochemistry and histochemistry, the function of each of these cells in normal and diseased skin.

2. Keratinocytes: Have a detailed knowledge of epidermal cell kinetics, the cell cycle, epidermal cell differentiation, keratinization, formation of the cornified cell envelope, and epidermal lipids. Be able to describe the
biochemical changes that occur in the keratinocyte as it matures (e.g. changes in keratin expression, protein content, lipid classes, enzymes that become activated during the process of cornification), and how diseases may affect this maturation. Be familiar with the turnover rates for keratinocyte proliferation for each of the domestic species and man, and understand how disease processes alter this turnover. Have a detailed knowledge of the adhesion structures of keratinocytes (desmosome, hemidesmosome, focal adhesions, adherens junctions) including their structure, components, location, functions, and diseases that affect these structures. Have knowledge of the role of keratinocytes in the skin immune response and their role in skin inflammation, including cytokines, adhesion molecules and inflammatory mediators that may be produced and secreted by keratinocytes. Understand the basic principles and requirements of in vitro culture of keratinocytes. Know how neoplastic keratinocytes differ from normal keratinocytes in terms of morphology, biochemical make-up, and regulation of growth.

3. **Melanocytes**: Have a detailed knowledge of the biology of melanocytes, melanogenesis (proteins, enzymes, co-factors, regulating factors, etc.), types of melanin, distribution of melanin in skin and hair, species differences, and diseases associated with abnormalities of melanin and melanin production.

4. **Langerhans cell**: Have a detailed knowledge of the morphology, life cycle, distribution, movement, and functional properties. Be familiar with the antigen processing activities of the Langerhans cells. In particular you should have a clear understanding of its role (and the cellular events that occur) in contact hypersensitivity, atopic dermatitis, microbial immunity and tumor immunity.

5. **Gamma-delta T cell of the epidermis**: Be familiar with the characteristics and proposed function of this cell in the epidermis.

6. **Nutrients/Nutrition of the skin**: know the nutritional supply to the epidermis, specific requirements of the skin, the role and effects of minerals (calcium, zinc etc), vitamins (vitamin D, retinoids), fatty acids, amino acids etc., and the effects of imbalances of these elements.

7. **Neuroanatomy and neurobiology of the skin**: be familiar with the cutaneous sensory nervous system, the cutaneous neuroceptors, their location in the body and the skin, and their specific function. Be familiar with any species differences. Have an understanding of the role of neurogenic inflammation in the normal function of skin and in disease.

B. **Dermo-epidermal junction or basement membrane zone**: Have a detailed knowledge of the basement membrane zone including its ultrastructural
organization and the specific components of each area. For each of the components (keratins, plakins, laminins, collagen, integrins etc.) have a clear understanding of their structure, connections, functions and related pathology. Be able to draw and label a detailed diagram of this area of the skin.

C. **Dermis**: Have a detailed knowledge of the origin, structure, biochemical features, synthesis, functions, staining characteristics, and location in the dermis of the extracellular matrix (collagen, elastic fibers, proteoglycans, glycosaminoglycans etc) and diseases that affect this matrix (congenital and acquired). As for the epidermis, be familiar with the cells that are found in the dermis (including fibroblasts, mast cells, macrophages, dendritic cells, other inflammatory cells), their structure and function, location normally, and their role in disease.

1. for the **mast cell** specifically: be familiar with both immunologic and nonimmunologic factors that activate these cells; be familiar with the constituents of mast cell granules: which are preformed and which must be synthesized de novo, how do these constituents induce or modify inflammatory tissue changes. Know the diseases in which the mast cell plays a significant role. (see also the section on immunology and inflammation).

2. for the **tissue macrophages**: in addition to the list above, be familiar with the location of these cells and their proposed function. Know their role in immunologic/inflammatory reactions. (see also the section on immunology and inflammation).

D. **Hair follicles**: Have a detailed knowledge of the anatomy of the hair follicle and hair, the components of each layer, types of hair, the hair cycle, regulation of the hair cycle and molting/shedding, functions of hair, and the pathophysiology of diseases affecting the hair follicle (also note species differences).

E. **Sweat glands and sebaceous glands**: Learn the characteristics of the cells that make up these glands, and how their secretion is formed. Know the normal morphology for the glands in species such as the dog, cat, horse, cow, pig, and man. Know the chemical constituents of sebum and sweat, and how they differ among the species, including man. Know what diseases affect these structures (e.g. anhidrosis in horses: learn the biochemical changes associated with this condition and the hypotheses for its development)

F. **Subcutaneous tissues**: Know the cellular and fibrous constituents of the subcutis, and its organization. Know also its function, and what diseases may affect this part of the skin.

G. **Nails, claws, hooves, horns**: Be able to describe the specific anatomy, structure and formation of these specialized structures. Be able to draw / label a diagram of each in the different species.
H. Processes of special interest:

1. **Pruritus**: Have a detailed knowledge of the classification, components and role of the neurosensory system, factors that induce pruritus, biochemical mediators (and their origin).

2. **Wound repair**: know what cells are involved, how they interact, what conditions promote effective wound repair, know also the roles of specific substances like cytokines and molecules like fibronectin.

I. **Functions of the skin**: you will be expected to understand in detail the many functions of the skin. For each function listed below, be familiar with the mechanisms by which the skin accomplishes its goal, and how the structural components of the skin correlate with particular functions.

1. **Barrier function**: know how the skin prevents loss of water, electrolytes, and macromolecules; know the mechanisms by which the skin excludes noxious external factors.

2. **Providing motion and shape**: know the factors that contribute tensile strength and elasticity to the skin.

3. **Production of adnexal organs**: know the modifications in the epithelial and dermal structures that contribute to the formation of keratinized structures, including hair, nail, claw and hoof, and the functions of these specialized organs.

4. **Temperature regulation**: know what structures contribute to this function, and the species differences in temperature regulation by the skin.

5. **Storage functions**: know the mechanisms by which the skin stores water, electrolytes, vitamins, fat, carbohydrates, proteins, etc.

6. **Indicator**: know how and why the skin and coat manifest internal disorders, malnutrition, and toxic insults.

7. **Immunoregulation**: know why the skin is considered the largest immune organ and how its function of immune surveillance is accomplished.

8. **Pigmentation**: know what structures or processes contribute to skin and coat color, and how they do so. Learn the functions of pigmentation.

9. **Sensory perception**: know the mechanisms that contribute to the ability of the skin to sense touch, pressure, pruritus and pain, and temperature changes.

10. **Secretion/excretion**: know the structures in the skin that contribute to secretory function, and the mechanisms by which they do so. Know what excretory products the skin can produce and how it does so.

11. **Blood pressure control**: be familiar with the general principles underlying the ability of the skin vascular bed to affect blood pressure.
12. **Vitamin D production**: know what role the skin plays in the formation of vitamin D and the general biochemical mechanisms underlying this production.

**INTERNAL MEDICINE**

There are three categories of questions that come under the "umbrella" of internal medicine:

A. **Systemic signs associated with any of the dermatologic diseases.** These questions cover clinical manifestations in other organ systems, the pathogenesis of those lesions, diagnosis and interpretation of laboratory tests used for other organ systems, treatment, and prognosis. These include many neoplastic, autoimmune, endocrine, nutritional, congenital, infectious, and other diseases.

B. **Fundamental aspects of systemic disorders not necessarily associated with skin disease, but that might be present in dermatologic patients.** These questions are at the level of difficulty of the qualifying exam for internal medicine. Be familiar enough with common medical disorders involving the gastrointestinal tract, the biliary system, the renal system, the hematopoietic system, and the cardiopulmonary system to be able to formulate differential diagnoses, to identify the clinical signs, and to formulate basic diagnostic and treatment plans. For example, you should understand the causes of proteinuria, hemorrhage, PD/PU, etc. These questions also cover interpretation of laboratory tests, including CBCs, clinical chemistries, and urinalyses. You are expected to know what these tests can and cannot tell you, as well as what factors may affect the results. Be familiar with basic renal and hepatic function tests. These questions are usually referenced from *Ettinger and Feldman* (Textbook of Veterinary Internal Medicine), recent issues of *Current Veterinary Therapy*, review articles in the Compendium (including the questions at the end of each article), *Journal of Veterinary Internal Medicine*, *JAVMA*, and *AJVR*.

C. **The systemic effects of any drug used in the treatment of dermatologic disease.** You should understand the pathogenesis of the observed abnormalities, how to diagnose the problem, and how to treat it. You should also know what medical problems might have an impact on the use of any drug in individual patients. This applies to drugs administered orally, parenterally, or topically.

**IMMUNOLOGY AND INFLAMMATION**

The questions in this section concern basic immune function and the role of the skin as an immunologic organ, as well as the pathophysiology of immunologic disorders, and comparative aspects of diseases among the domestic species, as well as humans.
A. Components of the immune system:

1. **Cells of the immune system:** Have a detailed knowledge of the origin, morphology, biochemical features, surface markers, biologic mediators produced, functions and effects of the cells of the immune system, in particular as they relate to the skin immune response and skin diseases (lymphocytes, mast cells, eosinophils, neutrophils, basophils, macrophages, dendritic cells). This should include specific cells of the skin such as keratinocytes and Langerhans cells.

2. **Cytokines:** There is an enormous amount of information on interleukins, TNF, TGF, IFN, colony stimulating factors, growth factors etc. and it is difficult to know where to “draw the line”. You are expected to have a basic knowledge of the principles of how cytokines work and their effects. Detailed knowledge (cell of origin, key functions in health and disease) should be studied for cytokines that are a.) of critical importance in the broad immune response (e.g. IL1, IL2, TNF). b.) cytokines in specific responses as they pertain to diseases affecting the skin (e.g. IL3, IL4, IL5, IL6, IL8, IL10, IL12, IL13, IFN), and c.) cytokines that are of importance in skin function (i.e. that affect keratinization like EGF, TGF, IL1, IL6, IL8, GM-CSF etc.). Be familiar with chemokines and their role in health and disease. This is not necessarily an all-inclusive list, and as you study it should become clear that some cytokines are more important and need to be studied in more detail (e.g. IL1, IL4) than others (e.g. IL3, IL10 etc.)

3. **Cellular adhesion molecules:** You will need to know the different groups that these molecules are from, the features of each group, examples from each group, and the ligands for the most important molecules (e.g. LFA-1, VLA-4, cadherins, ICAM-1, selectins, etc), and the role that these molecules play in health and disease. Also be familiar with the various leukocyte adhesion molecule deficiency syndromes.

4. **Immunoglobulins:** Know the types, structure, function, origin, and location of the different types of immunoglobulin. A detailed knowledge of IgE (biochemistry, receptors, synthesis, differences from IgG, etc) is necessary.

B. Basic immune function:

A detailed knowledge of the following activities and processes in immune function is expected:

1. **Normal immune function:** Know how diversity in the immune system is accomplished (e.g. the general principles behind genetic recombination of T and B cell receptors: random rearrangement of genes; do not memorize specific details about these rearrangements). Know what features of the immune system give it specificity. Know what kinds of help T helper cells can provide; e.g. how does a T cell help a B cell make antibody? What are the types of antibodies and how are the different classes produced? In the past there have been specific
biochemical questions about IgE in particular, e.g. sensitivity to temperature, and reducing agents. How does IgE differ from IgG? What are the characteristics of the other classes of antibodies? (i.e., in regard to ability to fix complement, to opsonize bacteria, etc.) What type of organism or antigen elicits a T cell response? a B cell response?

2. **Antigen processing presentation, and recognition:** Know what kind of cells can present antigen to T cells and what characteristics enable a cell to be a professional antigen-presenting cell. Understand how antigen is presented to T helper cells and how this differs from that presented to cytotoxic T cells. Know which cells have MHC Class I on their surfaces, and which ones have MHC Class II. Know which cells can present antigen to T helper cells and why they can do this: understand the principle of the two-signal model for activation of resting T lymphocytes. Know what CD4 and CD8 surface antigens are. Know Th1 vs Th2 cytokine profiles. You should also be able to discuss the ways in which T and B cell responses differ: What type of antigen is recognized and how do they recognize it? (meaning B cells recognize whole native antigen; T cells recognize processed antigen) How does the B cell receptor differ from the T cell receptor? Know that lymphocytes respond to antigenic stimulation by proliferation and differentiation; know how differentiation is manifested by the helper T cell, the cytotoxic T cell, and the B cell.

3. **Immune tolerance and prevention of autoimmunity:** Know what mechanisms regulate tolerance to self-antigens. Be familiar with the terms clonal deletion, clonal energy, and suppression. How are these processes mediated?

4. **Basic immunologic mechanisms for disease.** e.g. Hypersensitivities types I-IV. Be able to describe the types of hypersensitivity reactions: are they antibody or cell mediated? What antibodies or cells are involved? Give an example of each type. Be able to give an example of a disease that typifies each mechanism. For diseases such as lupus, recognize that multiple mechanisms are present and be able to discuss these, or answer specific questions on them. Know the conditions under which immune complexes cause disease and what factors influence the formation or precipitation of immune complexes in vivo. Be able to describe the cells involved in each of these types of hypersensitivity. Be able to give characteristics for these cells: how they are activated and what activates them? For example, what immunologic and nonimmunologic factors can trigger a mast cell to degranulate? When a mast cell degranulates, what does it release? What bioactive factors must the mast cell make de novo, e.g. the lipid factors, and what effects do they have? It is helpful to understand the concept of cross-linking receptors, and what types of reagents can do this, e.g. whole antibody vs F(ab) fragments.

5. **Inflammation:** Know the cells that characterize inflammatory disorders, including the neutrophil, the eosinophil, the macrophage, and the lymphocytes. What is their general function in the inflammatory response? Be able to give at
least one example of how neutrophils, eosinophils, and macrophages differ from each other functionally and biochemically (i.e. granule content, surface receptors for complement or immunoglobulin, response to chemotactic factors, etc.). In addition to the cytokines, there are lipid mediators of inflammation. Know what they are and their general functions. What are the enzyme pathways involved in the generation of these mediators, and how do we intervene therapeutically? (This means learn the arachidonic acid metabolism cascade - both cyclo-oxygenase and lipoxygenase pathways and what enzymes specifically are affected by glucocorticoids, non-steroidal anti-inflammatory agents, and the currently popular nutritional therapeutics such as n-3 and n-6, PUFA). Also, know how the complement, coagulation, fibrinolytic and bradykinin cascades interact in the inflammatory response. You should be able to pick out those complement proteins that are chemotactic, anaphylactic, and which ones constitute the membrane attack complex. You should know what an acute phase reactant is, and be able to name some and their general functions.

6. **Specific immunologic diseases**: There have been questions on organ specific diseases (e.g. the pemphigus complex, bullous pemphigoid, etc.) and systemic diseases (e.g. lupus, the vasculitides, rheumatoid arthritis). There are occasionally questions about the immunology of transplantation, and graft-versus-host disease. Topics have included specific clinical signs and how they might differ among the species, including man, pathophysiology of disease (e.g. the ability of pemphigus antibodies to induce the release of proteolytic enzymes from keratinocytes), the diagnostic tests and what they mean, pitfalls of immunofluorescence testing and reliability, what antigens can contribute to the ANA test (what specific proteins the antibodies bind to), histopathologic features and how they may differ among the species, treatment-advantages and disadvantages of each drug and any species specificities. Understand the role of complement in these disorders. What does complement do? You should also be able to characterize an immunodeficiency disorder, how to diagnose it, and the pitfalls of each diagnostic test. This should include discussion of those tests that are not routinely available in practice. Consider reviewing Feline Immunodeficiency Virus and Leukocyte Adhesion Deficiency as examples of immunodeficiency disorders.

7. **Allergic disease**: be familiar with the following disorders, in terms of species or breed affected, clinical signs, pathogenesis, histopathology, diagnosis, treatment, and prognosis. In addition, consider the following:

   A. **Atopic dermatitis**: Have a detailed knowledge of the immunopathogenesis, the cells and major cytokines involved in generating this reaction, the antibody classes involved in this reaction, the nature of the allergens, the tissues affected in different species (including man), diagnosis, treatments and prognosis. The advantages and disadvantages of the tests used (including those of historical or research interest, such as the PK test), treatment, prognosis. Know what drugs can affect the ability to perform intradermal skin tests or the RAST and ELISA tests. Be able to
outline the steps involved in running a RAST or ELISA test, and what factors can contribute to false positive and negative reactions (know these for ID testing, too!). Be familiar also with the late phase IgE response. Be able to describe the histopathologic findings that occur in an allergen-injected site over time.

B. **Insect hypersensitivity:** Be familiar with the immunopathogenesis of insect hypersensitivities, particularly flea allergy and Culicoides hypersensitivity. Be familiar with cutaneous basophil hypersensitivity, and what disorders have CBH as a component.

C. **Adverse food reactions:** Be able to compare and contrast food allergy with food intolerance, in terms of mechanisms that cause these disorders, and how they can be differentiated.

D. **Contact allergy:** Be familiar with the immunologic mechanisms mediating this disorder. Also be able to compare and contrast contact allergy and irritant contact dermatitis and how they can be differentiated.

E. **Drug reactions:** Be able to discuss the immunologic and nonimmunologic mechanisms mediating drug eruptions. Be able to give examples of the different kinds of lesions associated with drug eruptions.

8. **General aspects of immunologic disease:**

A. Review and understand the tests that are used to diagnose immune disorders, in sufficient detail to be able to write a short essay on them: these include direct and indirect immunofluorescence, immunoelectrophoresis, the Coomb's test, the ANA, the rheumatoid factor tests, lymphocyte blastogenesis (what mitogens trigger T cells? B cells? What is a mitogen?) Explain the pitfalls of each, and problems associated with false positives and false negatives.

B. Review and understand how each of the immunosuppressive drugs works: glucocorticoids, azathioprine, chlorambucil, gold salts, cyclosporine, etc. Be specific: it is not sufficient to say that glucocorticoids inhibit inflammation--you should know how they do this. You must also be aware of potential toxicities, and any breed or species predilections for toxicity or adverse effects.

9. **Superantigens:**

You should understand the concept of "superantigens" and how they differ from conventional antigens, since they have been implicated in the pathogenesis of autoimmune diseases. Understand how a superantigen could break tolerance. Be able to list specific examples of dermatologic
diseases in which superantigens are thought to be involved including organism, toxin, and disease.

PARASITOLOGY

1. These questions concern ectoparasites primarily; however, there are questions on endoparasites, including intracellular parasites.

2. For the ectoparasites:
   A. Be extremely familiar with the mites causing the various types of mange, in small animals, large animals, lab animals, exotic animals and birds. Consider also the mites that infest man, particularly those that represent zoonotic disorders. You should understand parasitic disorders in large animals, lab animals and exotic animals in the same depth as you do those for small animals. Know the clinical characteristics of each disorder, the pathophysiology of the lesion (e.g. does hypersensitivity play a role, or are the lesions related to physical trauma), the diagnosis, and treatment. Consider the advantages and disadvantages of each type of treatment; understand the mechanism behind any toxic effects induced by the treatment. Know the life cycle of the mites, their ability to survive off the host, any vectors, and mode of transmission.

   B. Be familiar with the various insects causing disease in small and large animals; use the guidelines given above for mites. These include lice, fleas, mosquitoes, and the various flies (don't forget parasites such as sheep ked). Know the life cycle and biology of these ectoparasites, the pathogenesis of the lesions they cause, the advantages and disadvantages of each treatment modality. Be familiar with any diseases for which these insects can serve as vectors. Special emphasis should be placed on understanding the life cycle and control of fleas and Culicoides spp. These two ectoparasites cause significant disease in small and large animals respectively; be very familiar with the pathogenesis of these disorders.

   C. Be familiar with ticks and the diseases they can cause or transmit; understand the pathogenesis of lesions they cause. Don't forget chiggers, straw itch mites, fur mites, and some of the other unusual parasitic disorders. Be sure to know the effects of these infestations in man as well as animals, and how they may differ among the species.

   D. There may be questions on intracellular parasites such as Leishmania; be familiar with clinical signs associated with intracellular parasitic disorders, the specific histopathologic findings, the diagnosis and specific treatment. Be familiar with geographic distribution of these diseases. Be familiar
with the life cycle of the intracellular parasites and any vectors that might be important.

**BACTERIAL AND VIRAL**

1. The candidate should be familiar with viral disorders in small animals, large animals, exotics and birds. These include geographic location, clinical signs, and pathogenesis of the lesions the virus induces, histopathologic findings, diagnosis, treatment, prognosis, and zoonotic potential. You must learn specific details about each of these diseases e.g. how to differentiate between them based on clinical signs, serology, or characteristic histopathology and inclusions; know what cells are infected by the virus. Be familiar with the type of virus that causes each disease, e.g. is it a herpes virus, a lentivirus, a corona virus, etc? Understand how the virus causes the lesion you observe clinically. In addition to the viruses that directly affect the skin, know also the viruses that indirectly affect the skin and mucus membranes, e.g. the influence of feline leukemia virus or feline immunodeficiency virus on the development of skin or mucus membrane disease. Include the large animal viruses that cause vesicular disorders or the exotic viruses that have been eradicated from the US. You need to know viruses found worldwide.

2. The candidate should be familiar with the bacterial infections of the skin. The depth of knowledge about large animal bacterial infections should be equivalent to that for small animals; the candidate should know as much about dermatophilosis and corynebacterial infections, for example, as they do about staphylococcal pyoderma. Study also those diseases associated with higher bacteria, such as nocardiosis, actinomycosis, mycobacterioses, and diseases associated with anaerobic microbes. The format is the same as for the other diseases: know the species of organism causing the disease, predisposing factors, pathogenic factors, clinical signs, histopathologic findings, diagnosis, treatment, and prognosis. Understand the pathogenesis of the disease, and how the body attempts to fight it. If contagious, know how the disease is spread. Remember to learn about abscesses in large and small animals. Remember also to include the exotic (meaning out of the US) large animal bacterial infections of the skin, if they affect importation of livestock into the US.

3. There may also be questions on bacterial infections that are systemic, with the potential for dermatologic manifestations, and other microbes such as borreliosis, ehrlichiosis, and rickettsiae. Do not forget to learn about bacterial L-forms.

4. Be familiar with the normal bacterial inhabitants of the skin of each of the domestic animals for which it is known. Be familiar with the impact these commensal organisms have on the ability of a pathogen to infect the skin.
ENDOCRINOLOGY

1. These questions cover many levels of endocrinology, including normal hormone levels, and interactions among hormones in the normal animal, and how elevated hormone levels in one disease can affect other hormone levels (e.g. how does hyperadrenocorticism affect thyroid hormone levels, and why). Be aware of any species or breed differences.

2. In general most of these "basic science" endocrine questions cover alterations in hormones in disease states that we see clinically; these include thyroid hormone, glucocorticoids, sex hormones and growth hormone. The mechanism of action for these hormones must be learned in depth; e.g. know the different types of thyroid hormone and how they affect metabolism; know the nature and intracellular location of the thyroid receptors; know what the various tests for thyroid function are and how to interpret results. For glucocorticoid hormones, know diurnal rhythms and species differences, understand how glucocorticoid receptors work: i.e. their ability to bind directly to DNA to induce gene transcription. These facts can be mastered because thyroid hormone, glucocorticoid hormone, and sex hormones bind to receptors that are part of the big steroid receptor family. If you learn one, you know the basic concept of how all work; you also then understand how vitamin A, retinoids, and vitamin D work; expect to be asked about these vitamins/hormones. There are some differences in intracellular receptor location between the members of this family. In particular, know the effects of these hormones on hair and skin in the normal animal and in the diseased animal.

3. Other topics to consider:

A. comparative aspects of endocrine disorders in man and domestic animals.
B. for each endocrine disease: be familiar with all dermatologic and systemic manifestations, and the pathophysiology; histopathologic findings in skin and relevant organs, how blood counts, clinical chemistries, radiographic findings and other laboratory tests are affected; specific diagnostic tests for the disease in question and advantages and disadvantages for each; treatment protocols and advantages, disadvantages, and potential toxicities; prognostic factors.
C. how non-endocrine diseases can affect circulating hormone levels and why; what effects endocrine diseases have on lipid, protein, and carbohydrate metabolism
D. interplay between the various sex hormones
E. how drugs can affect circulating hormone levels and why
F. specific effects of individual hormones on the skin (e.g. how does a lack of thyroid hormone cause alopecia; what is the pathophysiology of
alopecia in the growth hormone dependent and sex hormone related disorders?)

G. molecular pathogenesis of special findings such as calcinosis cutis (e.g. know what changes can take place to foster calcium deposition in the dermis)

H. what happens in the normal animal when exogenous hormones are administered (thyroid, glucocorticoids, sex hormones), either orally, parenterally, or topically.

**MYCOLOGY**

1. The candidate is expected to answer questions on the dermatophytes, the subcutaneous mycotic infections, and the deep mycotic infections. Be familiar with the manifestations of these diseases in small animals, large animals, exotics, and laboratory animals.

2. For **dermatophytes**:

   A. know the reservoir and host spectrum of the following dermatophytes:


   B. know the spectrum of clinical disease caused by the various zoophilic dermatophyte species in all domestic and laboratory and exotic animals.

   C. know the colony characteristics and microscopic appearance of M. canis, M. gypseum, M. nanum, T. mentagrophytes, and T. rubrum.

   D. be able to describe the Dermatophyte Test Medium components and usage.

   E. know the pathogenesis and microscopic characteristics of follicular and epidermal dermatophytosis, kerion, and pseudomycetoma. Be able to describe host features and epidemiology that predispose to dermatophytosis in domestic animals.

   F. be thoroughly familiar with the principles of treatment and control of dermatophytosis for each domestic species. Be able to discuss any useful topical treatment, systemic medications, and for ruminants, the use of fungal vaccines.
be able to describe the appropriate use and principles which underlie the use of Wood's light and direct microscopic examination of hair and scale in the diagnosis of dermatophytoses.

be able to discuss a cattery management plan for the elimination or control of *M. canis* from an infected cattery.

be able to recognize/discuss zoonotic implications of animal ringworm.

3. for Malassezia:
   
   A. be familiar with current classification of members of the genus *Malassezia* that are associated with cutaneous diseases in animals or man.
   
   B. know the clinical features of the various diseases/syndromes attributed to infection or colonization by *Malassezia* in small domestic animals and man. Be able to describe the current state of knowledge about predisposing patient factors and the immunologic features of the diseases in man.
   
   C. be able to describe or recognize diagnostic tests applicable to the clinical investigation of syndromes associated with *Malassezia*.
   
   D. be able to describe or list therapeutic principles, including topical or systemic agents useful in managing *Malassezia*-associated diseases.

4. for subcutaneous mycotic infections: The diseases with which you should be familiar include: sporotrichosis*, eumycotic mycetoma+, phaeohyphomycosis+, hyalohyphomycosis, basidiobolomycosis, *Zygomycosis*, pythiosis*, and lagenidiosis.
   
   A. for those diseases marked *, be able to describe the biologic features of the causative agents in detail, including geographic distribution, habitat in nature, route of exposure, host susceptibility, host range, morphologic variations, or life cycle. Be able to recognize photomicrographs of cytology or histopathology of diagnostic specimens for each of the diseases listed.
   
   B. for those diseases marked +, be able to recognize agents associated with the diseases listed in the dog, cat, and any large animals that get the disease.
   
   C. for sporotrichosis, know the clinical manifestations expected in each domestic animal affected. Know the recommended treatment in each host
and be able to discuss diagnosis and therapy of sporotrichosis in cats in detail.

D. be able to discuss/recognize the zoonotic implications of feline sporotrichosis.

E. be able to discuss the clinical and pathologic features of equine pythiosis in detail including diagnosis, therapeutic options, and the major differential diagnostic considerations.

5. for **deep mycotic infections:** (blastomycosis, histoplasmosis, cryptococcosis, and coccidioidomycosis)

A. be able to describe or recognize the biologic features of the causative agent for each disease, the pertinent geographic distribution, habitat in nature, route of exposure, importance of each disease in each of the domestic species, morphologic variations of the life cycle. Be able to recognize diagnostic photomicrographs of cytologic or histopathologic specimens for each disease.

B. know which of the diseases commonly or uncommonly have cutaneous manifestations and know the major systemic manifestations of each of the diseases.

C. for each disease, be able to recognize or name appropriate therapeutic options.

D. be familiar with diagnostic methods for systemic mycoses, so that given an appropriate case history with clinicopathologic data, you can choose an appropriate diagnosis.

6. for **antifungal therapy:** Be familiar with antifungal drugs, so that you could discuss, list, or recognize important principles of usage, pharmacology, spectrum of action, mechanism of action, contraindications, toxicity, efficacy, and adverse reactions of each.

Griseofulvin (various formulations), amphotericin B, potassium or sodium iodides, ketoconazole, itraconazole, fluconazole and terbinafine.

**ONCOLOGY**

1. The candidate is expected to know the characteristics (clinical signs, biologic behavior, histopathology, diagnosis, treatment and prognosis) of each of the tumors that can affect the skin. Be familiar with tumors in all the domestic
species, and any species differences that occur. Have a detailed knowledge of round cell tumors affecting the skin.

2. The candidate should be familiar with general principles of oncology, which includes parameters for staging and grading tumors, and what influence these factors have on prognosis. Be familiar also with the methods used for staging disease severity, and the accuracy of each. Include those methods that might not be routinely used in practice, but are available at some academic or private hospitals, like CAT scans, MRI, photodynamic therapy (PDT), etc. (Check the recent veterinary literature for the tumors in which these techniques have been applied).

3. Be familiar with effects of neoplasia on general health, and the pathophysiology of these effects. Be familiar with paraneoplastic conditions and the mechanisms by which tumors cause the abnormalities associated with those conditions.

MISCELLANEOUS

1. This section can include questions on hereditary and congenital disorders; metabolic and nutritional disorders; environmental insults, either chemical or physical; idiopathic inflammatory disorders; idiopathic acquired disorders; degenerative disorders; and those disorders associated with the bites of venomous animals or insects. Know the species or breed predilections, clinical signs, histopathology, pathogenesis, diagnosis, treatment, and prognosis. You may be asked to compare and contrast hereditary diseases among the various species susceptible to each disorder; these include small animals, large animals, and man. There may also be questions on laboratory animal models for particular nutritional disorders or any of the other dermatoses.

2. Special techniques such as cryotherapy and laser surgery of the skin are used by some practicing veterinary dermatologists. You should be familiar with the general principles underlying the mechanism of action, the indications for use, the techniques, and the safety of each modality.

3. This section also contains questions on the use of the skin biopsy and histopathology.

   A. Be familiar with the biopsy procedures used for the skin and the advantages and disadvantages of each. Be able to compare and contrast the punch biopsy with the excision biopsy: indications or contraindications, the equipment used, the choice of anesthetic, etc.

   B. Be familiar with the fixatives used for routine histopathologic examination of tissue, as well as those used for special studies such as
immunofluorescence or immunohistochemistry, and electron microscopy. Know the advantages and disadvantages of each.

C. Be familiar with the special stains used for identification of specific cells, matrix components, or pathogens. Know the advantages and disadvantages of each.

D. Be familiar with descriptive terms for histologic findings in normal or diseased epidermis, dermis, or appendages, and what mechanisms mediate the development of these morphologic findings. Be familiar also with specific histopathologic patterns.

The topic of **otitis externa** may fit under various headings; however, a few comments specific to this disorder are necessary. Be familiar with the primary, predisposing and perpetuating causes of otitis externa; the bacterial, fungal and parasitic etiologic agents associated with otitis externa; the methods of diagnosis, the treatment, and prognosis. Be familiar with the contents of otic preparations, the indications for their use, and the potential for side effects. You should be very familiar with otitis media also.

**PHARMACOLOGY**

1. This section covers **pharmacology and pharmacokinetics** of any drug or therapeutic product you might use, either systemic or topical. This can include the route of administration; the absorption, metabolism and excretion of the drug, and any species differences in these parameters; the pharmacologic action; the indications or contraindications; the efficacy; and the potential for side effects. If a drug must be metabolized to be active, know this and the active metabolic product.

   A. Be familiar with the mechanisms of action, spectrum and side effects and toxicity of **antibiotics** and **antifungal agents**, and which products are useful for particular organisms, e.g. aerobe vs. anaerobe, extracellular vs. intracellular, gram positive vs. gram negative. Topical products are included. Be familiar with potential side effects and any species or breed or age predilections to adverse drug reactions.

   B. Be familiar with the specific indications, pharmacologic actions, limitations, and side effects for the use of **immunosuppressive agents**. Be familiar with any species or breed or age factors that would affect your choice of immunosuppressive agents. Know the specific mechanisms of action for each. It is important to distinguish between a mechanism of action and the effect on the immune system. Be familiar also with any type of **anti-inflammatory agents** that are used, and specifically, how their mechanisms of action differ. Be able to compare and contrast the advantages and disadvantages of each immunosuppressive or anti-
inflammatory drug used in the management of patients with dermatologic disorders.

C. **Parasiticidal agents**, either systemic or topical: For each class of compound, be familiar with the mechanism of action on the parasite, the potential toxicity for the host and the mechanism for that toxicity, breed or species predilections for the toxicity, the specific antidotes if available, and how they work. Know also which parasites are susceptible to each and which are not, e.g. ivermectins-which parasites are sensitive, which are not.

D. Understand and be able to discuss the principles of **topical therapy**, be able to comment on what factors affect percutaneous absorption of drugs (biochemical and physical factors, too); be able to discuss the uses of aqueous vs oil bases; be familiar with some of the ingredients in the various topical medications that affect absorption (either promote it or hinder it), and the conditions under which these are indicated. Be very familiar with the contents of the various shampoos, dips, sprays, etc. that are used in veterinary dermatology; know what each ingredient does, e.g. be specific: what effects do coal tars have on the epidermis and how do they promote these effects. You do not need to learn the various brand names, just the generic ingredients contained within the shampoos. JID has multiple articles on percutaneous absorption.

E. Be familiar with the contents and mechanisms of actions of any of the **nutritional therapies** that are used, including retinoids (know the difference in mechanism of action and side effects for each of the products used, either orally or topically, and their effects on various organ systems), essential fatty acids, vitamins, etc. There are often questions on fatty acid synthesis and metabolism, as they relate to the use of fatty acids in dermatologic disease.

**HINTS FOR PREPARING FOR THE EXAMINATION**

A. **Study materials:**

Please refer to the ACVD Exam Reference Guide 2006. Although textbooks are likely to provide the core materials for your studies, journal articles from the veterinary and human literature are also extremely important. There are many journals that are not referenced that you may find very useful as a source of review articles, especially for immunology.

B. **General Comments:**

The things about this exam that usually give people the most trouble:
1. basic science of the skin: structure, function, biochemistry of epidermis and dermis, biochemical steps in cornification, melanogenesis, etc.
2. basic science of immunology/inflammation
3. pharmacology of drugs used in dermatologic disease: you need to know the biochemical mechanisms by which these drugs work and what effects they may have on multiple organ systems.
4. large animal skin diseases, laboratory animal skin diseases, bird skin diseases, comparative aspects of human skin diseases; species differences. You should know and understand the pathogenesis of dermatologic disorders for large animals, lab animals, and exotic animals to the same extent as you do for small animals, if that information is available.
5. some people forget to read journals, as well as textbooks

Many of the college members who have taken the exam recently have suggested the following aids for preparation.

1. Make up "practice short answer-short essays" of your own on both clinical and basic science topics, then prepare a detailed answer outline that will comprehensively cover the topics.

2. Study from textbooks first to get the basics, and then address the current literature. Having a basic background before you start reading a journal like JID will make it easier for you to concentrate on those articles with relevance to animal dermatology, or with relevance to areas like structure and function.

3. It is important to organize the materials you study into a form that condenses it to its most useful form. For this reason, many people have found it helpful to study in groups. Some people have found it helpful to make note cards on journal articles to condense the message into a few short phrases. Charts on diseases, which affect many species, can be made to illustrate species differences. Charts can also be made on each of the sections. For example, on Structure and Function, charts can be made on each of the cells within the epidermis and what they do. Charts or note cards have also helped organize material on drugs, parasites, tumors, lab animal diseases, dermatophytes, etc. Charts are helpful when you need to learn basic facts about cytokines. Writing facts down provides a tactile stimulation, which reinforces what you have read, if you are a tactile learner.

4. Allow several days/weeks before the exam for a review session; do not try to learn new information right up to the day of the exam.

5. For some people, mastering this material is most efficient if you divide your studies up into topics. Rather than read every reference and book from cover to cover, you would select specific topics from the resounds given here and read them all in a block, then move on to the next topic.
6. Make charts of large animal parasites and viruses and exotic parasites and mites

C. Specific Comments:

Structure and Function:

1. Study carefully the beginning chapters on structure and function of skin in the human and veterinary dermatology textbooks. Especially recommended: Scott, Miller and Griffin Small Animal Dermatology (this book has extensive references to the older veterinary literature); Fitzpatrick, et al: Dermatology in General Medicine. Also useful: Moschella's Dermatology, and Rook's Textbook of Dermatology. Make outlines, note cards, or whatever it takes to get down the important details.

2. If you learn well from lectures attend, at least once, the annual AAD meeting. This meeting has special seminars on structure and function of the skin (there is usually a handout), as well as seminars on basic immunology. The information obtained at this meeting may help you formulate a rational study plan for structure and function of the skin.


Internal Medicine:

1. Review Current Veterinary Therapy: read the dermatology chapters, but also read the chapters that discuss systemic diseases with dermatologic manifestations, the chapters that discuss treatment of cancer, the chapters that discuss interpretations of laboratory tests for hepatic and renal diseases, and those chapters that concern the differential diagnosis of selected clinical signs or laboratory findings (e.g., bleeding diatheses, proteinuria).

2. Review the pertinent chapters of Ettinger's Textbook of Veterinary Internal Medicine.

3. Review the Compendium for review articles and questions on the diseases listed in the internal medicine section above. Practice answering the quiz questions at the end of the articles.

4. The Journal of Veterinary Internal Medicine contains some articles of interest to dermatologists. This journal has been recommended by several diplomates.

5. For infectious diseases, Greene's Clinical Microbiology and Infectious Diseases of the Dog and Cat (WB Saunders) is an excellent resource.

6. Also: pertinent review articles in journals such as JAVMA and JAAHA
7. Two books to help with interpretation of laboratory data:


OR


**Immunology/Inflammation**

1. Veterinary immunology textbooks may provide a reasonable overview and help with some specific details relating to veterinary medicine, however they tend to lack in detail. Consider Tizard (Immunology, an introduction) as a start.

2. Review the sections on immunology in the Fitzpatrick textbook (section 6 in particular). A current edition of a general immunology text like that written by Roitt (Veterinary Immunology, Blackwell Scientific Publications), or Abbas, et al (Cellular and Molecular Immunology, WB Saunders) will help you fill in any gaps you have, especially regarding basic immune function and concepts.

3. Review the sections on specific diseases in the human and veterinary dermatology texts. Remember comparing and contrasting human and veterinary diseases such as pemphigus, or atopy make great essay questions.

4. Review articles on pathogenesis in the JAAD, Archives of Dermatology, J Allergy and Clinical Immunology, and Journal of Investigative Dermatology on cutaneous inflammation and immunology. There are many other journals that also have excellent reviews eg. Immunology Today, Current Opinions in Immunology, etc.

5. Veterinary literature. Same list of journals given under Structure and Function. Don't forget about Veterinary Immunology and Immunopathology journal.

6. The ACVD Task Force on Atopic Dermatitis (Vet Immunol Immunopathol) provides detailed information on this disease in dogs and humans.

**Parasitology**

1. Review the relevant sections of the veterinary dermatology textbooks and veterinary journals.

2. Review also a good veterinary parasitology text. Look at the pictures of each relevant parasite, and make sure you can identify it as an unknown. Giorgi’s Parasitology for Veterinarians (8th Edition) is a good source.
3. Medical and Veterinary Entomology (the journal) has useful information on the biology of flies that affect large animals.

**Bacteriology and Virology**

1. Read the relevant sections of the veterinary dermatology textbooks mentioned above, and review the recent veterinary literature on these topics.

2. A good microbiology textbook can help fill in the gaps. Read especially the textbook by Dr. Craig Greene and colleagues (Clinical Microbiology and Infectious Diseases of the Dog and Cat, 3rd edition WB Saunders).

**Endocrinology**

1. Review endocrine sections in Muller, Kirk, and Scott's Small Animal Dermatology.

2. A recommended veterinary textbook by several college members is Feldman and Nelson's Canine and Feline Endocrinology and Reproduction. In particular, review the sections on thyroid, adrenal gland, sex hormones, and pituitary hormones; review also other endocrine diseases that may be associated with skin disease. For example, diabetes mellitus: know what impact this disorder can have on the skin.

3. Review the endocrine chapters in Ettinger's Textbook of Veterinary Internal Medicine.

4. Review the veterinary literature, particularly those articles appearing within the last five years. In particular, be familiar with the controversies, or pros and cons, associated with the various tests for specific diagnoses of endocrine disorders.

5. Review the human texts and literature pertaining to general mechanisms of hormone action and comparative aspects of disease, to specifically fill out the information you get from the above.

**Mycology**

1. Same as for bacteriology and virology--see also the human dermatology textbooks for good sections on fungal diseases.

**Oncology**

1. Read the veterinary dermatology textbooks, Goldschmidt's Skin Tumors of the Dog and Cat, and Tumors of Domestic Animals for the specific skin tumors.
Review the current veterinary literature. There are good chapters on general principles of cancer management in books like Current Veterinary Therapy.

Pharmacology

1. The veterinary and human dermatologic textbooks.

2. The human dermatology textbooks contain good sections on topical drugs, vehicles, and those factors, which affect absorption. Again, Fitzpatrick is an excellent text.

3. The veterinary literature, particularly the reviews in JAVMA on the pharmacology of various drugs. The human dermatology journals have good reviews on drugs; New England Journal of Medicine has excellent reviews on specific drugs, some of which are used in veterinary dermatology.

4. A good pharmacology textbook like, Veterinary Pharmacology and Therapeutics or Goodman and Gilman; you do not need to read this from cover to cover, just use it judiciously to answer specific questions, such as those on drug mechanism of action, pharmacology, or potential side effects.

5. You may also check out the PDR to fill in the gaps on some drugs. The AMA also puts out a nice drug review book every few years. Check it out in your library.

Hints for the Histopathology Section:

You will be expected to be very familiar with the histopathologic appearance of the inflammatory skin diseases and with those skin tumors which are distinctive, e.g. round cell tumors, sarcoid, etc. The best way to prepare for this section is to read as many glass slides on your own as you can. Practice writing descriptions of what you see, and giving a morphologic diagnosis. Where possible, give etiologic diagnoses or lists of possible etiologic diagnoses. Understand how the special stains work and how they can help you achieve a diagnosis. Be familiar with the patterns of inflammation seen in the skin and what they signify, in terms of potential diseases. Study with an experienced dermatopathologist if you can.

HOW TO PREPARE

1. Practice reading slides as described above. Compare your results with the official path results or review them with your mentor. Go back, if necessary, and see what you missed.

Gross, Ihrke, and Walder. For human diseases, Ackerman's textbook is excellent, Pinkus or Lever are also very good. In addition, you can use Jubb and Kennedy's veterinary text: the chapter on dermatology.

3. Review the histopathology sections in Muller, Kirk, Scott's Small Animal Dermatology.

Hints for the Digital Section:

You will be expected to look at slides of patients and formulate lists of differential diagnoses. You may also be expected to examine photomicrographs or electron micrographs of normal skin and identify distinctive and characteristic structures. There can be slides of small animals, large animals, laboratory animals, exotic animals, and birds in this part of the exam. You may be asked to interpret photomicrographs of cytology or histopathology. You may also be asked to differentiate common ectoparasites or fungal organisms. In this section you can expect to see many of the questions on exotic animals.

HOW TO PREPARE:

The best way to prepare is to see cases. If your residency does not have access to large animal or lab animal cases, consider a rotation in a place that does have access, or try to examine teaching slide carousels from these institutions. Review the microscopic appearance of the common mites, lice, etc., and the fungi. This is where you will see lots of your large animal questions and exotic animal questions. Know their mites, lice etc.