

Blackwell's Five-Minute Veterinary Consult
Clinical Companion



Small Animal Endocrinology and Reproduction



Deborah S. Greco
Autumn P. Davidson



WILEY Blackwell

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Edited by

**Deborah S. Greco
&
Autumn P. Davidson**

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Foreword



I have had the privilege, following graduation from veterinary school, of completing an internship, a three-year residency, several years in private practice, joining my first veterinary school faculty at the Western College of Veterinary Medicine in Saskatoon and then, for the past 35+ years, on faculty at the University of California, Davis. The absolute high point of my career, of any decade, year, month or day would certainly be having the opportunity to participate in 'rounds.' Sitting around a table or on the floor of a hospital ward, reviewing the presenting complaint and history, physical examination, laboratory and imaging studies ... trying to figure out the cause for an abnormality in a cat or dog ... these were the greatest of challenges, and they were consistently stressful, exciting and fun! Rounds were always a wonderful complement to my seeing cases, because they offered a place to share observations and thought processes with colleagues, to learn how they may have done or thought differently. Always a learning experience. However, it must be admitted, I always entered rounds with fear, honestly two fears: first, that my ignorance would be revealed; and/or second, that the rounds I was conducting would be boring. So, I always tried to determine ahead of time the case or cases to be presented – whether as a student or an intern – when I was going to be presenting a case and asked questions, or as a faculty member attempting to take advantage of a 'teaching opportunity.' As a person who was often a 'leader' in rounds (usually defined as being the oldest person in the room), it seemed that I was always expected to know the answer to any question asked, while having to shoulder the responsibility for making rounds interesting, logical, and practical. Quickly reviewing a subject prior to rounds or before any case discussion always added to my sense of confidence and competence.

The Blackwell Five-Minute Veterinary Consult's Clinical Companion; Small Animal Endocrinology and Reproduction will serve as a wonderful aid to those who may be preparing for rounds, for those concerned that their differential diagnosis is incomplete, or that their chosen strategy in managing a newly diagnosed condition may not be up-to-date, or for those preparing to meet and discuss one of these conditions with an owner, student, colleague, or teacher.

Among the many students with whom I had the honor and pleasure to share time on my internal medicine service were Deborah Greco and Autumn Davidson. Teachers love to impart their knowledge to their students. A few students absorb that knowledge and then dedicate their careers to build from that foundation while also teaching the next generation of 'students.' This should always be viewed as a wonderful compliment to their teachers. Doctors Greco and Davidson have evolved to become world-renowned and respected small animal endocrine and reproduction experts. As one of their early instructors, I take great pride in their successes. Deb Greco and Autumn Davidson are to be congratulated on assembling a thorough list of topics relative to canine and feline endocrinology and reproduction, with more than 60 chapter titles that encompass a huge number of conditions and biochemical abnormalities encountered in

small animal practice. Most importantly, the authors who were assembled to carry out the task of presenting each subject are among the world's best veterinary clinicians and clinical researchers. These individuals bring vast experience and a wealth of knowledge to their assignments. Each subject is succinctly reviewed practically and logically, while being cost-effective. When appropriate, discussions begin with typical client concerns, history and physical examination features, diagnostic approaches, therapeutic strategies, and prognosis.

This *Clinical Companion* should be on the bookshelf of every small animal veterinary hospital. The information it provides can be easily applied to the clinical diagnosis and treatment of endocrine or reproductive disorders for the benefit of the patient, owner, veterinarian and the entire veterinary health team.

Enjoy!

Edward C. Feldman, DVM
Diplomate, ACVIM (SAIM)
Emeritus Professor of Small Animal Internal Medicine
University of California, Davis, USA

Preface



As internal medicine consultants, Dr Davidson and I observed the need for a readily accessible, concise reference on endocrinology and reproduction for the busy veterinary practitioner. This book was developed as an expanded companion book to the *Five-Minute Veterinary Consult*, but also serves as a bridge to more comprehensive texts such as *Canine and Feline Endocrinology and Reproduction* by Feldman and Nelson. We would like to thank our contributors for sharing their expertise. We look forward to providing veterinary practitioners with another tool to manage challenging reproductive and endocrine cases. Thank you Dr Davidson for your friendship, unwavering support and hard work – all of which made this book possible.

Deborah S. Greco DVM, PhD, DACVIM (Internal Medicine)

I credit Dr Greco for first coming up with the idea of a comprehensive but concise reference text covering clinical conditions in small animal endocrinology and reproduction. She did not have to work hard to convince me that this would be a welcome addition to the library of small animal clinicians. Veterinarians in clinical practice – both generalists and specialists – are always pressed for time, but are also committed to providing the best care for their patients and the most current information to their clients. Excellent textbooks of endocrinology and reproduction already exist; their comprehensiveness begat lengthiness, and are difficult to peruse in 10 minutes between cases. Our thought was to create a reference text covering all of the topics we thought were relevant to the practice of endocrinology and reproduction, in a format that could be read in 5 minutes (well, maybe 10 minutes), yet permitted the reader to gain excellent knowledge of the topic (or to confirm their knowledge already in place). The list of topics grew alarmingly, but our list of knowledgeable and willing authors made it all seem possible. Voila! *Blackwell's Five-Minute Veterinary Consult Clinical Companion Small Animal Endocrinology and Reproduction!* Thank you Dr Greco, thank you to all our contributing authors for time spent preparing manuscripts in their already overly busy lives, and finally, thank you Tom (my loving husband) for patiently waiting for me to finish working on the computer every night.

A. P. Davidson DVM, MS, DACVIM (Internal Medicine)

About the Companion Website



This book is accompanied by a companion website:

www.fiveminutevet.com/endocrinology

The website includes:

- Client education handouts

Anthelmintics in Pregnant and Breeding Dogs



DEFINITION

- Dogs are subject to both external and internal parasites, putting them at risk for communicable diseases, severe anemia, as well as other complications.
- Parasites most commonly indicated include ectoparasites, heartworm and intestinal parasites.
- The Companion Animal Parasite Council (CAPC) recommends administering year-round broad-spectrum parasite control with efficacy against heartworm, intestinal parasites, fleas, and ticks.
- Some parasite preventives are contraindicated for use in pregnant bitches, as they may cause developmental toxicity or prenatal mortality.
- Similar precautions may also exist for breeding studs and neonates.



ETIOLOGY/PATHOPHYSIOLOGY

- Ectoparasites – ticks are small arachnids in the order Ixodida and subclass Acarina, whereas fleas are insects forming the order Siphonaptera. Both are ectoparasites living by hematophagy and are vectors of a number of diseases. Tick and flea prevalence varies by region within North America.
- Ectoparasites generally acquire pathogens when feeding on infected reservoir hosts, transmitting pathogens and toxins during hematophagy.
- Heartworm (*Dirofilaria immitis*) is a parasitic roundworm that is spread from host to host through the bites of mosquitoes.
- The heartworm resides in the pulmonary arterial system causing damage to the lung vessels and tissues.
- Transmission of intestinal parasites may occur through ingestion of paratenic hosts, infective larvae or fleas, transmammary, transplacental transmission, or parasitic vectors.
- Pathophysiology of intestinal parasites varies widely but they live primarily as adults in the dog's intestinal tract.

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Companion Website: www.fiveminutevet.com/endocrinology

- *Giardia*, the most common non-helminthic intestinal parasite, is a flagellated protozoan parasite that colonizes and reproduces in the small intestine, causing giardiasis.
- *Giardia* infection can occur through the ingestion of dormant microbial cysts in contaminated water, food, or feces.
- Neonates may have an increased risk of infection through physical interaction with (transmammary), or the ingestion of infective eggs disseminated by dams with postgestational infection or infected breeding studs still on premises.
- Transplacental transmission to the fetus can occur in some intestinal parasites; e.g., roundworms.



SIGNALMENT/HISTORY

- Ectoparasites can affect any breed and any age, though are most commonly found in dogs averaging 3–6 years and atopic breeds.
- Species-specific prevalence related to geographic distribution exists for ticks, intestinal parasites and heartworm.
- Heartworm is prevalent among medium to large breeds aged 3–8 years (outdoor dogs).
- Hookworm infection causes acute disease in neonates and young puppies, and chronic blood-loss anemia in mature dogs.
- Roundworm clinical disease is most severe in young puppies.
- Tapeworm and whipworms show no sex, breed, or age predilection.
- *Giardia* is seen primarily in young dogs.

Historic Findings

- Ectoparasites cause symptoms such as scratching or rubbing, licking, chewing or biting, skin abrasions, or pyoderma (caused by secondary bacterial infection).
- Heartworm-infected dogs are primarily asymptomatic until late in the course of disease.



CLINICAL FEATURES

- Clinical features of parasitic infection vary based on species and severity (parasite load).
- Visualization of parasite evidence (fleas, flea dirt, attached ticks, tick-feeding cavities, vomit, diarrhea, or perianal coat containing eggs or worms).
- Lesions or abrasions are primarily caused by self-trauma.
- Wide variation of gastrointestinal signs, including vomit, diarrhea, abdominal distention, weight loss, obstruction.
- Wide variation of associated parasitic-borne diseases.
- Heartworm infection can result in varying severity of cardiac and pulmonary abnormalities.
- Neonates are often at higher risk for increased severity of symptoms.



DIFFERENTIAL DIAGNOSIS

- Skin irritation can be caused by:
 - Food allergy
 - Atopy
 - Sarcoptic mange
 - Cheyletiellosis.
 - Primary keratinization defects
 - Drug reaction
- Diarrhea and vomiting can be caused by:
 - Diet change
 - Food intolerance or sensitivity
 - Bacterial infection
 - Viral infection
 - Toxins
 - Idiopathic hemorrhagic gastroenteritis
 - Small intestinal bacterial overgrowth (SIBO); also called antibiotic-resistant diarrhea
 - Lymphangiectasia
 - Infiltrative disease
 - Exocrine pancreatic insufficiency
 - Idiopathic inflammatory bowel disease
 - Histoplasmosis
 - Intestinal obstruction
 - Histiocytic ulcerative colitis
- Cardiopulmonary dysfunction
 - Pulmonary hypertension
 - Pulmonary bacterial, viral, or mycotic infection
 - Inflammatory lung disease
 - Acquired or congenital cardiac disease



DIAGNOSTICS

- Physical examination of skin, perianal coat, or feces for parasites, parasite dirt or resulting abrasions/lesions.
- Blood + fecal testing (large variation).



THERAPEUTICS

- Refer to *The 5-Minute Veterinary Consult Clinical Companion Canine and Feline Infectious Diseases and Parasitology* for specific therapies by parasite species.

Prevention

- Therapeutic precautions in pregnant/lactating bitches, breeding studs and puppies are indicated below.

TABLE 1.1. Parasite Preventive Charts

Commercial name	Active ingredient(s)	Indicated use	Dosage	Route	Pregnant and lactating bitch			Breeding stud	Puppy
					Unsafe	Safe	Safe		
Comfortis	Spinosad	Fleas	Spinosad (30 mg/kg PO)	Oral	Unsafe	N/A	N/A	14 Weeks	
Program Tablets	Lufenuron	Fleas	Lufenuron 10mg/kg monthly PO	Oral	Safe	Safe	Safe	4 Weeks	
Program Flavor Tabs	Lufenuron	Fleas	Lufenuron 10mg/kg monthly PO	Oral	Safe	Safe	Safe	4 Weeks	
Vectra for Dogs and Puppies	Dinotefuran + Pyriproxyfen	Fleas	Available in 1.3, 2.0, 4.0 and 6.0ml sizes. Apply every month.	Topical	Unsafe	N/A	N/A	8 Weeks	
NexGard	Afoxolaner	Fleas + Ticks	2.5 mg/kg monthly	Oral	NE	NE	NE	8 Weeks	
Activyl	Indoxacarb	Fleas	Available in 0.51 ml, 0.77 ml, 1.54 ml, 3.08 ml, and 4.62 ml sizes. The topical solution should be applied monthly as a single spot between the dog's shoulder blades.	Topical	Unsafe	NE	NE	8 Weeks	
Scalibor Protector Band	Deltamethrin	Ticks	Deltamethrin (4%); one collar every 6 months	Collar	Safe	Safe	Safe	12 Weeks	
Preventic	Amitraz	Ticks		Collar	Safe	N/A	N/A	12 Weeks	
Sentry Natural Defense	Peppermint + Cinnamon + Lemongrass + Clove + Thyme	Fleas + Ticks	Available in 1.5 ml, 3.0 ml, and 4.5 ml sizes. Apply the entire contents in a single spot to the animal's skin.	Topical	N/A	N/A	N/A	12 Weeks	
Sentry Pro XFT	Etofenprox + Pyriproxyfen	Fleas + Ticks	The topical solution should be applied monthly as a single spot between the dog's shoulder blades.	Topical	Unsafe	N/A	N/A	12 Weeks	
Bio Spot Flea & Tick Collar with IGR For Dogs	Propoxur + (S)-Methoprene	Fleas + Ticks	One collar every 5 months	Collar	Unsafe	N/A	N/A	12 Weeks	

Seresto	Flumethrin + Imidacloprid	Fleas + Ticks	One collar every 8 months	Collar	NE	NE	7 Weeks
Bravecto	Fluralaner	Fleas + Ticks	25 mg/kg q 8-12 weeks	Oral	Safe	Safe	24 Weeks
Advantage II	Imidacloprid + Pyriproxyfen	Fleas + Chewing lice	Imidacloprid (10 mg/kg) and Pyriproxyfen (0.5 mg/kg) minimum	Topical	NPA	NPA	7 Weeks
Fiproguard	Fipronil	Fleas + Ticks + Chewing lice	Available in 0.67 ml, 1.34 ml, 2.68 ml, and 4.02 ml sizes. Apply the entire contents in a single spot to the animal's skin.	Topical	Safe	Safe	12 Weeks
Fiproguard Max	Fipronil + Cyphenothrin	Fleas + Ticks + Chewing lice	The topical solution should be applied monthly as a single spot between the dog's shoulder blades.	Topical	Unsafe	NPA	12 Weeks
PetArmor	Fipronil	Fleas + Ticks + Chewing lice	Available in 0.67 ml, 1.34 ml, 2.68 ml, and 4.02 ml sizes. Apply the entire contents in a single spot to the animal's skin.	Topical	Safe	Safe	8 Weeks
Certifect for Dogs	Fipronil + (S)-Methoprene + Amitraz	Fleas + Ticks + Chewing lice	Available in 1.70 ml, 2.14 ml, 4.28 ml, and 6.42 ml sizes. Apply the entire contents in a single spot to the animal's skin.	Topical	Safe	Safe	8 Weeks
Frontline Plus	Fipronil + (S)-methoprene	Fleas + Ticks + Chewing lice	Available in 0.67 ml, 1.34 ml, 2.68 ml, and 4.02 ml sizes. Apply the entire contents in a single spot to the animal's skin.	Topical	Safe	Safe	8 Weeks
Frontline Top Spot	Fipronil	Fleas + Ticks + Chewing lice	Available in 0.67 ml, 1.34 ml, 2.68 ml, and 4.02 ml sizes. Apply the entire contents in a single spot to the animal's skin.	Topical	Safe	Safe	8 Weeks

(Continued)

TABLE 1.1. (Continued)

Commercial name	Active ingredient(s)	Indicated use	Dosage	Route	Pregnant and lactating		
					bitch	stud	Puppy
Parastar	Fipronil	Fleas + Ticks + Chewing lice	The topical solution should be applied monthly as a single spot between the dog's shoulder blades.	Topical	Safe	Safe	8 Weeks
Parastar Plus	Fipronil + Cyphenothrin	Fleas + Ticks + Chewing lice	The topical solution should be applied monthly as a single spot between the dog's shoulder blades.	Topical	Unsafe	Unsafe	Unsafe
Flea4X	Fipronil	Fleas + Ticks + Chewing lice	Available in 0.67 ml, 1.34 ml, 2.68 ml, and 4.02 ml sizes. Apply the entire contents in a single spot to the animal's skin.	Topical	Safe	Safe	8 Weeks
Bio Spot Defense Flea & Tick Control For Dogs	Etofenprox + (S)-Methoprene	Fleas + Ticks + Mosquitoes	The topical solution should be applied monthly as a single spot between the dog's shoulder blades.	Topical	Unsafe	N/A	10 Weeks
Heartgard Chewables	Ivermectin	Heartworm	Ivermectin (0.006 mg/kg) monthly PO	Oral	Safe	Safe	6 Weeks
ProHeart6	Moxidectin	Heartworm + Hookworms	0.05 ml of the constituted suspension/kg body weight (0.0227 ml.lb) every six months subcutaneously.	Injection	Safe	Safe	6 Months
Tri-Heart Plus Chewable Tablets	Ivermectin + Pyrantel	Heartworm + Roundworms + Hookworms	Ivermectin (0.006 mg/kg) and Pyrantel (5 mg/kg) monthly PO	Oral	Safe	Safe	6 Weeks
Heartgard Plus Chewable Tablets	Ivermectin + Pyrantel	Heartworm + Roundworms + Hookworms	Ivermectin (0.006 mg/kg) monthly PO	Oral	Safe	Safe	6 Weeks

IverhartPlus Flavored Chewables	Ivermectin + Pyrantel	Heartworm + Roundworms + Hookworms	Ivermectin (0.006 mg/kg) and Pyrantel (5 mg/kg) monthly PO	Oral	Safe	NPA	6 Weeks
Iverhart Max Chewable tablets	Ivermectin + Pyrantel pamoate + Praziquantel	Heartworm + Roundworms + Hookworms + Tapeworms	Ivermectin (0.006 mg/kg) and Pyrantel pamoate (5 mg/kg) and Praziquantel (5 mg/kg) monthly PO	Oral	Unsafe	NPA	8 Weeks
Trifexis	Spinosad + Milbemycin Oxime	Heartworm + Roundworms + Hookworms + Whipworms	Milbemycin oxime (0.5 mg/kg) and Spinosad (30 mg/kg) monthly PO	Oral	Safe	Safe	8 Weeks
Interceptor Flavor Tabs	Milbemycin Oxime	Heartworm + Roundworms + Hookworms + Whipworms	Milbemycin (0.5 mg/kg) monthly PO	Oral	Safe	Safe	2 Weeks
Droncit	Praziquantel	Tapeworm	Praziquantel (5.0 mg/kg) PO, SC, or IM minimum	Oral	Safe	Safe	4 Weeks
Cestex	Epsiprantel	Tapeworm	Epsiprantel (5.5 mg/kg PO)	Oral	Unsafe	NPA	7 Weeks
Nemex Tabs	Pyrantel Pamoate	Roundworms + Hookworms	Pyrantel pamoate (5 mg/kg PO)	Oral	Safe	Safe	6 Weeks
Virbantel	Pyrantel Pamoate + Praziquantel	Tapeworms + Roundworms + Hookworms	Pyrantel pamoate (5 mg/kg) and Praziquantel (5 mg/kg) PO	Oral	Safe	Safe	12 Weeks
Drontal Plus	Praziquantel + Pyrantel Pamoate + Febantel	Tapeworm + Roundworms + Hookworms + Whipworms	Praziquantel (5 mg/kg) and Pyrantel pamoate (5 mg/kg) and Febantel (25 mg/kg) minimum PO	Oral	Unsafe	NPA	4 Weeks
Safe-Guard Canine	Fenbendazole	Tapeworm + Roundworms + Hookworms + Whipworms	Fenbendazole (50 mg/kg x 3 days PO)	Oral	Safe	Safe	6 Weeks

(Continued)

TABLE 1.1. (Continued)

Commercial name	Active ingredient(s)	Indicated use	Dosage	Route	Pregnant and lactating bitch	Breeding stud	Puppy
Dog Worms 3	Pyrantel pamoate + Praziquantel	Tapeworm + Roundworms + Hookworms + Whipworms	Small dogs (30mg tablets) - 6.0-12.0 lbs: 1 tablet, 12.1-25 lbs: 2 tablets Medium-Large dogs (114mg tablets) - 25.1-50 lbs: 1 tablet, 50.1-100lbs: 2 tablets, 100.1-150 lbs: 3 tablets, 150.1-200 lbs: 4 tablets		NE	NE	12 Weeks
Panacur C Canine Dewormer	Fenbendazole	Tapeworm + Roundworms + Hookworms + Whipworms	Fenbendazole (50 mg/kg x 3 days PO)	Oral	Safe	Safe	6 Weeks
Revolution	Selamectin	Fleas + Ticks + Heartworm + Roundworms + Hookworms	Selamectin (6 mg/kg) monthly TOPICAL	Topical	Safe	Safe	6 Weeks
Advantage Multi for Dogs	Imidacloprid + Moxidectin	Fleas + Heartworm + Roundworms + Hookworms + Whipworms	10% Imidacloprid and 2.5% Moxidectin topical spot-on	Topical	NPA	NPA	7 Weeks
Sentinel Flavor Tabs	Lufenuron + Milbemycin oxime	Fleas + Heartworm + Roundworms + Hookworms + Whipworms	Milbemycin (0.5 mg/kg) and lufenuron (10 mg/kg) monthly PO	Oral	NPA	NPA	4 Weeks

Trifexis	Spinosad + Milbemycin Oxime	Fleas, Heartworm, Roundworm, Whipworm, Hookworm	30 mg/kg Spinosad; 0.5 mg/kg Milbemycin oxime monthly	Oral	Safe	NE	8 Weeks
K9 Advantix	Imidacloprid + Permethrin	Fleas + Ticks + Mosquitoes + Chewing lice + Biting flies	Imidacloprid (10 mg/kg) and Permethrin (50 mg/kg) and Pyriproxyfen (0.5 mg/kg) minimum	Topical	NPA	NPA	7 Weeks
Vectra 3D	Dinotefuran + Pyriproxyfen + Permethrin	Fleas + Ticks + Mosquitoes + Lice + Sand flies + Mites	Available in 1.6ml, 3.6ml, 4.7ml, 8.0ml sizes	Topical	Unsafe	NPA	7 Weeks

NPA = No Problems Anticipated

NE = Not Evaluated



COMMENTS

- Companion Animal Parasite Council recommends year-round flea and tick control.
- Veterinarians are encouraged to evaluate new products not included in this chapter by reading the package insert or direct manufacturer consultation.

See Also

Canine Breeding Management.

Feline Pre-Breeding Examination and Breeding Husbandry.

Suggested Reading

Bowman, D.D., Barr, S.C. (eds) (2006) *Refer to The 5-Minute Veterinary Consult Clinical Companion Canine and Feline Infectious Diseases and Parasitology*. 1st edn. John Wiley & Sons.

<http://www.cpcvet.org/resource-library/parasite-product-applications-for-dogs>.

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Antimicrobial Stewardship in Small Animal Reproduction



DEFINITION

- Veterinarians recognize the need to maintain the usefulness of antimicrobial drugs in animals as well as humans, and that indiscriminant use of antimicrobial drugs contributes to the development of pathogen resistance. It is the responsibility of the veterinarian to prescribe antimicrobial drugs only when indicated to treat infection.



ETIOLOGY/PATHOPHYSIOLOGY

- Bacteria can be resistant to the action of antimicrobial drugs because of their inherent structure or physiology, or they can develop mechanisms to circumvent the action of the drugs through spontaneous genetic mutation. Antimicrobial use then applies a selective pressure to bacteria favoring resistant populations.

Systems Affected

- Cardiovascular
- Endocrine/metabolic
- Gastrointestinal
- Hemic/lymphatic/immune
- Hepatobiliary
- Musculoskeletal
- Nervous
- Neuromuscular
- Ophthalmic
- Renal/urologic
- Reproductive
- Respiratory
- Skin/exocrine

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Companion Website: www.fiveminutevet.com/endocrinology



CLINICAL FEATURES

- Breeders commonly express concern that infertility or subfertility in bitches is related to vaginal and uterine flora, requesting pre-breeding vaginal cultures and antimicrobial therapy based on the results. Stud dog owners specifically fear that a bitch will expose their male to pathogenic bacteria and damage his fertility. It has been shown that normal flora is exchanged during natural breedings without any detriment to either the bitch or the stud dog, or to their fertility or fecundity.
- The normal female reproductive tract harbors a variety of aerobic bacterial (including *Mycoplasma*) populations in the vaginal vault and uterus. Mixed vaginal cultures can be present in healthy, fertile bitches; the most common isolates include *Pasteurella multocida*, β -hemolytic streptococci, *Escherichia coli*, and *Mycoplasma* spp. The only bacterial species that is proven to be a specific cause of infertility in the bitch is *Brucella canis*. Recent development of transcervical uterine cannulation has enabled intrauterine cultures and biopsies to be collected noninvasively, and these may provide more accurate evaluation of actual infectious problems in the uterus than cranial vaginal cultures acquired with guarded swabs. During normal canine estrus, bacteria ascend the reproductive tract and are present within the uterus, subsequently regressing spontaneously. Vaginal and intrauterine cultures must both be interpreted with caution as many bacterial populations represent normal bacterial flora and do not indicate disease or explain infertility.
- The indiscriminant use of antibiotics before and during pregnancy is counterproductive and associated with the development of resistant organisms; it is not contributory to improved fertility or fecundity. It is unjustified to treat all positive vaginal cultures with antimicrobials, or to assume that all positive vaginal or uterine bacterial cultures are associated with infertility. As a general rule, growth of bacteria from the vagina or uterus in conjunction with clinical signs of excessive, malodorous or abnormal vaginal discharge, vaginal mucosal inflammation, peripheral leukocytosis and systemic illness, is significant and warrants treatment with antimicrobial agents. If possible, uterine cytology or biopsy should be examined for evidence of inflammation or infection.
- Breeders are less likely to request pre-breeding semen cultures of normal stud dogs, as commonly occurs with normal bitches. Previously fertile stud dogs currently failing to impregnate normal bitches with good husbandry and normal breeding behavior should have a semen evaluation performed; if the semen is abnormal and inflammatory in character, it should be submitted for aerobic, anaerobic and *Mycoplasma* spp. culture, and *B. canis* testing should be performed.
- If the semen contains excessive numbers of other cells such as white blood cells, macrophages, or red blood cells (pyospermia, hemospermia), an infectious/inflammatory disease should be considered.
- Bacterial infection of the testes (orchitis), epididymides (epididymitis), or scrotum can cause alterations in spermatogenesis as a result of the destructive properties of the organisms themselves, and as a result of local swelling and hyperthermia. Focal lesions can