Veterinarians in practice often have numerous questions about how to address the parasites affecting their patients. To answer these questions, they often rely on the advice of experts. This series is intended to address parasite problems that veterinarians must manage in everyday practice. To initiate the series, I have compiled a short list of common questions that I receive from veterinarians in the practice trenches. Hopefully, my answers can address some questions before you have to ask them.

1. Should I perform fecal examinations, gross parasite diagnostics, heartworm tests, and tests for vector-borne diseases in the clinic or send them to an outside laboratory?

   The answer to this question depends on several factors:
   • Do you have the necessary equipment and supplies in place or are you willing to acquire them?
   • Do you have trained staff with the skills to perform the tests?
   • How often are you called upon to perform these tests and how many tests will be run?
   • Do you have convenient access to a reference or academic laboratory?
   • Do cost and turnaround time factor into your decision?

   Reference and academic laboratories provide excellent parasitology resources for the practicing veterinarian. However, the conduct of in-clinic diagnostic testing is worthy of consideration.

   **Equipment & Supplies**
   The issue of equipment and supplies should not be of much concern. A quality microscope, centrifuge, and ancillary supplies are readily available. I often tell veterinarians that you can purchase a good microscope and centrifuge with needed accessories for less than several other pieces of in-clinic diagnostic equipment. They will likely last you a practice lifetime with little or no maintenance or repair.

   **Training Staff**
   Interested and enthusiastic staff can learn the more common parasitology tests and procedures very quickly and can become very good at it. I have a staff member who oversees my daily diagnostics that, when first hired, knew nothing about parasite diagnosis. She is now among the best in our field. Given the wet labs available at continuing education meetings and resources and counsel provided by academic laboratories and test manufacturers, training and experience are easily obtained. Most of us in academic laboratories are more than willing to offer training suggestions and resources to interested and enthusiastic staff members.

   **Number of Tests**
   Regarding the number of tests performed, when staff are trained and the procedures are in place, the number of specimens to be processed is of less concern. Once the decision is made to proceed with resident diagnostics, it is just a matter of time before the system is performing efficiently.

   **Reference Laboratories**
   If you submit specimens to a reference or academic diagnostic laboratory, it is important to ask about procedures and tests that they use. Some laboratories are running commercially available tests that you can purchase and your staff can perform. It is prudent to assure that the
laboratories to which you submit samples are performing accurate tests. Commercially available tests should have performance information included in the package inserts. If laboratories perform a custom test that they have developed, ask for performance data.

**Cost & Turnaround Time**
Cost and turnaround time both can be less if you perform diagnostics in-house. Remember, you always have the option of performing some tests yourself and sending others to outside laboratories. I have included several sources of information in the references section.1-4

2. **What is this parasite?**
This one almost always begins with, “Doc, I am seeing this parasite that I haven’t seen before—can you help?” Often it is a telephone description but, occasionally, it is a picture captured by a digital camera mounted to a microscope and connected to a computer (more about this later).

Although it is unlikely to encounter a parasite that is not included in the excellent laboratory manuals available today,1-4 you can shorten your search and save time by asking several important questions:
- What is the signalment (breed, age, sex, reproductive status) and history of this pet?
- Has the pet resided in your practice area its entire life or did the client move here recently?
- Do they travel with the pet and where?
- What do you know about recent use of antiparasitic drugs, including what, when, how much, and how often?
- What is the pet’s home environment—is it indoors, outdoors, or both?
- Does the client oversee a kennel or cattery, or is the pet a member of a multi-pet household?
- If the last question’s answer is “yes” to either or both, the age, breed, and sex of other pets can be important.

**Signalment & Geographic Region**
Why all the questions? Parasites are often predictable and tend to have stereotypic behaviors. Certain parasites, such as *Toxocara, Ancylostoma*, coccidia, and *Giardia*, are more common in younger pets. Others emerge or re-emerge as potential problems during pregnancy and lactation (sex, reproductive status). Those parasites that require intermediate hosts are, with some exceptions, seen in pets allowed outdoor access to the insects, gastropods, and furry creatures that they might prey upon. Parasites tend to occur (and reoccur) in certain geographic regions because of climate, prevalence of intermediate hosts, and vectors.

**Antiparasitic Drugs & Other Pets**
Prior use of antiparasitic drugs can confirm or rule out a tentative diagnosis based on:
- Which antiparasitic drugs were used
- Whether the proper dose was administered
- When they were last used.

Parasites can also be a greater problem when multiple pets are confined to smaller areas. Obviously, the risk of direct transmission is enhanced, particularly when the pets are of different ages and sexes, as mentioned.

**Pseudoparasites**
Keep in mind that other organisms or objects seen in feces and vomitus often are similar in appearance to parasites. These pseudoparasites can be challenging. Examples include:
- Tree pollen, which imitates *Toxocara* eggs
- Yeast, which masquerades as *Giardia*
- Free-living worms, which impersonate their parasitic counterparts
- Large motile bacteria, which resemble motile parasites.

Yes, diagnosis of parasites can be challenging, but armed with a little information and experience, you would be surprised how easily the puzzle is solved.

FIGURE. Attachment of a digital camera and computer with an Internet connection to your microscope will facilitate submission of captured images to experts for diagnosis.
Parasite Identification
I strongly encourage veterinarians to consider the use of a digital camera attached to their microscopes (Figure, page 87), which allows you to capture images in fecal preparations, blood smears, skin scrapings, and cytologic preparations and email them to your preferred expert. Often you will have a diagnosis or confirmation in a very short time.

All the equipment required is readily available through Internet sources. Contact an expert near you for more information. As mentioned earlier, several textbooks and/or diagnostic manuals are available to assist veterinarians.1-4

3. With all of the new antiparasitic drugs entering the market, I am having a difficult time deciding which ones to use. What products are best?
Some veterinarians view the wide variety of available antiparasitic drugs as a liability and burden in making choices. I view the assortment of new products as a bonus. It allows us to individualize treatment and prevention for each pet.

Product Criteria
Not surprisingly, criteria used in product selection should include:
- Target pet (eg, dog versus cat)
- Formulation (oral, topical, injectable)
- Efficacy
- Safety
- Convenience.

Additional criteria could include spectrum of activity (parasites eliminated), overlap with products currently used, and existence of parasite resistance. Certainly, veterinarians cannot ignore cost, invoicing and inventory issues, and prescription (including online pharmacies) versus marketing outside the veterinary channel.

New Drugs
New antiparasitic drugs, whether approved by the Federal Food and Drug Administration or Environmental Protection Agency, must comply with established performance mandates to gain approval. These products will prevent or eliminate the parasites that are included on their labels.

That said, there may be nuances of difference between categories of performance, such as speed of elimination of parasites, residual activity, and resistance of topical products to frequent water immersion and bathing, depending on products and individual pet situations. Veterinarians should carefully review the results of studies that support performance and safety claims.

Learning More
Product sponsors are enthusiastic about sharing their data in the clinic (breakfast meetings, lunch and learn forums) or at regional, local, and national scientific meetings. There is no lack of opportunity for those considering the use of a new product to get excellent detailed information.

Many veterinarians prefer to discuss new products with an academic mentor or other trusted professional. Just remember that it is not the responsibility of these individuals to make choices for the practice community, but rather to help sort through the complexities of the data and wealth of information that accompany new product launches.

4. I have conflicting canine heartworm results: one antigen test is positive, while the follow-up confirmation test is negative. Which test do I believe?
This is a common question that can cause significant concern for the veterinarian who must make a treatment decision.

First, let’s deal with the possible reasons for the discrepancy. If the 2 tests are different platforms (ie, enzyme-linked immunosorbent assay versus immunomigration) or even similar platforms but from different manufacturers, they can vary in their performance characteristics.

- Do they possess different sensitivity and specificity properties?
- Is one easier to read than the other?
- Is one more complex than the other with greater potential for error?
- Were the tests performed on the same blood sample or on samples collected at different time points?
- If one (or both samples) was shipped to another laboratory, was the sample stored properly prior to shipment and received by the test laboratory in a short time and in acceptable condition?

Answers to these questions can help explain why the discrepancy exists and which test result should determine a follow-up strategy. A low female heartworm burden that results in circulating antigen levels that are near the minimum detection level of the test is more likely to cause the discrepant result described.
It is always prudent to interpret a confounding heartworm test result together with other available information, such as client compliance and potential resistance to preventives. These issues have been addressed in previous publications.5,6 Also, the clinical condition of the patient, as determined by a thorough physical examination and blood and urine analyses, should always be used in conjunction with heartworm test results to make sensible treatment decisions.

5. I am interested in textbooks, laboratory manuals, and online information. What are some available resources? This is the easiest of the questions to answer. The information age is upon us. An extraordinary array of educational resources is available to practicing veterinarians.

Excellent parasitology textbooks and laboratory manuals are available in either hard copy or electronic versions.1-4 Most include high quality illustrations and photographs that can assist veterinarians with the most challenging cases. Many contain detailed life cycles and up-to-date treatment information on companion animals, livestock, and exotics; understanding life cycles is crucial in implementing a successful parasite control strategy. One of my favorite quotes is by CR Reinemeyer and MK Nielsen7: They say, “a thorough knowledge of life cycles is not emphasized merely to torment veterinary students. Rather, life cycle details reveal opportunities to control parasites through chemical or management interventions.”

The worldwide web provides access to global information on virtually any parasite in any location. The sheer number of websites is mind-boggling. Examples that should be of interest are listed in the Table. We veterinary parasitologists do not expect veterinarians to be experts on every parasite, but use of available information and resources can get you closer.

References

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<td>American Heartworm Society</td>
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Note: Several of these websites contain links to other resources.


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