

Getting the Most from a Veterinary Diagnostic Laboratory – A Pathologist’s Perspective.

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In the diagnosis, management, and prevention of animal diseases, the veterinary diagnostic laboratory (VDL) is a powerful ally of veterinarians, animal owners, and (often) state and federal regulatory personnel. The laboratories are the practitioner’s link to a wide variety of professional and laboratory services that are essential for accurate diagnoses and that facilitate cost-effective treatment of diseases of livestock and companion animals. If used improperly, however, the VDL can be a source of tremendous frustration for all involved.

Of the subjects taught in veterinary school, the least covered often seem to be the most practical. Veterinary students often get slight exposure to or training in the use of the VDL. On graduation, their initial interaction with the laboratory is often unrewarding because of a lack of understanding of the abilities and limitations of the VDL and of the activities by which it arrives at a diagnosis. Through trial and error, new graduates may eventually tap the potential of the laboratory or may be frustrated enough to avoid it altogether.

Accreditation by the American Association of Veterinary Laboratory Diagnosticians represents independent, third party assurance of a full-service laboratory with qualified personnel and adequate facilities

Some practitioners use the laboratory periodically but never fully utilize its potential benefits because communication between the laboratory and the practitioner is lacking or incomplete. The fault does not lie completely with the practitioner; some laboratories never offer useful feedback in verbal or written form. Feedback from the VDL concerning improving submissions is an important educational opportunity for veterinarians and their staff. Improved submissions allow the VDL to enhance service to veterinarians and clients.

Better use of diagnostic services depends on increasing understanding of how such laboratories operate. Although the operation of each VDL in the United States is different, there are certain unifying principles that are common to nearly all.

The first part of the two-part presentation discusses services offered by most veterinary diagnostic laboratories, criteria for selecting a laboratory, how diagnostic laboratories work internally, and reasonable expectations. Part II will consider selection and handling of specimens and selection of tests. Discussion will focus on university-based and state-sponsored diagnostic laboratories, with a few comments concerning commercial laboratories.

NONCOMMERCIAL AND COMMERCIAL LABORATORIES

Noncommercial VDLs are generally state-supported or state-mandated and perform general and regulatory diagnostic testing for animal diseases. The federal government provides funds for the operation of a national laboratory (the National Veterinary Services Laboratory [NVSL] in Ames, Iowa), which is intended to be a reference and support source for other diagnostic laboratories. With the exception of certain so-called program diseases, the NVSL does not accept samples from the general public.

State-mandated veterinary diagnostic laboratories, which exist in most states, vary widely in mission and scope. Many such laboratories are full-service laboratories, offering a wide range of diagnostic services; others concentrate almost exclusively on regulatory concerns. State legislatures justify support for animal diagnostic services because regulatory and nonregulatory testing is generally considered to be for the collective public good. Animal health affects all state residents directly (as livestock or pet owners) or indirectly (via its effect on agriculture and thus on the state economy, because virtually all state residents consume animal products, and because animal health is integrally related to public health). State diagnostic laboratories are often associated with universities and are outgrowths of early university agriculture experiment stations.

Commercial veterinary laboratories may be operated by companies that manufacture products for animal agriculture (e.g., veterinary biologicals) or by companies organized strictly for the purpose of providing veterinary diagnostic services. Many commercial laboratories offer specialized services related to their products and are less likely to have the range of services offered by noncommercial laboratories. A few human medical laboratories provide veterinary diagnostic services, especially in the area of clinical pathology.

THE ROLE OF THE AAVLD

The American Association of Veterinary Laboratory Diagnosticians (AAVLD) is a private, nonprofit organization with a specific mission statement (see text box). The accreditation committee of the AAVLD has minimum requirements that VDLs must meet or exceed to be accredited. A laboratory is accredited by the association after (1) the voluntary submission of a detailed, written application that includes descriptions of facilities, tests offered, test methodology and personnel qualifications and (2) a site visit is made by members of an AAVLD laboratory accreditation team.

Laboratories accredited by the AAVLD must offer necropsy, histopathology, clinical pathology (which can be on a direct referral basis), bacteriology, virology, mycology, serology, parasitology, and toxicology services. Minimum requirements for each service (with respect to facilities, techniques, and personnel) must be met. Some specialized procedures may be performed by outside laboratories because it is not reasonable or cost-effective to expect the requisite expertise of equipment to be available at all laboratories. For the most part, however, accreditation by the AAVLD assures the user of a full-service laboratory that meets or exceeds minimum standards.

A list of the AAVLD-accredited laboratories in the United States can be obtained (*contact Harvey Gosser, Secretary, The American Association of Veterinary Laboratory Diagnosticians, Veterinary Medical Diagnostic Laboratory, PO Box 6023, Columbia, MO 65205*). The AAVLD does not accredit commercial laboratories or laboratories operated by the federal government. Regardless of whether they are AAVLD-accredited, all state operated or commercial facilities that perform regulatory testing (e.g., for equine infectious anemia, Pseudorabies, or Brucellosis) are periodically required to certify their procedures by the U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS).

SELECTION OF A LABORATORY

The foremost considerations in selecting a VDL are service, quality, and confidence. Service includes the availability of required tests and the speed at which the results are available to the practitioner. The use of AAVLD-accredited laboratories generally provides access to most routine testing required for livestock and pets. Many AAVLD-accredited laboratories have in-house access to extremely specialized techniques, and most can provide such services on a referral basis through links with other laboratories.

Because many disease processes have come and gone by the time results arrive, untimely diagnostic results are not generally of great benefit to owners or veterinarians in controlling or treating the current outbreak. Such information is rendered of epidemiologic significance only. Laboratories that provide good service will generally give results of routine testing within one week, and a few laboratories will routinely provide results within three working days.

The quality of diagnostic service may be difficult for practitioners to assess for the same reason that it is difficult for the public to assess the quality of medical services – customers may lack the expertise necessary to judge the quality of the technical, skilled procedures performed. In most professions, states have adopted licensing examinations to protect consumers from unqualified practitioners; however, few such controls exist for the operation of diagnostic laboratories. Independent, third-party accreditation (like that provided by the AAVLD) gives some indication of the quality of service offered by a diagnostic laboratory. Determining laboratory quality by splitting samples and submitting them to two laboratories may help in some cases; however, the results may produce confusion as well.

Confidence in a diagnostic laboratory is like goodwill from a practice standpoint; it is difficult to define but vital to success or failure. Confidence in a laboratory comes from working with laboratory personnel for a period and gaining a feel for their level of commitment to excellence. The following characteristics of a VDL should instill confidence: well-qualified personnel; results presented in a neat, concise, understandable manner; diagnostic

Statement of Purpose

American Association of Veterinary Laboratory Diagnosticians

- * Dissemination of information relating to the diagnosis of animal diseases
- * Coordination of diagnostic activities of regulatory, research, and service laboratories
- * Establishment of uniform diagnostic techniques
- * Improvement of existing diagnostic techniques
- * Establishment of accepted guidelines for the improvement of diagnostic laboratory organizations relative to personnel qualifications and facilities
- * Serving as consultant to the United States Animal Health Association on uniform diagnostic criteria involved in regulatory animal disease programs.

*From Membership Directory. Columbia, MO,
The American Association of Veterinary
Laboratory Diagnosticians, 1993.*

personnel who are willing to discuss cases; and an appreciation for the position of the practitioner (i.e., not intentionally circumventing the referring veterinarian to deal separately and exclusively with clients).

Qualities in the diagnostician that instill confidence are candor, knowledge of the weaknesses and strengths of laboratory tests and procedures, and especially the desire to provide the best possible service. Confidence should develop over time through rapport with laboratory diagnosticians. The handling of a difficult case usually affects rapport. Good diagnostic laboratories do not hesitate to retest if requested (on an in-house or referral basis), submit findings for review, or seek additional expertise from outside sources.

In addition to these important primary criteria, cost and proximity should be considered. It is penny-wise and pound-foolish to choose a laboratory on the basis of cost alone. If service, quality, and confidence are equal, cost should be considered; however, such situations are rare. Fees at most state diagnostic laboratories are set to recover only a portion of the operating costs because such services are partially subsidized by state revenues. User charges generally have to be higher at facilities that receive less state subsidy. Some laboratories have ceilings that limit the maximum charge per accession. Even at state-subsidized laboratories, additional charges for specialized services (e.g., examinations for legal or insurance purposes) may be assessed because such cases often require additional time and documentation.

Some state-mandated laboratories are required by law to offer costly specialized services that are not generally available at commercial laboratories. Fees charged by such laboratories must recover the high cost of providing these services. Laboratories may add surcharges or charge increased fees to out-of-state users. Veterinarians may find that such fees are acceptable if better service and quality are available at a laboratory in a neighboring state. Although commercial laboratories must recover all costs and normally must produce a profit, costs may be subsidized by sales of other products.

Proximity to the laboratory is becoming less important. With the many overnight shipping services available, reasonably sized samples can be sent anywhere in the world by the next day. Regular shipping and mail channels generally provide overnight service within a radius of several hundred miles. Proximity *is* important if necropsy services are to be performed by diagnostic laboratory personnel; such services are often a bargain compared with the cost of providing these services.

LABORATORY PHILOSOPHIES

Diagnostic laboratories have different philosophies with respect to users, testing, and reporting. The relative merits of these philosophies are debatable, but particular users may prefer the approach of one laboratory to that of another. The examples considered here illustrate philosophical extremes; most laboratories operate somewhere in between. To make the best use of a laboratory, the practitioner must know how it functions.

At some laboratories, veterinary diagnosticians (often veterinary pathologists) are present when non-necropsy samples are received. Each sample is assessed professionally before being sent for testing. At such laboratories, diagnosticians customarily decide which testing procedures are appropriate in addition to or in lieu of those requested by the referring veterinarian. Tissues submitted to such laboratories are generally subsampled by laboratory personnel for specific testing. Reports from these laboratories typically reflect all laboratory findings and provide an interpretation of the findings by the assigned diagnostician.

Other laboratories perform only tests that are requested and allow the referring veterinarian to act as diagnostician. Mail may be opened and dispersed to testing laboratories by individuals that lack sufficient training in animal diseases to determine which tissues are appropriate for specific tests. Laboratories that operate in this manner generally require the user to group tissues and indicate the tests to be performed on each specimen or group of specimens. Reports from laboratories with this philosophy often contain only laboratory findings; the practitioner correlates and interprets the findings of the various tests.

Diagnostic laboratories also differ with respect to from whom they will accept samples. Although many state-supported VDLs are required by state law to accept samples directly from animal owners, most such laboratories prefer to accept samples only on the order of a practicing veterinarian for the same reason that human diagnostic services are not offered directly to the public. Diagnostic findings are not readily interpretable by laypersons, and most laboratories do not have enough time to explain the findings and (as is usually requested) to suggest therapies to animal owners. Diagnostic veterinarians are usually reluctant to become involved to this degree because of the fact that a doctor-client relationship is rare between the diagnostician and the animal owner.

In many states, diagnostic veterinarians are not required to be licensed to practice. There is some concern about violation of practice acts and liability when diagnosticians interpret findings, especially if treatments are prescribed. Exceptions exist, especially in the case of avian medicine in areas in which there are few or no poultry practitioners. Many avian diagnosticians also act as clinicians, frequently prescribing therapy and offering management advice. Some VDLs, especially commercial laboratories, encourage owner submission of samples and employ licensed veterinarians to work directly with clients in interpreting results and prescribing treatments.

Certain diagnostic laboratories (mainly state-mandated ones) are required by law in some or all cases to provide diagnostic reports and findings directly to the animal owner (small animal and companion animal biopsy reports and necropsy findings might be exempt). This requirement makes some veterinarians uncomfortable and may dissuade them from using such laboratories. In many cases, however, such reporting actually increases the dialogue between the owner and veterinarian; sometimes, comments made by diagnosticians can be more motivational to owners than recommendations by the practitioner.

ACCESSIONS

Most VDLs handle diagnostic investigations on the basis of accessions. To the diagnostic laboratory, an accession represents samples from single animals or groups of animals of similar age with a single clinical problem. Depending on the circumstances, the sample may be a single animal or several animals (or specimens from them). When an accession is composed of several animals, they are generally handled as if they were a single animal (i.e., tissues from the animals are pooled, if appropriate, for purposes of laboratory testing).

Although some clinical problems cross age boundaries (e.g., an outbreak of pseudorabies on a swine farm), most do not. For example, diarrhea in 2-day-old pigs is generally *not* caused by the same pathogen as diarrhea in 5-week-old or even 15-day-old pigs. There may be some overlap, but diarrhea problems in pigs of two days, three weeks, and five weeks of age are generally considered to be three different clinical problems and thus three accessions. A single clinical problem, and therefore an accession, almost always represents a sample from a group of commingled animals of the same age with similar clinical signs.

In most cases, it is logistically difficult for the diagnostic laboratory to handle multiple clinical problems within one accession; results and findings are generally clearer if the practitioner correctly groups submissions according to clinical problem. Veterinarians sometimes improperly group samples from several groups of animals as a single submission in an attempt to save money; however, laboratory findings generated from such submissions are often frustrating to diagnosticians and confusing to veterinarians and owners. The practitioner may attempt to save clients money by such inappropriate grouping; in the long run, however, this approach may actually lead to higher costs for clients in the form of lost diagnostic results or the need for additional tests. Many diagnostic laboratories separate such mixed submissions into appropriate accessions and bill accordingly.

REALISTIC EXPECTATIONS

Animal owners and, with some frequency, veterinarians may have unrealistic expectations concerning what a VDL can do with a given specimen and how long it takes to achieve results. On television, a medical examiner and his assistant have more than enough time to reconstruct an entire crime scene from a single hair during a one-hour program. In the real world, veterinary diagnosticians are rarely able to generate such spectacular results.

The computer adage "Garbage in, garbage out" also applies to VDLs. A laboratory cannot work miracles with severely autolyzed, inappropriate, or inadequate specimens. Far too often, small intestine is submitted to confirm a diagnosis of swine dysentery, or a long history suggests the need to examine the brain of a dog but only liver, kidney, and spleen are submitted.

Some situations require so-called state workups; other situations only seem to. Not all procedures can be accelerated. Bacteria, viruses, and cells cannot be made to grow faster; fluids cannot be made to diffuse through gels faster; and tissues require a certain amount of time for processing. Before requesting the VDL to give highest priority to a perceived emergency, practitioners should ask themselves whether immediate knowledge of the diagnosis would significantly alter management of the patient. This question will allow apparently urgent cases to be handled on a more realistic basis.

Abortion is a common problem that generates in owners and veterinarians considerable anxiety and the perception of a need for an urgent workup. Realistically, there is usually not much that can be done to stop an abortion storm, even if the cause is known. Examining aborted fetuses often produces information that can only be applied next year or to the next group of pregnant animals.

Potential and real toxicoses are often problematic for diagnostic laboratories and practitioners. When companion animals die unexpectedly, many (most?) owners believe their pets to have been poisoned. Although a percentage of these deaths *can* be attributed to poisoning, toxicosis is confirmed in relatively few cases and laboratory evaluations demonstrate many unexpected deaths to be due to natural causes. Despite the fact that chemical detection techniques have improved dramatically in recent years, toxicologists and chemists must have a starting point from which to work when confronted with the possibility of a poisoned animal.

Because of the number of potentially toxic compounds, screening procedures to identify an unknown toxin in the body of an animal are virtually useless as well as being extremely expensive. Clinical signs are not often helpful; clients may simply find the animal dead or may report signs inaccurately because of lack of knowledge or observation of only the terminal stages of the process.

Except in cases of malicious poisoning, one of the most reliable pieces of information is the availability of the toxin to the animal. If the probability of exposure to the toxin is low, the probability of toxicosis caused by the toxin is also low. In cases of suspected malicious poisoning, some diagnostic laboratories analyze specimens for a few common toxins (e.g., strychnine, insecticides, and rodenticides). Such toxins such as cyanide, strychnine, and fluoroacetate were once the poisons preferred by malicious people; although these substances have limited availability today, they are occasionally found in the possession of some individuals or stored in some old buildings.

Potential episodes of poisoning and suspected toxicosis should be discussed with diagnostic laboratory personnel before samples are submitted. Unlike living organisms, which can be cultured to increase their numbers in specimens, chemical toxins must be extracted from the sample and separated from interfering compounds in sufficient quantity to allow detection, further complicating the job of the toxicologist.

Some cases are particularly frustrating to veterinarians and owners, especially if the diagnostic laboratory is unable to arrive at an appropriate diagnosis despite florid clinical signs. Such problems are often a consequence of inappropriate or inadequate sampling but can result from a lack of communication. Not all diseases produce morphologic alterations in tissue, and the alterations produced by some diseases may not indicate specific causes.

If communication is appropriate, most diagnostic laboratory personnel make every effort to help practitioners and owners with specific, frustrating problems. Because it is easy to blame the absent party, VDLs receive much blame. If a VDL generally gives good service and inspires confidence, it is advisable to contact and work with the laboratory rather than placing blame in a particularly frustrating case. A good laboratory will consider such a case to be a diagnostic challenge and will often expend considerable energy in partnership with the clinician and owner to resolve the problem.