

Chapter 1

Introduction to the Hematology Laboratory

Key Concepts

In the hematology laboratory, manual and automated test techniques are used in the study of blood and other body cells and fluids.

Blood tests obtained in the laboratory are used by the clinician for screening the health status of an animal or in making a diagnosis of a disease condition.

Quality control of laboratory procedures is essential to ensure that test results reflect the true status of the patient.

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Hematology is the study of blood and the tissues that form, store, or circulate blood cells. Examination of the blood is a very common and useful procedure for several reasons. Blood bathes all the other cells of the body carrying nutrients, oxygen, and waste products, and is exposed to almost all metabolic processes of these cells, often reflecting any alteration from normal function. Blood is essential in water and electrolyte balance, temperature control, and the functioning of the immune system, which is the defense mechanism of the body. Obtaining, studying, and testing a blood sample is a relatively easy way of gathering information on many parts of the body.

Even though the term “hematology” literally means “the study of blood,” many of the techniques of collection, sample preparation, and cell identifications learned by the technician can be applied to other regions of the body, such as joint fluid, cerebrospinal fluid, thoracic and abdominal fluids, aspirants from abnormal growths or swellings, and cells collected from mucous membranes (e.g., the oral cavity, trachea, or vagina).

Veterinary technicians should expect to encounter a wide range of laboratory facilities and instrumentation in various veterinary clinics. This can vary from a separate room fully equipped with the latest automated analyzers to a small area on one counter with a microscope, slides, and stains in smaller clinics (Figs. 1.1, 1.2, and 1.3). Even if the clinic sends out all of its hematology tests to a commercial lab, or to the local human hospital, the technician is still usually responsible for correctly collecting, preparing, and mailing or delivering the sample as well as reporting and recording the results.

Hematology is one of several specialties in the field of clinical pathology, a field that encompasses any manual or automated laboratory procedure used on the animal to aid in diagnosing a clinical condition. Clinical chemistry, parasitology, and urinalysis



Figure 1.1 Some clinics may have limited laboratory equipment and may routinely send samples to hospital or commercial laboratories.



Figure 1.2 Technicians will find clinics with an area dedicated to laboratory work with some of the latest automated equipment.



Figure 1.3 Larger veterinary hospitals often have a complete laboratory room that may be staffed by one or more full-time laboratory technicians.

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are additional classical aspects of clinical pathology. Other diagnostic tools used by the veterinarian that qualify as clinical pathology under this definition are microbiology, diagnostic imaging (radiology and ultrasound), and the microscopic interpretation of biopsies (tissue samples).

Uses and Benefits of Hematology Results

The most common use of the hematology laboratory is to screen the general health of an animal and to assess its overall ability to transport oxygen and defend against infectious agents. Hematology results provided by the technician are also used by the veterinarian as tools that, when combined with the history, physical examination, and other laboratory findings, help to form a diagnosis. Although occasionally a blood test will yield a definitive diagnosis (e.g., blood parasites), most laboratory results should be viewed as large or small pieces of a diagnostic puzzle that must be assembled.

Hematology results may also indicate a course of treatment for the animal. An example of this is the use of hematology to differentiate between anemia caused by internal hemorrhage and that caused by bone marrow depression. Another example is finding specific infectious organisms within blood cells. Laboratory findings may also suggest other beneficial tests, such as a bone marrow biopsy.

Serial sampling, which is the collection and testing of a series of blood samples over a period of time (hours, days, or even weeks), can demonstrate the severity of a disease process and the ability of the animal to respond. By combining these results with clinical evaluation, the veterinarian will be better able to understand the disease process and make a prognosis for the patient.

It has been said that a clinician who relies entirely on laboratory results to make a diagnosis is probably inexperienced and a clinician who claims not to need a laboratory is uninformed.

Limitations of Laboratory Findings

The validity and usefulness of both manual and automated laboratory results can be influenced by many factors that should be understood by the technician, so they may be eliminated or minimized as much as possible. Technical errors associated with individual tests are discussed in later chapters, but those of general laboratory procedures are addressed in this section.

The first potential problems arise in the collection and handling of the sample. The blood sample, or any other tissue sample, should not be subjected to traumatic physical forces, such as being forced rapidly through a small needle or violently shaken, or to extreme temperatures of heating or freezing. Care must be taken to avoid contaminating the sample with foreign material such as dirt, infectious agents, chemicals, or even water. Test results are always more meaningful with fresh samples, but when this is not possible samples should be refrigerated since blood, like other organic material, begins to degenerate after removal from the body. A more extensive list of sample handling errors is found in Chapter 4.

Quality control, or more accurately “quality assurance,” should be considered a laboratory commitment, rather than a laboratory problem. Whether the test procedures are performed manually, carried out by automated equipment, or even sent to a local hospital or a commercial or state laboratory, it is essential to know that the results reflect the patient’s status and not a difference in machines, technicians, or techniques.

Test results often vary with different test conditions, and the “normal” animal may routinely test higher or lower than published “normal” ranges. Commercial and state laboratories usually provide their established reference values for each test being performed on each species with the laboratory report. Clinical laboratories should establish reference values for any manual or automated test procedure performed in the clinic. For reference values to be statistically valid, a large number of tests must be performed, which may be difficult in a small clinical setting. By keeping a record of all tests run (and data on the patients), plus checking medical records for other similar test results, clinics can establish a database to compare with published values. At a minimum, tests on several known normal or control samples should be run for each procedure by each technician who will be performing the tests. These control samples can also be sent to the outside laboratory being routinely used and the results compared with the in-house results. Some slight variation in results should be expected, but they should fall within the established range for that procedure. Paired samples, half sent to an outside source and half run in-house for comparison, can also be quite instructive. Running such tests will ensure that current test procedures and results are reliable, or the tests can be used to establish reference readings for a new technique, technician, or a piece of equipment. The frequency of checking in-house tests will vary with the type and a number of tests performed and often varies from daily to weekly to monthly but should never be overlooked.

Another area of quality control that must not be overlooked is the variation in skill levels, accuracy, and care of the technician, especially in manual procedures. While the decision about which laboratory test to perform in the clinic or hospital and which to send out depends a great deal on the cost-effectiveness and timely availability of outside services, the number of tests being performed should also be considered. Routinely, if a test is not being done at least a few times per week, it does not provide the laboratory personnel with adequate opportunities to become skilled at, and comfortable with, the procedure or the equipment.

The veterinary technician is often responsible for collecting, preparing, and examining the sample and reporting the results. All counts or measurements should be done on a “blind” basis, that is, with no comparisons to normals or expectations of changes that could lead to bias in reported results. Since the technician may be the only person to actually see the sample, it is imperative that all observations, whether normal or abnormal, be recorded. Often the “comments” section of a lab report is as informative as the recorded results.

Laboratory Safety

Although most diseases of domestic animals routinely handled by the technician are not communicable to humans (zoonotic), the ones that tend to be quite severe, possibly fatal. All biological samples, whether blood or other body tissues and fluids, should be handled as if potentially infectious. Routine handwashing and disinfection of glassware and

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Figure 1.4 A laboratory smock should be worn at all times, and protective gloves, eyewear, and confining of long hair are important when working around potentially infectious or hazardous conditions.

working areas is essential. There should be no drinking, eating, use of tobacco products, or other hand-to-mouth activities, nor any storage of food or beverages in the laboratory area. A laboratory coat should be worn at all times, long hair confined (especially around Bunsen burners and centrifuges!), and sandals, open-toed shoes, or canvas shoes should be avoided. Laboratory gloves should be worn whenever potentially infectious samples are being handled (Fig. 1.4). All disposable pointed or cutting instruments (e.g., needles and scalpel blades) should be placed in an appropriate “sharps” container, such as an empty gallon jug or commercial container, prior to disposal. Laboratory safety policies should not only be posted in the laboratory area but also be read and followed.

Review Questions

1. What is the major function of the hematology laboratory?
2. Compare the benefits and limitations of the hematology laboratory.
3. What is meant by the term “quality control” in relation to reporting test results?
4. Why is laboratory safety important to the hematology technician?