# Chemistry Panels & Tests for Pets

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A veterinary chemistry panel (also termed 'biochemical profile') includes tests for multiple chemical constituents within one sample. The quantities of these chemicals can reveal many things about the various organs of the body. Most veterinary chemistry panels check blood electrolyte and for diseases of the liver, kidneys, and pancreas.

Whole blood is a combination of blood cells and liquid. The Complete Blood Count (CBC) deals with the cell portion and quantifies the different kinds of red and white blood cells, platelets, and hemoglobin. The chemistry panel deals with the liquid portion of the sample after the cells have been removed. To obtain the liquid, the blood sample is allowed to clot within the tube and then the tube is spun in a centrifuge. This forces the clot to the bottom of the tube and the liquid remains at the top. The fluid left after the clot has been removed is referred to as ' serum.' This is the portion used for a chemistry panel.

Many veterinarians can perform some small chemistry panels 'in house,' which means within the veterinary facility. For larger panels, the tests are often performed by a local laboratory, frequently within a human hospital. There, a small quantity of the serum from the original collection is drawn into a single large machine. Tiny samples from that serum are tested for various chemical components. The results of each test are compiled and printed out on a single form. To make it easier for veterinarians and physicians, the form lists the patient's results along with the expected normal values for that species.

Types of panels

Since the laboratory equipment has the ability to run numerous different tests, there can be many different chemistry panels (e.g., liver panels, electrolyte panels, geriatric panels, pre-surgical panels) produced depending upon which individual tests are requested and included.

A typical veterinary chemistry panel will measure the following:

- Blood Glucose
- BUN
- Creatinine
- Calcium
- Total Protein
- Albumin
- Globulin
- Total Bilirubin
- Alkaline Phosphatase
- ALT (SGPT)
- Cholesterol
- Sodium
- Potassium

Thirteen different tests, that if run individually, would cost hundreds of dollars. But when performed as a panel, the tests can be done at a more reasonable price. Not only is there a large saving in cost, but the panel often makes diagnosis of a wide range of disorders much, much easier.

It would be nice to state that all veterinarians are great diagnosticians. The truth is that numerous times every year veterinarians can be 'bailed out' or saved by a chemistry panel. In these instances, the panel leads us to a diagnosis that we had not even considered in our mental list of possible disorders. Sometimes, a veterinarian can just listen to the history and examine the dogs and know immediately what is wrong. In other cases, the veterinarian can examine the pet closely every two hours for three days and not have a clue as to the underlying problem. In this latter situation, the chemistry panel is of unquestionable value. Sometimes, the results are of little or no help in the process of making a diagnosis, but that is very, very rare.

Descriptions of specific tests

Blood Glucose: When the body takes in carbohydrates, it converts them to glycogen, which is stored in the liver. As the individual needs energy, the glycogen is converted to glucose, which enters the bloodstream and is transported throughout the body. Blood glucose, is therefore, a measure of the animal's nutritional level, but it is more often used to monitor metabolism and physiology. The normal range for blood sugar is 60 to 120 mg/dl (that is milligrams of glucose for each deciliter of whole blood). If the results are lower than 60, the animal is said to have low blood sugar and is referred to as hypoglycemic. If the findings are much greater than 130, the dog is said to be suffering from hyperglycemia.

Hypoglycemia is a frequent problem in young puppies, especially the toy and smaller breeds. These animals may seem weak, uncoordinated, and even have seizures. Some adult dogs also have problems with hypoglycemia, especially during periods of increased or prolonged activity. This is very common in some of the hunting breeds. Low blood sugar is also seen in animals that have been sick and debilitated for a long time and in certain forms of cancer.

Slightly elevated blood sugar results are often found when the animal is stressed or very excited when the blood sample is taken. We have frequently seen results greater than 160 from excitement alone, especially in cats. However, when the level is

over 180 mg/dl, it signals problems. At this point, the threshold of the kidneys is exceeded. (While the blood is being filtered by the kidneys, the kidneys are supposed to prevent the loss of glucose in the urine. However, once this high level is reached, the ability of the kidneys to retain glucose is surpassed and 'sugar' spills over into the urine.) The most common cause of this is diabetes mellitus. The full name of this disease is diabetes mellitus, which means 'sweet urine.' In this condition, the body does not produce enough insulin, which is needed for glucose to enter the cells of the body. With inadequate insulin production, the glucose remains in the blood. We have seen blood sugar readings in diabetics as high as 900!

BUN: 'BUN' stands for Blood Urea Nitrogen. The proteins that animals consume in their diet are large molecules. As they are broken down and utilized by the body, the by-product of this metabolism is nitrogen-containing urea compounds. These are of no use to the body and are excreted by the kidneys. If the kidney is not working correctly and filtering these compounds from the blood, they build up to excessively high levels. When this happens to a human, they are said to be 'uremic,' and will probably be placed on a dialysis machine.

When the BUN result is high, it is only an indication that the nitrogen wastes of protein are not being removed from the body. While kidney disease is the primary reason for studying the BUN level, there can be other causes for its elevation. We also see significant BUN elevations when the patient is dehydrated, since there is just not enough fluid in the body for the kidneys to function correctly. Additionally, if anything causes decreased blood flow to the kidneys, they cannot adequately filter the blood and the BUN will elevate. An example of this would be heart disease with decreased circulation. If there is an obstruction so that the urine cannot get out of the body, it will build up in the bladder preventing the kidneys from producing more. This would also elevate the BUN.

Lower than normal BUN levels are frequently noted in liver disease. This organ is one of the primary sites of protein breakdown. If this breakdown does not occur, the nitrogenous wastes will be found at lower than normal levels.

Creatinine: Creatinine is also used to measure the filtration rate of the kidneys. Only the kidneys excrete this substance, and if it builds up to higher than normal levels, it is a sign of decreased or impaired function of these organs.

Calcium: Calcium is a mineral that is found in consistent levels within the bloodstream. While a dog is pregnant or nursing puppies, the calcium level can become seriously depressed in a disease called eclampsia. Additionally, certain medications, tumors, etc., can affect calcium levels. It is important to detect an abnormal blood level of calcium quickly before it leads to serious heart and muscle disorders.

Total Protein: The total protein level is a combined measurement of two blood protein molecules, albumin and globulin. Albumin is normally produced by the liver. We often see albumin levels depressed when the animal is receiving inadequate or poor quality nutrition, or following chronic infectious diseases in which their stores have been used up and not yet replaced.

The term 'globulins' includes immunoglobulins which are produced by the body's immune system as part of the body’s defense against bacteria and viruses. In certain diseases, such as Feline Infectious Peritonitis, elevated globulins can occur.

An elevated protein level is usually a sign of dehydration.

Bilirubin: Bilirubin is by-product of the breakdown of hemoglobin. Hemoglobin is the molecule within red blood cells that is responsible for carrying oxygen to the tissues. When the blood cells die or are destroyed, hemoglobin is released and quickly broken down and excreted by the liver as bilirubin. Therefore, bilirubin levels may be higher than normal when excessive numbers of red blood cells are breaking down, or if the liver is diseased and unable to clear the bilirubin from the blood. If there is an obstruction within the liver or bile duct so that the bilirubin cannot be released into the intestine, blood levels will also elevate.

Alkaline Phosphatase: Serum alkaline phosphatase (often abbreviated 'SAP') belongs to a class of compounds called enzymes. These are protein molecules that function to assist various chemical reactions. Although the normal level of alkaline phosphatase varies in different species of animals, alkaline phosphatase in a dog is seen at higher levels in certain forms of cancer and some muscle and liver diseases.

SGPT: Serum Glutamic Pyruvic Transaminase (SGPT) is also called 'alanine amino transferase' (ALT). It is an enzyme important in liver function. An elevation usually means that the liver cells are breaking down for some reason. The liver may be cancerous, have an infection within it, be congested or engorged with too much blood (as in heart failure), failing or worn out as in cirrhosis, obstructed so that the waste products and toxins it filters from the blood cannot be removed from the body via the bile duct, etc. Basically, anything that adversely affects the liver or its ability to function correctly will elevate the SGPT.

Cholesterol: Cholesterol does not have the same connotation as it does in human medicine. Hardening and obstruction of the vessels of the heart is not a common problem in canine and feline medicine. Rather, cholesterol deviations are generally secondary signs of other diseases. Animals with inadequately functioning thyroid glands often have elevated cholesterol. Starving animals or those with poor levels of nourishment may have lower than expected cholesterol.

Sodium and Potassium: Sodium and potassium levels are interpreted together. Their levels can be seriously affected in diseases of the adrenal glands, heart, kidneys, or by various medications, etc. Conversely, changes in their levels can lead to very serious secondary problems. such as preventing the heart, nerves, and kidneys from functioning correctly.

Conclusion

Compared to the Complete Blood Count (CBC) that looks at the cellular components in the blood, the chemistry panel

frequently offers more information related to specific diagnoses. The tests listed above provide direct evaluations of the health of the liver, kidneys, adrenal glands, immune system, etc. Also, in addition to helping us make a diagnosis, the chemistry panel is just as helpful in determining a prognosis, (a forecast of the outcome of the disease). In some cases, however, a diagnosis only comes from watching the various parameters change over a period of time.

Still, as with the CBC, the chemistry panel is just a picture of the patient's body at one moment in time. The readings may be very different in 24 hours, or even one hour. The veterinarian must always take into consideration everything that is affecting the patient and in turn, how that may affect the test results.