

# The Blood Chemistry Panel Explained

## The Serum Chemistry Profile

(for patients in their adult years, the following tests are added to the “mini chem profile”)

As pets age, we expect that they may have more problems than younger patients. We recommend adding a few more blood chemistries to screen for problems in older patients. In adult patients, we look at electrolytes, calcium, phosphorus, bilirubin, glucose, and the thyroid level to screen for middle aged problems such as Addison’s disease, lymphosarcoma, or hemolytic anemia. **The following tests are done in addition to the tests on the Mini-Chem profile recommended for younger patients.**

- **Total Protein**: Total protein is simply the sum of albumin and globulins. It can be elevated or decreased for the same reasons that albumin and globulins are elevated or decreased.
- **Bilirubin**: This is a pigment made by the liver. It’s what makes vomit yellow. It’s what makes the skin and eyes yellow in jaundiced patients. It is elevated in patients with liver disease, red blood cell disorders, or infections. Liver diseases causing elevated bilirubin levels include hepatitis, cholangiohepatitis, hepatic lipidosis, and bile duct obstruction. Pancreatitis can cause elevated bilirubin levels due to its proximity to the liver. Patients with hemolytic, or autodestruct, anemias will have an elevated bilirubin because hemoglobin is released into circulation once the red blood cell breaks open and is converted into bilirubin as part of its metabolism. Pennies made before 1986 contain enough zinc to cause patients who ingest them to have hemolytic anemia and high serum bilirubin concentrations. Serious infections anywhere in the body, such as prostatitis, can elevate the bilirubin mildly. Low bilirubin has no significance.
- **Calcium**: Calcium is one of the main minerals of bone. It exists in the blood stream as an ion or bound to other molecules. Calcium is necessary for normal muscle function, including the heart muscle. High calcium levels are associated with oversupplementation of Vitamin D, hypoadrenocorticism, lymphosarcoma, anal sac adenocarcinoma, some systemic fungal infections, hyperparathyroidism and renal failure. High calcium will cause seizures, renal failure, and cardiac arrhythmias, regardless of the cause. Low calcium is associated with hypoparathyroidism and lactation. Nursing mothers frequently start trembling and become weak due to low calcium.
- **Chloride**: Chloride is an electrolyte. It can be low due to vomiting, diarrhea, chronic respiratory disorders, or diuretic administration. It can be high due to diarrhea (yes, again) or salt poisoning (dogs who eat Playdough). Chloride levels often follow sodium levels. It is often easier to determine the cause of sodium imbalances than chloride.

- **Cholesterol**: Cholesterol is most commonly elevated due to recent feeding. This is considered normal. High cholesterol after a 12 hour fast is not normal. This can be due to hypothyroidism, hyperadrenocorticism, or conditions that cause protein leakage through the kidneys. High cholesterol can cause corneal lipid deposits. High cholesterol is not associated with heart disease as it is in people.
- **CPK**: CPK stands for creatine phosphokinase. This is an enzyme commonly associated with muscle injury. Even mild muscle injury can make this enzyme become substantially elevated in muscular breeds of dogs. When CPK is elevated concurrently with ALT, the ALT is interpreted to be from muscle origin and not liver origin. Rarely, CPK is an indicator of myositis or inflammation of the muscle.
- **Phosphorus**: Phosphorus is the other major mineral component of bone. Its metabolism is integrally associated with calcium. Low phosphorus may be caused by diabetes mellitus, hyperparathyroidism, lymphosarcoma, or anal sac adenocarcinoma. Low phosphorus levels will cause hemolysis of red blood cells, regardless of cause. High phosphorus levels are associated with renal failure, hypoparathyroidism, Fleet enema toxicity, oversupplementation of vitamin D, and growth (normal cause). High phosphorus causes nausea, vomiting, and diarrhea, regardless of the cause.
- **Potassium**: Potassium, K, is an electrolyte. Potassium influences muscle function and cardiac rhythm. Low potassium is associated with anorexia, chronic renal failure, vomiting, and diarrhea. Low potassium can cause cardiac arrhythmias and generalized weakness. High potassium levels are caused by acute renal failure, hypoadrenocorticism, and urinary tract obstruction. High potassium causes cardiac arrhythmias and muscle tremors.
- **Sodium**: Sodium, Na, is an electrolyte. It is the major positive ion of the body. It is responsible for maintaining normal blood volume. It is necessary for all life functions. Low sodium is caused by diabetes mellitus, chronic renal failure, hypoadrenocorticism, vomiting, and diarrhea. High sodium levels are associated with diabetes insipidus, salt toxicity (Playdough), water restriction, and brain tumors. Rapid changes in sodium levels, either up or down, are likely to cause seizures or other neurologic dysfunction.
- **Total T4**: Total T4 is a measurement of the sum of protein-bound thyroxine and nonprotein-bound thyroxine in the bloodstream. It is used as a screening test for hypothyroidism and hyperthyroidism. Hypothyroidism is an endocrine disorder where the thyroid glands do not make enough thyroid hormone for normal life functions. Signs of low thyroid are poor hair coat, bilaterally symmetric hair loss, skin and ear infections, thick looking face, decreased activity, decreased mentation, heat-seeking behavior, and weight gain. This level is checked when there are symptoms present to suggest hypothyroidism. It is a screening test only because the total t4 is commonly low for reasons other than hypothyroidism. If the result is low, a complete thyroid panel is needed for confirmation that the patient actually needs lifelong thyroid supplementation. Low thyroid over time can lead to myxedema in the brain which will cause seizures. Once this starts, thyroid supplementation will no longer work to prevent seizures.

Hyperthyroidism is primarily a disease of cats. It occurs in older cats and is slow and subtle in progression. Symptoms of high thyroid are rapid heart rate, increased activity, loss of normal sleeping patterns, vomiting, weight loss, increased or decreased appetite, and behavior changes. High thyroid levels cause hypertension, heart disease, and renal failure.