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BETTER + BETTER.

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*VetScan*<sup>®</sup>  
**ROTOR**  
UTILIZATION BOOKLET



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The **VetScan VS2** is amazingly simple and intuitive, featuring an advanced user interface, expanded printing capabilities and precision reference laboratory quality results in 12 minutes from 100 µL of whole blood, serum, or plasma, making it ideal for veterinary clinics, research laboratories and pharmaceutical and biotech companies.

Increasing Care Standards and Revenue with Preventive Care Testing

At What Age Should Preventive Care Testing Begin?

Preventive care testing can identify subclinical disease at any age.

Renal insufficiency caused by inflammatory or infectious processes, congenital renal disease, hepatopathy and congenital hepatic shunts are just a few of the common abnormalities found in young patients without clinical signs.

Pre-anesthetic testing in all age groups is a form of wellness testing and can detect subclinical disease prior to anesthesia and surgery, which may change your surgical premedication or anesthetic protocol, delay the procedure or provide a need for additional diagnostics.

Benefits of Preventive Care Testing

Patient Benefits

- Establish baseline values for important organ function
  - Not all normal patients have normal values
  - Changes within the normal range (elevations above baseline) can be clinically significant (e.g., creatinine)
- Identify disease at an early stage
  - Usually improves prognosis and response to therapy
  - Often reduces cost of treatment
  - Increases quality and length of life
  - Improves the human-animal bond
- Provides pre-anesthetic information
- Assess organ function and evaluate for short-term or chronic use of medications

Practice Benefits

- Higher quality medicine attracts high quality clients
- Early disease detection improves job satisfaction for veterinarians and staff
- Increased staff involvement improves productivity
- Increased profits
- Improve practice image/referrals
- Improve client communication, education and compliance

Benefits of In-House Preventive Care Testing

- Easily and effectively expand wellness testing and identify a significant number of patients with a subclinical disease at the point of care
- Offer affordable patient diagnostics for clients to encourage compliance on an annual basis
- Provide immediate feedback for a positive report
  - Peace of mind for the client, veterinarian and staff—everyone wants a positive report
- Provide ability to perform immediate additional diagnostics if necessary
- Provide face-to-face personal explanation of results, increasing value and image
- Reduced technician time, sample handling time and having to run multiple tests or send out
- Increased profits
- Reduced costs



Analytes

ALB, ALP, ALT, BUN, CA, CHW, CRE, GLOB, GLU, PHOS, TBIL and TP

Ideal For

Performing a comprehensive wellness chemistry panel and testing for heartworm antigen simultaneously on canine patients greater than 6 months of age, implementing a comprehensive wellness program or streamlining existing wellness programs while increasing profit and cost savings and reducing technician time

Used For

- Comprehensive wellness testing and heartworm screening prior to prescribing heartworm preventative:
  - Young dogs >6 months to obtain baseline values and begin heartworm screening prior to administering preventatives
  - Adult dogs <7 years to screen for renal insufficiency caused by inflammatory or infectious processes, congenital renal disease, hepatopathy and congenital hepatic shunts are just a few of the common abnormalities found in young patients without clinical signs
- Diagnosis of heartworm disease in patients suspected of having infection while gathering baseline values prior to administering treatment
- Monitoring internal organ function in a patient previously determined to have a heartworm infection at a wellness or recheck visit

Benefits of Combined Wellness and Heartworm Testing

- A published report<sup>1</sup> shows that a preventive care testing program has its advantages of combining a chemistry profile and heartworm testing:
- Easily and effectively expand wellness testing and identify a significant number of patients with a subclinical disease at the point of care
  - Offer affordable diagnostics to clients to begin and maintain annual exams
  - Provides great peace of mind for the client, veterinarian and staff—everyone wants a positive report
  - Reduced technician time, sample handling time and having to run multiple tests or send out
  - Increased profits
  - Reduced costs
  - Reduced possibility of human error associated with manual heartworm tests

Heartworm-Positive Patients

Use as a Primary Test

Should a patient test positive for heartworm infection with the Canine Wellness Profile, then all the tests necessary as an initial screen prior to adulticide treatment have already been performed, thus saving time and money. Examples include:

- Hepatic evaluation: ALT, ALP, TBIL, GLU, TP and ALB
- Renal evaluation: BUN, CRE, ALB, PHOS and CA
- Inflammation and hydration: TP, ALB, GLOB, BUN and CRE

The need for any additional chemistry testing can be determined from these values, if necessary.

Use as a Secondary Test

The American Heartworm Society recommends confirmatory testing of any asymptomatic heartworm-positive patient<sup>2</sup> with limited exposure. This is best performed with an alternate methodology from the original test to ensure that a false-positive test has not occurred. For example, if the positive heartworm test was performed with a lateral flow device (such as the Vetscan Canine Heartworm Rapid Test), then the Canine Wellness Profile is a perfect confirmatory test—not only does it have a methodology found in no other heartworm test, but it also provides all the additional chemistry tests necessary to assess the severity of the disease and evaluates the patient’s ability to undergo adulticide therapy.

<sup>1</sup>Irwin, J., *Veterinary Economics* 42[4]:36-40 Apr 2001

<sup>2</sup>American Heartworm Society Canine Guidelines for the Diagnosis, Prevention and Management of Heartworm (*Dirofilaria immitis*) Infection in Dogs; [www.heartwormsociety.org](http://www.heartwormsociety.org)





# Comprehensive Diagnostic Profile



## Analytes

ALB, ALP, ALT, AMY, BUN, CA, CRE, GLOB, GLU, K<sup>+</sup>, NA<sup>+</sup>, PHOS, TBIL and TP

## Ideal For

Providing complete chemistry and electrolyte analysis for pre-anesthetic, general health, ill patient, geriatric and wellness testing

## Used For

- Establishing new patient baselines
- Wellness exams for young, adult and geriatric patients
- Health screening prior to administering anesthesia or sedation
- Ill patients and critical care cases
- Recheck examination for administering medications or managing chronic disease

## Rotor Utilization

### Benefits of In-Office Chemistry Testing

In-office testing enables the veterinarian to evaluate a pet’s general health and become aware of any health problems at the point of care. The combination of immediate results and the complete chemistry information provided by the panel allows for:

### Disease Diagnosis

The tests included on the Comprehensive Diagnostic Profile provide the clinician with the chemistry and electrolyte information necessary to obtain:

- Immediate diagnosis
- Narrowed diagnostic rule-out list
- Information necessary to determine the need for additional tests or procedures

### Pre-Anesthetic Evaluation

As part of the pre-anesthetic evaluation, the Comprehensive Diagnostic Profile provides a full range of chemistry tests plus evaluation of the electrolytes needed to evaluate fluid therapy needs— tests vital to best practices in anesthetic protocols. The ability to perform the tests the day of the procedure provides:

- Evaluation of the patient in real time, not days or weeks prior to the procedure
- Lower client and hospital costs
  - Reducing client and patient time in the hospital prior to the procedure
  - No need for additional patient visits to obtain blood prior to the day of surgery

### Recheck Evaluations for Chronic Disease

A 14-chemistry-test recheck evaluation is not only realistic and economically feasible; it is usually a medical necessity, as evaluation of a limited number of tests provides incomplete information often leading to a missed diagnosis or a less than desired outcome. For example, regular evaluation of the patient BUN and creatinine in the chronic renal patient may seem medically and economically reasonable. However, renal patients often exhibit some or all of the following during the course of disease:

- Protein loss, especially albumin, from the kidney
- Inflammation or infection of the urinary system
- Elevated phosphorus levels
- Secondary parathyroid disease leading to calcium and phosphorus abnormalities
- Electrolyte abnormalities, especially K<sup>+</sup>
- Reduced GFR indicated by elevated amylase levels (among other values)

From these points alone, it is important to test not only BUN and creatinine, but also total protein, ALB, GLOB, PHOS, CA, NA<sup>+</sup>, K<sup>+</sup> and AMY. Additionally, these patients often exhibit other conditions where evaluation of hepatic values and glucose, for example, are necessary. A tiered pricing structure for this panel allows for excellent client compliance.

### Preventive Care Testing

The complete testing offered by the Comprehensive Diagnostic Profile is perfect for the wellness patient during a routine visit. Immediate results allows for:

- Ability to discuss the results with the client during the visit, providing increased value
- Additional diagnostics with the patient already in the exam room and the owner present
- Improved compliance and increased referrals
- Increased customer satisfaction
- Best diagnostics based on a complete profile

## The Value for Each of These Uses Is Enhanced By Immediate Results

- Provides timely information regardless of use
- Provides ability to discuss results with owners
- Reduces number of callbacks and phone tag
- Increases compliance
- Improves value
- Reduces client stress
- Increase additional testing and diagnostics through enhanced information, value and client understanding

### Small Sample Volume

- Reduced stress on the patient
- Capability of running multiple tests per sample
- Improved sample quality

### Time

- Time is saved for the owner and veterinarian with in-office testing
- Reduce phone time to contact clients
- Reduce unnecessary visits
- Increase necessary visits based on improved medicine, compliance and client communication



Analytes

ALP, ALT, BUN, CRE, GLU and TP

Ideal For

Basic health screen for pre-anesthetic evaluation and testing minimal values for baselines of young, healthy patients or recheck profile for some disease states

Used For

- Lower-cost option for clients to perform wellness screening for young pets
- Pre-anesthetic screening for common surgeries on apparently healthy, young patients for dental procedures, ovariohysterectomies and castrations
- Recheck for disease states such as diabetes mellitus and renal disease

Rotor Utilization

The Prep Profile II provides basic values for the clinical evaluation of young, apparently healthy patients as well as values commonly utilized for rechecks.

Pre-Anesthetic Testing

The 6 tests available on the Prep Profile II rotor are chemistry values commonly evaluated prior to procedures involving sedation or anesthesia. These values provide baseline information regarding:

- Renal health: BUN and CRE
- Hepatic health: ALT, ALP and GLU
- Hydration: TP and BUN
- Metabolism: GLU

Should abnormalities be identified, additional testing can be performed utilizing other profiles such as the Comprehensive Diagnostic Profile, the Mammalian Liver Profile or the Critical Care Plus profile.

Preventive Care Testing

A published report<sup>1</sup> shows that wellness testing identifies a significant number of patients with a subclinical disease, increases diagnostics in other areas of the practice, improves the quality of medicine provided by the practice and increases practice revenue and patient load. In addition, a completely normal wellness panel provides great peace of mind for the veterinary staff and pet owner—everyone wants a positive report!

The Prep Profile II provides important parameters often utilized in wellness testing of the young, apparently healthy patient. As with pre-anesthetic testing, additional testing can be performed with other panels should abnormalities be observed.

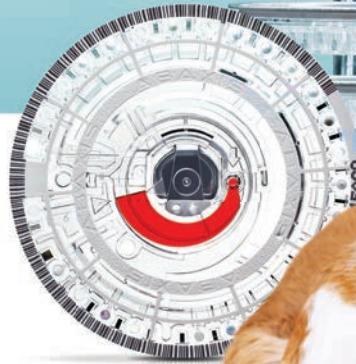
Recheck Evaluations and Hospital Monitoring

The Prep Profile II provides important information for renal, hepatic and diabetic patients being hospitalized, monitored, or undergoing long-term treatment. The lower cost of the rotor provides basic necessary values for cost-sensitive clients or for the clinician who has determined the need to monitor only the basic values provided.

- GFR and hydration: BUN and CRE
- Hydration and protein loss (renal, gastrointestinal, etc.): TP
- Metabolism, hepatic function and concurrent diabetes: GLU
- Hepatic cellular necrosis or leakage: ALT
- Hepatic swelling and endocrine screen: ALP

It is important to remember that many chronically ill patients often develop multiple-organ failure. For example, the renal patient often develops diabetes mellitus or hepatic disease. Therefore, monitoring at least the baseline values with the Prep Profile II is providing better care than monitoring only individual parameters.

<sup>1</sup>Irwin, J., *Veterinary Economics* 42[4]:36-40 Apr 2001





Analytes

ALT, BUN, CL<sup>-</sup>, CRE, GLU, K<sup>+</sup>, NA<sup>+</sup> and tCO<sub>2</sub>

Ideal For

Serial testing, rechecks, fluid therapy and monitoring hospitalized patients

Used For

- Hospitalized patient monitoring
- An alternative panel to the Prep Profile II rotor for lower-cost pre-anesthetic testing
- Recheck panel for cases such as hyperadrenocorticism, diabetes and renal disease
- Early diagnostic information regarding acid-base status

The Value of tCO<sub>2</sub>

Total carbon dioxide (tCO<sub>2</sub>) measured in venous blood is equivalent levels of bicarbonate (HCO<sub>3</sub>) with a minor contribution from the ventilatory component. The clinician will gain a deeper understanding of the acid-base status of the patient without additional analyzers.

Acid-Base Analysis and the Interpretation of tCO<sub>2</sub>

tCO<sub>2</sub> should be interpreted in light of history, signalment, physical examination, clinical signs and other laboratory data. A tCO<sub>2</sub> value outside the reference range is equivalent to a bicarbonate level outside the normal range. In general, this can be interpreted as:

tCO <sub>2</sub> Decreased	Consistent with Metabolic Acidosis
tCO <sub>2</sub> Increased	Consistent with Metabolic Alkalosis

If tCO<sub>2</sub> is abnormal, the clinician must determine whether complete acid-base analysis is warranted (measurement of pH, pCO<sub>2</sub>, HCO<sub>3</sub>, Anion Gap, +/- Base Excess) or if the patient should be treated based on tCO<sub>2</sub> alone. This depends on availability of additional tests, patient condition, economics, original diagnosis, etc.

Many other entities, including electrolytes, proteins, ketones, lactic acid, uremic acids, and metabolites of ethylene glycol and HCO<sub>3</sub> can affect the acid-base status of the patient. Additionally, the calculation of the anion gap can indicate the presence or absence of these entities.

Anion Gap = (Na<sup>+</sup> + K<sup>+</sup>) – (CL<sup>-</sup> + tCO<sub>2</sub>)

An increased anion gap is most often seen with metabolic acidosis due to lactic, keto-, or uremic acids or the presence of other metabolites (ethylene glycol). A decreased anion gap is uncommon, and seen most frequently with hypoalbuminemia.

Rotor Utilization

Hospitalized Patient Monitoring

Hospitalized patients requiring fluid therapy benefit from a monitoring regimen that includes the critical care rotor because of the acid-base values and complete electrolyte profile. Examples include patients with renal disease and diabetic ketoacidosis where renal (BUN and CRE) and electrolyte (Na<sup>+</sup>, K<sup>+</sup> and CL<sup>-</sup>) values along with understanding of the acid-base status are important. The rotor also allows evaluation of other important analytes such as GLU and ALT to monitor hepatic changes. The rotor can be used alone or in combination with other panels based on the clinician's judgment, clinical signs and laboratory results.

The economic benefits of the Critical Care Plus rotor allow for daily serial testing of hospitalized patients, and when used in combination with the Comprehensive Diagnostic Profile clinicians can monitor the patient with regard to the most necessary medical analytes.

Recheck and Follow-Up Examinations

Due to the lower cost of the profile, it can be used as a full-panel alternative to perform recheck examinations for certain conditions. For example, many clinicians perform annual or semiannual recheck evaluations on chronically ill patients with the Comprehensive Diagnostic Profile. Addition of the Critical Care Plus rotor in between those examinations provides an increased level of patient care at a more affordable cost to the client. Now you can obtain important values every 2–3 months to better monitor conditions that can rapidly change or deteriorate. For example:

- Renal disease
  - It is highly recommended by associations such as the American Association of Feline Practitioners<sup>1</sup> that acidosis is monitored in chronic renal disease patients. The availability of tCO<sub>2</sub> on this rotor fulfills this recommendation while monitoring other important values.
- Diabetes mellitus
- Addison's disease
- Cushing's disease
- Idiopathic hypokalemia (feline)

Pre-Anesthetic Evaluation

Many pre-anesthetic blood testing protocols include a chemistry panel that provides 6-chemistry-analyte testing. Replacement of that panel with the Critical Care Plus rotor provides additional values important to the anesthetic patient, such as electrolytes and tCO<sub>2</sub>.

Young, healthy patients often have mild elevations in ALP due to the bone isoenzyme. Therefore, if elevated ALP is found with a normal ALT, it is not usually diagnostically relevant. The advantages of additional testing included on the Critical Care Plus profile are:

- Electrolytes Na<sup>+</sup>, K<sup>+</sup>, CL<sup>-</sup> and blood gas tCO<sub>2</sub>
- Metabolism
- Fluid balance and choice of fluid therapy
- Acid-base status
- Baseline for cardiac and/or respiratory emergency glucose
- Screen for hypoglycemia, especially in small, immature patients
- Screen for diabetes: GLU
- Screen for renal insufficiency: BUN and CRE
- Screen for underlying hepatopathy: ALT

<sup>1</sup>American Association of Feline Practitioners Senior Care Guidelines—Revised 2008



Analytes

T<sub>4</sub> and CHOL

Ideal For

Routine screening of hypothyroidism in dogs and diagnostic for hyperthyroidism in cats, titrating and monitoring patients on thyroid hormone replacement therapy or patients being treated for hyperthyroid disease

Used For

- Screening for hypothyroidism in dogs
- Titration and monitoring of thyroid hormone replacement therapy
- Diagnosis of hyperthyroidism in cats
- Monitoring drug, I<sup>131</sup> or thyroidectomy therapy

Rotor Utilization

Thyroid disease in dogs and cats is one of the most common endocrine disorders seen in the veterinary practice. Therefore, utilization of the T<sub>4</sub>/Cholesterol Profile at the point of care will enhance patient care, improve veterinary diagnostics and provide additional practice revenue.

Canine Hypothyroidism

Canine hypothyroidism disease results from an inadequate level of thyroid hormones. Although there are other less common causes, the majority of hypothyroid disease is caused by idiopathic thyroid atrophy or autoimmune thyroiditis. The diagnostic challenge for the clinician is to determine:

- The need for thyroid testing
- The proper tests to run and how to interpret the results
- Determination as to whether a diagnosis of thyroid disease or euthyroid sick syndrome is appropriate

Need for Testing—Screening Hypothyroid Disease

The low cost of the T<sub>4</sub>/Cholesterol Profile combined with its ease of use, precision and accuracy makes it an outstanding tool to screen patients for the presence of thyroid disease. Some examples of appropriate times to screen patients for hypothyroid disease using the T<sub>4</sub>/Cholesterol Profile are:

- A patient exhibiting clinical signs consistent with hypothyroidism. Some of the more common clinical signs (which can be seen with any endocrine disorder) are:
  - Weight gain
  - Dry coat, alopecia or other skin and hair coat abnormalities (often appear as allergy/atopy) or hyperpigmentation
  - Lethargy, mental dullness or bradycardia
  - Anestrus (intact females)
- Any patient with laboratory abnormalities potentially caused by hypothyroidism:
  - Hypercholesterolemia
  - Anemia (mild, nonregenerative)
  - Indicators of hepatic changes due to endocrine disorders such as elevations of alkaline phosphatase
- An apparently healthy, middle-age or older patient (especially breeds with predisposition to thyroid disease as part of a wellness testing program)

Since the results of a T<sub>4</sub> level are available in minutes, whether additional thyroid testing is required can be immediately determined and discussed with the pet owner. If T<sub>4</sub> falls below the reference interval, further evaluation of health status (euthyroid sick syndrome) or send-out testing including fT<sub>4</sub>, TSH and TgAA is recommended. Since the patient is still in the examination room, collecting another blood sample is simple and additional testing can be discussed with the client.

Medication Titration and Monitoring

Once a diagnosis of hypothyroid disease has been made, titration of therapeutic medications must be accomplished to the proper level. The goal is to determine:

- Proper dose
- Proper frequency

After an initial dose is calculated and administered for several weeks, a T<sub>4</sub> level should be determined 4–6 hours after the morning medication dosing to determine the peak blood level. If desired or if once-daily dosing is initiated, a 12-hour trough level can be determined the same day.

- If T<sub>4</sub> values are within the middle to upper end of the normal range, no adjustment is necessary and the patient should be monitored 1–2 times yearly
- If T<sub>4</sub> values are either more than 1.5 times the upper limit of normal or below normal at 4–6 hours, a dosing adjustment should be made and a retest performed in 2–4 weeks
- If T<sub>4</sub> values are normal at 4–6 hours and still normal at 10–12 hours, the clinician may determine that once-daily dosing is appropriate
- If values are normal at 4–6 hours, but low at 10–12 hours, the clinician may consider twice-daily dosing

Requirements for hormone replacement therapy can change because of the multiple changes a patient can undergo when medicated for thyroid disease including changes in weight, body condition and basal metabolism. Therefore, monitoring of the hypothyroid patient with a T<sub>4</sub> level should be performed at least every 6 months for best control. The ability to perform medication monitoring in the practice provides the flexibility to change medication dosing with the client still present. This reduces unnecessary return visits to the practice and improves compliance by allowing a point-of-care discussion with the pet owner regarding the medication change.





Feline Hyperthyroidism

Feline hyperthyroid disease is one of the most common endocrinopathies of adult and senior cats, but has been reported in cats of all ages. The disease causes excessive circulating thyroid hormone concentrations resulting in a multisystemic metabolic disorder. Excessive circulating T<sub>4</sub> results in clinical signs caused by increased basal metabolic rate and the body's inability to meet that rate.

The majority of feline hyperthyroidism cases are caused by benign adenomatous hyperplasia. Thyroid carcinomas account for only 1%–2% of all cases.

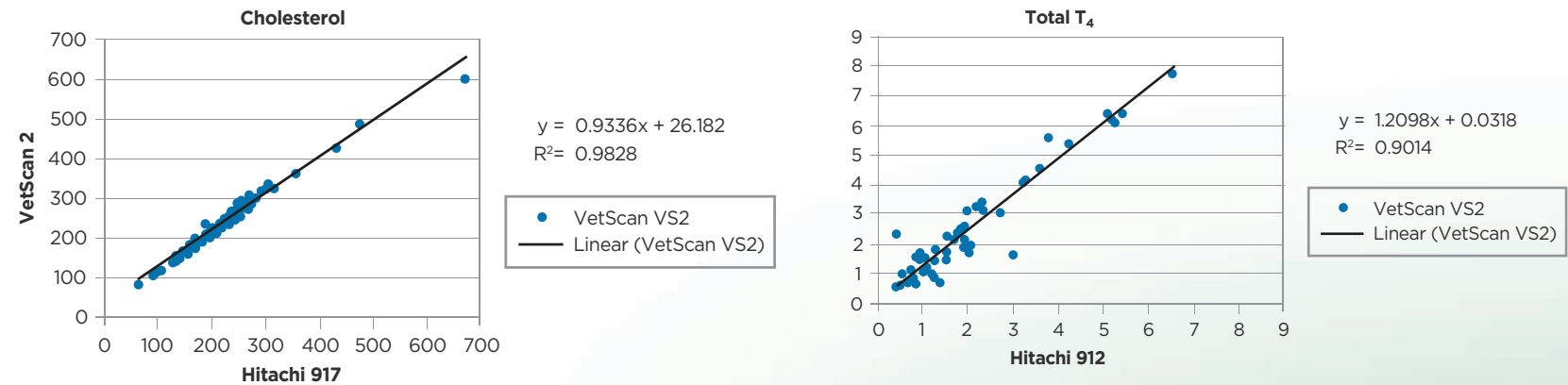
Screening for Hyperthyroidism

According to the American Association of Feline Practitioners' Senior Care Guidelines, 40% of hyperthyroid cats have mild clinical signs and can be diagnosed with hyperthyroid disease 1–2 years before obvious signs are noted. In addition, many hyperthyroid cats do not have palpable nodules. Therefore, a screening protocol should be instituted by the time the patient reaches 7 years old.

Monitoring Treatment

Common therapies for feline hyperthyroidism are I<sup>131</sup> or thyroidectomy. Patients receiving these therapies should be evaluated with a T<sub>4</sub> test 30 days after treatment. Treatment with I<sup>131</sup> or thyroidectomy should result in a euthyroid state. Some patients may require thyroid supplementation. Additionally, some cases will result in incomplete treatment leading to an elevated T<sub>4</sub> level in the future. In either scenario, routine monitoring of the patient with an annual or biannual T<sub>4</sub> level evaluation is vital to the patient's continued health. Should the patient require thyroid hormone replacement therapy after these treatments, the same titration and monitoring protocol as stated for the canine is appropriate for the cat. Should the clinician and pet owner choose to treat with medication (such as methimazole) to control hyperthyroid disease, the T<sub>4</sub> level should be used to monitor response to therapy (in addition to other appropriate tests such as regular complete blood count and chemistry panel). T<sub>4</sub> levels should be performed at least every 6 months in conjunction with changes in medication until normal T<sub>4</sub> levels are reached. Once this has occurred, the patient should be monitored on a regular basis.

Accuracy



Conclusion

The study by the University of California, Davis, School of Veterinary Medicine Department of Pathology, Microbiology and Immunology shows that the Abaxis Total T<sub>4</sub> and Cholesterol assays show excellent statistical agreement with the university method. The study shows the VetScan VS2 to be an excellent point-of-care analyzer for evaluation of total T<sub>4</sub> and cholesterol in dogs and cats.







Analytes

ALP, BUN, CA, CL<sup>-</sup>, CRE, GLU, PHOS, K<sup>+</sup>, NA<sup>+</sup> and tCO<sub>2</sub>

Ideal For

Kidney Evaluation and monitoring in cats and dogs of all ages as well as implementing and streamlining your renal function monitoring protocol.

Used For

- Monitoring patients on medication toxic to the renal system
- Monitoring Addisonian patients
- Blocked cats (lower urinary tract disease)

Rotor Utilization

Evaluate kidney function for all patients with the accurate and cost-effective VetScan Kidney Profile Plus. Including all kidney specific analytes, complete electrolytes and initial acid-base evaluation, the Kidney Profile Plus allows for more cost-effective monitoring of renal patients, allowing you to practice the type of medicine you want, at a price that suits your practice.

Featured Tests

- Albumin
  - Blood Urea Nitrogen
  - Calcium
  - Chloride
  - Creatinine
- Glucose
  - Phosphorus
  - Potassium
  - Sodium
  - Total Carbon Dioxide

The Kidney Profile Plus is designed for use with the easy to use VetScan VS2 Chemistry analyzer. With few hands-on steps and no extra training required, every user can run 10 chemistries critical to monitoring their patient’s needs with accurate results in just 12 minutes.

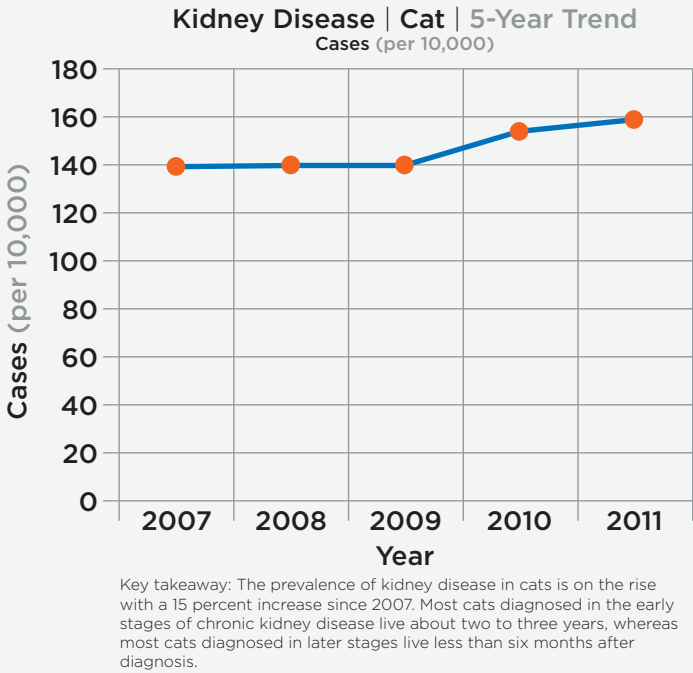
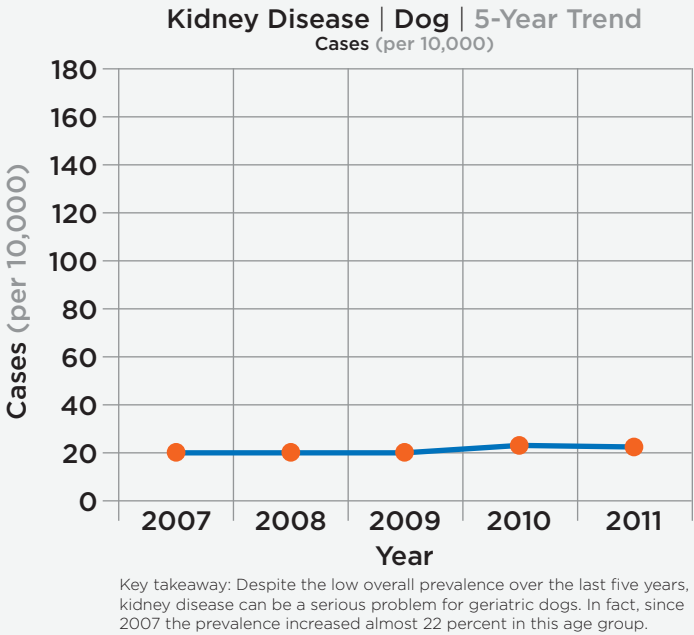
Background

- Kidney disease typically affects older animals.
- Half of all cats with kidney disease are > 7 years old
  - Half of all dogs with kidney disease are >10 years old

Kidney disease is 7 times more common in cats than it is in dogs. In 2011, 1 in every 12 geriatric cats had some form of kidney disease.

In 2011, approximately 20 in 10,000 dogs seen at Banfield hospitals were suffering from some form of kidney disease. This number jumps to nearly 160 cats in every 10,000 that showed some form of renal dysfunction. According to this same data, the numbers for cats are steadily increasing. See charts below for historical data.

Cases Per Year



Source: Kidney Disease, 2001, *Banfield Pet Hospital, State of Pet Health 2012* p. 23.

Mammalian Liver Profile



Analytes

ALB, ALP, ALT, BA, BUN, CHOL, GGT and TBIL

Ideal For

Obtaining baseline liver values, diagnosis and monitoring of hepatic disease and monitoring hepatic function while administering nonsteroidal anti-inflammatory drugs (NSAIDs) or other potentially hepatotoxic medications

Used For

- Diagnosis of liver disease
- Monitoring liver disease
- Diagnosis of congenital and acquired portosystemic shunts
- Obtaining baseline values prior to administration of NSAIDs
- Monitoring patients concurrent with the use of NSAIDs and other potentially hepatotoxic medications

Rotor Utilization

Hepatic disease is frequently a diagnostic challenge. The utilization of easy-to-use, in-office testing that includes bile acids assists with this challenge. Additionally, utilization of the Mammalian Liver Profile in the veterinary practice enhances patient care, improves veterinary diagnostics and provides additional practice revenue.

Hepatic Disease

- The liver is especially prone to the adverse effects of many diseases because:
  - The liver has two blood supplies:
    - The general circulation
    - Via the portal vein from the intestine
  - The general function of the liver and its complex functionality also place it at risk
- Changes in hepatic enzymes can be caused by pathology of the liver from secondary effects of other disease states
- Some of the enzymes used to evaluate liver function (e.g., ALP) can be induced by medications (phenobarbital) or nonhepatic disease states (hyperadrenocorticism). These tests do not provide evaluation of liver function; however, bile acid testing, included in the MLP, provides this ability

Diagnosis of Hepatic Disease Utilizing Bile Acids

Diagnosis of any condition requires a combination of history evaluation, physical examination, complete blood counts, chemistry, urinalysis and imaging, to name a few. However, when liver disease is indicated due to elevations in common liver enzymes, diagnosis of liver disease vs. secondary hepatic changes is vital in determining the need for additional diagnostics such as ultrasound and/or biopsy and interpretation of those results and prognosis. Bile acid evaluation provides the veterinarian with a highly sensitive test for liver disease and portosystemic shunts. It is easy to perform and a cost-effective method to aid in evaluating liver health.

Bile Acids

Bile acids are a family of detergent-like compounds synthesized from cholesterol exclusively within the liver. They provide intestinal fat digestion and absorption. In addition, they are efficiently reabsorbed into the portal blood and returned to the liver via the portal vein.

Bile acids elevate in the general circulation due to:

- Decreased bile acid clearance from portal blood
  - Hepatocyte damage reduces functional hepatic mass causing impaired clearance
  - Congenital and acquired portosystemic shunts or portosystemic vascular anomalies
- Decreased biliary excretion of bile acids
  - Impaired hepatic or post-hepatic bile flow due to any cause

Utilization of Bile Acids to Assist with Diagnosis of Hepatic Disease—General Rules of Interpretation

Bile acid levels should always be evaluated in light of other hepatic analytes.

Normal/mildly elevated preprandial BA	Liver function may be normal
Very elevated preprandial BA	Indicative of significant liver dysfunction, congenital or acquired portosystemic shunting
Normal preprandial BA and very elevated postprandial BA	Indicative of more subtle cases of liver dysfunction or portosystemic shunting
Very elevated pre- and postprandial BA, with minimal rise in BA after feeding	Indicative of possible post-hepatic biliary obstruction or biliary stasis
Preprandial BA higher than postprandial	In normal patients, may result from spontaneous interdigestive gallbladder contraction during fasting

Cost Savings

Because of the low cost of the Mammalian Liver Profile, paired bile acid testing is less expensive to perform in the office than sending it out to a commercial lab. Tests can be performed immediately upon suspicion of hepatic disease.

Monitoring the Effects of Potentially Hepatotoxic Medications and/or Chronic Liver Disease

Simple evaluation of routine enzymes, such as ALT and ALP, may not provide complete information as to the health of the liver. For example, many medications (e.g., prednisone) will induce liver enzymes without the presence of actual liver disease. In the case of chronic liver disease or monitoring response to therapy, monitoring the entire spectrum of values associated with the liver provides far better information than any individual test can provide. In addition, each enzyme or analyte may have a different half-life, rate of production or rate of excretion so that monitoring all of the values provides a more complete picture of the patient.

Monitoring of the effects of any long term medication can be easily evaluated using the Mammalian Liver Profile. Common medications such as NSAIDs have potential hepatic or renal toxicities. In fact, most medications make at least one pass through the liver, where they may or may not be altered. Therefore, regular monitoring of the patient is vital. This monitoring is more effectively performed with a panel designed to evaluate the relevant body system(s). The Mammalian Liver Profile was designed for this purpose. In addition, the Mammalian Liver Profile provides all the values at a cost to the clinician far lower per test than any other system available.

Recommendations for chronic medications:

- Perform a Comprehensive Diagnostic Profile and CBC at institution of drug therapy
  - Provides baseline levels of whole body function
- Perform a Mammalian Liver Profile plus CBC at 7–14 days post drug administration
- Perform an MLP/CBC every 3–4 months with a yearly CDP/CBC, to monitor the patient’s health status

Recommendations for chronic liver disease or response to therapy will vary with each condition and the half-life of the analytes involved. However, bile acid evaluation can be performed at any time to evaluate liver function.





Analytes

ALB, AST, BUN, CA, CK, CRE, GLU, GGT, GLOB, K<sup>+</sup>, NA<sup>+</sup>, TBIL, tCO<sub>2</sub> and TP

Ideal For

Routine equine checkups, wellness testing, ill patient diagnostics and prepurchase examinationsfor equine hospitals, ambulatory practitioners, critical care units and mixed animal hospitals

Used For

- Patient monitoring
- Wellness examinations
- Recheck examinations
- Prepurchase examinations
- Ill patient diagnostics
- Fluid therapy

Rotor Utilization

The Equine Profile Plus rotor is designed to provide the equine practitioner with comprehensive point-of-care chemistry results in minutes. When time is of the essence, the information provided by the rotor enhances patient care especially in critical case management. The ease of use and utility of the Equine Profile Plus not only allows the practitioner to diagnose the ill patient, but provides baseline data, which leads to improved medical management while incorporating a comprehensive health plan for each patient. Competitive pricing of the Equine Profile Plus and its rapid turnaround time adds value to clinical laboratory results, making the services more attractive to an increasingly knowledgeable clientele. Rapid turnaround equates to prompt, more defined treatment for your patients, which clients now demand.

The Equine Patient

The Equine Profile Plus is designed to provide the veterinarian with a profile of vital tests (ALB, AST, BUN, CA, CK, CRE, GLU, GGT, GLOB, K<sup>+</sup>, NA<sup>+</sup>, TBIL, tCO<sub>2</sub> and TP) to evaluate the equine patient. This information is critical in patient monitoring especially when fluid therapy is utilized. This data is useful in many aspects of equine practice in addition to diagnosis and management of the ill patient. The Equine Profile Plus is ideal for use in routine medical examinations, initial assessment of health in neonatal foals, prepurchase examinations, and geriatric case management

Presurgical Profiling

Presurgical evaluation is beneficial for both patient and client. Additionally, clients are highly inclined to accept the recommendation for this testing when adequately educated. The risk of complication from anesthesia is significantly increased if the patient has underlying renal impairment, hepatic dysfunction or other undisclosed health issues. Presurgical screening provides multiple benefits, which include:

- Identification of metabolic alterations that should be managed prior to surgical intervention
- Identification of subclinical disease that can compromise a positive outcome and can also be addressed to extend both length and quality of life
- Identification of organ dysfunction so that a safe anesthetic protocol can be determined
- Identification of the healthy patient so that the veterinary team may proceed with anesthesia with a higher degree of confidence

Measuring Response to Therapy

Once conditions are diagnosed and therapy begins, it is always prudent to assess response to therapy. While an important goal would be to see abnormal parameters return to normal, it is equally important to assure that other parameters remain normal. Renal dysfunction, hepatic compromise, muscle necrosis, and other complications can result from the use of certain therapeutics. Therefore, while only one analyte may be the focus of attention, best medical practice dictates evaluation of the entire patient and so the other analytes should never be discounted. Once normalcy is achieved, a follow-up evaluation can be performed to ensure wellness is maintained.

Chronic Use of NSAIDs

The chronic use of NSAIDs makes periodic blood chemistry evaluations of kidney and liver functions prudent. Use of long-term medications that may induce organ dysfunction should be evaluated on a regular basis and often serves as the basis for evaluating and continuing the drug.

Improved Profits Due to Enhanced Medical Utilization

The VetScan VS2 and Equine Profile Plus are the best instrument/chemistry profile to fulfill all the needs of the equine practitioner. The benefits of a full profile with speed and accuracy make it indispensable in any practice that wants to maximize its quality of care for their patients. With its small footprint and rugged stability, the VS2 would be a welcome addition whether in your clinic or tolerating the rigors of a mobile practice.





Analytes

ALB, AST, BA, CA, CK, GLOB, GLU, K<sup>+</sup>, NA<sup>+</sup>, PHOS, TP and UA

Ideal For

Measuring analytes that represent the most important areas of concern in avian and reptilian patients

Used For

- Evaluation of renal function, electrolyte status and liver integrity and function
- Wellness testing
- Annual health profiling
- Pre- or postpurchase exams
- Pre-anesthetic evaluation
- Emergency cases
  - Triage of clinically ill or injured patients
  - Evaluation of liver integrity and function
  - Ill patient diagnostics
  - Evaluation of renal status and electrolyte status
- Long-term monitoring after recovery and discharge
- Measuring response to therapy

Rotor Utilization

Utilization of the Avian/Reptilian Profile Plus in the veterinary practice will enhance patient care, improve veterinary diagnostics and provide additional practice revenue. Pet birds and reptiles are notorious for hiding signs of illness and will often do so until they reach a critical stage in which they can no longer compensate or mask those symptoms. The ease of use and utility of the Avian/Reptilian Profile Plus not only allows the clinician to diagnose the ill patient and screen for disease, but to incorporate a comprehensive health plan into the practice for every patient.

The Avian/Reptilian Profile Plus is designed to provide the clinician with a complete profile of vital tests to evaluate the patient. Values such as AST, BA, CA, CK, GLU and UA are indispensable in the avian practice. This profile offers the necessary analytes to gain an overview of the animal's health while providing focus on specific organ functions.

Sample Size

A sample size of 100 µL of whole blood, serum or plasma is required for a complete chemistry panel. This fact makes the Avian/Reptilian Profile Plus invaluable in avian and reptilian diagnostics. In many patients, only an extremely small blood volume is available from which all the necessary data must be obtained. The common parakeet, for example, can only provide approximately 300 µL of whole blood for which all diagnostic needs must be satisfied.

Utility of the Avian/Reptilian Profile Plus

Pre- or Postpurchase Exams

Pre- or postpurchase exams should always include a complete blood panel profile in addition to a physical examination and complete history evaluation. Reasons for including blood work within your purchase exam requirements are:

- Both juvenile and adult birds will hide signs of illness
- Novice bird owners are less likely to notice these telltale signs of illness
- Signs of illness may be mistakenly identified as “normal baby behavior” in baby birds
- Assisting the pet retailer to qualify the health of the inventory
- Postpurchase profiling accomplishes the following:
  - Ensuring that the new owner has acquired a healthy pet
  - Serves as a barometer of the health of the animals coming from a particular store
  - Establishes a healthy baseline for the new patient

Unhealthy or ill patients can be indentified early and the patient, pet owner and retailer benefit. Blood testing, in addition to a full and complete physical examination, provides the veterinarian with the complete picture of the patient's health.

Annual Health Screening

Pet birds are notorious for hiding signs of illness. In many cases, by the time illness is demonstrated, the patient is in an advanced state of deterioration. Many conditions, especially those that are noninfectious, may take years to reach a critical degree. The value of annual health profiling is that these conditions can often be diagnosed long before signs are exhibited, and well before the condition has become irreversible. The Avian/Reptilian Profile Plus is the only panel available that includes bile acids, maximizing the value of the annual exam by omitting no important analytes needed for a complete evaluation.

Presurgical Profiling

The risk of complication from anesthesia is significantly increased if the patient has underlying renal impairment, hepatic dysfunction or other undisclosed health issues. Presurgical screening provides multiple benefits, which include:

- Identification of subclinical disease that can compromise a positive outcome
- Identification of organ dysfunction so that a safe anesthetic protocol can be determined
- Identification of the healthy patient so that the veterinary team may proceed with anesthesia with a higher degree of confidence

Triage of Clinically Ill and Injured Patients

When an avian patient is presented in a compromised state of health and its condition must be assessed, time is of the essence. Sick birds are often near death, and data must be obtained immediately in order to render definitive therapy. While the urgency of obtaining diagnostic data in injured patients depends on the extent of the injuries, the data still must be complete and promptly obtained. Common subclinical conditions, often lead to complications following injury or surgery. The Avian/Reptilian Profile Plus provides the necessary information to properly assess and diagnose these patients.





Monitoring Response to Therapy

Once conditions are diagnosed and therapy begins, it is always prudent to assess response to therapy. While an important goal would be to see abnormal parameters return to normal, it is equally important to assure that other parameters remain normal. Renal dysfunction, hepatic compromise, muscle necrosis and other complications can result from the use of certain therapeutics. Therefore, while only one analyte may be the focus of attention, the other analytes should never be discounted.

Long-Term Monitoring for Recovery and Discharge

Once normalcy is achieved, it is wise to perform follow-up profiling to ensure wellness is maintained. Many avian disorders are the result of unstable conditions or predisposing factors. Therefore, long-term monitoring is vital to ensure continued health and verify proper husbandry practices.

Improved Profits Due to Enhanced Medical Utilization

The VetScan VS2 is the best instrument to fulfill all the needs of the avian practitioner. The benefits of full profiles with an extremely small sample volume, speed and accuracy make it indispensable in any practice that wants to maximize its quality of care for avian patients. Additionally, the menu provided by the Avian/Reptilian Profile Plus makes it impossible to perform the same spectrum of tests as economically with any other methodology. Because the rotor is the least expensive method of obtaining a complete avian profile, and because of the low processing time and sample requirements, it can be used in any number of clinical situations, thereby maximizing the ability to turn avian medicine into a significant profit center.

Avian and Reptilian Phlebotomy Techniques

Birds

Two routes are commonly employed for avian phlebotomy: toenail clip and venipuncture (jugular, basilic and medial metatarsal). Blood sample volume of 0.5%–1.0% of body weight has been proven within the limits of safety. Jugular venipuncture is the most accessible and least prone to complications.

Reptiles

Chelonians—Turtles, Tortoises and Terrapins

A 22–25 gauge needle fastened to a 3 mL syringe can be used to collect blood samples from most chelonians. Apply suction to the syringe and advance the needle into the vein until blood appears in the needle hub. The preferred site for venipuncture in the chelonian is the jugular vein, because this site is least likely to be contaminated with lymph. Other sites that can be used are the subcarapacial vein, dorsal tail vein and brachial vein. Samples should be inspected before being processed. Lymph-diluted samples can affect the results. The dorsal tail vein can also be accessed in several species of tortoises. With the tail extended, introduce a 25-gauge needle at the dorsal midline close to the base of the tail.

Snakes

Cardiocentesis provides good sample quality and quantity but should be reserved for animals weighing at least 300 grams. To collect the sample, place the animal in dorsal recumbency and look for the beating heart (approximately 1/3–1/4 the distance to the head). Stabilize the heart between the thumb and index finger, use a 25-gauge needle to enter the heart and slowly withdraw the blood. The ventral tail vein can also be used to collect blood from larger snakes.

Lizards

The caudal tail vein and jugular vein are the preferred sites for collecting blood from the majority of lizard species. For the caudal tail vein, the animal should be restrained in the dorsal recumbency with the tail on a solid surface. A 22–25 gauge needle fastened to a 3 mL syringe can be used to collect the sample. The needle should be inserted on the ventral midline in the cranial third of the tail.

The jugular vein can be located by drawing an imaginary line between the tympanum and shoulder. A 22–25 gauge needle fastened to a 3 mL syringe can be used to collect the sample.

Crocodilians

Most often blood samples are obtained from the supravertebral vessel just caudal to the occiput and dorsal to the spinal cord. Restrain the animal and prepare the area midline and caudal to the occiput. Use a 22–25 gauge needle to enter the skin at a perpendicular angle. Apply suction and advance the needle until it enters the sinus, when blood will appear in the hub.





Analytes

ALB, ALP, AST, BUN, CA, CK, GGT, GLOB, MG, PHOS and TP

Ideal For

Herd health assessment and monitoring, prognostic indicator and diagnostic tool for beef and dairy cattle

Used For

- Gathering baselines and maintaining health of both individual large animal patients and herds
- Monitor management of herd health
- Accurate diagnosis and prognosis as an aid in disease management
- Isolation evaluation and monitoring
- Presurgical evaluations
- Prepurchase exams

Rotor Utilization

Production Animal Medicine

The Large Animal Profile is not only for individual large animal patients. More value is being placed on the outcome of management practices intended to improve production and efficiency. Managing a herd and their health is critical given the importance of maintaining herd health for market and protecting the value while limiting costs to manage such a large investment. Additionally, more attention is being given to assure health and safety to the consumer.

With the Large Animal Profile, it is convenient and simple to obtain a herd assessment on a routine basis at the point of care. By evaluating a representative sampling of the herd, it is possible to identify problems before any physical signs are shown—allowing corrective action to be taken immediately. Additionally, sick animals can be evaluated and returned to the herd with peace of mind that the animal is truly recovered.

Herd Health Management

Herd health management practices can be measured and evaluated through the use of regular screening protocols to assure desired results or to implement modifications before poor performance or clinical signs arise. The availability of a complete chemistry profile at a low cost as well as the ability to obtain results on site during farm visits provides an excellent method to include chemistry profiles as part of the management plan.

III Patient Diagnostics

The ability to diagnose and determine treatment possibilities and value is enhanced by the point-of-care benefits and low cost of the Large Animal Profile. Metabolic diseases can be immediately diagnosed such that a reasonable prognosis and action plan can be discussed with the owner or manager immediately. This leads to improved medical care, reduced cost and improved customer relationships and retention.

Improved Profits Due to Enhanced Medical Utilization

The VetScan VS2 is the best instrument to fulfill all the needs of the large animal practitioner. The benefits of testing a full chemistry profile on site, in less than 12 minutes with the accuracy of a reference laboratory, make it indispensable in any mobile unit or practice that wants to maximize its quality of care. With its small footprint, reliability and rugged stability, the VS2 would be a welcome addition whether in your clinic or tolerating the rigors of a mobile practice.

Individual Large Animal Medicine

The Large Animal Profile is designed to provide a profile of vital tests to evaluate the patient. Accurate and timely TP, ALB, GLOB, ALP, AST, CK, GGT, BUN, MG, and PHOS results provide vital information for livestock herd and patients to enhance patient care, improve diagnostics and provide additional practice revenue with the common large animal species.

This is especially important in large animal or mixed animal practices where the individual patient is often considered valuable. With the increasing value of a particular large animal patient, clients are more inclined to pursue diagnostics and treat the individual animal with any needs necessary to ensure health. The ease of use and utility of the Large Animal Profile not only allows the practitioner to diagnose the ill patient and screen for metabolic disease, but to incorporate a comprehensive health plan into the practice for each patient. Competitive pricing of the Large Animal Profile and its rapid turnaround time adds value to lab results, making the services more attractive to an increasingly knowledgeable client base. Rapid turnaround equates to prompt, more defined treatment, which clients are demanding.

Presurgical Profiling

Surgical procedures requiring general anesthesia or profound sedation risk complication if the patient has underlying renal impairment, hepatic dysfunction or other underlying health issues. Presurgical evaluation of these patients is always useful and clients accept the recommendation for this testing when adequately informed of its value. The risk of complication from anesthesia is significantly increased if the patient has underlying renal impairment, hepatic dysfunction or other undisclosed health issues. Presurgical screening provides multiple benefits, which include:

- Identification of metabolic conditions that should be managed prior to surgical intervention
- Identification of subclinical disease that can compromise a positive outcome and can be addressed to extend both length and quality of life
- Identification of organ dysfunction so that a safe anesthetic protocol can be determined
- Identification of the healthy patient so that the veterinary team may proceed with anesthesia with a higher degree of confidence

Measuring Response to Therapy

Once conditions are diagnosed and corrective actions taken, it is important to assess the clinical response. While the goal is to see abnormal parameters return to normal, it is equally important to assure other parameters remain normal. Unintended metabolic complications or organ dysfunction can result from the implementation of corrective measures. Therefore, while only one abnormality may be the focus of the remedial action, best medical practices dictate evaluation of the entire patient, and monitoring of other analytes should never be discounted. Once normalcy is achieved, follow-up profiling helps ensure the intended outcome is maintained be it for an individual animal or a herd.