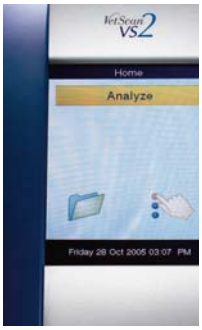

August 2008

VetCom

An Abaxis Newsletter For The Veterinary Community

Highlights

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About Abaxis, Inc.

Abaxis is a leader in the development and commercialization of leading-edge innovative technology, tools and services that support best medical practices, enabling practitioners to respond to the health needs of their patients, while operating economical and profitable practices, at the point of care.

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Potter Park Zoo: Amur Tiger Research Project Using The VetScan System

Contributing Author: Tara Myers Harrison, DVM, MPVM, Veterinarian/Curator, Potter Park Zoo, Lansing, MI 48912

Our project is quantifying the blood chemistry values of three, unanesthetized Amur tigers housed at our facility. This project is also part of a larger study involving operant conditioning (or training), and quantifying the normal levels of complete blood counts (CBC), cortisol levels, and blood pressures.

The eight subspecies of tiger (Panthera tigris) were once found throughout Asia. Today, only three subspecies remain within an ever-shrinking range of habitat. There are between 5,000 and 7,500 tigers left in the wild, but these populations are in danger from continued habitat loss and human interference. Maintenance of a stable, genetically viable captive population has become essential to this species' continued existence. The Species Survival Plan (SSP) in the United States is vital to this effort. Currently there are 151 Amur (P. tigris altaica), 60 Sumatran (P. tigris sumatrae), and 10 Indochinese (P. tigris corbetti) tigers under Tiger SSP management. The SSP makes breeding recommendations and produces a husbandry protocol. Knowledge of this species natural history and medical parameters is far from complete at this time.

Increasing numbers of institutions in the zoological setting are observing the benefits of conditioning and training to their animals, and incorporating it into their husbandry routines. There has been little evidence forth coming, however, that supports this on a physiological level. One recent study with chimpanzees (Pan troglodytes) found that positive reinforcement training significantly decreased the blood variables indicative of stress. The samples being tested were obtained without the use of anesthetics. The three tigers were born at Potter Park Zoo and have been trained to allow voluntary blood collection as well as several other veterinary procedures.

This study is gathering baseline data on the general chemistry, blood counts, blood pressure, and serum cortisol levels of unanesthetized tigers, animals that have been trained through positive reinforcement techniques. We aim to determine if differences in these variables can be observed when comparing anesthetized and unanesthetized animals and animals that are trained or are anesthetized without using hand-injection techniques. This data will assist veterinarians in better understanding how to evaluate blood work from an anesthetized large felid, improving the health of captive populations. ■

Conferences

Jul. 19-22	**AVMA** New Orleans Hilton New Orleans, LA
Jul. 27-31	**World Veterinary Conf.** Vancouver Convention Center www.vcea.ca
Aug. 1	**Hambletonian** Sheraton Meadowlands East Rutherford, NJ
Aug. 10	**VMSG** Ventura, CA www.vmsg.com
Aug. 11-13	**Association of Avian Veterinarians** Hyatt Regency Hotel Savannah, GA www.aav.org
Aug. 13-16	**South Dakota VMA** Rapid City, SD www.sdvetmed.org
Aug. 14-17	**Keystone Vet Convention** Hershey Lodge & Convention Center Hershey, PA www.pavma.org
Aug. 14-17	**Southern Veterinary** Conference Birmingham, AL
Aug. 15-17	**XXI Annual Convention** San Juan, Puerto Rico www.cmvpr.org
Aug. 23-26	**CVC Central** Kansas City, MO www.thecvc.com
Sep. 17-19	**Purdue University** School of Vet Med Lafayette, IN
Sep. 17-21	**IVECCS** JW Marriott Desert Ridge Phoenix, AZ www.veccs.org

Special Look

VetCom

This anesthetized Amur tiger is receiving a physical examination at Potter Park Zoo. Evaluation of blood results from this animal while awake may be different from when she is anesthetized.

This tiger is being trained through positive reinforcement while in a specialized cage to accept veterinary procedures such as drawing blood from the tail vein.

Potter Park Zoo Update

Potter Park Zoo in conjunction with Abaxis is evaluating the health of Amur tigers through operant conditioning or behavioral training. Blood is collected from the lateral tail vein of the tiger through the bars. Evaluating blood samples of animals trained for medical procedures is important for the evaluation of this endangered species. In the past, the only way to monitor the health of these animals is through anesthesia. Various anesthetic protocols and methods of inducing anesthesia in these animals could produce a stress response in various biochemical analytes as well as alter biochemical results. All of the normals developed for these species are based on animals that are anesthetized. Evaluating and developing normals for animals that are unanesthetized will allow veterinarians to determine the effect of anesthesia upon the biochemical analytes as well as to determine the health of an animal without the risk of anesthesia and also, in theory remove the stress response associated with anesthesia.

In addition to evaluating all the biochemical profiles on the Comprehensive Diagnostic Profile rotor, we are also evaluating cortisol levels to determine the stress of these animals that are trained for this procedure and exhibit no outward signs of stress.

Preliminarily, the ISIS (International Species Inventory System, Zoo Standard normals) mean normal for glucose is 134 mg/dL and our results are showing the overall mean for these animals is 100.4 mg/dL. Additional samples are being analyzed, as well as additional profiles, but at this point the trend is showing a much lower glucose level for awake, trained animals than animals that were anesthetized.

We will continue to analyze this and other analytes including cortisol, alkaline phosphatase, alanine amino transferase and creatinine. We hope that these results will aid in zoos and other conservation organizations to continue to provide improving health care for this endangered species. ■

Potter Park Zoo and its staff would like to thank Abaxis and Mr. Zavac for their participation and involvement in our research project involving Amur tigers.

1-800-822-2947

VetCom Issues

Valerie Goodwin
VetCom, EDITOR
Director, Veterinary Marketing
510-675-6604
valeriegoodwin@abaxis.com
questions and comments

Customer Service

David Bannister, ext. 6540
Director - Customer Care

Technical Support

Craig Darien, ext. 1521
Supervisor, Technical Support

North American Sales

Jeff Sumpter, ext. 1335
Area Sales Manager,
South Central
jeffsumpter@abaxis.com

Torrey Inez, ext. 1427
Area Sales Manager, South-west
torreyinez@abaxis.com

Bill Wilson, ext. 1455
Area Sales Manager, Southeast
billwilson@abaxis.com

Andy Koupas, ext. 1424
Area Sales Manager, West
andykoupas@abaxis.com

John Therrien, ext 1476
Area Sales Manager,
North Central
johntherrien@abaxis.com

Gerard Cabrera, ext. 1448
Area Sales Manager, Northeast
gerardcabrera@abaxis.com

Chris Ballinger, ext. 1492
Area Sales Manager, MidWest
chrisballinger@abaxis.com

VetScan System In Galapagos: Monitoring Survival In Galapagos Marine Iguanas

Contributing Authors: L. Michael Romero (Tufts University), Martin Wikelski (Princeton University), Gregory L. Florant (Colorado State University)

Many wild animal populations experience periodic catastrophic population declines. There can be many different causes for these declines, such as new diseases (e.g. introduction of West Nile virus to North America), wide-spread famines (e.g. during droughts), and human-induced changes in environmental conditions (e.g. climate change or habitat alteration). Wildlife managers around the world are searching for factors that allow them to predict which individual animal will most likely be in distress and needs help during environmental changes.

Animals have a number of physiological systems that help them cope with these events, but it is very difficult to study which physiological responses are most important for survival and why those responses are insufficient for the majority of individuals. The main problem is that it is very hard to study wild animals that are under significant physiological stress and may be in the process of dying.

For the past few years we've been using the Galapagos Islands as a natural laboratory to study environmentally induced periods of stress that lead to mortality. The Galapagos are subject to periodic El Niño weather events. The main effect of El Niños on the marine environment of the Galapagos is the failure of nutrient-rich upwelling. The lack of nutrients turns one of the most productive marine environments in the world into a natural disaster. The bottom of the food web contracts, leaving all the higher trophic levels in deep trouble. Mortality strikes the fish, the sea birds, and the sea lions.

We have studied the Galapagos marine iguana (Amblyrhynchus cristatus) population on Santa Fe Island continuously since 1981 and witnessed massive starvation - up to 90% - during an El Niño which can last for several months in a bad year. The Galapagos marine iguanas are the only marine lizard. Apparently due to a reliance on a unique suite of endosymbiotic gut bacteria, these iguanas feed exclusively on intertidal and subtidal marine algae, which virtually disappears during an El Niño. We have a 24 year data set on body length and weight from known individuals and have shown that mortality during El Niños is different between different size and weight classes; the largest individuals suffer the highest mortality. Perhaps as a coping mechanism, many iguanas shrink in body

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length during El Niños. Starting in 1997, we have also been collecting physiological data on how individuals respond to long-term fasting which represents a unique stress in the tropics.

We have been making use of the fact that Galapagos marine iguanas repeatedly experience natural catastrophes (El Niños) but at the same time are tame and can easily be observed as they die. What we've been trying to understand is why some animals live and why others die. All the animals face identical environmental conditions, yet some animals will be resting along the coastline next to carcasses. Due to their tameness, marine iguanas uniquely allow us to repeatedly take blood samples and therefore we can determine the blood chemistry from individually-known animals with a known growth trajectory and life history throughout a population bottleneck.

The Vetscan has been an important part of our recent work. We are using the natural experiment of coping with El Niño conditions to understand whether different blood chemistry parameters correlate with survival. Our goal is to be able to predict before the El Niño which animals are likely to survive and which are likely to die. This is a critical question in ecology. It is currently unknown what characteristics allow an individual, particularly marine reptiles, to survive environmental emergencies (e.g. long term fasting) while its neighbors succumb, even though this is an important foundation in natural selection.

Using the VetScan, we have already found some surprising results. For instance, all Galapagos marine iguanas have extremely high sodium levels. This is probably not surprising for a marine animal that drinks copious sea water as they forage on a marine algae. However, despite having a salt gland, the marine iguanas thrive with higher blood sodium concentrations than the Vetscan avian/reptilian rotors can measure. Much of the rest of our data are still being analyzed, but we are excited about the data the Vetscan has been able to provide.

Understanding how the blood chemistry changes in this reptile under various environmental and physiological conditions may very well enhance our ability to provide conservation measures to this and other marine animals. In addition, we hope that our data will provide us with clues about how natural selection works at the physiological level to promote changes in population structures.

Avian/Reptilian Profile Plus

12 tests per rotor

This rotor provides the following parameters: ALB, AST, BA, CA, CK, GLOB, GLU, K+, NA+,PHOS, TP, UA

An Important Tool in the Veterinary Practice

Contributing Author: Craig Tockman. DVM

The critical care rotor is often underutilized in the veterinary practices using the Vetscan point-of-care chemistry analyzer. In reality, it has incredible utility and you can and should make its utilization part of your everyday routine.

The testing parameters of the critical care rotor make it an excellent choice for monitoring your hospitalized patients on fluid therapy, regardless of the disease process. It is also an excellent rotor for recheck monitoring for many types of disease. A brief look at the tests the rotor offers will help understand how useful this rotor can be for your patients and your practice.

BUN and Creatinine allow the clinician to monitor renal function and hydration. ALT (alanine aminotransferase) maintains a window on liver cell death or leakage. Blood glucose measurements are reported. Sodium and potassium have always been present on the rotor, and now the addition of chloride provides the veterinarian with a complete electrolyte panel for fluid therapy determination.

We particularly like to monitor our chronic renal failure patients, Addisonian patients and diabetics with the critical care rotor. Simply monitoring BUN and Creatinine in renal patients is insufficient as these patients are often older or have other concurrent disease. The ability to monitor renal values along with glucose, ALT and electrolytes provides a better overall picture of the patients' health status between full diagnostic panels. Utilizing this rotor will help you catch early signs of hepatic disease (via ALT) and electrolytes are vital in renal patients, especially when the need for fluid therapy or diuretics is indicated. With routine use of this rotor, we have also found a significant number of renal patients with low levels of TCO2 indicating a chronic metabolic acidosis. The patients tend to feel worse, have poor appetites and do not thrive on standard treatments. We are able to identify them early and correct the metabolic disorder more effectively.

Glucose monitoring alone in the diabetic is also insufficient for complete patient assessment. Diabetic cats often develop hepatic lipidosis and renal failure, making concurrent monitoring of BUN, Creatinine and ALT vital. The importance of electrolyte monitoring in these patients should not be underestimated. The need for monitoring renal and hepatic values, along with complete electrolytes is obvious for the addisonian patient. In our hospital, the critical care rotor is used every 3-4 months to monitor these patients, along with a CBC. A comprehensive diagnostic rotor plus CBC is used every year.

Hospitalized patients on fluid therapy require frequent monitoring, regardless of the reason for the hospitalization. The critical care rotor provides an excellent panel to monitor these patients at least once daily. Possibly the most overlooked value is tCO2 (total carbon dioxide). Complete blood gas analysis is not often practical in the veterinary practice, but there are times when it is needed.

The availability of tCO2 on the critical care rotor provides you with a good idea as to the acid/base status of the patient. This, in combination with the electrolyte levels, allows you to choose the most appropriate and life saving fluid therapy.

When handled anaerobically, total carbon dioxide levels are equivalent to bicarbonate levels in the body. It is vital that blood drawn for this test be placed in the lithium heparin tube immediately after the sample is obtained to minimize contact with the air.

tCO2 determination can help the clinician determine if more extensive blood gas analysis is needed while allowing refinement of the diagnostic and therapeutic plan. The combination of tCO2 , clinical signs and other blood values allows for a matrix that allows more accurate interpretation than one value alone. The following table summarizes the diagnostic value of tCO2 :

Total CO2 Level	Acid-Base Disorder
Decreased tCO_2	Metabolic Acidosis
	Respiratory Alkalosis
Increased CO_2	Metalbolic Alkalosis
	Respiratory Acidosis

Since tCO2 is equivalent to Bicarbonate levels, we can narrow the likely metabolic disorder based on its level.

First let's look at decreased Total Carbon Dioxide. Decreased tCO2 levels indicate either metabolic acidosis (the most common acid-base disorder) or respiratory alkalosis. The most common causes of respiratory alkalosis are: tachypnea due to hypoxia, pulmonary disease, direct stimulation of the medullary respiratory center and excessive mechanical ventilation. Therefore, if the clinical signs of the patient are not consistent with these types of disorders, then metabolic acidosis is the likely reason for a decreased total carbon dioxide.

The most common causes of metabolic acidosis include:

- Small bowel diarrhea causing a loss of bicarbonate rich fluid. This can lead to hyperchloremic metabolic acidosis, so the chloride levels provided on the rotor can be very helpful in this determination.
- Ethylene glycol toxicity, salicylate toxicity and some medication can cause metabolic acidosis.
- Metabolic production of acid caused by lactic acidosis or diabetic ketoacidosis.
- Excessive urinary loss of bicarbonate due to renal failure, hypoadrenocorticism, etc.

A patient with a low tCO2 can be assumed to be in a state of metabolic acidosis when seen with the disease states listed above.

What if the total carbon dioxide is elevated? Elevated total carbon dioxide indicates the possibility of metabolic alkalosis or respiratory acidosis. Metabolic alkalosis is most commonly caused by loss of chloride rich fluid from the intestinal tract or kidneys, and chronic alkali administration. Vomiting and chronic diuretic administration would be the most common causes of these conditions.

Respiratory acidosis is most commonly a result of hypoventilation due to airway obstruction, neuromuscular disease, neuromuscular blocking drugs, restrictive respiratory defects (diaphragmatic hernia, pleural effusion, etc.), pulmonary disease or inadequate mechanical ventilation.

Utilizing clinical signs or confirmed diagnostics together with the total carbon dioxide and chloride levels will help determine the most likely acid-base status. Based on this, you can determine the proper fluid therapy and drug administration for your patients.

Case Study Utilizing the Critical Care Rotor

Courtney, a 14 year-old spayed female Himalayan cat presented for PU/PD, excessive appetite and weight loss. 14 months prior to presentation, she was diagnosed with polycystic renal disease with a concurrent normochromic, normocytic anemia. The patient had been maintained on a renal diet and was receiving injection of Epoetin Alpha to maintain the red cell mass. Physical examination revealed a thin patient (BCS 4/9) and palpably enlarged and cystic kidneys. Initial CBC and chemistry results were as follows:

WBC: 7.25 (5.5-19.5)
Lym: 1.36 (1.5-7)
Ly%: 18.7 (20-55)
Mon: 0.39 (0-1.5)
Mo%: 5.4 (1-3)
Gra: 5.50 (2.5-14)
Gr%: 75.9 (35-80)
RBC: 5.24 (5-10)
HGB: 8.7 (8-15)
HCT: 23.21 (24-45)
MCV: 44 (39-55)
MCH: 16.5 (12.5-17.5)
MCHC: 37.3 (30-36)
RDWc: 19.2%
PLT: 396 (300-800)
BUN: 99 (10-30)
CRE: 4.1 (0.3-2.1)
ALP: 24 (10-90)
ALT: 48 (20-100)
TBIL: 0.3 (0.1-0.6)
AMY: 1630 (300-1100)
CA: 11.2 (8-11.8)
PHOS: 10.4 (3.4-8.5)
GLU: 86 (70-150)
NA+: 153 (142-164)
K+: 4.9 (3.7-5.8)
TP: 7.9 (5.4-8.2)
ALB: 3.8 (2.2-4.4)
GLOB: 4.0 (1.5-5.7)
T4: 1.8 (1.5-4.8)

The patient was placed on 0.9% NaCl at 1.5 times maintenance to begin diuresis for a 48 hour period. Two days after initial presentation, a CBC/critical care profile was performed. The anemia had worsened (RBC 4.37, HCT 19.70), but was still normochromic, normocytic. BUN and CRE were decreased (82 and 3.5), K+ was low normal at 3.7 (3.7-5.8) and total CO2 was 14 (Normal 15-24) indicating a metabolic acidosis due to renal failure.

Fluids were changed to Lactated Ringers solution with the addition of sodium bicarbonate using the formula:

0.5 X Body Weight (in Kg) X (Desired tCO_2 mEq/L – Measured tCO_2 mEq/L) = mEq Bicarbonate Required

The following day, CBC and critical care panel results were:

WBC: 7.07 (5.5-19.5)
Lym: 0.83 (1.5-7)
Ly%: 11.7 (20-55)
Mon: 0.34 (0-1.5)
Mo%: 4.9 (1-3)
Gra: 5.89 (2.5-14)
Gr%: 83.4 (35-80)
RBC: 4.28 (5-10)
HGB: 6.7 (8-15)
HCT: 18.78 (24-45)
MCV: 44 (39-55)
MCH: 16.5 (12.5-17.5)
MCHC: 37.3 (30-36)
RDWc: 19.2%
PLT: 396 (300-800)
BUN: 73 (10-30)
CRE: 4.2 (0.3-2.1)
ALT: 66 (20-100)
GLU: 80 (70-150)
NA+: 141 (142-164)
K+: 3.8 (3.7-5.8)
tCO2: 17 (15-24)

The fluid change and addition of bicarbonate had corrected the metabolic acidosis. The anemia had stabilized, but the sodium level was slightly low. Fluids were again changed to 0.9% NaCl at 1.5 times maintenance, with bicarbonate added and calculated to reach a tCO2 of 19-20. After 2 days, the critical care rotor results were:

BUN: 68 (10-30)
CRE: 4.2 (0.3-2.1)
ALT: 58 (20-100)
GLU: 95 (70-150)
NA+: 146 (142-164)
K+: 3.8 (3.7-5.8)
tCO2: 19 (15-24)

The patient was released to the owner with a guarded to poor prognosis, as the anemia continued to worsen. However, the cat remains stable with regular subcutaneous fluid therapy and Epogen three times weekly.

This case clearly shows the clinical utility of the critical care rotor. Correction of metabolic acidosis and monitoring electrolyte balance is an important part of fluid therapy and helps improve recovery. ■

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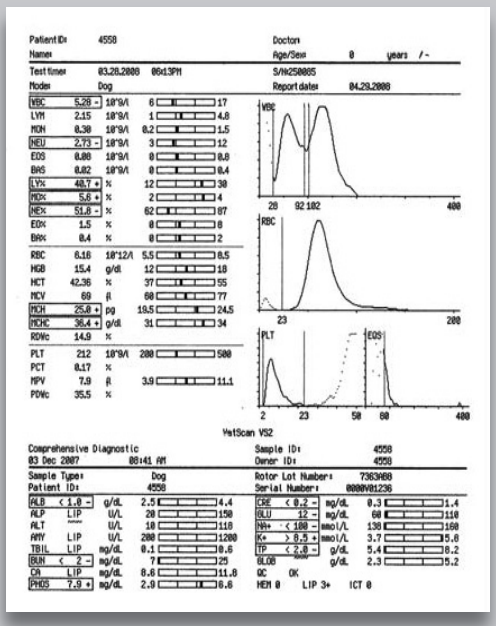

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Ideal For: Obtaining baseline values prior to administration of and concurrent with the use of NSAIDS as well as monitoring hepatic function and diagnosing liver disease.

Analytes Include: ALB, ALP, ALT, BA, BUN, CHOL, GGT, TBIL

Used For: Diagnosis and monitoring of liver disease, obtaining baseline values prior to administration of NSAIDS, and monitoring patients concurrent with the use of NSAIDS.

Avian/Reptilian Profile Plus

Ideal For: Measuring analytes that represent the most important area of concern in avian and reptilian patients.

Analytes Include: ALB, AST, BA, CA, CK, GLOB, GLU, K+, NA+, PHOS, TP, UA

Used For: Ill patient diagnostics, wellness testing, evaluate liver integrity and function, evaluate renal status, measure electrolyte status.

Equine Profile Plus

Ideal For: Routine equine checkups, wellness testing, ill patient diagnostics and pre-purchase examinations.

Analytes Include: ALB, AST, BUN, CA, CK, CRE, GLU, GGT, GLOB, K+, NA+, TBIL, tCO2 , TP

Used For: Ill patient diagnostics, wellness examinations, patient monitoring, fluid therapy, and re-check examinations. Ideal for both equine ambulatory practitioners and critical care units.

Large Animal Profile

Ideal For: Health assessment, prognostic indicator and a diagnostic tool for beef and dairy cattle.

Analytes Include: ALB, ALP, AST, BUN, CA, CK, GGT, GLOB, MG, PHOS, TP

Used For: Accurate diagnosis and prognosis, aid in the choice of therapeutics.

VetCom

3240 Whipple Road
Union City, CA 94587
Telephone: 510-675-6500

Fax: 510-441-6150
vetscansales@abaxis.com
www.abaxis.com

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