Catalyst One™ Chemistry Analyzer

IDEXX

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Preface

Safety Precautions

Note: If the equipment is used in a manner other than specified, the protection provided by the equipment may be impaired.

The analyzer does not contain any user-serviceable components. DO NOT disassemble.

Line voltage for the Catalyst One AC power adapter is 100–240 V AC, 50–60 Hz. Be sure to plug all equipment into properly grounded electrical outlets.

Use only the AC power adapter and AC power cable supplied.

Disconnect the power cable:

+ If the cable becomes frayed or otherwise damaged.
+ If anything is spilled onto the equipment.
+ If your equipment is exposed to excessive moisture.
+ If your equipment is dropped or the case has been damaged.
+ If you suspect that your analyzer needs service or repair.
+ Whenever you clean the case.

Performance Precaution

Do not use certain liquids, aerosols (such as canned air), solvents, ammonia, and other substances on or near the analyzer which could influence results.

Care of the Analyzer

It is recommended that you do not stack other equipment or containers on top of the analyzer.

Keep analyzer away from sources of heat or flames.

PROTECT your equipment from damp conditions, wet weather, or liquid spills.

Take care not to spill water or other liquids on the unit.

DO NOT use solvents, ink markers, sprays containing volatile liquids, or polish on the analyzer as it may damage the outer case. Clean only with a mild soap and slightly moist cloth and only when the analyzer is not in use.

Clean only with a mild soap and slightly moist cloth and only when the analyzer is not in use.

International Symbol Descriptions

International symbols are often used on packaging to provide a pictorial representation of particular information related to the product (such as expiration date, temperature limitations, batch code, etc.). IDEXX Laboratories has adopted the use of international symbols on our analyzers, product boxes, labels, inserts, and manuals in an effort to provide our users with easy-to-read information.

Symbol	Description
	Use by A utiliser avant Verwendbar bis Usare entro Usar antes de 使用期限
LOT	**Batch code (Lot)** Code de lot (Lot) Chargenbezeichnung (Partie) Codice del lotto (partita) Código de lote (Lote) ロット番号
SN	**Serial number** Numéro de série Seriennummer Numero di serie Número de serie シリアル番号
REF	**Catalog number** Numéro catalogue Bestellnummer Numero di catalogo Número de catálogo 製品番号
EC REP	**Authorized Representative in the European Community** Représentant agréé pour la C.E.E. Autorisierte EG-Vertretung Rappresentante autorizzato nella Comunitá Europea Representante autorizado en la Comunidad Europea EC内の正規販売代理店
	Manufacturer Fabricant Hersteller Ditta produttrice Fabricante 製造元
	Caution, consult accompanying documents Attention, consulter les documents joints Achtung, Begleitdokumente beachten Attenzione, consultare la documentazione allegata Precaución, consultar la documentación adjunta 注意、添付文書をご参照ください。

Symbol	Description
	Temperature limitation Température limite Zulässiger Temperaturbereich Temperatura limite Limitación de temperatura 保存温度（下限）
	Upper limit of temperature Limite supérieure de température Temperaturobergrenze Limite superiore di temperatura Limite superior de temperatura 保存温度（上限）
	Consult instructions for use Consulter la notice d'utilisation Gebrauchsanweisung beachten Consultare le istruzioni per l'uso Consultar las instrucciones de uso 取扱説明書をご参照ください。
	Keep away from sunlight Conserver à l'abri de la lumière Vor direkter Sonneneinstrahlung schützen Mantener alejado de la luz solar Tenere lontano dalla luce diretta del sole 遮光してください。
	WEEE Directive 2002/96/EC Directive 2002/96/CE (DEEE) WEEE-Richtlinie 2002/96/EG Directiva 2002/96/CE RAEE Direttiva RAEE 2002/96/CE 廃電気電子機器指令（WEEE Directive 2002/96/EC）
	Biological risks Risques biologiques Biogefährlich Rischi biologici Riesgos biológicos 生物学的リスク
	Do not reuse Usage unique Nicht wiederverwenden No reutilizarw Non riutilizzare 再利用しないでください。

Symbol	Description
	Caution, hot surface Attention, surface très chaude Precaución, superficie caliente Vorsicht, heiße Oberfläche Attenzione, superficie rovente 高温注意
	Keep dry Conserver dans un endroit sec Mantener seco Vor Nässe schützen Tenere al riparo dall'umidità 濡らさないこと。
	This side up Haut Este lado hacia arriba Diese Seite nach oben Alto この面を上にする。
	Do not freeze

Symbol	Description
	Electrostatic-sensitive device Appareil sensible aux charges éléctrostatiques Dispositivo sensible a descargas electrostáticas Gerät ist sensibel auf elektrostatische Ladung Dispositivo sensibile alle scariche elettrostatiche 静電気の影響を受ける装置
	Fragile Fragile Frágil Zerbrechlich Fragile 取扱注意
	Date of manufacture Date de production Fecha de producción Herstelldatum Data di produzione 製造年月日:

Other Symbols

Symbol	Description
	USB symbol

Symbol	Description
	Ethernet/network symbol

Getting Started

Introduction

Welcome to IDEXX's next-generation chemistry analyzer—the Catalyst One™ Chemistry Analyzer.

The Catalyst One analyzer's flexible test menu allows you to monitor the health status of specific organs, recheck values over time, customize profiles by adding single tests to CLIPs. You can even run up to 25 tests on a single sample (see a complete list of the individual slides and CLIPs available).

The Catalyst One analyzer is for veterinary use only.

IDEXX VetLab Station Connectivity

The Catalyst One analyzer is part of the IDEXX VetLab™ suite of analyzers, all of which connect to the IDEXX VetLab™ Station (IDEXX's laboratory information management system). Connecting multiple analyzers to the IDEXX VetLab Station helps you attain a comprehensive picture of your patient's health, with the ability to view test results from multiple analyzers on a single report, determine disease progression with parameter-trending capabilities, and more.

By connecting the Catalyst One analyzer to the IDEXX VetLab Station, you can:

+ Automatically review patients' prior results on every printout for easy comparison.
+ Improve client communications with illustrated diagnostic or treatment progress printouts.
+ Link to expert descriptions and common causes of abnormal values.
+ Print information to help explain the significance of results to your clients.
+ Allow new staff to train independently.
+ Learn proper protocols and tips for best techniques.

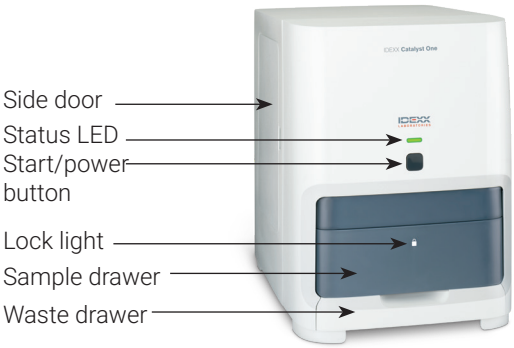
Proprietary Slide Technologies

Proprietary technologies in Catalyst™ slides minimize interfering substances:

+ **IDEXX dry-slide technology** uses multiple technologies that minimize interfering substances as the sample moves from the top to bottom layer, where it is analyzed.
+ **Scavenging and/or spreading layers** filter interferants from other blood chemistry components to ensure sample quality.
+ **An integrated wash process** is used with specific slides to remove debris from the sample, maximizing sensitivity and the accuracy of results.

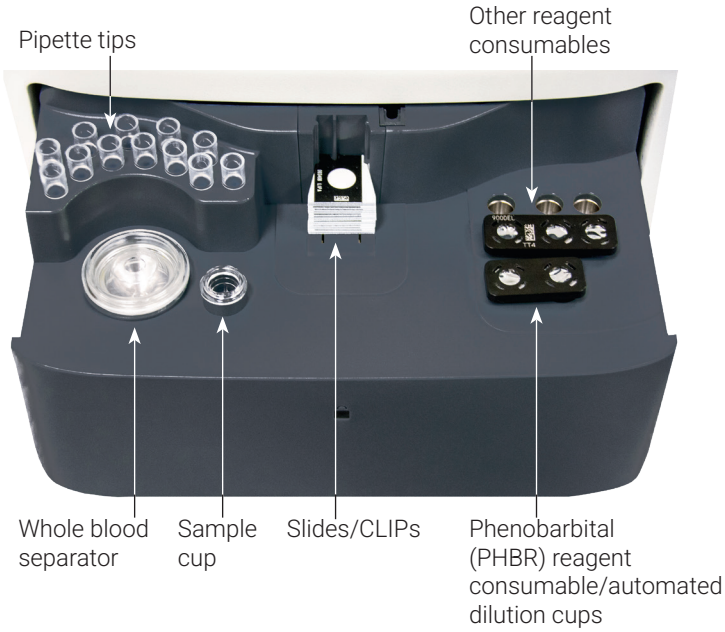
Catalyst One Components

Front of the Analyzer



Inside of the Sample Drawer

Note: This picture depicts where the sample cup and whole blood separator should be placed in the sample drawer. Do not load a whole blood separator AND a sample cup for a single run.



Side of the Analyzer

Back of the Analyzer

Analyzer Status

The light-emitting diode (LED) indicator on the front panel of the Catalyst One analyzer indicates the analyzer's status.

Note: You can also view the analyzer status by viewing its icon on the IDEXX VetLab Station Home screen.

LED Color	Description
Green (steady)	READY; analyzer is ready to process samples or perform maintenance tasks
Green (pulse)	STANDBY MODE
Yellow (steady)	IN PROCESS; analyzer is processing a sample or performing another activity
Yellow (pulse)	Analyzer is waiting for the user to begin processing a sample after receiving the patient information from the IDEXX VetLab Station
Red (flashing)	ERROR; an error has occurred; review error or alert messages on the IDEXX VetLab Station

Responding to an Alert

When the analyzer experiences a problem, an alert message appears on the upper right side of the IDEXX VetLab Station title bar, the LED on the front panel of the Catalyst One analyzer flashes red, and the Catalyst One icon on the IDEXX VetLab Station Home screen appears with an Alert status.

To View an Alert

Do one of the following:

+ Tap the Catalyst One icon on the IDEXX VetLab Station Home screen.
+ Tap the alert message in the title bar to display the alert message. Follow the instructions displayed in the alert message.

Installing the Catalyst One Analyzer

The Catalyst One analyzer works in conjunction with the IDEXX VetLab Station.

To Install the Catalyst One Analyzer

1. Before you unpack the analyzer, choose an optimum location for the instrument. The analyzer should be placed on a level surface in a well-ventilated area, away from obvious sources of heat, direct sunlight, cold, humidity, or vibrations, and with 2 inches of ventilation around the analyzer. For optimum results, room temperature should be at 15°C–30°C (59°F–86°F) and relative humidity at 15%–75%.

   IMPORTANT: Ensure proper ventilation. The analyzer's cooling vents are in the base and the back.

2. Use the Ethernet cable provided to connect the analyzer to a numbered port on the IDEXX VetLab router.

   Note: For more information about connecting your analyzer to the router, see the installation instructions that accompanied your router.

3. Power on the Catalyst One analyzer. Once the Catalyst One icon displays on the IDEXX VetLab Station Home screen, your connections are complete.

   Note: If the Catalyst One icon does not appear on the IDEXX VetLab Station Home screen within 3 minutes, contact IDEXX Technical Support for assistance.

‡Feature coming soon

Catalyst One Analyzer Consumables

The following consumables are available for use with the Catalyst One analyzer:

CLIPs, Panels, and Slides

You can run any IDEXX slide on any species; however, reference intervals may not always be provided (see footnotes for more information).

Chemistry	Abbreviation	Chem 18 CLIP	Chem 17 CLIP	Chem 16 CLIP	Chem 15 CLIP	Chem 11 CLIP	Chem 10 CLIP	Equine 15 CLIP	NSAID 7 CLIP	NSAID 6 CLIP	UPC Panel[†]	Lyte 4 CLIP	Individual Slides
Albumin	ALB	✓	✓	✓	✓	✓	✓	✓					✓
Alkaline Phosphatase	ALKP	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
Alanine Aminotransferase	ALT	✓	✓	✓	✓	✓	✓		✓	✓			✓
Amylase	AMYL	✓	✓										✓
Aspartate Aminotransferase	AST							✓	✓	✓			✓
Bile Acids[†]	BA												✓
Blood Urea Nitrogen	BUN	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
Calcium	Ca	✓	✓	✓	✓			✓					✓
Cholesterol	CHOL	✓	✓	✓	✓								✓
Cortisol[‡]	CORT												✓
Creatine Kinase	CK							✓					✓
Creatinine	CREA	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
Chloride[§]	Cl											✓	
C-Reactive Protein[‡]	CRP												✓
Fructosamine[†]	FRU												✓
Gamma-glutamyltransferase	GGT	✓	✓	✓	✓			✓					✓
Glucose	GLU	✓	✓	✓	✓	✓	✓	✓					✓
Potassium[§]	K											✓	
Lactate	LAC												✓
Lactate Dehydrogenase	LDH							✓					✓
Lipase	LIPA	✓	✓										✓
Magnesium	Mg												✓
Sodium[§]	Na											✓	
Ammonia	NH_3												✓
Phenobarbital[†]	PHBR												✓
Inorganic Phosphate	PHOS	✓	✓	✓	✓								✓
Pancreatic Lipase[†]	PL												✓
Progesterone[‡]	PROG												✓
N-terminal pro-B-type natriuretic peptide[†]	proBNP												✓
Symmetric dimethylarginine[†]	SDMA	✓		✓		✓			✓				✓
Total Bilirubin	TBIL	✓	✓	✓	✓			✓					✓

Chemistry	Abbreviation	Chem 18 CLIP	Chem 17 CLIP	Chem 16 CLIP	Chem 15 CLIP	Chem 11 CLIP	Chem 10 CLIP	Equine 15 CLIP	NSAID 7 CLIP	NSAID 6 CLIP	UPC Panel†	Lyte 4 CLIP	Individual Slides
Total Protein	TP	✓	✓	✓	✓	✓	✓	✓					✓
Total T_4†	TT4												✓
Triglycerides	TRIG												✓
Urine Creatinine	UCRE										✓		
Urine Protein	UPRO										✓		
Uric Acid	URIC												✓

†Validated reference intervals for canine and feline only.
‡Validated reference intervals for canine only.
§Validated reference intervals for canine, feline, and equine only.

Compatible Species

Specific reference ranges validated on the Catalyst analyzer	**Specific reference ranges validated on other IDEXX chemistry analyzers**	**Guideline reference ranges sourced from third-party veterinary reference materials**			
Canine	Bovine	Avian	Lizard	Pig	Sheep
Feline	Llama	Ferret	Monkey	Rabbit	Snake
Equine	Sea Turtle	Goat	Mouse	Rat	Tortoise

Using the Catalyst One Analyzer

Analyzing Samples

All Catalyst One™ analyzer runs are initiated via the IDEXX VetLab™ Station. The process for doing so varies depending on if your IDEXX VetLab Station is integrated with a practice information management system (PIMS). For detailed instructions on initiating a sample run, see the *IDEXX VetLab Station Operator's Guide*.

Slide Handling

The Catalyst One analyzer allows you to run up to 25 tests on a single sample. Before you begin, please take note of the following:

+ Frozen CLIPs/panels/slides can be run on the Catalyst One analyzer (no thawing required).
+ Most CLIPs/slides should be loaded within 5 minutes of opening their foil packaging. The Catalyst™ Lyte 4 CLIP and Catalyst™ Pancreatic Lipase should be loaded within 2 minutes of opening its foil packaging.
+ If you are running a Lyte 4 CLIP, be sure to load it in the sample drawer before any other CLIPs or slides.
+ For optimal time to results, the recommended load order is Lyte 4 CLIP on the bottom, followed by a chemistry CLIP (e.g., Chem 17, Chem 10, etc.), any additional slides, and TT_4 on top.

Diluting Samples

Dilutions should only be performed when a test value is outside the reportable range or when the sample contains interfering substances (e.g., medications) that cause a nonlinear or invalid result. The Catalyst One analyzer supports automated dilutions (the analyzer mixes the sample and diluent for you) and manual dilutions (you prepare the dilution outside of the analyzer). To initiate a dilution, on the Select Instruments screen tap the Catalyst One Analyzer icon and specify the dilution information.

Remember the following important notes when diluting samples for analysis on the Catalyst One analyzer:

+ Only dilute tests with results outside of the reportable range. Diluting tests with results in the normal range may produce invalid results.
+ All chemistries should be analyzed first on the undiluted sample. Some analytes, such as GGT and total bilirubin, have low serum/plasma concentrations. These analytes may be diluted out even with the lowest dilution. Dilute the remaining sample and analyze any chemistries that were outside of the reportable range on the first analysis.
+ Perform a dilution only when a test value is accompanied by a greater-than symbol (>) or when the analyzer informs you a dilution is necessary to receive accurate results.
+ Use the proper diluent material for your sample type.
  - For plasma and serum samples, use normal saline.
  - IDEXX does not recommend manually diluting whole blood in a Catalyst™ whole blood separator—only dilute the separated plasma.
  - For urine, use Catalyst™ Urine P:C Diluent.
+ Use an accurate measuring device, such as a calibrated pipette or syringe.
+ For best results, start with a 1:2 dilution (1 part sample to 1 part diluent)—do not exceed 9 parts diluent.
+ Do not perform a manual or automated dilution on electrolytes, NH_3, PHBR, TT_4, SDMA, PL, FRU, BA, CORT, proBNP, or PROG tests, or on whole blood samples.

- Do not dilute small samples to achieve a minimum sample volume. Such dilutions on normal analyte concentration cannot be read accurately. When dilution is needed to determine some analytes at very high concentration, the sample should be diluted manually.
- An automated dilution run will be canceled if:
  - There is insufficient diluent/sample volume.
  - There are too many slides in the run.

Minimum Sample Volume for Dilutions

The minimum sample volume varies based on the dilution factor and the number of slides that are being diluted (see table below).

Parts Sample + Parts Diluent = Diluent Ratio	Maximum Number of Slides per Dilution	Minimum Sample Volume		Diluent Volume
		Serum, Plasma, or Urine	Whole Blood	
1 + 1 = 1:2	5	155 µL	700 µL	300 µL
1 + 3 = 1:4	10	130 µL	700 µL	300 µL
1 + 5 = 1:6	10	130 µL	700 µL	300 µL
1 + 9 = 1:10	10	100 µL	700 µL	300 µL

Preparing Manual Dilutions

To Prepare a 1:2 Dilution

1. Accurately measure the desired amount of sample to be diluted and gently transfer it to a sample cup.
2. Accurately measure an equal amount of diluent and transfer it to the sample collected in step 1.
3. Thoroughly mix the sample and diluent.
4. Analyze the sample.

To Prepare Dilutions Greater Than 1:2

If additional dilutions beyond 1:2 are necessary, always begin with the original, undiluted sample. Then, incrementally increase the parts diluent as indicated in the dilution chart (below).

Volumes are for example only. Parts Sample + Parts Diluent = Total Parts (Dilution Factor)

Parts Sample	Parts Diluent	Total Parts (Dilution Factor)
1 (100 µL)	0	1 (undiluted sample)
1 (100 µL)	1 (100 µL)	2
1 (100 µL)	2 (200 µL)	3
1 (100 µL)	3 (300 µL)	4
1 (100 µL)	4 (400 µL)	5
1 (100 µL)	5 (500 µL)	6
1 (100 µL)	6 (600 µL)	7
1 (100 µL)	7 (700 µL)	8
1 (100 µL)	8 (800 µL)	9
1 (100 µL)	9 (900 µL)	10

Viewing and Printing Test Results

Analyzer results are automatically returned to the IDEXX VetLab Station and recorded in the appropriate patient's record. The diagnostic results report is a comprehensive report of all the test results specified in a laboratory request for that patient on a specific day.

Patient test results can be printed automatically each time a set of results are returned or you can manually print the results when needed.

For more information about how to view and print test results, see the *IDEXX VetLab Station Operator's Guide*.

Outside of Reportable Range Samples

Occasionally a test value may be outside the analyzer's reportable range capability. The test value may be greater than (">") the reportable range, or interfering substances in the sample may be causing a nonlinear or invalid result. See the following chart for reportable ranges on individual chemistries. If a value is required, it will be necessary to dilute the sample and repeat the test.

Chemistry	U.S. Units	S.I. Units	French Units
ALB	0.1–6.0 g/dL	1–60 g/L	1–60 g/L
ALKP	10–2,000 U/L	10–2,000 U/L	10–2,000 U/L
ALT	10–1,000 U/L	10–1,000 U/L	10–1,000 U/L
AMYL	5–2,500 U/L	5–2,500 U/L	5–2,500 U/L
AST	0–1,083 U/L	0–1,083 U/L	0–1,083 U/L
BA	1.0–180.0 µmol/L	1.0–180.0 µmol/L	1.0–180.0 µmol/L
BUN/UREA	2–130 mg/dL	0.6–46.4 mmol/L	0.034–2.730 g/L
Ca	1.0–16.0 mg/dL	0.25–4.00 mmol/L	10–160 mg/L
CHOL	6–520 mg/dL	0.16–13.44 mmol/L	0.06–5.20 g/L
CK	10–2,036 U/L	10–2,036 U/L	10–2,036 U/L
Cl‡	50–160 mmol/L	50–160 mmol/L	50–160 mmol/L
CORT‡	0.5–30.0 µg/dL	14–828 nmol/L	14–828 nmol/L
CREA	0.1–13.6 mg/dL	9–1202 µmol/L	1.0–136.0 mg/L
CRP	0.1–10.0 mg/dL	1.0–100.0 mg/L	1.0–100.0 mg/L
FRU‡	100–1,000 µmol/L	100–1,000 µmol/L	100–1,000 µmol/L
GGT	0–952 U/L	0–952 U/L	0–952 U/L
GLU	10–686 mg/dL	0.56–38.11 mmol/L	0.10–6.86 g/L
K‡	0.8–10 mmol/L	0.8–10 mmol/L	0.8–10.0 mmol/L
LAC	0.50–12.00 mmol/L	0.50–12.00 mmol/L	0.50–12.00 mmol/L
LDH	50–2,800 U/L	50–2,800 U/L	50–2,800 U/L
LIPA	10–6,000 U/L	10–6,000 U/L	10–6,000 U/L
Mg	0.5–5.2 mg/dL	0.21–2.17 mmol/L	5.0–52.0 mg/L
Na‡	85–180 mmol/L	85–180 mmol/L	85–180 mmol/L
NH_3‡	0–950 µmol/L	0–950 µmol/L	0–950 µmol/L
PHBR†‡	5–55 µg/mL	5–55 µg/mL	5–55 µg/mL
PHOS	0.2–16.1 mg/dL	0.06–5.19 mmol/L	2.00–161.00 mg/L
PL (canine)‡	30–2,000 U/L	30–2,000 U/L	30–2,000 U/L
PL (feline)‡	0.5–50 U/L	0.5–50 U/L	0.5–50 U/L

Chemistry	U.S. Units	S.I. Units	French Units
proBNP (canine)‡	250–10,000 pmol/L	250–10,000 pmol/L	250–10,000 pmol/L
proBNP (feline)‡	24–1,500 pmol/L	24–1,500 pmol/L	24–1,500 pmol/L
PROG‡	0.2–20.0 ng/mL	0.6–63.6 nmol/L	0.2–20.0 ng/mL
SDMA‡	0–100 µg/dL	0–100 µg/dL	0–100 µg/dL
TBIL	0.1–27.9 mg/dL	2–477 µmol/L	1.0–279.0 mg/L
TP	0.5–12.0 g/dL	5–120 g/L	5–120 g/L
TRIG	10–375 mg/dL	0.11–4.23 mmol/L	0.10–3.75 g/L
TT_4 (canine)‡	0.5–10.0 µg/dL	6.43–128.70 nmol/L	6.43–128.70 nmol/L
TT_4 (feline)‡	0.5–20.0 µg/dL	6.4–257.4 nmol/L	6.4–257.4 nmol/L
UCRE	6–350 mg/dL	0.06–3.50 g/L	0.06–3.50 g/L
UPRO	5–400 mg/dL	0.05–4.00 g/L	0.05–4.00 g/L
URIC	0.1–20 mg/dL	6–1,190 µmol/L	1–200 mg/L

† 1 µg/mL = 4.31 µmol/L
‡ Indicates sample types that should not be diluted.

Modifying the Settings on the Analyzer

Modifying the Sound Settings‡

The analyzer will beep when it encounters an alert. You can modify the Sound settings to turn the sound off or adjust its volume.

1. Tap the **Catalyst One** icon on the IDEXX VetLab Station Home screen.
2. If you do not want the analyzer to make any sounds, tap **Off** in the Sound area.

   OR

3. If you want the volume of the sound to be quiet, tap **Low** in the Sound area.

   OR

4. If you want the volume of the sound to be loud, tap **High** in the Sound area.

Entering Standby Mode

You can modify the settings of the analyzer so that it enters Standby mode at a certain time each day or put it in Standby mode immediately.

1. Tap the **Catalyst One** icon on the IDEXX VetLab Station Home screen.
2. If you do not want the analyzer to ever enter Standby mode, tap **Never** in the Standby area.

   OR

3. If you want the analyzer to enter Standby mode at a certain time each day, tap **Daily** in the Standby area and then select the desired start time from the available drop-down list.

   OR

4. If you want the analyzer to enter Standby mode immediately, tap **Now** in the Standby area.

Exiting Standby Mode

You can set the analyzer to exit Standby mode at a certain time each day or immediately.

1. Tap the **Catalyst One** icon on the IDEXX VetLab Station Home screen.
2. If you want the analyzer to exit Standby mode at a certain time each day, tap **Daily** in the Exit Standby area and then select the desired start time from the available drop-down list.

   OR

3. If you want the analyzer to exit Standby mode immediately, tap **Now** in the Exit Standby area.

‡Feature coming soon

Sample Preparation and Storage

Supported Sample Types for Catalyst CLIPs and Slides

The following sample types can be used with Catalyst™ CLIPs and slides:

CLIPs/Slides	**Abbreviation**	**Serum**	**Lithium Heparin-Treated Plasma**	**Fluoride/ Oxalate-Treated Plasma**	**Untreated Whole Blood** (using the Catalyst™ Lithium Whole Blood Separator)	**Urine**
Chem 18 CLIP	N/A	✓	✓		✓	
Chem 17 CLIP	N/A	✓	✓		✓	
Chem 16 CLIP	N/A	✓	✓		✓	
Chem 15 CLIP	N/A	✓	✓		✓	
Chem 11 CLIP	N/A	✓	✓		✓	
Chem 10 CLIP	N/A	✓	✓		✓	
Equine 15 CLIP	N/A	✓	✓		✓	
NSAID 7 CLIP	N/A	✓	✓		✓	
NSAID 6 CLIP	N/A	✓	✓		✓	
UPC Panel	N/A					✓
Lyte 4 CLIP	N/A	✓	✓		✓	
Albumin	ALB	✓	✓		✓	
Alkaline Phosphatase	ALKP	✓	✓		✓	
Alanine Aminotransferase	ALT	✓	✓		✓	
Amylase	AMYL	✓	✓		✓	
Aspartate Aminotransferase	AST	✓	✓		✓	
Bile Acids	BA	✓	✓		✓	
Blood Urea Nitrogen	BUN/UREA	✓	✓		✓	
Calcium	Ca	✓	✓		✓	
Cholesterol	CHOL	✓	✓		✓	
Cortisol	CORT	✓	✓		✓	
Creatine Kinase	CK	✓	✓		✓	
Creatinine	CREA	✓	✓		✓	
C-Reactive Protein	CRP	✓	✓		✓	
Fructosamine	FRU	✓	✓		✓	
Gamma-glutamyltransferase	GGT	✓	✓		✓	
Glucose	GLU	✓	✓	✓	✓	
Lactate	LAC		✓	✓	✓	
Lactate Dehydrogenase	LDH	✓	✓		✓	
Lipase	LIPA	✓	✓		✓	
Magnesium	Mg	✓	✓		✓	

CLIPs/Slides	Abbreviation	Serum	Lithium Heparin-Treated Plasma	Fluoride/ Oxalate-Treated Plasma	Untreated Whole Blood (using the Catalyst™ Lithium Whole Blood Separator)	Urine
Ammonia	NH_3		✓		✓	
Phenobarbital	PHBR	✓	✓		✓	
Inorganic Phosphate	PHOS	✓	✓		✓	
Pancreatic Lipase	PL	✓	✓		✓	
N-terminal pro-B-type natriuretic peptide	proBNP	✓	✓		✓	
Progesterone	PROG	✓	✓		✓	
Symmetric dimethylarginine	SDMA	✓	✓		✓	
Total Bilirubin	TBIL	✓	✓		✓	
Total Protein	TP	✓	✓		✓	
Total T_4	TT_4	✓	✓		✓	
Triglycerides	TRIG	✓	✓		✓	
Uric Acid	URIC	✓	✓		✓	

Preparing Samples for Use on the Catalyst One Analyzer

You can run untreated whole blood, lithium heparinized whole blood, plasma, serum, and urine samples on the Catalyst One analyzer.

IMPORTANT: Do not use EDTA or sodium heparin for chemistry analysis.

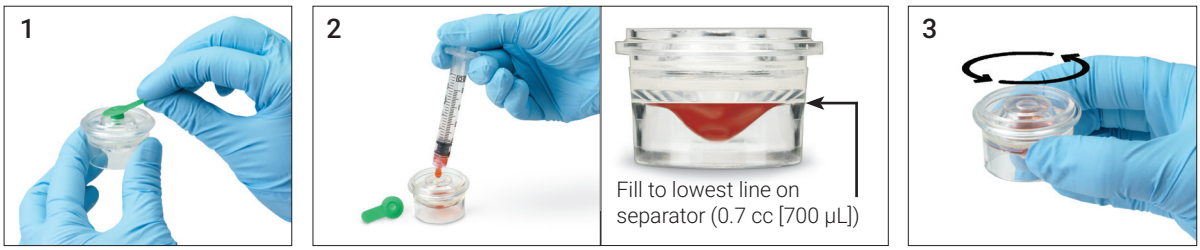
To Prepare an Untreated Whole Blood Sample (Using a Lithium Heparin Whole Blood Separator)

1. Remove the green cap from the lithium heparin whole blood separator to prepare it for sample collection.
2. **Immediately** after sample collection (to avoid clotting), dispense 0.7 cc of **untreated** (no additive) whole blood into the lithium heparin whole blood separator using an untreated syringe with the needle removed.

   Tip: Use the fill line on the separator to ensure proper fill volume.

   Note: Heparinized samples can be used in the lithium heparin whole blood separator *except* when running feline AST, LDH, or CK. Double dosing may elevate the results for these assays in feline samples.
3. Gently swirl (**do not invert or shake**) the whole blood separator at least 5 times to mix the sample with the anticoagulant.

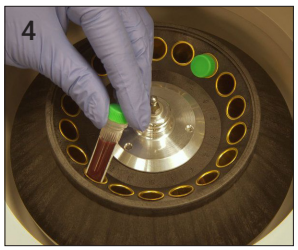
   Caution: Ensure that the cap is removed before loading the separator into the analyzer.



To Prepare a Plasma Sample

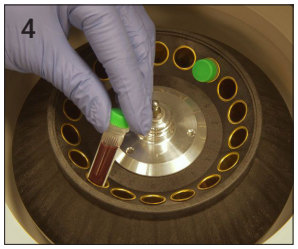
1. Use the appropriate tube and collection device.
2. Draw the sample gently and transfer if necessary.

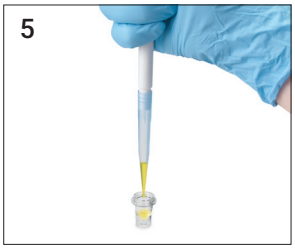
   Note: Be sure to use the correct blood-to-lithium heparin ratio.
3. Gently invert (do not shake) the sample for 30 seconds to mix.
4. As soon as possible (within 30 minutes of collection), centrifuge the sample at the appropriate setting (refer to your centrifuge operator's guide for settings and times).
5. Immediately after centrifugation, use a transfer pipette (or a 300 µL pipette) to transfer the appropriate volume of sample to a Catalyst sample cup (ensure there are no bubbles in the sample cup and take particular care not to aspirate cells during plasma collection). The volume needed varies depending on the number of slides being used in the run—for more information, see "Proper Sample Cup Volume."



To Prepare a Serum Sample

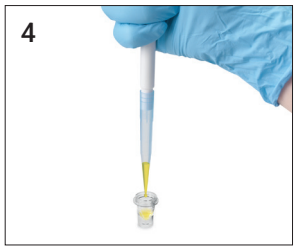
1. Use the appropriate tube and collection device.
2. Draw the sample gently and transfer if necessary.
3. Let the sample clot for a minimum of 20 minutes.
4. Within 45 minutes of collection, centrifuge the sample (refer to your centrifuge operator's guide for settings and times).
5. Immediately after centrifugation, use a transfer pipette (or a 300 µL pipette) to transfer the appropriate volume of sample to a Catalyst sample cup (ensure there are no bubbles in the sample cup and take particular care not to disturb the clot during serum collection). The volume needed varies depending on the number of slides being used in the run—for more information, see "Proper Sample Cup Volume."





To Prepare a Urine Sample

1. Obtain the sample through cystocentesis (recommended), catheter, or free-catch method.
2. Transfer the sample to a disposable sample tube.
3. Centrifuge the sample.
4. Use a transfer pipette (or a 300 µL pipette) to transfer the appropriate volume of supernatant urine to a Catalyst sample cup (ensure there are no bubbles in the sample cup). The volume needed varies depending on the number of slides being used in the run—for more information, see "Proper Sample Cup Volume."



Proper Sample Cup Volume

When using a Catalyst Sample Cup, 300 microliters of serum or plasma will allow you to run most test combinations. The following table provides general guidance for tests that do not include a reagent consumable. Refer to applicable quick reference guides for test-specific sample type and volume requirements.

Number of slides	Sample cup fill volume (µL)
1	60
2	70
3	80
4	90
5	100
6	110
7	120
8	130
9	190
10	200
11	210
12	220
13	230
14	240
15	250
16	260
17	270
18	280

Sample Inspection After Centrifugation

It is good practice to examine the sample carefully following centrifugation in a centrifuge and/or in the analyzer (by running a whole blood separator). If fibrin strands can be seen in the sample, they may interfere with sample pipetting. It may be necessary to rim the serum/plasma with a wooden stick, respin the sample, and proceed.

Various conditions, such as hemolysis, may affect results. You might also want to modify your test panel based on the following visual observations. Refer to the "Chemistry Descriptions" section for information about how each condition may affect specific chemistries.

Note: When using the Catalyst whole blood separator, we recommend that you inspect the sample after the run for the conditions listed below and interpret the results accordingly.

Hemolysis

Visual: Sample has a transparent reddish hue ranging from pale pink to deep red.

Indications: Damage to red blood cells during sample preparation or intravascular hemolysis.

Icterus

Visual: Plasma has a transparent yellow to opaque brown color.

Indications: Obstructive or toxic liver disease, intravascular hemolysis.

Lipemia

Visual: Sample has a pale, milky appearance, possibly with floating fat globules.

Indications: Recent ingestion of a fatty meal or dysfunction in lipid metabolism.

Sample Storage

We recommend that you prepare and analyze samples immediately after collection for best results. However, if storage is necessary, follow these sample storage and testing guidelines.

Storing Serum/Plasma

For storage, the serum or plasma must be separated and removed immediately from the blood cells. Do not attempt to pour off the sample.

+ Using a transfer pipette, carefully transfer the serum or plasma to an untreated collection tube, taking care not to draw up any white or red blood cells.
+ Cap the tube tightly to avoid contamination and evaporation. Avoid frothing at any stage as this damages the serum proteins.

If you cannot perform analysis within 4 hours of drawing and processing the sample, refrigerate the sample immediately after preparation at 2°C–8°C (36°F–46°F). If you cannot analyze the refrigerated sample within 48 hours, you should freeze the serum/plasma at -18°C (0°F). Serum/plasma can be frozen immediately after preparation and stored for up to 1 month.

Notes:

+ For additional information on the effects of delays in removing serum or plasma from the cells, see the "Chemistry Descriptions" section.
+ See the calcium (Ca), total bilirubin (TBIL), lactate dehydrogenase (LDH), ammonia (NH_3), electrolytes (Na, K, Cl), and glucose (GLU) chemistry descriptions for additional special handling and storage requirements.
+ IDEXX does not recommend freezing samples that will be used to run electrolytes, PROG, TT_4, SDMA, BA, or NH_3.

Storing Whole Blood

Lithium heparinized whole blood samples should be analyzed immediately. Samples that will not be analyzed within 30 minutes should be placed in a tube to be separated and stored (see instructions above).

Important: Do not store whole blood samples in whole blood separators.

Storing Urine

Urine should be tested within 2 hours. Do not store urine in the refrigerator for more than 24 hours. Urine should not be stored in the freezer.

Analysis of Stored Samples

For samples stored at 2°C–8°C (36°F–46°F) and at -18°C (0°F):

- Allow the samples to come to room temperature (19°C–27°C/66°F–81°F).
- Mix the samples gently, but thoroughly, by inversion. Do not shake.
- Centrifuge the samples to remove any fibrin particles (or urine sediment) that may have formed during storage.
- Analyze the samples immediately after centrifugation.

Quality Control

Overview

The purpose of quality control (QC) is to verify that your Catalyst One™ analyzer is functioning properly.

You should run a QC test:

+ When the analyzer is first installed.
+ After cleaning the internal components of the analyzer.
+ If the analyzer has been moved.
+ To verify system performance.

Quality Control Materials

Catalyst™ SmartQC™ Control

Catalyst SmartQC should be run monthly after cleaning the internal components of the analyzer, at installation, or whenever the analyzer has been moved.

In each box of Catalyst SmartQC, there are three prepackaged CLIPs and three reagent packs. The lot number can be found on the CLIP foil packaging.

Storage

+ Store in the refrigerator (2°C–8°C/36°F–46°F). Do not freeze.
+ Expired, unwanted, or used/punctured material should be discarded with other clinical waste.

Stability and Handling

+ Can be stored in unopened pouches at room temperature for up to 8 hours up to 5 times. After 8 hours, store unused and unopened materials in the refrigerator.
+ If accidentally frozen:
  - <8 hours, thaw at room temperature for at least 60 minutes before use.
  - >8 hours, discard.

UPRO Control

UPRO Control should be run on an as-needed basis when requested by IDEXX Support.

In each box of UPRO Control, there are six vials containing the control fluid. The lot number can be found on the product packaging.

Storage

Control fluid should be refrigerated (2°C–8°C/36°F–46°F). Discard at the expiration date. Expired or unwanted material should be discarded with other clinical waste.

Stability and Handling

Use within 24 hours after opening (refrigerate when not in use).

PHBR Control

PHBR Control should be run on an as-needed basis when requested by IDEXX Support.

In each box of PHBR Control, there are six vials containing the control fluid. The lot number can be found on the product packaging.

Storage

Store frozen until the expiration date, or store in the refrigerator for up to 7 days.

Stability and Handling

Once thawed, PHBR Control cannot be stored and reused—discard remaining fluid after use.

Running Quality Control

The process for running quality control varies depending on the type of control you are running.

To Run Catalyst SmartQC on a Monthly Basis

1. Tap the **Catalyst One** icon on the IDEXX VetLab Station Home screen.
2. Tap **Maintenance.**
3. Tap **SmartQC**.
4. Tap **Run SmartQC**.
5. Follow the on-screen instructions for loading the SmartQC materials and completing the run.
   IMPORTANT: Only load pipette tips and the Catalyst SmartQC CLIP and reagent in the sample drawer for the QC run**—do not** load a sample cup, whole blood separator, or other CLIPs/slides (including the Catalyst™ Lyte 4 CLIP, which was once required for monthly QC).

Notes:

+ Your Catalyst SmartQC run will provide “pass” or “out of range” results less than 15 minutes after the start of the run:
  - Pass results confirm that your analyzer is functioning optimally and you can proceed with using the analyzer as needed.
  - Out of range results indicate that an issue was detected during the run. If you receive an “out of range” result, rerun with new Catalyst SmartQC slides and reagent. If the second run is also “out of range,” please discontinue analyzer use and contact IDEXX Customer and Technical Support for assistance.
+ To view Catalyst SmartQC results at any time, tap the **Catalyst One** icon on the IDEXX VetLab Station Home screen, tap **Maintenance**, and then tap **SmartQC**. The 12 most recent Catalyst SmartQC results display on the left side of the screen.

To Run UPRO or PHBR Control on an As-Needed Basis

1. Prepare the control fluid:

   If you’re running UPRO Control:

   a. Take one vial of UPRO Control out of the refrigerator and gently invert it 6–10 times to mix thoroughly.

   b. Transfer 300 µL of UPRO Control into a Catalyst™ sample cup.

   c. Let the contents in the sample cups reach room temperature (approximately 10 minutes).

   OR

If you're running PHBR Control:

a. Take one vial of PHBR Control out of the freezer and allow it to reach room temperature (approximately 60 minutes).

b. Once you have confirmed that there is no visible frozen material in the vial, gently invert it 6–10 times to mix thoroughly.

c. Transfer 300 µL of PHBR Control into a Catalyst™ sample cup.
Note: You will need one PHBR slide wash and one PHBR slide for the quality control procedure.

2. Tap the **Catalyst One** icon on the IDEXX VetLab Station Home screen.
3. Tap **Maintenance** and then tap **All Other QC**.
4. Tap the quality control lot number you are using and then tap **Run QC**.
5. Follow the on-screen instructions for preparing and running the UPRO or PHBR Control.

Notes:

+ To view UPRO or PHBR QC results at any time, tap the Catalyst One icon on the IDEXX VetLab Station Home screen, tap **Maintenance**, tap **All Other QC**, tap **View QC Results**, select the desired date that QC was run, and then tap **View Results**.
+ To view the expected ranges for UPRO or PHBR in a QC lot, tap **Maintenance**, tap **All Other QC**, select the desired QC lot, and then tap **View QC Lot Information**.

Maintenance

Overview

In addition to performing monthly quality control checks on the Catalyst One™ analyzer, it is recommended that you:

+ Clean the analyzer internally and externally.
+ Upgrade the software promptly.

Upgrading the Software

As new features and functionality are added to the Catalyst One analyzer, you will receive software upgrades from IDEXX. If you have IDEXX SmartService™ Solutions, the upgrade will be sent via your IDEXX VetLab™ Station automatically. If you do not have SmartService Solutions, you will receive your upgrade in the mail. Be sure to read the software notes contained with each new release.

Cleaning the Internal Components of the Analyzer

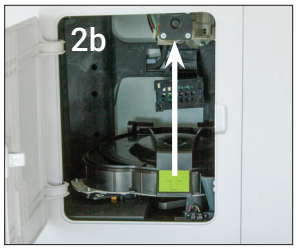
To ensure optimal performance of your analyzer, it is important that you clean the internal components (incubator ring, optics window, and carousel) monthly and before performing quality control.

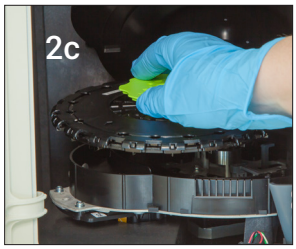
It is recommended that you wear clean powder-free latex or nitrile gloves when cleaning the internal components of the analyzer. Wearing these gloves helps to avoid smudges on the components and ensures an effective cleaning.

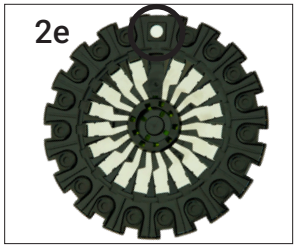
IMPORTANT: Never use cleaning materials (such as alcohol cleaning wipes containing sodium bicarbonate) that leave a residue once the alcohol/solvent evaporates.

To Clean the Internal Components

1. Tap the **Catalyst One** icon on the IDEXX VetLab Station Home screen.
2. Tap **Maintenance**, tap **Clean**, and follow these on-screen instructions.
   a. Open the side door on your analyzer.
   b. Raise the carousel cover until the green lever magnetizes itself to the inside of the analyzer.
   c. Lift up on the carousel and remove it from the analyzer.
   d. Using an IDEXX-supported alcohol prep pad, wipe the incubator ring and optics window in a counterclockwise direction. Repeat this step at least three times using a new alcohol prep pad for each wipe.
   e. Clean the white reference tile using a new alcohol prep pad.
   f. Using a dry optical tissue, dry the optics window and reference tile, ensuring all signs of dampness have evaporated from the cleaned components. If streaks or smudges remain, repeat the cleaning process.
   g. Replace the carousel inside of the analyzer, lower the carousel cover and close the side door.
   h. Tap **Done**.







Cleaning the Outside of the Analyzer and the Sample Drawer

Clean the outside of the analyzer or sample drawer with a damp (not wet) lint-free cloth. A mild liquid soap will remove grease. Do not use any of the following near the analyzer: organic solvents, ammonia-based cleaning products, ink markers, sprays containing volatile liquids, insecticides, disinfectant, polish, or room freshener.

Care should be taken not to spill any samples, chemicals, cleaning agents, water, or other fluids on/in the analyzer.

Note: Dust and animal hair can lead to analyzer failures. Routinely dust off the analyzer with a damp cloth and dust around its location. Do not block the cooling vents under the analyzer by allowing paper, loose materials, or dust to accumulate.

WARNING: Never wipe the analyzer or its surroundings with ammonia-based cleaning products. Avoid urine odors around analyzer. Ammonia in the atmosphere will falsely increase ammonia (NH_3)quality control and patient test results.

Emptying the Waste Drawer

It is essential that you empty the waste drawer after every run or when prompted. The analyzer will not operate when the waste drawer is full. Pull the waste drawer to remove it from the analyzer.

Appendices

Chemistry Descriptions

Serving veterinarians throughout the world, IDEXX Laboratories understands that medical content, including interpretation of diagnostic results and medical protocols, may vary from country to country. A medical review board has approved the content presented in this document.

IDEXX has more than 40 reference laboratories worldwide employing over 100 veterinarians. If you have any questions about the medical content or interpretation of results in this document, please contact IDEXX Laboratories.

Introduction to Biochemical Profiling

By performing appropriate biochemical tests on quality samples, you can obtain information that, when combined with patient history and clinical findings, should assist you in making an accurate diagnosis. Appropriate biochemical tests are also essential for monitoring and prognostication purposes once a diagnosis is achieved.

Single tests are helpful in particular circumstances, such as following the course of an identified disease or for monitoring the effect of therapy. However, many individual chemistry tests give information about different organ systems and should be used in combination with other tests (panels or profiles) to help characterize disease.

Alanine Aminotransferase (ALT)

For practical purposes, the enzyme alanine aminotransferase is specific to the liver in dogs and cats. It is found in the hepatocyte cytoplasm and may be released into the blood during both reversible and irreversible (cell necrosis) changes.

Principal Reason for Performing the Test

To investigate hepatocellular injury in dogs and cats.

Note: This test is not useful in the detection of liver disease in ruminants, horses, and pigs as the enzyme activity in the liver is very low. Even with severe liver disease in these species, the increase in activity is minimal.

Most Common Abnormality Indicated by the Test

Hepatocellular injury.

Sample Type and Precautions

Remove plasma or serum promptly from the cells or clot. Hemolyzed specimens should not be used because ALT contamination from red blood cells will occur. If plasma is being collected, use only lithium heparinized samples.

Complementary Tests

Alanine aminotransferase activity is usually determined in conjunction with other tests of hepatic function or damage.

Reaction Sequence

$$\text{alanine} + \alpha\text{-ketogluterate} \xrightarrow[\text{P-5-P}]{\text{ALT}} \text{pyruvate} + \text{glutamate}$$

$$\text{pyruvate} + \text{NADH} + \text{H}^+ \xrightarrow{\text{LDH}} \text{lactate} + \text{NAD}^+$$

Albumin (ALB)

Albumin forms the largest fraction of the total serum protein in the healthy animal. It is synthesized solely by the liver, has a relatively low molecular weight, and plays an important role in the transport of endogenous and exogenous compounds by binding with those compounds. Albumin also plays a major role related to osmoregulation.

Principal Reasons for Performing the Test

To investigate causes of hypoalbuminemia: protein-losing nephropathy, protein-losing enteropathy, as well as hepatic insufficiency (decreased production) and decreased absorption due to malabsorption (gastrointestinal disease) or malnutrition. In addition, it is helpful in characterizing the degree of dehydration with increases in serum albumin concentrations, and it is commonly decreased with active inflammatory disease (negative acute phase reactant).

The test should not be performed in isolation because of its lack of specificity.

Most Common Abnormalities Indicated by the Test

Decreased albumin—inflammatory disease, protein-losing nephropathy and enteropathy, and decreased production (hepatic insufficiency).

Increased albumin—dehydration.

Sample Type and Precautions

Remove plasma or serum promptly from the cells or clot. Hemolysis may occur if the sample is not handled properly. Although dry-slide technology minimizes the interfering effect of mild-to-moderate hemolysis, marked hemolysis will cause an increased albumin value.

Complementary Tests

Albumin concentration is usually determined in conjunction with the measurement of total protein and other tests of renal and hepatic function. When albumin is measured with total protein, the total globulins will be calculated automatically and given with the results.

Reaction Sequence

$$\text{albumin} + \text{bromocresol green (BCG)} \longrightarrow \text{BCG-albumin complex}$$

Alkaline Phosphatase (ALKP)

The enzyme alkaline phosphatase is found in many body tissues. Highest levels are found in the kidney cortex, small intestinal mucosa, and osteoblasts. The enzyme is also present in the liver primarily located on the bile canalicular; thus an increase in ALKP may indicate cholestasis.

In cats and horses, the half-life of hepatic alkaline phosphatase is very short for ALKP and even shorter for other natural tissue sources of ALKP due to rapid renal excretion/metabolism. Sensitivity of the test in cats and horses is low. Since the nonhepatic sources of ALKP have relatively short half-lives compared to the hepatic source, a mild-to-modest increase in ALKP in these species can be a specific indicator of cholestasis.

Principal Reason for Performing the Test

As an indicator of hepatic and/or biliary disease.

Most Common Abnormality Indicated by the Test

Obstructive changes in the biliary system. A special consideration for interpreting ALKP changes in the dog is required because there are "induced" forms of ALKP due to glucocorticoids and other influences that are not associated with the natural tissue sources of ALKP. The nonhepatic sources of ALKP (bone, intestinal, placental) in the dog will only rarely be measured as high as threefold above the high end of the reference range because of their relative short half-lives compared to the induced and hepatic forms of ALKP. With both the induced and hepatic source (cholestasis) of ALKP, serum enzyme activities are commonly greater than the threefold increase; therefore, when a greater than threefold increase is noted in ALKP in the dog, either cholestasis or induced enzyme is suspected.

Sample Type and Precautions

Remove plasma or serum promptly from the cells or clot. If plasma is being collected, use only lithium heparinized samples. Hemolyzed specimens should not be used because ALKP contamination from red blood cells will increase results while hemoglobin decreases results. Above normal total bilirubin levels may reduce ALKP results.

Complementary Tests

Alkaline phosphatase activity is usually determined in conjunction with other tests of hepatic function and damage.

Reaction Sequence

$$\textit{p}\text{-nitrophenyl phosphate} \xrightarrow[\text{ALKP}]{Mg^{2+},\ AMP} \textit{p}\text{-nitrophenol} + H_3PO_4$$

Ammonia (NH_3)

Ammonia is the catabolic product of protein digestion and is extremely toxic. It is converted rapidly in the liver to urea, which is eliminated from the body by the kidneys.

Principal Reason for Performing the Test

To evaluate hepatic function.

Most Common Abnormality Indicated by the Test

Increased ammonia—decreased hepatic functional mass or hepatic vascular shunt.

Sample Type and Precautions

Use only lithium heparin whole blood or plasma samples. Do not use serum.

Blood should be processed and centrifuged immediately following collection; for this reason, plasma is recommended as the sample of choice.

Ammonia measurements in plasma are significantly affected by environmental factors and/or the passage of time. **Minimal exposure of the sample to the air is essential.** All sample containers should be capped unless sample is being introduced or withdrawn. Do not attempt to measure ammonia in hemolyzed samples. Contamination from the red blood cells will invalidate the test.

Complementary Tests

Ammonia may be determined in isolation but more often in conjunction with other tests of hepatic damage or dysfunction, such as pre- and postprandial bile acids.

Reaction Sequence

$$NH_3 + \text{bromophenol blue (ammonia indicator)} \longrightarrow \text{blue dye}$$

Amylase (AMYL)

This section should be read in conjunction with the Lipase (LIPA) section.

The main source of serum amylase is the pancreas, although pathology of the liver and small intestine may result in significant elevations of this enzyme (above the reference range). Since amylase is cleared by the kidneys, renal pathology may also result in elevation of amylase independent of pancreatic disease.

Principal Reason for Performing the Test

As an indicator of pancreatic disease and potential acute pancreatitis.

Most Common Abnormality Indicated by the Test

Acute necrotizing pancreatitis.

Sample Type and Precautions

Remove plasma or serum promptly from the cells or clot. Hemolyzed specimens should not be used. Do not use oxalate, citrate, or EDTA anticoagulants. If plasma is being collected, use only lithium heparinized samples.

Blood samples should be taken within one day of the onset of symptoms that suggest acute pancreatitis.

Complementary Tests

Amylase and lipase are usually determined in conjunction with one another. Evaluation of a comprehensive chemistry profile that includes electrolytes is generally recommended because of secondary effects of acute pancreatitis. Specific pancreatic lipase should be considered in suspected cases of pancreatitis.

Reaction Sequence

$$\text{dyed amylopectin} \xrightarrow{\text{amylase}} \text{dyed saccharides}$$

Aspartate Aminotransferase (AST)

The enzyme aspartate aminotransferase is present in large amounts in multiple tissues of dogs, cats, and many other animal species. Hepatocytes, cardiac muscle cells, and skeletal muscle cells have relatively high concentrations of AST. It is found in the cytoplasm and mitochondria of the cells and is released into the blood during cell injury. If no increase in ALT is seen in conjunction with an increased AST in the dog and cat, cardiac or skeletal muscle cell injury is most likely. For increased AST values with equine, bovine, and porcine samples, liver, cardiac, and skeletal muscle cell injury must be considered.

Principal Reason for Performing the Test

To investigate damage to liver, cardiac, or skeletal muscle.

Most Common Abnormalities Indicated by the Test

Dogs and cats—cardiac or skeletal muscle injury when ALT is not increased; liver, cardiac, or skeletal muscle injury if both ALT and AST are increased.

Horses, cows, and pigs—liver, cardiac, or skeletal muscle injury.

Sample Type and Precautions

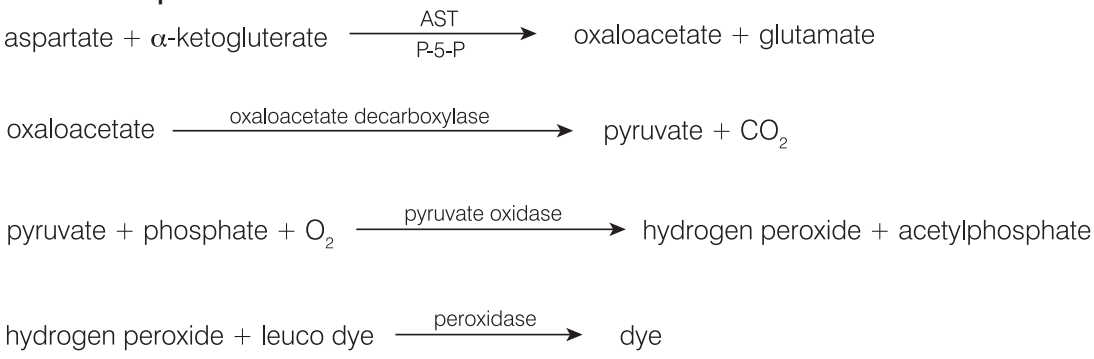
Remove plasma or serum promptly from the cells or clot. Hemolyzed specimens should not be used because AST contamination from red blood cells will occur. EDTA and fluoride/oxalate should not be used as anticoagulants. If plasma is being collected, use only lithium heparinized samples.

Blood samples should be processed and centrifuged immediately after collection. Even slight hemolysis can cause marked increases in activity because of high intracellular concentrations of AST in red blood cells.

Complementary Tests

Aspartate aminotransferase activity is usually determined in conjunction with other tests of liver, cardiac, or skeletal muscle function or damage.

Reaction Sequence



Bile Acids (BA)

Bile acids are produced in the liver, stored in the gallbladder, and released into the intestinal tract where they aid in lipid digestion. In healthy animals, bile acids are efficiently reabsorbed from the intestinal tract and recirculated to the liver via the portal vein. Once in the liver, bile acids are removed from circulation by the hepatocytes. In states of disease or abnormal portal blood flow, bile acids can become elevated in the systemic circulation, indicating reduced liver function.

Principal Reason for Performing the Test

Bile acids testing is primarily used to evaluate for loss of liver function or presence of portosystemic shunts; however, bile acids results can also be elevated with cholestatic diseases that cause bile retention. Bile acids testing is particularly useful when there is suspicion of liver disease before more expensive or invasive testing is performed (e.g., ultrasound, biopsy). Bile acids testing may also be useful for monitoring the effects of some therapeutic drugs on hepatic function and as part of the evaluation for hepatic encephalopathy in patients with neurologic signs. Please refer to the IDEXX Bile Acids Algorithm for additional information.

Most Common Abnormalities Indicated by the Test

Elevated pre- and/or postprandial bile acids are suggestive of liver dysfunction. Normal bile acids do not rule out the presence of hepatic disease. Mild elevations may also be seen with extrahepatic diseases (e.g., small intestinal bacterial overgrowth [SIBO], hyperadrenocorticism, etc.). Moderate to severe elevations are consistent with hepatic dysfunction but cannot discriminate specific liver diseases or the relative severity or reversibility of liver disease. For additional information see the Bile Acids differentials in VetConnect™ PLUS.

Sample Types and Precautions

Catalyst Bile Acids supports the use of serum, lithium heparin plasma, and whole blood (using the Catalyst Lithium Whole Blood Separator). Remove plasma or serum promptly from the cells or clot. IDEXX does not recommend freezing samples that will be used to run Catalyst Bile Acids.

- Catalyst Bile Acids is robust to lipemia.
- Moderate to marked hemolysis can result in elevated Catalyst Bile Acids results.
- If the serum/plasma bilirubin concentration is elevated or the animal is icteric, there is little additional diagnostic value in performing a bile acids test. Icteric samples may result in moderately elevated Catalyst Bile Acids results.
- Be careful not to aspirate cells during serum/plasma preparation, and ensure the Catalyst Lithium Whole Blood Separator is filled with 0.7 cc to prevent overfilling.

Stimulation testing that includes both pre- and postprandial samples collected using typical bile acids stimulation protocols is recommended to increase sensitivity. The following bile acids stimulation protocol is recommended:

1. Fast the dog or cat for approximately 12 hours and collect a fasting (preprandial) sample. Obtain a result from the preprandial Catalyst Bile Acids test.
2. Feed the animal a small amount of high-fat food to stimulate gallbladder contraction.
   - The minimum amount of food recommended is 2 tsp for small patients (<10 lb) and 2 tbsp for large patients.
   - If encephalopathic effects of protein are anticipated, use a restricted-protein food mixed with a small amount of corn oil.
3. Two hours after feeding, collect a postprandial sample. Obtain a result from the postprandial Catalyst Bile Acids test.

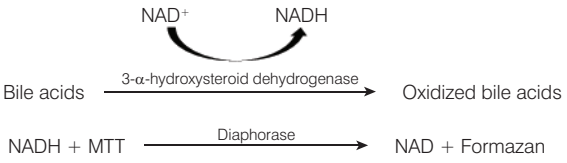
Complementary Tests

Bile acids testing is most frequently utilized after abnormal results on a minimum database indicate concern for liver dysfunction. When paired with appropriate clinical signs, abnormal results that may prompt the need for bile acids testing include:

+ CBC (decreased MCV)
+ Chemistry (decreased albumin, BUN, glucose, or cholesterol; increased ALT, AST, ALKP, GGT, or ammonia)
+ Urinalysis (ammonium biurate crystalluria)

If bilirubin concentration is elevated or the animal is icteric, there is little additional value in performing a bile acids test.

Reaction Sequence



Blood Urea Nitrogen (BUN)

The catabolism of proteins results in the production of ammonia, which is extremely toxic. Ammonia is converted to urea in the liver and eliminated from the body by glomerular filtration in the kidneys.

Principal Reason for Performing the Test

As an indicator of renal disease or pathologic conditions that result in bleeding into the gastrointestinal tract.

Most Common Abnormalities Indicated by the Test

Increased urea—prerenal, postrenal, and renal azotemia with decreased glomerular filtration rate; high-protein diet or bleeding into the gastrointestinal tract.

Decreased urea—decreased protein intake; hepatic insufficiency; diuresis.

Sample Type and Precautions

Remove plasma or serum promptly from the cells or clot. If plasma is being collected, use only lithium heparinized samples.

Blood should not be drawn for urea determination within 6 hours of a meal. Do not use sodium fluoride or EDTA as anticoagulant. Samples that contain hemoglobin increase urea nitrogen.

Complementary Tests

Urea concentration should usually be determined in conjunction with measurements of creatinine, inorganic phosphate, total protein, albumin, and a complete urinalysis. Urea concentration is influenced by high-protein diet rather than creatinine.

Reaction Sequence

$$H_2NCONH_2 + H_2O \xrightarrow{\text{urease}} 2NH_3 + CO_2$$

$$NH_3 + \text{ammonia indicator} \longrightarrow \text{dye}$$

Calcium (Ca)

Calcium is an essential element that is involved in many body systems. These include the skeleton, enzyme activation, muscle metabolism, blood coagulation, and osmoregulation. In the blood, calcium exists in ionized and protein bound forms. Factors governing the total plasma, whole blood, or serum concentration are complex and include interaction with other chemical moieties, proteins, and hormones.

Calcium, phosphorus, and albumin metabolism are interdependent.

Principal Reason for Performing the Test

As an indicator of certain neoplasias, bone disease, parathyroid disease, eclampsia, and renal disease.

Most Common Abnormalities Indicated by the Test

Increased calcium—hypercalcemia of malignancy (due to tumor release of PTH-like substances), spurious.

Decreased calcium—potential renal failure with resultant hyperphosphatemia, dietary, spurious.

Sample Type and Precautions

Remove plasma or serum promptly from the cells or clot. If plasma is being collected, use only lithium heparinized samples.

Centrifugation should take place quickly after the sample has been drawn. The sample should not be exposed to the air for long periods. Glassware must be scrupulously cleaned to avoid contamination by sources of calcium (e.g., detergents). Prolonged contact with the clot may lead to lowered calcium values due to dilution by red blood cell water.

Do not use tubes containing fluoride, oxalate, citrate, or EDTA as these agents will cause significant negative interference due to calcium chelation.

If analysis cannot be performed within 4 hours, the sample should be removed from the red blood cells and refrigerated in a tightly stoppered container at 2°C–8°C (36°F–46°F) for short-term storage (up to 24 hours). The sample should not be frozen. The sample must be allowed to reach room temperature before analysis.

Complementary Tests

Calcium should be determined in conjunction with measurements of inorganic phosphate, albumin, total protein, and glucose. Ionized calcium measurement will provide more specific information related to the physiologic form of calcium.

Reaction Sequence

$$Ca^{2+} + \text{Arsenazo III} \xrightarrow{\text{pH 5.6}} \text{colored complex}$$

Chloride (Cl)

Chloride is the major anion, predominantly in the extracellular spaces, where it maintains cellular integrity by influencing osmotic pressure. Chloride determination is significant in monitoring acid-base balance and water balance.

Principal Reason for Performing the Test

Low chloride levels are usually found in severe vomiting or diarrhea, ulcerative colitis, severe burns, heat exhaustion, fever, and acute infections. Increased values are found in dehydration, hyperventilation, anemia, and cardiac decompensation.

Most Common Abnormalities Indicated by the Test

Hyperchloremia—if increased with sodium then the same cause of hypernatremia. Without a concurrent increase in sodium: hyperchloremic acidosis: GI or renal loss of HCO_3.

Hypochloremia (without related change in sodium)—upper GI tract loss (vomiting).

Sample Type and Precautions

Avoid hemolysis—sample should be run as soon as possible after serum or plasma is separated from the cells or clot. If plasma is being collected, use only lithium heparinized samples. Potassium bromide may increase Catalyst electrolyte results.

Do not freeze samples for use with the Catalyst One analyzer.

Complementary Tests

Sodium, potassium, and chloride should always be assayed together to determine electrolyte balance. If sodium, potassium, chloride, and bicarbonate are measured together, accurate assessment of metabolic acid-base physiology is possible.

Reaction Sequence

$$\text{Chloride} + \text{fluorescent dye} \longrightarrow \text{fluorescence change}$$

Cholesterol (CHOL)

Serum cholesterol occurs predominantly at high concentration in the esterified form; the remainder is in the free form. Cholesterol is synthesized in the liver and other tissues and is also absorbed in the free form from the small intestine. It is esterified in the liver and is the precursor of steroid hormones.

Cholesterol is broken down in the liver to bile acids and eliminated via the bile duct.

Principal Reason for Performing the Test

May be a marker for cholestasis or endocrine disease, such as hypothyroidism, hyperadrenocorticism, diabetes mellitis, as well as nephrotic syndrome.

Most Common Abnormality Indicated by the Test

Increased cholesterol—hypothyroidism, postprandial, nephrotic syndrome.

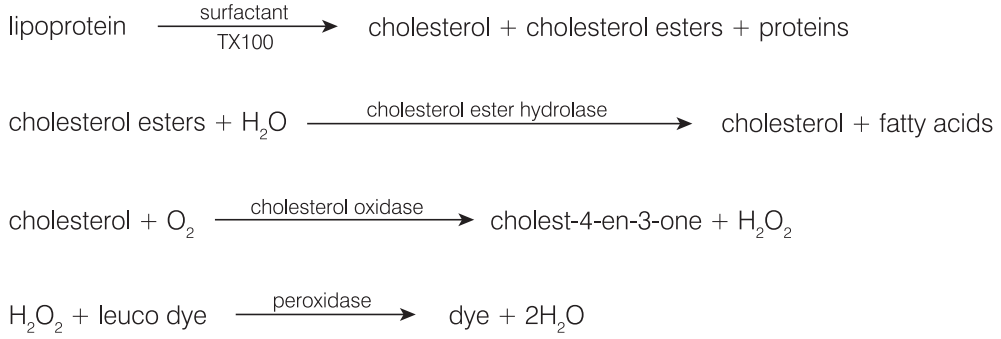
Sample Type and Precautions

Remove plasma or serum promptly from the cells or clot. Blood should not be drawn within 12 hours of a meal. If plasma is being collected, use only lithium heparinized samples.

Complementary Tests

Cholesterol measurements should not be performed in isolation but as part of a profile of tests to investigate endocrine, hepatic, and renal disease. If high cholesterol is found in the absence of diabetes, hepatic, or renal disease, hypothyroidism may be present. This can be evaluated by measuring thyroid function.

Reaction Sequence



Cortisol (CORT)

Cortisol is a fluorescent immunoassay for the quantitative measurement of cortisol in canine patients. With the Catalyst™ Cortisol Test (when used in conjunction with accepted protocols for ACTH stimulation and low-dose dexamethasone suppression tests [LDDS]), you can diagnose hypoadrenocorticism (Addison's disease) and hypercortisolism (Cushing's syndrome). You can also monitor response to treatment and make adjustments to medications for patients diagnosed with Cushing's syndrome.

IMPORTANT: Exogenous glucocorticoid administration (injectable, oral, or topical) can affect Catalyst Cortisol results by cross-reacting with the assay and/or altering the patient's natural ability to produce cortisol (HPA axis). Dexamethasone will not cross-react with the Catalyst Cortisol Test, but administration will affect the HPA axis.

Principal Reason for Performing the Test

To screen, diagnose, and monitor adrenal diseases affecting cortisol production. The measurement of cortisol (when used in conjunction with accepted protocols for ACTH stimulation and LDDS tests) helps veterinary practitioners to assess adrenal function. Cortisol is a hormone secreted by the adrenal cortex and is critical to the stress response and metabolic processes.

Most Common Abnormality Indicated by the Test

+ **Hypercortisolism (Cushing's syndrome)**—an increased cortisol concentration after dynamic testing (LDDS, ACTH stim) in a dog without other underlying health or conditions causing stress is consistent with hypercortisolism (formerly hyperadrenocorticism). Diagnosis of Cushing's syndrome requires appropriate history and clinical signs along with dynamic testing results.
+ **Hypoadrenocorticism (Addison's disease)**—a decreased cortisol concentration after dynamic testing (ACTH stim) in a dog who has not received recent exogenous corticosteroids is consistent with hypoadrenocorticism.

Sample Type and Precautions

+ For use with serum, plasma, and whole blood (when using the Catalyst™ Whole Blood Separator). Remove plasma or serum promptly from the cells or clot. If plasma is being collected, use only lithium heparinized samples.
+ Catalyst Cortisol is robust to lipemia.
+ Moderate-to-marked hemolysis can result in increased Catalyst Cortisol results.
+ Icterus can result in decreased Catalyst Cortisol results.
+ Be careful not to aspirate cells during serum/plasma preparation and ensure the Catalyst Lithium Heparin Whole Blood Separator is filled with 0.7 cc to prevent overfilling.

Complementary Tests

Cortisol should be evaluated in conjunction with a comprehensive history, physical examination, CBC, complete biochemical profile (including electrolytes), and urinalysis to provide a comprehensive database of information in the diagnosis or suspicion of adrenal disease. In dogs diagnosed with hypercortisolism based on the results of a LDDS or ACTH stimulation test, an abdominal ultrasound or endogenous ACTH may help differentiate between ACTH-dependent hypercortisolism (pituitary-dependent) and ACTH independent hypercortisolism (adrenal-dependent) if results of the LDDS test do not assist with differentiation. For dogs diagnosed with hypoadrenocorticism based on the results of an ACTH stimulation test, an electrolyte panel should be performed to evaluate for mineralocorticoid deficiency. Additionally, an endogenous ACTH concentration prior to corticosteroid treatment may be performed to distinguish between primary and secondary hypoadrenocorticism.

Creatine Kinase (CK)

Creatine kinase is found at high activity only in the cytoplasm of cardiac and skeletal muscle. This enzyme catalyzes the reversible phosphorylation of creatine by ATP to creatine phosphate and ADP. Creatine phosphate is the major source of high-energy phosphate used in muscle contraction.

Principal Reason for Performing the Test

To identify injury to skeletal or cardiac muscle.

Most Common Abnormality Indicated by the Test

Skeletal muscle lesions attributable to trauma or vigorous exercise.

Sample Type and Precautions

Samples must be processed and centrifuged immediately after drawing blood. Blood samples should be taken within 6 hours of a suspect lesion. It is important to determine that the patient has not been exercised vigorously during the 12 hours prior to sampling. This may cause marked increases in creatine kinase activity. Remove plasma or serum from the cells or clot. If plasma is being collected, use only lithium heparinized samples. EDTA and fluoride/oxalate will reduce creatine kinase results.

Complementary Tests

Creatine kinase determination provides a specific, sensitive indication of muscle cell damage. Aspartate aminotransferase and lactate dehydrogenase activities may also be measured but are less specific and show smaller corresponding increases when muscle damage is present.

Reaction Sequence

$$\text{creatine phosphate} + \text{ADP} \xrightarrow[\text{NAC, } Mg^{2+}]{\text{CK}} \text{creatine} + \text{ATP}$$

$$\text{ATP} + \text{glycerol} \xrightarrow{\text{GK}} \alpha\text{–glycerophosphate} + \text{ADP}$$

$$\text{L-}\alpha\text{-glycerophosphate} + O_2 \xrightarrow{\alpha\text{–GPO}} \text{dihydroxyacetone phosphate} + H_2O_2$$

$$H_2O_2 + \text{leuco dye} \xrightarrow{\text{peroxidase}} \text{dye} + 2H_2O$$

Creatinine (CREA)

Creatinine is a degradation product of creatine in muscle metabolism. The daily production of creatinine is fairly constant and not influenced markedly by age, diet, exercise, or catabolism. Creatinine is eliminated from the body by glomerular filtration and tubular secretion in the kidneys.

Principal Reasons for Performing the Test

As an indicator of renal disease and/or an index of glomerular filtration rate.

Most Common Abnormality Indicated by the Test

Increased creatinine—prerenal, postrenal, and renal azotemia.

Sample Type and Precautions

Remove plasma or serum promptly from the cells or clot. If plasma is being collected, use only lithium heparinized samples.

Interfering substances, such as creatine, in a sample can affect the analyzer's ability to accurately provide creatinine results. When the analyzer detects such an interfering substance, dilution of the sample may be required to obtain an accurate creatinine value.

Complementary Tests

A complete urinalysis with a refractometry specific gravity measurement is essential for proper interpretation of increases in creatinine. Creatinine determinations should usually be performed in conjunction with measurements of BUN, inorganic phosphate, total protein, and albumin. A complete blood count (CBC) can sometimes demonstrate changes such as nonregenerative anemia with chronic renal failure.

Reaction Sequence

$$\text{creatinine} + H_2O \xrightarrow[\text{amidohydrolase}]{\text{creatinine}} \text{creatine}$$

$$\text{creatine} + H_2O \xrightarrow[\text{amidinohydrolase}]{\text{creatine}} \text{sarcosine} + \text{urea}$$

$$\text{sarcosine} + O_2 + H_2O \xrightarrow[\text{oxidase}]{\text{sarcosine}} \text{glycine} + \text{formaldehyde} + H_2O_2$$

$$H_2O_2 + \text{leuco dye} \xrightarrow{\text{peroxidase}} \text{dye} + 2H_2O$$

C-Reactive Protein (CRP)

C-reactive protein (CRP) is the major acute phase protein released by the liver in response to systemic inflammation in selected species including the dog. The Catalyst CRP Test is a sandwich immunoassay using monoclonal antibodies conjugated to gold nanoparticles and latex particles for the measurement of CRP.

Principal Reason for Performing the Test

CRP is a highly sensitive biomarker of active systemic inflammation in the canine patient. CRP will help the veterinarian detect active inflammation early, characterize the severity of the inflammatory response, and closely monitor the resolution or progression of the inflammatory process following therapeutic intervention.

Most Common Abnormality Indicated by the Test

CRP will be significantly increased in any condition where active, systemic inflammation is present. The increase in CRP correlates with the severity of the inflammation. An increased CRP value may be seen with infectious and noninfectious inflammatory disease (i.e., pneumonia, pancreatitis, pyelonephritis, pyometra, septicemia, and pyothorax), immune-mediated disease (i.e., immune-mediated hemolytic anemia and polyarthritis), as well as inflammation associated with tissue injury as seen in major surgery.

Sample Type and Precautions

Samples acceptable for CRP measurement include serum, plasma, and whole blood (when using the Catalyst Lithium Heparin Whole Blood Separator). Remove plasma or serum promptly from the cells or clot. If plasma is being collected, use only lithium-heparinized samples.

When testing CRP on patients with suspected severe systemic inflammation, dilutions of the sample may be performed to avoid repeat testing when CRP values are above 10.0 mg/dL (100.0 mg/L). The recommended dilution is one part serum or plasma in one part normal saline (0.9% saline). IDEXX recommends only diluting tests with results outside of the reportable range. Diluting tests with results in the normal range may produce invalid results.

Note: Whole blood samples processed in the whole blood separator should not be diluted.

CRP cannot be run with the Phenobarbital (PHBR) test.

Complementary Tests

CRP should be evaluated in conjunction with a comprehensive history, physical examination, complete blood count, complete biochemical profile, and urinalysis to provide a comprehensive database when suspecting systemic inflammation. If infection is suspected, detecting of the pathogen is needed to make a final diagnosis.

Fructosamine (FRU)

Fructosamine is glycated albumin or other proteins. Its concentration is related to blood glucose concentration during the preceding 2 to 3 weeks.

Principal Reason for Performing the Test

Measurement of fructosamine concentration as part of the routine evaluation of a diabetic patient undergoing therapy. It provides information about the status of glycemic control during the 2–3 weeks prior to evaluation. In cats, fructosamine concentrations can be measured to identify if a stress response or diabetes mellitus is the reason for high blood glucose concentrations. In addition, during management of diabetes in both canine and feline patients, fructosamine concentration is used to clarify discrepancies between the history and physical examination findings and serial blood glucose concentration measurements and it is also used to assess the effectiveness of therapy.

Most Common Abnormality Indicated by the Test

Increased fructosamine indicates lack of or inadequate glucose regulation due to diabetes mellitus. Fructosamine concentrations increase with poor glycemic control and decrease when glycemic control improves. Less common, a low fructosamine may indicate prolonged hypoglycemia.

Sample Type and Precautions

Samples acceptable for FRU measurement include serum, plasma, and whole blood (when using the Catalyst Lithium Heparin Whole Blood Separator). Remove plasma or serum promptly from the cells or clot. If plasma is being collected, use only lithium heparinized samples. If you cannot perform FRU analysis within 4 hours of sample collection, store the processed serum in the freezer (-18°C [0°F]) for up to 1 month.

It is important to separate the sample from the red blood cells as promptly as possible.

Serum is preferred for fructosamine testing as customer experience shows that it more consistently provides good quality samples.

Examine the serum or plasma for hemolysis. Although IDEXX dry-slide technology dramatically reduces the effect of this interfering substance, marked hemolysis can result in inaccurate fructosamine results. Typically, marked hemolysis will lower the reported value on the Catalyst analyzers.

Reaction Sequence

$$\text{Fructosamine} + \text{NBT} \xrightarrow{OH^-} \text{formazan dye (measured at 560 nm)}$$

Gamma-glutamyltransferase (GGT)

The enzyme gamma-glutamyltransferase is membrane-bound. It is present in large quantities in the kidney medulla and cortex and to a lesser extent in the small intestinal mucosa and bile ductular epithelium.

Despite the high activity of gamma-glutamyltransferase in the kidney, renal disease does not result in high enzyme activity in the serum sample. GGT in the kidney is primarily related to tubular lining epithelial cells and the enzyme is localized to the apical portion of the cell. Pathologic changes in these tubular epithelial cells result in loss of GGT directly into the urine. Measurement of GGT in the urine can prove to be a sensitive indicator of tubular epithelial cell injury/nephrotoxicity.

Principal Reason for Performing the Test

As an indicator of cholestasis or gallbladder disease.

Most Common Abnormality Indicated by the Test

Increased GGT—cholestasis.

Sample Type and Precautions

Remove plasma or serum promptly from the cells or clot. If plasma is being collected, use only lithium heparinized samples. Hemolyzed specimens should not be used. Do not use fluoride/oxalate as an anticoagulant.

Complementary Tests

Serum gamma-glutamyltransferase activity is usually determined in conjunction with other tests of hepatic function or damage.

Reaction Sequence

$$\text{L-}\gamma\text{-glutamyl-}p\text{-nitroanilide} + \text{glycylglycine} \xrightarrow{GGT} p\text{-nitroaniline} + \gamma\text{-glutamyl glycylglycine}$$

Glucose (GLU)

Glucose is the principal source of energy in monogastric mammals. The circulating concentration in the healthy animal is maintained within narrow limits.

Principal Reason for Performing the Test

To investigate carbohydrate metabolism.

Most Common Abnormality Indicated by the Test

Increased glucose—diabetes mellitus; glucocorticoid influence; epinephrine influence.

Sample Type and Precautions

For glucose determinations, the animal should have been fasted for 5–8 hours before sampling. Hemolysis may affect glucose results.

For plasma samples: Use only lithium heparinized samples. When blood is collected in lithium heparin, it is important that the sample be centrifuged immediately after collection. In this anticoagulant, glycolysis occurs quite rapidly in the presence of red blood cells and the glucose concentration in the sample can diminish at up to 10% an hour at room temperature. Remove plasma promptly from the red blood cells. Hemolyzed specimens should not be used.

For serum samples: Do not centrifuge serum samples until clotting is complete. Samples must be centrifuged completely. Remove serum promptly from the clot to avoid metabolism of glucose by the cells. A maximum of 30 minutes between drawing and separation from the clot is recommended. Hemolyzed specimens should not be used.

Complementary Tests

When the patient is a diagnosed diabetic, glucose tests may be performed in isolation. It is, however, useful to perform other tests for renal and hepatic function and lipid metabolism to monitor secondary effects of poorly controlled diabetes. Because stress in companion animals, particularly cats, can significantly raise glucose above the reference range, a fructosamine level should be considered in suspected cases of diabetes mellitus. A concurrent urinalysis should also be performed to evaluate for the presence of glucose and ketones.

Reaction Sequence

$$\beta\text{-D-glucose} + O_2 + H_2O \xrightarrow{\text{glucose oxidase}} \text{D-gluconic acid} + H_2O_2$$

$$2H_2O_2 + \text{4-aminoantipyrine} + \text{1,7-dihydroxynaphthalene} \xrightarrow{\text{peroxidase}} \text{red dye}$$

Inorganic Phosphate (PHOS)

Phosphorus plays a major role as a metabolic intermediate and is a constituent of nucleic acids, phospholipids, and nucleotides. Phosphates are also important components of buffering systems within the body fluids. Phosphate and calcium are absorbed in the small intestine. Absorption is influenced by the presence of other minerals, nutrients, vitamins, and intestinal pH. Calcium and phosphorus metabolism are interdependent.

Principal Reason for Performing the Test

As a measure of glomerular filtration rate.

Most Common Abnormality Indicated by the Test

Increased inorganic phosphate—decreased glomerular filtration.

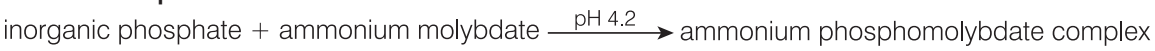
Sample Type and Precautions

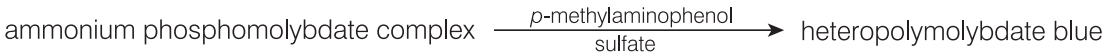
Remove plasma or serum promptly from the cells or clot. If plasma is being collected, use only lithium heparinized samples. Do not use oxalate, fluoride, citrate, or EDTA as anticoagulants. Blood samples must be processed and centrifuged as soon as possible after collection as phosphates are released quickly from the red blood cells. Hemolysis can result in marked increases in phosphate concentration.

Complementary Tests

Inorganic phosphate determination should be performed in conjunction with measurements of calcium, albumin, total protein, and glucose. If renal disease is suspected, BUN, creatinine, albumin, total protein, and a complete urinalysis should also be determined.

Reaction Sequence





Lactate Dehydrogenase (LDH)

The enzyme lactate dehydrogenase is present in large amounts in all organs and tissues (including red blood cells) of most animals. It is found in the cell cytoplasm and is released into the blood during reversible and irreversible (necrosis) cell injury. The test is not a specific or sensitive indicator of damage to any organ or tissue.

Note: The normal range of lactate dehydrogenase in the dog and cat is wide, as can be the intra-animal variation from day to day. Consequently, small increases in activity due to minimal organ damage are difficult to identify. The measurement of lactate dehydrogenase is a somewhat traditional test whose diagnostic value is limited in practice.

Principal Reason for Performing the Test

To investigate damage to liver, cardiac or skeletal muscle.

Most Common Abnormality Indicated by the Test

Increased activity is usually associated with hepatic parenchymal lesions.

Sample Type and Precautions

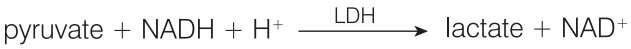
Remove plasma or serum promptly from the cells or clot and analyze as soon as possible. If plasma is being collected, use only lithium heparinized samples. Fluoride/oxalate and EDTA should not be used as anticoagulants.

Hemolyzed specimens should not be used because LDH contamination from red blood cells will occur.

Complementary Tests

Lactate dehydrogenase activity is usually determined in conjunction with other tests of liver, cardiac, or skeletal muscle function or damage.

Reaction Sequence



Lactate (LAC)

Lactate is produced by anaerobic metabolism of glucose and its concentration depends on relative rates of production in muscle cells and erythrocytes and metabolism in the liver.

Principal Reason for Performing the Test

Increased lactate levels usually are caused by overproduction or under metabolism. They result from tissue hypoxia, diabetes mellitus, malignancies, ethanol or methanol ingestion, and metabolic acidosis.

Most Common Abnormality Indicated by the Test

Hypoxia secondary to severe exercise, shock, hypovolemia, cardiac disease, pulmonary edema, and seizures.

Sample Type and Precautions

Use lithium heparinized or Fl/oxalated samples. When using lithium heparinized samples, separate the plasma from the red cells within 5 minutes of collection.

Complementary Tests

CBC, biochemical panel, complete urinalysis, and blood gas.

Reaction Sequence

$$\text{L-(+)-lactic acid} + O_2 \xrightarrow{\text{lactate oxidase}} \text{pyruvate} + H_2O_2$$

$$2H_2O_2 + \text{4-aminoantipyrine} + \text{1,7-dihydroxynaphthalene} \xrightarrow{\text{peroxidase}} \text{red dye}$$

Lipase (LIPA)

Lipase is secreted by the pancreas and to a lesser extent by the gastrointestinal mucosa. Lipase is a relatively sensitive indicator of pancreatic pathology (as compared to amylase). Generally a greater than threefold increase above the reference range is supportive of pancreatitis.

Principal Reason for Performing the Test

As an indicator of acute pancreatitis.

Most Common Abnormality Indicated by the Test

Acute pancreatitis.

Sample Type and Precautions

Blood samples should be taken within one day of the onset of symptoms suggesting acute pancreatitis. Promptly remove plasma or serum from the cells or clot. If plasma is being collected, use only lithium heparinized samples. Do not use oxalate/fluoride, citrate, or EDTA anticoagulants. Lipemia and icterus may increase lipase results.

Complementary Tests

Lipase and amylase are usually determined in conjunction with tests of hepatic and pancreatic function or damage. Canine and feline pancreas-specific lipase tests should be performed in questionable cases.

Reaction Sequence

$$\text{1-oleoyl-2,3-diacetylglycerol} \xrightarrow[\text{pH 8.5}]{\text{lipase, colipase}} \text{2,3-diacetylglycerol} + \text{oleic acid}$$

$$\text{2,3-diacetylglycerol} \xrightarrow{\text{diacetinase}} \text{glycerol} + \text{acetic acid}$$

$$\text{glycerol} + \text{ATP} \xrightarrow[MgCl_2]{\text{glycerol kinase}} \text{L-}\alpha\text{-glycerophosphate} + \text{ADP}$$

$$\text{L-}\alpha\text{-glycerophosphate} + O_2 \xrightarrow{\text{L-}\alpha\text{-glycerophosphate oxidase}} \text{dihydroxyacetone phosphate} + H_2O_2$$

$$H_2O_2 + \text{leuco dye} \xrightarrow{\text{peroxidase}} \text{dye} + 2H_2O$$

Magnesium (Mg)

Magnesium plays an important intracellular role in the activation of enzymes including those responsible for many anabolic and catabolic processes. It is also involved in the formation and destruction of acetylcholine, which governs the transmission of electrical impulses at the neuromuscular junction. The adrenal, thyroid, and parathyroid glands appear to regulate serum magnesium concentration.

Principal Reason for Performing the Test

The importance of measuring serum magnesium concentration in dogs and cats has not been fully investigated. However, there have been reports of hypomagnesemia in dogs following the removal of the parathyroid gland.

Most Common Abnormalities Indicated by the Test

Increased magnesium—decreased glomerular filtration.

Decreased magnesium—parathyroid gland removal.

Sample Type and Precautions

Blood samples should be centrifuged immediately after collection as magnesium is released from hemolyzed erythrocytes and can give erroneously high magnesium results. Remove plasma or serum promptly from the cells or clot. If plasma is being collected, use only lithium heparinized samples. Do not use oxalate/citrate or EDTA as anticoagulants. Blood collection tubes preserved with sodium fluoride cause lower results.

Reaction Sequence

$$Mg^{2+} + Ca^{2+} \xrightarrow{\text{chelator}} Mg^{2+} + Ca^{2+}\text{-chelator complex}$$

$$Mg^{2+} + \text{formazan dye derivative} \xrightarrow{\text{pH 9.75}} Mg^{2+}\text{-dye complex}$$

N-Terminal pro-B-Type Natriuretic Peptide (proBNP)

B-type natriuretic peptide (BNP) is stored in cardiomyocytes as a prohormone (proBNP) and is released in response to stretch or strain on heart muscle. On release, proBNP is cleaved into a biologically active hormone C-BNP and an inactive amino-terminal fragment (NT-proBNP). NT-proBNP has a longer half-life than C-BNP, making the quantification of circulating NT-proBNP more amenable for clinical purposes. NT-proBNP is released in proportion to the amount of stretch and strain on the myocardium. For brevity, “NT-proBNP” and “proBNP” are often used interchangeably in IDEXX documentation and product naming when referring to N-terminal pro-B-type natriuretic peptide.

Principal Reason for Performing the Test

The measurement of NT-proBNP is informative in three key clinical presentations:

- The measurement of NT-proBNP can be used to screen cats as part of annual wellness or pre-anesthetic checks for subclinical heart disease.
- NT-proBNP concentrations can help to assess whether a healthy, small-medium breed dog with a heart murmur consistent with myxomatous mitral valve disease has B1 or B2 heart disease.
- The quantification of NT-proBNP can be used to help diagnose the cause of respiratory distress in both dogs and cats.

The measurement of NT-proBNP can also be helpful in a wide range of other clinical scenarios, such as screening at-risk dog breeds for dilated cardiomyopathy and in the assessment of ascites in dogs. The quantification of NT-proBNP can also provide insights into the response of therapy and longer-term prognosis in both dogs and cats.

Most Common Abnormalities Indicated by the Test

Increased stretch and strain on the myocardium results in increased NT-proBNP concentrations. In dogs, the most common primary cardiac diseases are myxomatous mitral valve disease in small–medium breed dogs and dilated cardiomyopathy in large–giant breed dogs. In cats, the most common primary cardiac disease is hypertrophic cardiomyopathy. See the NT-proBNP differentials alongside your result in VetConnect™ Plus or on your IDEXX VetLab™ Station for additional differentials and recommended next steps.

Sample Types and Precautions

Catalyst proBNP compatible sample types include serum, lithium heparin plasma, and whole blood using the Catalyst™ Lithium Heparin Whole Blood Separator.

Catalyst proBNP is robust to hemolysis, lipemia, and icterus.

Be careful not to aspirate cells during serum/plasma preparation and ensure the Catalyst Lithium Heparin Whole Blood Separator is filled with 0.7 cc/700 µL (0.8 cc/800 µL if running with other slides) to prevent overfilling.

Complementary Tests

Echocardiography is the gold standard for assessing cardiac structure and function. Additional diagnostics may include thoracic radiography (including measurement of Vertebral Heart Score and Vertebral Left Atrial Score), blood pressure assessment, and biochemistry (including T4 in cats). Other tests such as CBC, electrocardiogram, Holter monitoring, infectious disease testing, urinalysis and abdominal ultrasonography may also be informative.

Pancreatic Lipase (PL)

Pancreatic lipase is a digestive enzyme produced by the pancreas to hydrolyze lipids. Under normal circumstances, only small amounts of pancreatic lipase are found in the circulation. When the pancreas undergoes inflammation or damage (i.e., neoplasia, trauma), an increased amount of pancreatic lipase is released and is an indicator of pancreatic pathology.

Principal Reason for Performing the Test

To diagnose and monitor pancreatitis in sick patients.

Most Common Abnormalities Indicated by the Test

Acute or chronic pancreatitis.

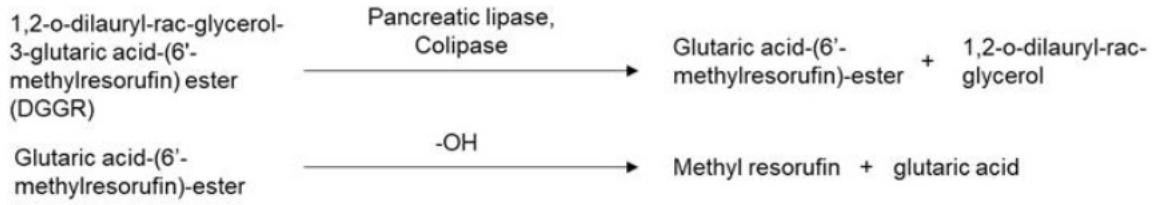
Sample Types and Precautions

- Catalyst™ Pancreatic Lipase supports the use of serum, lithium heparin plasma, and whole blood (using the Catalyst Lithium Whole Blood Separator). Remove plasma or serum promptly from the cells or clot.
- Catalyst Pancreatic Lipase is robust to lipemia and icterus.
- Moderate-to-marked hemolysis can result in decreased Catalyst Pancreatic Lipase results.
- Be careful not to aspirate cells during serum/plasma preparation, and ensure the Catalyst Lithium Whole Blood Separator is filled with 0.7 cc to prevent overfilling.

Complementary Tests

Catalyst Pancreatic Lipase should be evaluated in conjunction with a comprehensive history, physical exam, complete blood count, complete biochemical profile, and urinalysis to evaluate for evidence of systemic complications of pancreatitis and comorbidities.

Reaction Sequence



Phenobarbital (PHBR)

Phenobarbital is a commonly used drug used to treat seizures in a variety of species. Phenobarbital levels should be evaluated during initial dosing and throughout treatment to ensure that the blood levels are within the targeted therapeutic range.

Principal Reasons for Performing the Test

Phenobarbital is a controlled barbiturate medication that is used to treat veterinary patients that have seizures. The dosage of phenobarbital needs to remain within a specific range to be effective. If the level is <10 µg/mL, there may not be a sufficient level of phenobarbital to prevent seizures. If the level is >30 µg/mL in cats or dogs, phenobarbital can be toxic and potentially life threatening.

In most patients, steady state is achieved after 2–3 weeks of consistent dosing with phenobarbital. **Once steady state is achieved, timing of sample collection is not important in more than 90% of patients.** However, there can be variability of the phenobarbital half-life in a small percentage of patients. Therefore, if toxicity is suspected, a peak sample (4–5 hours post-pill) may be helpful, and if breakthrough seizures are occurring and inadequate dosing is suspected, a trough level (collected immediately prior to the next dose) may be helpful.

Therapeutic monitoring should be performed after two to four weeks of consistent dosage following initiation of treatment or dosage change to allow most patients to achieve a relatively steady state. Patients on lower doses (mg/kg) may take longer to come to steady state. **Consistent timing of sampling remains important for comparison across time as there may still remain some fluctuation throughout the day, especially for patients receiving higher doses.** Monitoring should then be repeated at a minimum of every six months thereafter, depending on clinical response.

Most Common Abnormalities Indicated by the Test

Over or under dosage of medication.

Sample Type and Precautions

Do not use separator tubes as contact with the gel may decrease levels.

Complementary Tests

CBC, full chemistry panel, urinalysis, bile acids (minimally 2 times per year)

Reaction Sequence

$$\text{PHBR} + \text{PHBR}^{\dagger} + \text{Ab} \rightleftharpoons \text{PHBR–Ab} + \text{PHBR}^{\dagger}\text{–Ab} + \text{PHBR} + \text{PHBR}^{\dagger}$$

$$\text{Immuno-wash} + \text{PHBR-Ab} + \text{PHBR}^{\dagger}\text{–Ab} + \text{PHBR} + \text{PHBR}^{\dagger} \xrightarrow{\text{wash}} \text{PHBR}^{\dagger}\text{–Ab} + \text{PHBR–Ab}$$

$$H_2O_2 + \text{leuco dye} + \text{PHBR}^{\dagger}\text{–Ab} \longrightarrow \text{dye} + 2H_2O$$

†PHBR = phenobarbital-peroxidase conjugate

Potassium (K)

Potassium is the major cation of intracellular fluid, where it is the major buffer within the cell, facilitates nerve conduction and muscle function, and helps maintain osmotic pressure. Abnormally high or low potassium levels cause changes in muscle irritability, respiration, and myocardial function.

Principal Reasons for Performing the Test

High potassium (hyperkalemia) is usually found in urinary obstruction, renal failure, metabolic or respiratory acidosis, and hypoadrenocorticism as well as excessive hemolysis for horses, cattle, cats, and some breeds of dogs. Decreased values (hypokalemia) usually follow excessive salt loss through severe vomiting or diarrhea, inadequate intake, anorexia (especially cats), malabsorption, and severe burns.

Most Common Abnormalities Indicated by the Test

Hyperkalemia—renal failure, postrenal obstruction.

Hypokalemia—excessive loss of potassium.

Sample Type and Precautions

Remove plasma or serum promptly from cells or clot. If plasma is being collected, use only lithium heparinized samples. Avoid hemolysis. Potassium bromide may increase Catalyst electrolyte results.

Do not freeze samples for use with the Catalyst One analyzer.

Complementary Tests

Sodium, potassium, and chloride should always be assayed together to determine electrolyte balance. The additional measurement of bicarbonate will allow accurate assessment of metabolic acid-base physiology.

ACTH stimulation test for suspect cases of hypoadrenocorticism.

Reaction Sequence

Potassium + ionophore – fluorescent dye $\longrightarrow$ fluorescence change

Progesterone

Progesterone is a female reproductive hormone. In the bitch, increased production occurs during late proestrus, through estrus, and into diestrus. It is necessary for the maintenance of pregnancy in most species.

Principal Reason for Performing the Test

In the bitch, uses of progesterone testing include:

- Predicting (and later confirming) ovulation for timing of breeding.
- Predicting parturition date and/or time of cesarean section.
- Investigating reproductive abnormalities.

Sample Type and Precautions

Catalyst Progesterone has been optimized for use with canine whole blood (using the Catalyst™ Lithium Heparin Whole Blood Separator) and lithium heparin plasma samples. Serum is also acceptable. It is important to remove plasma or serum promptly (within 30 minutes) from the red blood cells or clot.

- If plasma is being collected, use only lithium heparinized samples.
- If serum is being collected, **do not use a serum separator tube (SST)** as the gel interferes with progesterone testing.
- Catalyst Progesterone is robust to icterus and lipemia. Marked hemolysis (obvious on visual inspection of the serum/plasma) can result in inaccurate progesterone results (falsely low).

- The sample should not be diluted.
- Serial progesterone concentrations should be monitored using a consistent sample type and handling method.
- Catalyst Progesterone was designed to measure naturally occurring progesterone in canine samples. Use of progesterone supplementation may impact results.

Do not expose progesterone tests to topical progesterone products (e.g., creams applied to human skin). If these creams have been used, the operator should wear clean, powder-free latex or nitrile gloves whenever using the Catalyst Progesterone Test or the Catalyst One™ or Catalyst Dx™ analyzers. Tests exposed to progesterone products may experience an increased reported value on the Catalyst One and Catalyst Dx analyzers.

Complementary Tests

To increase the accuracy of predicting ovulation and timing breeding:

- Trend progesterone results over many days taking care to be consistent with sample type and handling.
- Use progesterone trends in combination with vaginal exfoliative cytology.
- Monitor (once or twice daily) for the onset of vulvar softening.

To increase the accuracy of determining parturition date:

- Trend progesterone results over many days taking care to be consistent with sample type and handling.
- Use progesterone trends in combination with knowledge of mating events, repeated measurement of body temperature, and observation of clinical signs.
- Before cesarean section, confirm a persistent decrease in progesterone concentrations with repeat testing.

For some cases, the addition of LH (luteinizing hormone) testing may be useful, particularly when using frozen semen for artificial insemination.

Different methods for measuring progesterone have differing performance and it is important to use the interpretive comments supplied with the relevant test. When trending progesterone results to determine ovulation timing, always use one methodology and sample type. Decisions regarding breeding should not be made based on progesterone testing alone.

Sodium (Na)

Sodium is the major cation of extracellular fluid, where it maintains osmotic pressure, acid-base balance, and transmits nerve impulses. The body maintains total sodium content, and only slight changes are found even under pathologic conditions.

Principal Reasons for Performing the Test

To evaluate electrolyte status in conjunction with potassium and chloride levels.

Low sodium (hyponatremia) is usually caused by a relative excess of body water. Reduced levels may be due to low intake, loss through vomiting or diarrhea plus adequate water and inadequate salt replacement, salt-losing nephropathy, osmotic diuresis, metabolic acidosis, and various glandular conditions.

Increased values (hypernatremia) usually follow water loss in excess of salt loss through profuse sweating, severe vomiting or diarrhea, inadequate water intake, and dehydration of renal sodium conservation in hyperaldosteronism.

Most Common Abnormality Indicated by the Test

Hypernatremia secondary to dehydration, gastrointestinal fluid loss (vomiting or diarrhea).

Sample Type and Precautions

Remove plasma or serum promptly from cells or clot. If plasma is collected, use only lithium heparinized samples. Avoid hemolysis. Potassium bromide may increase Catalyst electrolyte results.

Do not freeze samples for use with the Catalyst One analyzer.

Complementary Tests

Sodium, potassium, and chloride should always be assayed together to determine electrolyte balance. The additional measurement of bicarbonate will allow accurate assessment of metabolic acid-base physiology.

Reaction Sequence

Sodium + ionophore – fluorescent dye ⟶ fluorescence change

Symmetric dimethylarginine (SDMA)

Symmetric dimethylarginine (SDMA) is a stable molecule that originates from posttranslational methylation of arginine residues of intranuclear cellular proteins integral to basic cellular metabolism, and subsequent protein degradation. SDMA production is constant and is largely unaffected by body condition, advanced age, diet, exercise, disease state, or catabolism. SDMA is eliminated from the body by glomerular filtration in the kidneys.

Principal Reason for Performing the Test

SDMA is a sensitive biomarker of glomerular filtration rate. SDMA increases earlier than creatinine as kidney function declines and, unlike creatinine, SDMA is not impacted by non-renal factors, such as lean muscle mass or diet.

Most Common Abnormality Indicated by the Test

Increased SDMA indicates reduced glomerular filtration rate due to prerenal (dehydration, hypotension), renal (acute and active kidney injury and/or chronic kidney disease), or postrenal (urinary obstruction) conditions.

Sample Type and Precautions

Samples acceptable for the Catalyst™ SDMA Test include canine and feline serum, plasma, and whole blood (when using the Catalyst Lithium Heparin Whole Blood Separator). Remove plasma or serum promptly from the cells or clot. If plasma is being collected, use only lithium heparinized samples. The sample should not be diluted.

Complementary Tests

Changes in kidney function associated with increased SDMA should be acted on immediately and evaluated considering the clinical presentation and physical examination findings. Complementary laboratory testing begins with a complete urinalysis and complete biochemical profile, including creatinine, BUN, inorganic phosphate, total protein, albumin, and electrolytes. A complete blood count is suggested.

Probable kidney disease should be investigated for an underlying cause with a urine culture and MIC susceptibility, infectious disease testing, and diagnostic imaging, as well as a search for exposure to kidney toxins or nephrotoxic medications. Patients with increased SDMA should also be assessed for confounding conditions by measuring blood pressure and a urine protein to creatinine ratio and by testing thyroid function.

Total Bilirubin (TBIL)

Hemoglobin from degenerated erythrocytes is converted to bilirubin in the monocyte-macrophage system. Free unconjugated bilirubin is transported to the liver bound to albumin, where it is conjugated with glucuronic acid and eliminated in the bile. In obstructive liver disease, the concentration of conjugated bilirubin in the blood increases.

During intravascular or extravascular hemolysis, very large numbers of erythrocytes may be destroyed quickly and the conjugation mechanism in the liver may become overloaded so that high concentrations of unconjugated bilirubin are found in the blood. If the loss of hemoglobin and erythrocytes is very large, anoxia may occur. Hepatocyte dysfunction follows leading to cellular swelling, which occludes the bile canaliculi preventing the elimination of conjugated bilirubin. A concomitant rise in circulating conjugated bilirubin then occurs.

Principal Reason for Performing the Test

To detect hepatobiliary disease and excessive erythrocyte destruction.

Note: In healthy dogs and cats, the concentration of total bilirubin in the serum is very low. Visual inspection of the sample will frequently indicate whether bilirubin determination is necessary (serum and plasma only).

Most Common Abnormality Indicated by the Test

Increased bilirubin—cholestatic liver disease (conjugated bilirubin) and hepatic insufficiency (unconjugated bilirubin), hemolytic disease (unconjugated and possible conjugated bilirubin), and intrahepatic obstruction.

Sample Type and Precautions

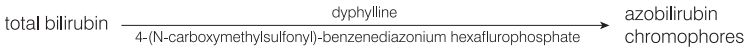
Remove plasma or serum promptly from cells or clot. Samples should be analyzed immediately as bilirubin degrades rapidly in light. If immediate analysis is impossible, the sample must be kept in the dark and preferably at 4°C–8°C (36°F–40°F) in a refrigerator. Sample must be allowed to come to room temperature before analysis. If plasma is collected, use only lithium heparinized samples.

It is critical that samples be properly centrifuged. Otherwise, leukocytes and platelets may remain in suspension, even when red blood cells have been separated. Cellular material on the slide may cause significant positive error. Also, hemoglobin increases total bilirubin results, so avoid even moderately hemolyzed samples.

Complementary Tests

Total bilirubin should be determined with other tests of hepatic function or damage. Hematocrit should also be performed to eliminate or confirm the presence of hemolytic disease. Determination of urinary urobilinogen and bilirubin may also be useful.

Reaction Sequence



Total Protein (TP)

The serum total protein concentration comprises all the proteins found in the aqueous phase of the blood. In healthy animals, albumin is the major single component. The remaining proteins are the alpha, beta, and gamma globulins. The globulin concentration is determined by subtracting the albumin from the total protein.

Principal Reason for Performing the Test

Total protein measurement may provide useful information when used in combination with tests to investigate hepatic and renal function, the degree of hydration, protein-losing enteropathies, or gammopathies. The test is nonspecific and, if performed in isolation, will be unlikely to provide diagnostic information.

Most Common Abnormalities Indicated by the Test

Increased total protein—dehydration, inflammatory disease.

Decreased total protein—loss of proteins through blood loss and gastrointestinal loss, decreased albumin associated with protein-losing nephropathy and enteropathy, and decreased albumin associated with hepatic insufficiency and inflammatory disease.

Impaired renal and hepatic function, dehydration, and gastrointestinal lesions.

Sample Type and Precautions

Remove plasma or serum promptly from the cells or clot. If plasma is collected, use only lithium heparinized samples. Moderate-to-marked hemolysis can result in false high total protein concentration.

Results obtained from the analysis of plasma may be slightly higher than serum due to the fibrinogen that remains in the plasma.

Complementary Tests

Total protein concentration is usually determined in conjunction with the measurement of albumin and other tests of renal and hepatic function.

Reaction Sequence

$$\text{protein} + \text{copper tartrate} \xrightarrow{\text{LiOH}} \text{colored complex}$$

Total T_4 (TT_4)

An enzyme-linked immunosorbent assay (ELISA) for the quantitative measurement of total T_4 (thyroxine) in canine and feline patients. With a total T_4 test, you can assess thyroid function, provide comprehensive one-visit screening for feline hyperthyroidism, presumptive canine hypothyroidism, as well as monitor response to treatment and adjust dosages immediately.

Principal Reason for Performing the Test

To screen, diagnose, and monitor thyroid disease. The measurement of total thyroxine helps veterinary practitioners to assess thyroidal function by measuring the bound and unbound thyroxine in the blood. Thyroxine is the principal hormone secreted by the thyroid gland and is critical to metabolic processes.

Most Common Abnormality Indicated by the Test

Hyperthyroidism—an increased TT_4 is consistent with hyperthyroidism. Naturally occurring hyperthyroidism is a common endocrine disorder in cats and rare in dogs.

Hypothyroidism—a decreased TT_4 is consistent with but not necessarily definitively diagnostic of hypothyroidism. Naturally occurring hypothyroidism is a common endocrine disorder in dogs and rare in cats.

Nonthyroidal illness (NTI)—nonthyroidal illness can affect TT_4 levels (and potentially other thyroid tests as well). Nonthyroidal illness can lower TT_4 levels, potentially into the hypothyroid range. The more severe the nonthyroidal illness, the greater the potential impact on TT_4 levels.

Sample Type and Precautions

For use with serum, plasma, and whole blood (when using the Catalyst Whole Blood Separator).

Remove plasma or serum promptly from the cells or clot. If plasma is being collected, use only lithium heparinized samples. Do not use fluoride/oxalate as an anticoagulant.

Complementary Tests

Total T_4 should be evaluated in conjunction with a comprehensive history, physical examination, CBC, complete biochemical profile, and urinalysis to provide a comprehensive database of information in the diagnosis or suspicion of thyroid disease.

In dogs with low or low normal T_4 results and with consistent clinical signs, evaluate free T_4 (fT_4) and endogenous thyroid-stimulating hormone (TSH) and possibly thyroglobulin autoantibodies (TgAA) to aid in confirming hypothyroidism.

Cats with consistent clinical signs and total T_4 (TT_4) values in the borderline high range (gray zone) may have early hyperthyroidism or a concurrent nonthyroidal illness (NTI). In these cases, consider a free T_4 (fT_4), a T_3 suppression test or radionuclide thyroid imaging to aid in confirming the diagnosis.

Triglycerides (TRIG)

Triglycerides are usually present in the diet of dogs and cats, especially when the animals are fed table scraps. They are also synthesized in the liver, mainly from carbohydrates, to provide a secondary energy source and are stored in fatty tissue. Their hydrolysis to mono- and diglyceride glycerol and free fatty acids is catalyzed by pancreatic lipase.

Principal Reason for Performing the Test

To detect abnormalities in lipid metabolism.

Most Common Abnormality Indicated by the Test

Increased triglycerides—High-fat diet or abnormalities in fat metabolism.

Sample Type and Precautions

Blood should not be drawn within 12 hours of a meal.

Remove plasma or serum promptly from the cells or clot. If plasma is collected, use only lithium heparinized samples. Grossly lipemic specimens probably have very high triglycerides and should be diluted before analysis.

Complementary Tests

Triglycerides should not be measured in isolation. If the sample is turbid or milky, the test should be determined in conjunction with measurements of cholesterol and glucose, and hepatic and renal function tests. Also consider repeat sampling if the patient has not been fasted for 12 hours.

Reaction Sequence

$$\text{lipoproteins} \xrightarrow{\text{surfactant}} \text{triglycerides} + \text{proteins}$$

$$\text{triglycerides} + H_2O \xrightarrow{\text{lipase}} \text{glycerol} + \text{fatty acids}$$

$$\text{glycerol} + \text{ATP} \xrightarrow[MgCl_2]{\text{glycerol kinase}} \text{L-}\alpha\text{-glycerophosphate} + \text{ADP}$$

$$\text{L-}\alpha\text{-glycerophosphate} + O_2 \xrightarrow{\text{L-}\alpha\text{-glycerol-phosphate oxidase}} \text{dihydroxyacetone phosphate} + H_2O_2$$

$$H_2O_2 + \text{leuco dye} \xrightarrow{\text{peroxidase}} \text{dye} + 2H_2O$$

Uric Acid (URIC)

Uric acid determinations are useful in avian patients and dalmatians in place of urea determinations. In all dogs (except dalmatians) with diffuse hepatic disease, there is marked elevation of blood uric acid above the normal levels of <1 mg/dL.

Principal Reason for Performing the Test

As an indicator of the severity of renal disease in avian populations (and dalmatians).

Most Common Abnormality Indicated by the Test

Increased uric acid—prerenal, postrenal, and renal azotemia associated with decreased glomerular filtration rate.

Sample Type and Precautions

Remove plasma or serum promptly from the cells or clot. If plasma is collected, use only lithium heparinized samples. Plasma collected from sodium fluoride, citrate, or EDTA preservative should not be used.

Complementary Tests

Creatinine, UCRE/CREA, UPRO

Reaction Sequence

$$2H_2O + \text{uric acid} \xrightarrow{\text{uricase}} \text{allantoin} + H_2O_2 + CO_2$$

$$H_2O_2 + \text{leuco dye} \xrightarrow{\text{peroxidase}} \text{dye}$$

Urine Creatinine (UCRE)

Urine creatinine is determined so that the concentration of electrolytes filtered or lost through the glomeruli or renal tubules, such as urinary protein or cortisol, can be quantitated, compared, and expressed as ratios with diagnostic significance.

Principal Reason for Performing the Test

To be performed with urine protein in order to determine the urine protein:creatinine ratio (UPC).

Most Common Abnormality Indicated by the Test

Proteinuria indicating early renal disease, protein-losing nephropathy.

Sample Type and Precautions

Centrifuged urine, preferably collected through cycstocentesis, collected in a clean container. An inactive urinary sediment should be demonstrated and urinary tract infection (UTI) via culture and sensitivity should be ruled out before performing, as UTI may mildly to moderately raise the UPC.

Complementary Tests

Complete urinalysis with culture and sensitivity. Serum chemistries, such as creatinine, BUN, albumin, and globulin.

CBC

SNAP™ 4Dx™ Plus Test

Storage Information

Urine samples should be run within 2 hours of collection and can be stored in a refrigerator for up to 24 hours. DO NOT freeze urine samples.

Reaction Sequence

$$\text{creatinine} + H_2O \xrightarrow[\text{amidohydrolase}]{\text{creatinine}} \text{creatine}$$

$$\text{creatine} + H_2O \xrightarrow[\text{amidinohydrolase}]{\text{creatine}} \text{sarcosine} + \text{urea}$$

$$\text{sarcosine} + O_2 + H_2O \xrightarrow[\text{oxidase}]{\text{sarcosine}} \text{glycine} + \text{formaldehyde} + H_2O_2$$

$$H_2O_2 + \text{leuco dye} \xrightarrow{\text{peroxidase}} \text{dye} + 2H_2O$$

Urine Protein (UPRO)

Urinary protein is determined and compared to the concentration of creatinine in order to assess the level of renal protein (glomeruli and tubular) loss to determine the urine protein:creatinine (UPC) ratio.

Principal Reason for Performing the Test

To be performed with urine creatinine in order to determine the urine protein:creatinine (UPC) ratio.

Most Common Abnormality Indicated by the Test

Proteinuria indicating early renal failure, protein-losing nephropathy.

Sample Type and Precautions

Centrifuged urine, preferably collected through cycstocentesis, collected in a clean container. An inactive urinary sediment should be demonstrated and urinary tract infection (UTI) via culture and sensitivity should be ruled out before performing as UTI may mildly to moderately raise the UPC.

Complementary Tests

Complete urinalysis with culture and sensitivity. Serum chemistries such as creatinine, BUN, albumin, and globulin.

CBC

SNAP™ 4Dx™ Plus Test

Storage Information

Urine samples should be run within 2 hours of collection and can be stored in a refrigerator for up to 24 hours. DO NOT freeze urine samples.

Reaction Sequence

$$Mo^{6+} - \text{pyrocatechol violet dye} + \text{oxalate} + \text{protein} \longrightarrow \text{colored complex dye}$$

Medical Protocol Descriptions

Ammonia Protocol

Baseline ammonia levels should be assessed in animals with signs of hepatic encephalopathy or in patients suspected of having portosystemic shunts (PSS). Ammonia tolerance tests may be considered to evaluate for PSS where bile acids are not considered (for example, in Maltese).

Ammonia tolerance test: A baseline sample is drawn after the patient has been fasted for 12 hours. Ammonium chloride (0.1 g/kg) by mouth via stomach tube or gelatin capsules. A second sample is drawn 30 minutes after ammonium chloride administration.

Note: Vomiting during the procedure will invalidate results.

Sample Requirements: 1 mL heparinized plasma, separated from RBCs. Do not use serum.

Storage/Stability: Samples must be analyzed immediately after collection. If there is any delay between collection, centrifugation, and analysis, the sample must be capped and placed on ice immediately.

Interferences: Hemolysis, glucose levels over 600 mg/dL (33.33 mmol/L), high BUN values

Comments: Anticoagulated blood must be centrifuged immediately after collection. Separate plasma and place it in a glass container (RTT). Freeze immediately and keep frozen if not running sample immediately.

Note: Ammonia levels increase with time.

UPC Protocol

Principal Reason for Performing Test: To aid in the diagnosis of protein-losing nephropathies such as glomerulonephritis and amyloidosis and as an early marker of chronic renal failure.

Includes: Urine protein (UPRO), urine creatinine (UCRE), protein:creatinine (UPC) ratio

Sample Requirements: 2 mL urine in a sterile container

Storage/Stability: 48 hours at 2°C–8°C (36°F–46°F)

Interferences: Gross hematuria, pyuria.

Complementary Tests: Complete urinalysis with culture and sensitivity. Serum chemistries such as creatinine, BUN, albumin, globulin; CBC; SNAP™ 4Dx™ Plus Test; and imaging studies.

Interpretation: Proteinuria requires proof of persistence and localization to prerenal, renal, or postrenal origins. Prove persistence of proteinuria by repeating the UPC ratio at least three times, a minimum of 2 weeks apart.

+ Prerenal proteinuria is possible when a CBC and a biochemical profile detect hemolysis, hyperglobulinemia or evidence of muscle damage. Recommend investigation and management for the underlying cause.
+ Postrenal proteinuria is caused by urogenital tract diseases, hematuria, or pyuria. Repeat the test with a cystocentesis sample or evaluate urine sediment for hemorrhage or inflammation. Consider a urine culture. Recommend investigation and management for the underlying cause.
+ Renal proteinuria: evaluate in the face of azotemia.

Nonazotemic, persistent, renal proteinuria (dogs and cats):

UPC <0.5 = within reference range

UPC 0.5–1.0 = questionable, repeat at appropriate range

UPC 1.0–2.0 = excessive proteinuria; recommend investigation for underlying systemic diseases

UPC 2.0 = excessive proteinuria; recommend investigation for underlying systemic diseases and medical management

Azotemic, persistent, renal proteinuria (dogs):

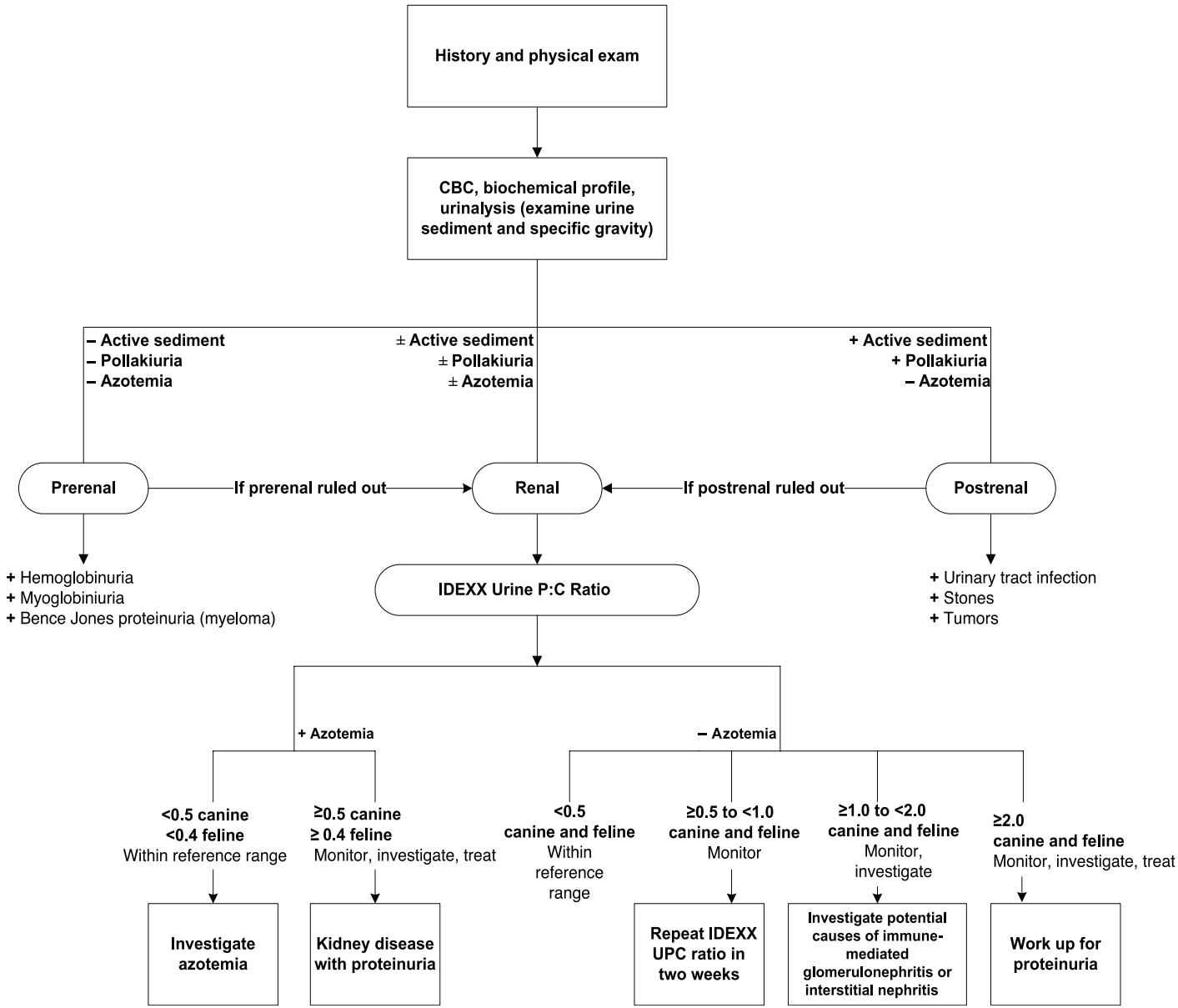
UPC <0.5 = warrant monitoring and investigation

UPC ≥0.5 = excessive proteinuria; recommend investigation for underlying systemic diseases and medical management

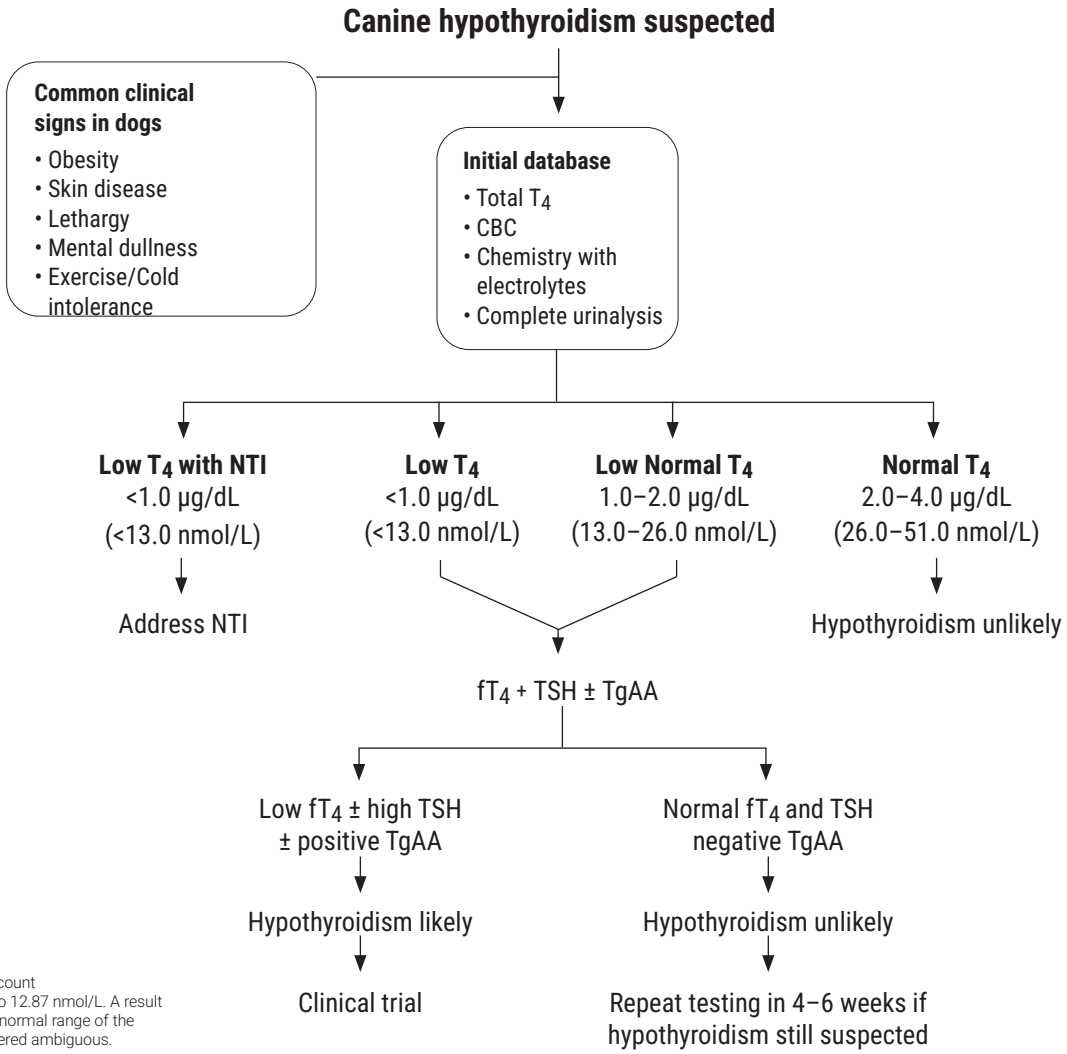
Azotemic, persistent, renal proteinuria (cats):

UPC <0.4 = warrant monitoring and investigation

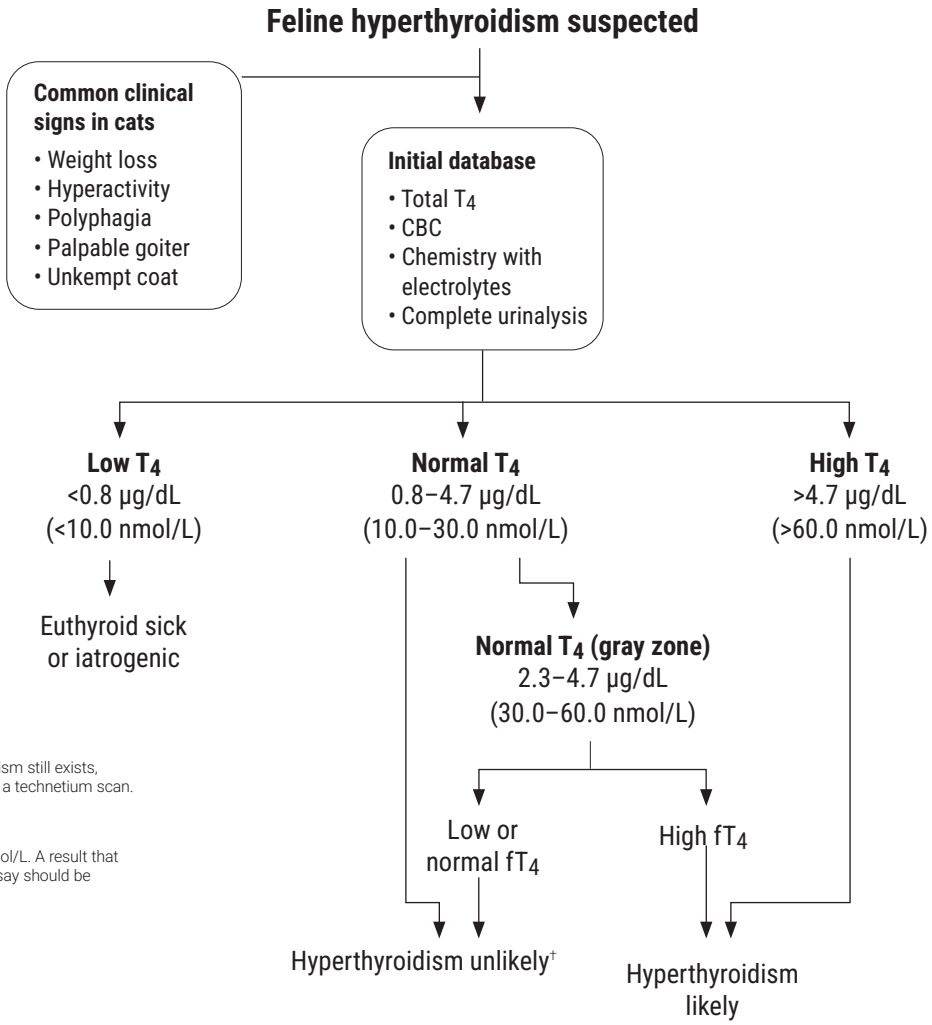
UPC ≥0.4 = excessive proteinuria; recommend investigation for underlying systemic diseases and medical management


History and physical exam
CBC, biochemical profile, urinalysis (examine urine sediment and specific gravity)
– Active sediment
– Pollakiuria
– Azotemia
± Active sediment
± Pollakiuria
± Azotemia
+ Active sediment
+ Pollakiuria
– Azotemia
Prerenal
If prerenal ruled out
Renal
If postrenal ruled out
Postrenal
+ Hemoglobinuria
+ Myoglobiniuria
+ Bence Jones proteinuria (myeloma)
IDEXX Urine P:C Ratio
+ Urinary tract infection
+ Stones
+ Tumors
+ Azotemia
– Azotemia
<0.5 canine
<0.4 feline
Within reference range
≥0.5 canine
≥ 0.4 feline
Monitor, investigate, treat
<0.5
canine and feline
Within reference range
≥0.5 to <1.0
canine and feline
Monitor
≥1.0 to <2.0
canine and feline
Monitor, investigate
≥2.0
canine and feline
Monitor, investigate, treat
Investigate azotemia
Kidney disease with proteinuria
Repeat IDEXX UPC ratio in two weeks
Investigate potential causes of immune-mediated glomerulonephritis or interstitial nephritis
Work up for proteinuria

Total T_4 Protocols



CBC = Complete blood count
Note: 1 µg/dL is equal to 12.87 nmol/L. A result that falls within the low normal range of the assay should be considered ambiguous.



†If strong suspicion of hyperthyroidism still exists, consider retesting in 4–6 weeks or a technetium scan.

CBC = Complete blood count
Note: 1 µg/dL is equal to 12.87 nmol/L. A result that falls within the gray zone of the assay should be considered ambiguous.

Differences in Results

With a Commercial Laboratory or Other Instrument

Reference ranges must be created for each analyte and each new instrument or method of analysis. Every commercial laboratory must establish its own species reference ranges for the equipment and methodology used. IDEXX is continually doing this work for you with every software release.

Comparing results from different laboratories that may be using different equipment or methods is imprecise at best. Any comparisons should be performed on the same sample that has been "split," stored under like conditions, and tested at approximately the same time. Compare each result to the reference range stated by IDEXX or the commercial laboratory (as appropriate). Each result should have the same relationship to its method's reference range. For instance, a sample giving a Catalyst One™ result that is slightly below the Catalyst One analyzer's normal range should give a laboratory result slightly below the laboratory's normal range.

Technical Specifications

Dimensions

Width: 10.0 inches

Depth: 14.8 inches

Height: 14.0 inches

Weight: approximately 25 pounds

Power Supply

Input: 100–240 V AC, 50–60 Hz, 2 Amps

Power Supply Protection: IPX0

Rated: 24VDC, 6.25A

Input/Output Connections

There are two user-accessible Input/Output connections on the rear of the Catalyst One analyzer (power connection and Ethernet port for connection to IDEXX VetLab™ Station).

Operating Conditions

Indoor use only

Altitude: Up to 2,000 meters

	Operating	Storage
Temperature	15°C–30°C (59°F–86°F)	5°C–38°C (41°F–100°F)
Relative Humidity	15%–75%	20%–85%

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