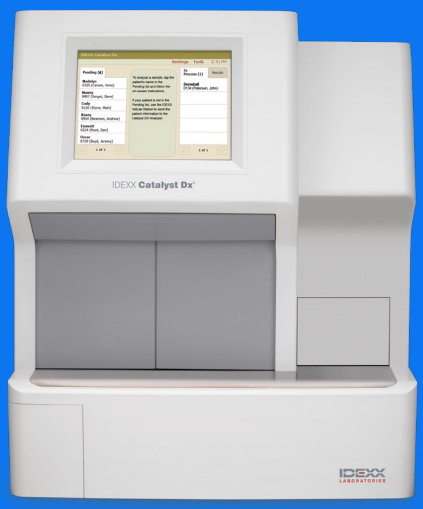
# Catalyst Dx* Chemistry Analyzer




IDEXX

## Proprietary rights notice

# Contents

# Preface

## Safety Precautions

The Catalyst Dx* Chemistry Analyzer weighs approximately 50 pounds (22 kg). It may require multiple people to lift the instrument.

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

DO NOT stack other equipment or containers on top of the analyzer.

Keep analyzer away from sources of heat or flames.

DO NOT place or operate the analyzer near x-ray equipment, photocopiers, or other devices that generate static or magnetic fields.

PROTECT your equipment from damp conditions or wet weather.

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

DO NOT use any of the following liquids, abrasives, or aerosol sprays on, inside, or near the analyzer, as they may damage the analyzer and may influence results:

+ Organic solvents
+ Ammonia-based cleaners
+ Ink markers
+ Sprays containing volatile liquids
+ Insecticides
+ Disinfectant
+ Polish
+ Room freshener
+ Canned air

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

Use only the 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.

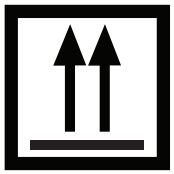
If the equipment is used in a manner other than specified, the protection provided by the equipment may be impaired.

## 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.

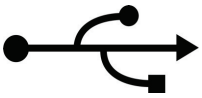
| Symbol | Description |
|---|---|
|  | **Use by**<br>A utiliser avant<br>Verwendbar bis<br>Usare entro<br>Usar antes de<br>使用期限 |
|  | **Batch code (Lot)**<br>Code de lot (Lot)<br>Chargenbezeichnung (Partie)<br>Codice del lotto (partita)<br>Código de lote (Lote)<br>ロット番号 |
|  | **Serial number**<br>Numéro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

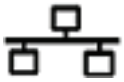
| Symbol | Description |
|---|---|
|  | **Temperature limitation**<br>Température limite<br>Zulässiger Temperaturbereich<br>Temperatura limite<br>Limitación de temperatura<br>保存温度（下限） |
|  | **Upper limit of temperature**<br>Limite supérieure de température<br>Temperaturobergrenze<br>Limite superiore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

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

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

## Other Symbols

| Symbol | Description |
|---|---|
|  | USB symbol |

| Symbol | Description |
|---|---|
|  | Ethernet/network symbol |

# Getting Started

## Introduction

Welcome to the Catalyst Dx* Chemistry Analyzer.

The Catalyst Dx 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, and test blood and urine at the same time to uncover early renal disease (click here for a complete list of the individual slides and CLIPs available). You can even run up to 25 tests on a single sample.

The analyzer's touch-screen interface provides easy-to-follow instructions to help you navigate the system, enter patient data, specify testing information, and more.

The Catalyst Dx analyzer is for veterinary use only.

### IDEXX VetLab* Station Connectivity

The Catalyst Dx 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 Dx 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.

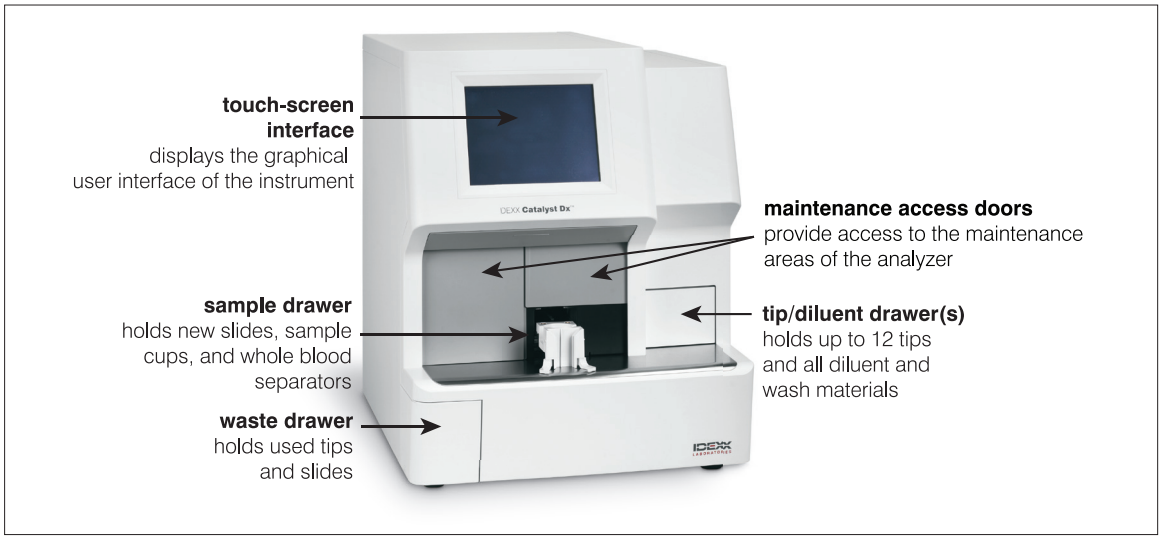
### Proprietary Slide Technologies

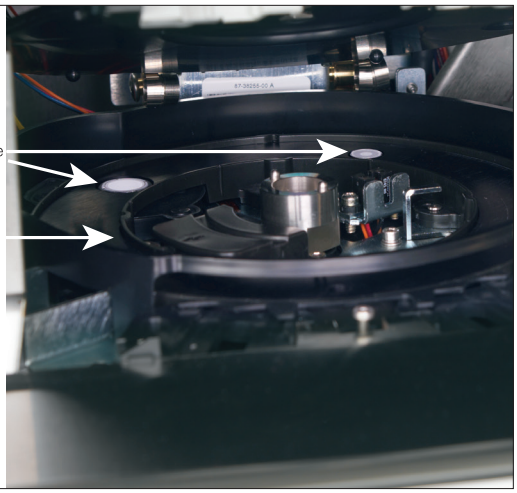
Proprietary technologies in Catalyst* slides minimize interfering substances:

+ **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 Dx Components

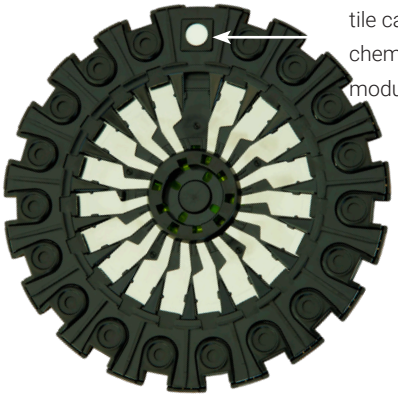
**Note:** Some of the components on the Catalyst Dx analyzer have been redesigned since the analyzer was originally launched. The images in this section show the new hardware designs (for example, a single tip/diluent drawer).



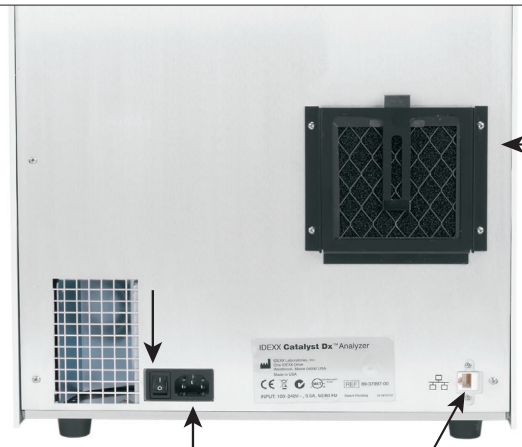
**optics windows**
allow LED light to pass through in one direction and either reflectance or fluorescence to return to be analyzed

**incubator ring**
incubates the chemical reaction of the slide and the sample



white reference tile calibrates the chemistry optics module

Underside of carousel



**fan filter**
should be cleaned quarterly (monthly if operated in dusty/dirty environment)

**power receptacle**
power cable plugs in here

**Ethernet port**
use to connect the analyzer to the IDEXX VetLab Station

## Installing the Catalyst Dx Analyzer

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

### To Install the Catalyst Dx Analyzer

1. Before you unpack the analyzer, choose an optimum location for the instrument. The analyzer should be placed on a level surface with a minimum of 2 inches (5 cm) between the back of the analyzer and any wall. Choose a well-ventilated area away from obvious sources of heat, direct sunlight, cold, humidity, or vibrations. 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. Leave at least a 2-inch (5-cm) clearance around the machine so that air can circulate on all sides.

2. Unpack the analyzer.

   **IMPORTANT:** The analyzer weighs approximately 50 pounds (22 kg). It may require multiple people to lift the instrument.

3. Remove the packaging foam located inside of the open maintenance access doors.
4. Verify the two black whole blood separator carriers on the top of the sample drawer assembly are seated properly (flat) and in the left and right positions.
5. Verify the white centrifuge sleeve is in place to the right of the sample drawers.
6. Close the maintenance access doors (for detailed instructions, see "Opening/Closing the Maintenance Access Doors").
7. Fill the tip drawer with pipette tips.
8. Ensure the Catalyst Dx analyzer is switched off and then connect the power cable to the analyzer and to a properly grounded electrical outlet.

   **IMPORTANT:** Do not power on the Catalyst Dx analyzer. After connecting the power cable, you must then connect to the router and to the IDEXX VetLab Station (instructions follow).

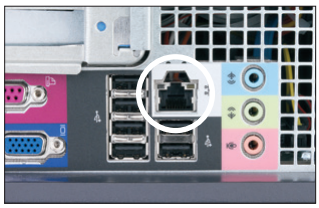
### To Install the IDEXX VetLab Station Connectivity Router

**Note:** If you already have a network router connected directly to the IDEXX VetLab Station computer, you can skip this section and move to the "To Connect the Catalyst Dx Analyzer to the IDEXX VetLab Station" section (on the next page).

1. Connect the AC power adapter to the power port on the back of the network router supplied by IDEXX Laboratories.
2. Plug the AC power adapter into an electrical outlet.
3. Connect one end of the Ethernet cable (provided with the router) into any available port on the router.

   **IMPORTANT:** Do not connect the IDEXX VetLab Station directly to the Internet port on the router.

4. Connect the other end of the Ethernet cable (from step 3) into the IDEXX VetLab Station computer's Ethernet port, which is located near the center panel on the back of the computer.



Ethernet port on the back panel of the IDEXX VetLab Station computer's CPU

### To Connect the Catalyst Dx Analyzer to the IDEXX VetLab Station

1. Connect the Ethernet cable provided with the Catalyst Dx analyzer to the next available port on the back of the router.

   **IMPORTANT:** Do not connect the Catalyst Dx analyzer directly to the Internet port on the router.

2. Connect the other end of the Ethernet cable (from step 1) into the Ethernet port on the back of the Catalyst Dx analyzer.

3. Power on the IDEXX VetLab Station. Ensure all analyzer icons (except Catalyst Dx) are present with a "Ready" status. Then, power on the Catalyst Dx analyzer. Once the Catalyst Dx Home screen displays and its icon displays on the IDEXX VetLab Station Home screen, your connections are complete.

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

## Powering On the Analyzer

To turn on the analyzer, press the power switch on the back of the analyzer. The analyzer may take 15–25 minutes to warm up. While warming up and performing a system check, the Catalyst Dx analyzer screen will display "IDEXX Laboratories," the maintenance access doors will open, and sample drawers will slide out and back in. The analyzer is ready for use once the "Initializing" status message disappears on the Catalyst Dx Home screen.

**Note:** Ensure the IDEXX VetLab Station is powered on prior to powering on the analyzer. If the IDEXX VetLab Station is restarted while the analyzer is on, you may need to reboot your analyzer.

## Shutting Down the Analyzer

### To Shut Down the Catalyst Dx Analyzer

1. Tap **Tools**.
2. Tap **Shut Down** and then tap **Yes** to confirm that you want to shut down the analyzer.
3. When the analyzer indicates it is okay to do so, press the power switch on the back of the analyzer to power the analyzer off.

## Printing Test Results

The Catalyst Dx analyzer is connected to the IDEXX VetLab Station. Therefore, you print your Catalyst Dx analyzer test results using the print settings on the IDEXX VetLab Station (compatible printer required). For more information on printing from the IDEXX VetLab Station, see the *IDEXX VetLab Station Operator's Guide*.

# Catalyst Dx Analyzer Consumables

The following consumables are available for use with the Catalyst Dx 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 17 CLIP | Chem 15 CLIP | Chem 10 CLIP | Equine 15 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 | | | | | | | | ✓ |
| Symmetric dimethylarginine† | SDMA | | | | | | | | ✓ |
| Total Bilirubin | TBIL | ✓ | ✓ | | ✓ | | | | ✓ |
| Total Protein | TP | ✓ | ✓ | ✓ | ✓ | | | | ✓ |

| Chemistry | Abbreviation | Chem 17 CLIP | Chem 15 CLIP | Chem 10 CLIP | Equine 15 CLIP | NSAID 6 CLIP | UPC Panel† | Lyte 4 CLIP | Individual Slides |
|---|---|---|---|---|---|---|---|---|---|
| Total $T_4$† | TT4 | | | | | | | | ✓ |
| Triglycerides | TRIG | | | | | | | | ✓ |
| Urine Creatinine | UCRE | | | | | | ✓ | | |
| Urine Protein | UPRO | | | | | | ✓ | | |
| Uric Acid | URIC | | | | | | | | ✓ |

†Validated reference intervals for equine and "other" species are unavailable.
‡Validated reference intervals for feline, equine, and "other" species are unavailable.

### Other Consumables

Catalyst* Sample Cups

Catalyst* Lithium Heparin Whole Blood Separator

Catalyst* Pipette Tips

300 µL Pipette

300 µL Pipette Tips

Catalyst* PHBR Control

Catalyst* Advanced Control

Catalyst* SmartQC* Control

UPRO Control Fluid

Urine P:C Diluent

Alcohol Prep Pads

Optical Tissues

## Compatible Species

**Species with specific reference intervals:**

| | |
|---|---|
| Canine† | Bovine |
| Feline† | Llama |
| Equine† | Sea Turtle |

†Species-specific intervals are available for these species. All other species are qualified as "other."

**Groups of species with guideline reference intervals:**

**Note:** Guideline reference intervals will vary because there is diversity within the species of these groups.

| | | |
|---|---|---|
| Avian | Monkey | Rat |
| Ferret | Mouse | Sheep |
| Goat | Pig | Snake |
| Lizard | Rabbit | Tortoise |

# Using the Catalyst Dx* Analyzer

## Overview

The Catalyst Dx analyzer is controlled via a touch-screen monitor on the front of the analyzer and by the IDEXX VetLab* Station.

## Using the Touch Screen

To get the best results when using the touch screen:

+ Do not rest your hand on the touch screen. The screen is sensitive to touch. Pressure from your hand prevents the touch screen from functioning properly.
+ Tap the screen firmly.
+ Never tap the touch screen with a sharp or abrasive object.

The touch screen is on whenever the analyzer is on.

## Analyzing Samples

The Catalyst Dx analyzer allows you to run up to 25 tests on a single sample. You can even load multiple patient samples at the same time.

Before you begin, please take note of the following:

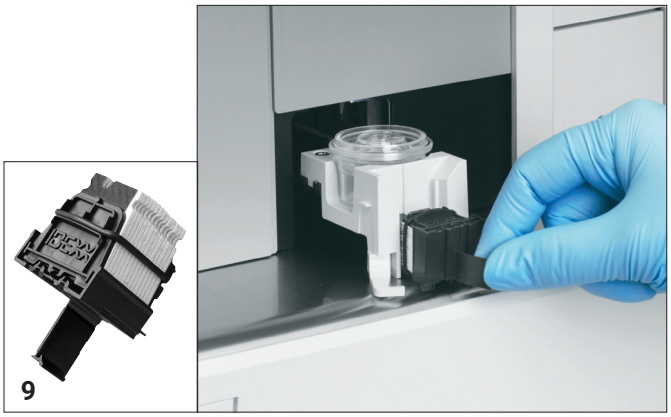
+ Frozen CLIPs/panels/slides can be run on the Catalyst Dx analyzer (no thawing required).
+ Most CLIPs/slides should be loaded within **5 minutes** of opening their foil packaging. The Catalyst* Lyte 4 CLIP and Catalyst* Pancreatic Lipase should be loaded within **2 minutes** of opening its foil packaging.
+ 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.
+ If you are running a Lyte 4 CLIP or $NH_3$ slide, be sure to load it in the sample drawer before any other CLIPs or slides. If running both, $NH_3$ slides should always be loaded first.
+ If you are running a UPC panel or a PHBR slide, do not load any other CLIPs or slides in the sample drawer.
+ Only one test that requires a reagent pack can be processed in a single run. (For example, a total T4 test cannot be processed with a CRP test.)
+ If you run a special slide without selecting the applicable special slides check box and/or you do not follow the on-screen instructions, your results will be flagged and you may receive inaccurate results.

**To Run a Sample**

1. Enter the patient information on the IDEXX VetLab Station (for more information, see the "Analyzing Samples" chapter of the *IDEXX VetLab* Station Operator's Guide*).
2. Once the patient's name appears in the Pending list on the Catalyst Dx Home screen, tap the patient's name and then tap **Select**.
3. Select the Sample Type (**whole blood**, **plasma**, **serum**, **urine**, or **other**).

   **Note:** To learn which sample types can be run for a particular slide or CLIP, see this chart.

4. If you are running a special slide, select the applicable special slides check box.
5. Tap **Next**.
6. If you are running a UPC panel or PHBR slide, follow the on-screen instructions and then tap Next.
7. Load the sample in the sample drawer in either a whole blood separator (whole blood samples only) or a sample cup (plasma, serum, or urine samples only).
8. Open the foil packaging containing the CLIP(s)/slide(s) you are running.




9. Load the slides in the sample drawer. 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.

   If you are loading a Catalyst CLIP, snap open the CLIP handle and then use the handle to load the CLIP onto the sample drawer. Once the slides are secure in the sample drawer, pull the CLIP to detach the slides from the handle.

   Note: Urine should be centrifuged prior to loading.
10. If you are running a TT4, CRP, BA, PROG, or PHBR slide, load the reagent in the tip/diluent drawer(s).
11. Tap **Run**. The Catalyst Dx analyzer begins to process the patient sample automatically and transfers the results to the IDEXX VetLab Station once the run is complete.
12. If you loaded a TT4, CRP, BA, PROG, UPC panel, or a PHBR slide, remove and dispose of the sample/wash cups from the diluent drawer when prompted.

## 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 Dx analyzer supports automated dilutions (the analyzer mixes the sample and diluent for you) and manual dilutions (you prepare the dilution outside of the analyzer). Select the appropriate option on the Identify Sample screen.

Remember the following important notes when diluting samples for analysis on the Catalyst Dx 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 whole blood, 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 10 parts diluent.
- Do not perform a manual or automated dilution on electrolytes, $NH_3$, PHBR, $TT_4$, SDMA, PL, FRU, BA, CORT, or PROG tests, or on whole blood samples.
- Do not perform an automated dilution on CRP, but it can be manually diluted.
- 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.
- You cannot perform two automated dilution runs at the same time, but you can perform an automated dilution run with a manual dilution run.
- An automated dilution run will be canceled if:
  - The diluent and tip drawer(s) is/are opened during the run.
  - There is insufficient diluent/sample volume.
  - There is an insufficient number of tips in the tip drawer.
  - There are too many slides in the run.

## 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 using the "To Run a Diluted Sample" instructions below.

#### 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 |

**To Run a Diluted Sample**

1. Enter the patient information on the IDEXX VetLab Station (for more information, see the "Analyzing Samples" chapter of the *IDEXX VetLab* Station Operator's Guide*).
2. Once the patient's name appears in the Pending list on the Catalyst Dx Home screen, tap the patient's name and then tap **Select**.
3. Select the Sample Type (**plasma**, **serum**, **urine**, or **other**).
4. Select a dilution option (**Automated** or **Manual**). Then, use the up/down arrows to specify the desired dilution factor (total parts).

   **Note:** You cannot perform an automated dilution on electrolytes, CRP, $NH_3$, PHBR, TT4, SDMA, PL, PROG, BA, CORT, or FRU tests or whole blood samples.
5. Tap **Next**.
6. If you chose to have the analyzer dilute the sample for you (automated dilution), follow these steps:
   a. Open the tip and diluent drawer(s). **Do not** open the drawer(s) if there is an automated dilution run in process.
   b. Fill the tip drawer completely.
   c. Load an empty sample cup in the left circular cup holder.
   d. Load a sample cup containing 300 µL of diluent in the right circular cup holder (the sample cup should fit inside the holder easily).
   e. Close the tip and diluent drawer(s).
   f. Tap **Next**.
7. Load the sample in the sample drawer in either a whole blood separator (whole blood samples only) or a sample cup (plasma, serum, or urine samples only). 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 | 110 µL | 700 µL | 300 µL |
| 1 + 9 = 1:10 | 10 | 100 µL | 700 µL | 300 µL |
| 1 + 20 = 1:21 | 10 | 110 µL | 700 µL | 300 µL |

8. Open the foil packaging containing the CLIP(s)/slide(s) you are running.
9. Load the slides in the sample drawer.
10. Tap **Run**. The Catalyst Dx analyzer begins to process the patient sample automatically
11. Remove (and dispose of) the sample cups from the diluent drawer when prompted.

## Viewing Test Results

Once a test is completed, you can view the test results on the Catalyst Dx analyzer or on the IDEXX VetLab Station.

**To View the Test Results on the Catalyst Dx Analyzer**

1. On the Catalyst Dx Home screen, tap the **Results** list.
2. Tap the patient whose test results you want to view.

   **Note:** If you do not see the patient's name in the Results list, tap the page up ▲ and page down ▼ arrows to view additional patient names.
3. Tap **View Results** to display the Test Results screen.

**To View the Test Results on the IDEXX VetLab Station**

See the *IDEXX VetLab Station Operator's Guide* for detailed instructions on viewing test results.

## Canceling a Run That Is In Process

To cancel a run that is in process, tap the applicable patient in the In Process list (on the Home screen) and then tap **Cancel Run**. Then, tap **Yes** to confirm the cancellation. The analyzer cancels the run and ejects the slides into the waste drawer.

You can also cancel a run using the Edit In Process List feature in the Tools screen. For more information, see "To Delete a Patient from the In Process List."

## Removing a Sample from the Analyzer

You can remove a sample from the sample drawer when loading a new sample, by using the Sample Available notification in the In Process list (on the Home screen) or by using the Remove Sample option in the Tools screen.

**To Remove a Sample Using the Home Screen**

1. Tap the patient in the In Process list (on the Home screen) when the Sample Available notification displays
2. Tap **Remove Sample**. The sample drawer opens.
3. Remove the sample cup or whole blood separator from the sample drawer.
4. Tap **OK** to confirm the sample has been removed. The sample drawer closes.

**To Remove a Sample Using the Tools Screen**

There are two Remove Sample buttons in the Tools screen (one for the left sample drawer and one for the right sample drawer). When a sample cup or whole blood separator is detected in a sample drawer, the patient name associated with that sample is listed on the button (for example, "Remove Sample Fluffy"). When a sample cup or whole blood separator is not detected, the Remove Sample buttons are unavailable.

1. Tap **Tools**.
2. Tap **Remove Sample <Patient Name>**. The sample drawer opens and a confirmation message displays on the screen.
3. Remove the sample cup or whole blood separator from the sample drawer.
4. Tap **OK** to confirm the sample has been removed. The sample drawer closes.

## 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 | 10–2000 U/L | 10–2000 U/L | 10–2000 U/L |
| ALT | 10–1000 U/L | 10–1000 U/L | 10–1000 U/L |
| AMYL | 5–2500 U/L | 5–2500 U/L | 5–2500 U/L |
| AST | 0–1083 U/L | 0–1083 U/L | 0–1083 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 | 10–2036 U/L | 10–2036 U/L | 10–2036 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‡ | 100–1000 µmol/L | 100–1000 µmol/L | 100–1000 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 | 50–2800 U/L | 50–2800 U/L | 50–2800 U/L |
| LIPA | 10–6000 U/L | 10–6000 U/L | 10–6000 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 |
| 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 | 6.43–128.7 nmol/L | 6.43–128.7 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 | 6–1190 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

## Overview

Some of the Settings and Tools screen features allow you to customize the analyzer, such as selecting a time/date format and editing the In Process and Pending lists on the Home screen. This chapter describes how to use those features.

## Changing the Language/Local Settings

Tapping the Language/Local option on the Settings screen allows you to modify the analyzer's language, name format, unit system, time, and/or date.

**Notes:**

+ This option is unavailable when the Catalyst Dx* analyzer is processing a sample run.
+ The analyzer will prompt you to restart it whenever the language/local settings are changed. You must restart the analyzer in order for the changes to take effect.

**To Change the Language/Local Settings**

1. Tap **Settings** on the Catalyst Dx Home screen.
2. Tap **Language/Local**.
3. Select the desired language from the **Language** drop-down list. When a language is chosen, the Unit System and Name Format default settings change.
4. If desired, select a different **Name Format** option (last name, first name or last name first name).
5. If desired, select a different **Unit System** option (US, SI, or French SI).
6. Tap **Next**.
7. If desired, update the time settings:
    a. Tap the arrows above or below the hour/minutes text boxes to increase or decrease the hours/minutes incrementally.
    b. Select the **AM** or **PM** option for your system time.
    c. Select a time format (hh:mm in 12-hour format or hh:mm in 24-hour format).
8. If desired, update the date settings:
    a. Select a date format (**mm/dd/yyyy** or **dd/mm/yyyy**). The left and right date fields (above the date format options) vary depending on the date format you choose. For example, if you choose the date format mm/dd/yyyy, the month field is the left-most field, the day field is the middle field, and the year field is the right-most field. If you choose dd/mm/yyyy, the day field is the left-most field, the month field is the middle field, and the year field is the right-most field.
    b. To change the month, tap the arrow above/below the current month selection to change the month incrementally.
    c. To change the day, tap the arrow above/below the day to increase/decrease the day incrementally.

   d. To change the year, tap the arrow above/below the year to increase/decrease the year incrementally.

9. Tap **Save**. When prompted, tap **Yes** to restart your analyzer and save the new settings.

## Deleting a Patient from the Pending and In Process Lists

The Tools screen is available from the Home screen and provides options for editing the Pending and In Process lists. You can edit these lists by deleting a patient from the list.

### To Delete a Patient from the Pending List

1. Tap **Tools**.
2. Tap **Edit Pending**.
3. Tap to select the patient you want to remove from the Pending list.
4. Tap **Delete** in the Delete from Pending box.

### To Delete a Patient from the In Process List

You can also delete a patient from the In Process list by selecting the patient in the In Process list (on the Catalyst Dx Home screen) and then tapping **Stop Run** in the Home screen's center display area.

1. Tap **Tools**.
2. Tap **Edit In Process**.
3. Tap to select the patient you want to remove from the In Process list.
4. Tap **Delete** in the Delete From In Process box. The slides are ejected into the waste drawer. Remove the sample.

**Note:** The IDEXX VetLab* Station displays the "New Results" alert even though no results exist for the deleted patient run (this message only displays if you've selected to receive a message with new results in the New Results Alert tab on the IDEXX VetLab Station's Settings screen).

# 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 17 CLIP | N/A | ✓ | ✓ | | ✓ | |
| Chem 15 CLIP | N/A | ✓ | ✓ | | ✓ | |
| Chem 10 CLIP | N/A | ✓ | ✓ | | ✓ | |
| Equine 15 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 | ✓ | ✓ | | ✓ | |
| Ammonia | $NH_3$ | | ✓ | | ✓ | |
| Phenobarbital | PHBR | ✓ | ✓ | | ✓ | |
| Inorganic Phosphate | PHOS | ✓ | ✓ | | ✓ | |
| Pancreatic Lipase | PL | ✓ | ✓ | | ✓ | |

| CLIPs/Slides | Abbreviation | Serum | Lithium Heparin-Treated Plasma | Fluoride/Oxalate-Treated Plasma | Untreated Whole Blood (using the Catalyst* Lithium Whole Blood Separator) | Urine |
|---|---|---|---|---|---|---|
| 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 Dx Analyzer

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

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

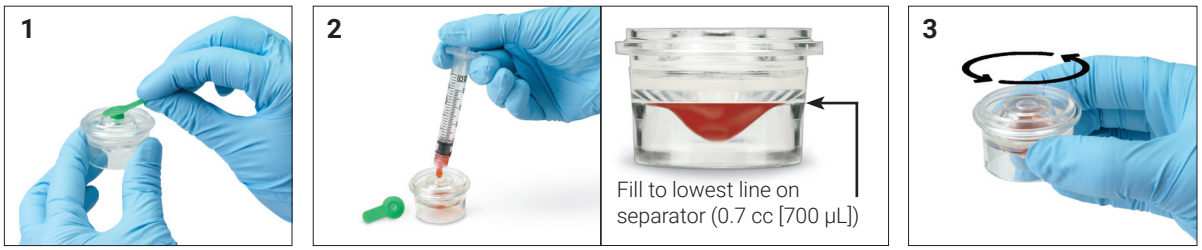
### To Prepare an Untreated Whole Blood Sample (Using a Lithium Heparin Whole Blood Separator)

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.**

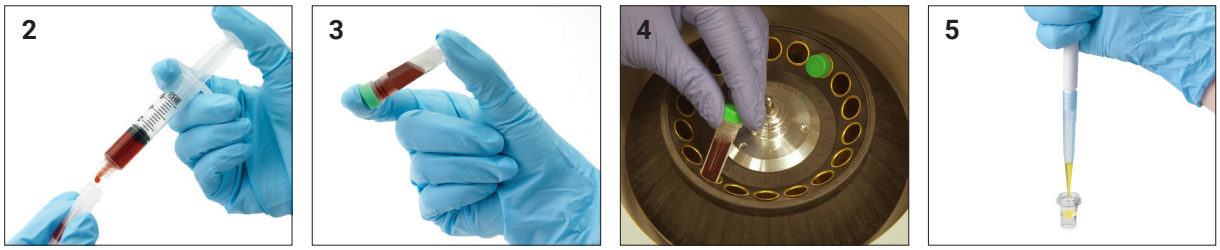



### To Prepare a Plasma Sample

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 the 300 µL pipette provided) 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" on the next page.




**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 the 300 µL pipette provided) 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" on the next page.


**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 the 300 µL pipette provided) 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" on the next page.

## 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), progesterone (PROG), 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 two 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 Dx* 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).

### Advanced Control

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

In each box of Advanced Control, there is one vial containing the control fluid. The lot number can be found on the product packaging.

**Note:** Each vial contains enough fluid for 2 runs, in the event a secondary run is necessary.

#### Storage

Store frozen until the expiration date, or store in the refrigerator for up to 5 days.

#### Stability and Handling

Once opened, Advanced Control cannot be stored and reused—discard remaining fluid after 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 Dx** icon on the IDEXX VetLab* Station Home screen.
2. Tap **SmartQC**.
3. Tap **Run SmartQC**.
4. Follow the on-screen instructions on the Catalyst Dx touch screen for loading the SmartQC materials and completing the run.
   **IMPORTANT:** Only load pipette tips and the Catalyst SmartQC CLIP and reagent 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 Dx** icon on the IDEXX VetLab Station Home screen and then tap **SmartQC**. The 12 most recent Catalyst SmartQC results display on the left side of the screen.

**To Run UPRO, Advanced, 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 Advanced Control:

   a. If the Advanced Control has been frozen, allow it to thaw for 30 minutes prior to use.

   b. Invert the Advanced Control vial at least 5 times.

   c. Transfer the contents of the Advanced Control vial to a Catalyst* sample cup.

   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 Dx** icon on the IDEXX VetLab Station Home screen.
3. Tap **Quality Control**.
4. Tap the quality control lot number you are using and tap **Run QC**.
5. Tap the QC information in the Pending list on the Catalyst Dx Home screen and then tap **Load**.
6. Load the QC materials in the analyzer:
   - If you're running UPRO Control, load the sample cup containing 300 µL of UPRO Control and a UPRO slide (**do not load a UCRE slide**) into the sample drawer and then tap **Run**.
   - If you're running Advanced Control, load the sample cup containing Advanced Control and an applicable slide into the sample drawer and then tap **Run**.
   - If you're running PHBR Control, load the tip/diluent drawer with pipette tips and the PHBR wash, tap **Next**, load the sample cup containing PHBR Control and a PHBR slide into the sample drawer, and then tap **Run**.

**Note:** Once the results are complete, you can view the results by tapping the QC run in the Results list.

# Maintenance

## Overview

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

+ Clean the analyzer internally and externally.
+ Upgrade the software promptly.
+ Reboot your analyzer weekly (while backing up and rebooting the IDEXX VetLab* Station).

## Upgrading the Software

As new features and functionality are added to the Catalyst Dx 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.

## Opening/Closing the Maintenance Access Doors

The maintenance access doors provide access to the internal components of the analyzer. You will need to open the maintenance access doors during the cleaning procedure, when clearing a slide jam, etc.

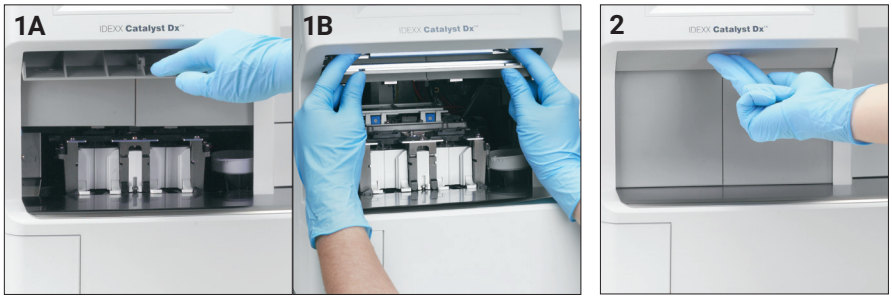
**Note:** The procedure for opening/closing the maintenance access doors varies depending on the configuration of your analyzer.

**To Open the Maintenance Access Doors**

1. Press up on the door panel below the touch screen.
2. **If the area above the door panel has vertical plastic slats** (see photo 2A below), push down firmly on the door panel. The maintenance access doors are released.
   OR
   **If the area above the door panel has a metal handle** (see photo 2B below), pull down on both sides of the metal handle above the door panel until you hear a click. The maintenance access doors are released.
3. Place a finger beneath the center of the maintenance access doors and push up until the doors lock in place.

**To Close the Maintenance Access Doors**

1. **If the area above the door panel has vertical plastic slats** (see photo 1A below), push and hold down on the door panel. The maintenance access doors close automatically.
   OR
   **If the area above the door panel has a metal handle** (see photo 1B below), pull down on both sides of the metal handle above the door panel until you hear a click. The maintenance access doors close automatically.
2. Press up on the door panel below the touch screen until it clicks.




## 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.

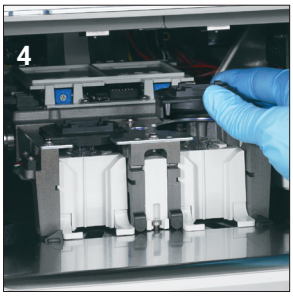
**It is recommended that you wear clean powder-free latex or nitrile gloves when cleaning the internal components of the analyzer. Wearing clean latex gloves helps to avoid smudges on the components and ensures an effective cleaning.**

**IMPORTANT:**

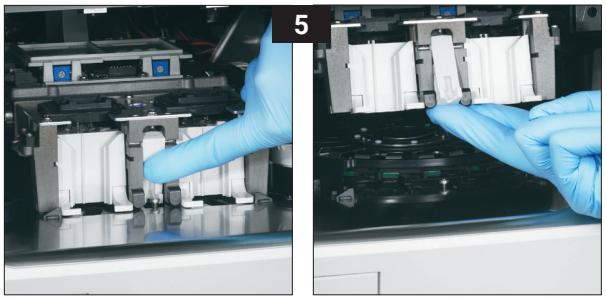
+ Never use canned air in or around the Catalyst Dx analyzer.
+ Never use cleaning materials (such as alcohol cleaning wipes containing sodium bicarbonate) that leave a residue once the alcohol/solvent evaporates.
+ If you use cleaning/decontamination methods except those recommended by IDEXX, check with IDEXX that the proposed method will not damage the equipment.
+ Cleaning and decontamination may be necessary as a safeguard before laboratory centrifuges, rotors, and any accessories are maintained, repaired, or transferred.

**To Clean the Internal Components**

1. Tap **Tools**.
2. Tap **Clean Analyzer**.
3. Open the maintenance access doors (for detailed instructions, see "Opening/Closing the Maintenance Access Doors").
4. Remove the black whole blood separator carriers, any whole blood separators or sample cups from the sample drawer, and the white centrifuge shield. Then, clean the black carriers and white shield with an IDEXX-supported alcohol prep pad and return them to their positions.

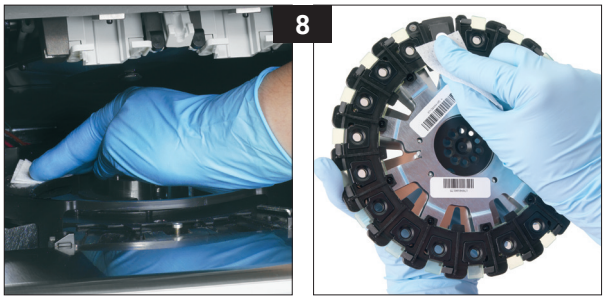


5. Lift the sample drawer assembly by pressing the center latch and lifting up.



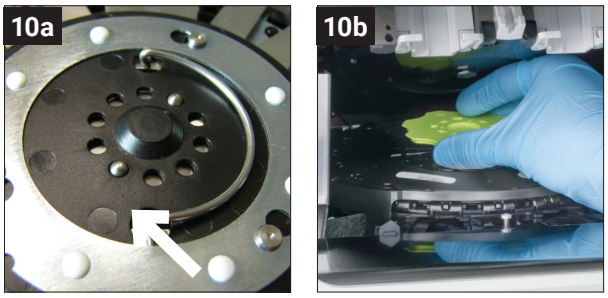

6. Remove the carousel:
   - **If there is a wire handle in the middle of the carousel** (see photos 6a below), remove the carousel by lifting the center wire handle in the middle of the carousel straight up.
   - **If there is a plastic handle in the middle of the carousel** (see photo 6b below), remove the carousel by lifting up with the handle.


7. Using an IDEXX-supported alcohol prep pad, wipe the incubator ring track in a counterclockwise direction (do not wipe the optics or ion windows at this time). Repeat this step at least three times using a new tissue for each wipe.
8. Clean the optics, ion windows, and reference tile on the carousel using the instructions in step 7.




9. Using a dry optical tissue, dry the optics, ion windows, and reference tile, ensuring all signs of dampness have evaporated from the cleaned components. If streaks or smudges remain, repeat the cleaning process.

10. Replace the carousel on the incubator ring track:
    - **If there is a wire handle in the middle of the carousel**, ensure it engages securely with the two carousel mounting posts (see photo 10a below). Then, lower the wire handle.
    - **If there is a plastic handle in the middle of the carousel**, position the front of the carousel below the railing on the incubator ring track and then press the carousel down so that it locks into place (see photo 10b below).



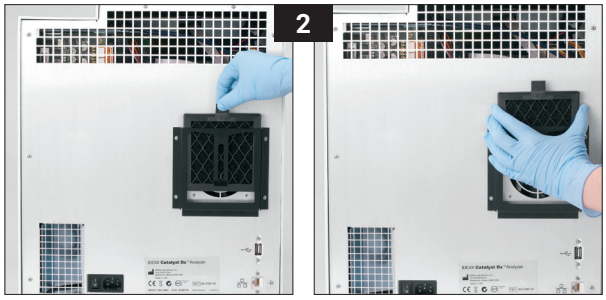

11. Lower the sample drawer assembly and ensure that it is locked into place.
12. Close the maintenance access doors (for detailed instructions, see "Opening/Closing the Maintenance Access Doors").
13. On the Catalyst Dx touch screen, tap **Done**. The analyzer initializes.

## Cleaning the Fan Filter

Clean the fan filter once quarterly in normal laboratory conditions. If the Catalyst Dx analyzer is operated in environmental conditions that are dusty or dirty, the fan filter may need to be cleaned on a monthly basis instead of quarterly.

### To Clean the Fan Filter

1. Locate the fan filter on the back right side of the analyzer.
2. Gently pull up on the black plastic tab to move the filter upward. Then, hold both sides of the filter to remove it.




3. Vacuum the filter thoroughly.
4. Slide the filter back into place.

## Cleaning the Centrifuge

Clean the centrifuge as needed to remove any residue from the whole blood separator.

**IMPORTANT:**

+ If you use cleaning/decontamination methods except those recommended by IDEXX, check with IDEXX that the proposed method will not damage the equipment.
+ Cleaning and decontamination may be necessary as a safeguard before laboratory centrifuges, rotors, and any accessories are maintained, repaired, or transferred.

**To Clean the Centrifuge**

1. Open the maintenance access doors (for detailed instructions, see "Opening/Closing the Maintenance Access Doors").
2. Remove the whole blood separator carriers over the sample drawer stations and ensure that there are no sample cups or whole blood separators in the sample drawers.
3. Return the whole blood separator carriers to their positions.
4. Lift the sample drawer assembly by pressing the center latch and lifting up.
5. To the right of the slide loading stations, gently pull the tab up on the white centrifuge shield to remove it from the analyzer and then gently clean it with mild soap and water to remove the residue. Once it's rinsed and dried thoroughly, replace it by aligning the notch on the shield to the recessed section on the centrifuge and gently press down. The shield is properly seated in the centrifuge when it is level and does not spin when attempting to turn.


6. Lower the sample drawer assembly. Push in on the center latch to ensure that it is locked into place.
7. Close the maintenance access doors (for detailed instructions, see "Opening/Closing the Maintenance Access Doors").

## Cleaning the Exterior of the Analyzer

Always disconnect the power cable before cleaning the analyzer.

Clean the outside of the analyzer 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 cleaners, ink markers, canned air, 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.

## Cleaning the Screen

If the screen gets dirty, apply an antistatic screen cleaning agent (NOT ammonia-based) to a clean cloth or paper towel and wipe the screen. Do not spray the cleaner directly onto the screen as liquid can run inside the case and damage electrical circuits. Take care not to scratch the screen.

## Emptying the Waste Drawer

It is essential that you empty the waste drawer when prompted by the analyzer. The analyzer will not operate when the waste drawer is full. Pull the waste drawer to remove it from the analyzer. After you have emptied and replaced the waste drawer, tap **Yes** to confirm that the drawer has been emptied.

**IMPORTANT:** The waste drawer should not be opened or removed during a run.

# Troubleshooting

## 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 Dx* result that is slightly below the Catalyst Dx analyzer's normal range should give a laboratory result slightly below the laboratory's normal range.

## Status Messages

Status messages are displayed in two different locations on the analzyer. Some are reported in the center display area on the Catalyst Dx Home screen. Others appear in the status bar at the top of the screen. These messages provide information on the current state of the analyzer.

**Note:** If you cannot run a sample on the analyzer, be sure to check the center display area and status bar on the Home screen for helpful messages.

### Home Screen Messages

| Icon | Message | Description |
|---|---|---|
|  Clock with red background | Sample drawers are in use | The analyzer is processing samples from both sample drawers. You cannot process another patient's sample at this time.<br>When this icon disappears from the Home screen, a sample drawer has become available again for use (after approximately 2 minutes). |
|  Waste basket with red background | Empty the waste drawer | The analyzer has determined that the maximum number of slides and/or tips is currently in the waste drawer.<br>To prevent waste overflow, please empty the waste drawer. Once you have confirmed that it is empty, this icon will disappear and you can use the analyzer as needed. |
|  Pipette tip with red background | Add pipette tips | The analyzer has determined that there are not enough tips to process a sample on the analyzer.<br>Open the tip drawer and fill it with up to 12 pipette tips. The icon will then disappear and you can use the analyzer as needed. |

| | | |
|---|---|---|
|  Stop sign and hand with red background | Tip drawer in use | The analyzer is currently performing an automated dilution and/or is processing a test that requires a reagent pack. You cannot perform another automated dilution, including a UPC ratio, or run another test that includes a reagent pack at this time.<br>You can process a patient's sample that does not require an automated dilution or run a test that does not require a reagent pack while this icon is present.<br>**Important: Do not open the tip/diluent drawer while an automated dilution or a test that requires a reagent pack is in process.** |
|  Hourglass with red background | TT4 run in process<br>PHBR run in process<br>Dilution drawer in use<br>Initializing | The analyzer is currently running a PHBR slide or initializing. You must wait for this icon to disappear before running another patient sample.<br>**Important: Do not open the tip/diluent drawer while a PHBR run is in process.** |
|  Hand and cloth with a red background | Cleaning required | The analyzer must be cleaned before another sample can be processed. Once you clean the internal components of the analyzer successfully, this icon will disappear and you can use the analyzer as needed. |
|  Calibration slide with a red background | Calibration required | The analyzer must be calibrated before another sample can be processed. Once the analyzer has been calibrated successfully, this icon will disappear and you can use the analyzer as needed. Please contact IDEXX Technical Support. |

## Status Bar Messages

| **This status message...** | **Indicates...** |
|---|---|
| Close Tip Drawer | The tip drawer is open. |
| Initialize Analyzer | The maintenance access doors are open. |
| Maintenance Required | The analyzer requires cleaning. |
| Instrument Maintenance | The analyzer is performing an automatic self-check to ensure optimal performance of the optics. (This message will display periodically.) |
| Initializing | The analyzer is preparing for a ready state. |
| Diagnostic | A white reference slide has been placed in the analyzer for calibration. |
| Initialization Required | An error has occurred with the analyzer. Please contact IDEXX Technical Support. |

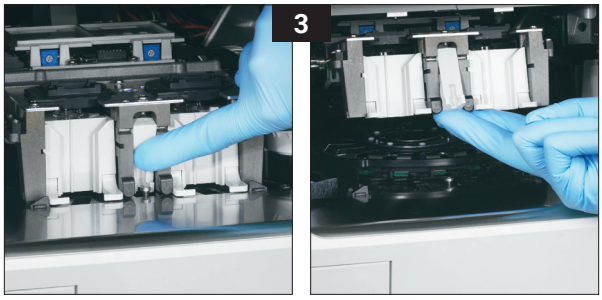
| This status message... | Indicates... |
|---|---|
| Processing Dilution: Please Wait | An automated dilution run and/or a test that requires a reagent pack is in process. You must wait for the automated dilution/reagent pack run to complete prior to starting another automated dilution/reagent pack run. |
| Not ready—PHBR run in process | The analyzer is currently running a PHBR slide. |

## Removing a Slide Jam

If there is a slide jam inside of the Catalyst Dx analyzer, use the following procedure to remove the slides.

**To Remove a Slide Jam**

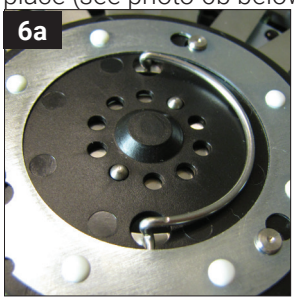
1. Open the maintenance access doors (for detailed instructions, see "Opening/Closing the Maintenance Access Doors").
2. Remove any slides and sample from the sample drawer.
3. Lift the sample drawer assembly by pressing the center latch and lifting up.




4. Remove the carousel:
   - **If there is a wire handle in the middle of the carousel** (see photos 4a below), remove the carousel by lifting the center wire handle in the middle of the carousel straight up.
   - **If there is a green plastic handle in the middle of the carousel** (see photo 4b below), remove the carousel by lifting up with the handle.


5. Ensure all slides have been removed from the carousel.
6. Replace the carousel on the incubator ring track:
   - **If there is a wire handle in the middle of the carousel**, ensure it engages securely with the two carousel mounting posts (see photo 6a below). Then, lower the wire handle.
   - **If there is a green plastic handle in the middle of the carousel**, position the front of the carousel

below the railing on the incubator ring track and then press the carousel down so that it locks into place (see photo 6b below).





7. Lower the sample drawer assembly and secure the latch.
8. Close the maintenance access doors (for detailed instructions, see "Opening/Closing the Maintenance Access Doors").
9. Initialize 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.

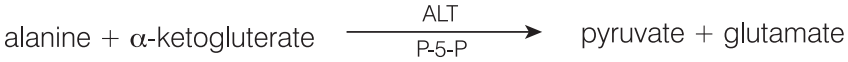
#### Sample Type and Precautions

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**





## 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.

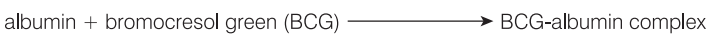
**Sample Type and Precautions**

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**




## 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.

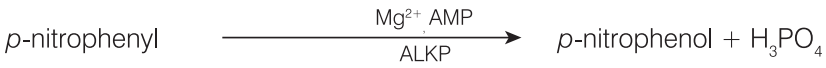
**Sample Type and Precautions**

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**




## 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 heparinized samples.

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

Ammonia measurements in either plasma or serum 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**

$NH_3$ + bromophenol blue (ammonia indicator) ⟶ 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 Indicted 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 suggesting acute pancreatitis.

**Complementary Tests**

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

**Reaction Sequence**

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

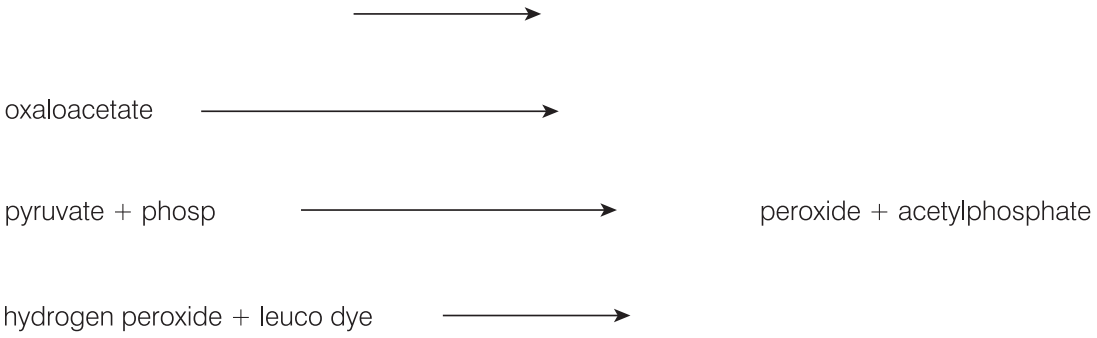
Remove plasma or serum promptly from the cells or clot. Hemolyzed specimens should not be used because AST contamination from red blood cells will occur. EDTA and fluoride/oxalate should not be used as anticoagulants. If plasma is being collected, use only lithium heparinized samples.

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.

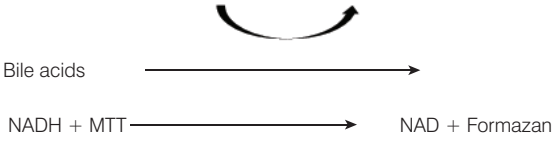
**Complementary Tests**

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 six 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 four 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**

$Ca^{2+}$ + Arsenazo III $\xrightarrow{\text{pH 5.6}}$ 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 Dx 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**

Chloride + fluorescent dye $\longrightarrow$ 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.

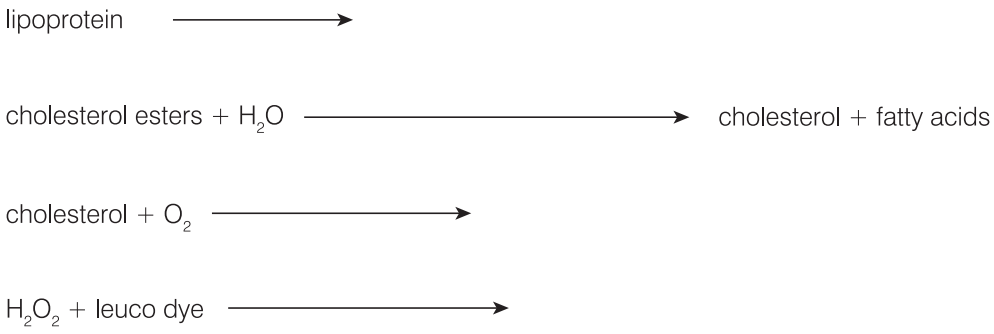
**Sample Type and Precautions**

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.

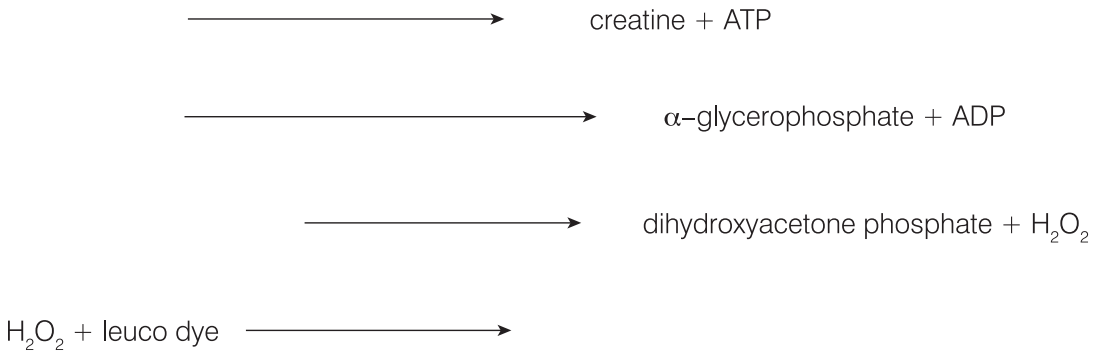
**Sample Type and Precautions**

Samples must be processed and centrifuged immediately after drawing blood. Blood samples should be taken within six 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 CK 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**




## 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**

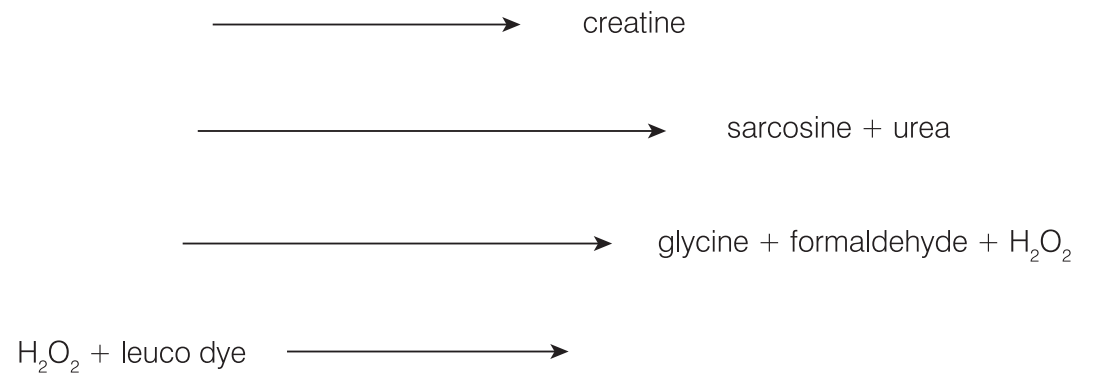
Remove plasma or serum promptly from the cells or clot. If plasma is being collected, use only lithium heparinized samples.

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**



## 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 canine 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, manual 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. Automated dilutions are not available for CRP on the Catalyst Dx.

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

Please note that only one test that requires a reagent can be processed during each run (i.e., CRP, Total T4, PHBR).

### 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.

Please note that for runs with greater than 18 slides, CRP must be loaded within the first 18 slides.

## 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. 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 One and Catalyst Dx analyzers.

### Complementary Tests

The fructosamine test should be interpreted in conjunction with a blood glucose curve as well as the history and physical examination findings. A concurrent urinalysis should also be performed to evaluate for the presence of glucose and ketone. A urine culture is recommended in newly diagnosed diabetics and in animals with poorly controlled diabetes. In addition, a complete blood count and chemistry panel may be indicated to assess overall health of patient, to assess for secondary effects of poorly controlled diabetes, or for evidence of insulin antagonist disease. Further testing should be performed as indicated.

### 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**

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

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

$2H_2O_2$ + 4-aminoantipyrine + 1,7-dihydroxyn $\longrightarrow$ 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.

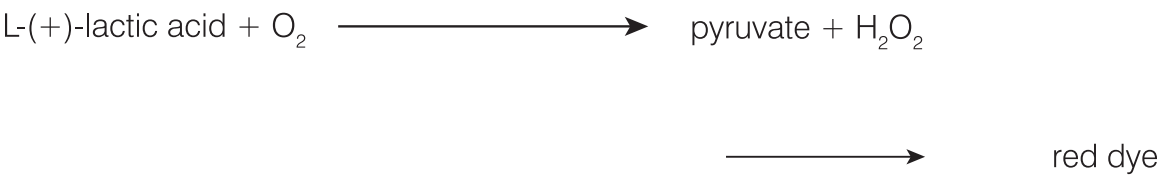
**Sample Type and Precautions**

Use lithium heparinized or FI/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**




## 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.

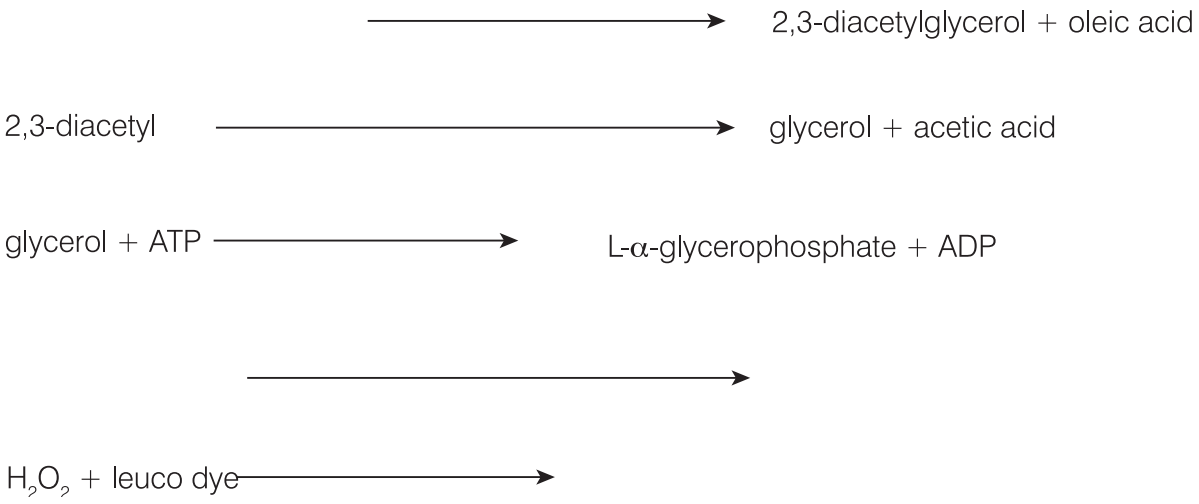
**Sample Type and Precautions**

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**




## 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**

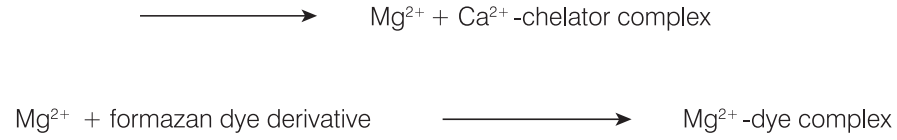
Increased magnesium—decreased glomerular filtration.

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**



## 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.

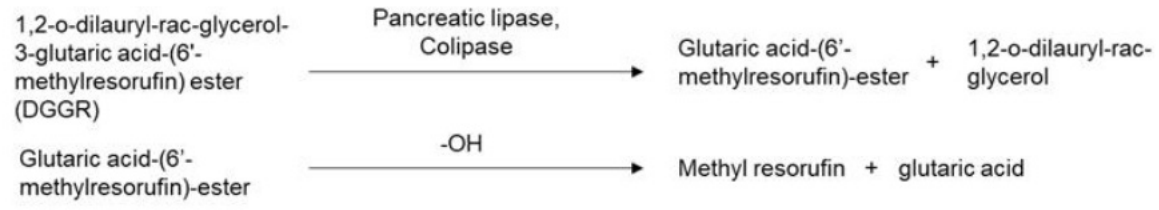
### Sample Types and Precautions

+ 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 >30 µg/mL in cats or >40 µg/mL in 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**

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

$$\longrightarrow \quad \text{PHBR}^{\dagger}\text{–Ab} + \text{PHBR–Ab}$$

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

†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 Dx 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 ⟶ 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 Dx 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 $\longrightarrow$ 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

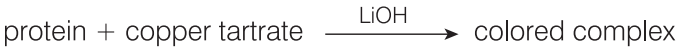
Remove plasma or serum promptly from the cells or clot. If plasma is collected, use only lithium heparinized samples. Moderate-to-marked hemolysis can result in false high total protein concentration.

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




## 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 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. 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

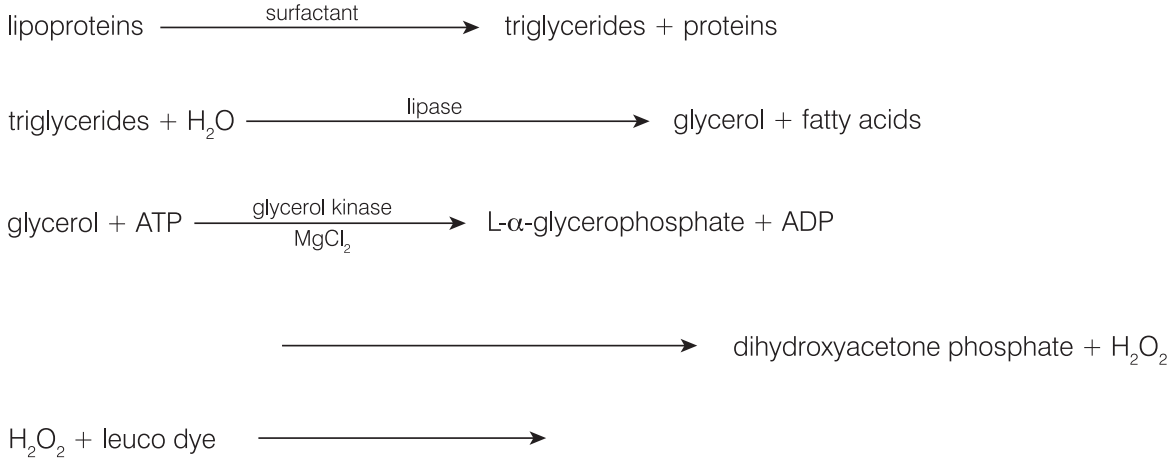
Blood should not be drawn within 12 hours of a meal.

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**




## Uric Acid (URIC)

Uric acid determinations are useful in avian patients and Dalmations dogs in place of urea determinations. In all dogs (except Dalmations) 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 Dalmations).

**Most Common Abnormality Indicated by the Test**

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

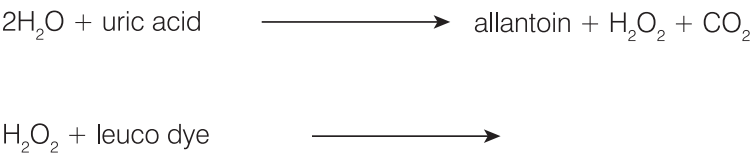
**Sample Type and Precautions**

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**



## 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.

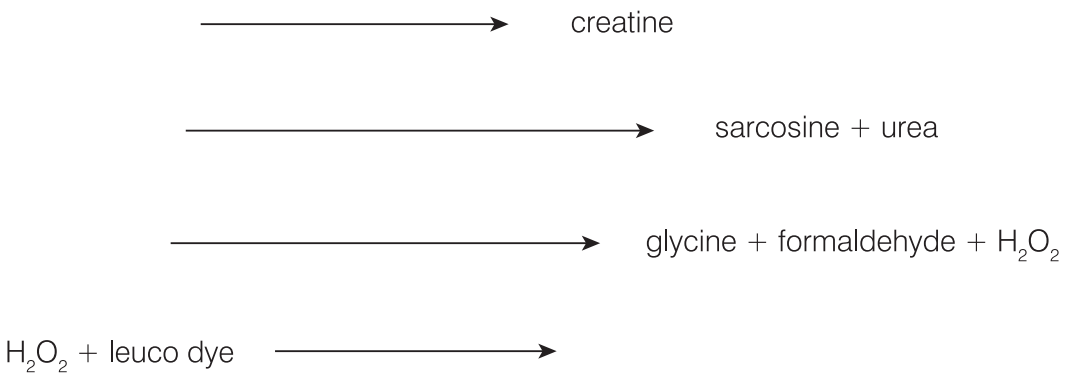
### Complementary Tests

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




## 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**

$Mo^{6+}$ – pyrocatechol violet dye + oxalate + protein $\longrightarrow$ 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 dogs).

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 two 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):**

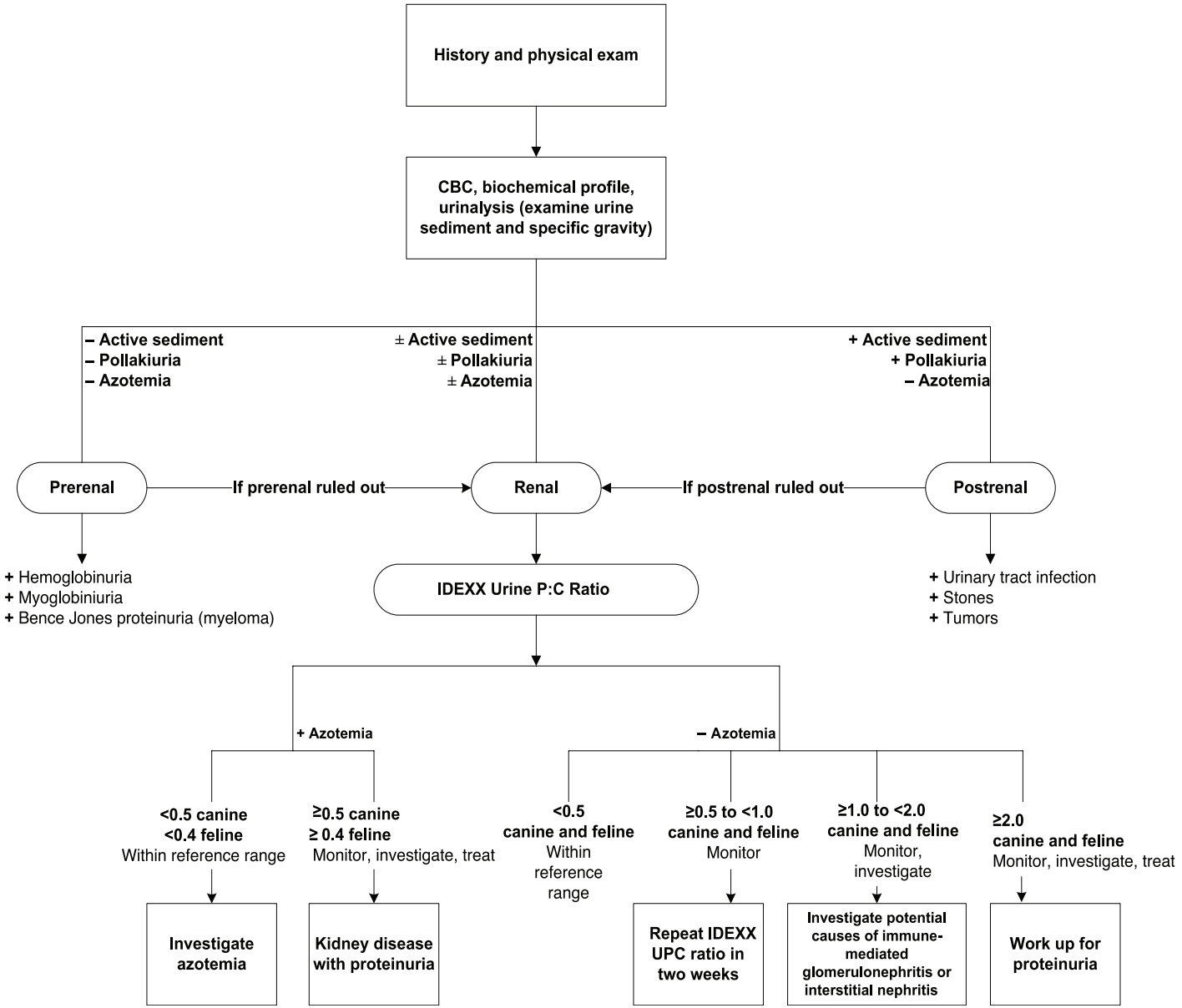
UPC <0.5 = warrant monitoring and investigation

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

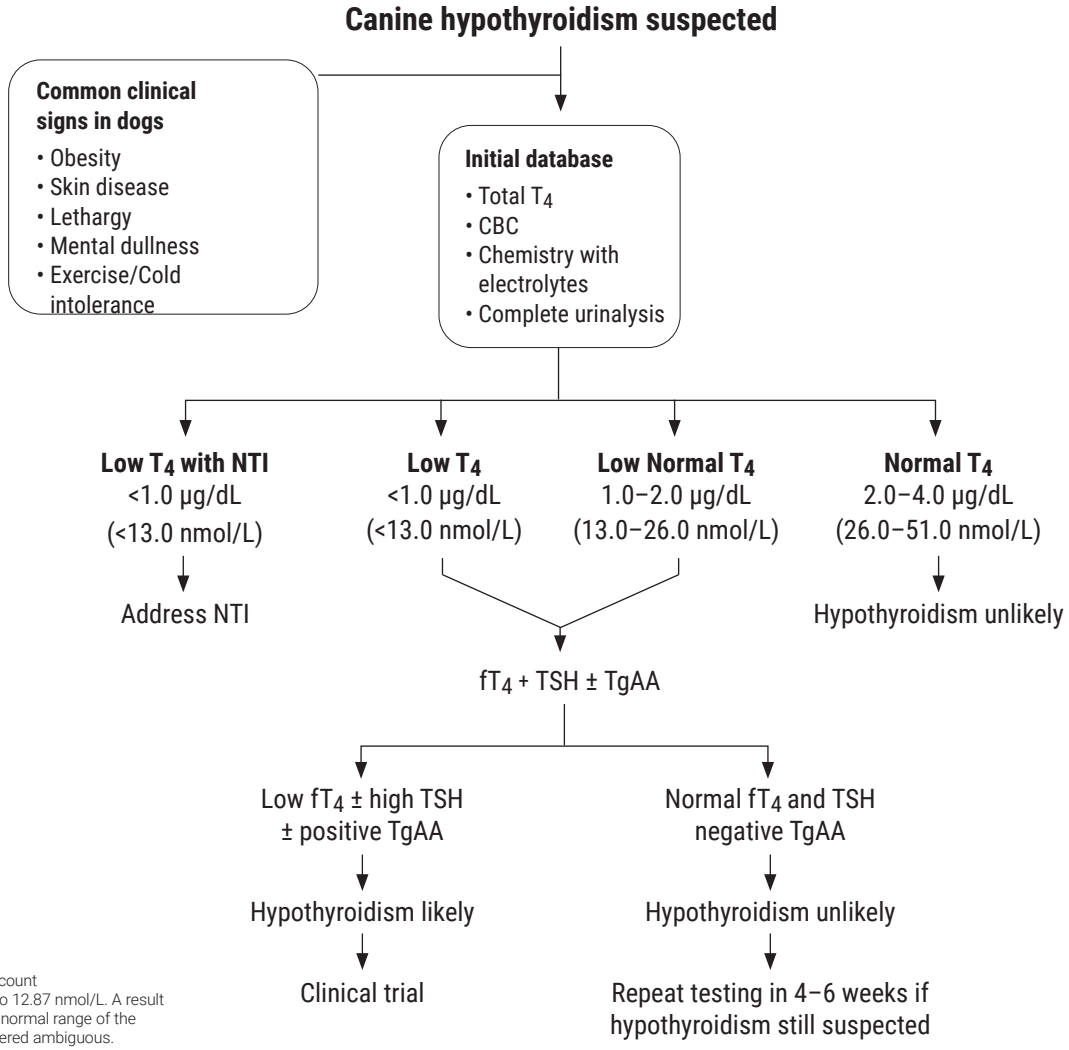
**Azotemic, persistent, renal proteinuria (cats):**

UPC <0.4 = warrant monitoring and investigation

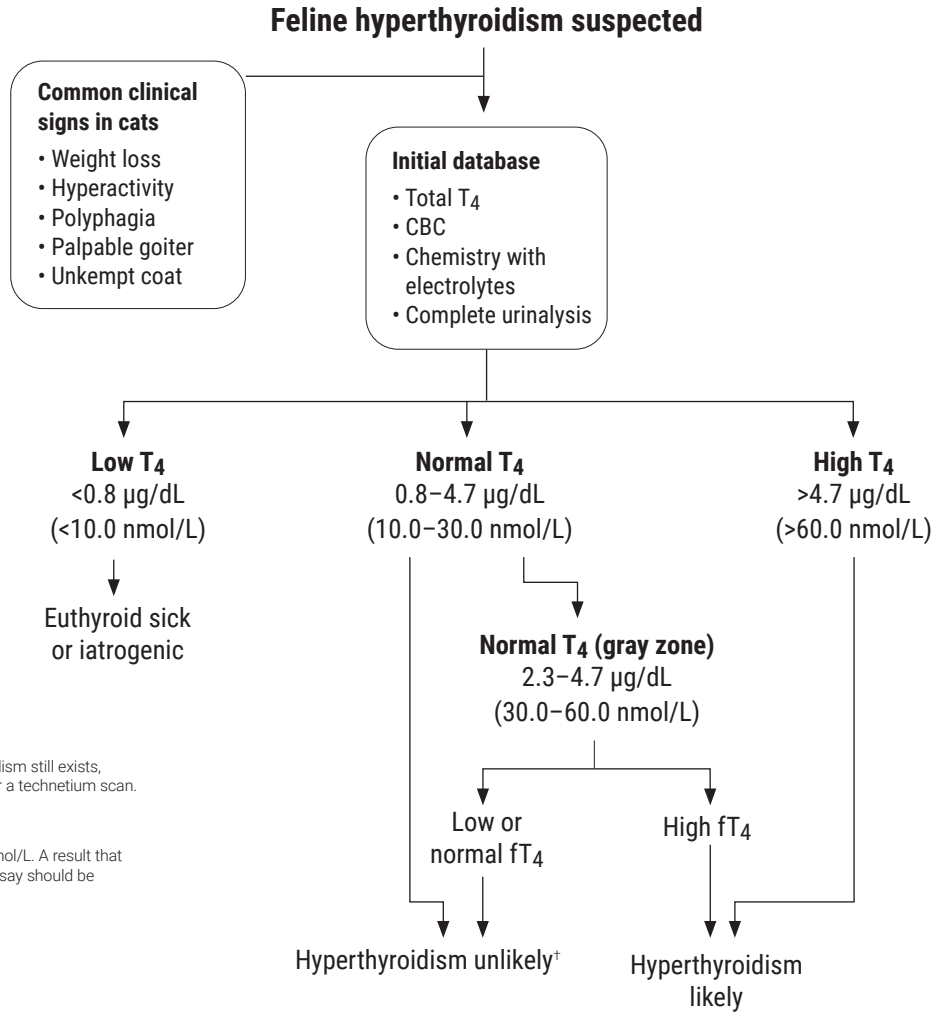
UPC ≥0.4 = excessive proteinuria; recommend investigation for underlying systemic diseases and medical management


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.

# Technical Specifications

## Dimensions

Width: 14 inches (35.56 cm)

Depth: 16.25 inches (41.28 cm)

Height: 17.25 inches (43.82 cm)

Weight: approximately 50 pounds (22 kg)

## Power Supply

Input: 100–240 V AC, 50–60 Hz, 3.5 Amps

Power Supply Protection: IPX0

## Input/Output Connections

There are four Input/Output connections for the Catalyst Dx analyzer. Three are on the rear of the instrument (power connection, Ethernet port for connection to IDEXX VetLab* Station, and a USB port) and one is accessible when the waste drawer is removed (USB port).

## Operating Conditions

| | 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% |

# IDEXX Customer and Technical Support contact information

| | |
|---|---|
| United States/Canada | 1-800-248-2483 |
| Europe | idexx.eu |
| Australia | 1300 44 33 99 |
| New Zealand | 0800 83 85 22 |
| Brazil | 0800 -777-7027 |
| Latin America | soportelatam@idexx.com.br |
| China (PRC) | 400-678-6682 |
| South Korea | 080 7979 133 |
| Taiwan | 0800 291 018 |
| Japan | 0120-71-4921 |