CREATING CLARITY

CKD vs AKI – So many markers, so little time, so much confusion!

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Disclosure:
Full-time Employee of IDEXX

Learning outcomes

01 **What is the function of kidneys?**

+ Recall the role the kidneys play in overall health

02 **How do we assess kidney health?**

+ Describe the different biomarkers for glomerular filtration rate (GFR) and what they tell us

03 **What is kidney disease?**

+ Recognise the difference between acute kidney injury (AKI) and chronic kidney disease (CKD)
+ Review IRIS CKD guidelines and the utility of FGF-23
+ Describe the AKI and CKD continuum
+ Discuss kidney injury and the value of cystatin B

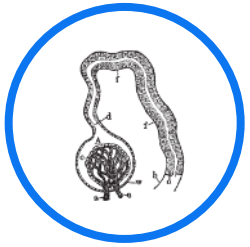
04 **How has our understanding of kidney health evolved?**

+ Recognise the importance of staging and managing changes in kidney function

Timeline of kidney biomarkers

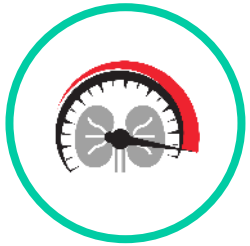
Proteinuria

Described by Hippocrates 400 B.C.



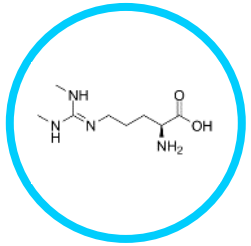
Creatinine

Jaffe reaction 1886



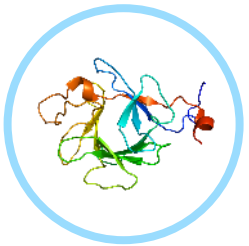
Glomerular filtration rate

Cockcroft-Gault equation for estimating GFR in 1973



SDMA

Validated for use in dogs 2015



FGF-23

Launched for felines with chronic kidney disease 2022

Urinary cystatin B

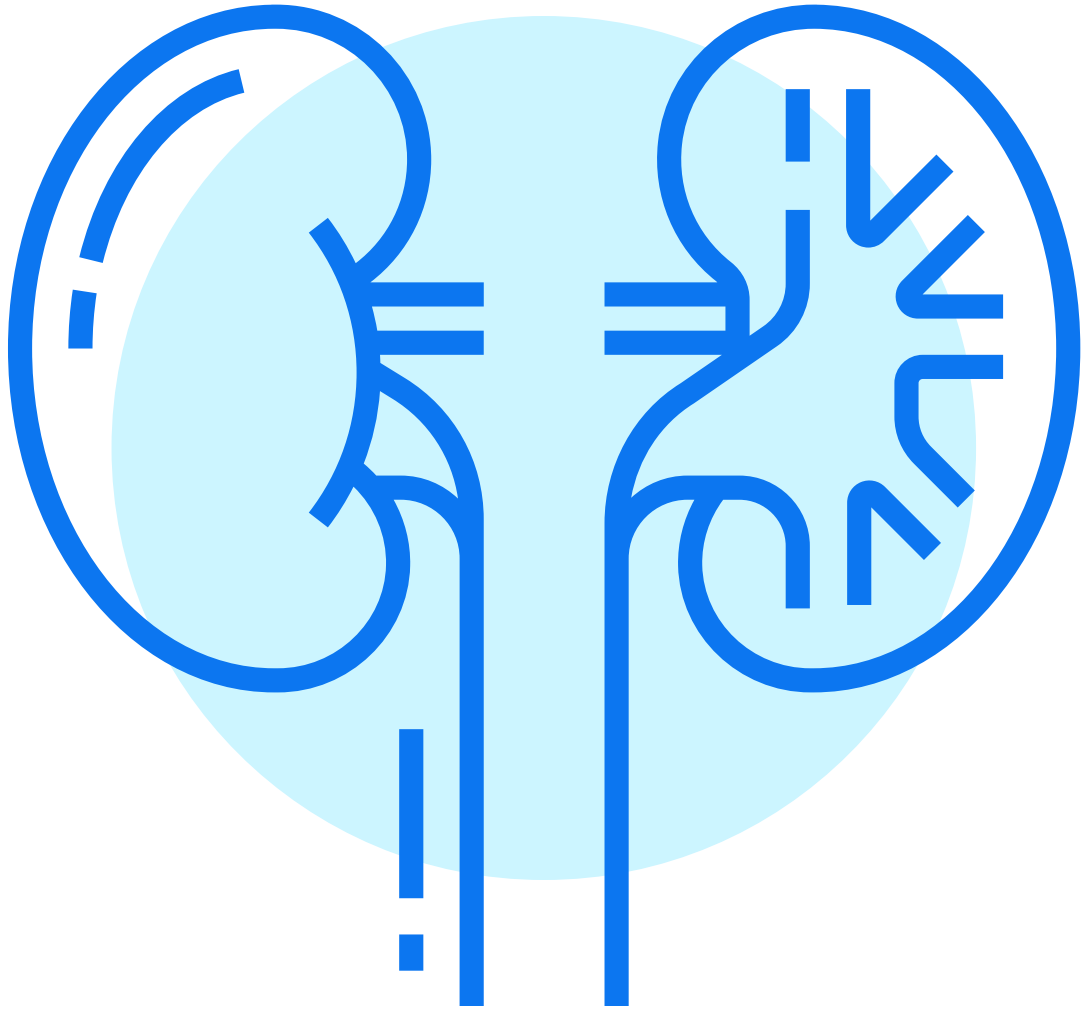
Detects both active and acute kidney damage

Launched December 2023

Function of the kidneys

Key responsibilities:

+ Fluid balance in the body
  + Blood pressure
  + Hydration
+ Electrolyte balance in the blood
  + Integral to cellular and organ function
+ Removal of nitrogenous waste
  + Ammonia and urea
+ Excretion of drugs
+ Production of erythropoietin
  + Stimulates red blood cell production



Comorbidities or disease states can heavily impact kidney health

				
Heart disease	**Liver disease**	**Gastrointestinal disease**	**Endocrinopathy**	**Infectious**
Cardiorenal or renocardial syndrome	Hepatic disease, congestion	Inflammatory effect, hypoproteinemia	Hormone imbalance, catabolic state	Inflammatory/ immune (acute or chronic)
NT-proBNP Troponin SDMA	CRP Iron	CRP Microbiome	Aldosterone PTH Vitamin D Iron	Regional infectious disease testing Leishmaniasis Ehrlichiosis Lyme disease

How do we measure kidney health?

Diagnosing kidney disease is more than diagnostics

Physical exam

Kidney palpation

Muscle mass

Cardiac auscultation

Medical history

Appetite/weight loss

Energy

Water consumption

Diagnostics: lab work

Chemistry

CBC

Urinalysis

Imaging

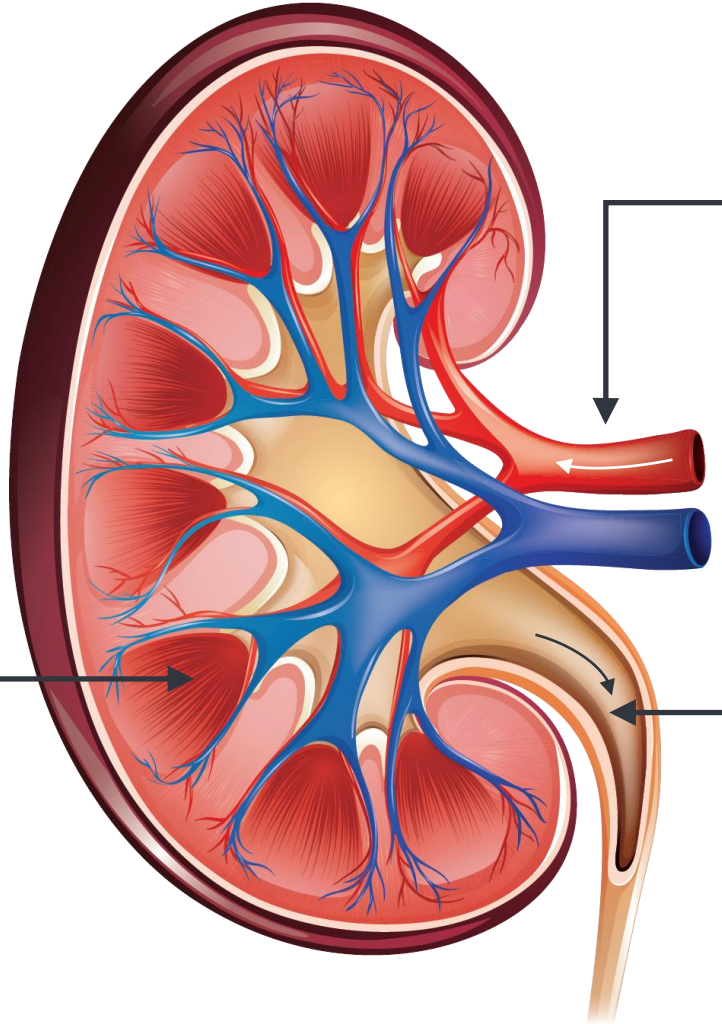
Radiographs

Ultrasound

Clinical decision points

Where is the problem?

Prerenal:
Marked decrease in renal blood flow



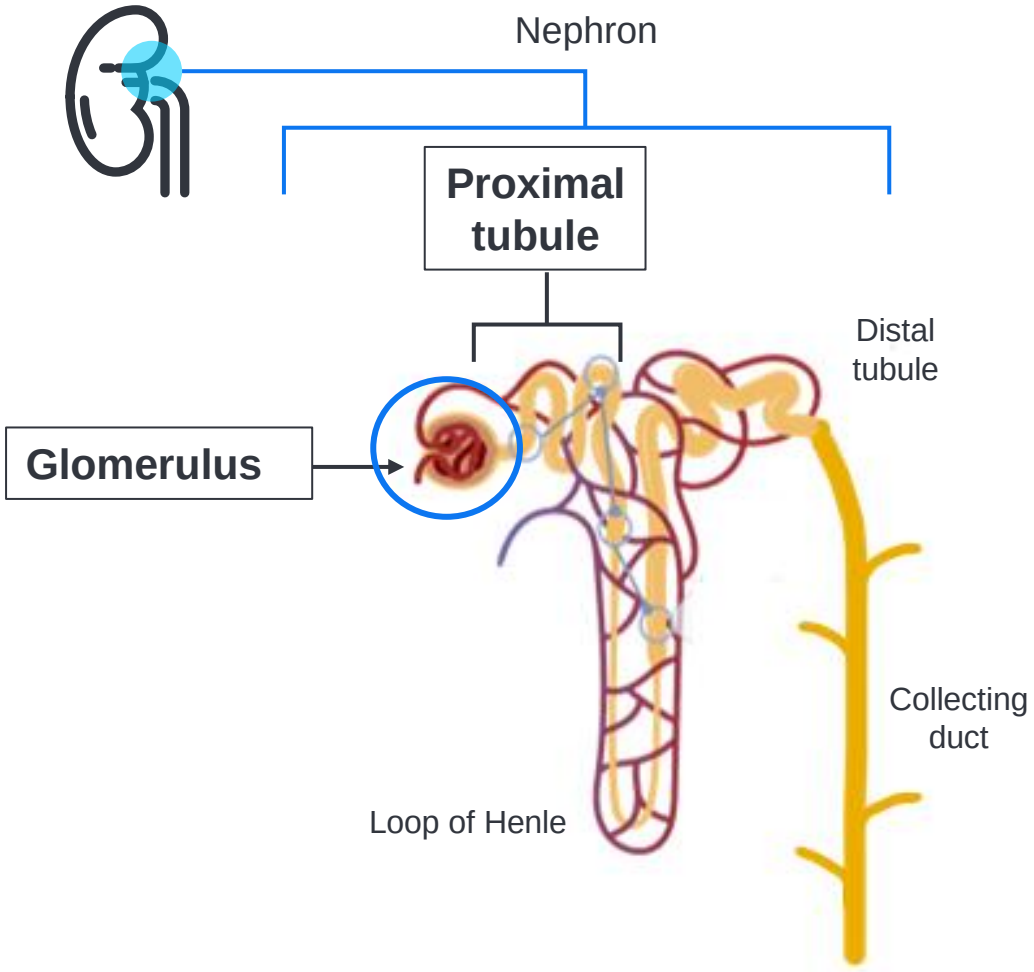
Renal:
Damage within the kidney structure

Postrenal:
Obstruction of urine outflow

Function versus injury

Functional markers

- Reflect **GFR**
  - **SDMA**
  - **Creatinine**
  - Urea
- Measured in serum or plasma
- May **not** change with injury



Injury markers

- Indicate **damage**
  - Usually **proximal tubules**
  - Tubules are the most metabolically active segment of the kidney
- May increase before or without functional marker change
- Measured in urine

Anatomy of a nephron

- Glomerulus
  - Filtration
    - Water
    - Small solutes
- Proximal convoluted tubule
  - Resorbs 60%–65% of filtrate
  - Secretes cations, anions, H+
- Loop of Henle
  - Produces ultrafiltrate
- Distal tubule
- Collecting tubule
- Collecting duct
  - Electrolyte balance
  - Acid-base balance
  - Water resorption

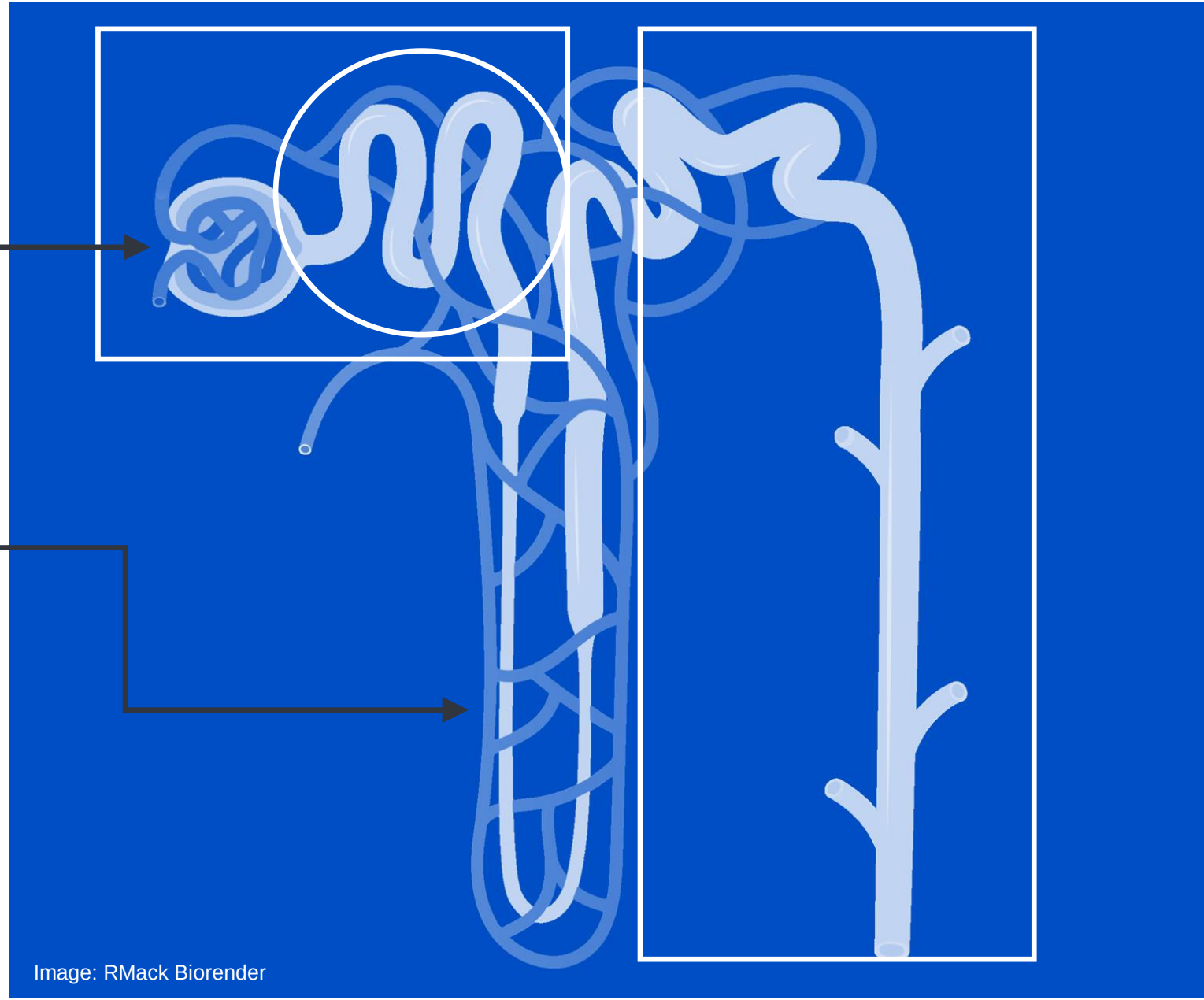


Image: RMack Biorender

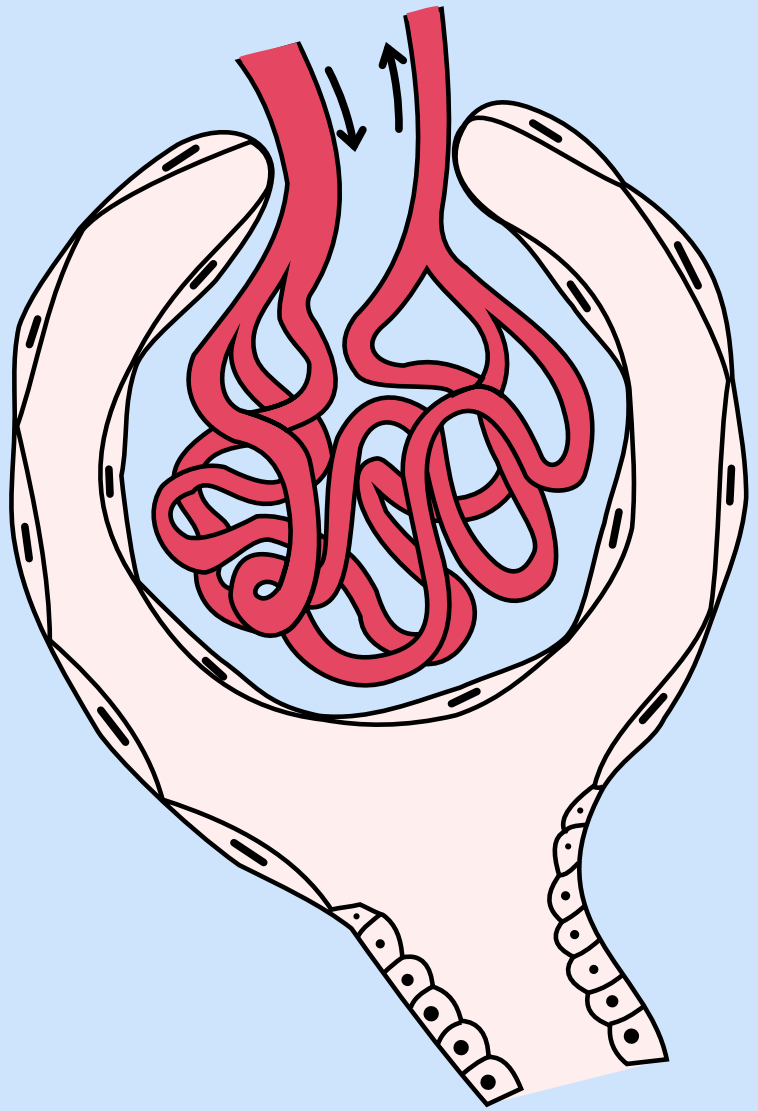
How do we assess kidney function?

Glomerular filtration rate (GFR)

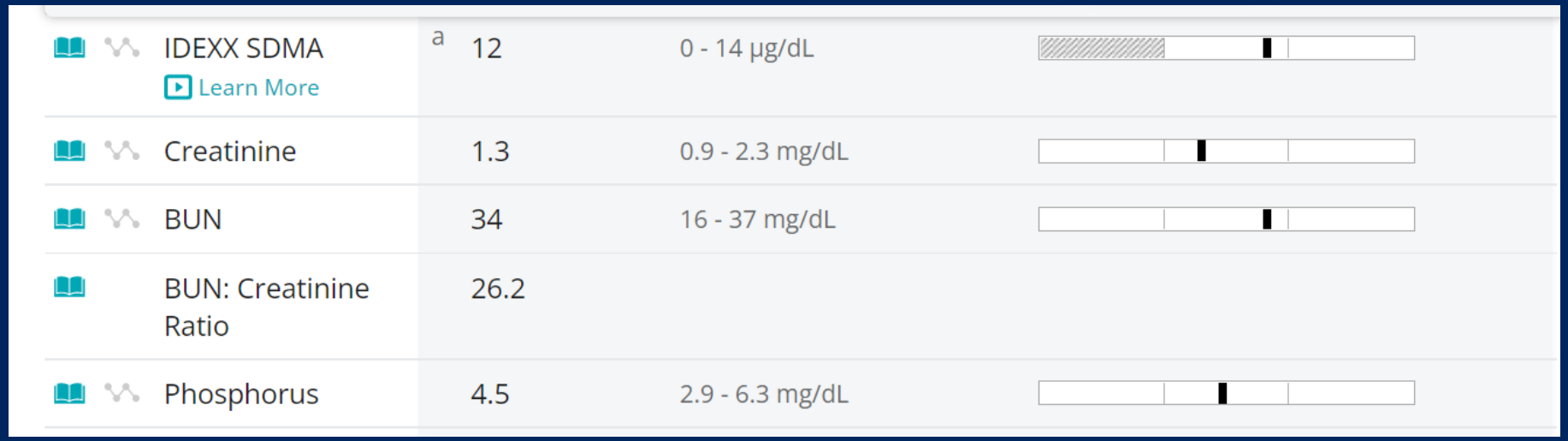
Gold standard

Expensive

Rarely done in practice



GFR Biomarkers



IDEXX SDMA Learn More	a 12	0 - 14 µg/dL	
Creatinine	1.3	0.9 - 2.3 mg/dL	
BUN	34	16 - 37 mg/dL	
BUN: Creatinine Ratio	26.2		
Phosphorus	4.5	2.9 - 6.3 mg/dL	

The biochemistry panel

BUN

+ Late marker—up to 75% loss of function before changes noted
+ Impacted by other factors including diet and liver disease

Creatinine

+ Late marker—up to 75% loss of function[4] before changes noted
+ Impacted by other factors, including muscle mass[2,4]

SDMA

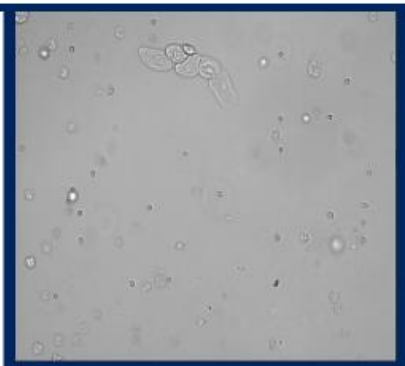
+ **Earlier marker**—SDMA increases on average with a 40% loss and as little as 25% loss of kidney function versus creatinine, which does not increase until 75% of kidney function.[1-3]
+ Not impacted by diet, muscle mass, liver disease

References

1. Hall JA, Yerramilli M, Obare E, Yerramilli M, Yu S, Jewell DE. Comparison of serum concentrations of symmetric dimethylarginine and creatinine as kidney function biomarkers in healthy geriatric cats fed reduced protein foods enriched with fish oil, L-carnitine, and medium-chain triglycerides. *Vet J*. 2014;202(3):588–596. doi:10.1016/j.tvjl.2014.10.021
2. Hall JA, Yerramilli M, Obare E, Yerramilli M, Almes K, Jewell DE. Serum concentrations of symmetric dimethylarginine and creatinine in dogs with naturally occurring chronic kidney disease. *J Vet Intern Med*. 2016;30(3):794–802. doi:10.1111/jvim.13942
3. Nabity MB, Lees GE, Boggess MM, et al. Symmetric dimethylarginine assay validation, stability, and evaluation as a marker for the early detection of chronic kidney disease in dogs. *J Vet Intern Med*. 2015;29(4):1036–1044. doi:10.1111/jvim.12835
4. Hall JA, Yerramilli M, Obare E, Yerramilli M, Jewell DE. Comparison of serum concentrations of symmetric dimethylarginine and creatinine as kidney function biomarkers in cats with chronic kidney disease. *J Vet Intern Med*. 2014;28(6):1676–1683.

Urinalysis

	Collection	Free Catch	
	Color	Pale Yellow	
	Clarity	Slightly Cloudy	
	Specific Gravity	1,026	
	White Blood Cells	3 /HPF	
	Red Blood Cells	5 /HPF	
	Bacteria, Cocci	None Detected	
	Bacteria, Rods	None Detected	
	Squamous Epethelial Cells	<1 /HPF	
	Non-Squamous Epethelial Cells	1-2 /HPF	
	Hyaline Casts	None Detected	
	Urine Creatinine	50.3	mg/dL
	Urine Protein	198.8	mg/dL
	Urine Protein: Creatinine Ratio	4.0	
	Color	e Yellow	



Urine analysis

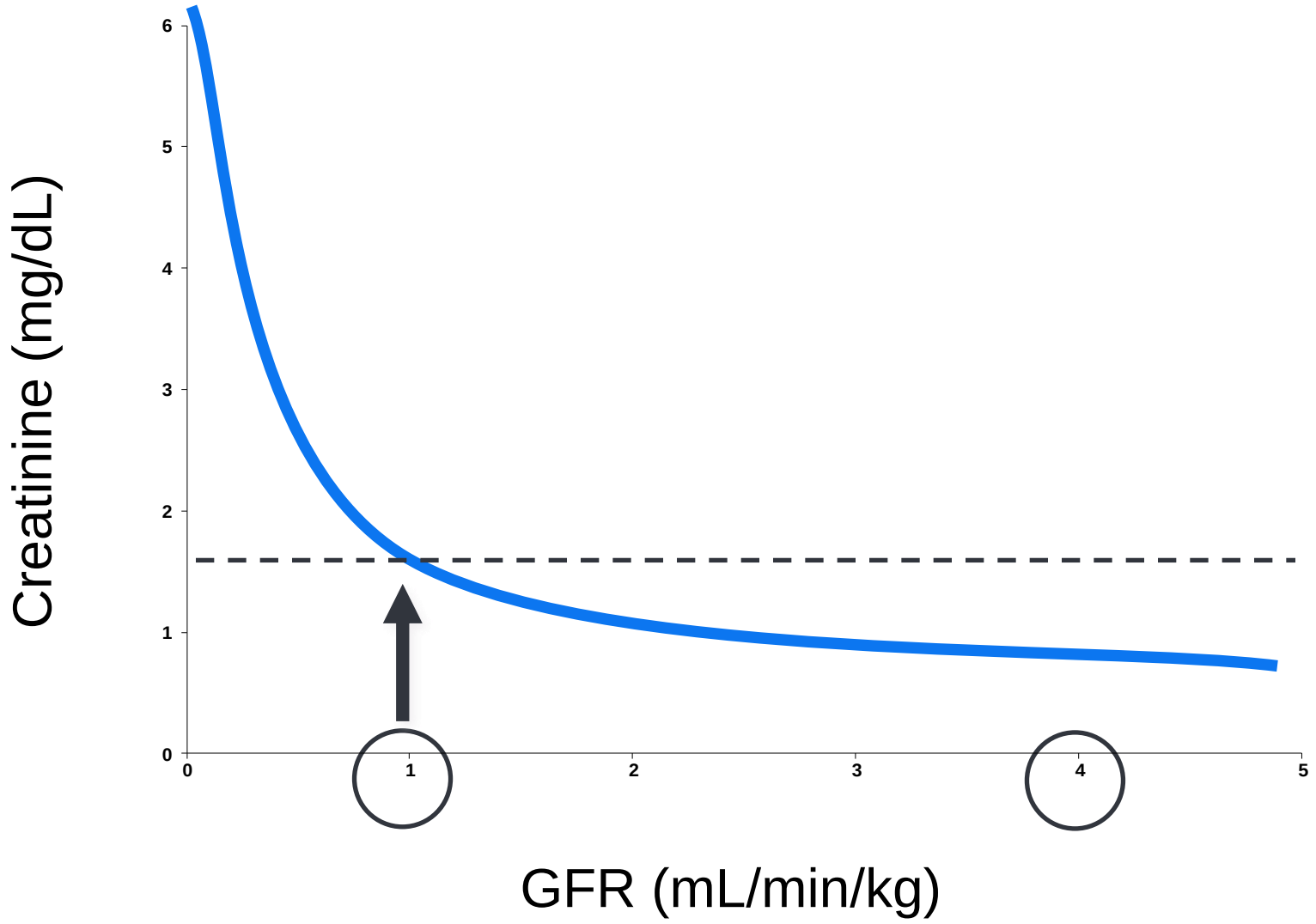
- Evaluates many aspects of renal function including glomerular, tubular, endocrine, fluid balance, and acid-base functions
- Includes Urine specific gravity (USG), Chemical analysis (glucose, ketones, pH), and Sediment evaluation (manual or automated)
- Affected by other factors, including endocrine disease and lower urinary tract disease

Urine protein:creatinine ratio (UPC)

- Evaluates glomerular filtration barrier health and renal tubular function
- May increase **earlier** than Creatinine, Urea or SDMA or be the **only** abnormality in some types of renal dysfunction
- Required by IRIS for substaging and monitoring **all** dogs and cats with CKD

IDEXX

Kidney function: creatinine versus GFR

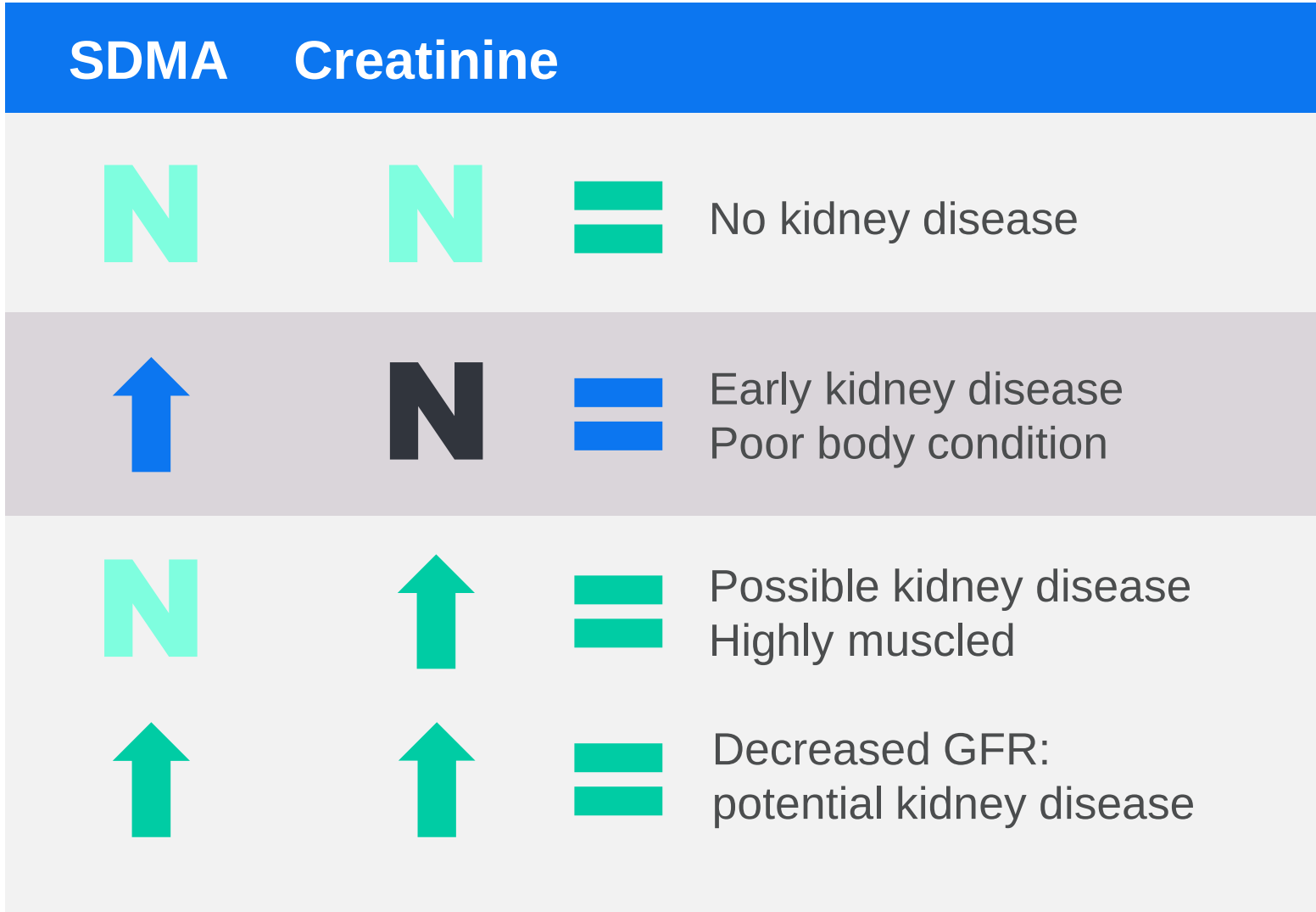


Graph used with permission from Dr. Sheri Ross.

Source: Braun JP, Lefebvre HP, Watson ADJ. Creatinine in the dog: a review. *Vet Clin Pathol*. 2003;32(4):162–179. doi:10.1111/j.1939-165x.2003.tb00332.x

How to interpret SDMA with creatinine

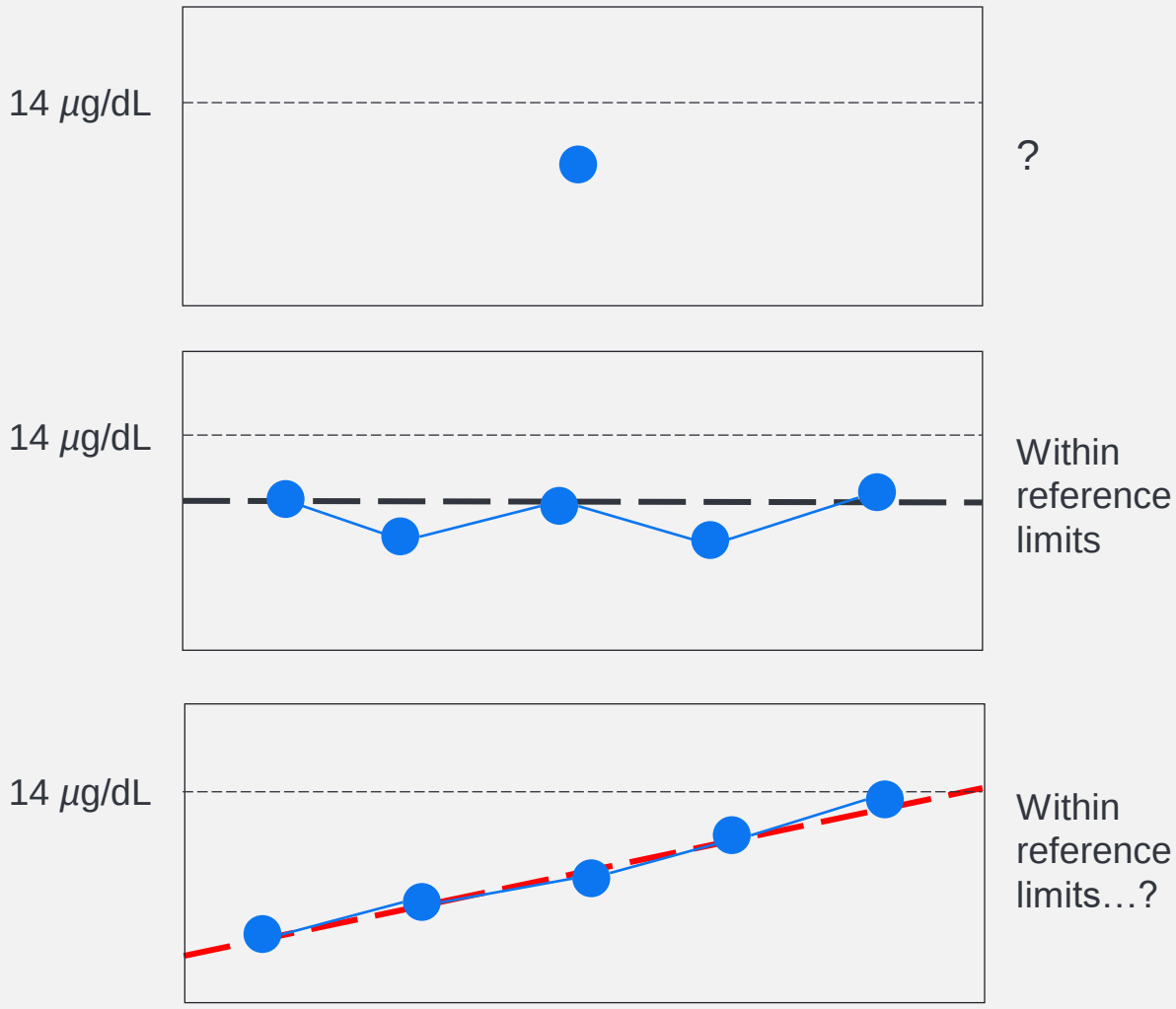
- SDMA should always be interpreted along with creatinine and urinalysis.
- Diagnostic algorithms and interpretive comments promote complete kidney evaluation.



The importance of monitoring results

Establish a baseline:

- Allows for personalised care
- Informs decisions in a crisis
  - Preanaesthetic choice
  - Fluid rate
  - Post-op pain management
- Guides decision-making as pet ages
  - NSAIDs for degenerative joint disease?
  - Diet change?



What is kidney disease?

What is kidney disease?

Active kidney injury (AKI)
Potentially reversible

Ongoing kidney injury

Caused by:

+ Toxin exposure
+ Nephrotoxic drugs
+ Infectious diseases, such as leptospirosis in dogs
+ Dehydration
+ High blood pressure

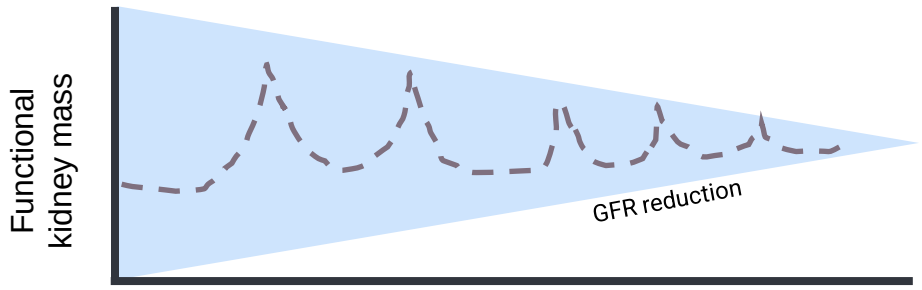
Chronic kidney disease (CKD)
Irreversible

Caused by:

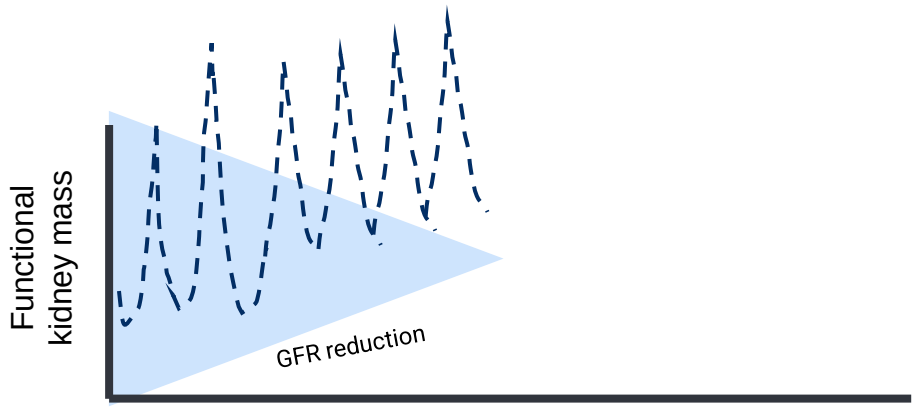
+ Kidney infections
+ Kidney and ureteral stones
+ Toxin ingestion
+ Infectious diseases, such as Lyme disease in dogs
+ Hereditary conditions

Acute kidney event and chronic disease continuum

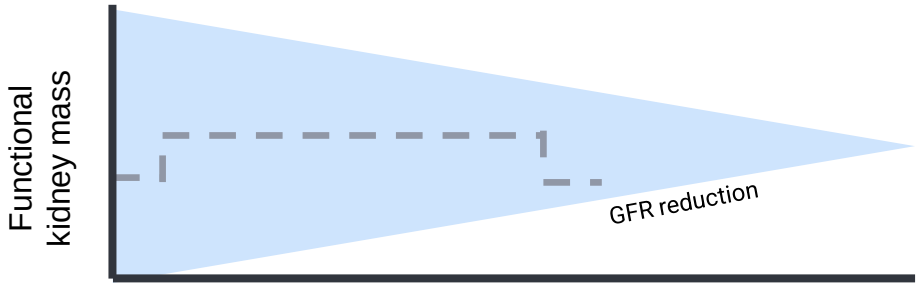
Multiple small acute kidney injuries



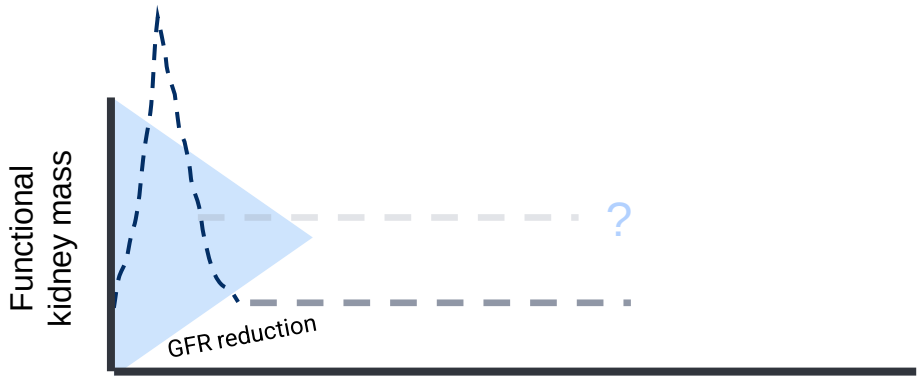
Multiple larger acute kidney injuries



Sustained injury, ongoing



Single severe injury



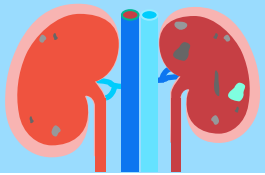
Chronic kidney disease

Early CKD symptoms are often nonspecific

+ Decreased appetite
+ Weight loss
+ Decreased activity level
+ Vomiting
+ Lethargy

Symptoms in later stages may include the following

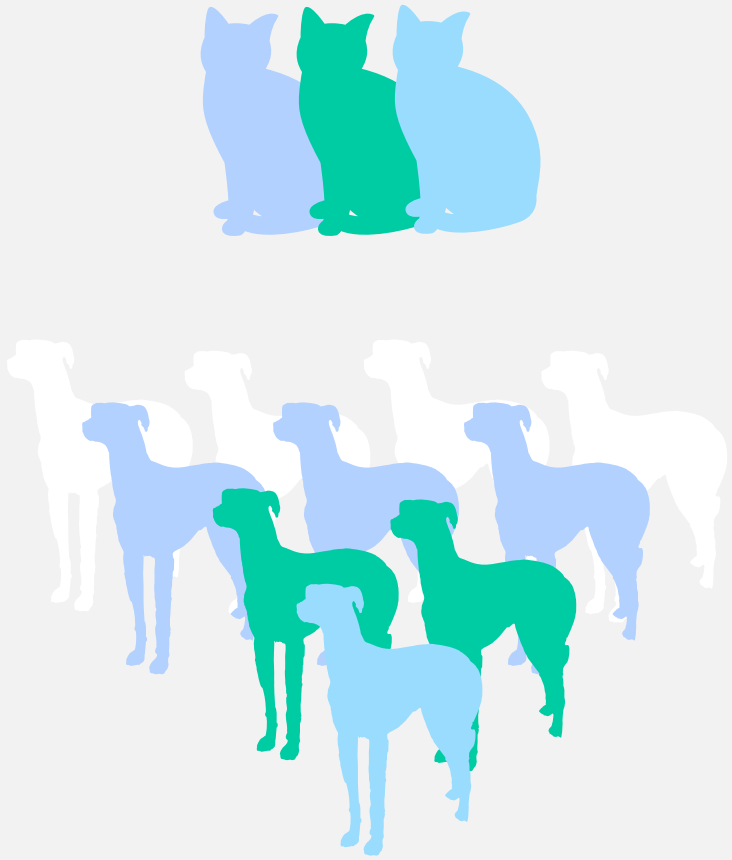
+ Drinking and urinating a lot
+ Loss of appetite
+ Vomiting
+ Bad breath
+ Oral ulcers
+ Marked weight loss



Pet owners may not recognise subtle changes

Kidney disease is common in both dogs and cats

- Chronic kidney disease is a **leading cause of suffering** in both dogs and cats.[1]
- Prevalence increases with age.[2]
  - With pets living longer, uncovering disease earlier can improve quality and lifespan.
- Including SDMA in every chemistry profile **can improve outcomes** for your patients.



In time, at least **1 in 3 cats**[1] and **1 in 10 dogs**[3] will develop kidney disease.

References

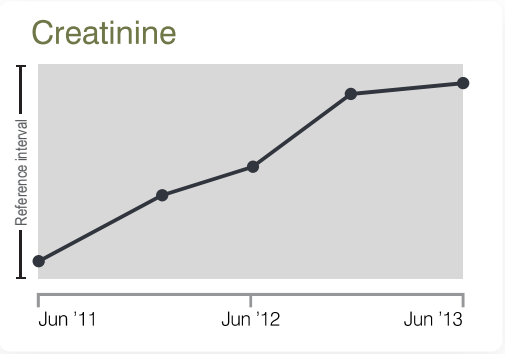
1. Lulich JP, Osborne CA, O'Brien TD, Polzin DJ. Feline renal failure: questions, answers, questions. *Compend Contin Educ Pract Vet*. 1992;14(2):127–153.
2. Brown CA, Elliott J, Schmiedt CW, Brown SA. Chronic kidney disease in aged cats: clinical features, morphology, and proposed pathogeneses. *Vet Pathol.* 2016;53(2):309–326. doi:10.1177/0300985815622975
3. Brown SA. Renal dysfunction in small animals. The Merck Veterinary Manual website. www.merckvetmanual.com/mvm/urinary_system/noninfectious_diseases_of_the_urinary_system_in_small_animals/renal_dysfunction_in_small_animals.html. Updated October 2013. Accessed December 6, 2024.

Chronic kidney disease

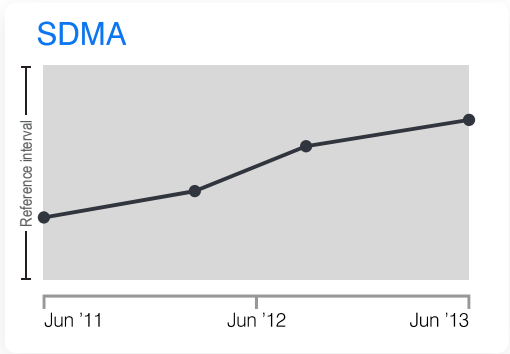
To diagnose IRIS CKD Stage 1 and early IRIS CKD Stage 2

One or more of these diagnostic findings

1



Creatinine increasing within the reference interval when no prerenal cause is apparent

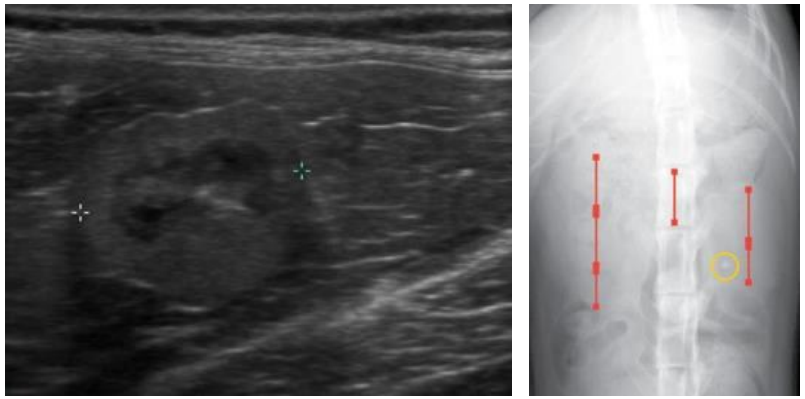


SDMA increasing within the reference interval where no prerenal cause is apparent

2 **Persistent increased SDMA* > 14 µg/dL**

*SDMA = IDEXX SDMA® Test result

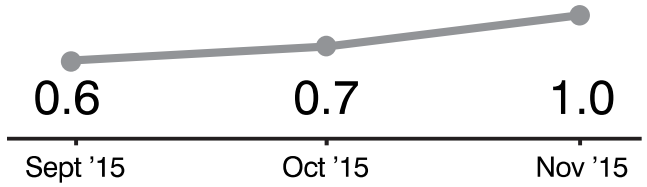
3 **Abnormal kidney imaging**



4 **Persistent renal proteinuria**

Urine protein to creatinine (UPC) ratio

- > 0.5 in dogs
- > 0.4 in cats



Reference
International Renal Interest Society (IRIS). IRIS Staging of CKD. IRIS website. www.iris-kidney.com/guidelines/staging.html. Accessed December 6, 2024.

To diagnose more advanced CKD (late IRIS CKD Stage 2–4)

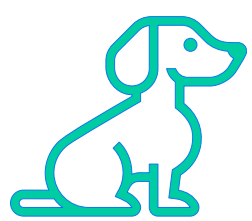
Both of these diagnostic findings

Increased creatinine and SDMA concentrations

CREATININE

SDMA

Results of both tests should be interpreted in light of a patient's hydration status.



Urine specific gravity
< 1.030

Urine specific gravity
< 1.035*

1.030	**Canine**	**1.008**
1.035	**Feline**	**1.008**

*Some cats can produce hypersthenuric urine in the face of renal azotemia.

Reference
International Renal Interest Society (IRIS). IRIS Staging of CKD. IRIS website. www.iris-kidney.com/guidelines/staging.html. Accessed December 6, 2024.

Staging CKD using IRIS guidelines

	Stage 1 No azotemia (Normal creatinine)	Stage 2 Mild azotemia (Normal or mildly elevated creatinine)	Stage 3 Moderate azotemia	Stage 4 Severe azotemia
Creatinine in mg/dL Stage based on stable creatinine — Canine	Less than 1.4 (125 µmol/L)	1.4–2.8 (125–250 µmol/L)	2.9–5.0 (251–440 µmol/L)	Greater than 5.0 (440 µmol/L)
Feline	Less than 1.6 (140 µmol/L)	1.6–2.8 (140–250 µmol/L)	2.9–5.0 (251–440 µmol/L)	Greater than 5.0 (440 µmol/L)
SDMA* in µg/dL Stage based on stable SDMA — Canine	Less than 18	18–35	36–54	Greater than 54
Feline	Less than 18	18–25	26–38	Greater than 38
UPC ratio Stage based on stable proteinuria — Canine	Nonproteinuric **< 0.2**	Borderline proteinuric **0.2–0.5**	Proteinuric **> 0.5**	
Feline	Nonproteinuric **< 0.2**	Borderline proteinuric **0.2–0.4**	Proteinuric **> 0.4**	
Systolic blood pressure in mm Hg Substage based on blood pressure	Normotensive **< 140** Hypertensive **160–179**	Prehypertensive **140–159** Severely hypertensive **≥ 180**		

Familiar biomarkers aid in staging

SDMA provides an earlier window into changes in GFR

Urine protein:creatinine (UPC) ratio strengthens findings beyond urine specific gravity (USG)

Systolic blood pressure may indicate need for additional intervention

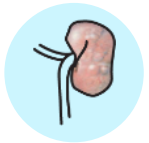
Note: In the case of staging discrepancy between creatinine and SDMA, consider patient muscle mass and retesting both in 2–4 weeks. If values are persistently discordant, consider assigning the patient to the higher stage.

*SDMA = IDEXX SDMA® Test result

See www.iris-kidney.com for more detailed staging, therapeutic, and management guidelines.

Treatment of CKD using IRIS guidelines





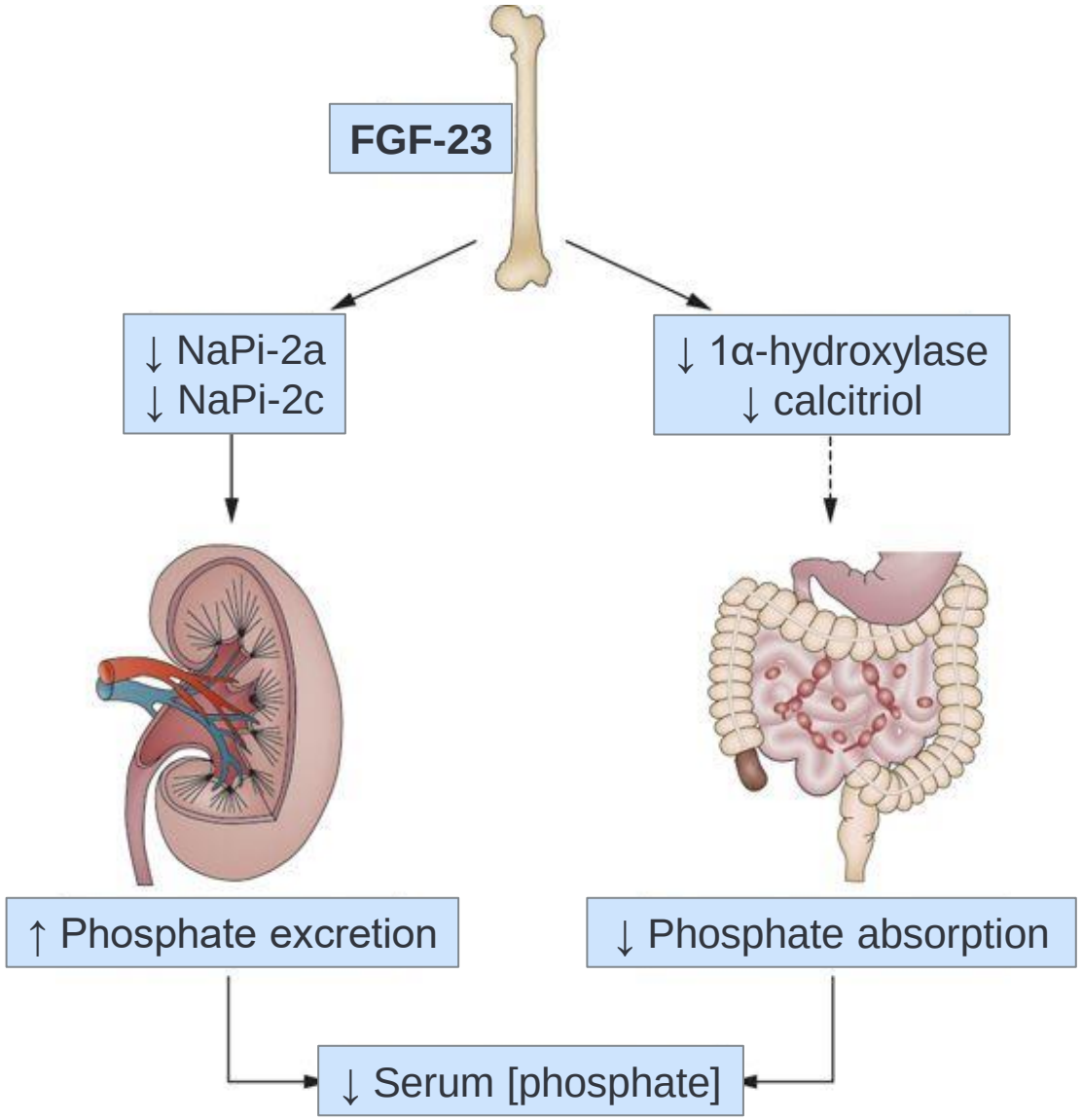

Treatment recommendations	Stage 1	Stage 2	Stage 3	Stage 4
	Use nephrotoxic drugs with caution	Same as Stage 1	Same as Stage 2	Same as Stage 3
	Correct prerenal and postrenal abnormalities	Renal therapeutic diet	Keep phosphorus < 5.0 mg/dL (< 1.6 mmol/L)	Keep phosphorus < 6.0 mg/dL (< 1.9 mmol/L)
Routine chemistry monitoring including SDMA, urinalysis, and UPC ratio	Fresh water available at all times	Treat hypokalemia in cats	Treat metabolic acidosis	Consider feeding tube for nutritional and hydration support and ease of medicating
	Monitor trends in creatinine and SDMA to document stability or progression	Treat inappetence and nausea if present	Consider treatment of anemia	
	Investigate for and treat underlying disease and/or complications		Treat vomiting, inappetence, and nausea	
	Treat hypertension if systolic blood pressure persistently > 160 or evidence of end-organ damage		Increased enteral or subcutaneous fluids may be required to maintain hydration	
FGF-23 in **cats** with IRIS CKD Stages 1 and 2	Treat persistent proteinuria with renal therapeutic diet and medication			
	Keep phosphorus < 4.6 mg/dL (< 1.5 mmol/L)			
	If required, use renal therapeutic diet plus phosphate binder			

See www.iris-kidney.com for more detailed staging, therapeutic, and management guidelines.

Regulation of phosphorus in CKD

Hyperphosphatemia

- Other relevant players: phosphatonins
- Fibroblast growth factor 23 (FGF-23)
- Released from osteocytes in response to increased phosphorus, calcitriol, and PTH concentrations
- Decreases phosphorus and calcitriol concentrations



Source: Razzaque MS. The FGF23-Klotho axis: endocrine regulation of phosphate homeostasis. *Nat Rev Endocrinol*. 2009;5(11):611–619. doi:10.1038/nrendo.2009.196

Chronic kidney disease–mineral bone disorder (CKD-MBD)

Decreased GFR

Reduced phosphorus excretion

Calcium–phosphorus imbalance

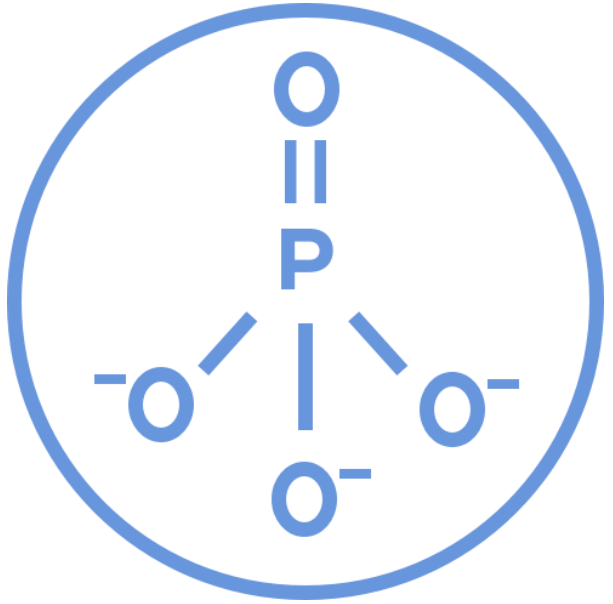
CKD-MBD

CKD-MBD

Hyperphosphatemia

One of the most important risk factors for CKD progression of disease and survival in cats and dogs

- Reduced phosphate excretion in CKD → CKD-MBD
  - Abnormalities of calcium-phosphate homeostasis, bone disease, and soft tissue calcification
    - Renal secondary hyperparathyroidism
    - Accelerated progression of CKD
    - Increased mortality rate
    - Renal osteodystrophy
    - Extraskeletal calcification
    - Hypo- or hypercalcemia, and hypo- or hypermagnesaemia

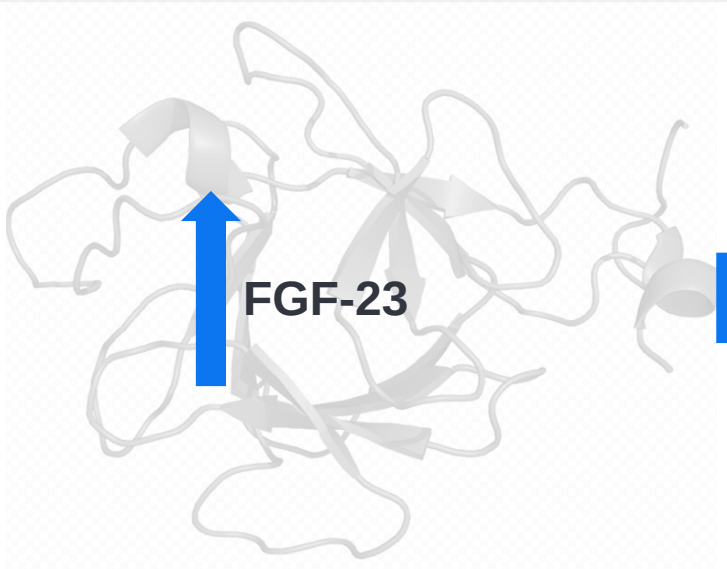


FGF-23

Cats diagnosed with
IRIS CKD Stage 1 or 2

Phosphorus < 4.6 mg/dL
(1.5 mmol/L)

IDEXX SDMA	a. 19	0 - 14 µg/dL	
Creatinine	2.0	0.9 - 2.5 mg/dL	
BUN	34	16 - 37 mg/dL	
BUN: Creatinine Ratio	17.0		
Phosphorus	3.7	2.9 - 6.3 mg/dL	

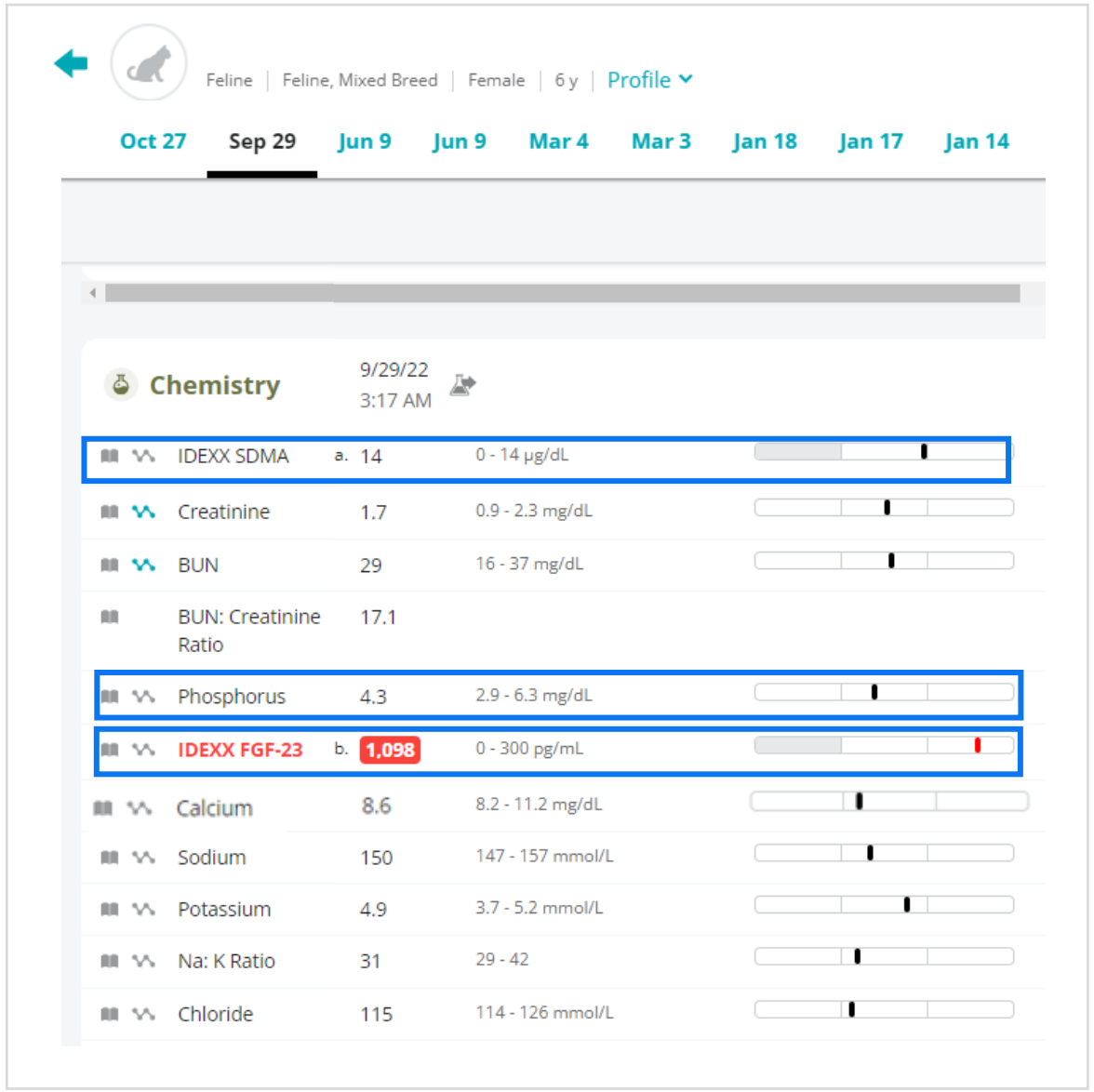


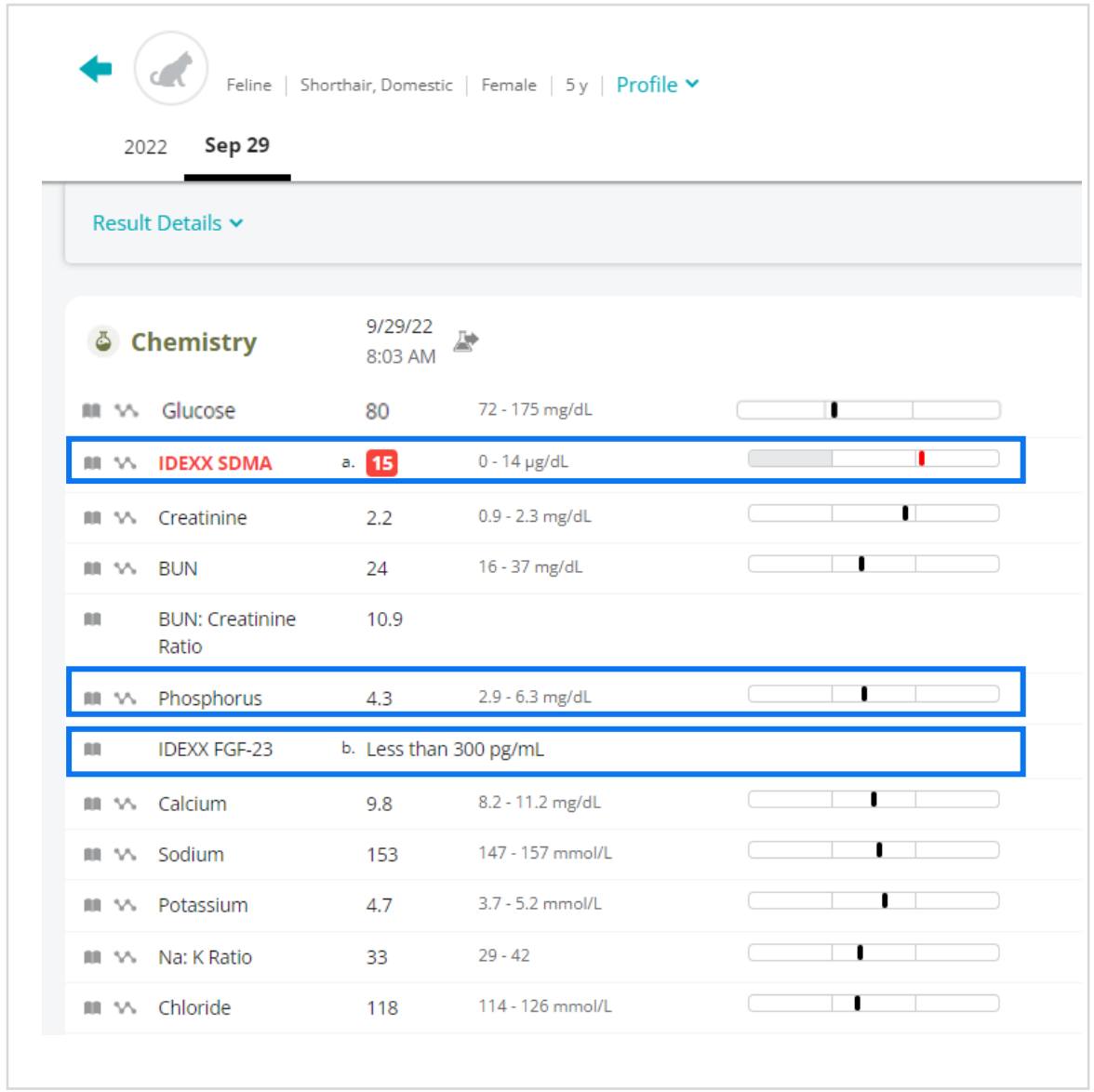
Homeostasis

+ Phosphorus
+ Parathyroid hormone (PTH)
+ Calcium
+ 1,25-dihydroxycholecalciferol (vitamin D)

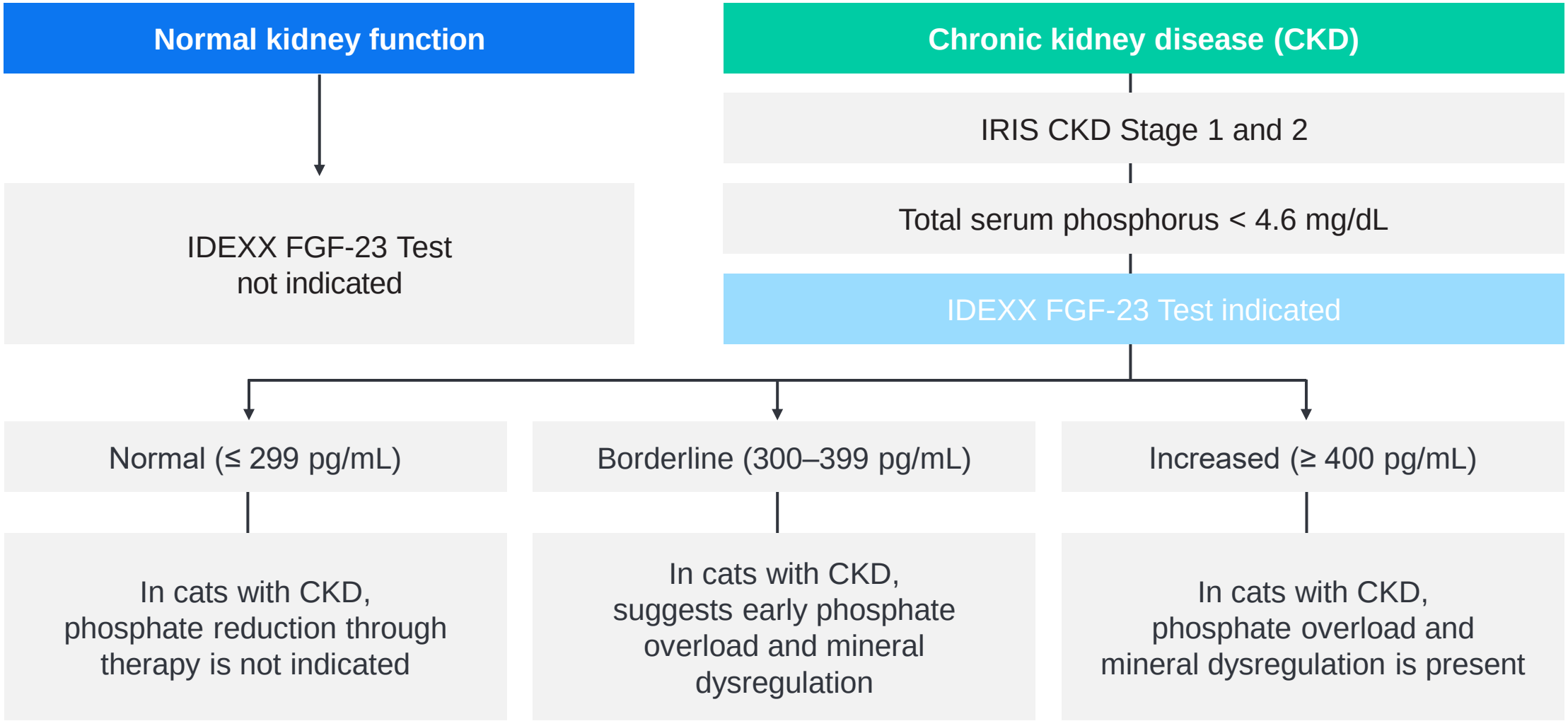
FGF-23 increases before overt hyperphosphataemia providing an opportunity for therapeutic intervention to **interrupt the progression of CKD-MBD**

FGF-23 identifies phosphorus overload before overt hyperphosphataemia





Algorithm: Identifying and managing phosphorus overload in cats diagnosed with CKD



FGF-23 fills a diagnostic gap for when to institute a therapeutic kidney diet in CKD for cats

FGF-23

Diagnosing CKD

SDMA
Creatinine
Phosphorus
Urinalysis

Management marker

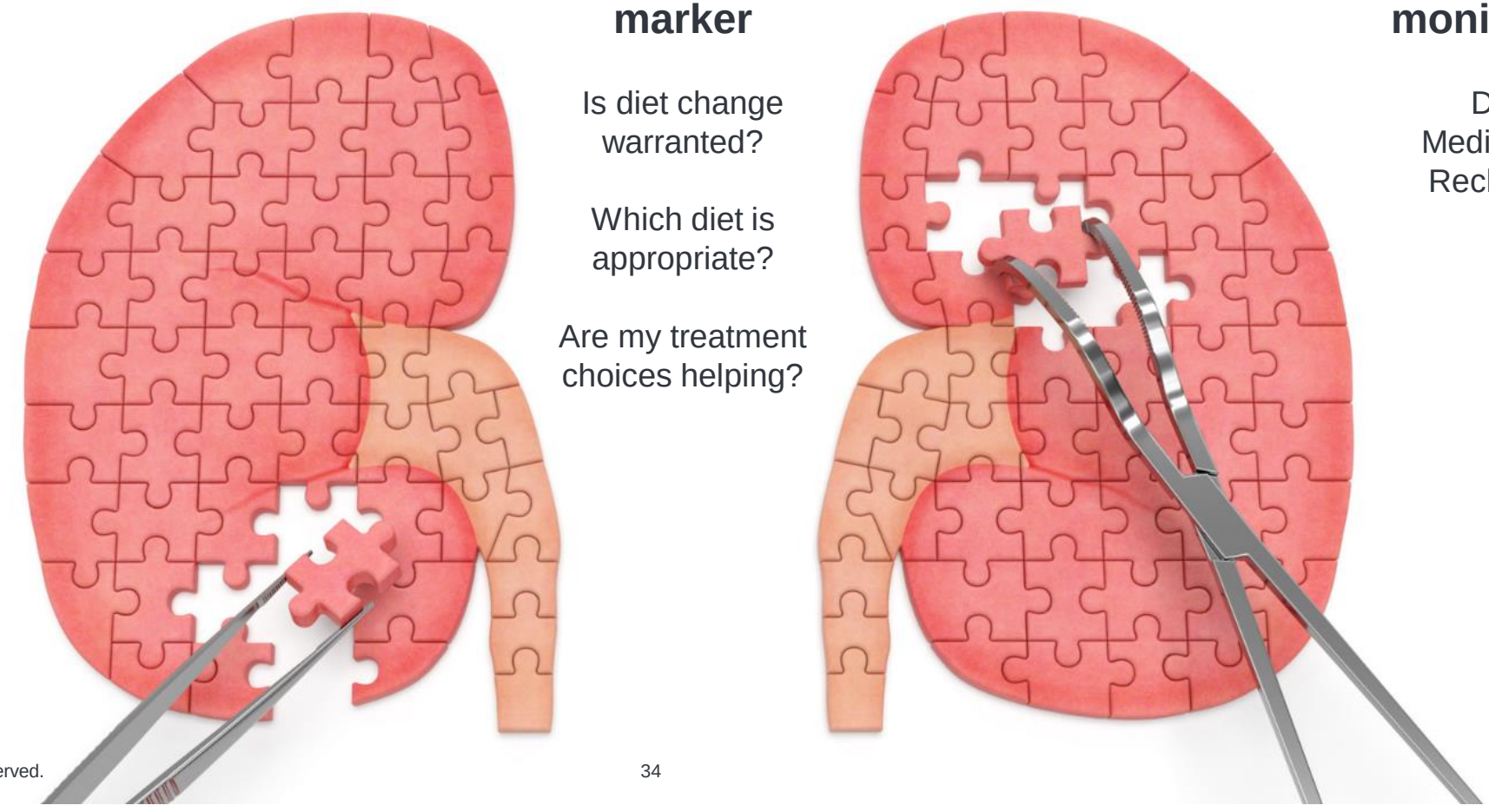
Is diet change warranted?

Which diet is appropriate?

Are my treatment choices helping?

Treatment and monitoring

Diet
Medication
Rechecks



Active/acute kidney injury

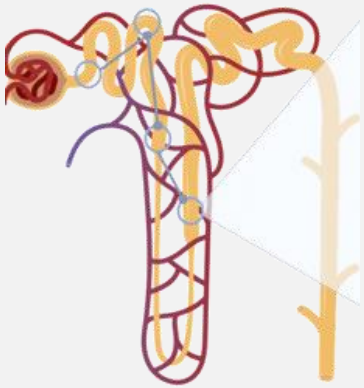
Potential causes of AKI

Prerenal

Decreased perfusion
- **Hypovolaemia**
- **Dehydration**
- Heart disease
- Live disease
- NSAIDs/ACEIs
- Other

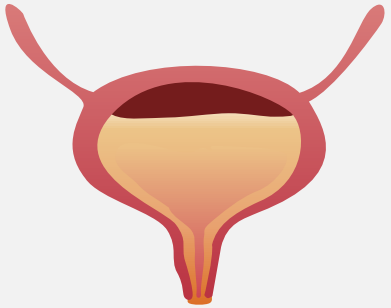
Intrarenal

- **Tubular** disease
  - Acute tubular necrosis (ATN)
    - Toxic
    - Ischemic
- **Glomerular** disease
  - Primary immune
  - Secondary immune
  - Amyloid
- **Interstitial**
  - Acute interstitial nephritis
  - Drug
  - Infectious
- **Vascular** disease



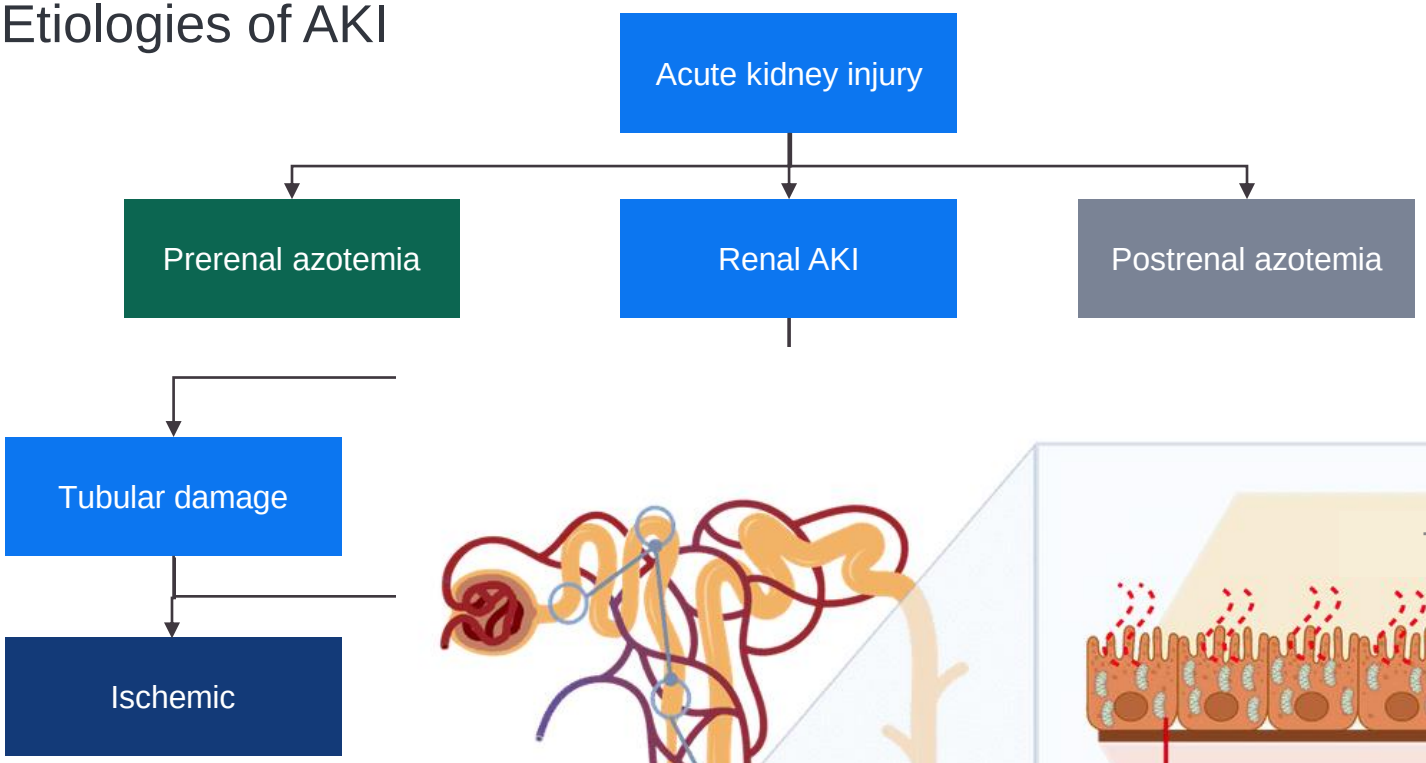
Postrenal

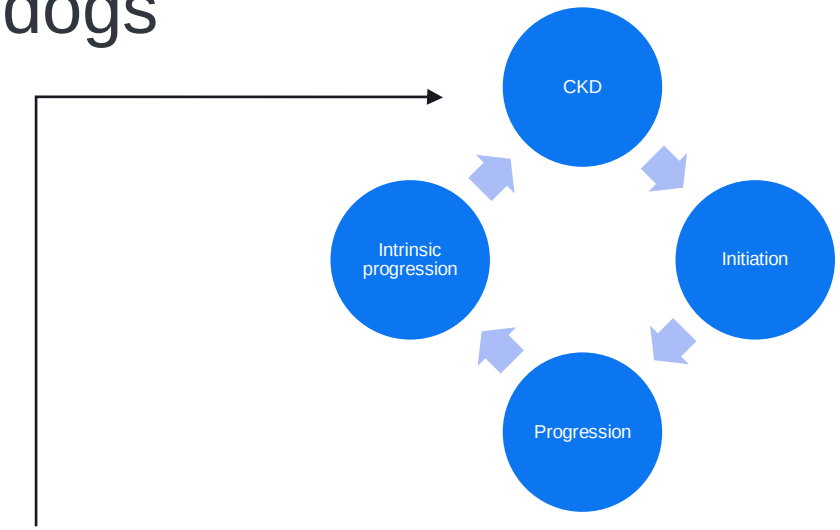
- Leak in urinary tract
  - **Obstructive**
    - Stones
    - Mass
    - Blood clot
    - Prostatic disease
    - Other



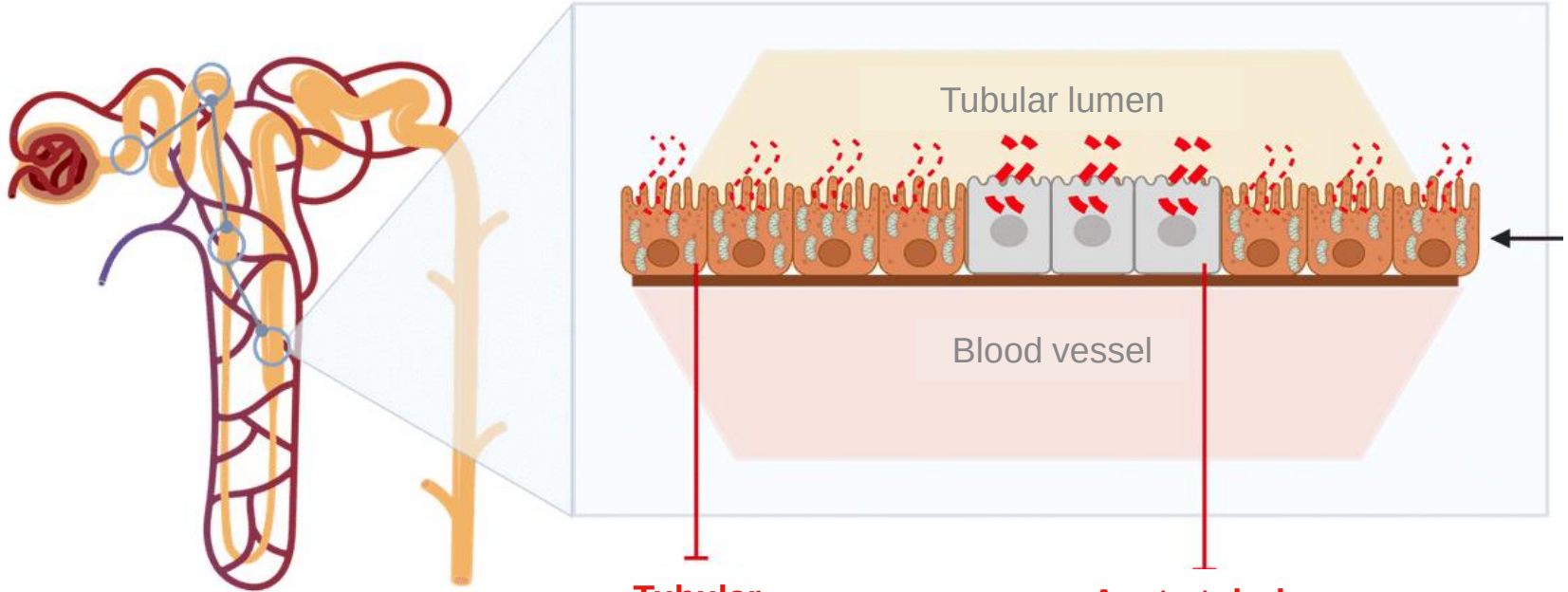
Mechanisms for pathogenesis of AKI in cats and dogs

Etiologies of AKI



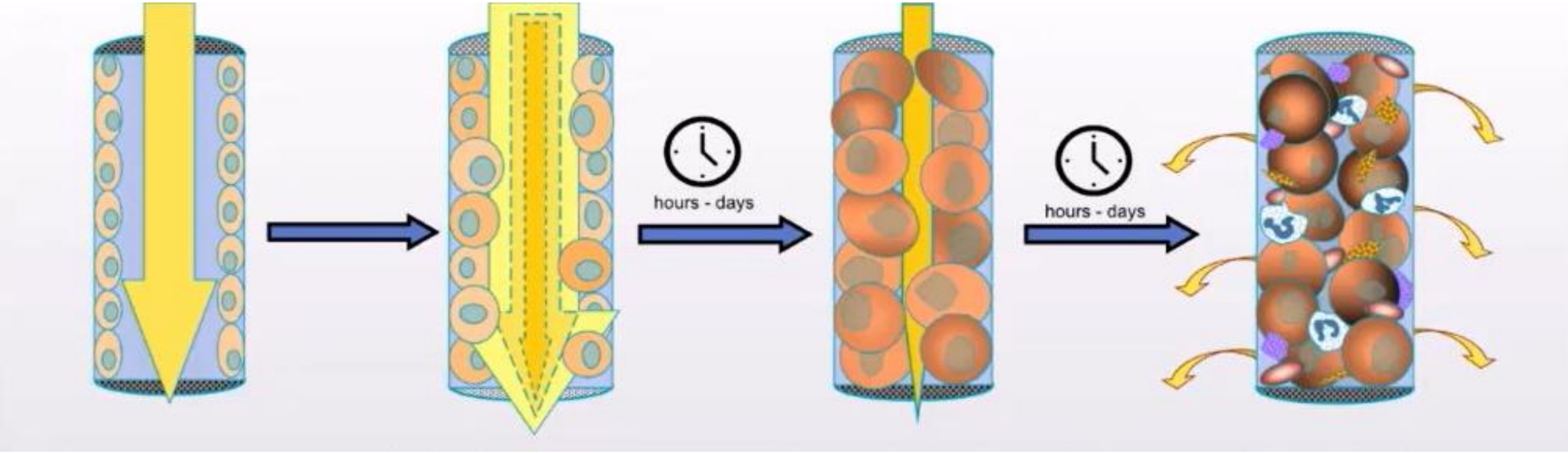


Tubular damage—Acute tubular necrosis (ATN) is the term used to designate AKI resulting from damage to the tubules.



Stages of AKI

Healthy	1. Initiation	2. Extension	3. Maintenance



Healthy tublar spithelium:
Normal urine output

Initial insult:
Cellular damage/death

Urine output may be unchanged

Progressive swelling with or without death of epithelial cells:
Oligoanuria possible

Cell lysis/sloughing

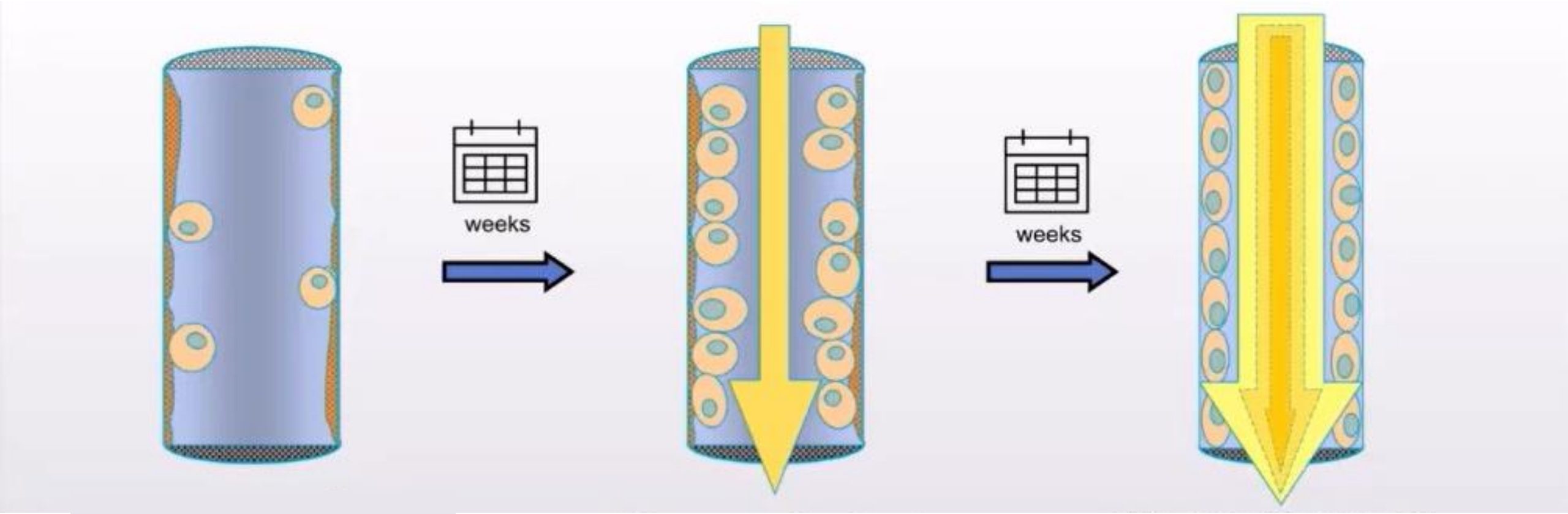
Debris occluding tubule

Back leak and inflammation

Oligoanuria

Courtesy of Dr. Sherri Ross

4. Recovery (hopefully)



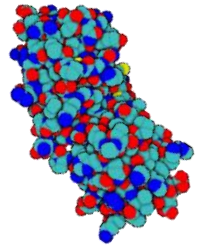
Sad renal tubule
If basement membrane intact, recovery possible

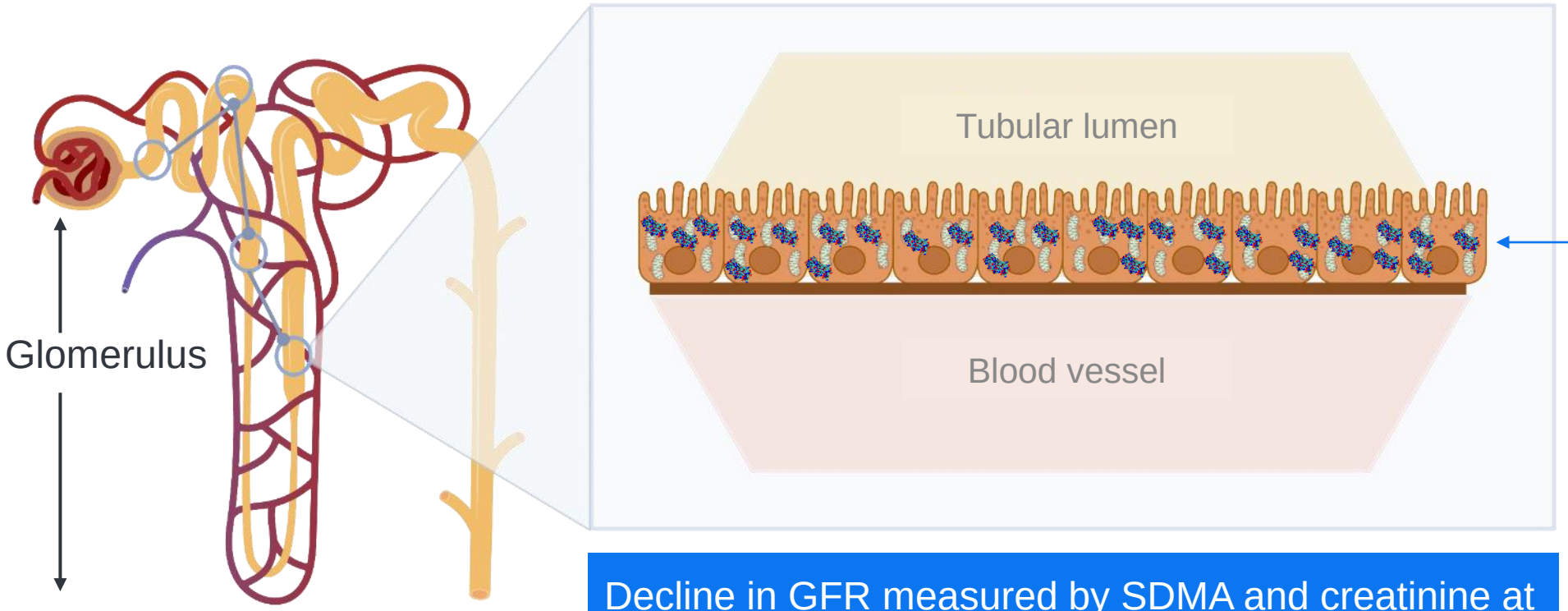
Cell regeneration begins
Some function returns

Tubular epithelial cells mature
Varying return of function

Courtesy of Dr. Sherri Ross

Cystatin B is a very small protein that is contained in the epithelial cells of the renal tubules



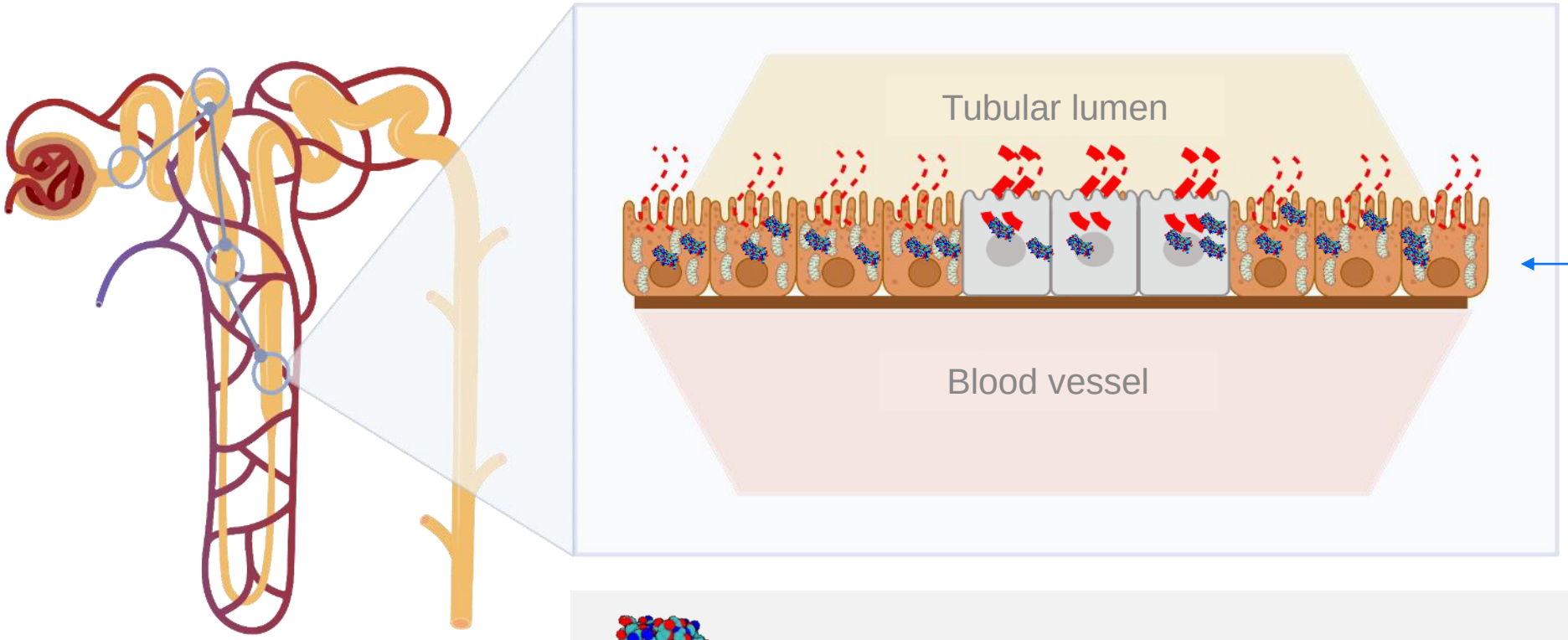


Decline in GFR measured by SDMA and creatinine at respectively 40%[1–3] and 75%[1,3,4] loss of function

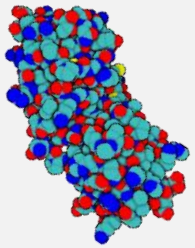
References

1. Hall JA, Yerramilli M, Obare E, Yerramilli M, Yu S, Jewell DE. Comparison of serum concentrations of symmetric dimethylarginine and creatinine as kidney function biomarkers in healthy geriatric cats fed reduced protein foods enriched with fish oil, L-carnitine, and medium-chain triglycerides. *Vet J*. 2014;202(3):588–596. doi:10.1016/j.tvjl.2014.10.021
2. Hall JA, Yerramilli M, Obare E, Yerramilli M, Almes K, Jewell DE. Serum concentrations of symmetric dimethylarginine and creatinine in dogs with naturally occurring chronic kidney disease. *J Vet Intern Med*. 2016;30(3):794–802. doi:10.1111/jvim.13942
3. Hall JA, Yerramilli M, Obare E, Yerramilli M, Jewell DE. Comparison of serum concentrations of symmetric dimethylarginine and creatinine as kidney function biomarkers in cats with chronic kidney disease. *J Vet Intern Med*. 2014;28(6):1676–1683. doi:10.1111/jvim.12445
4. Nabity MB, Lees GE, Boggess MM, et al. Symmetric dimethylarginine assay validation, stability, and evaluation as a marker for the early detection of chronic kidney disease in dogs. *J Vet Intern Med*. 2015;29(4):1036–1044. doi:10.1111/jvim.12835

During active or acute injury to the kidney, the cells that line the tubules can become damaged or necrotic

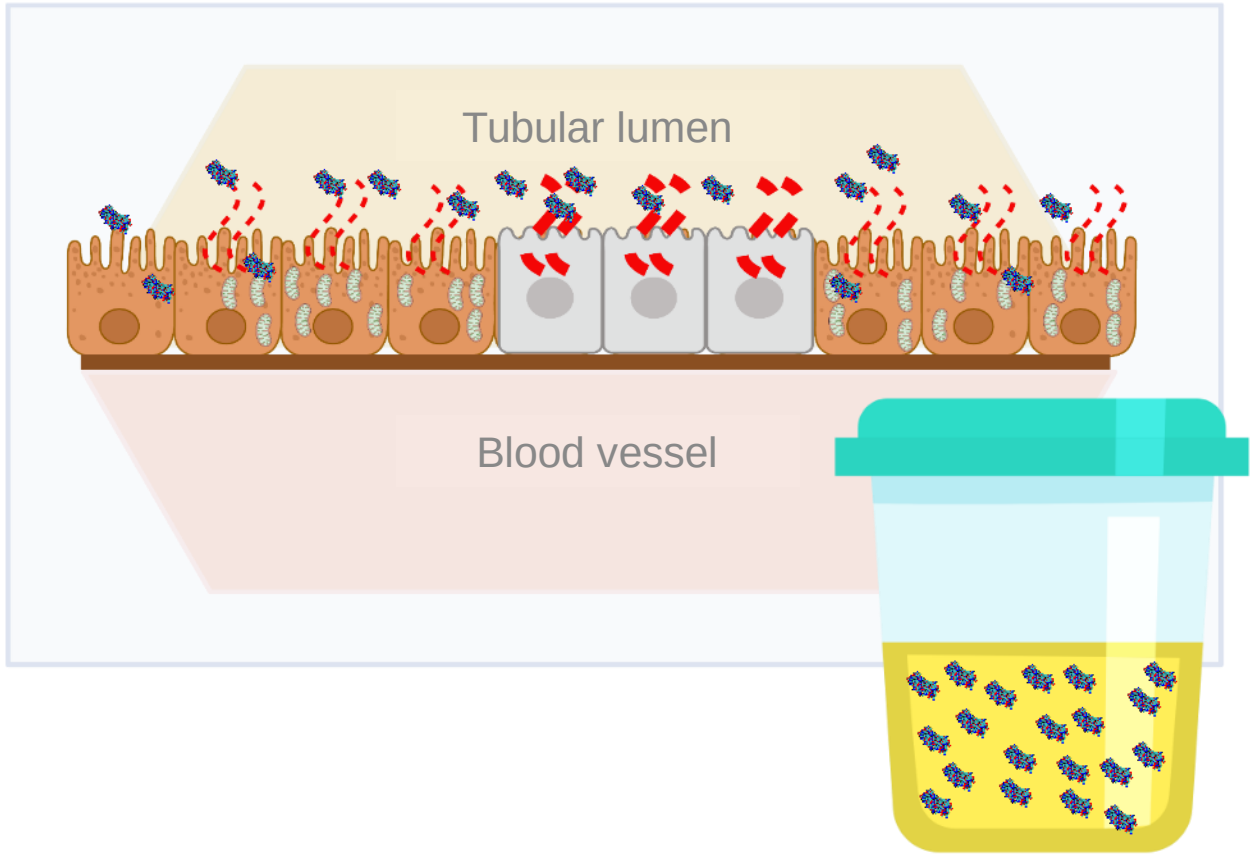


Cystatin B leakage from injured or necrosed tubular epithelial cells



Increased cystatin B can occur with or without functional marker increase, **alerting to earlier, ongoing, and unresolved** injury to the kidney.

The types of active and acute injury that can cause cystatin B to leak into urine include both primary and secondary insults to the kidney



1

+ Primary nephritis (GN or pyelonephritis)
+ Immune-mediated disease
+ Chronic kidney disease (CKD)

2

+ Toxic insult
+ Systemic inflammatory disease (pancreatitis, vasculitis, other shock-related conditions)
+ Hypotension during anesthesia
+ Hypovolemia (blood loss)

The IDEXX Cystatin B Test

Novel kidney injury marker

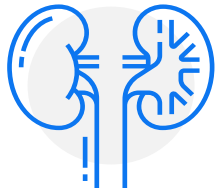
- Urine-based test
- Cystatin B is very stable within urine when refrigerated/stored properly*
- Indicated for use on unwell dogs and cats
- Available from IDEXX Reference Laboratories and with IDEXX Anywhere Urinalysis with SediVue Dx® Urine Sediment Analyzer codes

*Stable for up to 7 days at 4°C and 3 days at 30°C.

When to use
Examples

Use case	Potential action
+ Veterinarian suspects a toxin exposure and is looking to confirm active injury	+ Confidence that treatment course is the correct one
+ Monitoring treatment/recovery from an injury event	+ Feedback that treatment is working or not; is the insult ongoing?
+ Dogs with IRIS CKD Stage 1	+ IDEXX Cystatin B Test can provide indication of CKD progression; if disease is progressing, consider more aggressive treatment
+ Patients that may be at higher risk when taking an NSAID	+ If ongoing injury is occurring, consider NSAID alternatives
+ Shock (heat stroke, acute pancreatitis)	+ Assess if injury occurred/is ongoing to determine next steps
+ Anesthetic hypotensive event	+ Assess if injury occurred/is ongoing to determine next steps

Renal health in the sick pet



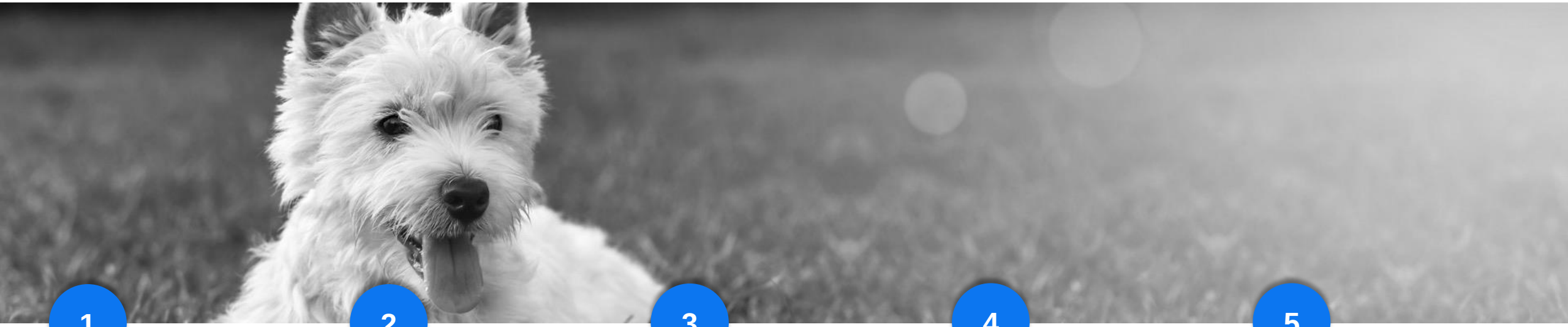
Emergent cases

+ Vehicular trauma
+ Hemoabdomen
+ Gastric dilatation and volvulus (GDV)
+ Uroabdomen
+ Toxin exposure
+ Seizures
+ Hyperthermia

Hospitalised patients

+ Post-op hospitalisation
+ Sick diabetic
+ Addisonian crisis
+ Pancreatitis
+ Urethral obstruction

Kidney’s role in renal monitoring in the sick pet



1

GDV

+ AKI as a significant risk factor for death[1]

2

Toxin exposure

+ Lilies (cats)
+ Ethylene glycol
+ NSAIDs
+ Aminoglycosides

3

Pyometra

+ Azotaemia/renal dysfunction[2]
+ Proteinuria[2]

4

Hyperthermia

+ Renal tubular necrosis[3]

5

Hospitalised patients

+ Postoperative
+ Diabetic ketoacidosis (DKA)
+ Addisonian crisis
+ Pancreatitis

References

1. Sharp CR, Rozanski EA. Cardiovascular and systemic effects of gastric dilatation and volvulus in dogs. *Top Companion Anim Med*. 2014;29(3):67–70. doi:10.1053/j.tcam.2014.09.007
2. Maddens B, Heiene R, Smets P, et al. Evaluation of kidney injury in dogs with pyometra based on proteinuria, renal histomorphology, and urinary biomarkers. *J Vet Intern Med*. 2011;25(5):1075–1083. doi:10.1111/j.1939-1676.2011.0772.x
3. Stern A. Canine environmental hyperthermia: a case series. *J Vet Med Sci*. 2019;81(2):190–192. doi:10.1292/jvms.18-0586

IDEXX Cystatin B Test: interpreting normal results

Cystatin B < 100 ng/mL
There is a decreased potential of kidney injury

SDMA or creatinine
within reference intervals

Appropriately concentrated urine

Evidence of renal injury not present
at this time

SDMA or creatinine
outside reference intervals

Inappropriately concentrated urine

Previous history of kidney disease

IDEXX Cystatin B Test: interpreting increased results

Cystatin B ≥ 100 ng/mL
There is an increased potential of active kidney injury

Patient presented for reason other than wellness visit (e.g., sick, anesthesia/sedation, etc.)

Patient presented for wellness visit

SDMA and creatinine within reference intervals

Appropriately concentrated urine

Possible active (ongoing) kidney injury or early IRIS* AKI Grades I–II (acute kidney injury)

SDMA and creatinine outside reference intervals

Inappropriately concentrated urine

Active/acute kidney injury is likely

SDMA and creatinine within reference intervals

Appropriately concentrated urine

Possible subclinical kidney injury

In a well patient, subclinical kidney injury cannot be ruled out

Subclinical kidney injury may be

IDEXX VetConnect PLUS | Home | Directory of Services | Imaging | Telemedicine

BELLA FITZPATRICK 203AB Patient Management

Canine | Mixed Breed | Female | 8y

2023 **Dec 21** 2022 Nov 2

Result details

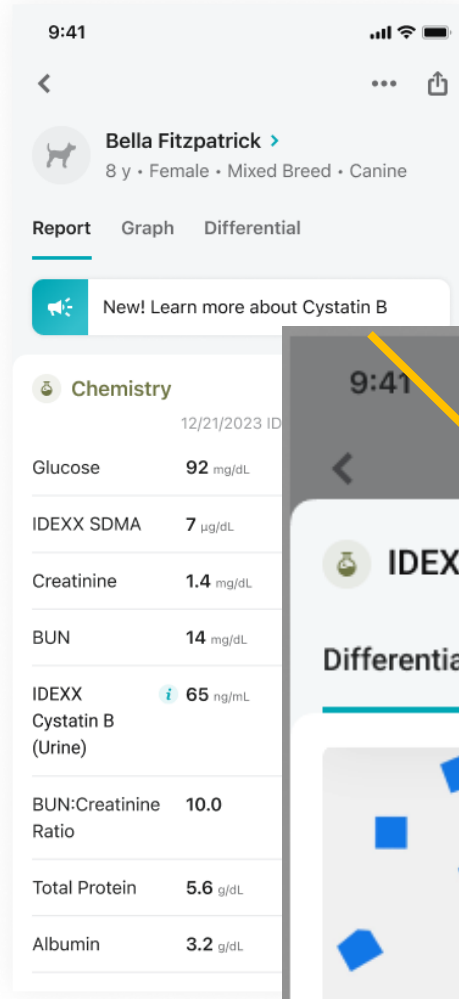
Chemistry

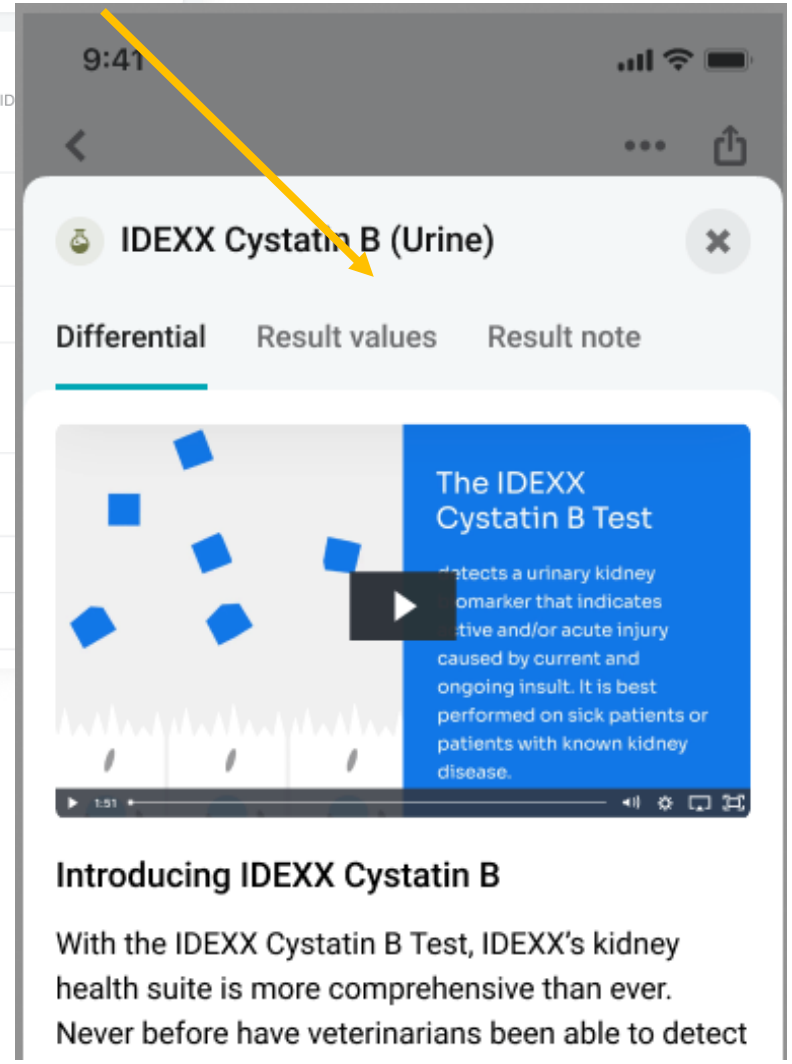
	12/21/23 5:13 AM		11/2/22 6:32 AM
Glucose	92	63 - 114 mg/dL	88
IDEXX SDMA	7	0 - 14 µg/dL	15
Creatinine	1.4	0.5 - 1.5 mg/dL	1.2
BUN	14	9 - 31 mg/dL	13
IDEXX Cystatin B (Urine)	65	0 - 99 ng/mL	

Learn More

Introducing IDEXX Cystatin B

With the IDEXX Cystatin B Test, IDEXX's kidney health suite is more comprehensive than ever. Never before have veterinarians been able to detect active or acute injury to the kidneys with a kidney injury marker. Now with the IDEXX





Cystatin B ≥ 100 ng/mL: There is an increased potential of active kidney injury

- Injury MAY RESOLVE
- Injury may NOT be permanent
- Consider ALL factors including
  - Age
  - Breed
  - History

Patient presented for wellness visit

Possible subclinical kidney injury

In a well patient, subclinical kidney injury cannot be ruled out

Subclinical kidney injury may be caused by a single acute inciting event and may not result in overt clinical signs or changes in functional markers

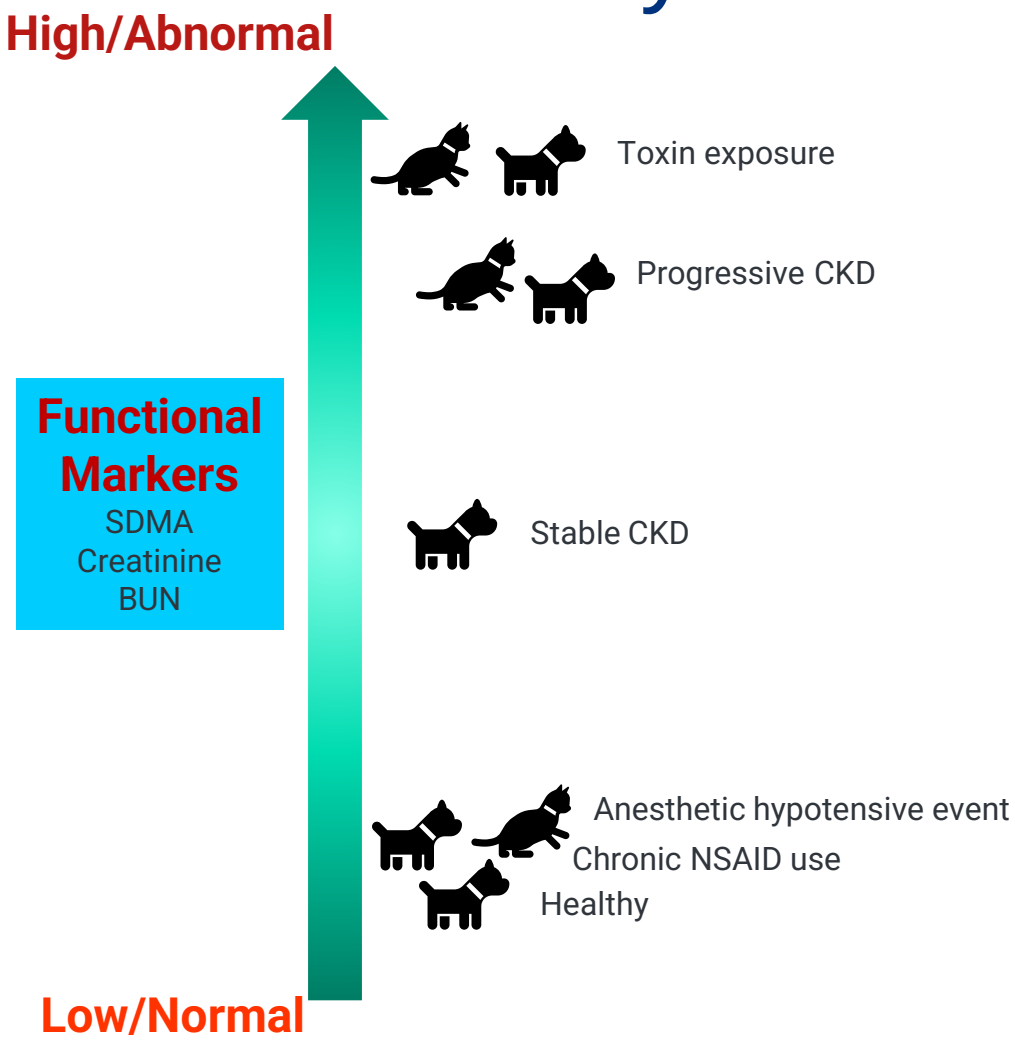
SDMA and creatinine within reference intervals

Appropriately concentrated urine

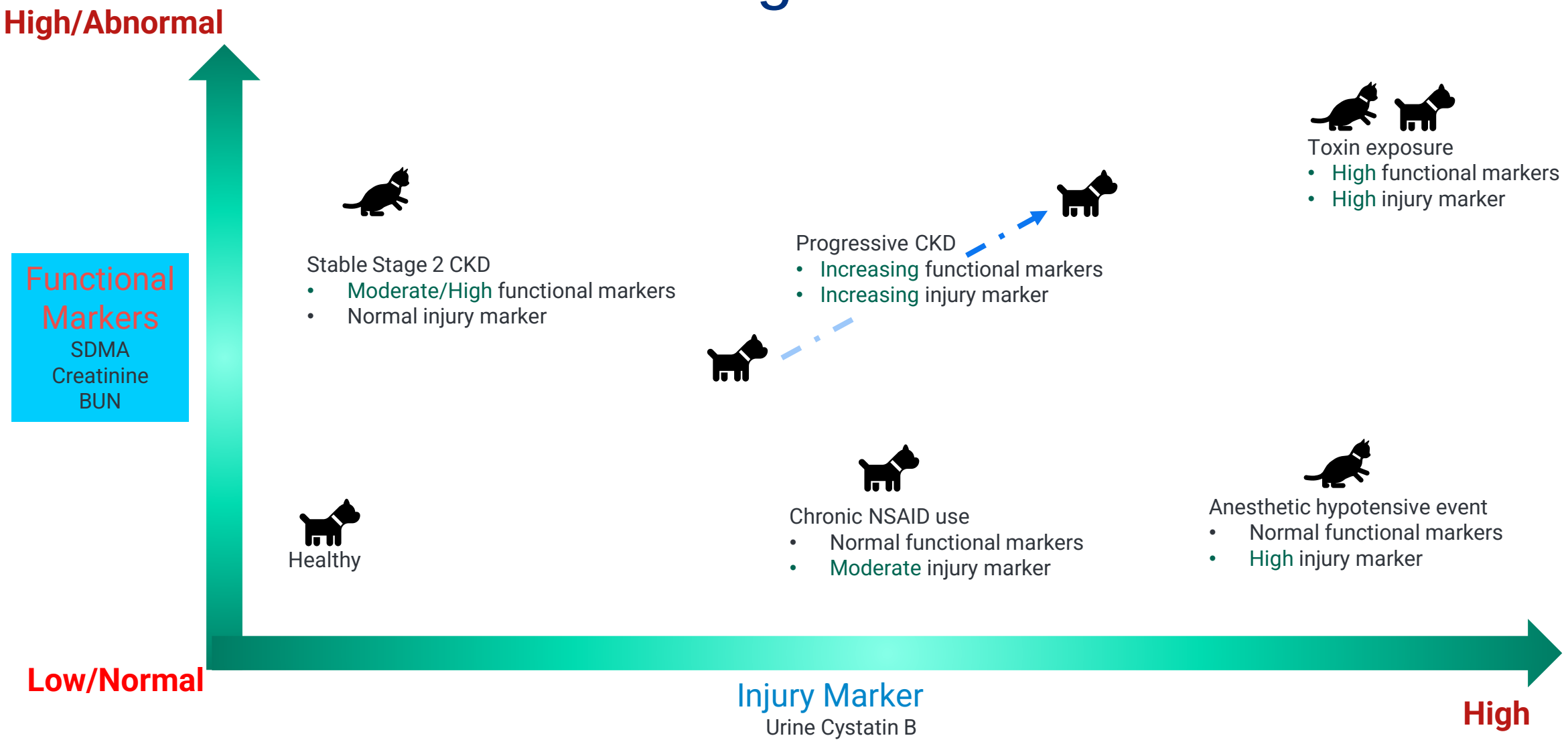
A comprehensive history, such as diet, medications, supplements, preventives, travel, and other information, should be obtained.

Consider rechecking cystatin B and other kidney markers, including SDMA, in 1–2 weeks or sooner if clinical signs become apparent

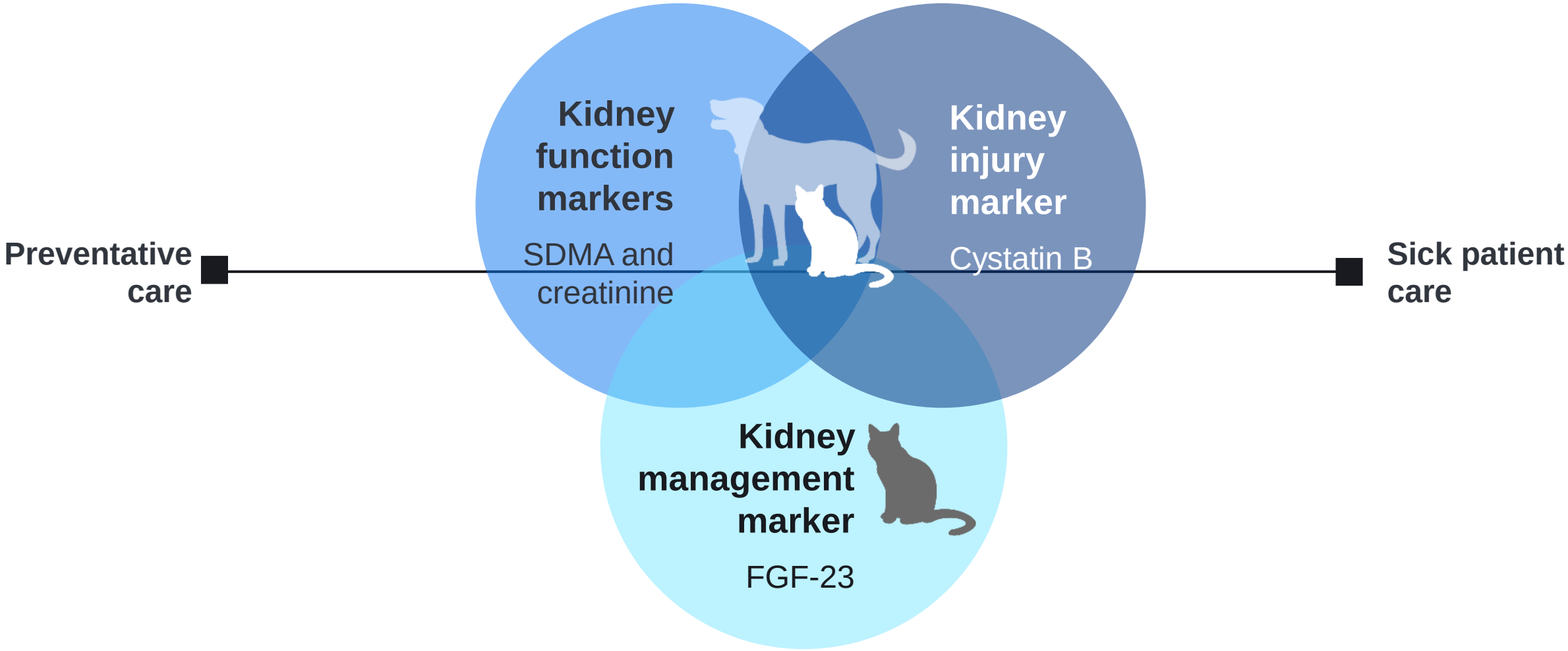
Traditional diagnostics only allow for case evaluation by functional markers



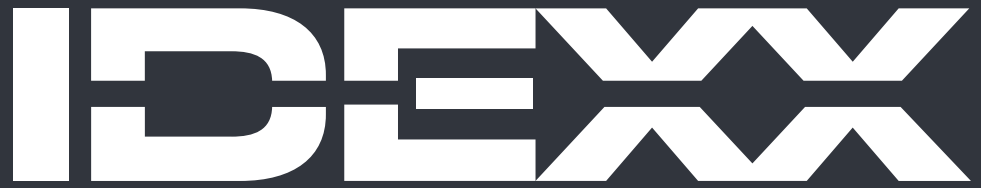
Addition of an injury marker provides better case discrimination and management



Diverse renal health portfolio



Questions?


IDEXX