Diagnosis and monitoring of adrenal disease: brush away your stress!

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Financial Disclosure

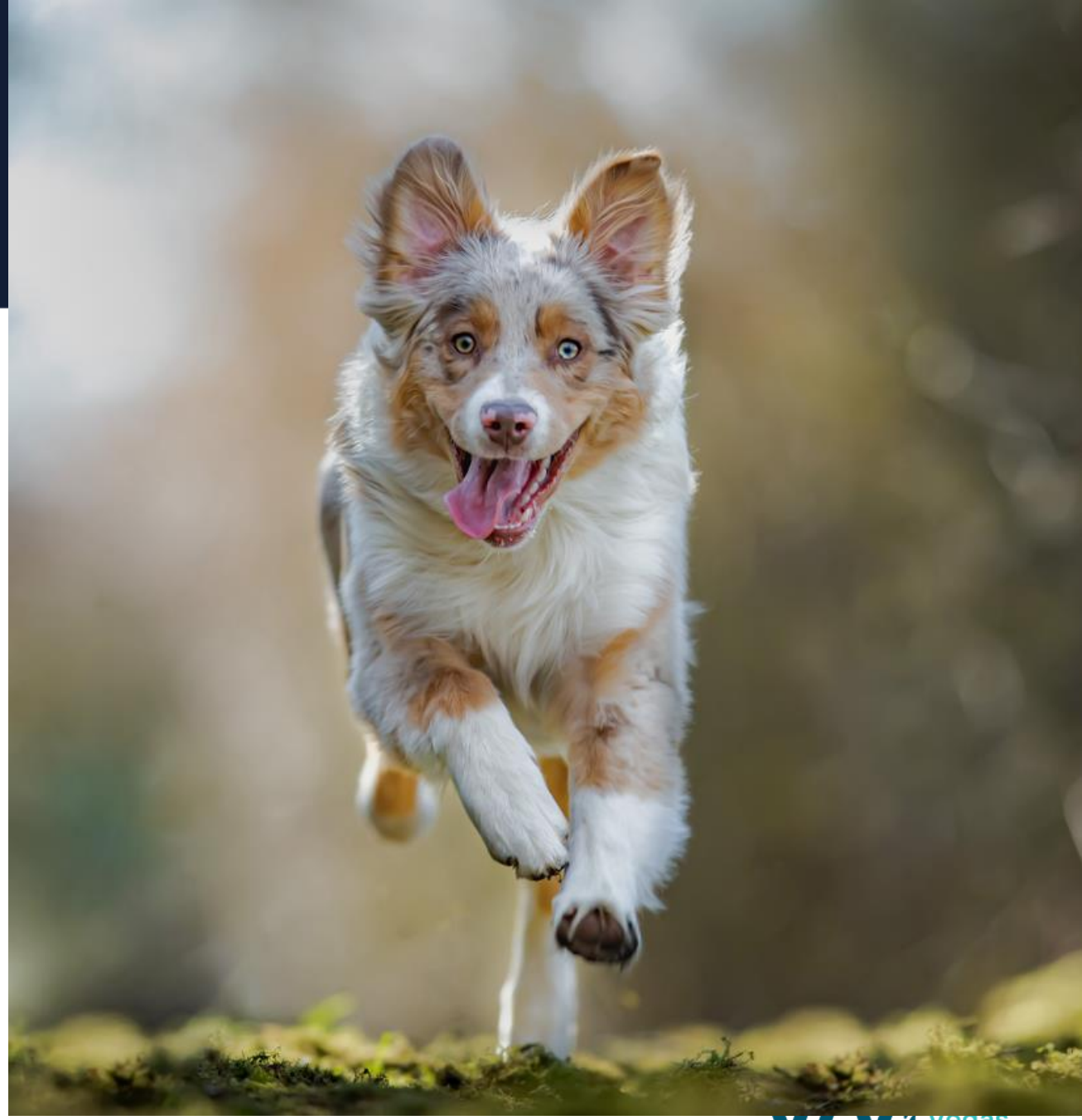
Beth - I have a direct or indirect relationship with IDEXX. Because of the nature of the relationship, it **will not** influence my presentation.

Patty - I have a direct or indirect relationship with Idexx, Dechra, BI, ScoutBio, and Hill's. Because of the nature of the relationship, it **will not** influence my presentation.

Bruce-I have a direct or indirect relationship with IDEXX. Because of the nature of the relationship, it **will not** influence my presentation

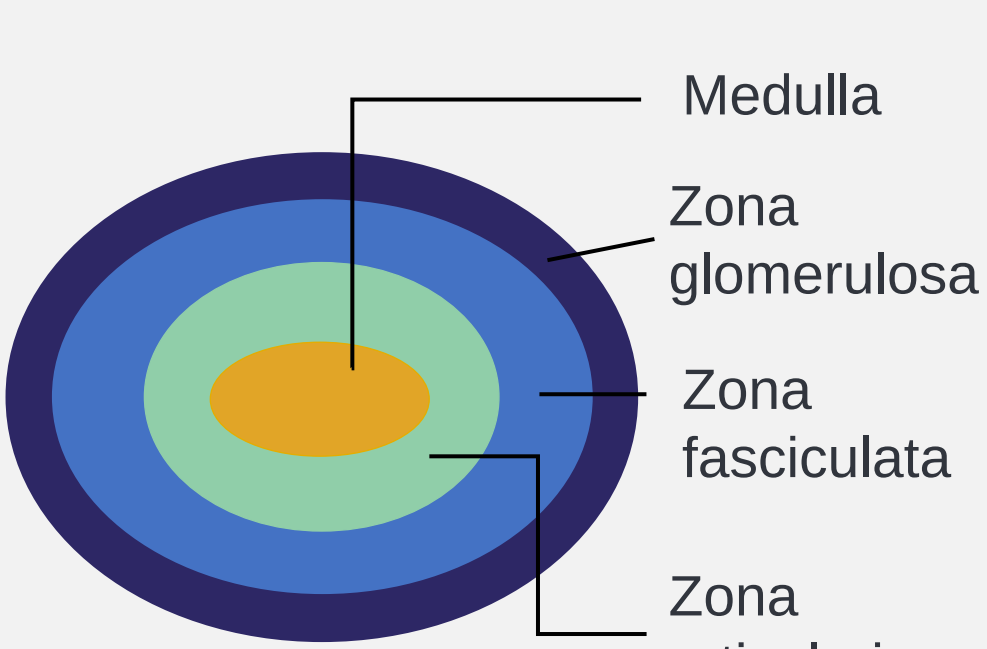
Agenda

1. How will the painting work?
2. Clinical content: Adrenal foundations
3. PAINT
4. Clinical Content: Addison's
5. PAINT
6. Clinical Content: Cushing's
7. PAINT and PRIZES



Foundational Flashback

Foundational flashback: Adrenal function

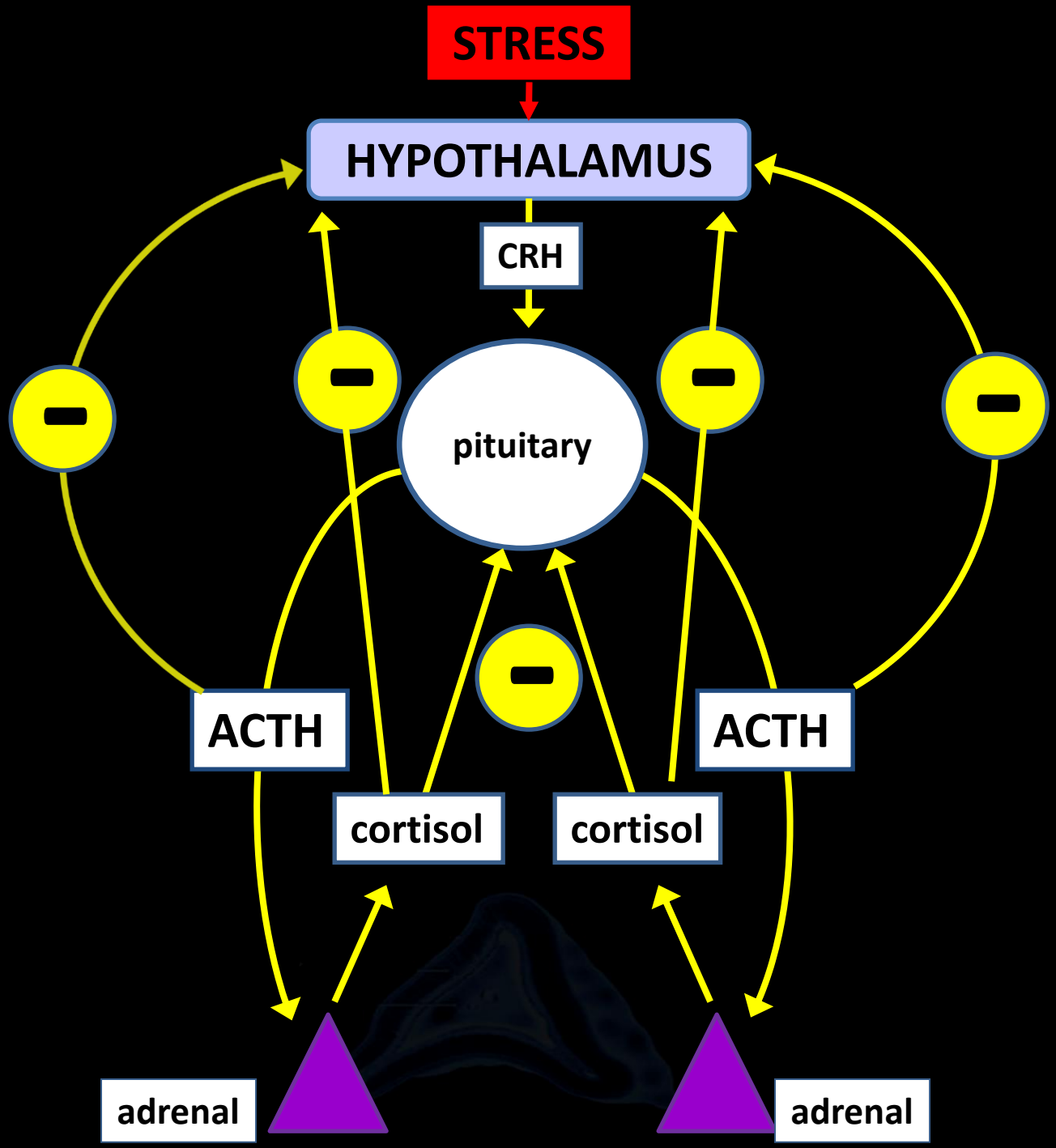


Adrenal gland

Sources

- Hess RS. Hypoadrenocorticism. In: Ettinger SJ, Feldman EC, Côté E, eds. *Ettinger's Textbook of Veterinary Internal Medicine Expert Consult*. Vol 2. 9th ed. Elsevier; 2024:2036–2045.
- Van Lanen K, Sande A. Canine hypoadrenocorticism: pathogenesis, diagnosis, and treatment. *Top Companion Anim Med*. 2014;29(4):88–95. doi:10.1053/j.tcam.2014.10.001

WVC Vegas


STRESS
HYPOTHALAMUS
CRH
pituitary
ACTH
ACTH
cortisol
cortisol
adrenal
adrenal

Time to get creative!!

Addisons Disease

Then and now…

Addison's disease	Primary hypoadrenocorticism
Atypical Addison's disease	Eunatremic, eukalemic hypoadrenocorticism
Addisonian crisis	Adrenal crisis
Relative adrenal insufficiency	Critical illness-related corticosteroid insufficiency

Source: European Society of Veterinary Endocrinology. Project ALIVE: Table of terms. Accessed June 20, 2025. www.esve.org/alive/search.aspx

Clinicopathologic findings

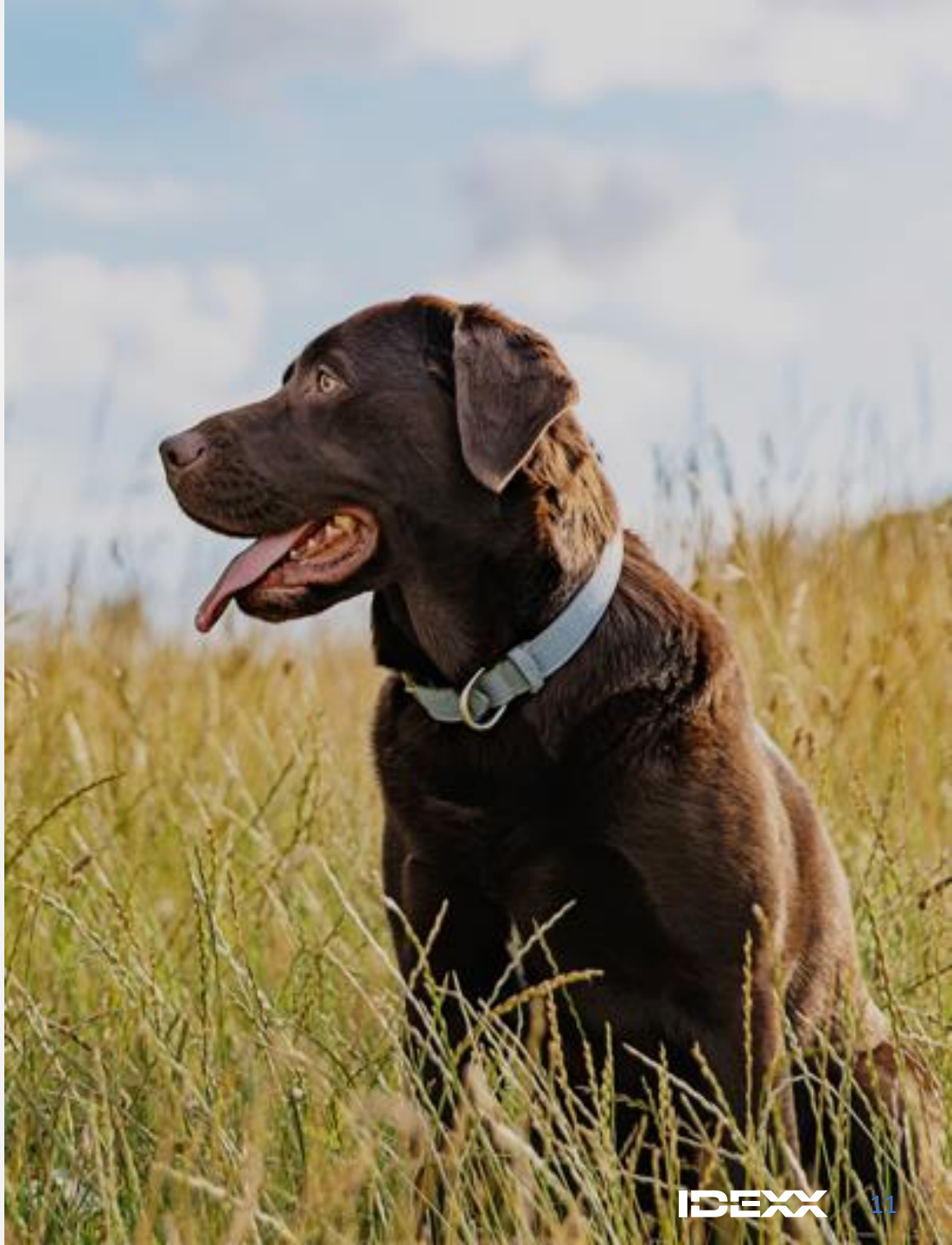
Classic

+ Lack stress leukogram
+ Hyponatremia
+ Hyperkalemia
+ Mild anemia
+ Hypoglycemia
+ Hypoproteinemia
+ Hypocholesterolemia
+ Hypercalcemia
+ Elevated ALT/AST
+ Azotemia

Sources
- Hess RS. Hypoadrenocorticism. In: Ettinger SJ, Feldman EC, Côté E, eds. *Ettinger's Textbook of Veterinary Internal Medicine Expert Consult*. Vol 2. 9th ed. Elsevier; 2024:2036–2045.
- Van Lanen K, Sande A. Canine hypoadrenocorticism: pathogenesis, diagnosis, and treatment. *Top Companion Anim Med*. 2014;29(4):88–95. doi:10.1053/j.tcam.2014.10.001

Meet Whitney

- 2-year-old, spayed female Labrador retriever
- Vomiting and collapse
- **History**
  - Waxing and waning history of lethargy
  - Some weight loss
  - Polyphagic
  - Polydipsic



Physical exam

Quiet

Alert

Responsive

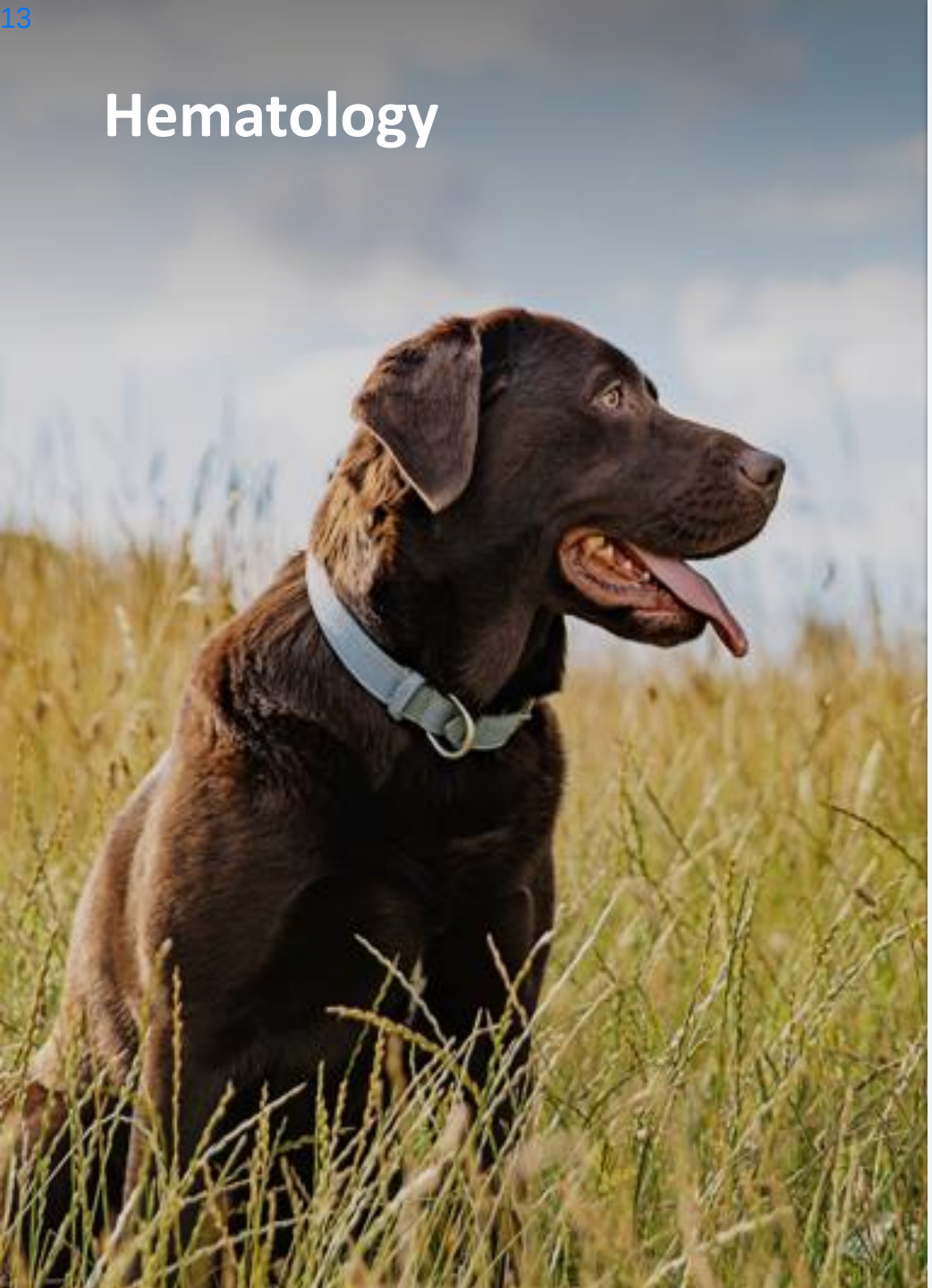
10%+
Dehydrated

T = 100.4°F

P = 84 bpm

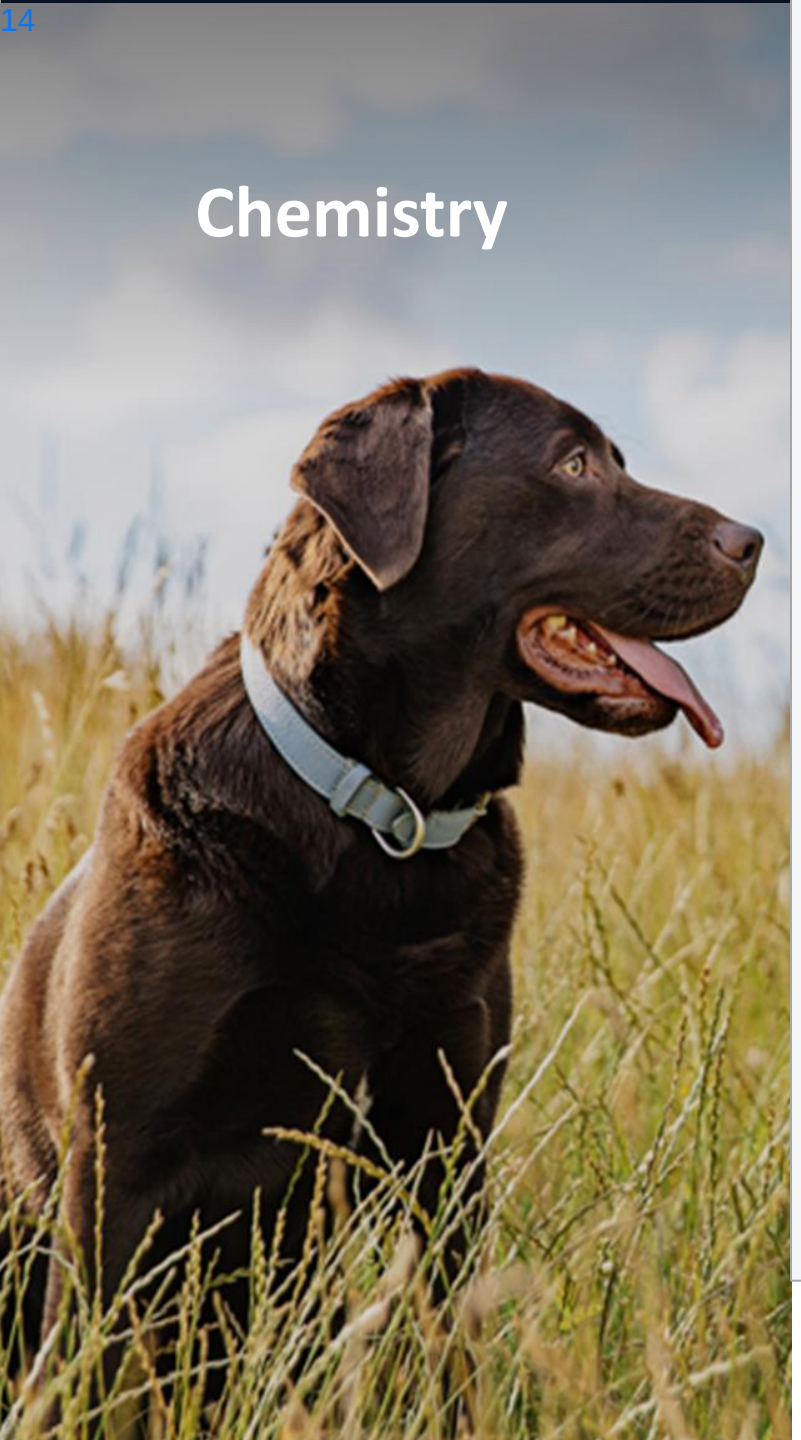
R = 16 bpm

Hematology



RBC	*4.69	5.50 - 8.50 M/µL	
Hematocrit	*30.6	37.0 - 55.0 %	
Hemoglobin	16.3	12.0 - 18.0 g/dL	
MCV	*65.2	60.0 - 77.0 fL	
MCH	34.8	18.5 - 30.0 pg	
MCHC	--.--	30.0 - 37.5 g/dL	
RDW	14.9	14.7 - 17.9 %	
% Reticulocyte	0.7	%	
Reticulocytes	33.0	10.0 - 110.0 K/µL	
WBC	11.13	5.50 - 16.90 K/µL	
% Neutrophils	53.9	%	
% Lymphocytes	31.8	%	
% Monocytes	9.4	%	
% Eosinophils	4.5	%	
% Basophils	0.3	%	
Neutrophils	6.00	2.00 - 12.00 K/µL	
Lymphocytes	3.54	0.50 - 4.90 K/µL	
Monocytes	1.05	0.30 - 2.00 K/µL	
Eosinophils	0.51	0.10 - 1.49 K/µL	

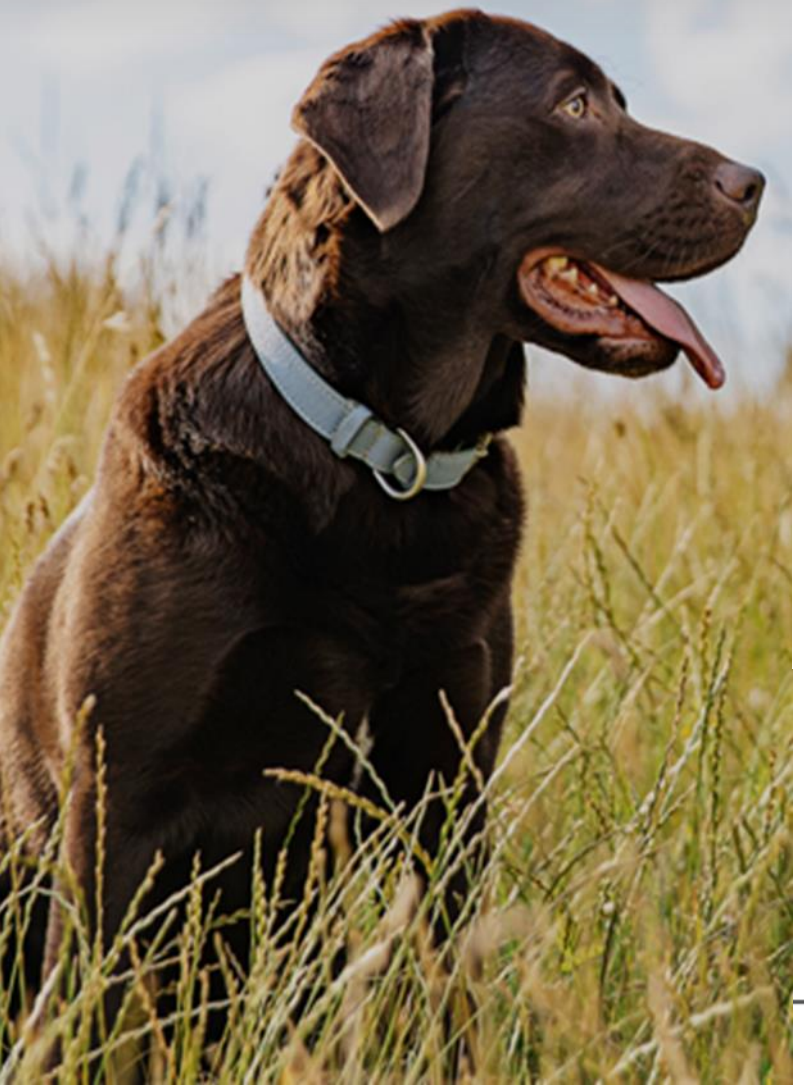
Chemistry



Total Protein	6.0	5.5 - 7.5 g/dL	
Albumin	k. **1.3**	2.7 - 3.9 g/dL	
Globulin	**4.7**	2.4 - 4.0 g/dL	
Albumin: Globulin Ratio	**0.3**	0.7 - 1.5	
ALT	54	18 - 121 U/L	
AST	**83**	16 - 55 U/L	
ALP	41	5 - 160 U/L	
GGT	3	0 - 13 U/L	
Bilirubin - Total	0.2	0.0 - 0.3 mg/dL	
Bilirubin - Unconjugated	0.1	0.0 - 0.2 mg/dL	
Bilirubin - Conjugated	0.1	0.0 - 0.1 mg/dL	
Cholesterol	**80**	131 - 345 mg/dL	

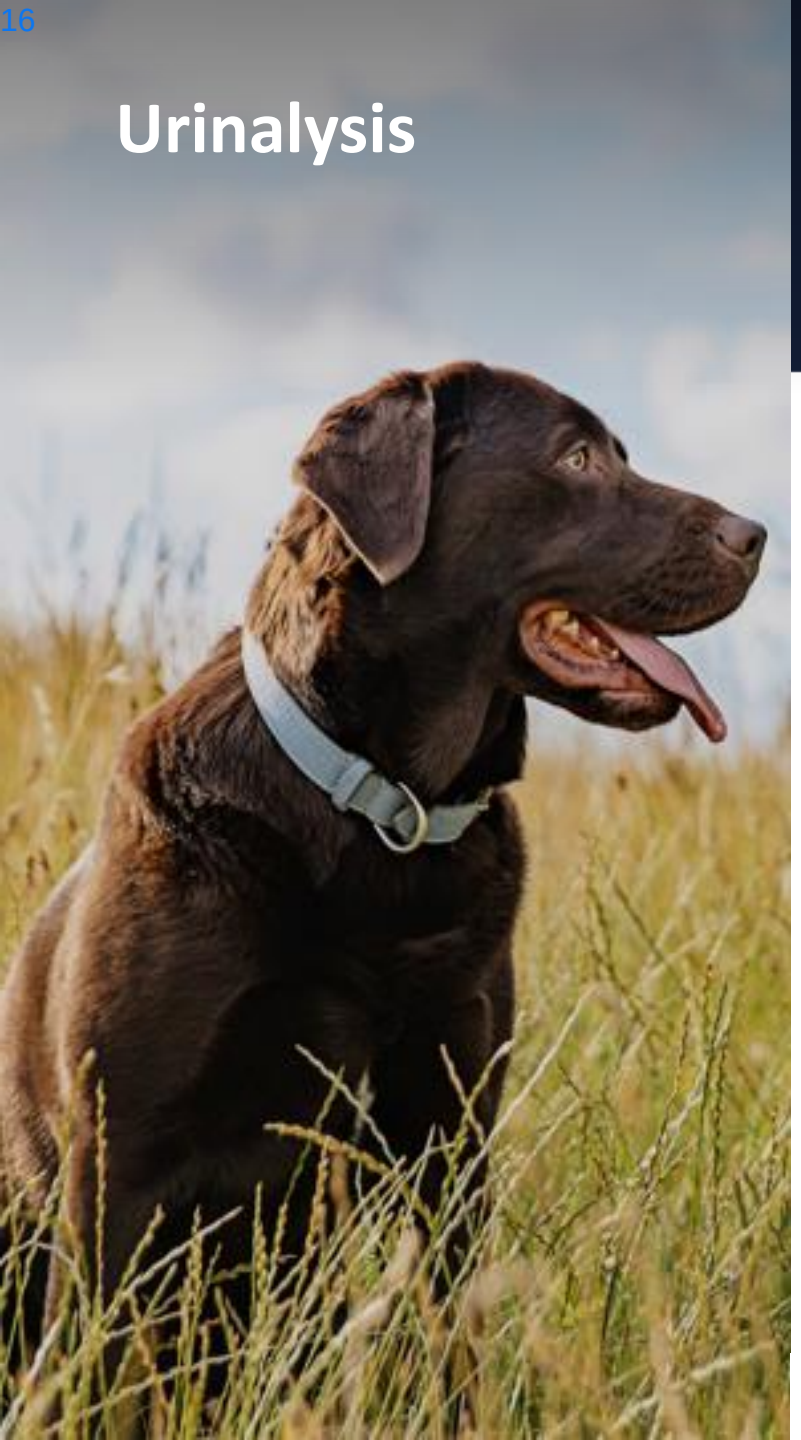
VVC Vegas

Chemistry (cont.)



TEST	RESULT	REFERENCE VALUE	
Glucose	112	74 - 143 mg/dL	
Creatinine	1.1	0.5 - 1.8 mg/dL	
BUN	25	7 - 27 mg/dL	
BUN: Creatinine Ratio	22		
Phosphorus	5.0	2.5 - 6.8 mg/dL	
Calcium	10.0	7.9 - 12.0 mg/dL	
Sodium	**133**	**144 - 160 mmol/L**	L
Potassium	**5.9**	**3.5 - 5.8 mmol/L**	H
Na: K Ratio	22		
Chloride	**97**	**109 - 122 mmol/L**	L

Urinalysis



	Collection	FREE-CATCH
	Color	Yellow
	Clarity	Cloudy
	Specific Gravity	1.017
	pH	7.0
	Urine Protein	c. NEGATIVE
	Glucose	NEGATIVE
	Ketones	NEGATIVE
	Blood / Hemoglobin	TRACE
	Bilirubin	NEGATIVE
	Urobilinogen	d. NORMAL
	White Blood Cells	0-2
	Red Blood Cells	2-5
	Bacteria	NONE SEEN
	Epithelial Cells	RARE (0-1)
	Mucus	NONE SEEN
	Casts	NONE SEEN
	Crystals	3+ CALCIUM OXALATE DIHYDRATE (21-50)/HPF

VMC Vegas

Resting cortisol is helpful for ruling out hypoadrenocorticism

Screening test

- \+ Inexpensive (hopefully)
- \+ Easy on the patient (sample and stress)
- \+ Logistically easier to run
- \+ **Meant to rule out the disease**

Sources
- Hess RS. Hypoadrenocorticism. In: Ettinger SJ, Feldman EC, Côté E, eds. *Ettinger's Textbook of Veterinary Internal Medicine Expert Consult*. Vol 2. 9th ed. Elsevier; 2024:2036–2045.
- Van Lanen K, Sande A. Canine hypoadrenocorticism: pathogenesis, diagnosis, and treatment. *Top Companion Anim Med*. 2014;29(4):88–95. doi:10.1053/j.tcam.2014.10.001

Resting cortisol is helpful for ruling out hypoadrenocorticism

Baseline cortisol

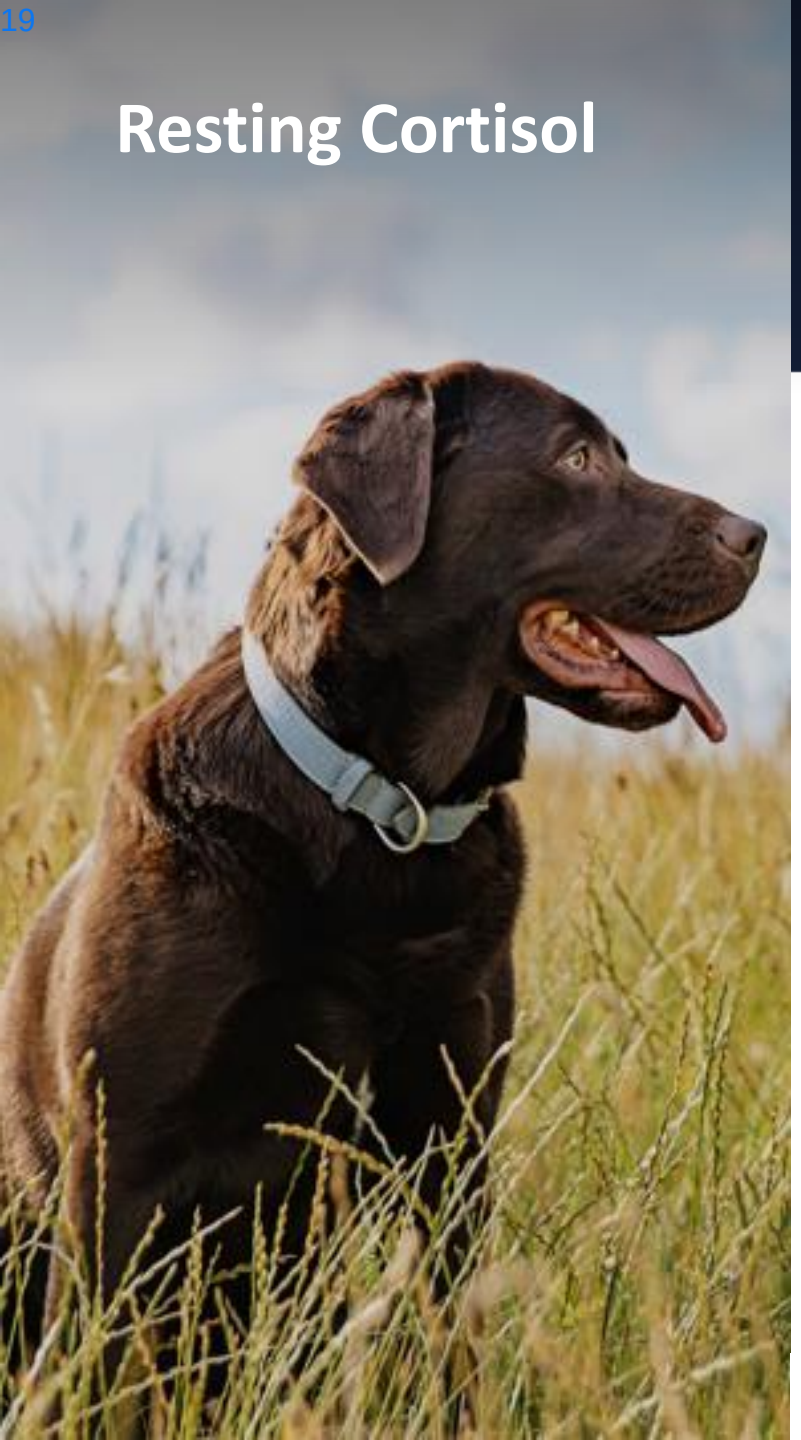
< 2 µg/dL is the cutoff

< 1 µg/dL increases suspicion significantly

< 3 µg/dL is not uncommon in dogs with primary GI disease

Sources
- Hess RS. Hypoadrenocorticism. In: Ettinger SJ, Feldman EC, Côté E, eds. *Ettinger's Textbook of Veterinary Internal Medicine Expert Consult*. Vol 2. 9th ed. Elsevier; 2024:2036–2045.
- Van Lanen K, Sande A. Canine hypoadrenocorticism: pathogenesis, diagnosis, and treatment. *Top Companion Anim Med*. 2014;29(4):88–95. doi:10.1053/j.tcam.2014.10.001

Resting Cortisol



Endocrinology

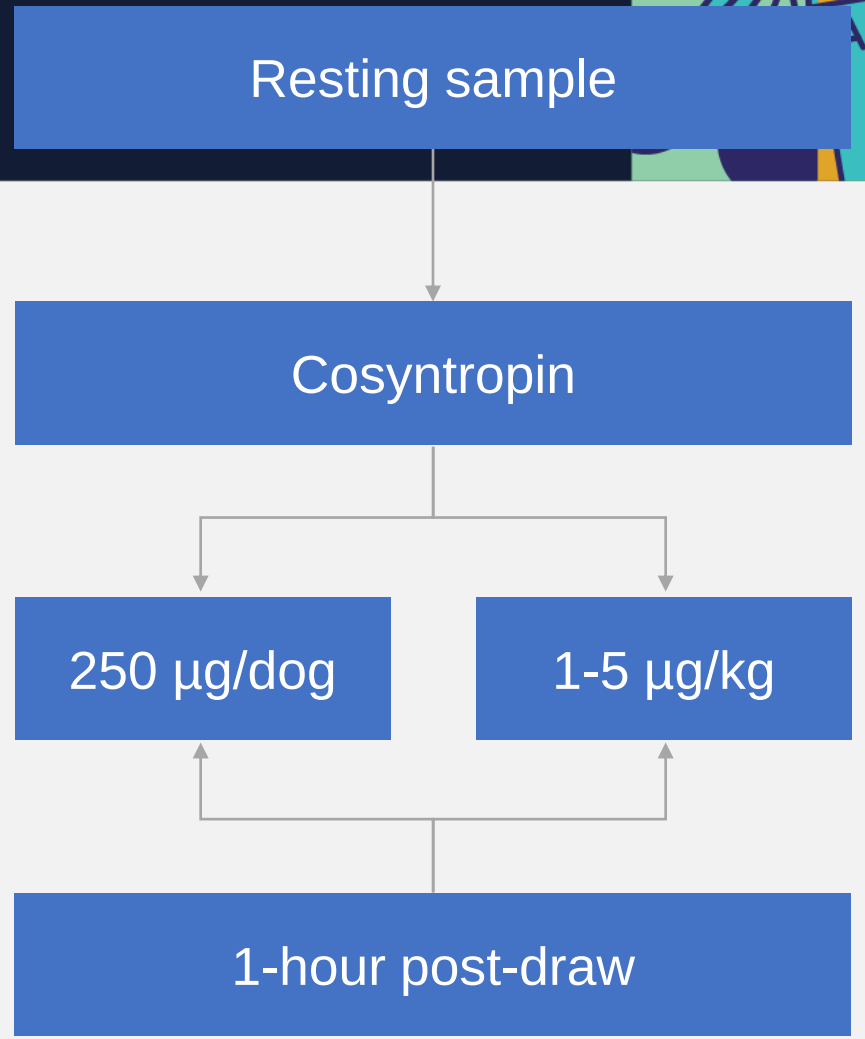
8/29/25 **9:35 AM**

TEST	RESULT	REFERENCE VALUE
Cortisol - Resting	<0.50	µg/dL

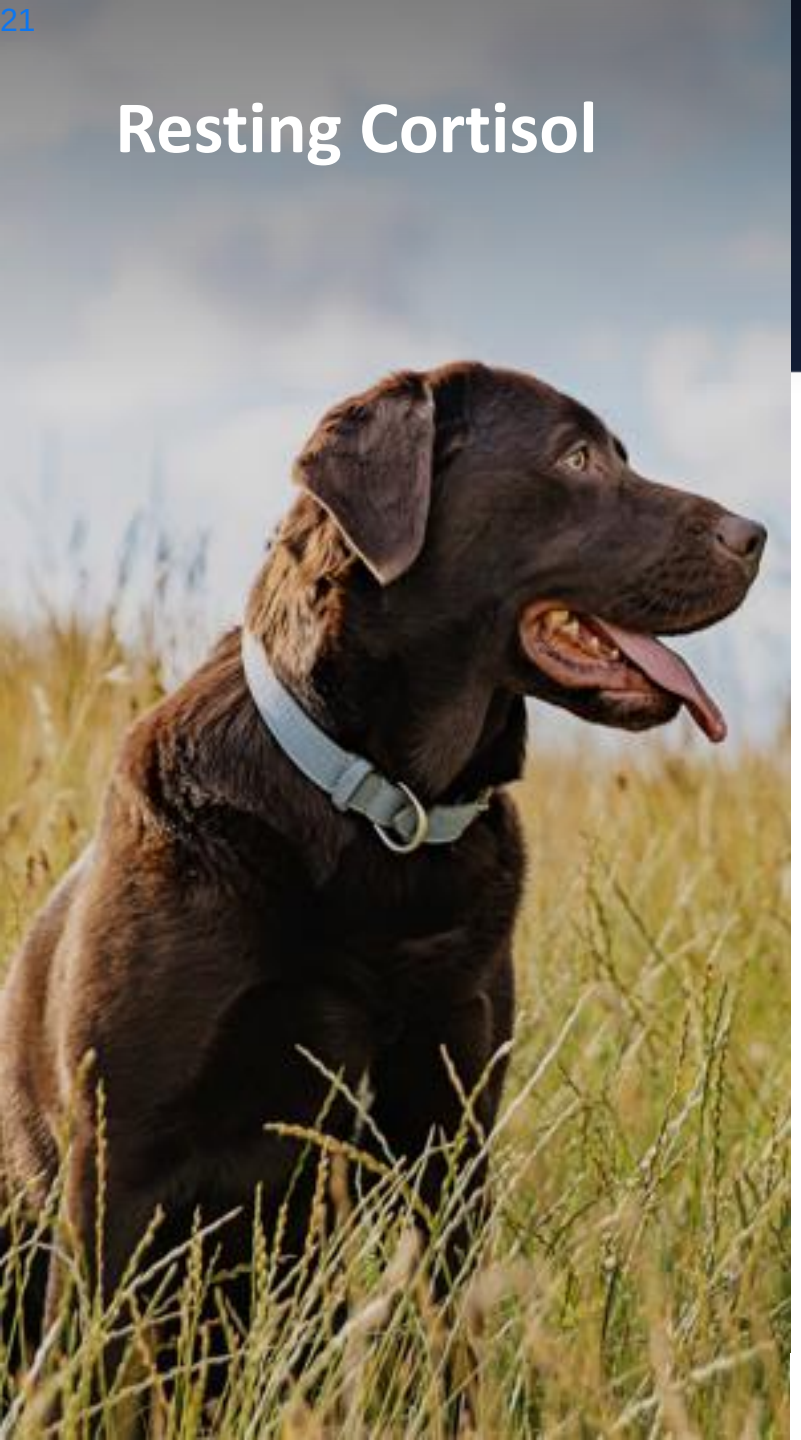
VIVC Vegas

ACTH stimulation test is required for diagnosis

- An ACTH stimulation test should always be performed to confirm the diagnosis if the resting cortisol is < 2 µg/dL



Resting Cortisol



Endocrinology

TEST	RESULT	REFERENCE VALUE
Cortisol - Resting	<0.50	µg/dL

Endocrinology

TEST	RESULT	REFERENCE VALUE
Cortisol - Post ACTH	<0.50	µg/dL

IVC Vegas

Time to get creative!!

Cushing’s Syndrome

Then and now…

Cushing's disease, Hypercortisolism	Cushing's syndrome
Pituitary-dependent Cushing's	ACTH-dependent Cushing's syndrome
Adrenal-dependent Cushing's	ACTH-independent Cushing's syndrome
Atypical Cushing's disease	Subdiagnostic Cushing's syndrome*

*Can be ACTH-dependent or ACTH-independent

Source: European Society of Veterinary Endocrinology. Project ALIVE: Table of terms. Accessed June 20, 2025. www.esve.org/alive/search.aspx

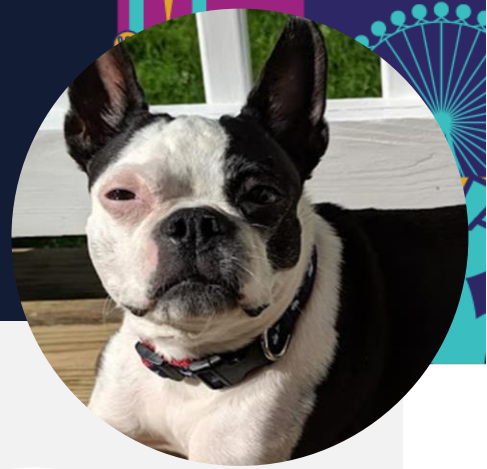
Called Cushing's syndrome for a reason

- Clinical syndrome due to chronic glucocorticoid excess
- More false positives if screen wrong patient
- Higher pretest probability of disease with:
  - Multiple supportive clinical and laboratory signs: typical plus…

Meet Loretta

- 13-year-old, spayed female Boston terrier
- **History**
  - Presented for senior exam
  - Hair loss on tip of tail
  - Potentially PU/PD

Physical exam



Quiet

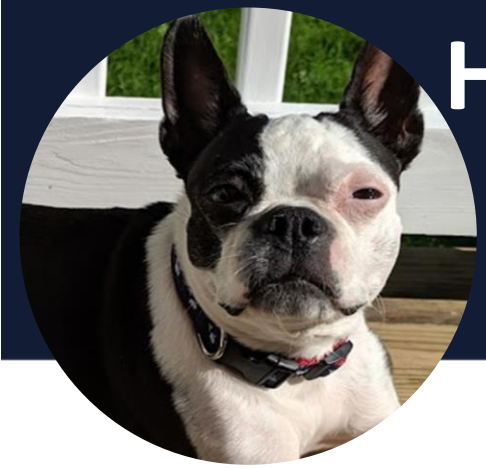
Alert

Responsive

Truncal alopecia

Muscle loss

Pot-belly and hepatomegaly



Hematology

Hematology

2/14/20 (Order Received)
2/14/20 8:21 AM (Last Updated)

TEST	RESULT	REFERENCE VALUE	
RBC	7.49	5.39 - 8.70 M/µL	
Hematocrit	50.9	38.3 - 56.5 %	
Hemoglobin	17.1	13.4 - 20.7 g/dL	
MCV	68	59 - 76 fL	
MCH	22.8	21.9 - 26.1 pg	
MCHC	33.6	32.6 - 39.2 g/dL	
% Reticulocytes	1.2	%	
Reticulocytes	90	10 - 110 K/µL	
Reticulocyte Hemoglobin	24.7	22.3 - 29.6 pg	
WBC	6.7	4.9 - 17.6 K/µL	
% Neutrophils	81.8	%	
% Lymphocytes	11.4	%	
% Monocytes	6.5	%	
% Eosinophils	0.3	%	
% Basophils	0.0	%	
Neutrophils	5.481	2.94 - 12.67 K/µL	
Lymphocytes	**0.764**	**1.06 - 4.95 K/µL**	L
Monocytes	0.436	0.13 - 1.15 K/µL	
Eosinophils	**0.02**	**0.07 - 1.49 K/µL**	L
Basophils [a]	0	0 - 0.1 K/µL	
Platelets	**472**	**143 - 448 K/µL**	H

Chemistry

Chemistry

2/14/20 (Order Received)
2/14/20 8:21 AM (Last Updated)

TEST	RESULT	REFERENCE VALUE	
Glucose	**127**	**63 - 114 mg/dL**	H
IDEXX SDMA [a]	4	0 - 14 µg/dL	
Creatinine	0.7	0.5 - 1.5 mg/dL	
BUN	16	9 - 31 mg/dL	
BUN: Creatinine Ratio	22.9		
Phosphorus	4.0	2.5 - 6.1 mg/dL	
Calcium	9.9	8.4 - 11.8 mg/dL	
Sodium	151	142 - 152 mmol/L	
Potassium	4.6	4.0 - 5.4 mmol/L	
Na: K Ratio	33	28 - 37	
Chloride	108	108 - 119 mmol/L	
TCO2 (Bicarbonate)	26	13 - 27 mmol/L	
Anion Gap	22	11 - 26 mmol/L	
Total Protein	6.0	5.5 - 7.5 g/dL	
Albumin	3.5	2.7 - 3.9 g/dL	
Globulin	2.5	2.4 - 4.0 g/dL	
Albumin: Globulin Ratio	1.4	0.7 - 1.5	
ALT	111	18 - 121 U/L	
AST	27	16 - 55 U/L	
ALP	**1,278**	**5 - 160 U/L**	H
GGT	6	0 - 13 U/L	
Bilirubin - Total	0.1	0.0 - 0.3 mg/dL	
Bilirubin - Unconjugated	0.0	0.0 - 0.2 mg/dL	
Bilirubin - Conjugated	0.1	0.0 - 0.1 mg/dL	
Cholesterol	239	131 - 345 mg/dL	
Creatine Kinase	**268**	**10 - 200 U/L**	H

Urinalysis

Urinalysis

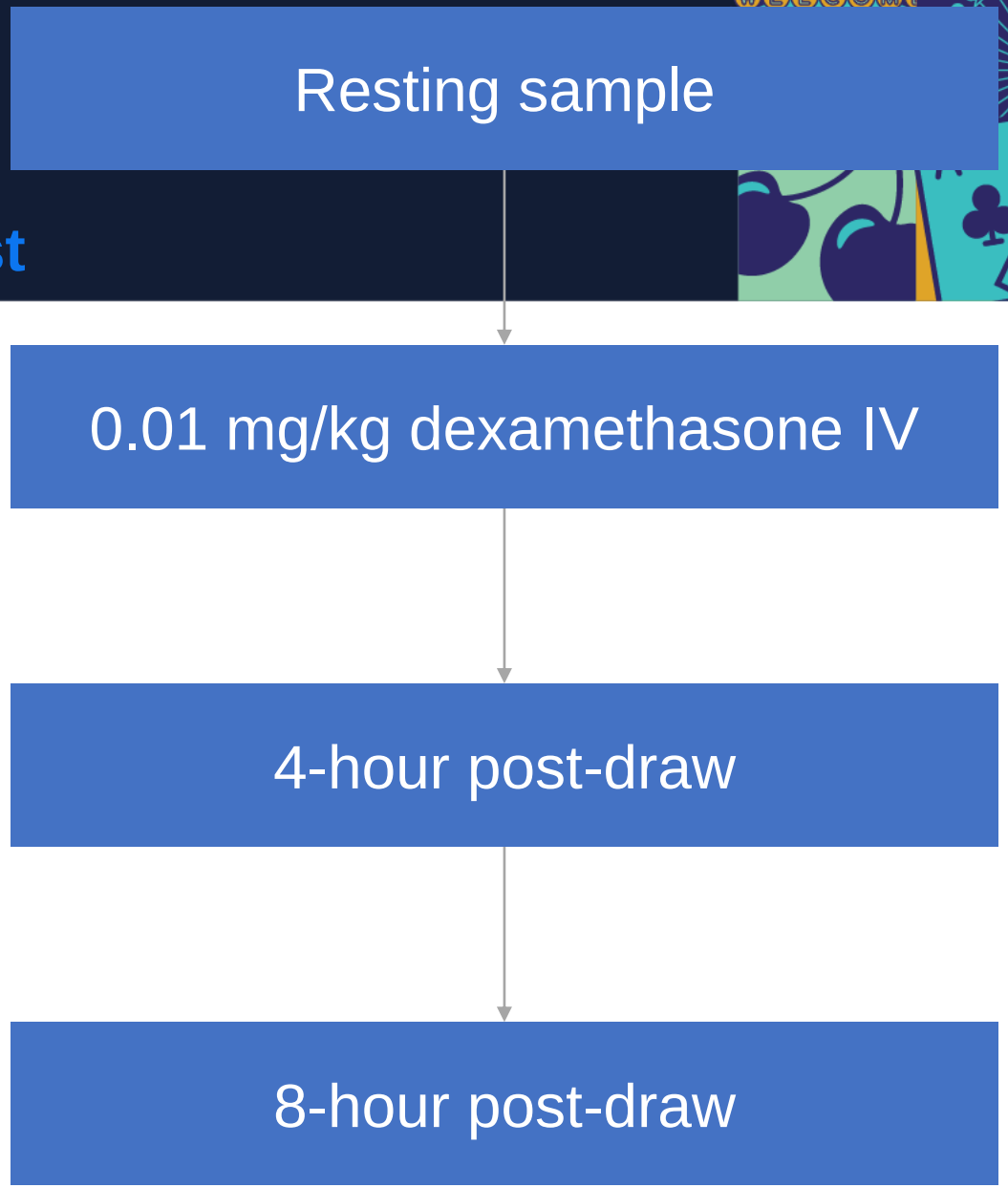
2/14/20 (Order Received)
2/14/20 8:21 AM (Last Updated)

TEST	RESULT	REFERENCE VALUE
Collection	FREECATCH	
Color	YELLOW	
Clarity	CLEAR	
Specific Gravity	1.026	
pH	8.0	
Urine Protein	NEGATIVE	
Glucose	NEGATIVE	
Ketones [a]	TRACE	
Blood / Hemoglobin	NEGATIVE	
Bilirubin	NEGATIVE	
Urobilinogen	NORMAL	
Leukocyte Esterase		
White Blood Cells	0-2	0 - 5 HPF
Red Blood Cells	0-2	HPF
Bacteria	NONE SEEN	

Dynamic testing is **REQUIRED** for diagnosis

Low-dose dexamethasone suppression test

- PREFERRED test to diagnose and *may* differentiate as well
- Reported sensitivity **85%–100%**
- Reported specificity **44%–73%**
- **Don’t want to start on a lifelong and expensive treatment if unsure of diagnosis**

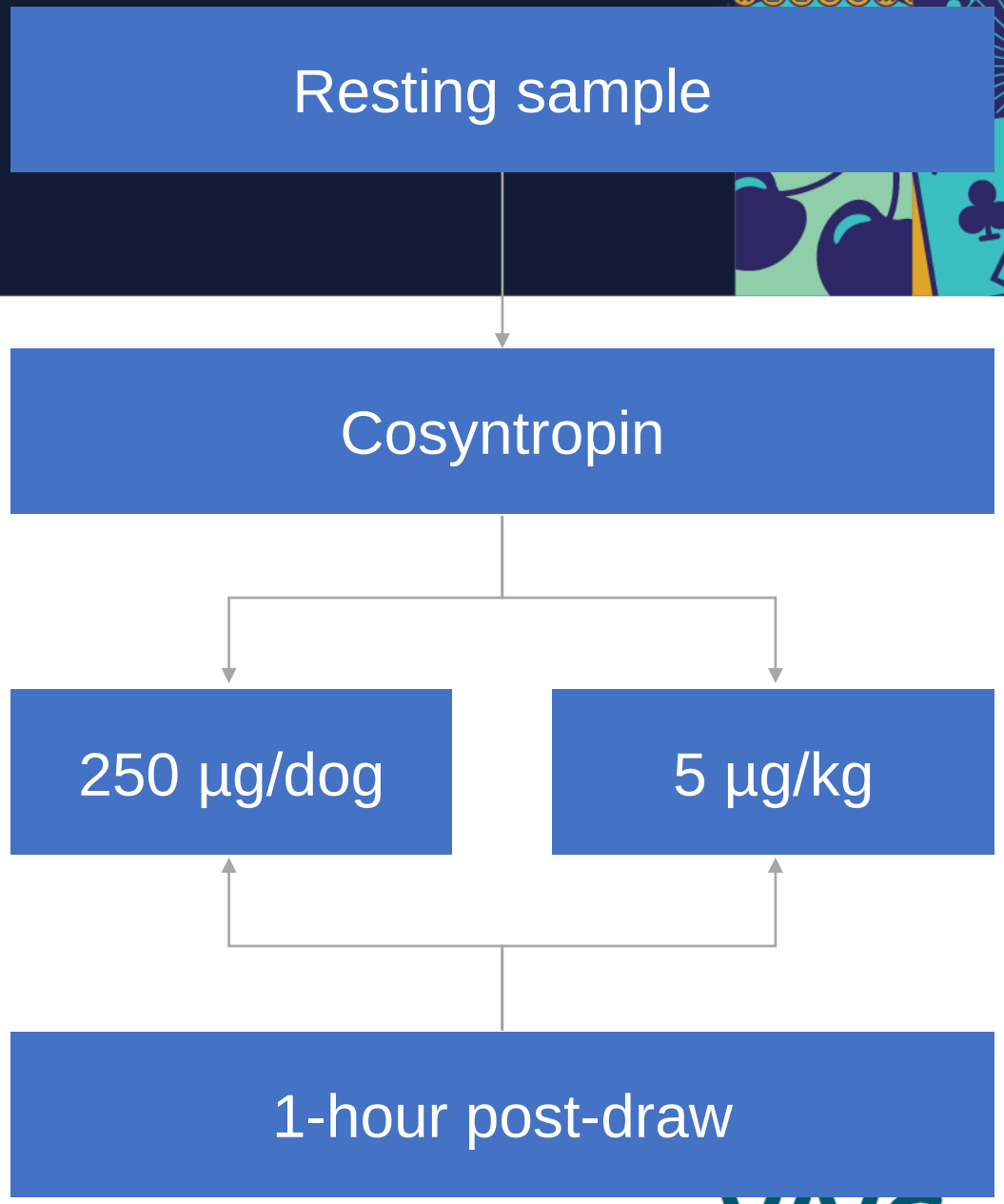


Source: Galac S. Hyperadrenocorticism (Cushing’s syndrome) in dogs. In: Ettinger SJ, Feldman EC, Côté E, eds. *Ettinger's Textbook of Veterinary Internal Medicine Expert Consult*. Vol 2. 9th ed. Elsevier; 2024:2004–2021.

Dynamic testing is **REQUIRED** for diagnosis

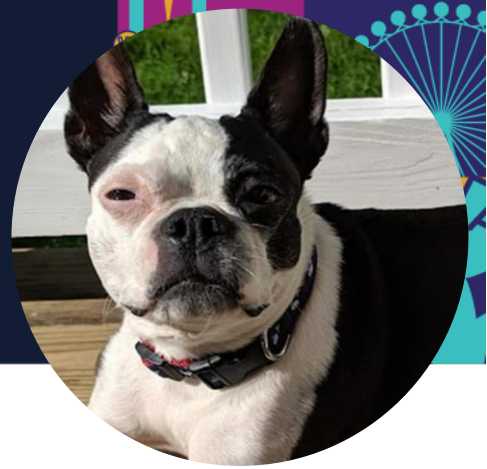
ACTH stimulation test

- Will not differentiate PDH from ADH
- May be preferred option if the animal is sick, the LDDST is equivocal or there is iatrogenic Cushing's syndrome
- Reported sensitivity: PDH **80%–83%**; ADH **57%–63%**
- Reported specificity: **59%–63%**
- Don't want to start on a lifelong and expensive treatment if unsure of diagnosis



Source: Galac S. Hyperadrenocorticism (Cushing's syndrome) in dogs. In: Ettinger SJ, Feldman EC, Côté E, eds. *Ettinger's Textbook of Veterinary Internal Medicine Expert Consult*. Vol 2. 9th ed. Elsevier; 2024:2004–2021.

Low-dose dexamethasone suppression test



Endocrinology

2/21/20
2:52 AM

Cortisol - Baseline	b	3.7	1.0 - 6.0 µg/dL
Cortisol - 4 hr Post Dex		5.6	µg/dL
Cortisol - 8 hr Post Dex	c	6.1	µg/dL

Differentiation tests for Cushing's syndrome

Differentiating

- High-dose dexamethasone suppression test
- Endogenous ACTH
- Advanced imaging

- Run differentiating test only after positive screen
- Important because treatment and prognosis differ for PDH and ADH

Source: Galac S. Hyperadrenocorticism (Cushing's syndrome) in dogs. In: Ettinger SJ, Feldman EC, Côté E, eds. *Ettinger's Textbook of Veterinary Internal Medicine Expert Consult*. Vol 2. 9th ed. Elsevier; 2024:2004–2021.

Questions?