Training will be started at 10:10 AM(GMT +2)

Please chat us or speak if you would need any assistance

All participants would be muted to eliminate noise while presentation

BIONOTE

Vcheck

T4 & TSH

Thyroid function tests

BIONOTE Marketing team

Mar. 2020

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Vcheck T4 & TSH

- Thyroid Hormones (T4, T3, TSH)
- The Thyroid Feedback Mechanism

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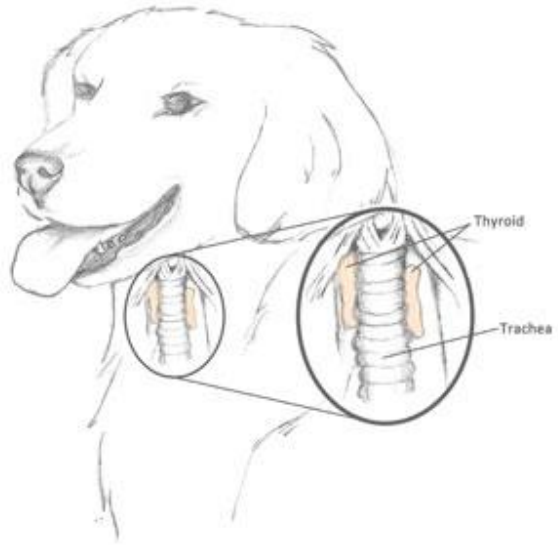
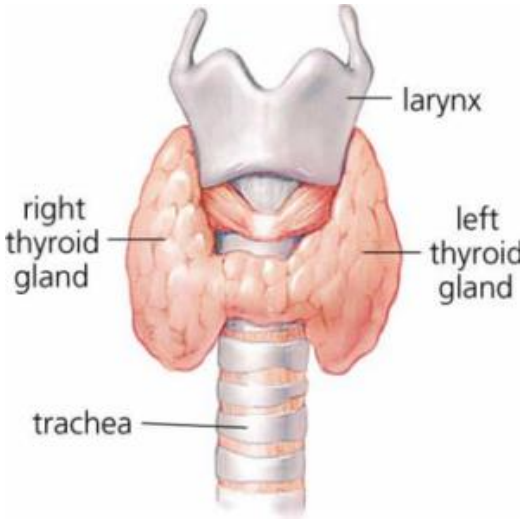
Vcheck T4 & TSH

Thyroid gland





- The thyroid glands are paired structures located along the trachea, about halfway down the neck of dogs.
- These glands produce thyroxin, a hormone that regulates the body's metabolism.

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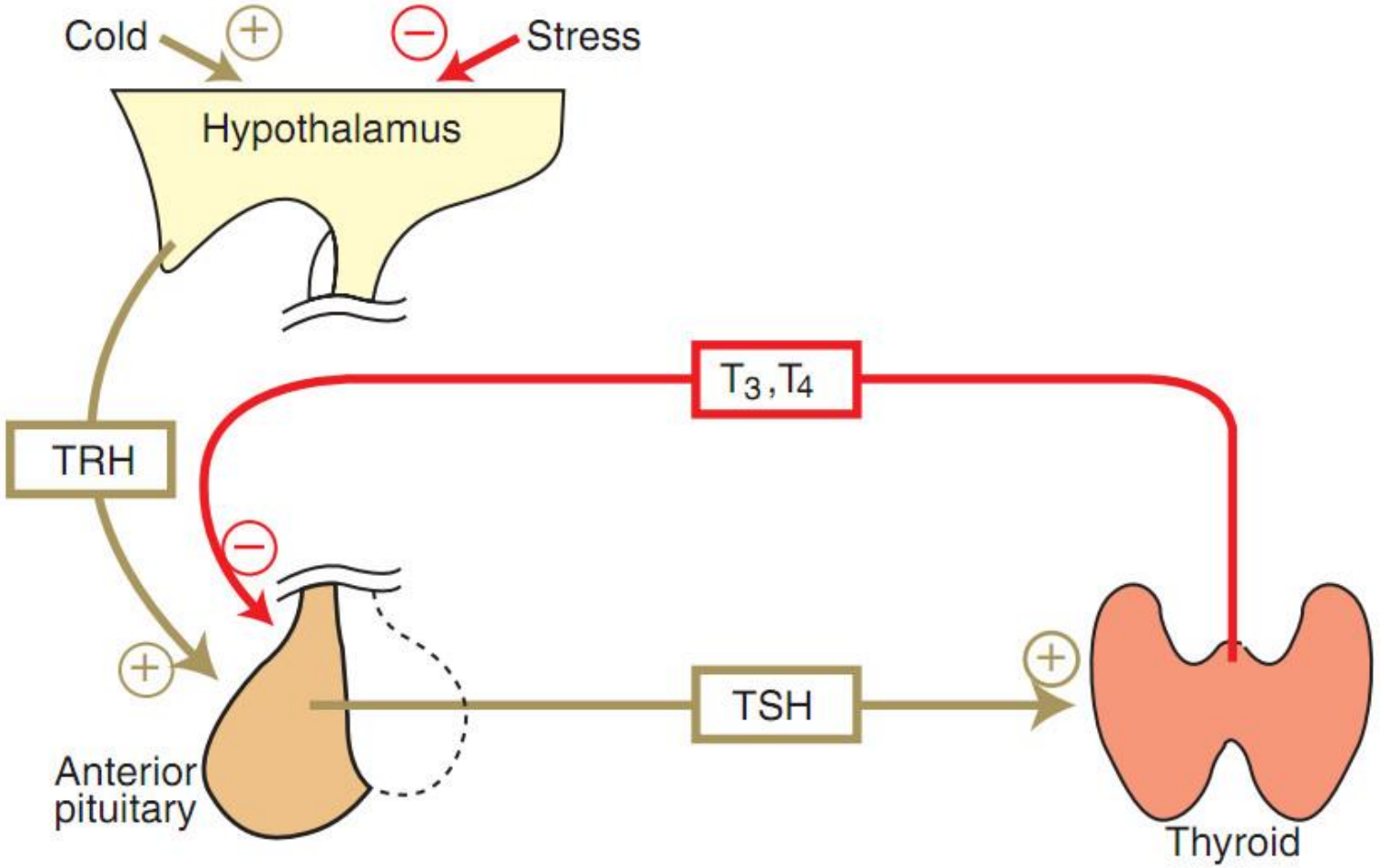
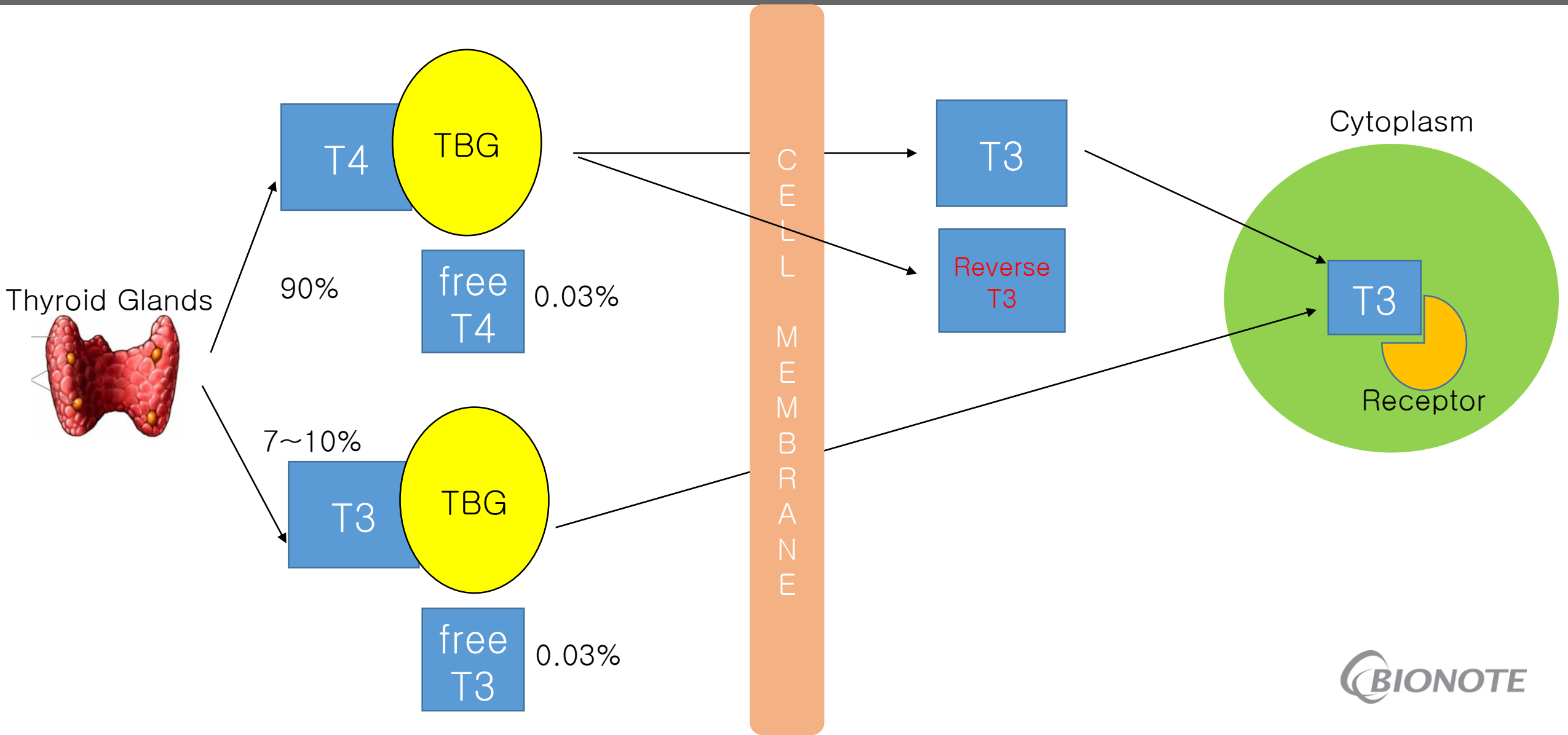
Thyroid gland

- Negative feedback



Vcheck T4 & TSH

Thyroid Hormones



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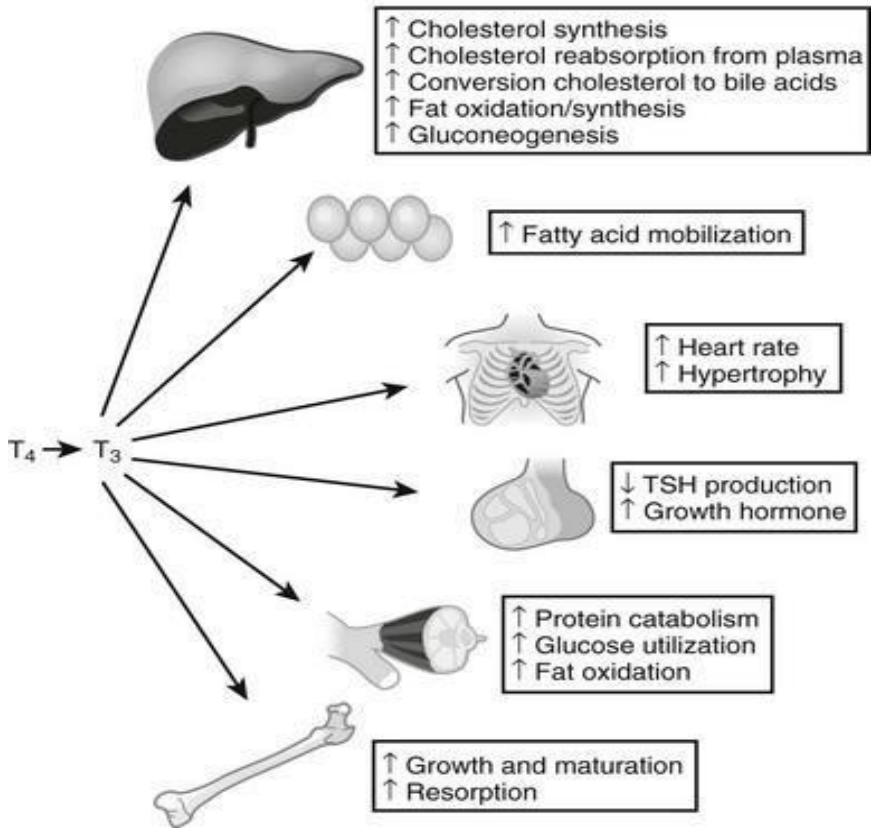
Effects of thyroid hormone



- ✓ Thyroid hormones are the primary factors for the control of basal metabolism.
- ✓ Thyroid hormone is important for the normal regulation of metabolic rate and activity in many tissues.

- Canine hypothyroidism is the common disease related to thyroid function in dogs.
- Feline hyperthyroidism is the most common endocrine disease affecting old cats.

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Vcheck T4 & TSH

Canine hypothyroidism

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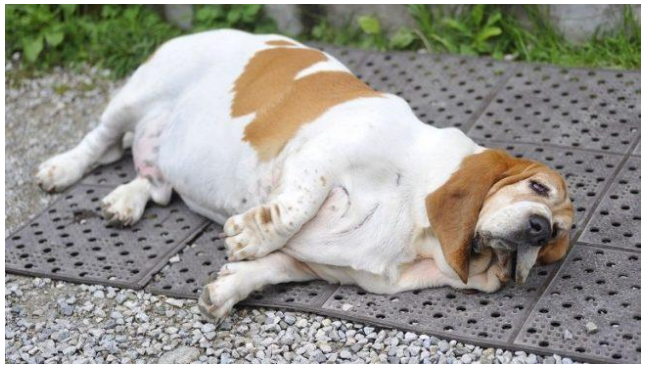
Vcheck T4 & TSH

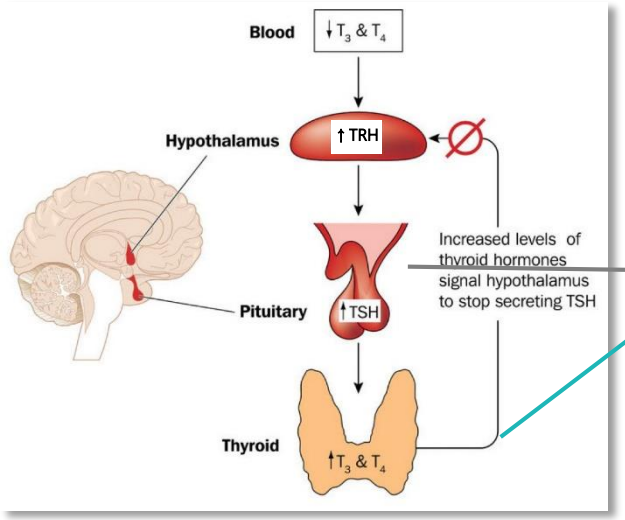
Canine Hypothyroidism

(Picture Credit: Getty Images)



Hypothyroidism in dogs is a disorder where the thyroid gland in the neck doesn't secrete enough thyroxine, a hormone that controls metabolism.

- One of the most common canine endocrine diseases
- Low concentrations of thyroid hormones (T4, T3) in the blood
- Results from impaired production and secretion of thyroid hormone



- Primary (Thyroidal) hypothyroidism (95%)
  - ✓ Due to destruction of the thyroid gland itself
  - ✓ Idiopathic atrophy of the thyroid, lymphocytic thyroiditis
- Secondary (Pituitary) hypothyroidism (<5%)
  - ✓ Impaired ability of the pituitary gland to secrete TSH
  - ✓ Anterior pituitary dysfunction, destruction from neoplasia

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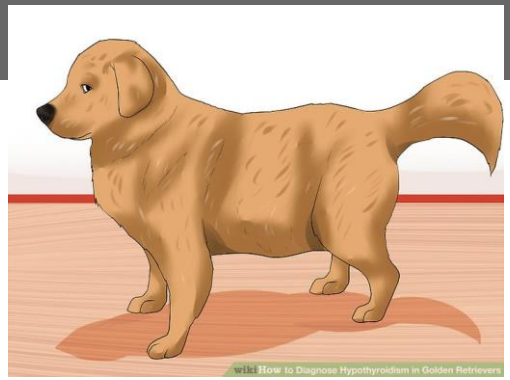
Vcheck T4 & TSH

Canine Hypothyroidism

✓ Signalment

- Age
  - Middle-aged
  - Mean age 7 years, with a range of 4-10 years
- Breed
  - **Large breed dogs** (Golden Retrievers, Doberman Pinchers)
  - Rare in miniature and toy breeds
- Sex
  - **Either sex at about the same rate**
  - Neutraled males and females have higher risk than intact ones.



▲ Hypothyroidism in Golden Retrievers

Several breeds are genetically predisposed to the disorder, including …

Airedale Terriers	Golden Retrievers
Boxers	Greyhounds
Cocker Spaniels	Irish Setters
Dachshunds	Labrador Retrievers
Doberman Pinschers	Miniature Schnauzers

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Vcheck T4 & TSH

Canine Hypothyroidism

✓ Clinical signs

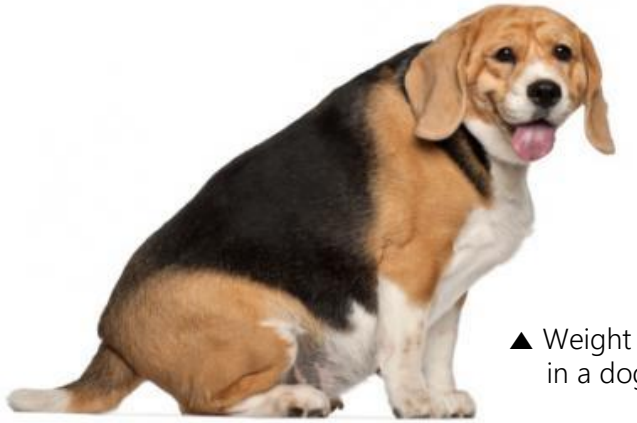
An underactive thyroid affects so many bodily functions that rely on thyroxine.

⇒ Symptoms of the disorder vary widely

Hallmark sign

- Lack of energy
- Frequent napping
- Exercise intolerance
- Loss of interest in running and playing
- Weight gain without increase in appetite or calorie intake
- Low tolerance for the cold
- Dull, dry, brittle, thin or greasy coat
- Hair loss or failure to regrow clipped hair

▲ Hair loss in a dog with hypothyroidism



▲ Weight gain without increase in appetite in a dog with hypothyroidism

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Canine Hypothyroidism

Never base a diagnosis on a single test result!

✓ Diagnosis ①

Based on a combination of clinical signs, physical examination, CBC, biochemistry, test of thyroid gland function.

- Haematology
  - Mild normocytic, normochromic, non-regenerative anemia (~4-50%)
- Serum Biochemistry
  - Hypercholesterolemia (75%)
  - Mild elevations in liver enzymes (ALP, ALT)

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Vcheck T4 & TSH

Canine Hypothyroidism

Never base a diagnosis on a single test result!

✓ Diagnosis ②

Based on a combination of clinical signs, physical examination, CBC, biochemistry, test of thyroid gland function.

Thyroid Function Tests

- **Serum Total T4** (TT4)
  - A good screening test (high sensitivity)
  - Low specificity especially in the presence of concurrent disease

    ⇒ Increases markedly if used in conjunction with endogenous TSH analysis

- **Serum TSH** (Thyroid Stimulating Hormone)
  - **Primary hypothyroidism**: Low T4 & High TSH
  - Poor sensitivity

    ⇒ Approaches 100% in combination with a low fT4 or TT4

- **Serum Free T4** (fT4)
  - Measures unbound fraction of T4
  - Influenced less by euthyroid sick syndrome

[Mechanism]

As thyroid hormone production drops,

⇒ Negative feedback

⇒ TSH levels secreted will be increased in response.

Vcheck T4 & TSH

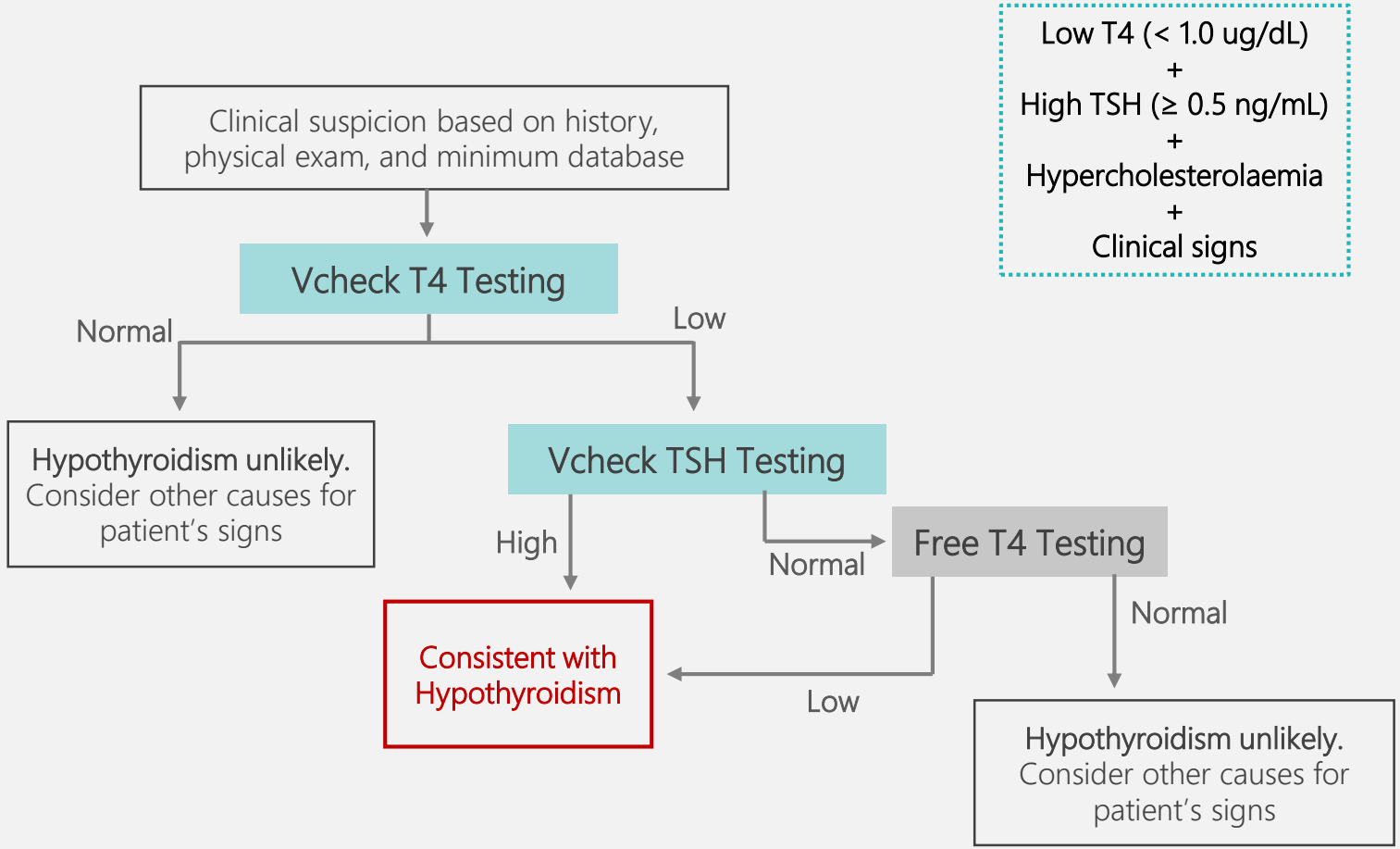
Canine Hypothyroidism

✓ Diagnosis ②

Thyroid Function Tests

- T4 + TSH combination test is mandatory for diagnosis of canine Hypothyroidism.

* A stepwise approach is helpful in accurately diagnosing canine hypothyroidism



Vcheck T4 & TSH

Canine Hypothyroidism

✓ Diagnosis ②

Thyroid Function Tests

Additional test (Ex. Free T4) is warranted in the following scenarios:

- If serum T4 is <1.0 ug/dL, but hypercholesterolaemia and clinical signs are absent.
- If severe systemic illness is present and the potential for ESS is high.
- If drugs known to decrease serum T4 concentration are being administered (prednisolone, phenobarbitone, etc).

What Is Euthyroid Sick Syndrome (ESS) ?

✓ Thyroid gland is secondarily affected by disease in some other organ system

- Other endocrine diseases (Hyperadrenocorticism. Diabetes mellitus)
- Liver, cardiac, renal, pancreatic, lung etc. (Cardiomyopathy, demodicosis, hepatitis, infections, renal failure)

✓ So, the diagnosis of hypothyroidism should never be based on a hormone assay alone, but depends on a large range of findings

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Vcheck T4 & TSH

Canine Hypothyroidism

✓ Diagnosis ②

Thyroid Function Tests

- T4 + TSH combination test is mandatory for diagnosis of canine Hypothyroidism.
- Combination of elevated serum TSH and decreased T4 or fT4 has a specificity of 98% for diagnosis of hypothyroidism

Thyroid Tests	T4 Normal	T4 Decreased
cTSH Normal	• Euthyroid * End thyroid investigation	• Non-thyroidal illness (NTI) • Drugs • 20% of hypothyroid dogs
cTSH Increased	• Sulfonamide treatment • Recovery from NTI * Withdraw drug Tx and retest * Wait until recovery complete and retest	• Hypothyroid * Treat with T4 therapy

→ Perform further tests (Ex. free T4) for accurate diagnosis!

→ Diagnosis of hypothyroidism in dogs

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Vcheck T4 & TSH

Canine Hypothyroidism

Considerations

- Greyhounds, Scottish deerhounds: have low T4 levels naturally

  ⇒ Diagnose based on clinical signs as well as test results; treat if clinically evident.

- Remember sick animals and animals on certain medications (anti-epileptics) may have depressed T4 levels. (Euthyroid sick syndrome) ⇒ Wait and re-test after treatment of underlying cause if clinical signs persist.

- Several medications have been demonstrated to lower the serum T4 concentration of dogs.

Drugs That Alter Canine Thyroid Hormone Function or Test Results

- ✓ Prednisone (high dose)
- ✓ Phenobarbital
- ✓ Trimethoprim–sulfamethoxazole
- ✓ Aspirin (high dose)
- ✓ Clomipramine
- ✓ Thyroxine supplementation

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Vcheck T4 & TSH

Canine Hypothyroidism

Case Study-1

- Signalment
  - **Age**: 11 year-old
  - **Sex**: Castrated Male
  - **Breed**: Cocker spaniel
- Chief Complaint
  - Lethargy, Dull
  - Dermatologic lesion (Alopecia)
- Tests Performed
  - Physical examination
  - CBC & Serum chemistry
  - Thyroid hormones testing

▲ 11Y, Castrated Male

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Vcheck T4 & TSH

Canine Hypothyroidism

Case Study-1

*Test Results

- Hormone test
- CBC: mild anemia
- Serum Chemistry

Name	Reference	Result
Total T4	1.0-4.0	<0.5
fT4	0.6-3.7	<0.3
TSH	0.05-0.42	1.08

Name	Reference	Result	Name	Reference	Result
ALB	2.9-4.2	2.6	ALKP	15-127	791
ALT	19-100	293	AST	0-50	97
GGT	0-6	55	T-bil	0-0.4	0.4
TP	5.4-7.4	6.8	Ca	7.8-12.0	8.8
CRE	0.8-1.6	0.85	Chol	135-345	>520
GLU	70-118	99	TriG	10-100	178
BUN	8-31	14	Phos	3-6.2	3.2

▲ 11Y, Castrated Male

- Final Diagnosis
  - Canine Hypothyroidism
- Treatment
  - Levothyroxine 0.02 mg/kg bid PO

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Vcheck T4 & TSH

Feline hyperthyroidism

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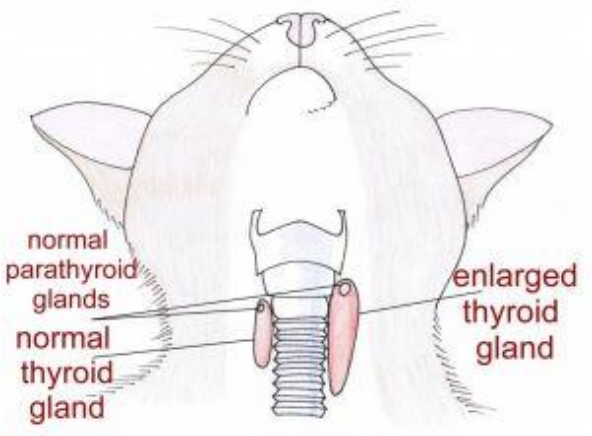
Vcheck T4 & TSH

Feline Hyperthyroidism

Hyperthyroidism is one of the most commonly diagnosed diseases of the older cat.

- The most **common endocrinopathy** of older cats.
- Increase in production of thyroid hormones (T3, T4) from an enlarged thyroid gland
- Bilateral (70%) / Unilateral (30%)

- **Cause**: unknown
  - **Possible contributing factors**: deficiencies or excesses of certain compounds in the diet and chronic exposure to thyroid-disrupting chemicals in food or the environment



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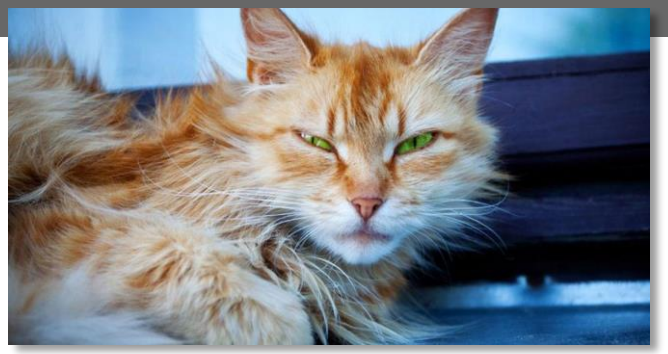
Vcheck T4 & TSH

Feline Hyperthyroidism



▲ Feline Hyperthyroidism

✓ Signalment

- **Age**
  - Older than 8 years (Most)
  - Mean age: 12–13 years
- **Breed**
  - Siamese and Himalayan breeds are at decreased risk
- **Sex**
  - Either sex at about the same rate
  - Neutraled males and females have higher risk than intact ones.
- **Risk Factor**
  - Consumption of tinned cat food (especially fish or liver and giblet flavour)
  - The use of cat litter

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Vcheck T4 & TSH

Feline Hyperthyroidism

▲ Weight loss in a cat with hyperthyroidism

✓ Clinical signs

Develops a variety of signs that may be subtle at first but that become more severe as the disease progresses.

Hallmark sign

- Weight loss
- Increased appetite
- Hyperactivity and Aggression

- Vomiting (up to 30% of cases)
- Diarrhea
- Increased thirst and urination (PU/PD)
- Unkempt, matted, or greasy coat

◀ The thin, unkempt appearance of a cat with hyperthyroidism.

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Vcheck T4 & TSH

Feline Hyperthyroidism

Never base a diagnosis on a single test result!

✓ Diagnosis ①

Based on a combination of clinical signs, physical examination, CBC, biochemistry, test of thyroid gland function.

- Physical examination
  - Palpation of the cat's neck area to check for an enlarged thyroid gland
  - Thyroid gland enlargement is palpable in 90 % of cases.

- Ophthalmoscopic examination
  - Reveals evidence of hypertension with retinal vessel engorgement and rarely retinal detachment.

▲ Palpation for an enlarged thyroid gland

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Vcheck T4 & TSH

Feline Hyperthyroidism

Never base a diagnosis on a single test result!

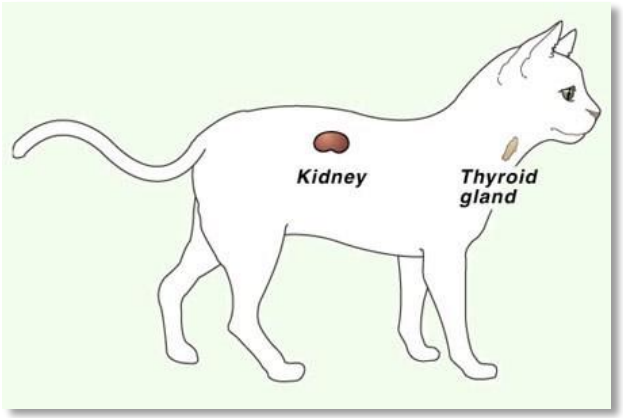
✓ Diagnosis ②

Based on a combination of clinical signs, physical examination, CBC, biochemistry, test of thyroid gland function.

- Haematology
  - Increased haematocrit (40–50% of cases)
  - Some might show a stress leukogram.

- Serum Biochemistry
  - Increased ALT, ALP (more than 75% of cases)
  - Hyperphosphataemia (20% of cases)
  - Increased BUN, Creatinine

  * Concomitant renal disease is common in older cats.



▲ Concurrent Hyperthyroidism and Chronic Renal Failure in Older Cats

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Feline Hyperthyroidism

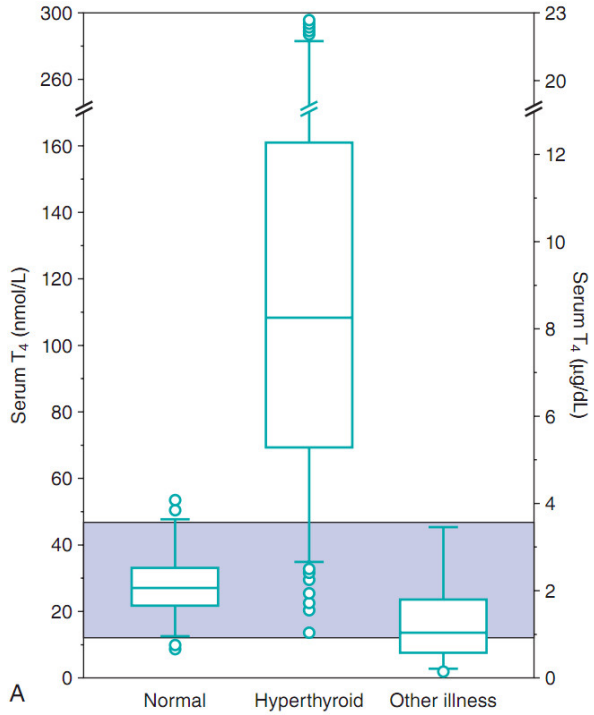
✓ Diagnosis ③

Thyroid Function Tests

The best screening test for the diagnosis of hyperthyroidism is the total T4 (TT4) concentration.

- **Serum Total T4** (TT4)
  - The best screening test (high sensitivity)
  - An increased Total T4 is specific for hyperthyroidism
  - However, false negative results may occur with non-thyroidal illness(NTI) (e.g., CKD). ⇒ **Repeat the test in two weeks**

- **Serum free T4** (fT4)
  - More sensitive compared to total T4
  - However, More false positive results



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Vcheck T4 & TSH

Feline Hyperthyroidism

✓ Diagnosis ③

Thyroid Function Tests

Clinical signs?
(Weight loss despite good appetite, palpable thyroid nodule)

Vcheck T4
Measures serum total T4

T4 clearly high
(> 4.7 ug/dL)

T4 high-normal
(3.4 - 4.7 ug/dL)

T4 normal
(3.4 - 4.7 ug/dL)

Diagnosis of Hyperthyroidism

- Identify and treat any non-thyroidal illness
- Recheck total T4 in 2 weeks

T4 high-normal

Free T4 or TSH testing

T4 normal

- Recheck total T4 in 6 months

** Diagnostic approach to a cat*
With suspected hyperthyroidism

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Vcheck T4 & TSH

Feline Hyperthyroidism

✓ Diagnosis ③

Thyroid Function Tests

What if the results are border line?

- The simplest approach
  ① Wait 2 weeks
  ② Retest the T4 concentrations again

- With some chronic concomitant diseases,
  - T4 concentration depressed into the upper normal range (by the principal of the sick euthyroid syndrome)
    ⇒ Elevated free T4 + other classic clinical findings

Euthyroid sick syndrome

- ✓ Geriatric cats with hyperthyroidism may also have concurrent chronic kidney disease (CKD).

- ✓ Concurrent chronic kidney disease (CKD)
  - Depresses thyroid hormone concentrations
  - ⇒ making it more difficult to diagnose hyperthyroidism

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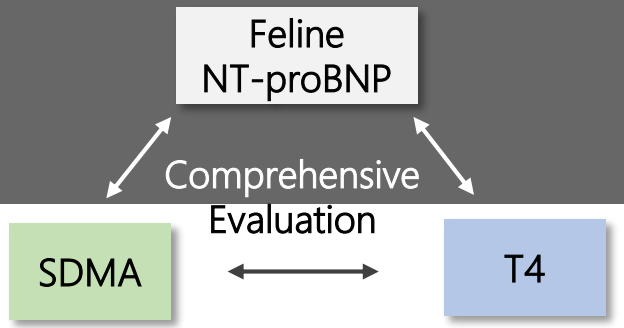
Vcheck T4 & TSH

Feline Hyperthyroidism



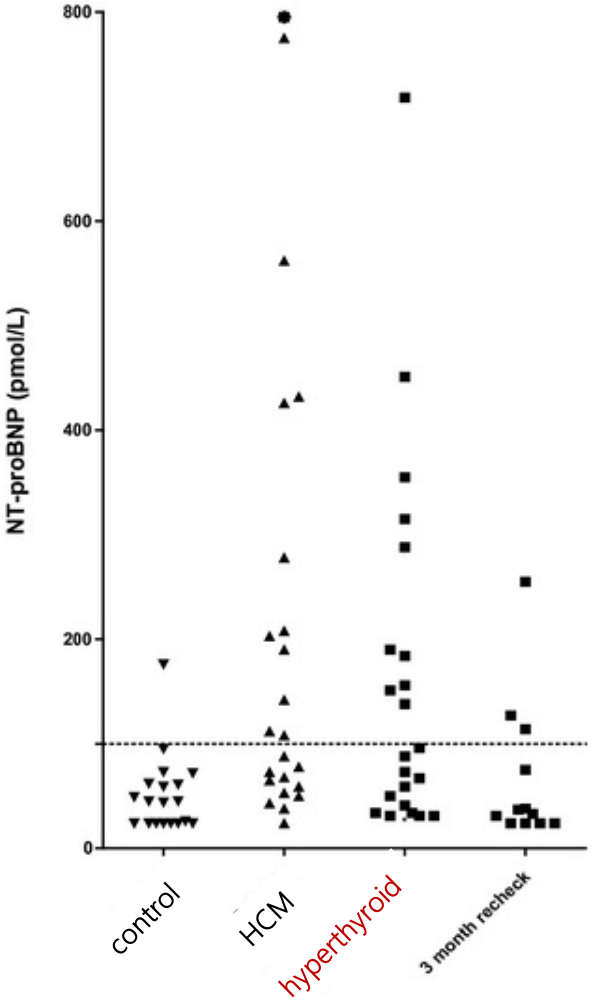
Considerations

- SDMA: Hyperthyroidism can mask the diagnosis of concurrent chronic kidney disease (CKD)
  - ✓ Increases glomerular filtration rate (GFR) in cats with CKD

    ⇒ Reductions in BUN Creatinine, SDMA levels ⇒ Makes it more difficult to detect concurrent CKD
  - ✓ CKD will become apparent after treatment of the hyperthyroidism. ⇒ Retesting for CKD should be performed in 2-3 months.

- NT-proBNP: No differences between hyperthyroid cats and cats with HCM
  - ✓ Cardiovascular abnormalities in hyperthyroid cats :
    - Diverse and comprise subtle, clinically inconsequential myocardial changes
    - (+) Severe changes that can be associated with development of heart failure.

    ⇒ Myocardial abnormalities resolve after treatment in many cats, but persist in others.
  - ✓ Hyperthyroid cats with increased NT-proBNP with echocardiographic abnormalities should be re-evaluated ≥3 months after resolution of hyperthyroidism.



Vcheck T4 & TSH

Feline Hyperthyroidism

Case Study

- Signalment
  - **Age**: 10 year-old
  - **Sex**: Sprayed female
  - **Breed**: Korean shorthair cat
- Chief Complaint
  - Weight loss for 1 year
  - Aggression increased
- Tests Performed
  - Physical examination
  - CBC & Serum chemistry
  - Electrolyte
  - Thyroid hormones testing (T4)
  - Auscultation
  - NT-ProBNP testing
  - Ultrasonography

▲ 10Y, Sprayed female, Korean shorthair cat

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Vcheck T4 & TSH

Feline Hyperthyroidism

Case Study

- Tests Results
  - **Palpation**: No enlarged thyroid gland
  - **CBC**: mildly increased HCT
  - **Auscultation**: No murmur
  - **Serum chemistry**: Increased ALT 272 (10-100)
  - **NT-ProBNP**: negative result
  - **Ultrasonography**: No enlarged thyroid gland (3mm)
  - **Total T4**: 6.6 ug/ml (0.8-4.7)

- Final Diagnosis
  - **Feline Hyperthyroidism**

▲ 10Y, Sprayed female, Korean shorthair cat

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Product Introduction

- Vcheck T4
- Vcheck TSH

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Product Introduction

Vcheck T4

Specifications

- **Species:** Dog, Cat
- **Sample:** Serum 50 µl
- **Testing Time:** 20 min.
- **Measuring Range:** 0.5~8 µg/dL (6.44~102.96 nmol/L)

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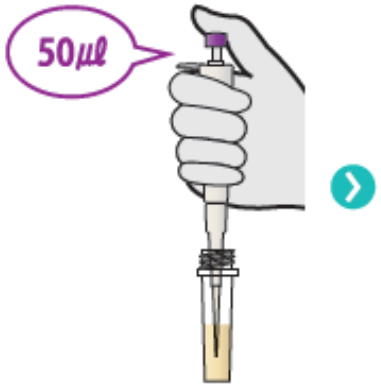
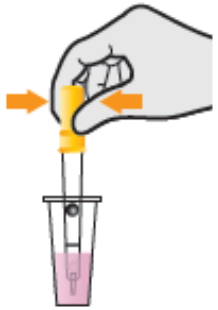
Product Introduction

Vcheck T4

Test procedure

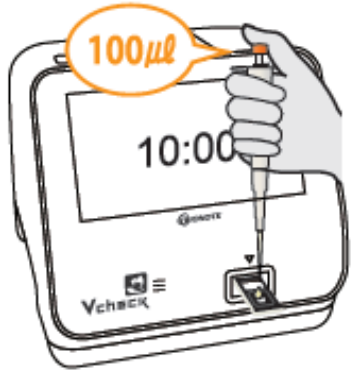


Draw 50 µl of serum and add it into an assay diluent tube



Mix over 8 times until the tablet is completely dissolved

Wait 10 minutes for incubation



Add 100 µl of mixture

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Vcheck T4

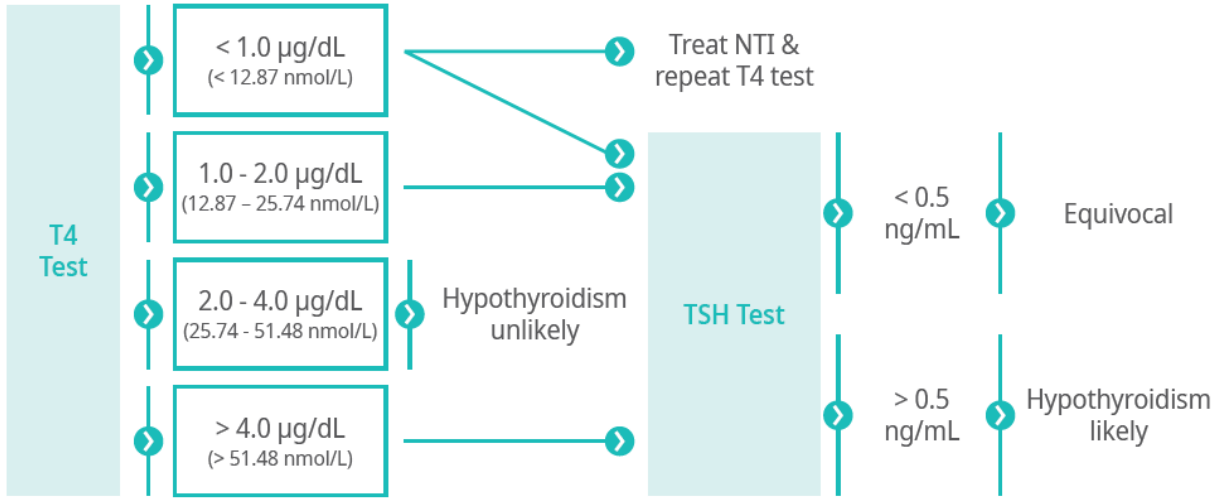
Result Interpretation (Dog)

Diagnosis of Canine hypothyroidism and treatment monitoring

< 1.0 μg/dL (< 12.87 nmol/L)	1.0~2.0 μg/dL (12.87 – 25.74 nmol/L)	1.0~4.0 μg/dL (12.87 - 51.48 nmol/L)	> 4 μg/dL (> 51.48 nmol/L)	2.1~5.4 μg/dL (27.03 – 69.50 nmol/L)
Low	Low normal	Normal	High	Therapeutic

* 1 μg/dL is equal to 12.87 nmol/L

Diagnosis & Monitoring



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Vcheck T4

Result Interpretation (Cat)

Diagnosis of Feline hyperthyroidism and treatment monitoring

< 0.8 µg/dL (< 10.30 nmol/L)	0.8~4.7 µg/dL (10.30 – 60.49 nmol/L)	2.3~4.7 µg/dL (29.60 – 60.49 nmol/L)	> 4.7 µg/dL (> 60.49 nmol/L)
Low	Normal	Gray zone	Consistent with hyperthyroidism

* 1 µg/dL is equal to 12.87 nmol/L

Diagnosis & Monitoring

T4 Test

< 0.8 µg/dL (< 10.30 nmol/L)	Euthyroid sick or iatrogenic
0.8 - 2.3 µg/dL (10.30 – 29.60 nmol/L)	Hyperthyroidism unlikely
2.3 - 4.7 µg/dL (29.60 – 60.49 nmol/L)	Additional tests including free T4 suggested
> 4.7 µg/dL (> 60.49 nmol/L)	Hyperthyroidism likely

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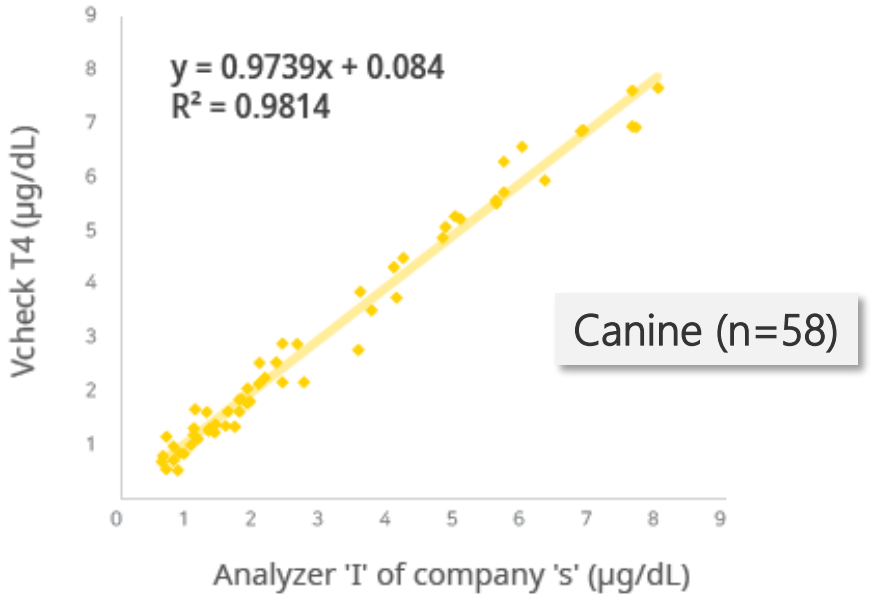
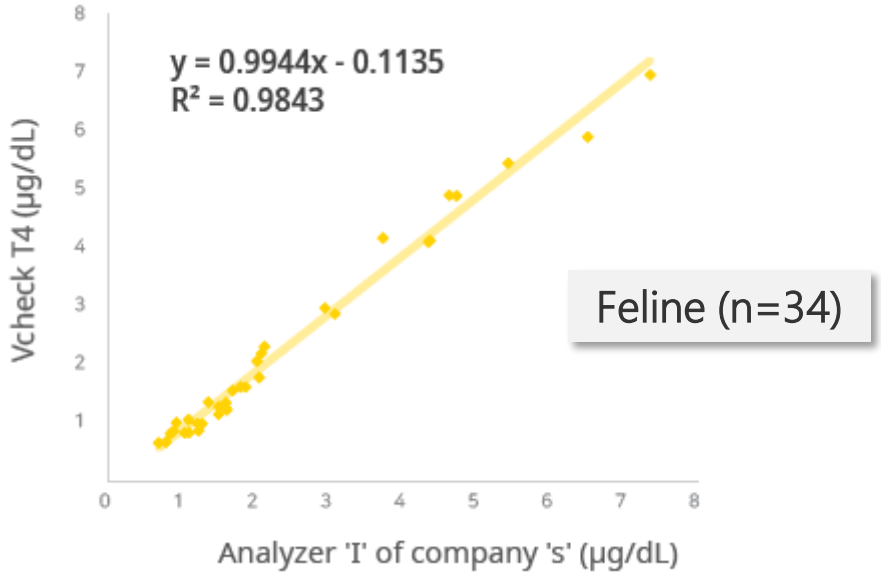
Vcheck T4

Evaluation Data

- Correlation with analyzer 'I' of company 'S'



Canine (n=58)



Feline (n=34)

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Product Introduction

Vcheck TSH

- **Species:** Dog
- **Sample:** Serum 100 µl
- **Testing Time:** 15 min.
- **Measuring Range:** 0.25~5.00 ng/ml
- **Result Interpretation**

< 0.5 ng/ml	>0.5ng/mL
Normal	High

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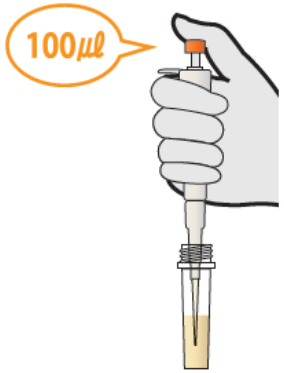
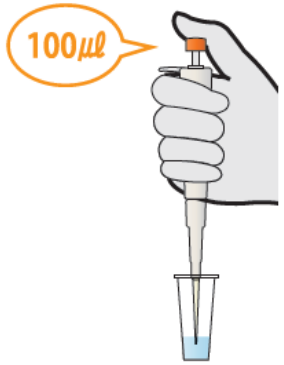
Vcheck TSH

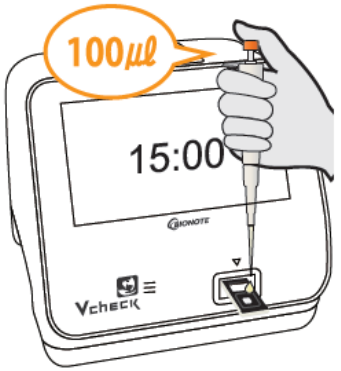
Test procedure



Draw 100 µl of serum and add it into an assay diluent tube



Mix well 5-6 times by using a 100 µl pipetting



Add 100 µl of mixture

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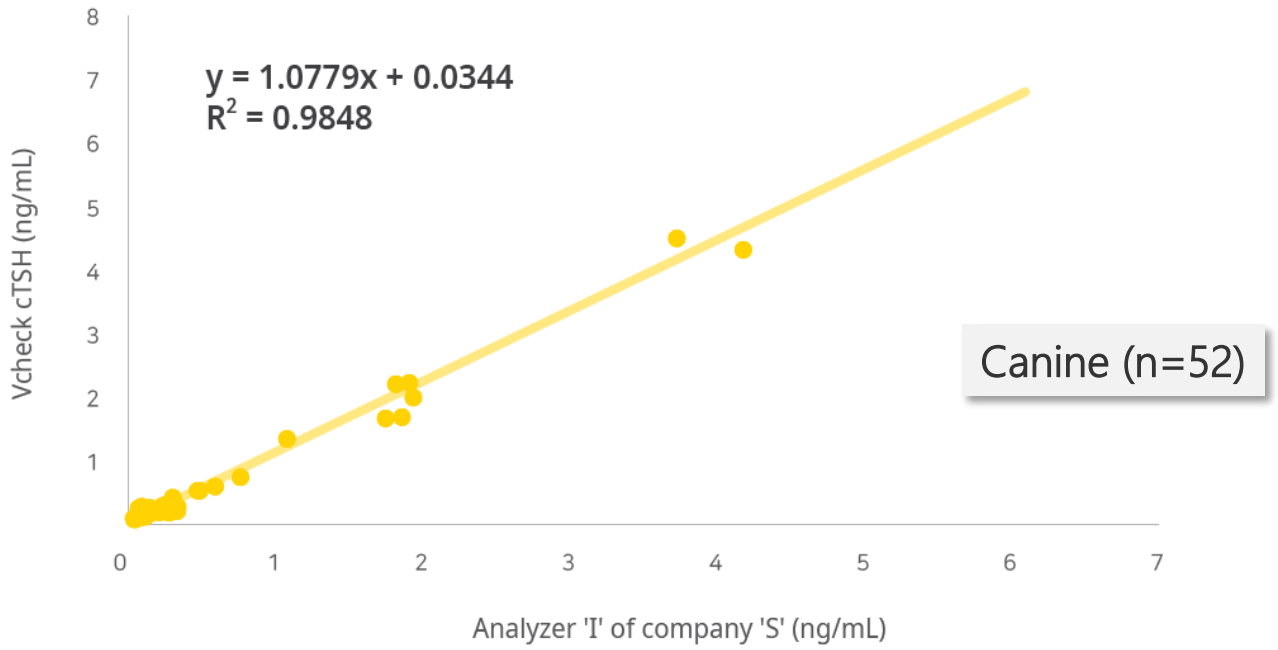
Vcheck TSH

Evaluation Data

- Correlation with analyzer 'I' of company 'S'



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Vcheck TSH

Variation per analyzer

Patient	VCHECK	Laboratory 1	Laboratory 2	Laboratory 3	Laboratory 4
PIES BONO	1,23 µg/dl	2,42 µg/l	X	X	X
PIES ARGO	2,47 µg/l	2,94 µg/l	2,4 µg/l	X	X
PIES LADY	1,29 µg/l	1,78 µg/l	1,55 µg/l	X	X
PIES MAFI	3,5 µg/l	X	2,51 µg/l	X	X
PIES MISIU	5,99 µg/l	4,06 µg/l	3,39 µg/l	5,59 µg/l	X
PIES ISKIERKA	1,45 µg/l	1,57 µg/l	1,58 µg/l	2,28 µg/l	X
PIES LUNA	3,12 µg/l	3,34 µg/l	X	4,35 µg/l	3,4 µg/l
PIES DORA	1,88 µg/l	1,7 µg/l	1,98 µg/l	3,55 µg/l	2,4 µg/l
PIES DROPSIK	2,57 µg/l	2,25 µg/l	1,99 µg/l	3,18 µg/l	X
PIES FIGA	2,94 µg/l	3,24 µg/l	2,94 µg/l	X	X
PIES ROXI	2,42 µg/l	X	2,39 µg/l	X	X
PIES GAGA	2,61 µg/l	2,94 µg/l	2,88 µg/l	4,26 µg/l	2,9 µg/l
PIES BARI	2,4 µg/l	1,69 µg/l	1,67 µg/l	2,55 µg/l	1,7 µg/l
PIES MIMI	2,05 µg/l	1,66 µg/l	1,75 µg/l	2,63 µg/l	1,7 µg/l
PIES MAX	3,28 µg/l	1,79 µg/l	1,77 µg/l	X	1,7 µg/l
PIES HERA	1,38 µg/l	1,38 µg/l	1,53 µg/l	X	1,39 µg/l
PIES NELI	2,25 µg/l	1,48 µg/l	1,6 µg/l	X	1,49 µg/l
PIES LILI	1,51 µg/l	1,57 µg/l	X	2,32 µg/l	1,7 µg/l

- Lab 1,2,3,4 uses same analyzer

  ("I" from company "S")
- Same sample was sent to each laboratory
- Result vary per analyzer

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Thank you for your attention

Any Questions?

BIONOTE Marketing team

Mar. 2020

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