

# Saluki Studies supported by Saluki Health Research, Inc.

prepared by MaryDee Sist, DVM

for the Saluki World Congress in Helsinki, Finland, June 2008

MaryDee Sist, DVM is the President and Director of Saluki Health Research, Inc.; owner/practitioner at the Animal Care Clinic in Williamston, Michigan; Endocrinologist, DCPAH, CVM at Michigan State University; and breeder-owner of Tazi Farm Salukis

I am honored to have been asked to talk about my Saluki Studies in the USA. This will be a brief summary of many years of work done primarily at the College of Veterinary Medicine, Michigan State University, and supported by Saluki Health Research, Inc (SHR).

***My areas of research have included:***

***normal Saluki cardiac parameters and pathology  
cancer incidence***

***complete blood counts in healthy Salukis***

***thyroid hormone values in healthy Salukis***

Handouts are available which go into more detail of the findings in each of the studies. I would like to address your health concerns and hope that you will have questions.

Brian Duggan wrote an article in the *AKC Gazette* that summarized how my research evolved. Salukis became my passion when I got my first in 1974. I was devastated when she died suddenly. The diagnosis was cardiomyopathy, or degeneration of the heart muscle, based on her heart size, which was larger than that of a mixed breed dog of the same weight. Other heart conditions had been diagnosed in Salukis, but not cardiomyopathy, which can be an inherited in Doberman Pinchers, Boxers and Irish Wolfhounds. She was an active courser and it is accepted that conditioned athletes, as well as Greyhounds, could have large hearts that were not diseased. How large of a heart could be normal for a Saluki? The goal was to characterize the normal Saluki heart through auscultation, electrocardiogram (ECG) and ultrasonographic (echo) evaluation by a cardiologist. When compared to mixed breeds, however, many Salukis had changes that could be associated with heart disease and these dogs had to be followed over time to see if these changes were significant.

## SHR, Inc. Mission Statement

*The purpose and goals of the non-profit corporation, Saluki Health Research, Inc. are as follows:*

*"Initiating, sponsoring, supporting, and carrying out veterinary research into diseases and health problems of dogs, with an emphasis of the Saluki breed, including comparing the normal physiological parameters of health or disease in the Saluki and other breeds of dogs, collecting statistical samples and information needed for study and analysis of data, analyzing the frequency and effects of health problems, and reporting on findings through scientific journals and other means that inform dogs fanciers, and raising funds needed to support the organization's work."*



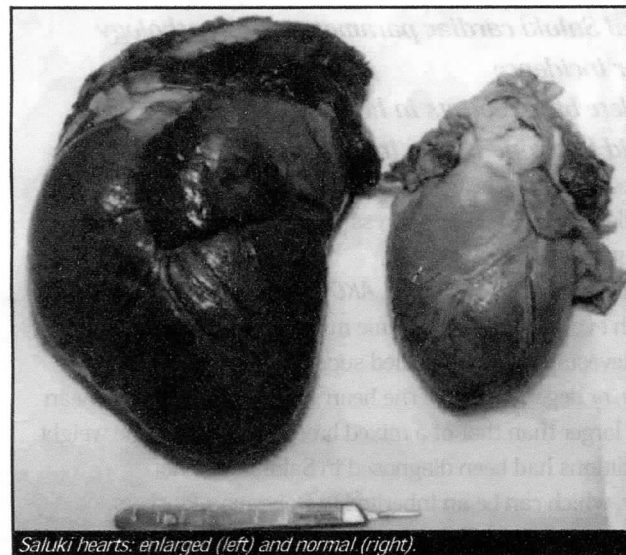
## Saluki Heart Study

In the **Normal Saluki Heart Study**, 100 Salukis were evaluated one to six times over a six-year period by a board certified cardiologist at the College of Veterinary Medicine, MSU. The findings included:

- \* Over 1/3 had a **heart murmur** on auscultation due to abnormal blood flow across the heart valve. Most were soft murmurs and the dogs remained free of heart disease.

- \* Over 1/4 had **arrhythmias**, or an irregular heart rhythm and/or rate on the ECG recording.

- \* Many of the Salukis had **enlarged hearts**, especially the left ventricle, when compared with other breeds of a similar body size.



Saluki hearts: enlarged (left) and normal (right).

- \* Some had **decreased contractility** (% fractional shortening) of the heart muscle during the echo examination.

These changes can be associated with significant valvular heart disease as well as dilated cardiomyopathy in certain breeds.

## Conclusions

- \* Some of these changes were normal for Salukis. Normal measurements derived from mixed breeds do not always apply to the Saluki. They can have "athletic hypertrophy," or enlargement of the heart, especially of the left ventricle.

- \* They have enlarged aortas, which might be a physiological adaptation to the tremendous outflow of blood they need during the "chase."

- \* The presence of a soft murmur or an arrhythmia does not necessarily indicate significant heart disease.

- \* Acquired heart disease, mostly mitral valve insufficiency, was prevalent and increased in severity as the dog aged.

This high incidence of changes found necessitated

pathological examinations to determine their significance, especially as the Salukis aged.

## Saluki Heart Pathology Study

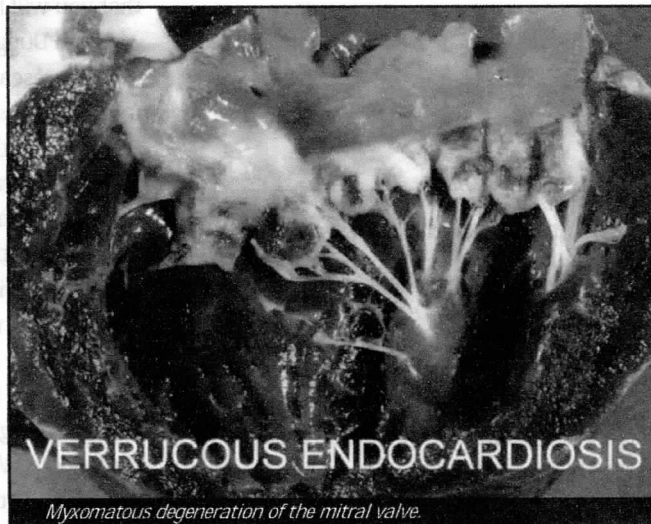
A surprising array of pathological changes were found in the 100 Saluki hearts examined, while few developed clinical signs of heart disease. The cardiac findings and cause of death included:

- \* 52% had **mitral valve insufficiency** due to myxomatous degeneration of the valvular endocardium or verrucous endocardiosis of the left AV valve. These nodular thickenings stop the valve from closing properly and the valve becomes insufficient or leaks. The heart shows compensatory enlargement or dilation as the condition progresses.

Clinically, a heart murmur is present when examined prior to death. While prevalent, the lesions were of sufficient severity to cause the demise of only half of these dogs.

- \* Five Salukis died of **congenital heart valve defects** which had been present since birth.

- \* Only two died of primary **dilated cardiomyopathy**.

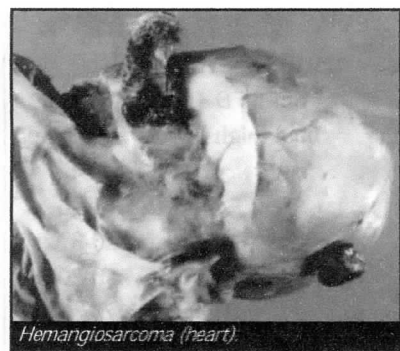


A dilated heart or the presence of an **arrhythmia** does not mean the dog has or will develop cardiomyopathy, but it may cause sudden death. These changes are used to diagnose cardiomyopathy in Dobermans and Boxers.

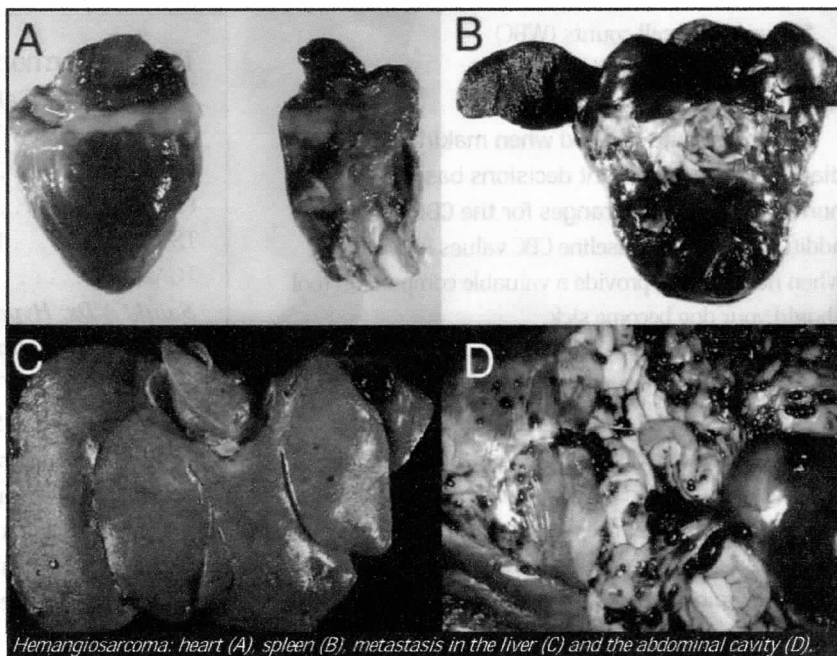
- \* A rare type of vascular cancer, **hemangiosarcoma**, was found in 25% of the Salukis. The photo on the next page shows a ruptured hemangiosarcoma tumor in the atrial appendage, the most common site, and a small metastasis growing in the epicardial surface of the ventricle.

- \* **Sudden death** can often, but not always, be attributed to an arrhythmia or rupture of a hemangiosarcoma.

- \* The most disconcerting finding was that greater than 50% of the Salukis examined had one or more forms of **cancer** contributing to their demise.



Hemangiosarcoma (heart)



Hemangiosarcoma: heart (A), spleen (B), metastasis in the liver (C) and the abdominal cavity (D).

## Saluki Tumor Registry

To assess the types of cancer that are prevalent in our Salukis, SHR, Inc. started a neoplasia, or **tumor registry**. The goal of this ongoing study is to identify and classify tumors that occur in Salukis and bank the DNA for future examination. This study should help explore the frequent types of cancer found in Salukis and provide clues to potential causes and ultimately, early diagnosis, treatment and prevention.

To date, 89 tumor samples have been examined and are what are commonly seen in older dogs. Thirty-three were not cancerous.

**Nearly 1/3 of the samples submitted, from the skin, mammary glands, and spleen, were not malignant and surgical removal was curative.**

Primary hemangiosarcomas were found in five spleens and seven hearts. Metastases were frequently found in the liver, spleen, mesentery and lung showing how often it had spread prior to diagnosis.

The mass size did not influence the prognosis, since most die from blood loss when the mass ruptures.

## Conclusions

Microscopic examination of any growth is needed to determine the prognosis or how the growth will affect the life of your Saluki.

**Hemangiosarcoma continues to be prevalent and confirmed in over 1/3 of the samples submitted.**

These tissue samples, as well as

blood collected from ~300 Salukis, have been banked and will be used in future studies exploring the genome for DNA markers for hemangiosarcoma, as well as other cancers, to potentially identify at risk individuals.

## Autoimmune Disorders

A third area of concern to U.S. Saluki owners was **autoimmune disorders** in which the dog makes antibodies to its own cells.

The most common are: **autoimmune hemolytic anemia** where the red blood cells are destroyed and the dog becomes anemic and **thrombocytopenia** where the platelets are destroyed and the dog bleeds inappropriately. These are life threatening and a routine complete count can be run periodically to screen for

these conditions.

In **autoimmune thyroiditis**, the dog's immune system makes antibodies to thyroglobulin which eventually destroy the thyroid gland and the dog becomes hypothyroid.

These studies were undertaken to see if Salukis again deviated from "normal" reference ranges derived from other or mixed breeds.

## Saluki Complete Blood Count (CBC) Study

One of the most common laboratory tests done is the complete blood count, which measures the indices of red and white cells. CBCs were run on 44 clinically healthy Salukis and, when compared to the mixed breed reference range, showed that Salukis have significantly:

\* higher packed cell volumes (PCV) and hemoglobin (Hb)

### CBC reference ranges

	MSU ref values (n=120)	Saluki ref values (n=44)	Greyhound ref values (n=36)
Hemoglobin (Hb, g/dl) . . . . .	14.1-20.0	15.24-22.22	16.74-22.98
Packed cell volume (PCV, %) . .	43.3-59.3	48.26-70.94	46.0-71.2
White blood cell count . . . . . (WBC, X 1000/uI)	6.02-16.02	3.94-11.02	2.77-13.00



- \* lower white cell counts (WBC)
- \* these changes are similar to what has been found in Greyhounds

**Caution should be used when making a diagnosis and treatment decisions based on non-Saluki reference ranges for the CBC.** In addition, obtaining baseline CBC values for your dog when healthy, can provide a valuable comparison tool should your dog become sick.

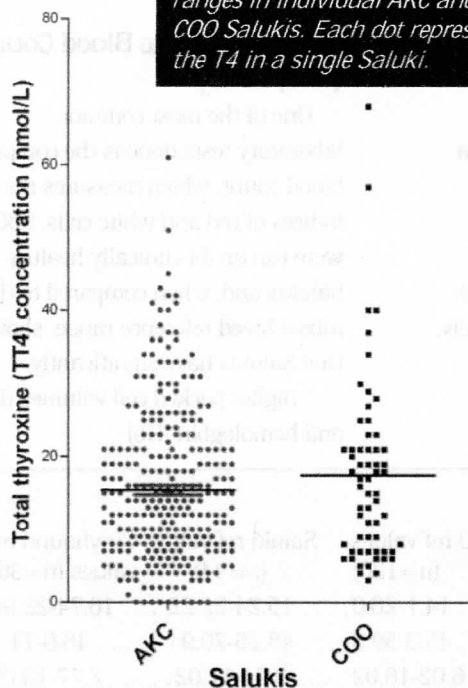
## Saluki Normal Thyroid Study

Hypothyroidism is considered to be the most common endocrine disease of dogs, and is most often the result of inherited autoimmune thyroiditis. Signs of hypothyroidism can be nonspecific and interpretation of thyroid profiles can be complicated by non-thyroidal disease, medications and breed variations.

Blood samples from 335 Salukis were analyzed and compared to the mixed breed reference ranges. Salukis were found to have:

- \* **Lower T4 and free T4 average values and ranges**
- \* A "low" T4 does not necessarily mean the Saluki is hypothyroid
- \* These results were similar for both American Kennel Club registered and Country of Origin Salukis.
- \* These results are similar to what has been found in Greyhounds

*Similar low T4 average and ranges in individual AKC and COO Salukis. Each dot represents the T4 in a single Saluki.*



## Thyroid hormone assay results (DCPAH, CVM, MSU)

Test	Saluki A fat & lethargic	Saluki B bald thighs	Normal ref range
T4	8	6	15-67
Free T4	2	1	8-26
TSH	183	17	0-37
TGAA	37	8	0-20

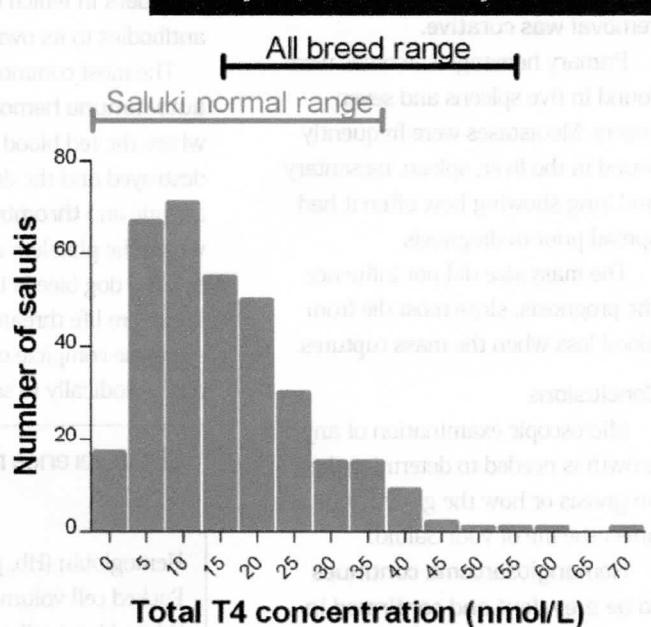
**Saluki A Dx: Hypothyroid due to lymphocytic thyroiditis**

**Saluki B Dx: normal Saluki**

Thyroid profiles on Salukis need to be interpreted in light of breed specific normal ranges. Above are thyroid test results from two Salukis that were recently submitted to our laboratory. Saluki A was fat and lethargic. Her T4 and free T4 assay results were clearly below the normal reference range. Her TSH was elevated indicating that she needed a higher level of thyroid hormones. She also tested positive for thyroglobulin autoantibodies. Her diagnosis was hypothyroidism due to lymphocytic thyroiditis. She needs to be given thyroid supplementation for the rest of her life.

The sample from Saluki B was submitted because she had a thin coat and especially bald thighs. Her T4 and free T4 were also low, but her TSH was within the normal range. This indicates that at the cellular level, her body had adequate thyroid hormone concentrations. She was negative for TgAA so she could not pass on the inherited form of hypothyroidism to her pups. Severe diseases and some medications can also cause low thyroid hormone concentrations, but since this Saluki is clinically normal she is not hypothyroid.

## Total thyroxine (T4) in clinically normal Salukis



\* lower white cell counts (WBC)

\* these changes are similar to

what has been found in Greyhounds

**Caution should be used when making a diagnosis and treatment decisions based on non-Saluki reference ranges for the CBC.** In addition, obtaining baseline CBC values for your dog when healthy, can provide a valuable comparison tool should your dog become sick.

## Saluki Normal Thyroid Study

Hypothyroidism is considered to be the most common endocrine disease of dogs, and is most often the result of inherited autoimmune thyroiditis. Signs of hypothyroidism can be nonspecific and interpretation of thyroid profiles can be complicated by non-thyroidal disease, medications and breed variations.

Blood samples from 335 Salukis were analyzed and compared to the mixed breed reference ranges. Salukis were found to have:

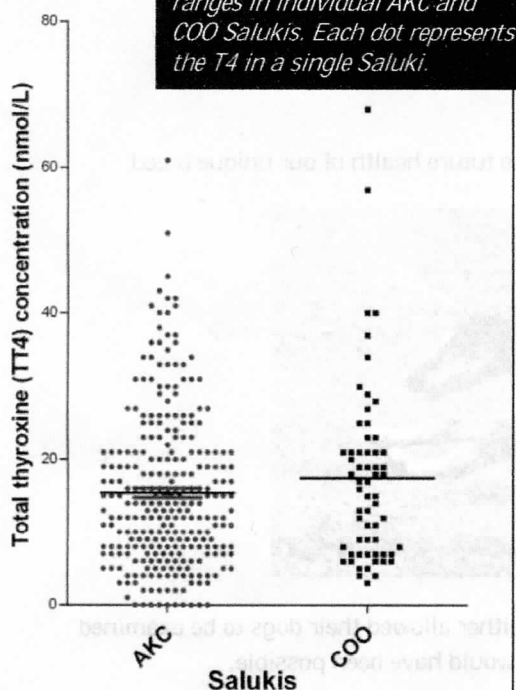
\* **Lower T4 and free T4 average values and ranges**

\* A "low" T4 does not necessarily mean the Saluki is hypothyroid

\* These results were similar for both American Kennel Club registered and Country of Origin Salukis.

\* These results are similar to what has been found in Greyhounds

*Similar low T4 average and ranges in individual AKC and COO Salukis. Each dot represents the T4 in a single Saluki.*



## Thyroid hormone assay results (DCPAH, CVM, MSU)

Test	Saluki A fat & lethargic	Saluki B bald thighs	Normal ref range
T4	8	6	15-67
Free T4	2	1	8-26
TSH	183	17	0-37
TGAA	37	8	0-20

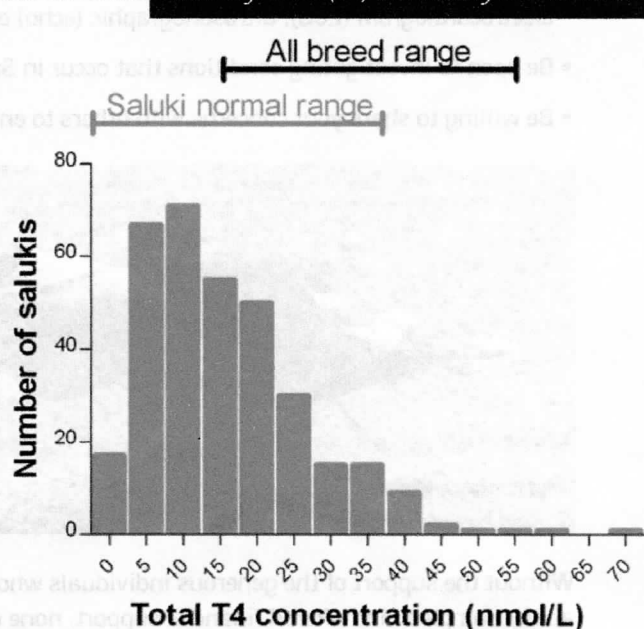
**Saluki A Dx: Hypothyroid due to lymphocytic thyroiditis**

**Saluki B Dx: normal Saluki**

Thyroid profiles on Salukis need to be interpreted in light of breed specific normal ranges. Above are thyroid test results from two Salukis that were recently submitted to our laboratory. Saluki A was fat and lethargic. Her T4 and free T4 assay results were clearly below the normal reference range. Her TSH was elevated indicating that she needed a higher level of thyroid hormones. She also tested positive for thyroglobulin autoantibodies. Her diagnosis was hypothyroidism due to lymphocytic thyroiditis. She needs to be given thyroid supplementation for the rest of her life.

The sample from Saluki B was submitted because she had a thin coat and especially bald thighs. Her T4 and free T4 were also low, but her TSH was within the normal range. This indicates that at the cellular level, her body had adequate thyroid hormone concentrations. She was negative for TgAA so she could not pass on the inherited form of hypothyroidism to her pups. Severe diseases and some medications can also cause low thyroid hormone concentrations, but since this Saluki is clinically normal she is not hypothyroid.

*Total thyroxine (T4) in clinically normal Salukis*



At right is a microscopic view of a normal thyroid gland. Most of the thyroid is composed of spherical follicles which produce and contain thyroglobulin. This is converted to thyroid hormones and released into the blood. If not enough thyroid hormones are available, then the brain secretes thyroid stimulating hormone (TSH) to encourage more production of thyroid hormones.

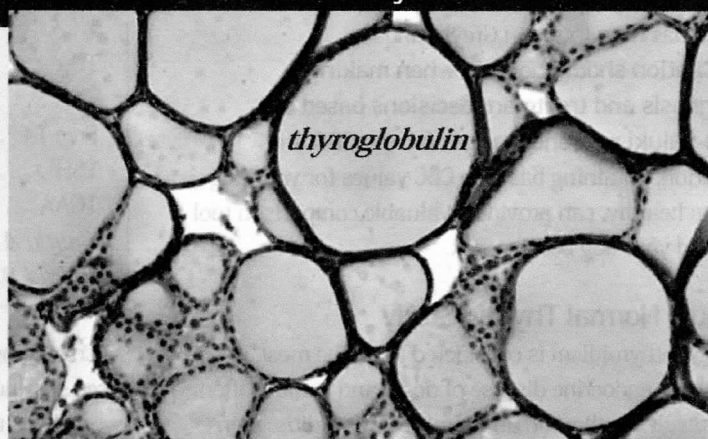
In **lymphocytic thyroiditis**, an immune response is mounted against the thyroid follicles. The photo shows white cells (dark staining) attacking the thyroglobulin (TgAA) which progresses until the gland is destroyed. For a while, elevated TSH causes more conversion of thyroglobulin but eventually the dog becomes clinically **hypothyroid**.

\* **Additional tests for TSH and TgAA are needed to diagnose hypothyroidism**

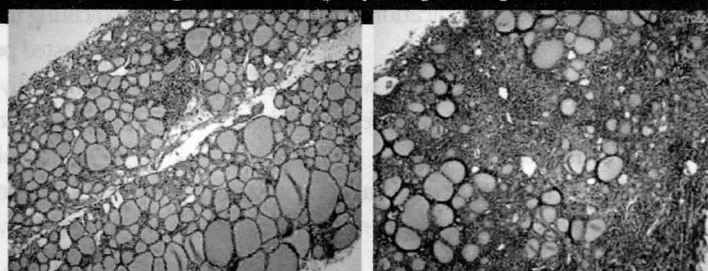
\* Salukis had a low incidence of TgAA - 4.6% versus 10% for all breeds.

\* **Autoimmune thyroiditis and hypothyroidism is not a widespread problem in Salukis.** By breeding dogs that are negative for TgAA we can continue this healthy trend.

Normal canine thyroid follicles



Progression of lymphocytic thyroiditis



## Saluki studies: overall conclusions

- Mixed breed reference ranges are not always appropriate for Salukis on radiograph (X-ray), electrocardiogram (ECG), ultrasonographic (echo) evaluations, CBC and thyroid assays
- Be open to investigating conditions that occur in Salukis
- Be willing to share your concerns with others to ensure the future health of our unique breed



Without the support of the generous individuals who have either allowed their dogs to be examined and/or sampled, and offered financial support, none of this would have been possible.