

The “ODD COUPLE” ...The Professor and the Thermographer.

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ABSTRACT

Equine Laminitis is the 2nd largest killer of horses behind Colic. Researchers from around the world have done many experiments in an effort to understand the effects of this crippling disease. In an attempt to show how the horse's feet are affected by Laminitis we conducted a 48-hour experiment with Professor Christopher C. Pollitt BVSc (Massey) PhD (Qld). Professor Pollitt is the director of the Australian Equine Laminitis Research Unit (AELRU) and has written and traveled extensively on the subject of horse hooves. In 2003 he received the Pfizer Scientific award for his work. The images taken during this experiment were put together in a time lapse presentation by Professor Pollitt from the University of Queensland. These thermal images have enabled the Professor to visually show the temperature changes to the hoof during the first 48 hours of a horse with Laminitis. The images also have been used during speaking engagements by Professor Pollitt around the world.



Figure 1. Professor Chris Pollitt at a speaking engagement in Argentina on Laminitis.



Figure 2. The Professor and his life's passion.... Horses.

INTRODUCTION

After conducting some thermal inspections on race horses for a local vet in Brisbane, I was introduced to Professor Pollitt. The vet I was working with happened to be part of the research unit that Professor Pollitt had set up at the School of Veterinary Science at The University of Queensland. From this initial introduction, meetings were planned to discuss the experiment, its aims and how the use of thermography would assist.

AIM

The Professor's aim was to collect scientific data relating to the onset and establishment of Laminitis. His request for the use of thermography was to visually show the temperature increases/decreases within a horse's hoof during the first 48-hour period of Laminitis. By using Thermal Imaging (Inframetrics PM 290 Focal Plane Array Camera) Professor Pollitt was hoping to put a visual time clock to the onset of Laminitis that would complement and enhance his other Laminitis research.

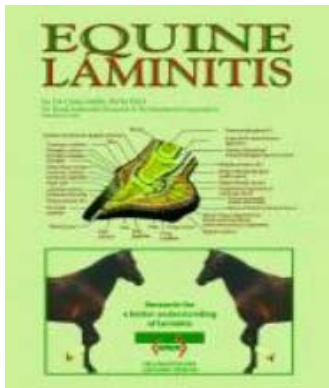
WHAT IS LAMINITIS?

In the normal horse or pony, the distal phalanx (coffin or pedal bone) is attached to the inside of the hoof by a tough but flexible suspensory apparatus. The surface of the inner hoof wall is folded into leaf-like lamellae (laminae) to increase the surface area of this suspensory apparatus.

A horse has laminitis when these lamellae suddenly fail. Without the distal phalanx properly attached to the inside of the hoof, the weight of the horse and the forces of locomotion drive the bone down into the hoof capsule. Important arteries and veins are sheared and crushed and the corium of the coronet and sole is damaged. There is unrelenting pain in the feet and a characteristic lameness.

Laminitis has a developmental phase in which lamellar separation is triggered. This precedes the appearance of the foot pain of laminitis. The developmental period lasts 40-48 hours in cases where laminitis is caused by excessive ingestion of soluble, non-structural carbohydrates, such as starch or fructan. Sometimes no developmental phase can be recognized; the horse or pony is discovered in the acute phase of laminitis with no apparent ill health or inciting problem occurring beforehand. This appears to be the case with grass founder (laminitis resulting from the ingestion of lush pasture).

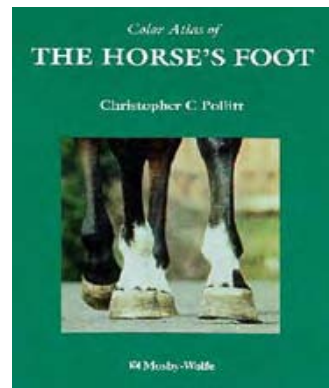
When a horse develops laminitis the front feet are usually the most severely affected. It is extremely painful for the horse to accept weight on the toes of the front feet. Large, heavy horses are often more severely affected by laminitis than small ponies. Laminitis is the most serious disease of the equine foot.



Two books written by Professor Pollitt on Equine Laminitis.

1. Equine Laminitis by C Pollitt, BVSc, PhD

2. Color Atlas of the Horse's Foot by Christopher C. Pollitt BVSc, PhD



METHOD

Since it was a scientific experiment, the Professor had very strict guidelines that we had to follow during this 48-hour period so as to not compromise the data collected. Thermal data was not the only data collected over this period. Thermocouples were attached to the horse's hoofs to collect temperature data so as not to rely solely on the thermal readings. The horse was under constant veterinarian observation by the Professor and his team of veterinary research members who recorded regular medical information. They also fed and tended to the horse during this period.

This experiment was carried out in the basement holding area underneath the University of Queensland Veterinary Building in their St. Lucia Campus in Brisbane, Australia. This location was chosen for consistency of ambient temperature and availability of the university's scientific equipment and resources. As the experiment was conducted from 6pm Friday night to 6pm Sunday night, all the necessary equipment had to be on hand.

The professor and his team set up the horse and the holding area in accordance with their scientific requirements.

Prior to commencing the experiment, a distance bracket was made up for use with the IR Camera. This distance bracket was important as it ensured we were the same distance from each hoof at each of the 48 images taken.

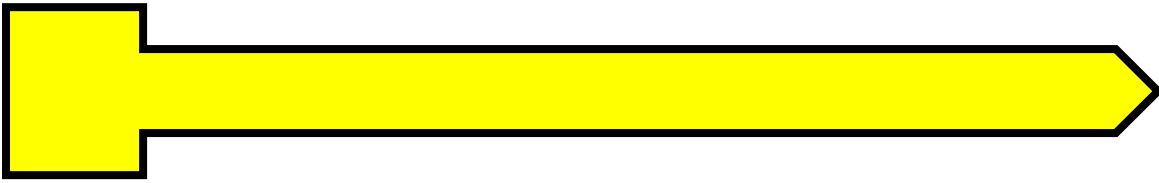


Figure 3. 30cm(12inches) long Distance Bracket

The bracket had a point at one end, used to line up each thermal image. On each of the horse's hooves the angle of the hoof was determined and a center mark was placed in the middle (measured). This mark was used as a placement point for the pointed end of the distance bracket. Once in place the distance bracket enabled us to take 48 hourly images with the distance and positioning identical for each image, thus giving us consistency. By providing consistent thermal data, we enabled the professor to create a visual time line of temperature variances within the horse's hooves.

To successfully operate the IR Camera, two thermographers were used during this experiment: my business partner Brendan Gowdie and myself. We both did two 12-hour shifts, with me leading off Friday afternoon at 4pm. With the thorough preparation, all we needed to do was follow Professor Pollitt's plan. As time ticked down to our starting time we went through our own scanning plan. We set up our Infrared camera equipment and laptop to store data and practiced using the distance bracket as it was critical to our consistency in data collection.

From a thermography perspective, we had to set up the PM290 so as to run from a 240-volt power source instead of batteries, because we needed the camera to be operational at all times during this 48-hour period and did not want to have the inconvenience of changing and charging batteries during the time of the experiment. Once set up the camera was placed on standby—ready for use on an hourly basis.

The finer details of the Inframetrics PM290 were set up with the ambient temperature and humidity settings updated from the university's equipment. We set our emissivity at 0.98; this figure was based on skin emissivity as we found no table including horses in their emissivity charts. Some other thermographers whom we asked ranged from 0.96 to 1.00, so we were in the middle at 0.98. Prior to commencing our scan we had to take a starting reference image which is shown in figure 4 below.

The top LHS of each image shows the hour taken.

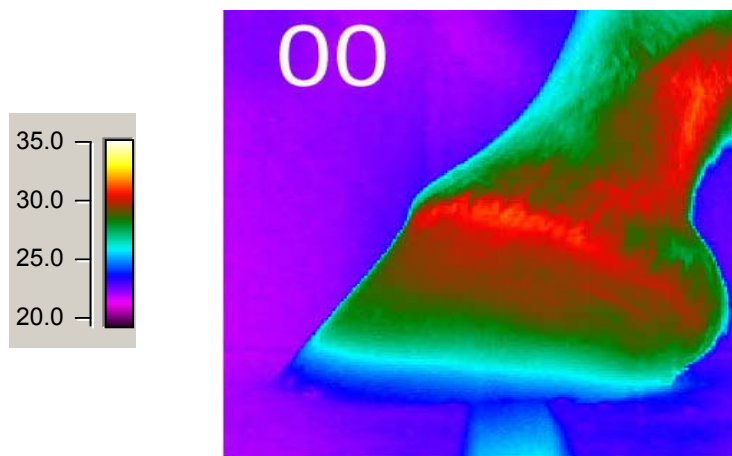


Figure4 . The first Thermal Image of Lateral Hoof at the beginning of experiment.

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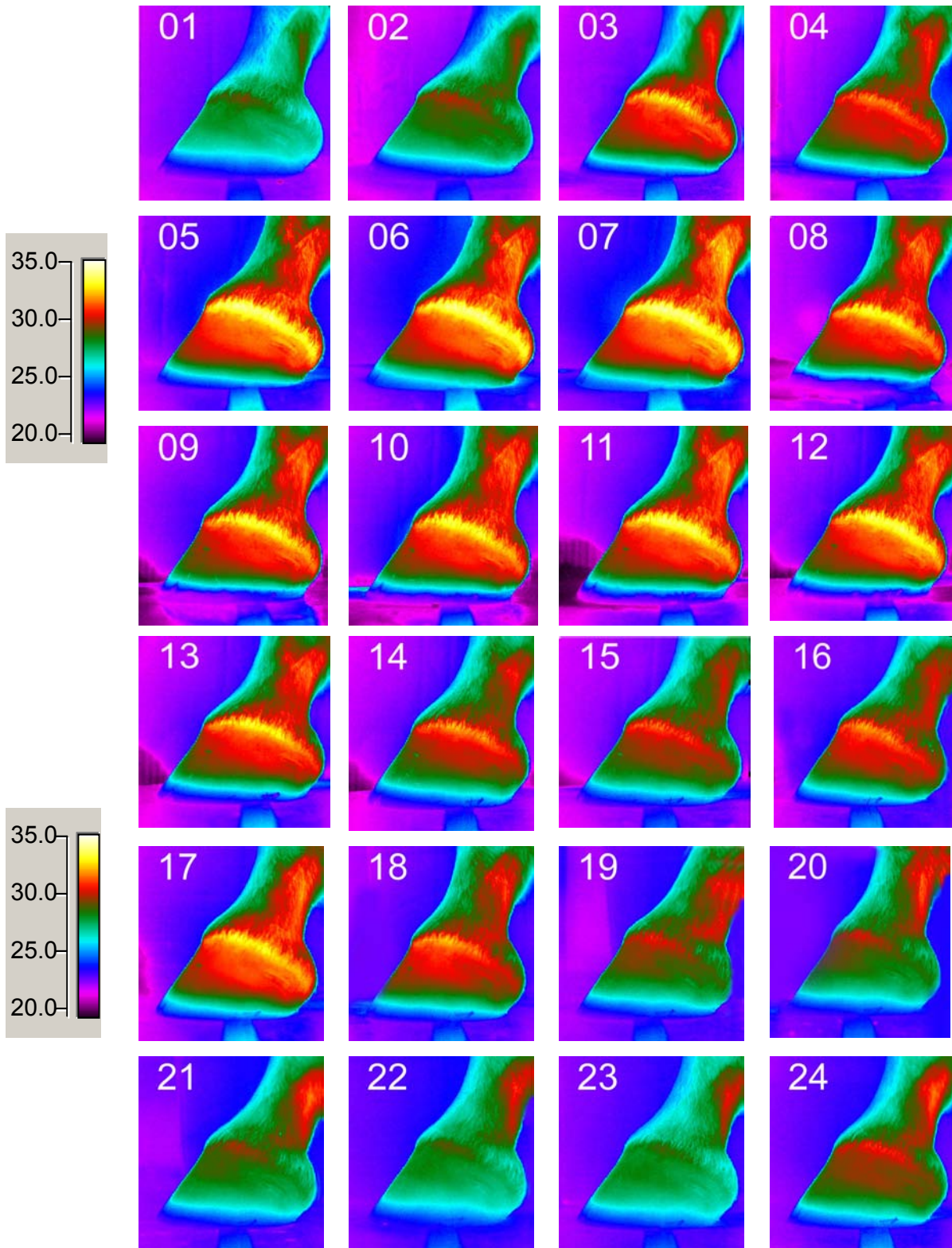


Figure 5 . Thermal Images of Lateral Hooves hours 1 to 24 (7pm Friday to 6pm Saturday)

INFRA^MATION

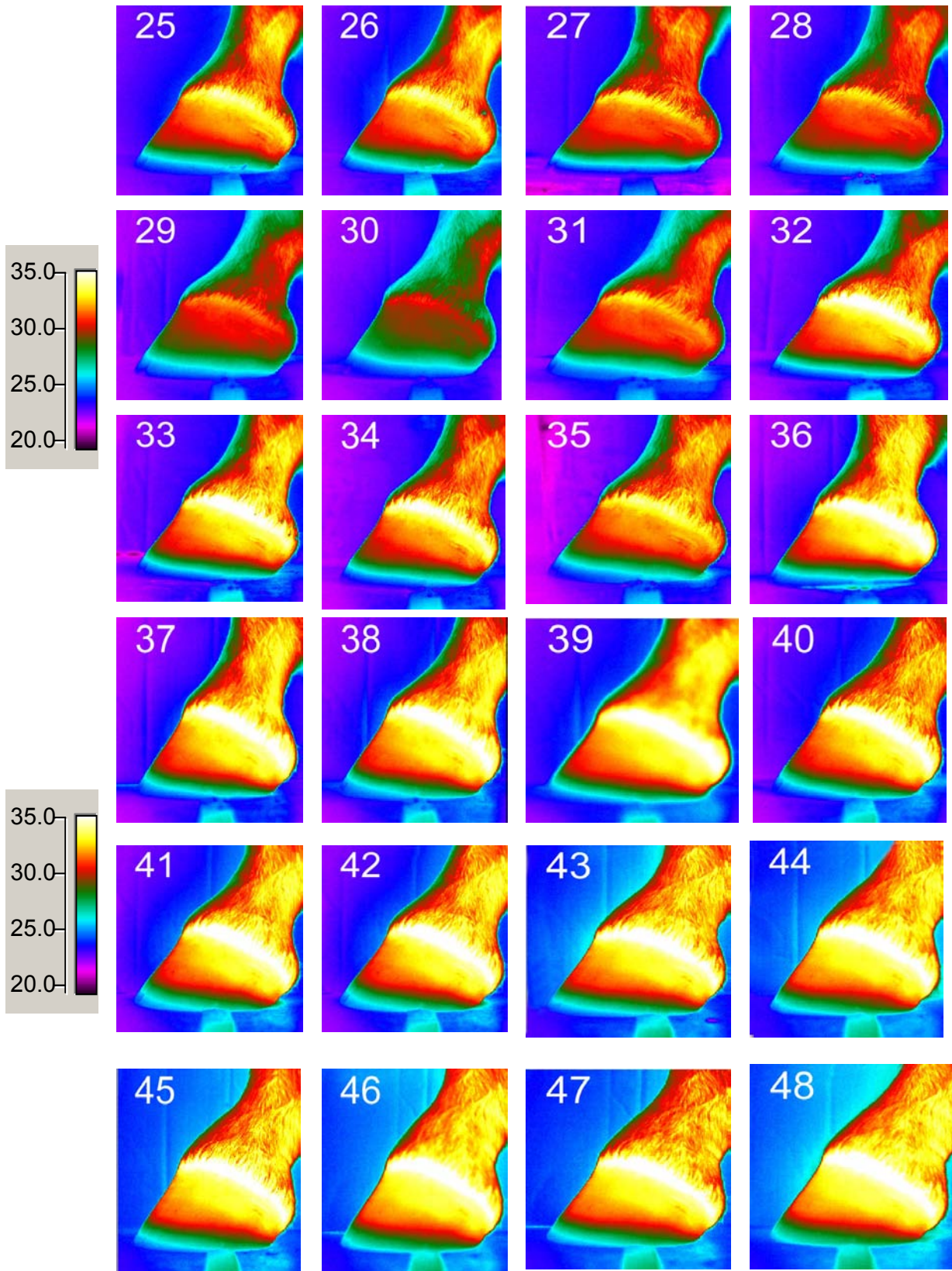


Figure 6 . Thermal Images of Lateral Hooves hours 25 to 48 (Saturday 7pm to Sunday 6pm)

CONCLUSION

When examining the images taken during the 48-hour period we note some interesting things. At the beginning of the experiment the hoof seems to cool only to heat up again around hours five to thirteen. At this point the temperature starts to cool again up to hour 24. According to Professor Pollitt this is quite normal as horse's feet can change temperature constantly.

However, except for a slight drop in temperature around hours twenty-nine and thirty, we start to see a gradual increase in temperature within the hoof as the crippling disease takes hold. From hours thirty-six through forty-eight we see images almost exactly the same. These thermal results can be shown on the following two graphs taken from some of Professor Pollitt's other work on Laminitis. The first (figure 7) shows hoof temperatures in a horse without laminitis. The second graph (figure 8) shows readings taken at the same time as figure 7 but from a different horse with laminitis.

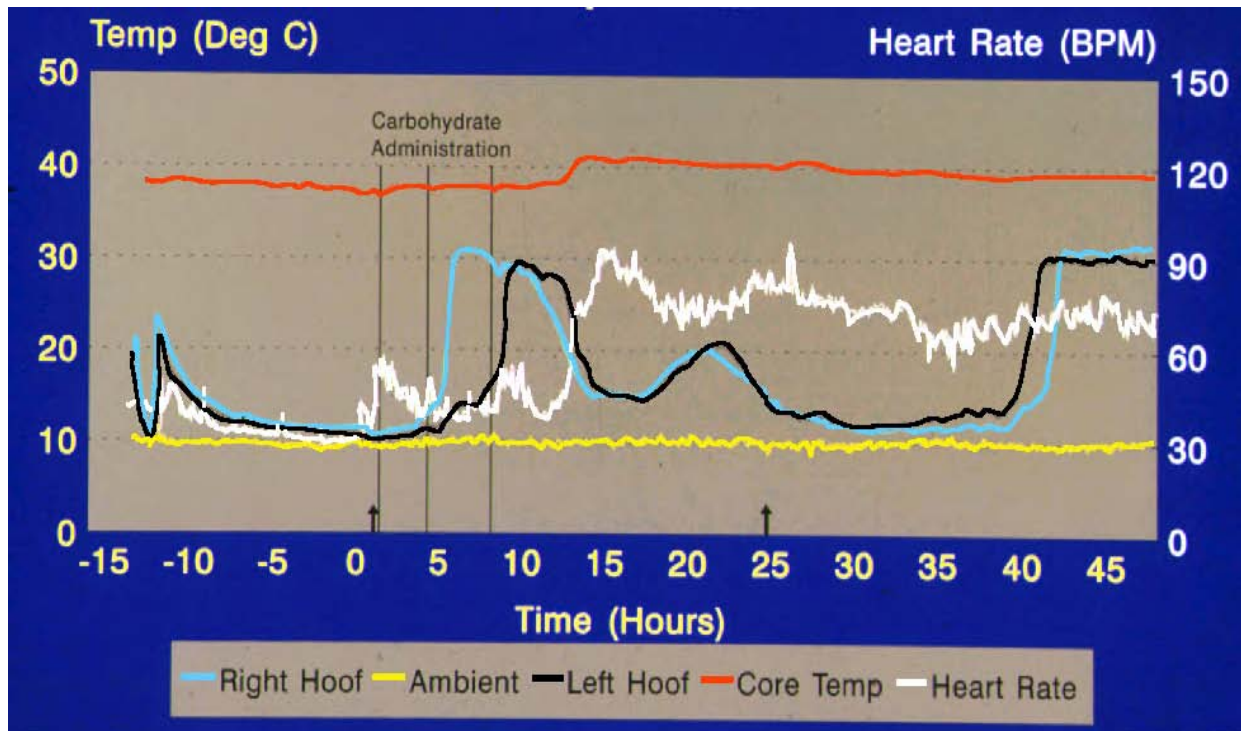


Figure 7 . Laminitis Negative Horse

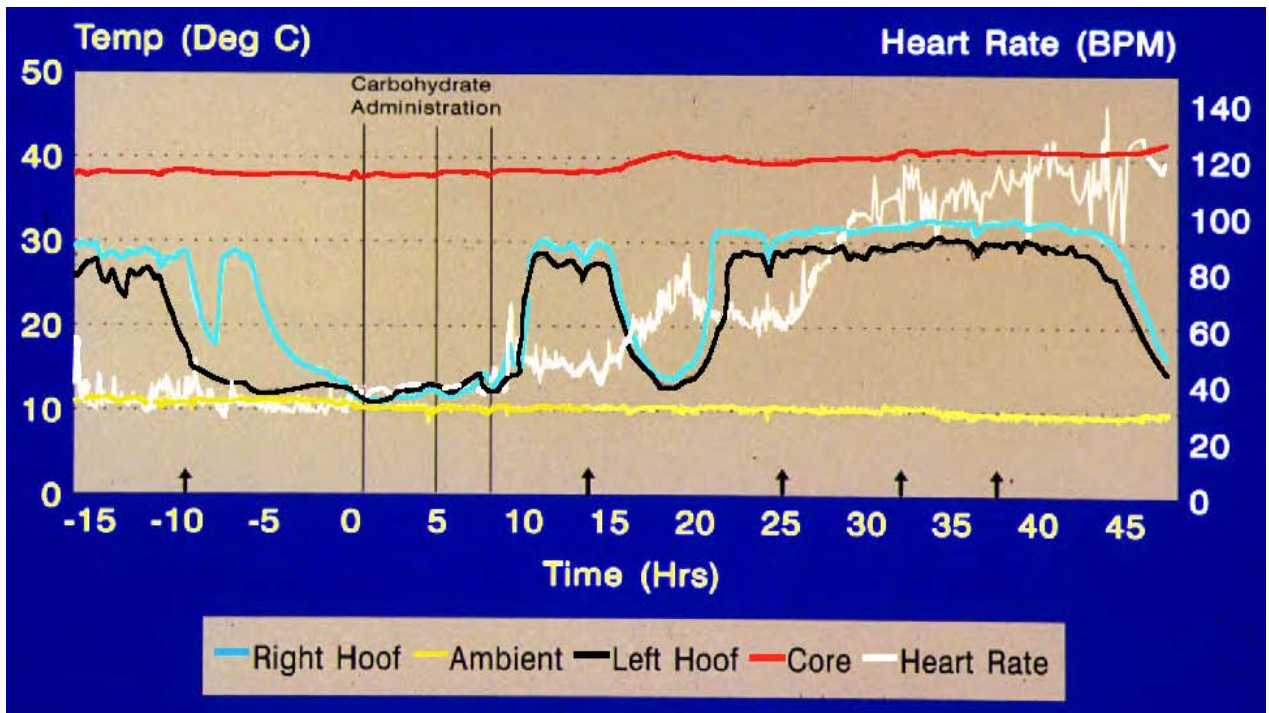


Figure 8 . Laminitis Positive Horse

SUMMARY

At the end of 48 hours with one Professor, one horse, two thermographers, and three vets, we concluded our journey. As thermographers we experienced a unique opportunity to be involved in a University Experiment that will help horse lovers around the world. We were able to use a medium—infrared imaging—that has countless uses (some not even thought of yet). Increases in temperature, however slight, can be important when looking at Equine Laminitis and many other situations as well.

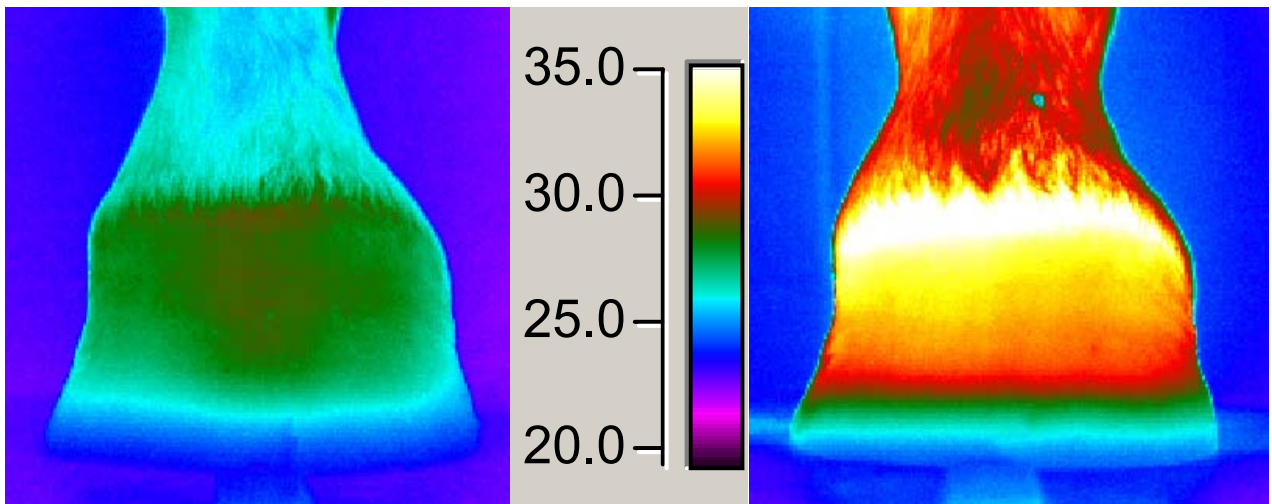


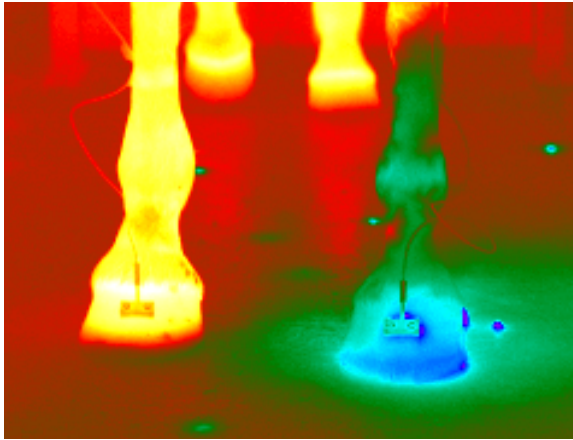
Figure 9. Constricted blood circulation. Image taken at beginning of experiment

Figure 10 Dilated blood circulation. Image taken after 4 hours

After studying the temperature changes in the hoofs during the first 48 hours of the onset of Laminitis, Professor Pollitt and his colleagues felt that temperature data collected from the experiment had possible answers to some Laminitis questions. Since our 48 hours with Professor Pollitt and his team, they have

INFRA^MATION

conducted further experiments (Australia, USA & Norway) around the theme of being able to control the temperature of hooves. By cooling the legs of horses during a brief window in the onset of Laminitis, it may play a part in saving thousands of horses worldwide. Following are a preview into some interesting observations made.



Figures 11a & 11b Thermal Image shows a horse with laminitis. As one foot was constantly cooled during the onset of the disease, we see the heating effects of Laminitis in 3 of the 4 legs. The leg placed in the ice boot shows no effects of Laminitis. Photo shows the horse with one leg placed in the ice boot.

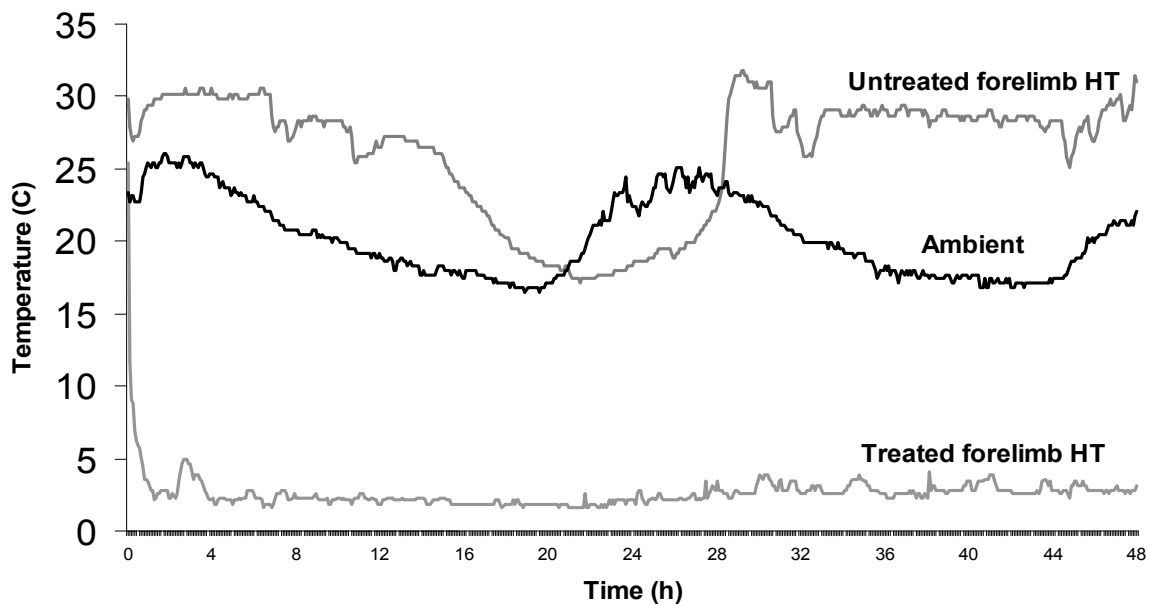


Figure 12 . Temperature graph of a horse with Laminitis in 3 of 4 legs.

Observations from Professor Pollitt's team:

- Vasodilation (warm feet) promoted laminitis
- Vasoconstriction (cold feet) protected (cryotherapy?)
- Data do not support ischemia reperfusion
- Hypothesis: vasodilated circulation delivered greater dose of laminitis trigger factors (LTF)

REFERENCES

C.C.Pollitt and C.T.Davies:. (paper)

Pollitt, Christopher C. and Davies, C. T., "Equine Laminitis: its development coincides with increased sublamellar blood flow", pp 125-132, The Equine Hoof, Suppl. 26, 1998.

The School of Veterinary Science pages at the University of Queensland web page:

<http://www.uq.edu.au/~apcpolli/>

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Prof. Chris Pollitt

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The Members of the Australian Equine Laminitis Research Unit, who assisted during our 48hr experiment.

For more Information on the wonderful work that Professor Chris Pollitt has done on Equine Laminitis please use the contact details below.

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Malcolm is a Level I Thermographer with the Australian Institute of Non destructive Testing (AINDT) and has been using the technology for 11 years. He has gone from working for an electrical maintenance company running their thermography division to running his own Thermal Imaging business for the last 6 years.

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