

Summer Research Proposal 2011

*Seasonal Variation of Hemostatic and Hemolytic Factors in
Hibernating and Non Hibernating Mammals*

Stephanie Triggas working in the laboratory of Dr. Margaret Field

Background information:

Seasonal variation was first studied in turtles. Researchers wanted to know why hibernating turtles did not clot when their heart rate and blood flow slowed to a near standstill. In most animals such stagnation would cause clotting and death. An increase concentration of Heparin, a natural blood thinner, was found in these turtles during the winter months, beginning in mid-October and continuing through February (Kupchella). Although sought, researchers never found an environmental trigger for this increase in serum heparin concentration. Suggestions for such alterations in clotting factors have ranged from changes in temperature, to light exposure and solar radiation, all of which have been ruled out by laboratory testing so far. It has been suggested by anecdotal evidence that some non-hibernating animals may also have elevations in plasma heparin during the winter months. Heparin industries have reported that their yield of heparin in the winter is elevated over summer values. While one suggestion was that higher summer temperature might cause more rapid degradation by enzymes, no mechanism has ever been investigated. This was an industrial observation which was never studied further. In researching the literature on the subject we were only able to find 6 articles that pertained to clotting in animals with only three suggesting seasonal variation (Johansson). There is some literature which suggests that humans, a non hibernating mammal, have an increase in clotting factors during the winter months, this is contradictory to hibernating animals, yet we do not know if this pertains to hibernating mammals. New techniques for examining clotting proteins provides us with the opportunity to investigate clotting and anti-clotting factors in hibernating and non-hibernating mammals.

Experimental infection was first studied in turtles. Researchers were first to have

observed that turtles with their feet sore and blood oozing from the sores

had a high concentration of bacteria in their blood. A

study of the concentration of bacteria in the blood of turtles was first

conducted during the winter months, beginning in mid-October and continuing through

the spring. Although the concentration of bacteria in the blood of turtles

was found to be higher in the winter months, the concentration of bacteria

was found to be higher in the summer months. The concentration of bacteria

was found to be higher in the summer months. The concentration of bacteria

was found to be higher in the summer months. The concentration of bacteria

was found to be higher in the summer months. The concentration of bacteria

was found to be higher in the summer months. The concentration of bacteria

was found to be higher in the summer months. The concentration of bacteria

was found to be higher in the summer months. The concentration of bacteria

was found to be higher in the summer months. The concentration of bacteria

was found to be higher in the summer months. The concentration of bacteria

was found to be higher in the summer months. The concentration of bacteria

was found to be higher in the summer months. The concentration of bacteria

was found to be higher in the summer months. The concentration of bacteria

was found to be higher in the summer months. The concentration of bacteria

was found to be higher in the summer months. The concentration of bacteria

Seasonal variation has not had enough research to draw conclusions about the mechanism nor what role it plays in non-hibernating mammals or if it is retained as a vestigial trait.

Objective:

In this project, we will directly look at clotting and anti-clotting factors in hibernating and non-hibernating mammals, in order to determine if there is seasonal variation. An extensive literature search failed to reveal any definitive underlying reason for a decrease in clotting in hibernating mammals. We want to determine if such proteins are working in unison or in opposition with heparin factors in winter months and to determine if the seasonal variation, only observed in turtles, also is found in hibernating and non-hibernating mammals.

Purpose:

Knowing when the body is naturally producing clotting or anti-clotting factors have numerous advantages. For example, knowing when to administer anti-clotting drugs and how much can aid in physician prescriptions. It can also aid in veterinarians and physicians in surgery decision making. For veterinarians, it is important to know whether or not the patient is producing clotting or anti-clotting factors and to know why that animal is clotting or not clotting. More information on seasonal variation could potentially aid in pharmaceutical professions as well in producing pre-surgical and post-surgical medicines to either raise or lower heparin or thrombin levels. This proposal has application not only to compare to physiology but to environmental biology. Should we find winter serum to have higher levels of anti clotting factors, we intend to induce

Seasonal variation has not been enough reason to draw conclusions about the

mechanism not what role it plays in non-fibrinolytic mammals or if it is related to a

vertical shift

Objective

In this project, we will directly look at fibrinolytic and anti-fibrinolytic factors in

hibernating and non-hibernating mammals, in order to determine if there is seasonal

variation. An extensive literature search failed to reveal any definitive and ongoing research

for a decrease in fibrinolytic mammals. We want to determine if such

changes are working in unison or in opposition with seasonal factors in winter mammals and

to determine if the seasonal variation only observed in hibernating mammals also occurs in

hibernating and non-hibernating mammals.

Proposal

Knowing when the body is naturally producing clotting or anti-clotting factors

have numerous advantages. For example, knowing when to administer anti-clotting

drugs and how much can aid in physician prescriptions. It can also aid in veterinarian

and physician in surgery decision making. For veterinarians, it is important to know

whether or not the patient is producing clotting or anti-clotting factors and to know why.

Just as it is clotting or not clotting. More information on seasonal variation on the

potentiality and in pharmaceutical professions as well in producing pharmaceutical and food

and medical medicines to either raise or lower levels of fibrinolytic levels. This proposal has

application not only to compare to physiology but to environmental biology. Studies

and winter seem to have higher levels of anti-clotting factors. We intend to include

hibernating conditions (temperature and day/night cycle) in Golden Syrian Hamsters to determine if we can induce a similar result during the summer months.

Techniques:

We will be measuring Fibrinogen, Thrombin, Tissue Plasminogen Activator, Tissue Plasminogen Activator-Inhibitor, and Heparin Cofactor II. The choice to use heparin cofactor II was because it allows us to look at a protein which is proportional to heparin but as a protein, a corresponding project in Dr. Keith Garrison's lab, will allow investigation of the gene which makes this protein in the liver. Heparin cofactor has been found on chromosome 14, location 14;14 according to NCBI. This will help them in determining expression and that information will in turn help us to determine if there is more heparin or more degradation of the clotting factors.

These proteins will be measured in sera taken from Golden Syrian Hamsters (hibernators) and Swine (*Sus scrofa*) a non-hibernator. The samples are further divided by gender, which has been implicated in clotting in humans, but never examined in other animals to date. We have serum samples taken in December/January and will be receiving additional sera in June/July. The project will use Enzyme-linked immunosorbent assay (ELISA) to identify and quantify the proteins.

liberating conditions (temperature and daylight cycle) in Golden Syrian Hamsters to determine if we can induce a similar result during the summer months.

Techniques:

We will be measuring Fibronectin, Thrombin, Tissue Plasminogen Activator, Tissue Plasminogen Activator-Inhibitor and Lipoprotein Lipase. The choice to use fibronectin as a marker was because it allows us to look at a protein which is produced in the liver but as a protein, a corresponding protein in the liver. Tissue Plasminogen Activator has been found on chromosome 10, location 14.1 according to NCBI. This will help us in determining expression and that information will help us to determine if there is more repair or more degradation of the clotting factors.

These proteins will be measured in sera taken from Golden Syrian Hamsters (liberating) and (Swine) (non-liberating). The samples are further divided by gender which has been implicated in clotting in humans, but never examined in other animals to date. We have serum samples taken in December/January and will be testing additional sera in January. The project will use ELISA-like immunosorbent assay (ELISA) to identify and quantify the proteins.

Works Cited

Kupchella, C. E., Jacques, F. A., 1970. "The effects of induced cold torpor and time of year on the plasma acid mucopolysaccharide levels in p.s. elegans and c.p. belli". *Comparative Biochemistry and Physiology*, 36:657-668.

Johansson, BW, et.al., "Seasonal variations in the physiology and biochemistry of the European hedgehog (*Erinaceus europaeus*) including comparisons with non-hibernators, guinea-pig and man". *Acta Physiol Scand Suppl.* 1972;380:1-159.

Sagripanti, Andrea. "Natural Anticoagulants, Aging, and Thromboembolism." *Experimental Gerontology* (1998). Print.

Stout, R. W. "Seasonal Changes in Haemostatic Factors in Young and Elderly Subjects." *Oxford Journal* (1996). Print.