

# Why do horses bleed?

Researchers are still trying to understand the cause of bleeding in performance horses

BY DENISE STEFFANUS

**W**HILE THE debate whether to ban bleeder medication on race day rages, researchers continue to seek an answer to why horses' lungs bleed during exercise, or exercise-induced pulmonary hemorrhage (EIPH). Although millions of dollars have been spent on research, finding an answer has remained elusive. But researchers at Michigan State University are hopeful their latest theory is the key to solving the mystery.

EIPH has been recognized since racing began. When scoped, 50% to 70% of racehorses show bleeding in the lungs serious enough to require treatment. As many as 95% show specks of blood in the lungs. The team at Michigan State has been exploring changes in the small veins of the lungs in response to stress—called vein remodeling or vein scarring—that it believes may be at the core of EIPH.

N. Edward Robinson, B.Vet.Med., Ph.D., who holds the Matilda R. Wilson Chair in Large Animal Clinical Science at Michigan State, is a member of the team of scientists that has been researching EIPH for decades. Frederik Derksen, D.V.M., Ph.D., and pathologist Kurt Williams, D.V.M., Ph.D., lead the Michigan State team that is investigating vein remodeling.

"What is critical in EIPH is what is happening to the pressure inside the small blood vessels of the lungs [pulmonary capillaries]," Robinson said.

He gave the analogy of a garden hose, with the capillary being midway between the faucet and the water's destination. Standing on the end of the hose constricts it and causes the pressure within the hose (capillary) to go up, and it will rupture.

"When we looked at the lungs of horses that had been retired from racing because of severe EIPH, there was always venous remodeling—the small veins had more fibrous tissue around them and the hole through which the blood was passing was smaller," Robinson said. "So this is somewhat like putting a tourniquet where the blood is trying to flow out of the capillaries."

The most widely accepted theory of why capillaries rupture during EIPH had been that the pressure in them increases with the rise in the horse's blood pressure during exercise.

"What we think is that it is this vein remodeling that is the straw that breaks the camel's back," Robinson said. "Using again the garden hose as an analogy, if it is just the pressure at the arterial end—the faucet—that is causing the problem, it is difficult to explain why bleeding always occurs at the back portion of the lungs, the dorso-

caudal region, which is up under the saddle."

Derksen, Williams, and Robinson came to the hypothesis that this area of the lungs has more blood flow and, consequently, higher pressure within the blood vessels that pass through it.

"It's well known that if a vein stretches, it will remodel," Robinson said. "It will develop more tissue and more vessel wall to withstand the strain. So we think this remodeling is a result of the high pressure."

## Exercise causes EIPH?

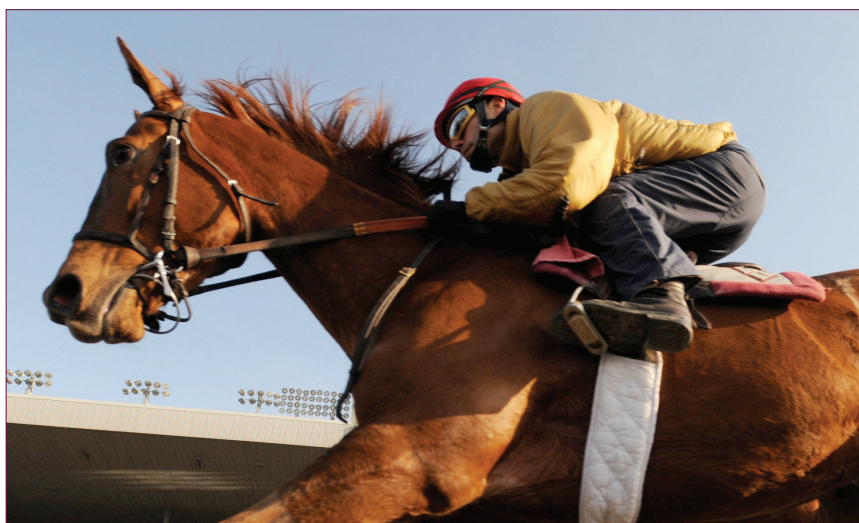
Robinson and his colleagues believe that every time a horse exercises, not just during a race, the pressure goes up in its lungs enough to stretch the veins.

"These repeated bouts of pressure cause the veins to remodel," Robinson said. "Once one region [of the lung] becomes severely remodeled, blood can no longer flow through there, so it reroutes through the adjacent region and raises the pressure there. It's like closing branches of a highway. The traffic then has to go another pathway and that causes a backup. Within the capillaries and veins, rerouting of the blood causes the pressure to go up."

A horse races an average 6.2 times a year, but it exercises about 300 times a year, Robinson said. Each of those training sessions, whether it is a gallop or a workout, may cause some venous remodeling, depending on the intensity of the exercise. The Michigan State team theorizes that it may be more important for a horse to train on bleeder medication 300 days a year than only be administered it when it races.

"That's the logical conclusion," Robinson said. "Furosemide is a beneficial medication, but it's logical to ask the question, 'How much worse does racing make the situation?' If venous remodeling is being stimulated 300 days of the year, and you don't give them furosemide for the six days out of the year that they race, how much difference is that going to make?"

Robinson acknowledged that questions remain about the effects of long-term use of furosemide, especially on demineralization of



Michael Burns photo

Researchers believe the vein remodeling leads to changes in capillaries and bleeding

bones, and no studies have been done to see if there is a deleterious effect of withholding furosemide on race day from a horse that trains on it 300 days a year.

## Scarring of the lung tissue

Robinson said once the capillary breaks, the blood gets trapped in the tissues of the surface of the lungs, forming a substance called hemosiderin, which leads to pulmonary fibrosis, or a scarring of the lung tissue.

He and his colleagues have mapped the regions of the lungs where venous occlusion occurs to see if there are any regions where venous remodeling precedes formation of hemosiderin and the subsequent changes.

In humans, pulmonary veno-occlusive disease mirrors EIPH. It causes venous remodeling, hemorrhage, formation of hemosiderin, and pulmonary fibrosis. The cause of this rare disease in humans is unknown, and no effective treatment is available, although vasodilators seem useful in some cases.

Besides reducing blood pressure through its diuretic action, furosemide, although not technically a vasodilator, relaxes blood vessels to allow more blood to flow through them. The MSU team is presently investigating how high

pressure causes veins to remodel. They are hopeful that these investigations will lead to discovery of medications or even training methods to reduce the progress of remodeling.

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**Concussion theory**

At England's Animal Health Trust and the Imperial College-London, researchers David Marlin, Ph.D., and Robert Schroter, Ph.D., have formulated a hypothesis that vibration passed up the horse's forelegs during strenuous work may transfer to the lungs and ultimately cause damage in the same region the Michigan State group identified.

"It's the same reasoning that when you're in a car accident and you bang your head on the windshield,

the part of the brain that is damaged is the bit at the back of your skull, because the shock waves travel through your brain and are focused there," Robinson said.

The British researchers theorize that the concussive force from the impact of the forelimbs on the ground is transmitted through the shoulder, to the chest wall, and into the lungs, where it is then reflected by the ribs and spine and focused in the dorso-caudal part of the lung, ultimately causing rupture of the capillaries.

"There's no measurement for

these [concussive forces]; it's just a theory," Robinson said.

**Treatments that work, those that don't**

Emeritus Professor Howard Erickson, D.V.M., Ph.D., supervised the Equine Exercise Physiology Laboratory at Kansas State University for 20 years. During that time, he and his research associates investigated various means of treating EIPH.

"We've studied the use of furosemide; we've studied the use of the Flair nasal strip," Erickson said.

In tests conducted at Kansas State in the late 1990s, Erickson found lavage fluid washed from the lungs after treadmill exercise contained 30% fewer red cells when the horse was wearing a nasal strip. They also found furosemide to be effective in lowering a horse's blood pressure.

"We've looked at some herbal medications, which don't seem to provide any benefit," he said. "We've looked at the conjugated estrogens and aminocaproic acid, and they do not seem to be beneficial. We've looked at Seramune, a concentrated equine serum manufactured by a company here in Kansas named Sera Inc., and it appears to provide some benefit for chronic bleeders. Seramune typically is used for failure of passive transfer in foals, but I understand some veterinarians have used it for chronic EIPH as well.

"We've looked at omega-3 fatty acids to supplement the diet, and that shows some promise. It has some anti-inflammatory properties, and it makes the veins more flexible, and I think the blood cells, in particular, can slide through the vessels more easily."

**Time to recuperate**

Erickson said he believes it is very important to routinely give a horse a rest, not just wait until it goes sour or sustains an injury to lay it up.


"I'm inclined to think that horses sometimes are run back too soon, although I don't have any documented evidence of that," Erickson said. "I'm aware it relates to economics, how often a horse races. You have to consider how often a horse trains, as well, because when they're training, they're potentially bleeding, too. If a horse is a bleeder, I think it needs some off time, recovery time to let the blood vessels and the airways heal."

Although finding a way to combat EIPH is a formidable task, Derksen is optimistic that answers are not too far in the future.

"Research will result in a better understanding of EIPH and likely this will lead, through a combination of training strategies and medication aimed at both decreasing pressures in the blood vessels and preventing vein scarring, to effective management of EIPH," he said. ☺



Denise Steffanus is a contributing editor of THOROUGHBRED TIMES who writes frequently on veterinary and farm management topics.



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