All across Cornell University's campus, students attend classes; staff and professors work in offices or labs. Meanwhile, at any given moment, on the northeast edge of campus, Norm G. Ducharme, Clinical Sciences, may be performing surgery on a 1,200-pound, pedigreed sport horse. Or he may be watching a race horse run 40 miles per hour on a huge treadmill set in the floor of a hangar-like room. He may be scanning the latest international race and sporting results, to guess if his treatments have worked.

The horses Ducharme treats have diseases of the upper respiratory system, which are surprisingly common and troublesome in horse athletes. “We basically do sports medicine for horses,” he says. Ducharme and collaborators were able to make big strides in their research when, in the 1980s, they began studying and treating actual competitors (versus research horses), where the respiratory diseases naturally occurred. Trainers and owners have been bringing their horses to Cornell ever since.
As he treats some of the fastest, most agile and graceful competitors, Ducharme is also working to understand why these diseases occur, how to better diagnose them, and how improvements in treatment can restore the horses to health and competition.

**Snorers**

Dorsal Displacement in the Soft Palate (DDSP) is a disease that affects 10 to 20 percent of race horses and a smaller percentage of sport horses, or show horses. The disease has some resemblance to sleep apnea in humans; when the horses exercise, they emit a snoring noise. In sport horses, the noise isn’t appealing to judges, and in both race horses and sport horses, DDSP can result in an obstructive issue; the soft palate, the soft tissue at the back of the throat, obstructs the airway, restricting airflow during exhalation, increasing turbulence of airflow, and making it difficult for the animal to breathe.

Ducharme, along with Jonathan Cheetham, Clinical Sciences, and postdoctorate Marta Cercone, continue working to understand what causes DDSP. “We think that the horses are experiencing muscle fatigue of a specific upper airway muscle,” Ducharme says. “The evidence says that the muscle is normal, but they’re fatiguing early.”

Their hypothesis is that the muscle fatigue is caused by a disadvantageous proportion of muscle types in this particular muscle. Ducharme is studying whether horses with DDSP have a higher proportion, in the muscle, of the fast-twitch muscle type (fiber type 2A) and less of the fatigue-resistant muscle type (fiber type 1).

If this proportion plays a role, the next step is to test how researchers and veterinarians can manipulate it. “We can electrically change the muscle type by stimulating it at different frequencies and daily recruitment rate, etcetera, to see if we can change the proportion,” says Ducharme. “Then we can watch and see what’s happening in the upper airway.”

**Roarers**

A second project addresses the other major respiratory disease in horses: laryngeal hemiplegia. Three to five percent of race horses have this disease and close to 50 percent of work horses, or draft horses. It’s particularly prevalent in tall horses, and work done at Cornell and elsewhere has pointed to a genetic predisposition for the disease.

In the case of laryngeal hemiplegia, the nerves of the larynx become paralyzed. The larynx, similar to the voice box in humans, connects the nasal passage to the windpipe and is made up of sections of cartilage that protect the airway. When one or both of the arytenoid cartilages, one on the left and one on the right, become partially or fully paralyzed, the airway becomes obstructed. Horses with laryngeal hemiplegia are sometimes referred to as roarers because of the abnormal sound they make when exercising.

“The standard surgical treatment is to elevate and fix the paralyzed arytenoid cartilage or half the larynx so that it doesn’t collapse during exercise,” Ducharme says. “We’re looking at different anchoring systems to make this stronger. Instead of suspending the arytenoid cartilage, can we support it? We think this would be mechanically stronger and a much quicker treatment in terms of the animal returning to work.”

Ducharme and his team are also looking at reinnervation—restoring the supply of nerve tissue to the area through nerve transplant—as well as electrical stimulation of the
Winning, Failure, Success

As in many fields, Ducharme says that the more they uncover about these respiratory diseases, the more they realize they don’t know. Ducharme quotes his colleague Richard P. Hackett, Clinical Sciences. “Thirty years ago, it was simple—we knew everything there was to know,” he says. Then they started studying horses where the diseases occur naturally. Around the same time, they also began studying the horses dynamically—as they exercised versus static examination.

“We got our first treadmill in 1987,” Ducharme says, “and were able to do a lot of studies as far as the physiological impact of an airway obstruction. By doing this with the horses where the disease occurred naturally, we realized that there were a lot of shades of the same disease.” That complexity has required greater understanding of the diseases as well as a precision medicine approach. Different horses, depending on the stage of the disease, may require different treatments.

Treating horses that compete comes with some cost. It’s difficult to track the results of the surgeries, as trainers don’t want to subject their horses to unnecessary travel or tests post-treatment. While admitting that it’s not full-proof, Ducharme and his team do look at how much money the horses make as a way to track the success of the surgeries.

“You can see that in 80 percent of the horses we operated on, the earning would go up, so it did cross some people’s minds that we should put two dollars on any horse that comes here,” Ducharme jokes. “That did sound like insider trading, so we didn’t do that.”

Ducharme, who grew up around horses, says he follows the big horse races, but whether or not a horse he’s treated earns money is not the biggest reward for him. “It’s nice when you get a win picture, but the reward for us is not having as many failures. We hate failures,” he says. “It used to be that a failed surgery would mean a horse that couldn’t swallow or food and water coming out its nose, and as a surgeon, you think, what have I done? We’re more motivated by ‘we’ve got to be able to do a better job.’ I’d like to treat them all like they’re my own horse. You never settle.”

Ducharme spends three or four days a week in surgery, answering as many calls as he can. “I don’t want to turn anyone away because that’s our research, that is how we learn, that’s how we’re going to find out what’s working,” he says.

A Smart and Caring Team of People

Ducharme jokes that he’d be living on the street if it wasn’t for Cornell. “The brand is so important. It gives you credibility. If you’re on the Cornell payroll, people assume there must have been some vetting process,” he says. “And you are surrounded by very smart people!”

Ducharme came to Cornell for his residency, working under Hackett, and returned as a faculty member in 1986. He says one of the things he loves about Cornell is the sense of being on a team.

“You have the right mentors, the right colleagues working in different areas. We have all these people who really care, working together,” he says. “You need all of it. You need to align basic medical research with the clinical population, and you need a performance testing clinic, which we have here. My part in this is very small.”
Ducharme tells a story of how the Cornell Polo team even helped his group by bringing their horses in to establish baseline testing on the treadmill. “There really wasn’t anything in it for them. It was more, we’re all on the same team,” he says. “Really, whatever things our group has achieved, we’ve achieved as a group within a great university.”

by Caitlin Hayes

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