# WILD HORSES — THE STRESS OF CAPTIVITY

Bruce Nock, PhD

Washington University School of Medicine, Departments of Psychiatry and of Anatomy and Neurobiology, St. Louis, MO 63110, USA

Liberated Horsemanship
LiberatedHorsemanship.com

Stress — we've all experienced it at one time or another. Too little time, not enough money, loss of a loved one, problems with no good solutions, thoughts of death, taxes, traffic, deadlines, boredom, aches, pains, illnesses. Sometimes the causes of stress seem endless.

Here's the thing. I bet everyone reading this knows too much stress isn't good. A little maybe is OK under some circumstances. It can be a motivator for some people, even fun. More than that … not so good.

But few people really appreciate how damaging too much stress is and how far reaching its negative consequences are. It might surprise you but experts now commonly estimate that up to 90% of all of our visits to primary care physicians are stress related in one way or another. Ninety percent! What if I changed it around a little and said 90% of all of our visits to physicians were related to some environmental contaminant? There would be panic in the streets. Protests. People screaming for the government to get it cleaned up, right?

The evidence that stress is a powerful destructive force is indisputable. It pokes and prods, finds weaknesses, and then exaggerates them … turns them into pathologies. Diseases and disorders from the common cold to degenerative diseases like diabetes to the atrophy of certain brain regions are now known to be caused or made worse by stress. There is every reason to believe the same is true for horses. And it may be hard to believe but psychological stress is the worst kind.

So let me tell you what happens to a wild horse's physiology when he/she suffers the severe stress, trauma, of being chased and sequestered into captivity. Then, I'll tell you what some of the consequences are. I don't think it's an exaggeration to say, as gathers are routinely done in the USA, if a wild horse doesn't die straight off from the immediate devastation and commotion, it compromises him/her physically and mentally, putting him on a path of accelerated deterioration.

## THE CHASE

There you are, a wild horse leisurely passing the day on the open rangelands of western United States. Life is good—congenial herd mates, nice weather and enough to eat. Suddenly you are startled by movement and strange sounds behind you. All of your senses instantly come alive—your eye sight sharpens and your hearing becomes more acute. You make a flash decision … run!

But it doesn't take long for your body to realize it's going to take a ton of energy to fuel the burst of action needed to outrun that thing in the sky that's coming after you. Good news: There are still nutrients in your bloodstream from when you were grazing that can be used for fuel. The bad news is, insulin is directing it into cells for storage. But this isn't a time to store energy away; you might need all that you can get to survive the moment. So your sympathetic nervous system kicks in and turns insulin secretion off. At the same time, cortisol, a hormone secreted by the adrenal glands, makes cells insensitive to any insulin still floating around in your bloodstream. Now, the nutrients from that last meal are no longer being stored away but are kept available for immediate use.

But that still may not be enough energy. Where is the extra energy going to come from? There is no time to eat and digest more forage. In fact, you lost your appetite and digestion came to a screeching halt the instant you were alarmed. Your only option is to tap into stored sources of energy. Cortisol, along with several other hormones, including glucagon, spring into action and reverse the metabolic steps that were followed when you were storing nutrients away: protein is broken down into amino acids; triglycerides are degraded to fatty acids, glycerol and ketone bodies; and glycogen is converted to glucose. And all of the products are spewed into the bloodstream as energy sources.

But, amino acids are not good energy sources in themselves. So, through a process called gluconeogenesis, the liver converts certain ones into glucose, a far better source of energy. Now there is lots of fuel available.

But you are also going to need extra oxygen. So you take in a bunch of it with a sudden gasp. Then you breath deeper and faster and your bronchial tubes dilate to increase oxygen intake.

At the same time your heart beats at a higher rate and with a greater force to distribute the extra fuel and oxygen to your tissues and organs. But the resources aren't wasted on processes that aren't vital to surviving the moment. Through changes in vascular dilation and constriction and other complex processes, the fuel and oxygen is shunted to precisely those tissues and organs that need it most, like the muscles used for running, and away from those that are not as critical for surviving the moment, like the digestive tract. And Voilà! You gallop away as fast as you can to avoid the noisy monster in the sky behind you.

But what if you get hurt during the commotion. Well, your body prepares for that too: Blood vessels in your skin constrict to minimize bleeding. Levels of the clotting factor, fibrinogen, rise in the blood to accelerate blood clotting. Many aspects of your immune system are enhanced to help protect you against infection. In fact, at the instant you were alarmed, white blood cells, the first line of defense against infection, were strategically dispatched to places that are most susceptible to wounding, like the skin. When they got to those places, they

attached to nearby tissues and organs and waited for a call to action. At the same time, the potent pain killer, ß-endorphin, a morphine-like substance, was released in your brain so you can continue to flee pain free under the worst circumstances.

## THE FIGHT-OR-FLIGHT REACTION

The intricate physiological events described above are part of what is known as the fight-or-flight reaction—bodily changes that enhance a horse's chances of surviving a frightening situation by increasing his/her alertness, capacity for physical exertion and ability to withstand injury.

It all begins in a primitive part of the brain called the hypothalamus. The hypothalamus collects information about the state of the environment and the state of the body, integrates it and then signals for appropriate changes to physiology and behavior. When a horse is faced with a threatening or frightening situation, it is the hypothalamus that marshals the forces for action.

The first action of the hypothalamus is to activate the sympathetic nervous system—a subdivision of the autonomic nervous system. The sympathetic nervous system originates in the spinal cord and sends branches out to nearly every organ in the body. It also sends nerve fibers to every blood vessel and sweat gland. The sympathetic nervous system does many other things as well to

help horses deal with threatening/frightening situations. Remember, it innervates nearly every organ in the body.

The hypothalamus also activates a direct neural link to the inner core of the adrenal glands which are perched on top of the kidneys. The adrenal glands respond by pumping out the first of two vital fight or flight hormones, epinephrine, into the bloodstream. I'm sure you have heard of epinephrine; maybe you know it as adrenalin—epinephrine and adrenalin are different words for the same hormone. Unusual feats of strength and bravery in real life, sports and movies are commonly attributed to the release of adrenalin under emotional or emergency conditions.

Next, the hypothalamus signals the adrenal glands to secrete another type of hormone. This time the signal is indirect. It's relayed through the pituitary gland which lays at the base of the brain. The hypothalamus signals the pituitary gland by secreting a hormone called corticotropin releasing hormone, CRH to keep it simple, into a private network of tiny blood vessels called the hypophyseal portal system which links the hypothalamus with the pituitary gland. The pituitary gland responds by releasing another hormone, adrenocorticotropic hormone, ACTH for short. ACTH, in turn, travels through the bloodstream to the adrenal glands where it induces the synthesis and release of cortisol. Among it's many functions cortisol helps to regulate the metabolism of carbohydrates, like **gluco**se —it belongs to a class of hormones called **gluco**corticoids. Glucocorticoids are

**catabolic** steroids. In contrast to the **anabolic** steroids that enhance muscle growth and get major league baseball players in all sorts of trouble, glucocorticoids stimulate complex materials, like the proteins that make up muscles, to breakdown.

Cortisol is synthesized in and secreted from the outer shell of the adrenal glands. It influences the functioning of virtually every tissue and organ in the body and it affects an amazingly large number of different bodily processes. It is crucial for adaptation and survival. A chronic cortisol insufficiency results in Addison's Disease and, in turn, death, if it goes untreated. But too much of this powerful hormone isn't good either. In fact, many of the harmful consequences of stress are due to overexposure to cortisol.

## THE RUB

You might be thinking, "So, what's the problem? All of the physiological changes described above that are activated by a chase are normal … beneficial. They help horses deal with physical threats and emergencies. They maximize his/her capacity to run and ability to withstand and cope with injury. In essence, they optimize a horse's chances of surviving a gather." All true. But, here's the rub.

The fight-or-flight reaction is about surviving the moment—not efficiency, not growth, not repair. Resources are shunted to organs and processes that are critical for surviving the moment. Long-term projects, like reproduction, are put

on hold when the fight-or-flight reaction is active. Expending resources to sustain and maintain a fetus, for example, just isn't physio–logical if it seems like you are about to die. It isn't surprising that the BLM reported 20 – 30 mares "miscarried" in association with the Calico Complex Gather. In addition to the miscarriages, one wonders whether and how many fetuses were resorbed by mares?

You might also recall what I said above about digestion. It came to a screeching halt as soon as the horse was alarmed. Perfect conditions for the development of intestinal compactions and colic—the #1 killer of horses. Again, it is no surprise the BLM reported colics associated with the Calico Complex Gather.

The same can be said for the horses reported to be "Not Adapting to Hay." Of course not! Let's be honest. It has nothing at all to do with the hay and probably little to do with the change of diet. It's about being scared our of their wits and the sympathetic tone shutting down processes related to appetite and digestion.

But these overt consequences are just the tip of the iceberg. Let me explain. Here's the thing, psychological stress regardless of the source also activates the fight-or-flight reaction. The body doesn't distinguish between a fight-or-flight situation, like being chased by a helicopter, and a psychological stressor. That means the bad news for wild horses only begins with the gather.

Once in captivity, there are all sorts of unnatural stressors to deal with … things that go against some of the most basic instincts of horses. And they cause the same bodily changes as the "chase."

There's the confinement itself. Imagine how stressful confinement in an unfamiliar place must be to a species who depends on running for survival and who instinctively avoids places where they might get trapped.

On top of that, there's the social unrest from confinement in close quarters with unfamiliar horses. And don't overlook the importance of such things as the loss of or separation from lifelong herd mates … companions and family. It is egocentric to think such things are only important to our species.

Then, there's the boredom that goes along with captivity. Again, it causes the same bodily changes as the "chase." But, physiological changes that were designed to maximize physical capabilities do little to help horses deal with the boredom and inactivity that goes along with confinement in paddocks.

A loss of control also goes along with captivity. Freedom of choice is merely something to dream about. I know, some of you are skeptical about this one, right? Consider this. Horses attain social order within a herd by forming a dominance hierarchy. But they don't all go to the town hall and vote to decide the rank order; it's the outcome of agonistic encounters—contests to see who can intimidate or out fight who. Have you ever wondered why horses fight to attain social order? It doesn't make sense. Think about it. It's like making a house

messy so you can put it back in order. Why not leave well enough alone … everyone just mind their own business. Well, the truth is, a horse doesn't strive to outrank another horse because he or she anticipates that it will lead to social order. That's not it; social order is merely a byproduct. Horses strive for a high rank because high ranking horses go where they want to go and do what they want to do—**Freedom of Choice**—to horses, it's worth fighting for.

The ability to control one's own movement and activity is as important to horses as it is to us. The loss of control, on the other hand, is a powerful psychological stressor. In fact, it is a key factor in determining whether situations, events and circumstances are stressful and mentally or physically damaging.

Along the way, there are also transfers from one paddock and group to another, and transportation in trailers from here to there for one reason or another. And so on and so on. To these wild horses, the sources of stress must seem endless. Everything is foreign … truly disturbing for a species that depends on familiarity for safety and comfort.

So, the gather is just the beginning. And, I've only touch on some of the more obvious stressors gathered horses subsequently face. For example, I haven't mentioned captivity can even compromise a wild horse's ability to deal with natural stressors, like severe weather conditions, biting insects, and so on. I don't think it is too far out of line to say nearly everything about captivity is probably

stressful to one degree or another to wild horses, especially when it begins with the traumatic experience of a gather.

It is extremely detrimental to their long-term health and soundness. It's no different than what stress does to us. Remember, 90% of all of our visits to primary care physicians are now believed to be stress-related in one way or another.

## So What Goes Wrong?

The fight-or-flight reaction/stress response is about surviving the moment. It prepares the individual for intense physical action. To fuel this revved-up mode the body goes into metabolic overdrive, energy stores are mobilized & nutrients are dumped into the bloodstream. Activate the stress response too often or for too long and a horse is headed for trouble.

At the most basic level, it's just inefficient. Every time the stress response is turned on it's costly. It takes a great deal of energy to drive the fight or flight reaction. Consequently, the horse loses a chunk of potential energy that could be used for normal activities and for maintaining and repairing his body. In effect, a horse gets penalized each time the stress response is activated. Activate it too often or for too long and he's got problems. He ends up expending so much energy that, as a first consequence, he gets lethargic … no energy or enthusiasm.

At the same time muscles begin to very slowly waste away. You see, one of the ways the body makes more energy available for fight or flight is to break protein down into amino acids. Then the liver converts them to glucose, the body's main source of energy. Well, muscles are chock-full of protein. If stress repeatedly triggers protein breakdown into amino acids, it's called catabolism, muscles never get a chance to recover and rebuild properly. Catabolism can also weaken connective tissues and joints, thin skin and impair wound healing. It may even contribute to the development of laminitis and founder by weakening hoof laminae.

Too much stress isn't good for bones either. Stress wreaks havoc with the trafficking of calcium, biasing bone toward disintegration, rather than growth and repair. Activate the stress response too often or for too long and it interferes with bone growth, increases susceptibility to bone injury, slows recovery from bone damage and accelerates osteoporosis.

Stress is also a major contributor toward obesity and insulin resistance. You're probably wondering how that fits with my assertion that appetite and digestion come to a screeching halt when the stress response is activated, right? Well, stress also increases appetite. It's all in the timing. After the termination of a stressful period, cortisol levels remain elevated for a while. During this post-stress period cortisol increases appetite to help the body recuperate. More

importantly for horses, cortisol also promotes fat deposition during the post-stress period.

Now, this is even worse than you might think. The bodily changes that occur when the stress response/fight-or-flight reaction is activated are designed to support sudden, intense physical action. Tons of nutrients are dumped into the bloodstream to fuel it. But, often physical action isn't an appropriate response to the unnatural stressors gathered horses face. Consequently, much of the fuel isn't used. Then, when the stress response deactivates, the leftovers have to go somewhere. That somewhere is fat cells. It's not the fat you see at the crest of the neck, behind the shoulder blades or at the tail head. It's intra-abdominal fat. Intra-abdominal fat surrounds internal tissues and organs like the heart, liver and kidneys. It's the harmful fat that causes **all** of the problems associated with obesity.

There's more. To help fuel the fight-or-flight reaction muscle is broken down into amino acids that are then converted to glucose, the body's main source of energy, by the liver. So, how do you think some of that glucose that once was muscle ends up? Right, as fat.

The situation gets even more grim if the horse is on a high calorie diet , like alfalfa hay, because that ends up in fat cells too during the post-stress period. And maybe the horse is inactive for much of the day, just standing around in a paddock and using very little fuel—all the more for those bulging fat cells. Add

frequent periods of stress and over time some intra-abdominal fat cells expand to a point where they burst or leak. The cellular debris then sparks an inflammatory response. This is **the** crucial event in the etiology of insulin resistance … a major cause of chronic laminitis and founder.

Stress can also affect health through immunity. Stressors of all types, including psychological, boost immune function for 30 minutes or so. But with major stressors with longer durations immunity plummets to 40 to 70% below normal. Bad news for the horse. His/her ability to fight off and recover from diseases is compromised. It also compromises the horse's ability to identify and destroy tumors and parasites.

Stress can also affect gene activity. There are two general ways. First, when the stress hormone cortisol enters a cell it binds to specialized proteins called receptors. Together cortisol and the receptor then alter the activity of certain genes within the cell. Cortisol affects a huge number of bodily processes this way.

For example, the hoof wall grows throughout life. Regeneration occurs at the coronary band where hoof germinal cells, epidermal cells, produce daughter cells called keratinocytes or keratin producing cells, which mature and keratinize … form fibers of keratin filaments inside them. It's what makes the hoof wall hard. When cortisol enters an epidermal cell it turns off the process of keratinization and the integrity of the hoof is compromised. The body is very prudent when the

fight or flight reaction is activated. As I've said, it doesn't waste energy on long term projects like growing hoof.

Stress can also influence gene activity through newly discovered epigenetic mechanisms — changes to the micro-environment surrounding a gene. These changes can either increase or decrease the activity of a gene. Such changes can have dramatic effects on how an animal functions, behaves and even looks. And it can last a lifetime. Epigenetic modifications may even be inheritable. That means things we do to and with today's generation of horses may affect future generations as well.

## Just My Opinion

I'm 63 years old. There was a time when I was very proud of my generation. During the years of the Viet Nam war, we took a stand … spoke out against the war, civil injustices and so on. We protested, marched and preached peace, love and kindness. We condemned apathy.

It's now thirty five plus years later. Perhaps we can step forward again and leave our mark on history. We started out passionate about making things right, why not make some noise on the way out too. What our government is doing to the wild horses of the western US and the way it is being done is an atrocity. It is an injustices against nature. Even the horses left behind or turned back out suffer from the social disorder gathers cause.

The U.S. government now estimates that 33,000 horses are left on the range, while 36,000 are warehoused in Midwestern holding facilities. By contrast, some two million cattle still graze our public lands.

We have had people from 15 different countries come to our Liberated Horsemanship clinics here in Warrenton, MO. We also traveled to Italy and British Columbia for clinics in 2009. I can't tell you how many times I have heard people from other countries ask something like, "What's wrong with people who allow an icon of their country to be unnecessarily brutalized and exterminated by their government?" It's an embarrassment and I don't have a good answer. Apathy and self-indulgence maybe. But I believe it is more likely just too few people are aware of what is being done and its short and long-term consequences … for the horses themselves and for our country. Mahatma Ghandi once said, "A nation's greatness is measured by how it treats its weakest members." For me, and many others that includes animals.