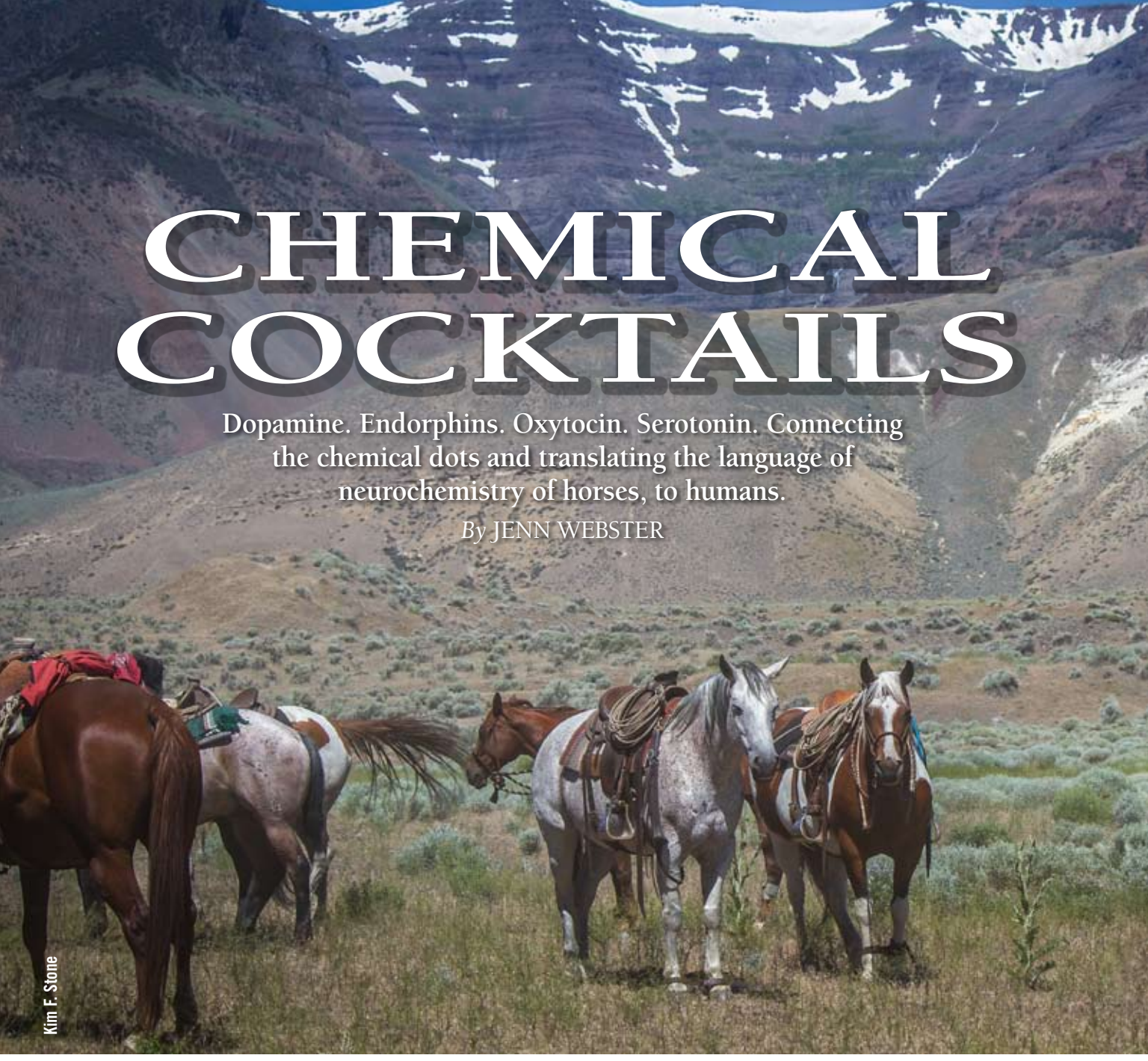
CHEMICAL COCKTAILS

Dopamine. Endorphins. Oxytocin. Serotonin. Connecting the chemical dots and translating the language of neurochemistry of horses, to humans.

By JENN WEBSTER



Kim F. Stone

In the first installment of our series, we introduced renowned clinician Martin Black, and neuropsychologist Dr. Stephen Peters to *WHR* readers. We also touched upon the basic anatomy of the horse's brain, compared it to that of a human and jumped head first into the brain functionality of an equine. In this segment, we will examine the processes of neurochemistry and how it impacts the learning process of the horse – both positively and negatively.

Seizing the rare opportunity of sitting down with both Black and Dr. Peters at the same time, *WHR* attained an invaluable understanding of evidence-based horsemanship.

In this segment, we examine some of the basic chemical reactions that occur within a horse's brain, during a learning process. As always, Dr. Peters' information is balanced by Black's empirical experience, gathered by his lifetime with horses. The facts assembled by these two highly respected professionals, can give horse owners a deeper understanding of their equines and an ideal for the optimal path to learning success.

Emily Luciano

Dr. Stephen Peters (left) and Martin Black have forged a ground-breaking movement in horsemanship across the globe.

THE DOCTOR & THE COWBOY

Like every American boy growing up at the time, Dr. Stephen Peters initially wanted to be a cowboy.

"Unfortunately I had to become a doctor to afford to become a cowboy," he laughs.

By profession, Dr. Peters is a neuropsychologist specializing in brain functioning. However, in the training of his own horses (incidentally he owns six horses, one burro and one mule), he began to crave a better comprehension of the neuro-functioning of the horse's brain.

"I understood the differences between horses and humans and that they should each react in certain ways, but then I would talk to five 'experts' in the field as to why my horses were reacting in certain ways and I'd get five different answers. So I began to question the answers I received."

Using evidence-based thinking, Dr. Peters began to look for evidence gathered by observation: best practices determined by empirical evidence. These best practices were seen to work, or not work in actual practice and not theory – giving Dr. Peters clinical observations supported by the most current scientific knowledge.

"As I started to apply scientific principles to horses, it became exciting because I felt like I was getting a handle on things. I was getting objective data because I would look at it with an open mind. Then I would go and visit various veterinarian programs, such as Cornell. I would ask say, 'This is what I'm finding...' and they'd say, 'Yeah, you're right on.'"

It was at this point that Dr. Peters met professional trainer, Martin Black. Over the course of his lifetime, Black had experience with thousands of horses – which was the foundation for the best research. By combining Dr. Peters' scientific observations with Black's empirical evidence, the duo was able to support the facts they assembled from their respective disciplines.

"When I talked to Martin about it all, he said, 'We have an obligation to let people know about this stuff.'" Dr. Peters explains.

"You can't talk neurochemistry to people without translating it to them."

"We also knew people would want to know how they could apply the information practically in the arena or on trail," Black chimes in.

Observations that Black had made for years could be corroborated with evidence based on the horse's central nervous system, autonomic nervous system and neurochemistry. Putting these pieces of the puzzle together – empirical observation informed by science, – is the essence of evidence-based horsemanship.

"Martin said to me, 'You're a scientist, but you've got a cowboy hat too.' He asked me to show him my findings and from there we wanted to see how it matched his experience. Turns out, it was a match made in heaven," Dr. Peters says.

CAPITALIZING ON DOPAMINE

Although horses have personalities based on how they behave, it would be anthropomorphic to assign human personality traits to them. Although we may want to believe that horses process things the same way we do, this assumption only makes us as humans feel better.

"A lot of times we want to think that our horses think like we do, but they can't. And I'll show you why," says Dr. Peters, matter-of-factly.

Horses have one brain with two hemispheres connected by the corpus callosum. The equine brain is approximately the size of a large grapefruit and proportionately 1/650th of the horse's body weight. The horse's brain has a large cerebellum for balance and smooth movement and most of it is dedicated to sensory and motor functions. Conversely, a human brain has three progressive layers, and this part of our anatomy makes up 1/50th of our body weight. Since horses don't have the large frontal lobe in their brains that humans do, they do not have the ability to analyze things, play jokes or plan for the future.

"Our horses have motor sensory systems. And their anatomy shows me that. Unlike horses, humans have a frontal lobe – that's where we analyze things, where our personal-


Maddy Butcher


Emily Luciano

left: Once the horse has established a pattern of dopamine-reinforced learning, he can become very good at finely discriminating which of his behaviors are awarded. His response times become faster and more accurate. right: Using evidence based practices (common in medicine), Dr. Peters and Martin Black are bringing to light, some of the mysteries surrounding how a horse thinks.

ity comes from, and it's how we can plan things in advance.

Evidence-based horsemanship can also help to dispel common myths and beliefs, and validate the empirical findings of people with expertise and a deep understanding of the horse.

"One of the myths out there is that because of a horse's eye placement, people think image information doesn't actually make it across to the other side of the horse's brain. But if a horse had a left brain and a right brain, why do you think it would have one large corpus callosum and an optic chiasm (or crossing of fibers) to send signals to both sides of the brain?" says Dr. Peters.

He continues, stating that the olfactory nerve is very important in the horse. By comparison, it's like a shoestring in a human. When a horse smells something, sensory impulses from the organ of smell in the nose pass via the olfactory nerve to the olfactory centers of the cerebral hemispheres in the brain, where they are interpreted and co-ordinated.

With the anatomy considered, Dr. Peters and Martin Black knew that the horse's brain was very different from that of a human.

"However, we began to get excited about what was going on chemically inside the horse's brain too," Dr. Peters states.

"I would talk to Martin about neurotransmitters and things that at first, sounded like they were a different language. But when we talked about how they looked, Martin knew exactly what it was. For years, he felt there was a chemical piece to all of this."

One of the elements that added to Black's understanding of horses was his ability to read their facial expressions and consequently, determine their dispositions. It's one of those traits, developed over years of experience that makes him a master horseman. Understanding equine facial expressions – or the ability to "read" horses – is something all great horsemen have in common. A horse's disposition determines how trainable the animal is and how well it will retain what it has learned.

"Learning the science behind what caused those expressions that I was seeing and how the different chemical reactions affected the disposition of the horse has given me access to better tools and a better understanding," says Black.

Dr. Peters goes on to explain that the horse was designed with drugs and receptors already set up in its brain. (Brain signals are sent electrochemically. The chemicals involved in signals are called neurotransmitters or neurochemicals.)

"We can actually dole out the dosages of those chemicals," states the scientist.

"Dopamine, endorphins, oxytocin (what we call the trust or social chemical), serotonin... They've found that if you scratch the horse's withers you can actually release oxytocin within the horse. And serotonin, for example, is an important chemical to look at when we watch it decline – chemically it can appear that the horse is becoming 'depressed.'"

"Although I had a sense that there may be some chemical reaction inside the horse, it wasn't until I met Steve and he explained how the neurochemical system works that it really made sense to me," Black remarks.

"Understanding that horses can be intoxicated from these chemicals in situations has given more definition to the expressions that I was basing judgments from."

The trainer explains that a person simply needs to recognize one point in the program when to tap into the horse's neurochemical system a little bit, and a positive learning experience can be found.

"That's what I try to get out of the horses that I handle. That's how I get to that willingness," he affirms.

"There was a cowboy Martin and I came across recently who told us, 'I always knew this stuff about horses – I just lacked the vernacular!'" Dr. Peters chuckles.

"All kidding aside, we do know there's an optimal chemical state for the horse to be in for learning. There's actually a switch, that the horse is seeking – which is central to the learning process."

Horses learn by habit. A handler's ability to predict positive feedback for the equine is the key to the learning process. Dopamine is an important neurotransmitter associated with reinforcement/reward and motor movement. In horses we might think of dopamine release as related to the relief of pressure. Horses want comfort and relief from pressure. They will seek out the dopamine release because it feels good. Many good horseman will associate the licking of the horse's lips with a positive experience in training. However, it's important to note that a dopamine release can happen regardless of a positive or negative change.

"One of the key components to training is

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getting the horse to lick the lips," says Black.

"I didn't know about dopamine at the time – Steve refined the path I was on with horses so I eventually became a little more centered on the road – But the thing with most trainers is that I've found they're not willing to take the time needed for a dopamine release within the horse. If we're not moving the horse's feet, we really should let the horse dwell and lick his lips. I've had horses that I've stood for 45 minutes and they're still licking their lips. The more times I've repeated this process, the quicker the animal was to make the right decision the next time.

"Just because the horse is licking its lips, doesn't mean they had a good learning experience. You can be shoeing a horse and he kicks you and rolls you out on the ground and, while you're trying to get your air and get back up, he's licking his lips, getting the dopamine. This isn't an experience you want him to repeat again."

Essentially horses don't discriminate between good and bad learning. They will search for the dopamine release regardless of how humans interpret their actions.

"It's interesting because we've done experiments with human patients with functional MRIs and we've gained some very valuable evidence. The experiments that involved having the patient do a series of things to learn discovered that humans who were allowed to sit and rest in between sessions, had more brain activity than those constantly drilled with learning. Initially we assumed there wouldn't be much brain activity going on while they sat quietly, stopped in the experiment," Dr. Peters states.

"But holy mackerel! The same areas of their brains that light up in the experiment, would light up again during the down time. The motor movement would replay again in the down time. Those people whom we stopped, actually learned better than those who didn't stop. And they remembered it better. Horses do the same – If you just keep after horse and you drill and drill and drill, you're actually closing the door to learning."

Repetition doesn't necessarily teach willingness. Stressing a horse however, and letting it come back to get some dopamine – every time it even thinks of becoming stressed again – means we can shape the way a horse thinks about coming back. Once the horse has established a pattern of dopamine-reinforced learning, it can be become very good at finely discriminating what behaviors get awarded and their responses become faster and more accurate.

Black concludes, "Comparisons or studies that I had made for years weren't based on how much a horse sold for or how athletic he was – even though that's how most people judge horses. I cared more about what makes that horse different on the inside, from another one. If I can get that horse in a specific frame of mind, he'll be just as quiet as a draft horse. He might not have athletic ability, but he has a desire. My goal is to be the perfect bartender – to mix exactly the right chemicals at exactly the right time for exactly the right situation. That's what I found to be the secret of good horsemanship."

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