

## Cowgirl and the Neuroplastic Revolution

My first avocation was as a Cowgirl. It was a gusty October morning in 1965, just two months after my ninth birthday, and I had set out on horseback with my dad and nineteen year old sister, to move about 85 yearling heifers to a pasture north of our ranch house in eastern Montana. I had been climbing the available rungs of advancement, mastering each of a couple dozen ranch horses with my developing equestrian skills; the pinnacle achievement still to ride my Dad's horse, Esquire. But my sister had returned from college with a new high-powered, part-thoroughbred, sorrel barrel-racing horse named Playboy, and I must have applied my "Bestest-buddy" status to get Dad's permission to ride Playboy on this day's mission.

Occasional gales buffeted us, rattling in the edges of the scarf tied around my head to keep my ears warm, and all the animals were ready to run with the crisp, cool giddiness of wind-driven impulsivity. As we approached the far fence with our bunch of surely yearlings, Dad (true to his "Cowboy Hall of Fame" legacy) loped the bronc he was training forward to pitch open a wire gate. Cattle began to run with wild wind in their ears, and I kicked Playboy out to head- off the lead. I could feel his muscular body respond and pick up the cadence as we loped wide-open toward the front of the herd. My sister's scarf began a fast flutter in the breeze, whisking right off her head, and when Playboy saw the white flash whip from behind, he abruptly cut to the side, ducking into a sudden jolting shy. My foot slipped through the stirrup and for several long and breathless seconds I dangled under Playboy as he bucked and kicked wildly, attempting to get free of his up-side-down rider. At about the time his hoof struck my head, my tennis-shoe slipped out of the stirrup and he thundered away.

They told me the rest, about how we got home and over the 75 miles to the nearest hospital, and since all the charter planes were occupied with hunters, the 116 mile ambulance ride to a bigger hospital with neurosurgeons waiting. The word was they opined that in another 20 minutes I would have been dead. The next thing I knew, a couple of weeks later, a five inch diameter chunk of my skull had been removed to accommodate brain swelling from an epidural hematoma, and I would require a metal plate the size of a horse's hoof to replace it. No one knew how much I would be changed by this experience. But perhaps it had something to do with my aspiration to achieve a doctorate and to make my life work in the domains of integrated healing.

For four hundred years mainstream medicine and science believed that brain anatomy was fixed. The common wisdom was that after childhood the brain changed only when it began the long process of decline; that when brain cells failed to develop properly, were injured, or died, they could not be replaced. Nor could the brain ever alter its structure and find a new way to function if part of it was damaged. Since the brain could not change, human nature, which emerges from it, seemed necessarily fixed and unalterable as well. In this way a neurological nihilism – a sense that treatment for many brain problems was ineffective or even unwarranted – had taken hold, and spread through our culture, even stunting our overall view of human nature.

The belief that the brain could not change had three major sources: the fact that brain-damaged patients could so rarely make full recoveries; our inability to observe the *living* brain's microscopic activities (western science's brain research was advanced over the past 400 years on the study of cadavers!!!); and the idea – dating back to the beginnings of modern science – that the brain is like a glorious machine (inherently incapable, however, of growth and change).

In the 60's and 70's brain scientists showed that the brain changed its very structure with each different activity it preformed, perfecting its circuits so it was better suited to the task at hand. If certain "parts" failed, then other parts could sometimes take over. The machine metaphor, of the brain as an organ with specialized parts, could not fully account for changes the scientists were seeing. They began to call this fundamental brain property "neuroplasticity." These scientists persisted in slowly overturning the doctrine of the unchanging brain. They showed that children are not always stuck with the mental abilities they are born with; that the damaged brain can often reorganize itself so that when one part fails, another can substitute; that if brain cells die, they can at times be replaced; that many "circuits" and even basic reflexes that we think are hardwired are not. One of these scientists even showed that thinking, learning, and acting can turn our genes on or off, thus shaping our brain anatomy and our behavior – surely one of the most extraordinary discoveries of the last century.

The idea that the brain can change its own structure and function through thought and activity is quite possibly the most important alteration in our view of the brain since we first sketched out its basic anatomy and the workings of its basic component, the neuron. The neuroplastic revolution has profound implications for our understanding of how love, sex, grief, relationships, learning, addictions, culture, technology, and psychotherapies change our brains. Neurofeedback is one of the leading technologies enabling our own participation in this revolution. I feel honored in the full circle of things to have as my occupation the assistance to others of increasing their neuroplasticity in service to empathy, compassion, and resilience.