

‘..... As neurons fire together, they wire together..... When we have an experience, our neurons become activated. What this means is that the long length of the neuron - the axon - has a flow of ions in and out of its encasing membrane that functions like an electrical current. At the far end of the axon, the electrical flow leads to the release of a chemical neurotransmitter into the small synaptic space that joins the firing neuron to the next, post synaptic neuron. This chemical release activates or deactivates the downstream neuron. Under the right conditions, neural firing can lead to the strengthening of synaptic connections. These conditions include repetition, emotional arousal, novelty and the careful focus of attention. Strengthening synaptic linkages between neurons is how we learn from experience.....

During gestation, the brain takes shape from the bottom up, with the brainstem maturing first. By the time we are born, the limbic areas are partially developed but the neurons of the cortex lack extensive connections to one another. This immaturity - the lack of connections within and among the different regions of the brain - is what gives us the openness to experience that is so critical to learning. A massive proliferation of synapses occurs during the first five years of life. These connections are shaped by genes and chance as well as experience, with some aspects of ourselves being less amenable to the influence of experience than others.....

But from our first days of life, our immature brain is also directly shaped by our interactions with the world, and especially by our relationships. Our experiences stimulate neural firing and sculpt our emerging synaptic connections. This is how experience changes the structure of the brain itself-and could even have an influence on our innate temperament.....

You may be wondering, ‘How can experience, even a mental activity such as directing attention, actually shape the structure of the brain?’ As we’ve seen experience means neural firing. When neurons fire together, the genes in their nuclei - their master control centres - become activated and express themselves. Gene expression means that certain proteins are produced. These proteins then enable the synaptic linkages to be constructed anew or to be strengthened. Experience also stimulates the production of myelin, the fatty sheath around the axons, resulting in as much as a hundred fold increase in the speed of conduction down the neuron’s length. And as we now know, experience can also stimulate neural stem cells to differentiate

into wholly new neurons in the brain. This neurogenesis, along with synapse formation and myelin growth, can take place in response to experience throughout our lives. As discussed before, the capacity of the brain to change is called neuroplasticity. We are now discovering how the careful focus of attention amplifies neuroplasticity by stimulating the release of neurochemicals that enhance the structural growth of synaptic linkages among the activated neurons.

An additional piece of the puzzle is now emerging. Researchers have discovered that early experiences can change the long term regulation of the genetic machinery within the nuclei of neurons through a process called *epigenesis*. If early experiences are positive, for example, chemical controls over how genes are expressed in specific areas of the brain can alter the regulation of our nervous system in such a way as to reinforce the quality of emotional resilience. If early experiences are negative, however, it has been shown that alterations in the control of genes influencing the stress response may diminish resilience in children and compromise their ability to adjust to stressful events in the future. The changes wrought through epigenesis will continue to be in the science news as part of our exploration of how experience shapes who we are.

In sum, experience creates the repeated neural firing that can lead to gene expression, protein production, and changes in both the genetic regulation of neurons and the structural connections in the brain. By harnessing the power of awareness to strategically stimulate the brain's firing, mindsight enables us to voluntarily change a firing pattern that was laid down involuntarily. As you will see throughout this book, when we focus our attention in specific ways, we create neural firing patterns that permit previously separated areas to become linked and integrated. The synaptic linkages are strengthened, the brain becomes more interconnected, and the mind becomes more adaptive.'