Like Siegel, the neuro-scientists Antoine Lutz and Richard Davidson, writing with scholar of Tibetan Buddhism John D. Dunne, note common ground between contemporary neuropsychological research and contemplative traditions; they have investigated Buddhist traditions of meditation. Buddhist contemplatives suggest that experience is not fixed, rigid, and predetermined. Emotions, attention, and introspection are ongoing, fluid processes that involve skills that can be trained, similar to other human skills like music, mathematics, or sports. Buddhist contemplative practices aim at observing the mind and training it to respond. Today, developmental models of cognitive processes support this view. Neuropsychological research is also supporting the view that experience changes the brain, a principle known as neuroplasticity.

Exciting current research on neuroplasticity shows concretely that experience can produce changes in the brain. For example, newborn rodents that receive varying levels of maternal care—licking by their mothers—develop very different behavioral characteristics. Those animals that receive high levels of nurturing grow to become more adaptable and relaxed adults. The brains of these animals are permanently affected by receiving different modes of rearing; the gene codes and gene expression are actually changed by this experience, and researchers have mapped the molecular pathways by which experience can alter gene expression.

Do similar alterations occur in humans? This has not been studied directly at the level of gene expression. However, research suggests that such changes do occur. For instance, research has shown that the brain of an expert, such as a chess player, taxi driver, or musician, is different from that of a non-expert. In a famous study, it was demonstrated that London taxi cab drivers have larger hippocampi than non cab drivers. Moreover, the longer an individual has worked as a cab driver, the greater the hippocampus, “as though the brain expanded to accommodate the cognitive demands of navigating London's streets.” Further research confirmed that brain size was actually altered by years of driving a
It has not been proved conclusively whether similar alterations in the brain can take place in response to emotional, rather than sensorimotor, experience, but both animal and human research suggests that it does. With respect to humans, research indicates that conditions such as chronic stress, neglect, and abuse produce functional changes in the brain. Likewise, research on depression shows that patients with mood disorders exhibit structural differences in the brain, which are even correlated with the number of days that the person has suffered from depression.

Researchers are now investigating whether experiences of positive emotions might similarly change the brain. Neuroscientists are studying meditative practices specifically designed to cultivate positive qualities, such as equanimity and loving kindness; researchers wonder whether they might not be able to produce long-term changes in the brain. Research has already indicated that even very brief short-term training in emotion regulation can produce long-term brain alterations, and that a two month course in Mindfulness-Based Stress Reduction (MBSR) creates changes in brain activity that have been shown to correlate with positive emotions.

The program of MBSR, developed by Jon Kabat-Zinn, teaches meditators to distinguish the initial primary sensory experience (for example, chronic pain, physical symptoms of anxiety) from secondary emotions and thoughts that arise in response to the primary experience. Mindfulness meditation teaches practitioners to observe their experience and to become aware of the impulse towards aversion and withdrawal from uncomfortable feelings and sensations. Practitioners of mindfulness gradually learn to tolerate unpleasant experience rather than retreating from it. This spares them the additional suffering created by the attempt to avoid discomfort.

Research has suggested that meditation training does cause changes in the brain. One study showed that brain regions associated with cognitive and sensory processing were thicker in meditators who had practiced Insight (vipassana) meditation for an average of nine years than for a control group of non-meditators.
We have seen that Zhuangzi puts stress on skill development. Many traditions see meditation as a skill of self-cultivation that can be learned through diligent practice.


Lutz, Dunne, and Davidson, 522; citing Sheline, Y. I., “Neuroimaging studies of mood disorder effects on the brain,” *Biological Psychiatry,* 54(3): 338-352

Lutz, Dunne, and Davidson, 522; citing Urry et al, *Neural correlates of voluntarily regulating negative affect.* (Report no. 725.18.); Davidson, R.J., “Alterations in brain and immune function produced by mindfulness meditation” [see comment]. *Psychosomatic Medicine,* 65(4): 564-570.

Ibid.

Ibid.