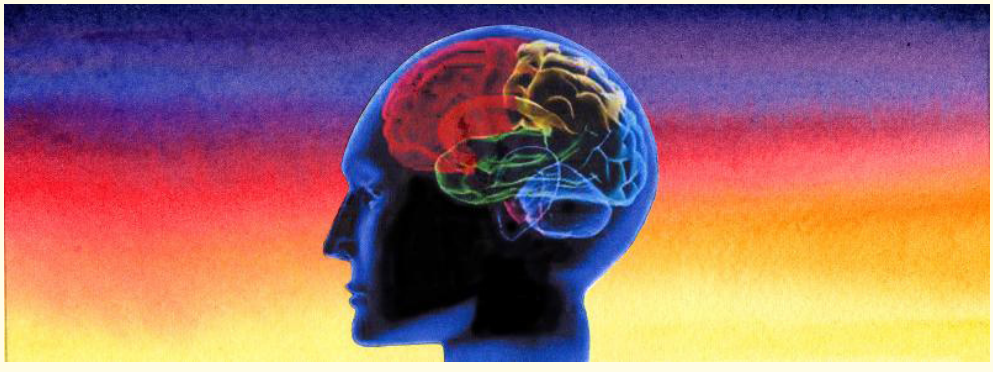
An Outsized, Outrageous Organ

Excerpted from The Human Potential Chronicles by George Leonard



We were 12 billion years or more in the making, our body the stuff of stars, our mind a mystery. We were born for learning, for journeying through inconceivable new worlds, destination unknown. We started in Africa beneath the trees and out across the open spaces at a time when there were no words, then traveled far and wide to light this world with speech and fire. From the beginning, we were extraordinary. Our Stone Age ancestors had brains as large as ours, brains with the capability, in potentia, to serve in piloting a spacecraft, playing a Bach partita, designing a computer, and understanding abstract mathematics. Even today, we are mostly untapped potential.

With one daring evolutionary gamble – the upright stance – our pre-human ancestors had set into motion a process that would lead to complex tools, cooking, agriculture, art, language, religion, cities, nations, worldwide communications, flight, the venture toward other worlds, and – perhaps most important of all – self-aware consciousness. All this would follow the earliest upright ape-human within a mere wink of evolutionary time. At last, after 12 billion or more years of life on this planet, the universe we know would get eyes with which to view itself.

A million billion connections

Before discussing the evolutionary leveraging that has made us what we are, let's examine the organ which in terms of size, function, and consequences most sets us off from our primate predecessors. Imagine your brain: three-and-a-quarter compact pounds of wet, slippery, blood-drenched protein and fat: the most complex, highly organized entity in the known universe. Weighing in at some two percent of our total body weight, it uses some 20 percent of our cardiac output. It is populated by as many as 100 billion twinkling neurons (brain cells), some with up to 10,000 or even more connections to other neurons.

Over 70 percent of the neocortex, the outer layer of the brain, is committed to no particular function and is thus available for learning beyond anything we could presently imagine. The neocortex alone has some 10 billion neurons, with at least a million billion connections. If you tried to

count just those connections, one per second, you'd finish counting 32 million years from now. The sum total of possible connections among all the neurons in the brain greatly exceeds the number of atoms in the known universe.

Beyond computation

Our neurons, contrary to popular assumptions in this electronic age, are not mere computer-like nodes. Many of them are versatile, complex personalities in miniature, able to learn new sensitivities, new behaviors. Not only can our neurons communicate directly with other neurons through electro-chemical synaptic connections; they can also tune into news of distant events in the brain through radio-frequency signals (both AM and FM) which influence the probability of firing. This occurs through resonance patterns caused by the cooperative firing of neuron groups, and through communications passed along by neuroglial cells.

These jelly-like neuroglial cells, once thought to be mere packing material between the neurons, are now understood to possess information storing and processing capabilities of their own. Neurons by the millions are also to be found in the spinal cord and gut, helping to direct our inner works, modulating messages between the brain and the rest of the body.

Add to all this a body-wide information system of a type that is entirely lacking in any computer. Small molecules called peptides are constantly swept along in the blood and cerebrospinal fluid, joining the brain with the rest of the body, causing complex and significant changes in thought, emotion, and immune function. Nearly a hundred different peptides have already been identified. Many more perhaps exist.

Some researchers in the comparatively new field of psychoneuroimmunology (PNI) argue that the interplay of peptides with peptide receptors on the surface of cells throughout body and brain carries considerably more information than all previously discovered brain mechanisms combined. Imagine a pharmacy with well over a hundred potions that can be mixed in all possible combinations and proportions, and you can begin to understand the power of this chemical information system.

Our ever-youthful brain

The architecture of the human brain was once thought to be dynamic in infancy and childhood, becoming increasingly static as we grow older. Recent research has shown that the adult brain is more dynamic than static, constantly reorganizing itself.

It was also once believed that after childhood we steadily lose brain cells which, once lost, can never be replaced. Decades ago, it was discovered that we can grow new dendrites, the microscopic tentacles that reach out from each neuron to make connections with others. More recent research reveals that if we stay active and keep learning we can also grow new neurons, from birth to death. Other factors being equal, the brain of an active, playful, lifelong learner could

contain far more neurons and even weigh more, up to 30 percent more, than otherwise would be the case.

Human vs. computer
In the 1960s, the top computer experts in the field were confidently predicting that by the 1990s we would have true Artificial Intelligence (AI). The AI ideal was typified by Hal the Computer in the 1968 Stanley Kubrick movie, 2001: A Space Odyssey. Hal could not only discuss technical matters but also engage in casual conversation with human astronauts and apparently feel and express love, sorrow, and fear.

The once-mythic year 2001 has come to pass and Hal is nowhere in sight. Undaunted, some present day computer mavens are predicting that, by the year 2030, computers will be far more intelligent than humans. These machines, they theorize, will by then have learned to reproduce and, if they so desire, can dispose of all carbon-based life and inaugurate the BES era (Better Evolution through Silicon).

Likely? Don't count on it. Computers are marvelous. In many ways they are and will increasingly become more marvelous than we might have imagined, especially in terms of the large and complex megacomputer we call the Worldwide Web. What the computer mavens have generally failed to recognize, however, is the even more marvelous potential of the human body and brain.

Yes, a computer can defeat the world's champion of chess, a game that depends on prodigious memory and blazing computational speed. But it can't really understand a book written for eight-year-olds, can't walk gracefully, can't engage in casual conversation, can't feel, can't dream, can't deal with ambiguity or easily shift context, and, essentially, can't create. The computer is fast and clean in its operations. The human being is comparatively slow and messy. But in that very messiness, that ability to create and deal with ambiguity, lies a significant part of the human genius. Our ability to build things never before built, think thoughts never before thought, create words and music and art never before created is unique. To put it simply, the ultimate creative capacity of the human brain is for all practical purposes infinite.