Chapter three: Who Am I?

-- "I think, therefore I am." -- Descartes --

Seen in even the earliest evidences of human intellect, we, as a species, tend to believe that we are special, better than Earth's other residents; but *what* is it that makes us better, separate from other animals? It has long been believed that this difference is our human consciousness -- our ability to ask that question in the first place. Yes, from what we know, we are the only animals that are intelligent enough to ask such questions. Our intelligence is greater -- that separates us; but we also know that greater intelligence is only related to the *amount* of brain that we possess and its organization, not that our brain is of some completely different general type than other mammals'. Our separation is more of a difference of quantity rather than quality. If fish developed a reason to evolve giant brains, perhaps they would become smarter than us. So, alternatively, is it consciousness that divides us, making us a completely different, more important form of life? Well, what exactly *is* consciousness, anyway?

Consciousness is a difficult concept to define. This is in part because we can't possibly imagine life without it; nor have we shared intelligent conversation with beings who don't possess it. Is it our sense of self -- the awareness of our looks, our actions, or of what makes us tick? Yet, even this sense can't be fully understood. There exists no way to experience someone else's consciousness -- we just see someone else's looks and actions and use our own conscious thought to decipher what makes them tick. With this information we may then assume that there is a conscious driver. Monitoring consciousness via machines gives an observer an *objective* sense of consciousness, but not the *subjective* form that we individually and uniquely possess. Let's explore some of the descriptions and definitions of consciousness that some have proposed.

Despite famous myths, consciousness is not an entity. It is an active process of the brain that requires the participation of many of its components. One can say that it is the combination of electrochemical processes and neurotransmitter dispersion that creates the sense of self that we enjoy. Susan A. Greenfield, a famous professor of Pharmacology, Fellow and Tutor in Medicine at Oxford, and writer for the British press, believes that consciousness and its levels are determined by the number of neurons that can be recruited, or corralled, to fire together. (Bolton p.234) Gerald Edelman, an American physiologist and previous Nobel Prize-winner, suggests that the used re-entrant neural "loops" -- the neurons involved in memory - evolve, and this grand, evolving structure creates our conscious awareness. (Papineau pp.166-7) The biologist and former Nobel Prize-winner for the discovery of the double-helixical structure of DNA, Francis Crick takes the theory of consciousness one step further. "Crick…asserts that the physical functioning of the brain neurons themselves are the sole basis of consciousness and perhaps even the human soul. Crick does not include ideas of God or the human spirit in his consideration of brain function. Nor does he include scientific knowledge about subatomic interactions. According to him, experiences felt by some people to be mystical sensations are produced by the physical functioning of our neurons that trick us into thinking there is something beyond our physical bodies. Crick's explicitly materialistic approach is summed up in his words" (Shanor p.4): "You, your joys and sorrows, your memories and ambitions, your sense of personal identity, and free will, are in fact, no more than the behavior of a vast assembly of nerve

cells…. As Lewis Carrol's Alice might have phrased it: 'You're nothing but a pack of neurons.'" (Crick)

Whatever consciousness may be defined as, it and all of its descriptions are directly related to the brain's development and complexity (its neural packing (encephalization) and organization.) We see this in the evolution of man. "Every advance, every conceptual achievement of mankind, has been connected with an advance in self-awareness…." (Jung p.61) The development of the "inner eye" created a consciousness that gave the gift of deception. The "inner I" later evolved and allowed humans to understand themselves. This led to morality and civilization. Although we have evolved to our more advanced, more modernized state of consciousness, our self-awareness is still a long way behind our actual knowledge; and, in this regard, we still have a long way to evolve (possibly into greater states of consciousness that we as of yet can't even comprehend.)

But where is the line drawn in evolution where it can be said that the brain has officially developed "consciousness?" Even the lowest form of life, *bacteria* chooses the path that it travels, sensing for potential food and dangerous radicals, using hair-like sensors. Something that experiences sensation of any kind is called *sentient*. Consciousness is a heightened degree of sentience. Anything that undergoes non-reflexive (not immediately instinctual) decision-making is regarded as being conscious. This is the result of the existence of thought in-between sensory input and action execution. The "inner eye" is the next step up: the ability to manipulate other organisms by predicting and anticipating their behaviors. Next comes primitive self-consciousness: the "Inner-I" that allows a being to be aware of itself. Language and communication then warps our general level of consciousness, commonly limiting our understandings of existence to what can be described with words, and, at the same time, expanding it using the presumption that others think as we do. Interaction and communication between other self-conscious beings also alters our state of consciousness, such as the way that it gives us the ability to feed off of the conscious creations of others, allowing a multi-perceptual, shared consciousness between separate beings.

In order for the first form of consciousness - the most basic form of non-reflexive decision-making -- to exist, the being must have an associative mind: a mind capable of comparing memories of the past with current situations. This type of consciousness is shared by *all* mammals, and some other animals, too. Anything that can be trained is capable of processing memory, processing non-instinctual decision-making, and can also undergo behavioral conditioning.

Perhaps if we can develop a deeper understanding of what exactly consciousness is, we will be more capable of understanding how our form of it may differ from other animals; if we look at it through quantum mechanical eyes. First of all, how do we know that the workings of consciousness are quantum mechanical in nature? We can see so through scientific observation.

Francis Crick, in collaboration with Christof Koch, developed the theory that the key to consciousness lies in the striking patterns of neural oscillations found in the visual cortex (occipital lobe) in the frequency range of *35-75 Hertz*. These frequencies of oscillations are the solution to "the binding problem": that several different aspects of a memory or registered sensory information stored in different locations in the brain somehow need to bind together in order to form the conscious "whole" that we enjoy. The brain, when digging out and examining its information, creates a brain wave, and Crick and Koch found that these broadcasts all possess a frequency range in the 35-75 Hertz range and are in *phase* together (meaning that the waves' peaks and troughs occur simultaneously.) This creates the illusion of a whole (in this case,

conscious visual awareness) -- the "neural correlate." (Papineau pp.114-5)

One can compare this correlation to an instrumental band. If the band members don't attempt to play together, it sounds like there are different songs playing simultaneously (they are out of phase); but if they play together, one, unified song forms, and they become in rhythmic phase. This can be compared to the conscious "whole" that our brains create. The frequency aspect of consciousness can also be applied to this example if the band is being broadcasted over the radio. If each member broadcasts his music on a different station (frequency), you'd have to adjust the tuner to hear each individual. In other words, the band isn't whole if they are on different frequencies.

When the perceived whole of sensory input is created and broadcasted throughout the brain, it then turns into memory and is processed in the frontal lobe to create a conscious decision. The frontal lobe then makes several possibilities for action evident, and from these choices, we consciously choose our action. All of this occurs in a very short fraction of a second. So, the sensory broadcasts enable the frontal lobe to calculate the action, and then it broadcasts this action to the motor cortex to be carried out.

What picks up the cortex's broadcasts? This isn't 100% concrete yet, but we will cover a couple possible theories. Dendrite webs near the border of synapses may be responsible. The use for these web-like structures of dendrites (neurons that receive nerve impulses from other nerve cells and carry them toward the cell body) is as of yet not fully understood; and they may possess the capability of picking up quantum waves and electronically signaling them to other neurons.

Perhaps a stronger possibility for a signal receiver is cytoskeletal structures called *microtubules*. These are cylindrical protein structures that are thought to possess quartz-like properties, like a radio receiver. Roger Penrose, the Rouse Ball Professor of Math at Oxford, holds that consciousness is tied to activity in these microtubules -- structures that provide the scaffolding for neurons and other cells. These structures are suitable for orchestrating quantum wave collapses -- he suggests that gravity is responsible for this phenomenon. Microtubules channel quantum waves until they reach the gravitational threshold for collapses. (Papineau p.127)

Now we can make some conclusions regarding the existence and functioning of consciousness. Consciousness is definitely based in quantum mechanics, but the exact nature of it isn't yet fully understood. To be able to think of the "self" requires a lot of thought processing, which comes from neuronal activity in the brain, so the amount of neurons in the brain is directly related to the amount of consciousness possessed by an organism. Memory (the ability to reflect on past events), the cerebrum, and the hypothalamic nuclei (the seat of the "self") are parts of it. Microtubules and/or dendrites may be associated with it. These (and possibly more) components of consciousness create the "whole" that we perceive. Perhaps the two most important things to remember regarding consciousness are that it is a biological constitution, and that it is the sum of many functions working together. This true, scientific understanding of consciousness proves the popular definition of it -- that it is one, indivisible entity -- to be utterly false.

Now that we know the quantum mechanical and biological functioning of consciousness, we can properly observe it as a psychic system. The *psyche* is a self-regulating system that maintains itself just as the rest of the body does. It is composed of different working divisions, rather than being one phase or state of mind. According to the psychologist D. L. Schacter, consciousness can be divided into response systems (senses), episodic memory, phenomenal

consciousness, an executive system, and a procedural/habit system. Specialized parts of the brain feed information into sensory processing and phenomenal consciousness (the phase that examines the possibilities of action using its provided sensory info.) Episodic memory stores some of the workings of phenomenal consciousness while supplying both it and the response systems with needed information. Phenomenal consciousness then decides on a possibility for action and sends it to the executive system to be carried out. (Reflexes go directly from the response system to the executive system.) Commonly used executive procedures feed into a procedural/habit system of the brain, which allows easier action processing through conditioning. (Papineau p.132) These divisions allow more efficient conscious thinking. (More on the divisions of consciousness in Chapters four and five.)

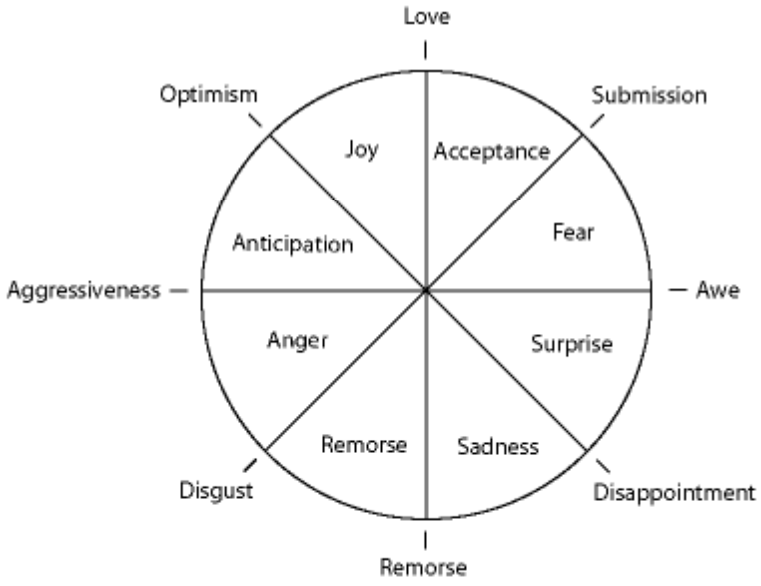
An Emotional Separation?

Having gathered information regarding what consciousness is, we can now go back to our main question: what makes us humans different than other animals? Some higher animals show recollection. Some chimps indulge in cigars and admire themselves in mirrors. They have also been known to deceive others. There exists *lots* of evidence of animals possessing consciousness. In fact, *most* animals show some degree of consciousness (vs. sentience), and perhaps the same kind (maybe not the same brand) as ours.

So, if other animals possess some degree of consciousness, is it our human emotions that separate us? Monkeys show *all* the emotions that we possess. Dogs, cats, horses, dolphins, whales, and other animals also show these emotions. *All* mammals embrace some degree of emotion. The evolutionary addition of emotion is very effective during reproductive cycles; a trait very useful for parenting when only a few offspring are produced in a significant period of time.

All emotions come from the limbic system -- the main components involved being the hypothalamus, the amygdala, and the cingulate gyrus. Some parts handle specific emotions, but they are largely manufactured through the teamwork of many of the brain's components. The right hemisphere handles predominately negative emotions, and the left, positive ones. The brain learns from them by processing them in the frontal lobe. (Damage to this lobe may result in an inability to learn from negative emotions. Recidivism is largely the result of such a failure.) The amygdala specializes in fear recognition, but also processes other emotions. The septum, the frontal division of the hypothalamus, is regarded as the pleasure center of the brain. Most emotions are simply communications between different areas of the brain via neurotransmitters. All of them are produced by simple chemicals exquisitely intertwined with physiological processes. In effect, what affects the body affects the mind and its emotions. According to the Cannon-Bard theory of emotion, external stimuli get processed by the brain to yield both the emotional experience and the arousal leading to action. So, chemicals are released by the processing of external stimuli to create all of the emotions that we experience on a daily basis (Fig 3.1.)

Fig 3.1



Robert Plutchik's Circle of Emotions

If consciousness as a whole has a "seat", this seat would be the conjunction of the amygdala, the hippocampus, and the cerebrum -- especially the prefrontal cortex -- because it is here where emotions, long-term memory, thinking, and the will to speak and act all come from. The thalamus then binds these traces of consciousness together (it is the major area of binding) to form a unified, conscious "whole."

So, what is it that separates us from other animals, which possess some degree of intelligence, consciousness and emotion? The devastating truth is, however humbling it may be, that there *isn't* any such blatantly obvious separation. The differences between us and most mammals are more a matter of quantity than of quality.

Furthermore, what is it that separates us humans from each other? The elements of the mind -- consciousness, memory, emotions, etc. -- are generally shared by all of us. We are anatomically much the same, and think almost alike at birth. It is *life* that individualizes us, and that is the subject of the next chapter: how the mind is molded and modified by life. *Why are you who you are?*