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THE THREE NEUROGENETIC PHASES OF HUMAN CONSCIOUSNESS: THE POSSIBILITY OF TRANSHUMAN AND POSTHUMAN CONSCIOUSNESS

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In previous works, the first neurogenetic account of human consciousness has been established and was delineated into three distinct phases- the emergence of neuron-based consciousness, the continuum of neuron-based consciousness, and neurodegeneration [1, 2].In this model, DNA consciousness gives rise to human consciousness in the form of neurogenetic correlates of consciousness (NgCC) and then the NgCC underlying the neurons provide continuous activity during the conscious experience. This engenders a continuum of neuron-based consciousness working in tandem with a neurogenetic substructure. Unfortunately, later in life the neurons wear down and modalities of human consciousness are decreased or lost [3]. This loss can proceed in an age-related fashion as seen in mild cognitive impairment or this process can have a genetic component as seen in Alzheimer disease (AD).
Currently, genetic experiments are underway to reverse some of the symptoms of AD, e.g., the FGF-2 gene transfer for memory improvement in mice with AD [4]. However, in the future can this, or similar, genetic therapies be used to enhance human consciousness in patients without AD? Would this be the first steps into posthuman consciousness?
In 2009, it was proposed and supported that genetic engineering technology may provide the opportunity for a *selected genetic destination* [5].This would make it possible to select a phenotype or genetic endpoint and make it possible in any organism including humans. This technology could potentially lead to a new transgenic subspecies- *Homo sapiens genomicus* (HSG)or "the man with the wisdom to alter his genome". HSG is not a teleological endpoint, but rather a fresh new branch on the tree of life that could blossom and unfurl the emergence of several new subspecies and eventually new species altogether. In this paradigm HSG could indeed signify the first manifestation of what would represent true transhuman, and eventually, posthuman consciousness!

An Introduction to Consciousness- what is it and how is it defined?

For centuries the concept of consciousness has intrigued humankind. On a very human level it is typically defined as a collective totality of awareness, bodily (or somatic) sensations, perceptions (sensory input and neurobiological information), emotions, thoughts, and recollections of the self within a moment on the time continuum. However, there is no consensus or general agreement about what consciousness *is*.

When contemplating the definition of what consciousness *is* I am always reminded of an editorial that I read from *The Journal of Consciousness Studies* by Chris Nunn [6]. In this editorial he points out that many of the definitions of consciousness are only subtly different in their description of what consciousness is and conversely that other definitions are incompatible with each other. This statement

highlights a very important but problematic issue in the in the field of consciousness studies-consciousness seems to mean different things to different people.

In this paper I will discuss a neurogentic account of human consciousness and then explain how the advent of genetic engineering may pave the way for the appearance of both transhuman and posthuman consciousness. Before I do this I will introduce several other theories of consciousness.

Cartesian Dualism is a well known proposal that was made famous by philosopher and mathematician Rene Descartes (1596-1650). This theory of consciousness maintains that the body extends into the physical world which is material, whereas, the mind is non-material. Therefore, there is a material and a non-material component to consciousness, ergo there is a form of dualism. Descartes, much like Plato, believed that human thoughts were produced by the soul, which is also non-material and only possessed by humans, hence only humans have consciousness. The idea that consciousness is a quality possessed only by humans is referred to as the *anthropistic theory* of consciousness [7].

The neurological or Darwinian definition of consciousness is a materialist/reductionist account of consciousness. It proposes that consciousness is an emergent property of the neurons and the brain. Thus, according to this theory, only animals with this anatomical tendency, i.e., cephalization and centralization of the nervous system can have consciousness. Nobel laureate Gerald Edelman proposed that neurobiological consciousness is a product of what he calls the *dynamic core hypothesis* and is distinguished as primary consciousness and higher-order consciousness [8, 9]. According to the dynamic core hypothesis consciousness is a dynamic, integrated, and multimodal process which is supported by an infrastructure of cortical-cortical, cortical-thalamic, and thalamo-cortical neuron connections [10]. On a primitive level this gives rise to a primary consciousness, which is a state of being aware of objects in the world at the present point in time, but is not accompanied by a sense of person with a past or future tense. According to this proposal, this would be the type of consciousness possessed by animals that are nonlinguistic and non-semantic. Edelman's theory of higher-order consciousness differs in that this degree of consciousness involves the recognition of the entities actions and affections, i.e., the entity is conscious of being conscious. In addition, Edelman's proposal maintains that humans have both primary and higher-order consciousness and the two connect to form a feedback loop and interact with one another.

The single cell approach to consciousness or *cellular consciousness* maintains that consciousness is a fundamental property of the cell. Ernst Haeckel (1834-1919), who was a German philosopher, biologists, physician, and professor, proposed in his book *The Riddle of the Universe* that there was the possibility that every living cell should be considered an "elementary organism" that give rise to multicellular systems [11]. He further proposed that cells can be considered "cell-souls" which are elementary "psychological units" that collectively give rise to the complex psychic (or psychophysical) activities of the higher organism. A different version of cellular consciousness was later proposed by psychologist and philosopher William James (1842-1910). The idea that he proposed is known as*polyzoism*(or *multiple monadism*) [12]. According to this proposal every brain-cell [neuron] has its own individual consciousness, which is ejective to each other [neuron], and there is a pontifical arch-cell and events in other cells influence this arch-cell.Another great thinker to hypothesize cellular consciousness was French philosopher and Jesuit priest Teilhard de Chardin (1881-1955). He viewed the appearance of the first cells as the primordial appearance of organized life and that this was a decisive step in the progress of consciousness [13]. Ironically, both Haeckel and James later in their respective careers rejected their theories on cellular consciousness, which can be surmised, most logically, because neither had the science or technology to validate it [14]. It is important not to forget that the DNA molecule was not even discovered during their time! In fact, Friedrich Miescher isolated the first crude preparations of what he called "nuclein" in 1869, but he did not publish this until 1871. However, the actual functional structure of DNA would not be understood by Watson and Crick until 1953.In the case of Teilhard, he was silenced by the Catholic Church toward the end of his career and even exiled from France by the Jesuit order. He was never able to elaborate on his ideas of cellular consciousness.

The theory of *DNA consciousness* was proposed in 2004 (but not published until 2006 [15]). This theory has two parts. The first part of this theory proposes that the DNA molecule possess a degree of consciousness of its own [16] and is an autopoietic entity [14]. DNA, as a conscious entity, can be objectified on three dynamic levels that rely on interactions: gene-gene interactions (epistatis), interactions between other nucleic entities (RNA, viruses, mitochondria, and other cells), and interactions between DNA and the external environment [17]. The second part of the theory of DNA consciousness maintains that DNA is responsible for giving rise to other higher degrees of consciousness, e.g., cellular consciousness and human consciousness. When DNA gives rise to human consciousness this takes place in three neurogenetic phases: the emergence of human consciousness, the continuum of human consciousness, and neurodegeneration [1, 2, 18]. Each of these three neurogentic phases is composed of gene-based NgCC. In the next section of this paper I will discuss a neurogenetic account of human consciousness and elucidate how it is important to the proposal of transhuman and posthuman consciousness.

Swedish physical biologist Carl Johan Calleman has also provided a proposal of DNA consciousness. In his proposal, anything that originates or is generated from the Cosmic Tree of Life is not only life, but consciousness as well; this includes sequences of DNA [19]. He further proposes that it was DNA consciousness that precipitated the primitive metabolisms of the first cells. This would imply that the appearance of the first functional cells were not a random event.Additionally,Chun Yang, a physician, has proposed analogous notions that support a theory of DNA consciousness. He proposed that DNA defines consciousness in a Recording-Relating Principle [20]. According to this principle,the recording portion is that any life form can sense or detect the internal or external interactions and the relating portion is that those life forms can integrate the sensed interactions within its molecular network (i.e. protein, RNA, and DNA) to generate consequential courses of action. At the DNA level, Yang surmises that stable (S) and adjustable (A) sequence regions in the genome provide limited consciousness to each species.A final idea that further supports the theory of DNA consciousness was proposed bydevelopmental biologist Scott Gilbert. He points out in his *Questions: Introducing Developmental Biology* [21] that as an embryo "You had to respire before you had lungs, digest before you had a gut, build bones when you were pulpy, and form orderly arrays of neurons before you knew how to think. One of the critical differences between you and a machine is that a machine is never required to function until after it is built. Every animal has to function even as it builds itself". Is it possible that DNA consciousness affords the embryo this responsibility in the form of master genes high in the developmental hierarchy? Could DNA consciousness be a proto-consciousness that gives rise, via NgCC, to human consciousness? This question will be answered in the upcoming section on the neurogenetic account of human consciousness.

There are several quantum theories of consciousness. Evan Harris Walker (1935-2006), a physicist, proposed that information is measured in the neurons by consciousness and will channel capacities which form a closed loop system. Walker modified the Schrodinger equation by adding $\log_2 P$ [22]. According to this proposal the information measured coerces on a real solution when one of the potential states (in superposition) manifests while the others collapse (or undergo decoherence). This theory works in collaboration with his earlier work which was called quantum mechanical electron tunneling effects [23]. This is explained as the occurrence of electrons jumping or tunneling from the pre-synapse of one neuron to the post-synapse of the next neuron. This system of electron tunneling comprises a virtual nervous system overlying the real (physical) nervous system.

English mathematical physicist and Nobel laureate Sir Roger Penrose proposed quantum mind theory in the late 1980's. He insisted that the laws of classic physics were too deficient to explain the perplexing problem of consciousness and hence quantum physics is required to construct a more precise account [24]. Penrose would team up with Stuart Hameroff, an anesthesiologist, to propose the Orchestrated Objective Reduction (Orch OR) model of consciousness. In the Orch OR model, quantum computations occur in microtubules on the neurons; specifically in the gap junction-linked dendrites/soma

of pyramidal neurons [25]. Here, synaptic inputs and axonal firing orchestrate quantum computations within the dendritic microtubules, which produce a discrete sequence of conscious moments in where each moment is a quantum computation that is eventually terminated by an objective threshold for quantum state reduction. This theory implies that consciousness and cognition are derived from a deeper-order, finer scale quantum vibrations in the microtubules. Penrose and Hameroff propose that this takes place during the integration phases inside the integrate-and-fire brain neurons [this was updated at the *Towards a Science of Consciousness* 2014 conference in Tucson, Arizona].

Another quantum model has been proposed by physicist Wolfgang Baer, which involves cognitive loops. In this model of consciousness a primitive consciousness is implemented by a field of physical interactions- these interactions take place between mass and charge (this entails aggregation and separation) which forms influence loops [26]. The charge and mass are pushed and pulled by the gravito-inertial and electro-magnetic forces from the outside of the brain. The inside material is affected by two forces of consciousness (Fc), which are charge on mass (Fcm) and mass on charge (Fmc) [27]. These forces are present at all scales and signify an accommodation of internal physical structures to the external gravito-electric influences. Accordingly, the fundamental architecture of influences is a double cycle between mind and electromagnetic forces which are converted back and forth by Fcm and Fmc. In Baer's depiction this process can produce a repetition of interacting architecture at different scales which can be visualized as a process flow diagram in where consciousness is represented as a cognitive process loop [28].

The Noetic Field Theory of consciousness, proposed by physicist Richard Amoroso, is a quantification of mind. This theory is similar to the cognitive/AI model but also maintains the Cartesian cosmological of *elan vital* or the "life principle" [29]. In the noetic proposal, spiritual matter is considered a real physical aspect of the unified field, which is a third regime of reality (Classical, Quantum, and Unified). The unified field mechanics have remained hidden just as quantum mechanics were concealed from classical mechanics for hundreds of years. The noetic field theory is based on three elements [30]: 1) Biology- temporal material of the brain and body. 2) Elemental Intelligence- an eternal boundary condition of individuality. 3) An interacting life principle- the noetic (or unified) field drives the evolution of Self-Organized Living Systems (SOLS).

There are several monistic theories of consciousness. Monism is the notion that all existing things can be ascribed to or explained by a single concept of system. In essence, there is only one basic substance or principle as the ground reality. In the 1860's Ernest Haeckel proposed the idea of a "monism of the cosmos" as an essential unity of organic and inorganic nature, which was not completely accepted during his time as some scientists still clung to the old antithesis of the two divisions of nature- as some still do in the modern era! This idea applies to consciousness in that there is a mind/matter monism instead of the thought that there is a material and a non-material mind. Chris Nunn has suggested that, by analogy with the monism of fundamental physics, the concept of symmetry breaking is likely to help gain an understanding of mind/matter monism as symmetry based theories can make extractable predictions about mind/matter problems regarding consciousness [31]. Physicists Peter Rowlands and Peter Marcer have proposed and substantiated that the symmetry breaking of the Galois group can prove a physics of emergent processes [32]. Rowland and Marcer base this on a universal rewrite system and the principle of nilpotency [33]. In the Rowland-Marcer paradigm, a system and its environment have a space-time variation defined by phase. This sustains the dual mirror-image relationship between the system and its environment.

The Triadic Dimensional Vortical Paradigm (TDVP) is a proposal made by physicists Edward Close and neuropsychiatrist Vernon Neppe [34]. In the TDVP, consciousness is a fundamental substrate of the universe which is equivalent to space and time i.e. there is a triadic relationship. This paradigm states that space, time, and consciousness (STC) are never separated. Instead they are tethered from their universal origin point. The tethering of STC allows movement across mathematical dimensions allowing STC to appear separated (i.e. the charge-mass separates). The movement across, within, and between multiple

fluctuating dimensions (while maintaining the connection of the STC components) allows individual-unit realities and sentient beings which can be humans and even DNA.

Spiritual theories of consciousness propose the concepts of altered states of consciousness- as seen in shamanism and with the use of hallucinogens, and in religious experiences- such as enlightenment or epiphanies. Some techniques, like meditation, have been proposed to have the propensity to heighten the level of "inner consciousness" within an individual. In many of these types of theories the spirit is equivalent to consciousness or consciousness is an extension of the spirit.

In terms of the science of meditation and the correlation to consciousness, some researchers have attempted to identify neural correlates. Patricia Sharpe from Bowling Green State University has proposed brain regions, e.g., the nucleus accumbens and its connection to dopamine release, the release of endogenous opioids, and two way feedback loop with the medial prefrontal cortex are correlated to meditation induced bliss [for more information on this presentation from the Towards a Science of Consciousness conference 2012 please consult reference 37].

The idea that the spirit and consciousness are connected, at least to an extent, is evident by reports of near death experiences (NDE) and out of body experiences (OBE). These are both phenomenon where a person has reported "leaving their body" and being able to "see" themselves or a tunnel, and sometimes a light, then return back to their body. Many have proposed that a NDE could be a circumstance brought about the brain while it was functioning in an oxygen-depleted state (caused by a metabolically near-death state) or a by production of being drugged- either medically or illicitly.

Goran Grip, a physician, has questioned whether the NDE/OBE is something more. Could a NBE be something different than the commonly assumed lack of oxygen theory or proof that consciousness can leave the body? Grip makes the following observations as to why investigations on NDE and OBE are difficult to prove, in part, because: 1) they are both rare events 2) very few observations can be made and most fall outside of research protocol, and 3) people that have OBE and NDE seem to observe and report only that which interests them [35]. He also points out that NDEs are often described as "timeless" and thus the nonlocality is inevitably connected to the problem of time; whereas the essence of OBEs seem to be lost in translation and this produces several inconsistences. However, the fact that there is no scientific explanation for the phenomenon of OBE and NDE is not proof that these observations are false.

Parapsychologist Susan Blackmore questions why some feel that we are one mind that lives in our body and that this mind could possibly survive death [36]. She proposes that this line of thinking emerges from the notion of dualism that is ingrained into the collective rational of many. Hence, she proposes that we have to overcome this false divided view. In some of her works, Blackmore has also pointed out the brain's role in OBE. The temporoparietal junction (TPJ) in the right hemisphere of the brain functions in the convergence of tactile, proprioceptive, and vestibular sensory information to construct a body image. This region of the brain is dynamic and constantly reorganizes as the individual moves and the environmental parameters changes. In essence, the TPJ fabricates a physical sense of self. Many researchers have demonstrated that dysfunctions or stimulation of this part of the brain produces OBEs. So what do NDE and OBE say about the possibility of a consciousness experience post-mortem? Blackmore confronts you with the very real likelihood that a post-mortem consciousness experience may not be possible and that in the end it is "death that dissolves the illusion that we are a solid self inside a body".

There are several other theories of consciousness that were not mentioned in this introduction, e.g., disorders of consciousness seen in coma and anesthesia, fractal consciousness, and higher order theories of consciousness which have all been discussed in the conference report on the *Towards a Science of Consciousness 2012* [37].

At this juncture I have discussed a multifarious and well-rounded variety of theories of consciousness; including DNA consciousness, which is pivotal to understanding of the neurogenetic account of human consciousness. Keep in mind that DNA consciousness is a different degree of consciousness than the degree of consciousness that humankind experiences. Next, a neurogenetic

account of human consciousness and how this is associated with the possible emergence of transhuman and posthuman consciousness, via genetic therapies, will be discussed.

A Neurogenetic Account of Human Consciousness

We have just reviewed several theories and interpretations of consciousness. These different theories of consciousness undulate from many different realms: dualism to neurons, cellular to cosmological, quantum to monism, and DNA to spirit. The theory of DNA consciousness maintains that DNA is a degree of consciousness within its own right [14,16,17] and that it gives rise to other higher degrees of consciousness which can be seen, at a smaller scale, in cellular consciousness and, at a larger scale, in human consciousness.To summarize this, when DNA consciousness gives rise to human consciousness several genes can be seen as NgCC in the emergence of human consciousness. Secondly, during the lifespan thousands of genes undertake an active role maintaining the continuum of human consciousness. Finally, towards the end of the lifespan there is a breakdown or down-regulation of the genetic expression of some of the NgCC which can lead to mild cognitive impairment and eventually dementia. Some forms of dementia can happen earlier in the lifespan and can also accelerate more profoundly. These types of dementia(s) tend to have a genetic cause as seen in Alzheimer disease (AD). Therefore, there are three neurogenetic phases of human consciousness that aregene-based NgCC- the emergence, the continuum, and neurodegeneration of human consciousness.

Next I will list some genes that are involved in each of the three neurogenetic phases of human consciousness. I mention the genes involved but I will not discuss the technical genetic or molecular details as this discussion is intended for a general audience and more scientific detail can be rendered in references 1, 2, & 18. When consulting the references please keep in mind that reference 18 is a short editorial summarizing the three neurogenetic phases, reference 2 is slightly more involved but not too intense in detail, and reference 1 is very comprehensive in the molecular and genetic content that supports each of the three neurogenetic phases.

The First Neurogenetic Phase: The Emergence of Human Consciousness

In the first neurogenetic phase we see the emergence of human consciousness. The genomic DNA yields a genetic blue print for the production of neurons and brain morphogenesis. Believe it or not, this process is set in motion when the two gametes unite their strands of DNA- one from the egg and one from the sperm. At this point in time, the maternal strand has a profound influence over what genes are going to be expressed and what phenotypes will be maintained. The zygote reaches the 2-two cell stage at the period of 30 hours after the initial contact of the maternal and paternal stands of DNA.

During the development of the human brain there are master genes higher up in the developmental hierarchy that induce other genes down stream which produces a genetic cascade. When one gene induces the expression of another gene this is referred to as transactivation. The genetic cascade of master genes is not a random act of biology; nor is it an auspicious process that constructs the body or the brain. Rather, it is an orchestrated activity that involves feedback loops, communication, and genes being turn on and off at precisely the right time, i.e., it is a degree of consciousness giving rise to another degree of consciousness. Next I will show some very brief examples of master genes that are involved in the first neurogenetic phase.

The Pax3 gene controls many genes during early development. For example, Pax3 inactivates TP53 during the closure of the neural tube (which happens at week 4 of embryogenesis), regulates Hes1 and Neurog2, and in collaboration with Pax7 it modulates Meis2. This type of Pax3-modulation allows the specification of certain types of neurons and specific brain regions by controlling other genes downstream. In this way, Pax3 acts as a master gene.

Pax6 is also a master gene and is responsible for eye development. This gene is highly conserved throughout the animal kingdom. One example of how Pax6 controls eye development is its influence over other genes that produce parts of the eye, e.g., L-maf, Sox1, Prox1, and the crystalline genes (alpha, beta, and gamma). Pax6 controls other genes as well, e.g., Neurog1, Neurog2, and Spag5. Additionally, Pax6 also is critical to the neurogenic fates of neural progenitor cells. So again, we have an example of a gene that acts as a master gene high up in the developmental hierarchy during the growth and progression of the brain and central nervous system.

There are many other genes that may not act as master genes but play pivotal roles in the morphogenesis of brain regions that are crucial to the neurobiological process of human consciousness. These are by definition NgCC. For example, Hoxb4 and Hoxd4; in collaboration with retinoic acid receptor beta-gene, enforce the borders of rhombomeres 6 and 7. A few more examples of some other genes that have a profound effect on the brain are Otx1 and Otx2. The Otx1 gene has a profound effect on the overall development and size of the cerebral cortex. The Otx2 gene is essential for the identity and fate of the neuronal progenitor domains in the ventral midbrain.

At this point we have seen some brief examples of how certain genes are involved in the emergence of brain regions that will later be involved in the process of human consciousness. Next, we will survey genes involved in the continuum of human consciousness.

The Second Neurogenetic Phase: The Continuum of Neuron-Based Human Consciousness

During the continuum of human consciousness there is a requirement for the proper functioning of the genetic expression that runs in tandem with the neurons, the brain, and the conscious experience. There is an overwhelming amount of scientific literature supporting neural correlates of consciousness and Gerald Edelman's dynamic core hypothesis. In the second neurogenetic phase of neuron-based human consciousness I clearly demonstrate that there is a complete substructure of gene-based NgCC, a genetic community if you will. Two genetic phenomenacan be studied objectively to support this notion. The first being neuron plasticity and the second being the abnormal genetic expressions seen in some psychiatric disorders. Now we will look at genes involved in both psychiatric disorders and neuron plasticity.

Psychiatric disorders, in certain ways, can represent a disruption in the normal functioning of the continuum of human consciousness. For example, in certain psychiatric conditions, e.g., autism and schizophrenia there is an abnormal regulation in how the brain reacts with and interprets the external environment respectively. One disorder that clearly demonstrates a breakdown in the reciprocal interactions with the environment is autism. Locus disruptions in the PTCHD1 gene have been associated with several forms of autism. On the other hand, schizophrenia represents a breakdown and distortion in the process of perception and interpretation. Thiscan be marked by hallucinations, aberrations in volition, hearing voices, and sometimes abnormal ideations that cannot be validated with in the clinical confines of what the majority of people consider reality. Several schizophrenia-related genes have been identified: PDE4B, DISC1, and the expression of transcription factor ZNF804a. This tells us that particular gene configurations and mutations can influence the way a person interprets and responds to the external environment, thus exposing a neurogenetic correlation between gene and conscious experience.

Neuron plasticity is the ability of the neurons and the brain to change in response to new information and sensory input. It is alsocritical to the function of neuron-based consciousness. Without neuron plasticity an individual would be perpetually stuck in the same conscious scene or lacking the capacity to progress through conscious points in time as new information and stimuli is encountered. The plastic connection among the many neurons in the brain is dependent upon two fundamentally different developmental programs- molecular guidance cues and patterned neural activities. There are molecular cues that guide axons to their target regions and then commence the development of the synaptic connections in the brain. After these synaptic connections are established, further development is reliant

on the coordination of neural activity between both the presynaptic and postsynaptic neurons. This system allows activity-dependent reorganizations in the acquisition of coordinated skills and behavior in general. This activity-dependent system is also required for the underlying neural functions critical for human consciousness.

There are several genes that are associated with neuron plasticity: BDNF, FGF-2, synapsin (I, II, and III), and the delta-FosB transcription factor. Interestingly, the delta-FosB transcription factor (a spliced gene variant produced from the FosB gene) affects the expression of four other genes: GluR, Cdk5, NF-kappaB, and dynorphin which have neuroplastic affects on brain regions involved in addiction [38].

At this point I have provided a brief example of genes that are involved in the proper maintenance of the continuum of human consciousness, i.e., the second neurogenetic phase. Next, we will look at genes involved in the decline of human consciousness.

The Third Neurogenetic Phase: Neurodegeneration

During the process of neurodegeneration there is a breakdown inthe expression of several genes, the neurons, and the brain. This ultimately results in a decrease in the degree of that particular individual's neuron-based consciousness. Unfortunately, for all of us, this takes place in a time-dependent fashion which can be manifested clinically as mild cognitive impairment. However, certain genetic mutations can cause forms of dementia, e.g., Alzheimer disease, which is associated with an earlier age of onset, an accelerated course, a poorer prognosis, and diminished quality of life. In general, a disease such as Alzheimer's, represents a malign process that insidiously erodes human consciousness. During this process the afflicted individual typically develops decreases in cognitive/executive function, memory, and the ability to inhibit inappropriate behaviors. Another way of saying this is that the afflicted individual ceases to be the person that they once were, i.e., their degree of consciousness has been diminished secondary to pathology.

Alzheimer disease has been associated with mutations in several genes: APP, PSEN1, PSEN2, APOE-epsilon4 gene variant, and TREM2. In previous works, Alzheimer disease has been correlated with the distinction of decreases in human consciousness manifested by these gene mutations and the consequent aberrant functions of their protein products [3]. Some genes, e.g., BDNF and FGF2, become less active later in life. Decreases in these gene products have been associated with several types of dementias and depression [see reference 2 for more detail]. Other genes are under investigation and some of those genes have been correlated with different types of dementia that are not Alzheimer-related.In this work I have used only Alzheimer disease as a primary example of the third neurogenetic phase. At this juncture we have a brief example of some genes involved in the neurodegeneration of human consciousness.

Summing Up the Three Neurogenetic Phases

Initially, the correct functioning of certain genes is pivotal for the proper development of the human brain and nervous system. Secondly, after this neurogenetic and neuron-based system is established the aptperformanceis required for the continuum of human consciousness. This apt performance is particularly vital for psychiatric equilibrium and neuron plasticity. Lastly, there are genetic correlations to the breakdown of human consciousness as seen with Alzheimer disease. This results in neuron degeneration and gross loss of brain matter. All three of these phenomena are correlated to three phases of human consciousness that are reliant on gene-related NgCC.

Humankind is not necessarily doomed to the third neurogenetic phase of human consciousness. The individual can consume a healthier diet, avoid neurotoxic chemicals, and exercise. All of these are known to increase the lifespan and maintain cognitive abilities. In the future gene therapies may be able to prevent developmental abnormalities from unfurling into debilitating diseases. It is also possible that

genetic therapies may be implemented in successfully treating psychiatric disorders. In addition, there are currently some genetic therapies that are being examined for their potential to reverse or cure Alzheimer disease. In the next section we will look at some of these genetic treatments and then ponder upon the possibility of those same treatments being used on humans with out Alzheimer disease, i.e., for the purpose ofhuman enhancement.

Gene Therapies

There are several genetic therapies being researched that may have the potential to reverse or cure Alzheimer disease. Many of these therapies have been successful in the mouse model. Hence, it is not unreasonable to speculate that some of these therapies may go on to human trials in the very near future. I will briefly discuss some of those therapies.

In 2011, Dr. Tomomi Kiyota and his group had success with FGF2 gene transfer therapy in Alzheimer-mice [4]. In this study, FGF2 gene was transferred directly to the hippocampus of bigenic mice (APP+presenilin-1). The FGF2 gene was delivered by an adeno-associated virus serotype 2/1 hybrid. Significant improvementwas seen in the mice receiving the injection at both the pre- and post-symptomatic stages of Alzheimer disease. This was verified by testing spatial learning in the radial arm water maze test.

The primary pathogenic feature of Alzheimer disease is the accumulation and deposition of beta-amyloid protein plaques in the brain. Hence, there are several therapies underway that attempt to reduce these plaques. In 2013, Dr. Ida Annunziata and her group demonstrated that deficiencies of the lysosomal sialidase (which is produced by the NEU1 gene)lead to the spontaneous occurrence of an Alzheimer-like amyloidogenic process to occur in mice [39]. This study subsequently demonstrated that cerebral injection of NEU1 in Alzheimer-mice resulted in substantial reduction of beta-amyloid plaques.

In 2014, Dr. Rocio Perez-Gonzalez and group demonstrated that leptin gene therapy was able to reduce the accumulation of beta-amyloid in APP/PS1 transgenic mouse model [40]. In this study a lentivirus vector expressing leptin protein in a self-activating HIV-1 was delivered by intra-cerebroventricular administration. This resulted in a reduction of beta-amyloid accumulation and a partial rescue of synaptic density in these mice.

A brief discussion of three current gene therapies in the Alzheimer-mouse model has been completed while keeping in mind that there are many other therapies currently being researched. All three of these gene therapies have been shown to be successful in the mouse model. Therefore, it is possible that these gene therapies may one day progress to human trials (or already have but the results have not been published as of yet).

It is possible that at some point in the future that one, or more, of these gene therapies may be successful in treating human Alzheimer patients. In fact, more than one of these genetic treatments may be required, e.g., a combination or a cocktail, to completely resolve Alzheimer disease. However, can these same treatments be used in humans without Alzheimer disease? Could this lead to neurogenetic enhancements that could increase human consciousness to a higher level or degree? Could this open the door to transhuman and eventually posthuman consciousness?

Transhumanism and Posthumanism

A transhuman is a philosophical proposal of the “transitional human”, which is a modern day human (*Homo sapiens sapiens*) that evolves as new information and technology usage becomes available. The transhuman is the proposed link between modern day humankind and the posthuman. Posthumanism is the phase that comes after humankind. It is also proposed that this new species will possess superior capabilities beyond those of humankind [41, 42]. These ideas are similar, but not identical, to Fredrick

Nietzsche's proposals of the higher human and overhuman. Another proposal is one where genetic engineering technologies (implicitly including epigenetics and nanotechnology) will give rise to a transgenic new subspecies *Homo sapiens genomicus* which can then branch off into several new subspecies and potentially new species all together. The concept of *Homo sapiens genomicus* has been compared and contrasted with the other proposals; the transhuman and Nietzsche's higher human, in previous works [see reference 5].

Human Enhancement

There are many proposals and debates in regards to human enhancement. There is some gray area in defining what would be considered treatment verse enhancement. In previous works I have made the distinction between passive human enhancements and aggressive human enhancements [5]. Passive human enhancement is the use of genetic therapy for medical purposes. Aggressive human enhancement is the use of genetic therapy for enhancement, i.e., with the absence of any underlying medical condition. It should be noted that in both cases it is enhancement of the original genetic-baseline. The question of course is where the line is drawn?

The ability to perceive a genetic endpoint and make it possible with genetic therapies is known as selected genetic destination (SGD) [5]; in that a genetic destination has been selected, regardless if it is passive or aggressive human enhancement, and made possible with genetic therapies. As I have mentioned earlier in this work there are many gene therapies underway to treat neurodegenerative disorders like Alzheimer disease. In essence, the treatment is enhancement. However, are there any gene therapies or possible treatments that could be used for aggressive human enhancements?

A gene variant of the anti-aging gene KLOTHO gene, known as KL-VS, is associated with the prolongation of lifespans [43]. In a recent experiment where the KL-VS was overexpressed in transgenic mice, a marked increase in learning and memory was observed compared to controls with out the KL-VS overexpression [44]. In this research, it was found that the overexpression of KL-VS enhanced long-term potentiation (a form of neuron plasticity) and enriched synaptic GluN2B (which has functions critical to memory and learning). Therefore, artificial overexpression of this gene variant enhances some functions related to human consciousness.

So here we have an example of a gene variant already in existence that gives humans health and cognitive enhancements compared to the general population and a recent experiment clearly demonstrating that it can in fact enhance learning and memory in mice when genetically overexpressed. Thus it appears that a likely candidate for aggressive human enhancement has been found. As time goes on it is very probable that others will be identified. A case may be made that enhancement with gene therapy, e.g., the KL-VS may pave the way for the emergence of the first transhumans, or more accurately *Homo sapiens genomicus*. The increase in cognitive powers may usher in the evolution of a novel and higher degree of consciousness.

It must be kept in mind that there are several reasons that some individuals may be against enhancement. For example, religious beliefs, philosophical reasons, lack of faith in humankinds current understanding of science (specifically genetic therapies, e.g., GMOs), and the fear of the unknown. A recent study demonstrated that >90% of people are accepting to gene therapy as a treatment for sever illness (like Alzheimer disease) but are less accepting (roughly 79%) for diseases that are considered less severe (like ADHD), and 47% support the use of gene therapy for non-therapeutic applications [45]. Thus, it appears that people today are more comfortable with the idea of genetic enhancements for medical treatment, but still on the fence for non-therapeutic applications.

Conclusion

DNA is conscious and generates a morphogenic field. It then fills that field with protein products. A particular combination of genes being expressed at the beginning puts into motion, for the most part, what will be the final product. The process of that initial configuration may some day be able to be modified with SGD. However, at this point in the development of humankind, our technology only allows us to work on the finished process. Meaning, that gene therapy is utilized only after the creation of the individual with the genetic mutation as part of the package. In terms of the future, now that human consciousness can be objectified into three neurogenetic phases and more NgCC continue to be identified, there are more potential targets for the enhancement of human consciousness.

I have proposed that a neurogenetic account of human consciousness questions several philosophical questions in terms of what individual consciousness is relative to the dynamics of the unit's genetic expression [46]. For example, is consciousness in the brain, the genes, or both? Is our freewill, to some degree, controlled by NgCC which maintains what the human brain considers reality? Do neurogenetic substrates represent an intermediate or interface between the realm of quantum consciousness and degrees of consciousness on the macroscopic scale? Furthermore, we must begin to examine and discuss how human neurogenetic enhancements may influence what we consider human consciousness and if this process opens doors to what some might consider transhuman consciousness (or the consciousness possessed by Homo sapiens genomicus) and eventually posthuman consciousness.

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