Il Dr. John K. Grandy ha pubblicato sull'*International Journal of Arts & Sciences* questo suo lavoro:

«THE THREE DYNAMIC LEVELS OF DNA CONSCIOUSNESS»

[«I TRE LIVELLI DINAMICI DI COSCIENZA DEL DNA»]

le cui parti di maggiore interesse sono riportate alle pagine 4-9, mentre l'articolo completo è leggibile nel sito http://universitypublications.net/ijas/0603/pdf/H3V446.pdf . Una sua versione di indirizzo filosofico ("*The Neurogenetic Substructures of Human Consciousness*") è pubblicata in *"Essays in Philosophy"* Volume 15, Issue 2 (July 2014) http://commons.pacificu.edu/eip/

Di seguito: *"Sintesi dei concetti principali"* e, a pag. 3, *"Alcuni commenti in chiave teilhardiana"*.

1. Sintesi dei concetti principali

Sono noti, in parte, i geni correlati alla formazione del cervello, al funzionamento delle aree di coscienza e ai processi neurodegenerativi che la danneggiano. Oltre a queste dirette correlazioni, la molecola del DNA è, come l'uomo, un'entità autopoietica[1] e perciò dotata di un certo grado di coscienza.

Il *primo livello dinamico di coscienza* del DNA comprende le interazioni fra i geni: come le molecole del DNA comunicano con il suo sé [con il suo "centro"], da una parte all'altra del genoma o come un gene comunica con molti altri geni. Tali interazioni conferiscono alla molecola del DNA un'energia vitale, un certo tipo d'intenzionalità, oltre che un grado di coscienza. Per illustrare tutto ciò, l'A. si sofferma sulle funzioni di alcuni principali geni (*master genes*), sul processo di metilazione [modificazione epigenetica del DNA], sui sistemi di riparazione del DNA, sugli elementi permutabili che possono alterare i geni. Tutte queste attività rappresentano un livello dinamico di coscienza posseduto dalla molecola del DNA. A questo primo livello dinamico di coscienza del DNA, la molecola del DNA comunica di continuo con il proprio sé.

Il *secondo livello dinamico di coscienza* del DNA comprende le interazioni fra il DNA molecolare (genomico) ed altre entità nucleiche, come l'RNA, i virus, il mitocondrio [un organello cellulare dotato di un proprio DNA, il DNA mitocondriale] ed altre cellule. A questo secondo livello di coscienza del DNA, si nota chiaramente che il DNA è capace di interagire in modo dinamico con i vari tipi di RNA e con altri DNA, mostrando in tal modo un certo grado di coscienza.

[1] In un'entità auto poietica: 1) c'è un confine ben identificabile rispetto all'ambiente esterno; 2) il confine è auto-prodotto; 3) i componenti del confine sono auto-prodotti; 4) operano cause ed effetti; 5) esistono degli elementi che la compongono; 6) gli elementi che la compongono sono auto-prodotti.

Il *terzo livello dinamico di coscienza* del DNA è espresso dalle interazioni fra DNA ed ambiente, attraverso le quali forze od entità esterne possono danneggiare il DNA o provocare in esso eventuali mutazioni. Il DNA interagisce con l'ambiente esterno in modi affatto nuovi che possono produrre dei cambiamenti nel grado di coscienza del DNA.

È importante sottolineare che ciascuno dei tre livelli dinamici di coscienza del DNA dipende dalle interazioni. Tutto ciò richiede una breve commento sul modello di coscienza basato sull'interazione (*interaction-based model of consciousness*).

Secondo tale modello, la coscienza è un'interazione fra *cose* (non importa che sia un organismo, la molecola del DNA od un atomo) con altre *cose* e con l'*ambiente esterno*. Più specificatamente, la coscienza emerge da un'interazione di energia con altre forme di energia. Questo modello offre quattro vantaggi:

a) Il superamento dei limiti posti dai modelli antropici e riduzionisti.

b) L'eliminazione di ogni criterio di esclusione relativamente a ciò che ha o non ha coscienza.

c) La coscienza basata sul modello dell'interazione può essere vista all'interno del quadro dinamico dell'evoluzione.

d) Nell'interpretazione della coscienza può essere utilizzata anche la fisica quantistica.

Le cose si fanno più complesse quando interagiscono, per esempio quando gli atomi diventano molecole. D'altra parte, se la complessità aumenta anche il livello di coscienza cresce. Questo modello è esprimibile con il concetto di interazione – complessità - coscienza (ICC), dove il livello di coscienza, in qualsiasi sistema, dipende dalla complessità basata sull'interazione.

John K. Grandy integra il suo pensiero con la teoria di Neppe e Close[2] al fine di rispondere a questa domanda: la coscienza è una proprietà fondamentale dell'universo oppure è una proprietà emergente?

La coscienza sarebbe di natura *frattale*[3] e quindi è: sia una proprietà fondamentale della stoffa dell'universo che una proprietà emergente. Si manifesta ai nostri occhi quando la materia, interagendo, si complessifica sempre più ascendendo dal livello quantico a quello molecolare e cellulare neuronico.

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[2] Cfr. http://www.i-newswire.com/scientists-dr-vernon-neppe-and/232098 Qui si legge che la realtà è a 9 dimensioni (e non quella, sperimentata, a 4 dimensioni). Ognuna delle 9 dimensioni include lo *spazio,* il *tempo* e la *coscienza.* A tale conclusione essi sarebbero giunti risolvendo un problema di fisica posto da Nicola Cabibbo (10 April 1935 - 16 August 2010).
Vernon M. Neppe ed Edward Close hanno inoltre formulato un nuovo modello che include, nella realtà fisica, la *coscienza.* Esso è denominato *"Triadic Dimensional Vortical Paradigm"* (TDVP) *["Il Vorticoso Paradigma Triadico Dimensionale"]* cfr. http://www.neuroquantology.com/index.php/journal/article/view/448 .

[3] Cfr. http://it.wikipedia.org/wiki/Frattale#Frattali_e_natura

2. Alcuni commenti in chiave teilhardiana

a. La visione di Teilhard de Chardin si fonda in gran parte sull'assunto che *Materia* e *Spirito* siano due facce di una stessa "stoffa cosmica": la Materia quale Molteplicità o direzione dissociativa, lo Spirito come Unità o direzione unificativa.

Nel 1911, nello stesso anno della sua ordinazione sacerdotale, egli così scriveva:

«… la matière, de soi, ne se révèle que comme principe de multiplicité: c'est donc à l'esprit qu'il lui faut demander son unité organique … Evidemment, accepter le dualisme, c'est, pour un philosophe, rester aux prises avec les difficultés de l'union entre l'âme et le corps. Comment l'inétendu peut-il se joindre à l'extensif, la matière se combiner partiellement avec l'esprit?».[4]

La risposta di Teilhard a tale questione si fonda sul *continuum* materia-spirito, sul moto "costruttivo" dell'evoluzione che unisce elementi in precedenza divisi, fermo restando che: *«Atomi, elettroni, corpuscoli elementari devono possedere un rudimento d'immanenza, cioè una scintilla di Spirito... qualche germe d'interiorità e di spontaneità, cioè di coscienza»* e che *«nella sua intima essenza, il Cosmo è di stoffa spirituale... nessun'altra sostanza potrebbe produrre la molecola umana».*

Il panpsichismo (o, meglio, il *paninterazionismo*[5]) di Teilhard de Chardin non è di carattere metafisico, in quanto è dedotto dalla realtà del fenomeno evolutivo. Esso infatti trova oggi sostegno in certe interpretazioni della fisica quantistica.[6] Tuttavia, pur approssimandosi al reale, il continuum *materia-spirito* resta un assunto di natura essenzialmente *logica.*

b. La ricerca del Dr. John K. Grandy conferisce concretezza alla posizione di Teilhard de Chardin, poiché dimostra che sussiste un *continuum* fra realtà fisico-chimica del DNA e realtà fisico-chimica dell'uomo, entrambe attraversate dalla luce della "coscienza".

Suscita qualche difficoltà il termine *"coscienza"* (che Teilhard equipara a *"ogni tipo di psichismo"*), poiché presuppone l'esistenza di un *"interno"* in tutte le cose. Tuttavia esso non è *evidente* nemmeno negli esseri umani, ma è *dedotto* sul versante esterno del linguaggio e dei loro comportamenti. Allo stesso modo, l'*"interno"* è pure *deducibile* dai modi di agire estremamente *razionali, concertati e finalizzati* delle molecole e delle cellule.

La seguente allegoria del fisico Jean Charon è ben esplicativa: *«Supponiamo che dei giganti visitino il nostro pianeta e che siano incapaci di distinguere qualunque cosa che sia più piccola delle nostre auto. Vedrebbero come queste si spostano seguendo delle leggi sconosciute, e attribuiranno quindi a loro delle proprietà psichiche, non sospettando affatto l'esistenza di piccoli esseri umani che guidano quei veicoli».*[7] f.m.

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[4] Cfr http://www.biosferanoosfera.it/it/studi-inediti-o-rari-di-teilhard-de-chardin *"**L'Homme... un prezioso inedito del 1911**"*, p. 8.
[5] Abbiamo proposto di sostituire il termine "panpsichismo" con quello di "**paninterazionismo**", nello scritto *"**Complessità-coscienza e panpsichismo**"* in http://www.biosferanoosfera.it/it/articoli p. 6.
[6] Cfr. Lo scritto citato alla nota precedente, p. 4.
[7] Jean Charon, *"**Lo psichismo nell'universo**"* in http://www.biosferanoosfera.it/it/articoli p. 4.

International Journal of Arts & Sciences,
CD-ROM. ISSN: 1944-6934 :: 6(3):313–327 (2013)

THE THREE DYNAMIC LEVELS OF DNA CONSCIOUSNESS

John K. Grandy[8]

Whitestone Consulting LLC, USA and North Country Urgent Care, Watertown, N.Y., USA

The theory of DNA consciousness proposes two main themes. First, that DNA possesses a degree of consciousness which is supported by the interaction-based model of consciousness and the concept of interaction-complexity-consciousness. Second, that DNA possesses the ability to give rise to higher degrees of consciousness e.g. cellular consciousness and human consciousness. In previous works I have assembled neurogenetic correlates of human consciousness into three distinct phases and used this evidence to support the second theme of the theory of DNA consciousness. In this article I will evaluate DNA as a degree of consciousness objectively on three dynamic levels. Each of these three levels will be supported by molecular and genetic principles which are validated by existing scientific literature. The results of this work clearly demonstrate that DNA consciousness can in fact be broken down objectively into three dynamic levels- the interactions between DNA and itself (gene-gene interactions also called epistatis), the interactions of DNA and other nucleic entities (RNA, viruses, the mitochondria, and other cells), and the interactions between DNA and the external environment. These results force us to view DNA not as a docile genetic storage unit, but rather as a dynamic degree of molecular consciousness that possess the ability to give rise to higher forms of consciousness. The results also suggest that the paradigm of interaction-complexity-consciousness demonstrates how consciousness is a fundamental property of the universe and an emergent property one as well that is interwoven in a fractal nature.

Keywords: DNA Consciousness, Interaction-based model of consciousness, Neurogenetic correlates of human consciousness, interaction-complexity-consciousness (ICC), fractal nature of consciousness.

[8] **John K. Grandy** completed his training at the D'Youville College Physician Assistant Program in 2004. He earned a Bachelor of Science degree in biology from Canisius College and a Masters degree from Roswell Park Cancer Research Institute with a distinction in neurophysiology and molecular immunology. John is a former medical provider for the Department of Defense at Fort Drum. He joined North Country Urgent Care in December 2010. His professional interest is focused on consciousness research. He has had many articles published, as well as book chapters and has given presentations at Harvard University, Las Vegas, Belgrade University in Serbia, Stockholm University in Sweden, Imperial College of London, and University of Rome on the DNA molecule, genetic engineering, consciousness, and Alzheimer disease. Some of these articles are available at: http://publicationslist.org/john.grandy

Introduction

The theory of DNA consciousness was proposed in 2004. It was first mentioned as a theory in the literature in 2006 (Grandy 2006a; Grandy 2006b). This theory maintains two main concepts:
1) that DNA has a degree of consciousness and 2) that DNA possess the ability to give rise to higher degrees of consciousness e.g. cellular consciousness and human consciousness.

Much work has been completed in order to validate the second concept of the theory of DNA consciousness. An initial outline was presented at the *Vigier VIII- British Computer Society Joint Meeting, London England 2012 Symposium* and published in the conference proceedings (Grandy 2013a). In that work, the relationship between human consciousness and DNA consciousness was broken down into three neurogenetic phases. Recently, a more comprehensive article was completed which delves into more genetic detail in order to support the second part of the theory of DNA consciousness (Grandy 2013b). The results of the later work comprised 8 genes and 14 associated genes in the first neurogenetic phase, 7 genes and 8 associated genes in the second neurogenetic phase, and 5 genes in the third neurogenetic phase.

With only these two works completed there is now a small but initial enumeration with several established neurogenetic correlates of consciousness (NgCC) of human consciousness, with many more to be discovered and objectified. This initial list is one that will continue to expand into a multitude of genetic pathways that are active and critical during the conscious experience.

NgCC are defined as any gene(s) that have a correlation to the emergence of the brain, the continuous functioning of regions of the brain involved in human consciousness, and are involved in neurodegenerative processes that erode modalities of human consciousness later in life (Grandy 2013a; Grandy 2013b). By establishing the existence of NgCC the second concept in the theory of DNA consciousness has become more of a science that involves genetic pathways that underlay the neurologic correlates of consciousness (NCC). However, what evidence do we have to support the first concept of the theory of DNA consciousness i.e. DNA is a degree of consciousness?

The article *The DNA molecule is autopoietic, dynamic, evolving, and a form of consciousness* (Grandy 2011) was an early attempt to support the first concept of the theory of DNA consciousness. This was accomplished by a comparative analysis of similarities between DNA consciousness and human consciousness. In this work, it was supported that DNA is autopoietic, dynamic, evolving, and consequently a degree of consciousness. In the case of human consciousness the elements of being autopoietic, dynamic, and evolving was previously established in earlier works (Combs and Krippner 2003; Combs and Goerner 1998; Maturana and Francisco 1972).

Autopoietic processes are defined as processes that are self-maintaining systems, which are organizations or organisms that produce and replace their own components. There are six criteria of an autopoietic system: the system has identifiable boundaries which distinguish it from the environment, these boundaries are self-produced, the components of the boundaries are also self-produced, the system is mechanistic and subject to cause and effect, the system possesses constituent elements and components, and the constituent elements and components are also self- produced. The DNA molecule meets all of these criteria (Grandy 2011).

In this work I will assemble established scientific literature to support three dynamic levels of DNA consciousness, which will be done in three corresponding sections. This will serve to establish the first concept of DNA consciousness as a science. With the establishment of three dynamic levels of DNA consciousness testable models can then be proposed. At this point, both concepts of the theory of DNA consciousness will be able to be subjected to scientific investigation and applied to the science of consciousness studies.

The Three Dynamic Levels of DNA Consciousness

I have already established that the DNA molecule is an autopoietic entity and a degree of consciousness. I will now go into more molecular and genetic detail in order to support this. This information will be separated into three distinct dynamic levels. Before I discuss these three dynamic levels I will first give a brief description of the DNA molecule and illustrate how it gives rise to microscopic life forms which represents the emergence of higher degrees of [cellular] consciousness sprouting from the realm of molecular consciousness.

The DNA molecule is composed of nitrogenous bases of either a purine or pyrimidine, which are aromatic, heterocyclic molecules that are connected to a deoxyribose sugar molecule; or in the case of ribonucleic acid (RNA) a ribose sugar molecule. These are known as nucleotides. The two purine components are adenine (A) and guanine (G). The two pyrimidine components are cytosine (C) and thymine (T); in RNA the pyrimidine T is substituted for uracil (U) (for review see references: Grandy 2010a & Grandy 2006b).

In the DNA molecule the amount of A equals the amount of T and the amount of C equals
the amount of G, which is known as Chargaff's rule. These nucleotides pair in this fashion because A and T have two compatible hydrogen bonds and C and G have three compatible hydrogen bonds, which is known as Watson-Crick base pairing. These pairs make up the center or "ladder rungs" of the DNA molecule- giving it a palindromic nature (i.e. GAATTC complements CTTAAG), while the sugar phosphate deoxyribose makes up the backbone. The phosphate links the sugar molecules above and below other sugar phosphates. This gives rise to a double helical structure of B-DNA that twist around displaying minor and major grooves. The DNA molecule utilizes this structure to replicate copies of it's self using what is known as a semiconservative model (For review see: Pritchard and Korf 2008- chapter 5).

DNA contains a genetic code made up of codons which are three nucleotides (e.g. ATG and
CTG) that, in collaboration with RNA subspecies, ultimately produces proteins. These proteins make up cellular parts and products. This is how DNA is able to give rise to simple forms of life and degrees of consciousness, which begins on the cellular level. In fact, Teilhard de Chardin had pointed out in *The Phenomenon of Man* that "The first appearance of organized life was the cell, which was a decisive step in the progress of consciousness." Teilhard referred to this as the "cellular revolution" in which he maintained that a primordial origin to the first lineaments of immanence within matter exists (de Chardin 1955).

In the introduction I mentioned autopoiesis and that DNA is made up of self-made components i.e. the nucleotides A, T, C, and G; and U in RNA. There are many genes that produce enzymes that produce these nucleotides. One example is the PRPS1 gene which encodes for phosphoribosyl pyrophosphate (PRPP) synthetase 1, which produces PRPP. PRPP plays critical roles in the biochemical catabolic pathways that produce both the purines and pyrmidines. Mutation in the PRPS1 gene are associated with X-linked Charcot-Marie-

Tooth disease-5, Arts syndrome, and X-linked nonsyndromic sensorineural deafness with the underactivity-type mutations; and uric acid overproduction (gout), mental retardation, ataxia, hypotonia, and hearing impairment with the over activity-type mutations (de Brouwer et al. 2010).

In the eukaryotic cell DNA is stored in the nucleus which is maintained by a nuclear membrane effectively separating it from the rest of the cell- with the nuclear pores allowing chemical signals and various RNA species to selectively enter the nucleus. Whereas in a prokaryotic cell there is no nucleus and DNA exists as circular DNA and plasmids, but the cellular DNA is contained within the cell by the cell wall. These layers of separation allow identifiable boundaries that distinguish the cell and the DNA from the environment.

Possessing an identifiable boundary is one of the criteria of autopoiesis. In previous works (Grandy 2011) I had mentioned some genes that allow an identifiable boundary, which consequently contributes to autopoiesis in both prokaryotes and eukaryotes. In prokaryotes the *Mur genes* are vital to the production of the peptidoglycan-based cell membrane. Whereas, in eukaryotes the DNA is encased in the nuclear membrane and genes such as the *Pah1p, Smp2p,* and *LMN* genes produce products that are the components of the outer and inner nuclear membrane. Therefore, there are genes that allow autopoiesis in prokaryotes and eukaryotes.

In addition to cellular degrees of consciousness, DNA and RNA can give rise to other nucleic entities that demonstrate a degree of consciousness- viruses. A virus is the simplest example of a nucleic life form. For example the influenza virus is a single-stranded RNA (ssRNA) virus with 11 genes found on 8 non-paired ssRNA segments in the viral genome (Fiddes 1997). These 11 genes code for 11 proteins (HA, NA, NP, M1, M2, NS1, NEP, PA, PB1, PB1-F2, and PB2) that make up the influenza virus. However, the virus is an obligate intercellular parasite which means that it needs to infect a cell and use the host DNA to make copies of it's self. Although RNA-viruses are small and require a host cell for replication they are none the less very efficient life forms. They demonstrate a level of intentionality and a degree of consciousness.

Now that we have a basic understanding of what DNA is and what it can do we are now in a position to attempt to understand the three dynamic levels of DNA consciousness which validate that the DNA molecule is in fact a degree of consciousness.

The First Dynamic Level of DNA Consciousness

The first dynamic level of DNA consciousness involves gene-gene interactions or what is known as epstatis. This is how the DNA molecule communicates with it's self from one part of the genome to the other or from one gene to many anothers. These interactions give the DNA molecule an inter-life-force of its very own, a type of vitality and intentionality if you will, but a degree of consciousness none the less. (……..)

Summing up the first dynamic level of DNA consciousness: at this juncture we have master genes controlling other genes, one gene – the *Hells* gene that has a significant impact on what is not expressed in the entire genome, TEs that can alter genes by inducing mutations or the size of the genome, and a system that "knows" how to repair it's self. Collectively, even with only these four motifs, this represents a dynamic level of consciousness bestowed upon the DNA molecule that is active at all times up until death, which of course is marked by the cessation of this activity. On this first dynamic level of DNA consciousness the DNA molecule is continuously communicating with it's self.

The Second Dynamic Level of DNA Consciousness

The second dynamic level of DNA consciousness consists of interactions between the nuclear (genomic) DNA and other nucleic-based entities e.g. RNA, viruses, mitochondria, and other cells. This dynamic level signifies a form of communication that takes place between the nuclear DNA and these other nucleic entities, which signifies and underscores a degree of consciousness. I will discuss a few examples of how these interactions justify a second dynamic level of DNA consciousness. (…….)

Summing up the second dynamic level of DNA consciousness: the second dynamic level of DNA consciousness clearly illustrates the ability of DNA to interact with RNA species in order to provide protein materials and to maintain vital housekeeping functions. Secondly, within the cell the nuclear DNA communicates with and shares genes with mtDNA in order to provide energy for the cell. Finally, the DNA from one cell can communicate, often via complex biochemical cascades, with the DNA in another cell. These are only three examples, but they clearly show DNA communicating in a dynamic fashion that justifies a degree of consciousness.

The Third Dynamic Level of DNA Consciousness

The third dynamic level of DNA consciousness consists of interactions between DNA and the external environment beyond the parameters of the cell. This is different than cell-cell interactions that were previously discussed as it is external forces or entities that cause physical changes and damage to the DNA molecule, which can result in mutations. Secondly, viruses can cause changes to DNA by the process that they utilize to infect the host cell. The third example of how DNA can be altered by external forces is by genetic engineering and epigenetic modifications- collectively called selected genetic destination. (…….)

Summing up the third dynamic level of DNA consciousness: on this third dynamic level of DNA consciousness we see that DNA can be changed. External forces and energies, foreign biological entities, and SGD can accomplish this. This dynamic level also exemplifies another characteristic of autopoiesis i.e. that DNA is mechanistic- it is subject to cause and effect. In addition, this demonstrates that DNA can interact with the external environment in a whole new fashion that can induce changes in the degree of DNA consciousness.

Discussion

The three dynamic levels of DNA consciousness have been discussed and several biological and genetic principles seem to support each of these levels. It is also important to point out that each of the three dynamic levels is implicitly dependent on interactions. This justifies a brief discussion on the *interaction-based model of consciousness.* For more detail please consult the references.

The interaction-based model of consciousness states that consciousness is the interaction of *things* (be it an organism, DNA molecule, or atom) with other *things*, the external environment, and more specifically the interaction of energy with other forms of energy [and forces]. This model provides four advantages that no current definition can currently offer (Grandy 2011):

a. Transcendence of the limitations that the anthropistic and reductionist models impose.

b. The eradication of any exclusion criteria as to what does or does not possess consciousness.

c. This interaction-based model allows consciousness to be viewed within the dynamic framework of evolution.

d. This definition allows the incorporation of quantum physics into the explanation of consciousness.

As things interact they begin to become more complex e.g. atoms become molecules. Secondly, as complexity increases the degree of consciousness increase as well. Therefore this model of interactions transforms into the concept of interaction-complexity-consciousness (ICC) in where the degree of consciousness of any system is dependent on the interaction-based complexity. However, it was pointed out by physicist Wolfgang Baer that this may be too general. (……)