An Incomplete Species:
Unfolding Of Space Law To Support The Survival Of Humankind And Its Unique Envoys Migrating Off-Earth; The Continuing Evolution Of Humanity, Society, Technology, And Law

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Introduction

All living species are transitory. Depending upon the definition of "technology" in specific contexts, they either evolve biologically or biotechnologically to meet ever-changing external and internal conditions, or they ultimately become extinct. Even the humankind sentient "essence," i.e., the whole seemingly being greater than the sum of its parts, is constantly in evolutionary transition. If not, it too becomes extinct, or perhaps may be transferred and incorporated in a similar fashion by a

subspecies or totally different species; perhaps even by a biotechnological or totally technological post human … beyond cyberpersona.[1] No species has "lasted forever"… yet!

Empirically-based human laws that have been formulated to enhance transitory and specific interests in space exploration, migration, and settlement, lack the essential and underlying philosophic construct, i.e., survival of the species, its descendants, and the evolutionary odyssey of their "essence."[2] This survival odyssey is the real empirical foundation of space law, specifically the survival of humankind and of its biotechnological descendants.

Moore's Law and the Singularity Principle[3] remind us that time and

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1 "Cyberpersona" is a component of "cyberspace" and includes a person's identification when on the network encompassed by e-mail address, computer IP address, cell phone number, and the like. Cyberpersona exist in cyberspace, which is a "global domain within the information environment consisting of the interdependent network of information technology infrastructures, including the Internet, telecommunications networks, computer systems, and embedded processors and controllers." Cyberspace has been defined in many different ways by both the private and public sectors, but on May 12, 2008, the U.S. Undersecretary of Defense officially signed a document defining cyberspace as in the preceding quote, and it is considered the same as land, sea, air, and space in the context of national defense strategy interests. In 2009, the Chairman of the U.S. Joint Chiefs of Staff "approved the definition of Cyberspace Operations as including computer network operations and activities to operate and defend the Global Information Grid." [http://www.signal.army.mil/ArmyCommunicator/2011/Vol36/No2/2011Vol36No2Sub06.pdf].
The terms *cyberspace, cyberpersona, and cyberlaw* are discussed in greater detail in the ensuing sections of this article.

2 For a working legal definition of "essence" in a jurisprudential context, *see* H.C. Black, *Black's Law Dictionary*, 7th ed. (St. Paul, Minn: West Group Publishers, 1999) , s.v., "essence."

3 For a working definition of Moore's Law*, see* fnt. 22*, infra*. The Singularity Principle is subject to multiple definitions and interpretations. In many ways, it represents the classic scientifically theoretical "work in progress." Nevertheless, despite being defined in many different ways for many different purposes, "Singularity" for the present discussion is described as having been invented or conceived initially by Vernor Vinge as "the fundamental discontinuity in history created by the technological invention of smarter-than-human intelligence. Other definitions have included a time of exponentially faster technological progress (even faster than now, that is), or the positive-feedback effect created by enhanced intelligences working out improved methods of intelligence enhancement. The core idea remains the same: There is a massive discontinuity approaching, a Singularity, within human history. This has to do with the rise of smarter-than-human intelligence, the ability of technology to alter human nature, the final conquest of material reality through nanotech, or some other fundamental change in the rules." More recent definitions may render that of Verner Vinge somewhat

technological evolution are compressing the time available for humankind's intentional evolution and space migration for purposes of promoting the survival of the human essence. The question posited is, "What is the relationship between individuals, society, civilization, a species, the solar system, the galaxy, and the constantly evolving empirical nature of the 'known' universe and potential parallel universes?" This is the question upon which the humankind evolutionary odyssey pivots, and the principal objective of this chapter is to examine jurisprudential issues that are applicable to a technologically altered species that is living and functioning off-Earth.

The humankind species is now shaping its ongoing survival by changing the life-support capabilities of Earth to the point where off-Earth migration may not be optional, but rather necessary for the continued evolution of the species, and the continuation of its odyssey to survive and inch toward understanding its own "essence."

I. Natural Law Theory, Jurisprudence, and some Fundamental Questions

The driving factors that underlie the evolution of all living systems also underlie what traditionally has been referred to as Natural Law, or Natural Law Theory. From Natural Law humans have derived jurisprudence, concepts aimed at individual and collective survival. Legal philosophies and the concepts of jurisprudence are not the products of a spiritually amorphous understanding of acceptable individual and collective behavior patterns formulated out of some ethereal or self-serving sense of "morality" or "ethic."

To the extent that the relevant empirical underpinnings are not yet known or quantifiable, laws remain "best guess" theories upon which individual and societal behavior is directed; it is a transitional framework.

The formulation and application of space law principles, domestic, international, and trans-global, are no exception. These laws should be, indeed, must be designed to enhance the survival of humankind and its descendants off-Earth; in space. They must reflect the underlying philosophic construct of survival of the humankind species and its evolving essence, however that latter term is defined and applied at any given time

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obsolete, *See*, therefore, E.S. Yudkowsky, "The Singulartarian Principles" (2001, rev. 5/14/ 2001) at [http://yudkowsky.net/obsolete/principles.html].

and in any given context. But do current and presently anticipated space laws really reflect this imperative?

The path from the simplest form of carbon-based life on planet Earth to the extraordinarily complex, spacefaring, modern human, Homo sapiens sapiens, has been indirect and seemingly meandering.[4] The phenomenon appears astonishing and bewildering, and was explained only by the development of technology and scientific methodology sufficient to describe the continuously unfolding complexity of the human organism.

To envisage and design a reasonable future for the human species, both Jurisprudence and Natural Law must be aligned with the currently prevailing direction of evolution. We must not lose sight of a basic dictate, the absolute requirement to adjust and adapt to change, and thus to survive … or become extinct. Our current dilemma is that human technology, as both the problem and the answer, is compressing the time available to the human species to adjust its survival strategies.[5]

Some of the questions that have to be addressed to design properly the enduring survival-strategy requirements or jurisprudence include:

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4 For an excellent discussion of the various factors involved in human evolution and what yet remains to be deciphered, *see*, generally, by R. Potts and C. Sloan, *What Does it Mean to be Human*, (National Geographic publication as the official companion book to the Smithsonian Institution, National Museum of Natural History's David H. Koch Hall of Human Origins, Washington, D.C. (2010).

5 In this general context, Dr. Lyn Margulis of the University of Massachusetts, Amherst, may be considered by some traditional biological evolutionists as somewhat limited in her views, perhaps even eccentric. Nevertheless, her views regarding the origins of all life forms, including *Homo sapiens*, as deriving from a single bacterium and its subsequent colonizing proclivity, are based upon what she terms an evolutionary symbiotic partnership. Every life form, including modern humans, is considered by Dr. Margulis literally to be a "community of symbiotic bacteria." She believes a great deal of empirical evidence exists that modern humans are "mammalian weeds" and "[l]ike many mammals, we overgrow our habitats and that leads to poverty, misery, and wars." *See*, therefore, "The Discover Interview: Lynn Margulis – Q+A," by Dick Teresi in *Discover* magazine (April 2011, pp.66-71). The importance of this perspective relates to human population dynamics run amok, as reflected in the exponential human population growth shortly reaching seven billion individuals in a relatively abbreviated time. Humankind carrying capacity of Earth, all involved factors considered, makes humankind off-Earth migration critical to survival of *Homo sapiens sapiens*, its biotechnological descendants, and any hope for the continuing evolution and odyssey of the species' "essence." *See*, generally, by L. Margulis, *Symbiotic Planet: A New look at Evolution* (Barnes & Noble, 2003). For an interesting perspective on symbiotioc evolution, *see* by R. Morrison, *The Spirit in the Gene: humanity's proud illusion and the laws of nature* (Comstock Book – 1999).

1. What is the evolutionary direction of humankind?[6]
2. Is it really understood, and does the current body of space jurisprudence embrace, catalyze, promote, and enhance it, or does it compromise the evolving pursuit of that evolutionary direction?
3. If technology is an integral biological component of humankind evolution (as it clearly was of its protohominid ancestors), is a next step in human evolution and survival the biotechnological adjustment necessary for space migration and permanent off-Earth habitation?
4. If and when that is achieved, will humankind habitation on Earth cease?
5. And if so, what time frame would be realistic for this?
6. What is the current scope and projected direction of Natural Law Theory[7] leading to a suitable jurisprudence, all in turn yielding to international, global, and transglobal law?
7. What, ultimately, may the evolving global and transglobal jurisprudence look like as it relates to space exploration, migration, and settlement?
8. Do, or will, these questions and issues lead global or transglobal jurisprudence support or secure survival of the humankind, transhuman, and post human species?[8]

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6 Collectively, *Homo sapiens* is referred to generally as humankind. However, as occasionally used herein, the term is considered a characterization of the biotechnologically integrated transitioning of the species into what is referred to as "transhumans," hence the emphasis of *kind* in human*kind* in certain specific contexts. *See, therefore,* by G. Robinson and R. Lauria, "Legal Rights and Accountability of Cyberpresence: A Void in Space Law/Astrolaw Jurisprudence," in Annals of Air and Space Law Vol. XXVIII (2003) at pp. 311-326.

7 In general terms, the theory of "natural law," or *jus naturale*, derived from philosophical musings in the Antonine Age, when Roman jurists attempted to formulate a system of core principles underlying rules to guide human behavior in a societal setting. These core principles were considered to be integral components of human *nature*, or human *biology*, shared by all humans. *See* Black's Law Dictionary, Fourth Edition, p. 1177 (1957). Interestingly, there is/will be a distinct point of departure between humans, transhumans, and post humans when the "nature," both biological and/or ephemeral and those that are generally thought to be non-empirically based at this point in time (such as morality, ethic, and the like), of *Homo sapiens sapiens* transitions into a totally separate and distinct set of core principles directing the survival of a biotechnologically integrated or totally separate and distinct entity with "judgmental capabilities" and non-biological metabolic and self-replicating characteristics, i.e., post humans.

8 *Op cit., supra,* Note 6, Robinson and Lauria, for a general discussion of the foundations of current human evolution leading to biotechnological descendants of *Homo sapiens sapiens.*

9. What is the current status of "space law" as it pertains to the biotechnological evolutionary potential of the "essence" or "nature" of Homo sapiens sapiens? Is it an obstacle to evolutionary potential and survival?
10. What is the role of current and projected cyberspace, cyberpersona, and cyberlaw?
11. Does cyberspace require a totally unique cyberlaw for a projected sovereign cybergovernment and cyberpersona?
12. Does presently developing space law, in an international context, suggest a reasonable likelihood of the survival of the humankind species and its evolving essence, as opposed to a short-term competitiveness?
13. Is there room for a unified global effort to ensure space migration and permanent survival off-Earth at the same time as both governmental and private commercial competitiveness is encouraged through space treaties and international governmental and private sector collaboration and agreements?
14. Do both approaches, governmental and commercial, support humankind evolution, adjustment, and permanent survival off-Earth?
15. Does the body of unfolding space law and its implementation in the form of treaties, conventions, bilateral/multilateral operating agreements, customary international space law, and relevant domestic laws, constructively and timely influence the ongoing survivability of humankind and its biotechnological descendants, i.e., transhumans and post humans?

This rather massive collection of questions unfortunately is only the tip of the iceberg, but for purposes of this chapter it is sufficient to provide us with plenty of working material.

II. Biotechnology and the Emerging Transhuman

Technology in a very significant part has allowed the evolution of Homo sapiens to reach its current species survival status. Technology will allow its further continuing evolution, or alternatively, lead to its extinction.

Based on our present understanding, it is reasonable to assume that from the very emergence of the first humans, technology has been the

primary factor in hominid adjustment, survival, and the ongoing evolution for Homo sapiens and its immediate predecessors on the evolutionary bush. It has been a rapid journey, as only about five millennia have passed between the time when metal was used in the first human tools, and the launch of the first human-made rockets into outer space, followed in an evolutionary instant by the space shuttle and then the International Space Station.

For this discussion, "technology" is defined as an "applied science, and a scientific method of achieving a practical purpose."[9]

"Biology" is defined as "a branch of knowledge that deals with living organisms and their vital processes."

When addressing the phenomenon of human evolution enhanced or permitted by the integration of biology with technology, i.e., "biotechnology," the result might be defined as an organism (or various of its organ and organelle components) integrated with technology to create a benefit to an individual or its interactive society.

But just what is the core benefit, the underlying objective which that integration serves? Answer: Survival. No matter how temporary or prolonged, if a biotechnologically enhanced organism performs more favorably than an alternative genetic coding, it is by definition survival enhancing, and hence evolutionary.

The modern era of biotechnology is generally considered to have begun with the discovery of deoxyribonucleic acid structure (DNA) by James Watson and Francis Crick.[10] The discovery of restriction enzymes

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9 *See*, therefore, "technology" defined in Webster's Ninth New Collegiate Dictionary at p. 1211 (1991). Note that lower primates also possess technological capabilities, as do most life forms in specific contexts, but not of the sophisticated capability of *Homo sapiens sapiens* to enhance a given technology exponentially, and even create a technology with the capacity to self-evolve. *See* section IV B, infra pp.: "Defining 'Technology' and its Potential Role in Ongoing Humankind Evolution." In this context, it also should be noted that humankind technology is increasingly enhancing the role and characteristics of autocatalysm in humankind evolution. It is important to know the role of technology in that evolution, and then establish values and laws that direct the use of the technology in humankind's own biotechnological evolution. *See*, therefore, by S. Kauffman, *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity* (Oxford University Press – 1991).

10 In February 1953, James D. Watson and Francis H.C. Crick announced that they had determined the double helix structure of deoxyribonucleic acid (DNA), the molecule that contains human genes. "Though DNA was discovered in 1869, its crucial role in determining genetic inheritance wasn't demonstrated until 1943. In the early 1950s, Watson and Crick were only two of many scientists working on figuring out the structure of DNA. California chemist Linus Pauling suggested an

in the 1960s by Werner Arber opened the pathway to a number of additional biotechnology pursuits, in particular recombinant DNA technology.[11]

The principle issue addressed in this discussion is the expanding role of biotechnology with respect to human DNA, i.e., on human evolution, particularly in an off-Earth space setting, and how the manipulation of the human genome[12] and specific genetic structures impact the process of humankind evolution and survival. Given the current state of technology and the direction of its development, we must assume that new subspecies of humans will soon emerge. For example Homo alterios spatialis, i.e., humans altered specifically for permanent survival off-Earth, will be created to carry, and be capable of carrying, the essence or nature of "humanity" into space. We also should anticipate that new entities will indeed be created through biotechnological integration to form a completely independent post-human species.[13]

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incorrect model at the beginning of 1953, prompting Watson and Crick to try and beat Pauling at his own game. On the morning of February 28, they determined that the structure of DNA was a double-helix polymer, or a spiral of two DNA strands, each containing a long chain of monomer nucleotides, wound around each other. According to their findings, DNA replicated itself by separating into individual strands, each of which became the template for a new double helix. In his best-selling book, *The Double Helix* (1968), Watson later claimed that Crick announced the discovery by walking into the nearby Eagle Pub and blurting out that 'we had found the secret of life.' The truth wasn't that far off, as Watson and Crick had solved a fundamental mystery of science--how it was possible for genetic instructions to be held inside organisms and passed from generation to generation." *See,* therefore, February 28, 1953, This Day in History, presented by Travelers, online at http://www.history.com/this-day-in-history/watson-and-crick-discover-chemical-structure-of-dna.

11 Werner Arber, a challenger of Charles Darwin, a Swiss microbiologist, and Nobel Laureat (along with fellow laureate physiologists Daniel Nathans and Hamilton O. Smith), discovered what is termed "restriction enzymes" and their applications to molecular genetics. Restriction enzymes cut DNA at specific places called restriction sites, allowing researchers to work with small sections of genes and to carry out recombinant DNA work, a process that launched the modern genetic revolution.." *See*, by J. Bergman, "Werner Arber: Nobel Laureate, Darwin Skeptic" at [http://www.icr.org/article/werner-arber-nobel-laureate-darwin-skeptic/]. The application of this technique to transhumans and post humans, particularly in an off-Earth synthetic life support environment, is particularly significant.

12 Simply defined, the "genome" is the sum of all the genetic information contained in the chromosomes of any organism, including its genes and DNA sequences. Physically, a chromosome is defined as a threadlike linear strand of DNA and associated proteins that carry the genes and their functions in single or multi-celled organisms, the nucleus of which is surrounded by a membrane.

13 *Op cit, supra* note 6, Robinson and Lauria. "Legal Rights and Accountability of Cyberpresence: A Void in Space Law/Astrolaw Jurisprudence," in *Annals of Air*

The incipient capability of genetic re-engineering notwithstanding, the basic principle of biological evolution is natural selection. This has been defined as those species best suited to survive in a given environment, and thereby most likely to reproduce successfully and pass along to the next generation certain characteristics that promote survival in those specific environmental dictates.

III. Population Dynamics, Evolution, And Space Law

For those left on the Earth, what will be the motivation to underwrite human space exploration with the objective of permanent off-Earth settlements?

Leaving aside for the moment the role of technology and biotechnological integration in human and humankind evolution and survival, there are four basic elements that seem to drive biological evolution.

The first is "mutation," which is described as "changes in the sequencing of DNA in a cell's genome." Changes in sequencing may have no manifest effect, and become "trash" genes with no harmful influences, but which may nevertheless play a role in mutation and survival purposes at some unknown point in the future. Change in sequencing may also result in immediate benefit to the survival of a cell, perhaps the cell's host organ, and even the organism.

But the change may also have a detrimental effect, long or short term, such as death of the cell or its host, and perhaps over a period of time even the decline and death of the particular society in which the organism exists, or even the extinction of the entire species, given sufficient time and perhaps negative environmental changes and influences. Nevertheless, mutations, even though often resulting from internal or external environmental changes and influences, are generally random and occur independent of any prevailing survival needs of the individual cell, organ, or organism. More succinctly, mutations do not occur as a result of their usefulness or potential harmfulness to the host.

From an evolutionary and/or survival perspective, mutations, however they occur (sexually, asexually, or epigenetically) that are passed

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and Space Law, Vol. XXVIII, pp 311-326 (2003); and by G. Robinson, "Space Law: Addressing the Legal Status of Evolving 'Envoys of Mankind," in *Annals of Air and Space Law*, Vol. XXXVI, pp 447-512 (2011).

on to succeeding generations have the potential to impact survivability of the individual and its succeeding generations.

Perhaps equally as important as mutations in species survival is "migration," which often is referred to as "gene flow." Here, individuals of a species drift to and mate with individuals of other populations. If the genetic structures are the same, or essentially the same, the ensuing offspring remain primarily the same. Individual specimens of each subpopulation or societal grouping mate "randomly" for the most part, but geographic distances and ecological barriers may make it difficult if not impossible to mate with specimens of other subpopulations. Passing on mutations that may prove beneficial for survival (or may prove fatal) may require movement to a new geographic and survival-beneficial ecotone.[14] Movement to and survival in such a new ecotone frequently does not result from, or require, a mutation.

Merely moving to a more survival-beneficial environment, such as one that is less physically competitive, or more biochemically favorable, or possessing greater nutrition resources and opportunities, etc., may also promote the survival of the genome of an individual or its group.

All of these forms of movement are referred to as "migration."

We must likewise assume that humankind migration off-Earth to promote the ultimate survival of the species and its biotechnologically evolving descendants is also inevitable. (Note that its descendants may include completely independent technological surrogates embracing and perhaps enhancing the principles of "human nature" or its "essence," i.e., robots).

Another primary component of biological and biotechnologically-integrated evolution is a phenomenon referred to as "genetic drift." This process results primarily in smaller subgroupings in which individual and collective genetic frequency[15] in the populations are random occurrences, and do not necessarily result from mutation, migration, or natural selection.

The fourth component of evolutionary change is an occurrence with which all students of biology are familiar, the differential reproduction of

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[14] An "ecotone" is a transitional area between two or more communities of different species, but with each specimen containing the characteristics of its participating species, i.e., where two different species survive successfully together over a given period of time.

[15] Gene frequency is defined as the frequency of occurrence of an allele in relation to that of other alleles of the same gene in a population. An allele is an alternative form of a gene (one member of a pair) that is located at a specific position on a specific chromosome.

genetically-varied individuals in a population, resulting in some individuals with greater fitness for survival in a specific geographic and specimen-interactive environment. This favors some offspring to perpetuate their genetic structures.

While these four principles of biological evolution are extraordinarily complicated in cause and effect manifestations, far beyond the brief characterizations presented here, their functioning in the context of human evolution beyond Earth leads us to posit the evolution of post-humans, whose survival potential off-Earth is so significantly enhanced technologically as to define a separate species or sub-species. Leaving aside for the present the potentials offered by, and the significance of, telepresence, teleportation, cybernetics and cyberpersona in space migration technology. We must also posit that post-humans will be accountable not to our present notions of jurisprudence, but to non-human formulated jurisprudential concepts and laws, i.e., the laws created by and for a new species taxonomically classified as simply Homo alterios spatialis, or perhaps cyber spatialis… or some similar innovative taxonomic model.

This presents an issue worth exploring, namely that of the transition of one legal regime to the next, a process that history has shown is often the source of sometimes severe conflict.

IV. The Human Essence

Leaving aside for the moment the evolving potential DNA evidence of past breeding between modern humans and Neanderthals, each human living today is a biological specimen of currently "modern" humankind, i.e., Homo sapiens sapiens.

In attempting to define the "essence" of being human, or what constitutes "human nature," the almost universal tendency is to raise humankind significantly, and even in a misleading fashion, above its biological origins and subtending biochemical/biophysical dictates. This certainly can be seen in all domestic and international jurisprudential concepts and implementing positive laws with roots in Natural Law Theory.[16]

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16 *Op cit, supra* note 7, wherein Natural Law Theory is defined and discussed. Note, also, that transhumans (and perhaps even post humans) deriving from hominid reproductive organs and technology also function in a fashion consistent with humankind definitions of Natural Law Theory.

Principles, values, specific words such as "ethical," "moral," "fair," etc., and concepts such as "human rights" and "private ownership" versus "common heritage," subtend most pevailing domestic legislation and international agreements, conventions, and treaties. But even with specific definitions in context, these words and phrases are designed to protect the parochial economic and other physically-oriented survival interests of the societies represented in these negotiated or dictated documents. Only recognizing these underlying biochemical and biophysical motivating factors in negotiating any type of agreement between two or more individuals (including societies, civilizations, and even the incipient stages of interspecies communication) will the basic principle(s) underlying Natural Law Theory be recognized. And this recognition is critical to any type of functional order in the current (and future) level of globalism being shaped by very sophisticated and complex electronic communications.

It is imperative that jurisprudents of any persuasion not rely on wishful thinking, such as the formulation of laws and relationships based on ephemeral definitions inherent in "moral" and "ethical" behavior that do not address the requirements of ultimate "physical" and "essence" survival. The meaning of the odyssey of Homo sapiens sapiens and its technologically altered offspring rests on the physical and sentient[17]

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[17] For purposes of the present discussion, "sentient" can be defined as "responsive to or conscious of sense impressions." [*Webster's Ninth New Collegiate Dictionary*, p. 1073 (1991).] Perhaps more accurately in the present context, emphasis should be placed upon a receptive sensitivity to abstract perception and reasoning. A *non-empirical* definition of "abstract," beyond simply "the whole being greater than the sum of its parts," is a "thought…apart from any particular…material object[s]." *Webster's New World Dictionary of American English* (1988) at p. 5. Nevertheless, "thought" is still only energy in the form of organized information. Beyond rather ephemeral lay definitions, the empirical foundations of what constitutes "sentience," "conscious," and "abstract" are being pursued in a secular fashion by neuroscientists, psychoneurophysiologists, and the like. David Engleman, a neuroscientist at the Baylor College of Medicine in Texas, asserts that "consciousness" is only a tiny fraction of the brain's function. For Engleman, individual perceptions, thoughts and beliefs are the final results or consequences of the seemingly endless interactions of billions of brain cells, interstitial fluids and hormones, whole body sensory systems, and the like. Actions taken by individuals are totally dependent upon the functionality of these assets working together. But resultant decisions are undertaken without awareness of these interrelated cerebral and whole-body organism activities. There is a significant gap between physiological awareness and actions taken on the basis of resultant specific or flexible knowledge. Consciously induced knowledge makes consequent actions almost endlessly adaptable…without tapping into the billions of neurophysiological underpinnings. This allows for *Homo sapiens sapiens* to have a flexibility capability to react to any existing or rationally perceived environment with which they are confronted…individually and collectively. Query: Can this

survival of the species and its biotechnological descendants, not on the ephemeral and trasitory social, cultural, or religious concepts.

Admittedly, this concept in itself presents a significant challenge to a great many individuals, but this is what science teaches us.

Humans are now, as in the past, using and fine-tuning their technological capacity to adapt to changes in Earth's natural phenomena. These changes include the planet's shifting orbital characteristics in relation to the Sun, as well as its other solar system and galactic physical relationships. Those technologies and their evolutionary fine-tuning consistent with Moore's Law[18] enable identification both of hostile and also survival-conducive environments, leading to the capacity for migration and adaptation to new environments, both on Earth and off.

Homo sapiens sapiens is faced with a pressing and relatively imminent migratory quest for survival. This time the direction is off-Earth. Although periodic natural disasters, now including those made by humankind as a result of its evolving technologies, may inhibit humankind population growth on Earth, such phenomena may also force relatively smaller humankind populations to focus on new technologies that enhance human and humankind survival capabilities required for space migration.

Also necessary for the success of this migration will be the formulation of the relevant space-related jurisprudence and its implementing laws, including domestic, international, global, and

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form of conscious awareness be reproduced artificially…whether through biotechnological integration or simply technologically? *See*, generally, by D. Eagleman, *Incognito* (Pantheon Books – 2011). Also, note should be made of the growing empirical data regarding sentient and cognitive awareness in taxonomically designated lower orders of animals, such as cetaceans, i.e., water adapted mammals such as whales, dolphins, and porpoises. In the context of ongoing research into the potential of dolphins, possessing, for example, a complex and sophisticated intelligence comparable to that of humans, and which allows an equally as complex interspecies communications with humans, *see*, for example, the work of John Fraser, D. Reiss, P. Boyle, K. Lemke, J. Sickler, E. Elliott, B. Newman, and S. Gruber, "Dolphins in Popular Literature and Media," *Society & Animals* 14:4 (2006).

18 Moore's Law refers to the observation made in 1965 by Gordon Moore, co-founder of Intel, that the number of transistors per square inch on integrated circuits had doubled every year since the integrated circuit was invented. Moore predicted that this trend would continue for the foreseeable future. In subsequent years, the pace slowed down a bit, but data density has doubled approximately every 18 months, and this is the current definition of Moore's Law, which Moore himself has accepted. Most experts, including Moore, expect Moore's Law to hold for at least another two decades. *See* online at http://www.webopedia.com/TERM/M/Moores_Law.html.

ultimately transglobal legal regimes. As noted in the introduction, the humankind species is now shaping its ongoing survival requirements by changing the humankind life-support capabilities of Earth to the point where off-Earth migration may not be optional, but rather necessary for the continued evolution of the species, and the continuation of its odyssey to survive and inch toward understanding and defining its own "essence." This is the odyssey of all life, beginning with single cell life forms, the "shoulders" upon which Homo sapiens sapiens and its evolving transhumans and post humans stand.

Survival has always been the objective of problem-solving hominids (and, indeed, that of all life forms regardless of their problem solving capabilities). Environmental changes frequently create the need for adaptations in life-style surroundings. Frequently, as noted above, adaptation is accomplished through migratory practices, moving to a more favorable environment or ecotone. In addition, perhaps a change in diet and/or new expressions of existing genetic codings and sequencing, as well as relevant corrective health technology may be available at the critical time.

For humankind, in addition to adaptations by anatomical and other biosystem characteristics, survival migration is, and has been in the past, enhanced by its sentient characteristics, its problem-solving capability, and its technology. In many ways, evolution of specific cultural characteristics can be said to result from weather and climate changes that forced migrations, or conversely that enabled long-duration settlement that led to agricultural practices based on seasonal predictability. On Earth, humankind currently lives in an interglacial climate that, leaving aside negative human induced alterations, has contributed significantly to the human population explosion and on-Earth migrations, and that may also eventually force humankind migration off-Earth

V. The Role of Technology in Hominid Migration and Evolution, and in its Secular Search for the Species' Individual and Shared "Essences"

In the greater context of the universe and possible parallel and succeeding universes, Carl Sagan put the question concerning the significance of humankind's odyssey quite simply. "Who are we? We find that we live on an insignificant planet of a humdrum star lost in a galaxy tucked away in some forgotten corner of a universe in which there are far more galaxies

than people."

Many believe our species has stopped evolving, and that there is no need for biologically or biotechnologically evolved changes. In this view, the conditions forcing genetic and epigenetic changes necessary for evolution, adjustment, and survival no longer prevail, and that what constitutes the "essence" of being human, or "human nature," has reached its ultimate pinnacle or end point as necessary for continuation of its existence ad infinitum.

Natural Law suggests that this is an incorrect formulation. Perhaps humans may not evolve, or need to evolve, within the extant ecosystem, but all environmental characteristics will change, and sooner or later create fatal conditions for human survival, whether on Earth or off. Put simply, modern humans have not yet reached an evolutionary end point.[19]

Humankind is indeed experiencing a rude awakening regarding the impermanence of atmospheric and geologic conditions. We are experiencing increasing reliance on humankind technology to help us adapt to conditions on Earth, and Natural Law indicates that to survive and perpetuate itself ad infinitum will require that we venture off planet Earth.

At the same time, humans are currently disrupting traditional understandings of the essence of humanity itself, of what it means to be human, both physically and in terms of sentient or abstract perception properties. These inroads are direct results of biotechnological integration

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[19] A fundamental precept of those advocating long term and permanent off-Earth human*kind* exploration, migration, and settlement is that it must be in the form of a new species with unique cognitive, and/or sentient abstract perception characteristics. Nothing is forever, of course. Not even *Homo sapiens sapiens*. The species must evolve to survive off-Earth in a completely synthetic and alien life support environment, amidst extraordinarily destructive effects of gravity free environments, solar and deep space radiation, psychology of long-term confinement, logistics required for organic life forms, and the like. This likely will result in a requisite biotechnological and artificial intelligence re-engineering of these space envoys of humankind that will result in a significantly altered "essence" of being a human. It also may require a totally new and different energy form, such as telepresence or some other form of teleportation, which in turn will raise the issue of the "legal" relationships between and among the designer/manufacturer and programmer/operator. As noted in the ensuing discussions relating to cyberlaw and its evolution, the conflicting interfaces may not be between entities of differing cultures dictated by their specific ecosystems, but rather between and among totally different forms of independent, unique entities with abstract perception and societally interactive requirements for survival.

of humans in cyber persona in cyberspace.[20] This leads us to posit an expansion of Natural Law to encompass not only a physical journey beyond the Earth, but also a cyber, informational, and perhaps even meta-physical one as well. So our evolutionary path is perhaps branching in multiple directions, into the physical including the biological and biotechnological, and into the physical and non-physical as well. Fascinatingly, all of this is occurring at the same time, i.e., now.

Some explorers are developing the empirical underpinnings describing what it means to transition into a separate and distinct post-human species. At the same time, the phenomena of telepresence and teleportation[21] are assisting in identifying precisely what constitutes the distinct individuality of each human, and in understanding that the individual is but one component in a larger and more complex organism with a greater sense of awareness and sentient capabilities. Therein rests a significant confrontation with the evolving tenets of humanism[22] and of religions, and the seeds of one an important future social/cultural challenge.

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20 "Cybernetics" is a term coined by American mathematician Norbert Weiner in 1948. While the word has many definition variations depending upon context, it usually refers to the general analysis of control systems and communication systems in living organisms and machines. Analogies in cybernetics are drawn between the functioning of the brain and nervous systems and the computer and other electronic systems. The science overlaps the fields of neurophysiology, information theory, computing machinery, and automation. *See* definitions online at http://encyclopedia2.thefreedictionary.com/Cybernetics. While "cyberperson" has many definitions in the context of cybernetics, it might be defined generally as someone who "continually searches for theories, models, paradigms, metaphors, images, [and] icons that help chart and define the realities that we inhabit" [http://amiquote.tumblr.com/post/2658717182/timothy-leary-on-cybernetics-and-a-new-global]. The word "cyber" means *pilot*, and "cyberspace" also seems to have many definitions, depending upon context and user intent. However, the coining of the word "cyberspace" is credited to William Gibson, who used it in his science fiction book, *Neuromancer*, written in 1984. Gibson defines cyberspace as "a consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts... A graphical representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the non-space of the mind, clusters and constellations of data" (New York: Berkley Publishing Group, 1989), p. 128.

21 For definitions and descriptions of "telepresence" and "teleportation," *see* fnts. 38 and 39, *infra*.

22 "Humanism" has many definitions, again, in differing contexts. For the present discussion, "humanism" may be said to be a characteristic typical of *Homo sapiens;* a reflection or component of human "nature," however that term may be defined empirically.

VI. "Technology" and its Role in Ongoing Humankind Evolution

The history of modern human evolution is a history of ever receding horizons. We stand on the shoulders of our single cell predecessors. Our evolutionary successors may never look back to our own shoulders.

As noted in section II, above, Webster defines "technology" as "an applied science, or a scientific method of achieving a practical purpose."[23]

Technology itself is a dual driver in the evolutionary process. It is, first of all, our improving understanding of technology that has enabled humanity to develop the tools to understand Natural Law itself. We may cite as examples gene sequencing mentioned above, or the tools of physics such as particle accelerators that reveal the previously hidden nature of fundamental physical particles, or the means and methods of computing technology, which result in the computational tools that are essential to both gene sequencing and particle physics. Technology is also likewise the application of technology that is precisely developing and defining what a trans-human or post-human organism may be, such as neuro-and bio-integrated prosthetics, not to mention cyber-worlds, and of course robots.

VII. Space Law Versus Cyberlaw and Post Human Law

Will astronaut/cosmonaut "Envoys of Humanity" continue to be subject to prevailing tenets of Earth-defined space law, or will they transition into a new subspecies of Homo sapiens, or perhaps into a truly independent species? In the context of this question, it is necessary to assess the present state of evolving space-related robotics. Although "Robonauts" designed and programmed in large part to conduct mechanically-oriented tasks in space[24] can do so relatively endlessly, the real problem may rest in the step-by-step ongoing fine-tuning of what characterizes "human essence," and then incorporating it into such robonauts.

Given exponentially increasing sophistication of self-replicating and

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23 *Webster's Ninth New Collegiate Dictionary* (1991), at p. 1211. *See*, also, *op cit., supra,* note 9.

24 At this point in space exploration and migration, robonauts have been designed primarily to work with and assist humans working and/or living in space. The succeeding generations of robonauts may well approach ever more closely to independent thinking plus a rather unique "essence" peculiar only to them.

even more sophisticated artificial intelligence in the form of post humans migrating to, and settling permanently in, space, it is essential to determine when and under what circumstances such entities are no longer humankind's "envoys" in space, as reflected in the spirit and intent, as well as wording, of the Outer Space Treaty of 1967.[25]

Reference to "envoys" in the Outer Space Treaty is in the context of representing the interests of all humans while those envoys, those messengers or agents "of all mankind," are in space, i.e., the "common heritage of all mankind" as specifically referenced in the treaty. The concept of space and its components being the "common heritage of all mankind" was introduced into this treaty primarily to assert among the signatories that individual sovereign nations and individual persons or public/private organizations would not be allowed to claim ownership rights over any areas and components of off-Earth space. With the planting of the American flag on the lunar surface by Neil Armstrong during the Apollo 11 mission, significant effort was made to assure the international community that the act did not represent the traditional planting of the flag on Earth as a symbolic gesture asserting sovereign control or ownership of that portion of Earth's land mass. The flag was planted as symbolic achievement of a lunar landing on "behalf of all mankind."

It will also be necessary to determine when the traditional dictates of space law are no longer responsive or applicable to post-humans functioning off-Earth and/or in cyberspace. Put differently, what are the determining factors regarding when such entities become subject to the law as it pertains to humankind and transhumans, and when they are solely subject to their own jurisprudential regimes of "cyberlaw" or "post-human law"?

Individuals engaged in telepresence[26] and teleportation[27] will

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25 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 commonly referred to as the Outer Space Treaty of 1967.

26 "Telepresence" also lends itself to varying descriptions of the same concept. For present purposes, it can be defined as "the projection of a user's sensory, cognitive, and motor capabilities to a distant environment. Alternatively, the distant environment can be created *virtually* at the location of the user or operator. In the former case, a user's sensory channels can be linked to remote sensors. For example, a user's vision can be linked to remote cameras, providing an exocentric or egocentric frame of reference. The user's actions in the proximal locality drive the movements of the remote actuators. In the latter case, the task environment surrounding the operator in which local actions are transformed into distant actions." G. Robinson and R. Lauria, "Legal Rights and Accountability of

continue to exist as "alter-egos" of humankind for the reasonably foreseeable future simply because they are and will continue to be programmed and controlled by humankind, transhumans, and possibly even post humans. At some point, however, telepresent and teleported entities would likely transition into the category of post-humans, no longer a taxonomic component of the human or transhuman species/subspecies. At that point such individuals would transition technologically into independent functioning and perhaps to self-replicating entities who will be subject to their own versions of Natural Law and resulting legal "philosophies" and implementing positive laws.

At a minimum, the present characteristics of cyberlaw[28] may provide hints of what and when distinctively unique post human space jurisprudence may come into existence, and how it will interface with traditional Natural Law Theory and the resulting variety of jurisprudential concepts formulated and practiced by what is quaintly referred to as "modern man," i.e., by Homo sapiens sapiens.

Another issue to consider is the applicability of space law dealing with the issue of "who owns space." Beyond the traditional tomes that have been written and published premised on the four primary treaties, this field is a bit unsettled to say the least. Technological advances have led to serious consideration of the use of space resources by both governments and entrepreneurs, but who in fact will have the right to assert ownership or

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Cyberpresence: A Void in Space Law/Astrolaw Jurisprudence," in Annals of Air and Space Law, Vol. XXVIII 311 at p. 313 (2003). *See*, also, M. McGreevy, "The Presence of Field Geologists in Mars-like Terrain (1992) 1 *Presence*: Teleoperators and Virtual Environments 375 at 377; and by T.B. Sheridan, "Musings on Telepresence and Virtual Present," 3 *Presence*: Teleoperators and Virtual Environments, 120 at p. 120.

27 Less relevant to the instant discussion at present is the concept of "teleportation," which can be defined as the hypothetical method of transportation in which matter or information (energy as "organized information") moves a solid object or person by psychokenesis (by kinetic information of the mind). It is a hypothetical method of transportation in which matter or information is dematerialized, usually instantaneously, and then re-materialized in a different physical location. *See*, therefore, "teleportation" in Webster's Ninth New Collegiate Dictionary, p. 1212 (1991).

28 "Cyberlaw" refers to the exponentially developing area both of civil and criminal law applying to computers and their uses and activities conducted over the internet and other similar networks. The principal areas of cyberlaw practice relate to the protection of intellectual property rights, and also to freedom of speech and public access to information transmitted by electronic communication. http://www.yourdictionary.com/cyberlaw and http://www.businessdictionary.com/definitions/cyberlaw.html

control over such space resources?

As a matter of evolving law, in other words, who or what will be permitted to own portions of off-Earth space and/or its components? While the Outer Space Treaty emphasizes the "common heritage" principle, growing efforts by the international community to amend the treaty in certain respects to make it more reflective of current geopolitical realities and technological advancements in space include reconsidering the likely necessity of sovereign and private ownership of certain space resources.

The underlying agreements establishing the International Space Station governance and operating rights, both public and classified, serve as the ownership resolution positions of the participants. But what will be the relevance of these operating documents when cyberpersona and/or post humans function permanently and independently in such an outer space environment? Indeed, the law as it is presently constructed does not reflect the realities of nor the implications of advancing technology, and is therefore becoming irrelevant. For example, we can readily foresee issues arising in the context of nation states versus transhumans and post humans who intend to, or actually do, permanently occupy portions of interstitial space or various of its celestial bodies.

VIII. Conclusion

As discussed, there are many basic questions to pose and address when assessing the issues of Natural Law and jurisprudence as they pertain to cyberspace and cyberpersona, as well as to transhumans, post humans, sentient robots, and every entity that carries or embodies the human "essence." Furthermore, legal regimes will have to be devised to address every "one" in all of these categories who intends to or actually does permanently reside either physically off-Earth, or in cybernetic, virtual, non-physical, informational environments.

In parallel with these issues, we are increasingly aware of potential natural disasters that threaten the existence of modern humans, such as the possibility of catastrophic eruption of Yellowstone National Park, asteroids and threatening Near Earth Objects of which we are made aware by advanced telescopic and other technological sensing capabilities, and, of course, modern humans' own species-threatening technologies, such as nuclear warfare, biological warfare, the inability to identify and control disease bearing biological mutants, uncontrolled human population growth dynamics, not to mention catastrophic climate change, and the like.

A threat of a different sort is the possibility that Homo sapiens sapiens will be overtaken by its own technology, in the form of an artificial intelligence with independent decision-making capabilities. Humans now give up much of their life and death decision making options to both crude technology and highly advanced artificial intelligence. Law enforcement and military operations are excellent examples of this form of cyber-enhanced decision making. Technology is gradually usurping human reasoning capacity, accelerated by the willingness of humans to accept "whatever the computer says." The transition step leading to a new jurisprudence that addresses post human cognitive sentience may well be seen in the current legal questions and issues relating to the somewhat esoteric nature and functioning of humankind and cyberpersona, as reflected in the conflicting concepts of cyberorder versus cyberanarchy in cyberspace.

But how will that jurisprudence and the implementing laws emerge? Indeed, the shift from one legal regime to another can be fraught with difficulty and conflict, as we see today in the ongoing legal tug of war concerning issues such as gay marriage, and indeed civil and voting rights issues remain in dispute nearly one-half century after a set of basic legal principles was supposedly adopted in the US.

Given the nature of change, and the resistance that it often provokes, we can anticipate a prolonged dispute between those advocating new legal systems that deal with the manifold issues of cyber-sentience, post-humanity, off-Earth resource and territorial rights, and those who prefer to remain with the legal structures that they are already accustomed to, and a whole host of related and derivative issues that we can well anticipate lie ahead of us in the coming centuries as the space movement leads to extensive human presence throughout and perhaps beyond the Solar System.

The general theme of this book is international cooperation for the development of space, so what can our topic in this chapter tell us about that? Regardless of the specific issue or topic, one thing this discussion makes quite clear is that the development of extensive and permanent space habitats will lead to the formation of new nations or quasi nations, and thus an increasingly complex realm in which Natural Law will be evidently evolving, and in which the derivative jurisprudence must therefore evolve as well.

As the foregoing discussion hopefully has made clear, we can expect that some nations will lead in the development of these new capabilities, and in the design and implementation of the laws that reflect and support

new capabilities, new needs, and indeed new forms of life à la the emergence of post-humanity, largely as a result of the space endeavor. Other nations will necessarily lag. Will the leaders and the laggards cooperate? Or will this become a matter of disagreement and dispute? Yes, and yes.

But ultimately what is at stake is not just disputes among species and subspecies, or disputes between a home world and maturing and independence-minded colonies. The underlying and enduring issue is human evolution and the survival of the human essence, whether that is in a form that we would recognize today as human, or in some other cyber, post human, or transhuman form of existence, one suited to micro-gravity or extra-gravity, one inhabiting orbiting or transiting craft. And five hundred or a thousand years from now, 100 generations in the future, will your descendants be sitting by the side of a lake, on Earth, at night, gazing up at the stars and planets, and wondering just how their great, great grandchildren are doing, voyaging way out there in the vast beyond, extending the reach of human evolution far beyond the reaches of our forgotten corner. What are they learning about the human essence as a result of that journey?

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Dr. George S. Robinson

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