

# BIOLOGY AND SOCIETY: EXPOSING THE VITAL LINKAGES—THE RELATIONSHIP BETWEEN THE STUDY OF LIFE AND HUMANITY'S CHANCE FOR A FUTURE

Larry David Wilson<sup>1</sup> and David Lazcano<sup>2</sup>



**Figure 1.** View of the “Blue Marble,” our Earth, taken from space in 2000. Our single satellite, the Moon, is visible in the upper left-hand corner of the image. The portion of the land surface shown is the Western Hemisphere. All four of the great spheres of the planet are evident. The thin, gaseous layer, the atmosphere is evident from the clouds shown, including those associated with a cyclonic storm off the western coast of Mexico. The deep blue surface giving our planet its nickname, evidenced by the Atlantic and Pacific Oceans, is part of the hydrosphere, the Earth's waters. The land surface or lithosphere of the planet is evidenced by the two continents on the pictured side, North and South America. The greatest evidence of the biosphere, the living portion of Earth is visible as the green regions on the continents, especially the Amazonian River Basin in northern South America and the Central Plains of eastern North America. These four spheres are what in interaction allow for humanity to subsist on planet Earth.

<sup>1</sup>Centro Zamorano de Biodiversidad, Escuela Agrícola Panamericana Zamorano, Departamento de Francisco Morazán, Honduras; 16010 SW 207th Avenue, Miami, Florida 33187-1056, USA. E-mail: bufodoc@aol.com

<sup>2</sup>Universidad Autónoma de Nuevo León, Facultad de Ciencias Biológicas, Laboratorio de Herpetología, Apartado Postal 513, San Nicolás de los Garza, Nuevo León, C.P. 66450 Mexico. E-mail: imantodes52@hotmail.com

## DEDICATION

The authors wish to dedicate this essay to the granddaughter of one of them, the lovely Lia Alejandra Lazcano-Ruiz, who was born on 14 September 2018. Sadly, by the time that this new occupant of Earth is 21 years old, she will be part of a human population of approximately 9,248,400,000, or about 1.6 billion more than are here as of this writing. We have written this essay in the hope that it will help our species to find ways out of the cycle of denial we describe and to design a way of life based on the prescriptions of the biological contract that governs the way all organisms have to live on our planet. In our view this is the only means for us to be able to design workable and lasting solutions to the problems we have created in our assault on the life-support systems that allow for all creatures to live on this planet. We have entertained the ideas we explore in this essay for most of the time that we have been professional biologists. Unfortunately, most humans seems to be embroiled in a plan, whether they know it or not, to render Earth unfit for life to occupy. Ultimately, we have to ask, for the sake of Lia and the remainder of her fellow humans who will be here after we two have departed, where are the leaders who will emerge to protect Earth?

## DEDICACIÓN

Los autores dedican este ensayo a la nieta de uno de ellos, la hermosa Lía Alejandra Lazcano-Ruiz, que nació el 14 de septiembre de 2018. Tristemente, cuando ella cumpla 21 años de edad, será parte de una población de 9,248,400,000 habitantes, o aproximadamente 1.6 billones más de los que están aquí al momento de escribir este ensayo. Hemos escrito este artículo con la esperanza de que ayude a nuestra especie a encontrar formas fuera del ciclo de negación que describimos y diseñamos, una forma de vida basada en las reglas del “contrato biológico” que rige a todos los organismos que viven en nuestro planeta. Desde nuestro punto de vista, este es el único medio que tenemos para poder generar soluciones verdaderas a los problemas que hemos creado en nuestro asalto a los sistemas que mantienen la vida en nuestro planeta. Las ideas que exploramos en este ensayo las hemos mantenido desde nuestra formación como biólogos. Desafortunadamente, la mayoría de los humanos parecen estar involucrados en un plan, sin importar si lo sepan o no, dejar a la tierra sin condiciones para que la vida prospere. Finalmente, nos tenemos que preguntar, por el futuro de Lía y el resto de los humanos que estarán con ella después de que nosotros hayamos partido, ¿dónde están los líderes que saldrán a proteger la tierra?



**Key Words: Biological contract, prevailing worldviews and ethical systems, anthropocentrism, ethnocentrism, egocentrism, mass addiction-denial cycle, fear of the inevitable, teaching and learning, species-wide psychotherapy, sustainable human society, extinction by design**

## SUMMARY

In this essay we examine the relationship between the science of biology and human society, especially as related to the chances for a future for the human species. We maintain that biology always has been the most important area of human study for it is this science that outlines the rules for the continued existence of life on Earth. We call this set of basic rules "the biological contract." The prevailing worldviews adopted by humans over their tenure on Earth, however, have involved misreading all of the biological contractual obligations, giving rise to global perspectives that are maladaptive, including the ethical frameworks intended to determine right and wrong behavior. The principal flaw of these prevailing worldviews and associated ethical systems is that they are afflicted with varying degrees of centristic orientation (e.g., anthropocentrism, ethnocentrism, and egocentrism). Forming views of how the world works based on misconceptions arising from such centristic orientation allows most humans to embroil themselves in a mass denial trap. Such an approach is dangerous in that it allows humans to remove themselves from the reality imposed upon them by the obligations of "the biological contract." Twenty-six years ago, a significant study appeared in 1992's *State of the World* volume entitled "Denial in the Decade of Decision." The author maintained that crafting sustainable solutions to global environmental problems will have to involve the stripping away of the mass denial that entraps humans across the planet. The author envisioned that such developments would need to be initiated in "the decade of decision," i.e., the decade of the 1990s, prior to the advent of the present millennium. Since such changes did not occur, the human species has significantly less time in which to take action. Our species, thus, remains locked in a mass addiction-denial cycle, allowing it to continue disassembling the planetary life-support systems because of its addiction to misuse and abuse of resources and its denial that continuing overpopulation is the basic fuel of such misuse and abuse. If humans are entrapped within a species-wide addiction-denial cycle, then it might be helpful to examine this global psychological problem by use of the disease model of substance abuse. Application of this disease model indicates that humans have

become addicted to resource overconsumption accompanied by denial that such overconsumption has given rise to global problems that threaten the continued existence of life on planet Earth. We submit that rerouting our destructive pathway will have to involve exposing the origin of the collective psychic trauma that has given rise to our addiction to overpopulation and overconsumption. In this attempt, we have constructed a multi-step hypothesis proposing the evolution of a series of events that have led from the appearance of rationality accompanied by self-awareness and awareness of space-time positioning establishing a fear of the inevitable giving rise to a cycle of addiction and denial promulgating violence of all types and at all levels leading to the development of destructive worldviews that reinforce the violence. Given the pervasive nature of such destructive worldviews, the violent behaviors they facilitate, and the social and environmental problems they have promulgated, a pivotal question facing our species is whether worldviews can be shaped that are constructive as opposed to destructive. In our opinion, if such a transformation is possible, it will have to involve neutralization of the fear of the inevitable that appears to arise from our rationality and the awareness it gives us of the limited nature of our existence as individuals. Such a transformation from destructive to constructive worldviews will have to be based on a clear understanding of the manner in which human culture has evolved from generalized behavior. Culture is dependent on the passage of information from one member of a species to another through the agency of teaching and learning. Teaching and learning is the aspect of human culture that will have to be marshalled to accomplish the neutralization of the fear of the inevitable necessary to intervene in the vicious cycle of addiction to violence and its denial and bring about a transition to a worldview that will support the creation of a sustainable human society. Formal teaching and learning occur within educational systems. The present educational system, however, acts as a hindrance to the change necessitated, because it is based on operant conditioning, which produces graduates of the system who are wedded to the status quo, i.e., the system that has given rise to the addiction-denial cycle of violence. As a consequence, the formal educational system will have to be restructured in a top-to-bottom fashion by recognizing that rational capability will need to rest

on the creation of evidence-based belief systems that emphasize operating within the world as it really is and not as we might like it to be. Furthermore, we will have to eschew short-term thinking that makes us think that it is possible to gain immediate benefits without having to face long-term consequences. In addition, we will have to learn that rights do not accrue to individuals without attendance to the associated responsibilities. Given such powerful impediments, it might be most efficacious to think of the role of education in effecting the transition from unsustainable to sustainable society as one of providing therapy for the various psychological ailments with which most humans appear to be beset. Envisioning educational reform to achieve sustainability as species-wide psychotherapy involves the realization of three principal goals as follows: (1) to alleviate the conditions that have led to the unsustainable society; (2) to modify the destructive behavior caused by embroilment in an addiction-denial cycle; and (3) to increase the understanding of the provisions of the "biological contract" to lead ultimately to the capacity to adapt to the requirements for living sustainably on the planet. We have written this essay in an attempt to identify why humans have embraced destructive worldviews in adapting to life on Earth and why the traditional educational approach has had so little effect on responding successfully to the global environmental problems issuing from these worldviews. In our view, we will have to confront the serious flaws in the human psychic and societal makeup in order to learn how to overcome these flaws in order to have any chance to create workable and lasting solutions to the set of problems that threaten the human species with extinction by design.

## RESUMEN

En este ensayo examinamos la relación entre la ciencia de la biología y la sociedad humana, especialmente con relación a las posibilidades de un futuro para nuestra especie. Consideramos que la biología siempre ha sido el área más importante de estudios sobre los humanos, porque esta es la ciencia que marca las reglas de existencia continua de la vida en la tierra. Nombramos a este conjunto de reglas básicas "el contrato biológico." Las ideas vigentes adoptadas por los seres humanos sobre su permanencia en la tierra, sin embargo, han implicado una interpretación errónea de todas las obligaciones contractuales biológicas, dando lugar a perspectivas globales mal adaptadas, incluyendo los marcos éticos destinados a identificar las conductas buenas y malas. El principal defecto de estas percepciones del mundo dominantes y sus sistemas éticos asociados es que están afectados por diferentes grados de una orientación centrista (por ejemplo, el antropocentrismo, el etnocentrismo y el egocentrismo). La formación de los puntos de vista sobre cómo funciona el planeta basada en ideas erróneas derivadas de una orientación centrista permiten que la mayoría de los humanos caigan en una trampa de negación masiva. Dicho enfoque es peligroso, pues permite que los seres humanos se excluyan ellos mismos de la realidad impuesta por las obligaciones de "el contrato biológico." Hace veintiséis años, un estudio importante apareció en el volumen de El Estado del Mundo de 1992, titulado "La Negación en la Década de la Decisión". El autor mantiene que para crear soluciones sostenibles a los problemas ambientales globales se tendrá que incluir la desintegración de la negación masiva que afecta a los seres humanos en todo el planeta. El autor pronostica que tales desarrollos tuvieron que iniciarse en la "década de la decisión", es decir, en los 90s, previo a la llegada del presente milenio. Puesto que tales cambios no ocurrieron, la especie humana tiene significativamente menos tiempo para actuar. Nuestra especie, por lo tanto, permanece atrapada en un ciclo masivo de adicción y negación de esta, permitiendo la desintegración continua de los sistemas que mantienen la vida debido a la adicción al mal uso y abuso de los recursos y a la negación de que el continuo crecimiento de la población es el combustible básico del mal uso y abuso. Si los seres humanos están atrapados dentro de un ciclo de adicción y negación a

nivel especie, entonces podría ser útil examinar este problema psicológico global utilizando el modelo de enfermedad de la drogadicción. La aplicación de este modelo de enfermedad indica que los seres humanos se han convertido en adictos al consumo excesivo de recursos, acompañado de la negación de que tal sobreconsumo ha generado problemas globales que amenazan la existencia de la vida en el planeta tierra. Consideramos que para reorientar nuestra ruta destructiva se tendrá que revelar el origen del trauma psíquico colectivo que ha dado lugar a nuestra adicción a la sobrepoblación y el sobreconsumo. En este artículo, hemos construido una hipótesis de varios componentes que propone la evolución de una serie de acontecimientos que ha llevado desde la aparición de la racionalidad acompañada de autoconciencia y el conocimiento de la ubicación del espacio-tiempo, estableciendo un temor de lo inevitable dando lugar a un ciclo de adicción y negación generando violencia de todo tipo y en todos niveles llevando al desarrollo de las percepciones destructivas globales que refuerzan la violencia. Dada la inescapable naturaleza de tales cosmovisiones, las conductas violentas que facilitan, y los problemas sociales y ambientales que han propagado, una pregunta fundamental que enfrenta nuestra especie es si las percepciones globales pueden ser modificadas de tal manera que sean constructivas y destructivas. En nuestra opinión, si semejante transformación es posible, entonces tendrá que incluir la neutralización del miedo a lo inevitable que parece surgir de nuestra racionalidad, y la conciencia que esta última nos da sobre la limitada naturaleza de nuestra existencia como individuos. Tal transformación hacia visones constructivas tendrá que basarse en una comprensión clara de la manera en que la cultura humana ha evolucionado desde una conducta generalizada. La cultura depende de la transmisión de información de un miembro de una especie a otro a través de la enseñanza y el aprendizaje. La enseñanza y aprendizaje son los aspectos de la cultura humana que deben ser organizados para lograr la neutralización del miedo de lo inevitable, necesario para intervenir en el círculo vicioso de la adicción a la violencia y su negación y llevar a cabo una transición de la cosmovisión que apoyará la creación de una sociedad humana sostenible. La enseñanza y aprendizaje formal ocurren dentro de los sistemas educativos. El actual sistema educativo, sin embargo, actúa como un obstáculo

para el cambio necesario, porque este se basa en el condicionamiento operante, que produce egresados o graduados del sistema moldeados al status quo, es decir, el sistema que ha dado lugar al ciclo de violencia de adicción y de negación. En consecuencia, el sistema educativo formal deberá ser reestructurado de arriba hacia abajo reconociendo que la capacidad racional tendrá que descansar sobre la creación de sistemas de creencias basadas en evidencias que hacen hincapié en funcionamiento en el mundo como realmente es y no como nos gustaría que fuera. Adicionalmente, tendremos que evitar ideas de corto plazo que nos hacen creer que es posible obtener beneficios inmediatos sin tener que enfrentarse a consecuencias a largo plazo. También tenemos que aprender que los derechos no se acumulan para las personas sin atención a las responsabilidades asociadas. Ante esos poderosos obstáculos, podría ser más eficaz pensar en el papel de la educación en efectuar la transición de una sociedad insostenible a una sostenible que incluya una terapia para los diversos padecimientos psicológicos con los que la mayoría de los seres humanos son acosados. La percepción de una reforma educativa que logre la sostenibilidad con una psicoterapia a nivel especie implica la realización de tres metas principales como los siguientes: (1) aliviar las condiciones que han llevado a una sociedad insostenible; (2) modificar el comportamiento destructivo causado por el enredo en un ciclo de adicción y negación; y (3) para aumentar la comprensión de las disposiciones del "contrato biológico" que conduzcan a la capacidad para adaptarse a las exigencias de vivir de forma sostenible en el planeta. Hemos escrito este documento en un intento de identificar por qué los seres humanos han adoptado enfoques destructivos en la adaptación a la vida en la tierra y por qué el enfoque educativo tradicional ha tenido muy poco efecto para responder con éxito a los problemas ambientales globales derivados de estas percepciones. En nuestra opinión, tendremos que hacer frente a los graves defectos en la apariencia social y psicosis humana para aprender a superar estas falacias, para poder tener la oportunidad de crear soluciones viables y duraderas al conjunto de problemas que amenazan la especie humana con extinción por diseño.

## INTRODUCTION

Biology, the science of life, has always been the most important discipline, scientific or otherwise, to the human species. Such is the case because it is to biology that we have to look for the set of basic rules for any organism's continued existence on Planet Earth, including that of our own species. The most fundamental and most intransigent problems that face humanity are those that arise from the ignorance of this set of basic rules. These problems are those that impact the capacity of our planet to support life now and into the future. As indicated by Johnson et al., (2017), "all life on planet Earth (i.e., the biosphere) exists at the intersections among the three abiotic spheres, i.e., the atmosphere, hydrosphere, and the lithosphere, and is dependent on their interplay for continued existence over time." Living creatures, however, are universally endangered by actions that humans have taken over the course of our relatively short time as a species on the planet that have compromised the ability of all three of the Earth's abiotic spheres to support the fourth sphere, i.e., the biosphere. Thus far, humanity has proved unable to harness its rationality to address these problems substantively.

If human society is to find workable and lasting solutions to these problems, it will have to root those solutions in this set of basic rules. It is the purpose of this essay, thus, to explore the vital linkages between the scientific discipline of biology and the process of devising rational solutions to humanity's most pressing problems arising within its society.

## THE SET OF BASIC RULES

It is a central thesis of this position paper that biology is the discipline that allows us to understand the set of rules all organisms must obey to continue to exist. Thus, human beings, the organism scientifically known as *Homo sapiens*, also are subject to these rules.

The most basic of the rules for existence is that humanity is the product of biological evolution, just as much as is any other creature (Wilson, 1994). As

such, the structure, function, and behavior of human beings are the result of the series of evolutionary events that occurred in the human lineage. As a consequence, what humanity has been, is, and will be is best understood ultimately within the framework of evolutionary biology. The fundamental nature of this truth is questioned by many, if not most, of the present-day human inhabitants of the Earth, which thus represents a major challenge to the design of effective solutions to humanity's threats to life's existence.

As with all animal societies, the integrity of human society depends on the interdependency of intraspecifically oriented neuronal- and hormonal-mediated skeletomuscular responses to environmental stimuli, both internal and external (Starr, 1994). In other words, human society is dependent on the maintenance of selectively advantageous social behavior patterns. This maintenance is contingent on communication and cooperation.

Human society relies on social behaviors involving communication signals that facilitate cooperative responses to stimuli. Communication signals are "actions or cues sent by one member of a species ... that can change the behavior of another member ... [or members]" (Starr, 1994). As rational creatures, communication among humans depends largely on language, the system of symbols they use both for thinking and communicating (Chaffee, 1994). Cooperation is an evolutionary strategy wherein survival and reproduction are facilitated by two or more members of a species acting in concert to obtain the material and energy resources necessary for life maintenance. Selfish genes (as envisioned by Dawkins, 2016) are still operating, yet in this case through reciprocal altruism. Cooperation relies on communication. It follows, then, that cooperation in human society depends on the efficacy of language communication. Contrariwise, breakdown of communication leads inevitably to breakdown of cooperation. The selfish gene reverts to selfishness as a survival strategy. We will return to these concepts.

Another basic rule is that all organisms interact with their environment. It is the environment that

supplies the resources necessary for the support of life. Communication and cooperation are the principal evolutionary strategies social organisms use to adapt to existing environmental conditions. They are also the most important strategies humans can use to attempt to adapt to present and future environmental conditions. Moreover, all organisms live within webs of organization in that they depend directly or indirectly on one another for energy and material resources. Interdependency among organisms is the rule, and there are no exceptions. In this context, it is of vital importance to remember that, as Wilson (1994) has pointed out, "The diversity of life is the cradle and natural heritage of the human species." It is the same for all other organisms. It is this aspect of humanity's heritage that must be preserved and conserved for it is irreplaceable and essential to our continued existence.

Energy and material resources are limited in amount and availability, which features are under the control of physical laws. This fact is recognized as an integral component of the modern theory of organic evolution according to natural selection (Mayr, 1982). This also makes it a basic concept of population ecology (Starr, 1994). In the face of limited resources, thus, no organism can possess a continually increasing population without risking an eventual overshooting of the carrying capacity for that organism. The ability of human beings to control some of the environmental limiting factors and, as a result, "enjoy" an exponentially growing population simply means that we passed one level of carrying capacity and are moving headlong toward another that will be enormously more effective in placing limits on growth. An exponential growth curve turned upside down is the picture of a precipice.

The biological concept of unity in diversity should teach us another lesson. As distinct as we are from all other creatures, we share with them some very fundamental features, most notably the properties of life, such as order, evolutionary adaptation, response to the environment, regulation, energy processing, growth and development, and reproduction (Campbell et al., 2008). We also share with them an absolute dependence on the planetary life-support systems. Finally, it is necessary to acknowledge that humans do have an inherent feeling for other creatures, what E.

O. Wilson (1984) has termed "biophilia." Wilson (1994) has noted that this affinity is "evoked, according to circumstance, by pleasure, or a sense of security, or awe, or even fascination blended with revulsion." Biologists are people who have turned biophilia into a preoccupation as well as an occupation. They are in the best position, as a consequence, to advise the remainder of humanity as to the probable outcomes of the conscious suppression of biophilia (Orr, 1994).

In summary, it is interesting that the set of basic rules humans must obey to continue to exist comprise concepts identified in the first chapter of any worthwhile elementary biology text. They are, for the most part, what Campbell et al. (2008) referred to as "the themes in the study of life." We are suggesting that it will be in the best interests of humanity to relearn this set of rules or, to put it another way, reread the provisions of our "biological contract."

## MISREADING THE "BIOLOGICAL CONTRACT"

We have suggested above that humanity's most fundamental and intransigent problems have arisen from a conscious disavowal of the set of basic rules to which all organisms must subscribe, the "biological contract" all organisms have with each other and with the abiotic environment. Humans, however, have constructed a society dominated by a striking set of misconceptions. It is upon these misconceptions that human worldviews have been constructed (Miller, 1993). It can also be argued that ethical frameworks have been built on the same misconceptions.

As noted by Miller (1993), one's "decisions and actions are built around [one's] worldview ... and [one's] ethics ..." A worldview involves "how individuals think the world works and what they think their role in the world should be" (Miller, 1993). Ethics, of course, are concerned with what we believe to be right or wrong behavior.

The prevailing worldviews, what Miller (1993) calls the "throwaway worldview" and the "spaceship-earth worldview," are based on the misconceptions we have indicated have arisen from the disavowal

of the provisions of the “biological contract.” The components of these worldviews can be compared to the biological contractual obligations, as is done below (Table 1).

Besides having built maladaptive worldviews, humans have also constructed ethical frameworks of similarly questionable survival value. The principal flaw of these systems of ethics is that they are afflicted with varying degrees of centristic orientation.

As noted above, ethical systems treat of right and wrong behavior. They also treat of good and bad. To the ethicist, right and wrong are not the same as good and bad. “Questions as to the nature of the right are a matter of ethical obligation; questions as to the nature of the good are a matter of ethical values. A basic division occurs between those who stress values and those who stress obligation” (Linton and Litchfield, 1979). Those who regard right as having a stand-alone quality argue that it is categorical; those who consider right to be so if it leads to ends that

are good argue that right is teleological (Linton and Litchfield, 1979).

The position we take in this paper is that what is good is defined in terms of what is right. In this sense, we adopt a categorical ethic. Similarly, questions of what constitute pleasure and happiness are resolved in light of what is right. We argue that what is right is that which enhances the survival of life on Earth. That which is wrong is that which compromises it. Along with the right to enjoy life comes the responsibility to not endanger the lives of others.

Most ethical systems make an axiological distinction between humans and other organisms. Greater value is placed on humans than on other creatures. Beyond this, many systems place greater value on one’s own group (based on religion, political ideology, or some other cultural [or genetic] feature) than other such groups. Finally, in practice individuals often place greater value on themselves than all other individuals. Thus, that which is right might mean that which is

**Table 1.** Comparison of the Throwaway and Spaceship-Earth Worldviews and the Biological Contractual Obligations

<b>Throwaway and Spaceship-Earth Worldviews (modified from Miller, 1993)</b>	<b>The Biological Contractual Obligations</b>
Humans are apart from nature.	Humans are products of biological evolution, components of ecosystems, and subject to chemical and physical laws.
Humans are superior to other species.	Humans are not the pinnacle of evolution, but rather one of the twigs on the tree of life.
Our role is to conquer and subdue wild nature and use it for our own purposes.	Our role is to use communication and cooperation to enhance our chances for survival and reproduction, but not at the expense of the integrity of the Earth’s life-support systems.
Resources are unlimited because of our ingenuity in making them available or in finding substitutes; there is always more.	Resources are limited. These limits shape the evolutionary process. Human ingenuity is primarily employed to steal resources from other organisms; humans operate as planetary thieves.
There is an “away” in which to throw things.	There is no “away.” The law of conservation of matter prescribes otherwise.
Science and technology can solve any problem that comes up.	Science is limited in what it can do by its methodology; technology is science wedded to destructive worldviews and, thus, is part of the problem.
The more we produce and consume, the better off we are. All economic growth is good, and more economic growth is better. There are no limits growth.	All economies rest firmly on a limited resource base. Economic growth thus depends on making continual withdrawals from limited earth capital. More growth makes bigger withdrawals.
The most important individual or nation is the one that can command and use the largest fraction of the world’s resources. Possession of more and more things is the source of happiness.	The nations that command and use the largest fraction of the world’s resources are the most dangerous nations in the world. Possession of more and more things is the source of real misery.
We know what we are doing.	Really?



good for my species, my cultural group, or, simply, me. Using such an approach, ethics can dissolve to value decisions that are not only teleological, but centristic, situational, and circumstantial. Such decisions become based on variously sized pieces of the “big picture.” Our ethical framework can be as badly misconceived as are our worldviews.

Basing worldviews and ethical systems on misconceptions is dangerous business. It can lead us to believe that it is possible for our species to continue to reproduce without limit because our ingenuity can find ways to support the burgeoning numbers for perpetuity, even in the face of incontrovertible evidence from everyday life to the contrary. It allows us to believe that every child that could be born should be born, without regard for the quality of life such a child will enjoy (in addition, it allows us to think that every life that can be prolonged should be prolonged, again regardless of quality of existence). It allows us to define as the measure of success how much one owns and not what one does with one’s life. It allows us to view biophobia as a virtue and biophilia as a laughable curiosity. It allows us to lie to ourselves with great and growing fervor.

## THE MASS DENIAL TRAP

Lying to oneself is a favorite human preoccupation. Lying to oneself is a dime store definition of psychological denial, more appropriately defined as “an unconscious defense mechanism marked by refusal to acknowledge painful realities, thoughts, or feelings” (American Heritage College Dictionary, third edition). In the sense of the definition, “unconscious” refers to “the division of the mind in psychoanalytic theory containing elements of psychic makeup that are not subject to conscious perception or control but that often affect conscious thoughts and behavior” (American Heritage College Dictionary, 2007). A defense mechanism is “an automatic, unconscious response to a threat, often triggered by conflict or anxiety” (Kass et al., 1992). When numbers of people engage in such refusal and mutual reinforcement of it, such is termed mass denial. Humans appear to be locked in species-wide mass denial. If psychoanalysis functions to expose the defense mechanisms that allow us to repress painful realities, thoughts, or

feelings so that psychic healing can occur, then psychoanalysts have their most significant challenge in dealing with humanity’s mass denial of the realities of the “biological contract.”

In truth, it is our opinion that psychoanalysts, operating alone, are ill-equipped for such a role, because they, like most other humans, operate from a basis of acceptance of the prevailing worldviews and ethical frameworks. The painful realities, thoughts, and feelings which psychoanalysts usually attempt to have their patients expose and resolve are either symptoms of more fundamental problems or are extraneous to such problems. As a consequence, it would appear that most psychoanalysts are poor psychobiologists.

It is not our intention to single out these health professionals for “bashing,” because they are as much a product of misconceived worldviews and ethics as are their patients. What we do wish to do is point out that species-wide mass denial is a psychological problem that defies the usual means employed for dealing with less widespread forms of denial. Furthermore, it is necessary to acknowledge that combatting such mass denial will need to be accomplished on an exceedingly short timeline. We have moved beyond the “decade of decision” denying that there are decisions of a magnitude greater than any ever faced by humanity that need to be made.

## DENIAL IN THE DECADE OF DECISION

The forecasters at the Worldwatch Institute have been taking the pulse of the world once each year since 1984 in their State of the World volumes. The lead article in the 1992 edition was entitled “Denial in the Decisive Decade.” This article, written by Sandra Postel pointed out that, “Psychology as much as science will ... determine the planet’s fate, because action depends on overcoming denial, among the most paralyzing of human responses. While it affects most of us to varying degrees, denial often runs particularly deep among those with heavy stakes in the status quo, including the political and business leaders with power to shape the global agenda ... By pursuing life-styles and economic goals that ravage the environment, we sacrifice long-term



health and well-being for immediate gratification -- a trade-off that cannot yield a happy ending." Postel (1992) maintained that this kind of denial is just as dangerous to society "as an alcoholic's denial is to his or her own health and family." Essentially, she is saying that humanity at large, and especially those people who work to amass great power, are locked into a massive addiction-denial cycle. The outcome of such incarceration is that we are disassembling the life-support systems of the planet because of an addiction to misuse and abuse of resources by the inhabitants of the developed world, and the rich and powerful wherever they live. We further deny that this addiction to an over consumptive lifestyle has any connection to poverty in the world or that poverty has anything to do with human overpopulation. Nonetheless, these connections are real. Postel (1992) indicates that the list of unmet human needs in developing countries is staggering, but that they are "dealing with these problems under greatly constrained conditions. Because of their staggering debt burdens, poor countries paid nearly as much to rich ones over the

last decade as they received in new funds ... Besides sapping them of capital, large debt payments force developing countries to plunder forests, fisheries, and other natural resources to increase export earnings ... Put simply, the global economy is rigged against both poverty alleviation and environmental protection ... Thus far, global environmental politics has been characterized more by foot-dragging and denial of problems than by cooperation. Few rich countries have acknowledged that they have caused the preponderance of environmental damage, and therefore have the responsibility to underwrite most of the transition to global sustainability".

Ultimately, those of us in the developed countries are going to have to acknowledge the role we have played in maintaining and exacerbating global environmental problems. To do so will require us to overcome the massive denial under which we operate before we can hope to move substantially to curb the addictions under which we suffer. As Sandra Postel (1992) , "Building a sustainable world

**Figure 2.** Tropical Wet Forest, based on an image taken on the road to Santa Cruz Tepetotutla, Municipio de San Pedro Usila, Oaxaca, Mexico, elevation 1,727 m, by Vicente Mata-Silva on 29 May 2018. This locality lies within the Sierra Madre de Oaxaca, which is documented as the most herpetofaunally rich physiographic region in the most herpetofaunally rich state in Mexico. We are using this image of this forest type to illustrate one of the most biodiverse habitats found on the land surface of the planet. All four ecospheres are evident in this photograph, including the trees representative of the biosphere, the waterfall and stream evidencing the hydrosphere, the rocky streamside shores indicating the lithosphere, and the sky at the top center showing a bit of the atmosphere.

will ask a lot of ourselves and our leaders. But it is within our power, if we choose to take on the challenge. Once denial is stripped away, what other option do we have?" As massive as the changes that have to take place will be, the policy decisions that will allow the building of workable and lasting solutions to humanity's most significant problems were supposed to be in place before the advent of the new millennium. Clearly, that did not happen. We now have significantly less time left to take these actions.

## INTERVENTION IN THE MASS ADDICTION-DENIAL CYCLE

If it is accurate to describe humanity as locked in a massive addiction-denial cycle, then it might be helpful to examine this problem by use of the disease model of substance abuse (Kass et al., 1992), because "stripping away denial" is much easier contemplated than accomplished. A major feature of the model is the recognition that substance abuse (as a form of addiction or dependence) is a disease, i.e., an abnormal and harmful condition that impairs normal physiological or psychological functioning. "The disease model emphasizes that people with dependency disorders are not 'bad,' they are sick. Therefore, they should not be scorned or punished for the use itself, but understood and helped ... Defining substance abuse as a disease helps promote recovery ..." and the realization that "they are not at fault for getting the disease but, as with any other illnesses, they are responsible for taking steps to get well from it" (Kass et al., 1992). A basic characteristic of substance abuse is that it provides relief from psychic pain and fear. A second feature is that this problem can lead to impaired functioning (Kass et al., 1992), as do almost all diseases. "The more trouble a substance causes a vulnerable individual, the more he or she tends to use it in order to escape from that trouble and to relieve the pain. Typically, substance abusers react to this vicious cycle with denial and rationalization" (Kass et al., 1992). Other features of the disease model include the experience of withdrawal symptoms and the possibility of relapse after recovery (Kass et al., 1992). It is the nature of such a disease cycle that it will continue until

something operates to intervene to break the cycle. As Kass et al., (1992) note, "Recovery from substance abuse is not usually done on one's own ...," but rather requires professional help depending on specific treatment approaches, as with most diseases.

Given the nature of this model, it can be asked whether humanity's ignorance of the "biological contract" results from being locked in a massive addiction-denial cycle, as Postel (1992) has suggested, and, if so, whether this involvement should be considered a disease in need of treatment. In support of this contention, we offer the following summary argument:

1. Human beings are the authors of the global environmental crisis. The intertwined problems of overpopulation, resource depletion, and pollution result from actions that humans have taken, especially over the last 500 years (Miller, 1993). These problems are impairing the normal functioning of the life-support systems of the planet, which in turn are impacting the survival of our own species. They have arisen because we have ignored the provisions of the "biological contract." In a sense, this is the equivalent, on a much grander scale, of course, of the dependent person impairing his or her own normal functioning, and through it, the normal functioning of his or her family. In our thinking, then, the environmental crisis is a large-scale disease, a pandemic, created by the addiction of human beings to misuse and abuse of the planetary resource base through overpopulation and overconsumption. The reasons for the existence of this addiction are explored in a following section.
2. This addiction continues to escalate as people make the assumption that there are no limits to the resource base, that it is there for us alone to use, and that whatever problems arise from such a mindset can be treated with the application of sufficient science and technology. The increasing energy appetite of people (an addiction provided us by the energy "dealers") in the United States is an example of such escalation.
3. As Postel (1992) has explained, humans react to the addictive escalation with denial and rationalization, creating a vicious cycle as

resistant to departure from the status quo as is drug addiction. The denial and rationalization have been codified into the throwaway and spaceship-Earth worldviews and centristic ethical schemata.

4. As noted above, these worldviews include the idea that "possession of more and more things is the source of happiness." It is also viewed as the measure of success in life. Deprived of this opiate, people can experience a type of withdrawal symptoms in the form of peer ostracism and lowered self-esteem. As with the substance abuser, almost any steps will be taken to acquire more things, including using other people's money (credit) to obtain them, leading for many of us to perpetual indebtedness to those who have the moneys to loan.
5. Finally, we humans deny that this addiction to "owning things" has any connection to the global environmental crisis we see displayed around us. We deny the urgency of effective responses to this crisis and move, inexorably, to (and, ultimately, beyond) the point of no return. We are like the drug addict who, unable to deal effectively with what caused the addiction, plummets toward the inevitable -- death from overdose.

Rerouting this destructive pathway will require the design of an effective specific treatment approach. This treatment approach design will have to depend on understanding the origin of the psychic trauma that has created our addiction to overpopulation and overconsumption.

## THE ORIGIN OF OUR COLLECTIVE PSYCHIC TRAUMA

A central question in the search for solutions to the global environmental crisis is why humans embrace such destructive worldviews, worldviews that lead to an addiction to overpopulation and overconsumption and the threat of our own extinction. Why do we continue on the pathway of escalating violence toward the environment and each other? Again, we can look to the disease model of substance abuse for the beginnings of an answer.

What we propose below is in the nature of a hypothesis, to be tested, presumably, by psychobiological

techniques. The components of the hypothesis are as follows:

1. Humans entertain worldviews promulgating behavior that is destructive to the environment that sustains them. Such behavior needs to be recognized as the highest order of violence, in the sense of "physical force exerted for the purpose of violating, damaging, or abusing" (American Heritage College Dictionary, 1992). Lesser levels of extreme violence would be represented, in descending order, by world wars, genocide, mass and serial murder, homicide, and suicide.
2. Possession of such destructive worldviews is symptomatic of envelopment in a pandemic addiction-denial cycle. The addiction is to violence toward the environment. The denial is that such behavior undermines the planet's life-support systems, and, in turn, threatens the survival of our own species.
3. Violence toward the environment appears to be the real opiate of the masses. We suggest that such compulsive, psychological dependence, as we have noted above, "provides relief from psychic pain and fear," in the same way as an addictive substance does for an individual.
4. Exposing the origin of such collective psychic trauma is at the core of any constructive attempt to deal with the problems that comprise the global environmental crisis. What follows, therefore, is the centerpiece of our hypothesis.
5. We hypothesize it is the same features of our nervous control system that distinguish us most significantly from other organisms that have burdened us with the psychic trauma that erupts into our violent behavior toward the environment.
6. The most significant way in which our nervous control system differs from that of other animals is the extent to which it allows for rationality. A useful meaning of this term is difficult to find. The American Heritage College Dictionary (1992) defines the term as "the quality or condition of being rational," rational as "having or exercising the ability to reason, and reason as "the capacity for logical, rational, and analytic thought;" thus, the definition is circular, redundant, and ambiguous). Nonetheless, for the purposes of this position paper, we define rationality as "the ability to catalogue and use information from the past to

plan for actions to be taken in the future by use of cause and effect analysis." Humans, thus, are not only able to communicate spatially (with other contemporaneous members of their species), but also temporally (with those who are dead, as well as those who are yet to live). Possession of an ability to communicate with both past and future appears to allow humans to position themselves on the time continuum. Communication with contemporaries appears to lead to positioning on the space continuum. Self-awareness would seem to lie at the point of convergence of these two continua.

7. Awareness of self and of occupancy of a shifting position in the space-time continua has both benefits and detriments. On the one hand, this awareness has allowed humans to transform the face of the planet as we have. The awareness enables humans to have a sense of mission, to establish goals, to work toward meeting these goals, and to have a sense of accomplishment upon their completion. Using these skills, we have been able to establish a world order in which the few benefit mightily at the expense of the many, and in so doing, to grind away at the direct and indirect ecosystem services, as Ehrlich and Ehrlich (1981) termed them, that sustain us. In short, we have used rationality and the awareness of self to position ourselves as the dominant creature in the biosphere. Documentation of this aspect of our makeup is virtually limitless.
8. It is the other side of rationality that presents the detriments that we wish to explore. This is the side we keep locked away from scrutiny, as the mentally infirm used to be. This is the closeted side of human rationality. We hypothesize that awareness of self and time-space positioning also generates an intensive, yet unacknowledged, collective fear of the inevitable. The inevitability of seemingly greatest importance to an individual is his own mortality. We posit that it is this fear that generates the psychic trauma that leads to entrapment in the addiction-denial cycle, which manifests itself in violence toward the environment and all of its components.
9. Fear is the "feeling of agitation and anxiety caused by present or imminent danger" (American Heritage College Dictionary, 2007). Fear is expressed to varying degrees from mild, short-lived anxiety to severe, long-term phobias (Kass et al., 1992). Anxiety is "a state of uneasiness and apprehension, as about future uncertainties" (American Heritage College Dictionary, 2007). In psychiatry, anxiety is recognized as "a state of intense apprehension, uncertainty, and fear resulting from the anticipation of a threatening event or situation, often to a degree that the normal physical and psychological functioning of the affected individual is disrupted" (American Heritage College Dictionary, 2007). A phobia is "a persistent, abnormal, or irrational fear of a specific thing or situation that compels one to avoid the feared stimulus" (American Heritage College Dictionary, 2007). In anxiety, thus, individuals experience uneasiness and apprehension, in some cases about the future, and in phobia we see the same feelings to the point that normal physical and psychological functioning is impaired. Phobias, thus, are a type of anxiety disorder (Kass et al., 1992).
10. What we hypothesize then is that almost all humans experience a phobia manifested as a fear of the inevitable, and that when this phobia is directed toward the individual, the fear is that of death -- a thanatophobia. We further suggest that, as with any phobia, the fear of death and of the inevitable in general is "abnormal and irrational." Kass et al. (1992) noted that, "Most experts agree that whatever the nature of the phobia, what people are trying to avoid is the feeling of being afraid and their response to the fear... The act of avoidance serves to reinforce the fear, however... Through association, phobic avoidance can generalize into phobic disorder, severely inhibiting enjoyment and opportunity in life." The phobia persists because the sufferers avoid confronting their fear in recognition of its irrational basis.
11. The steps people take to alleviate the fear of the inevitable, including death, vary in elaborateness. Nonetheless, the measures become the source of an addiction, which in turn can take many forms. The addiction is fueled by denial that the addiction exists or that it is "inhibiting enjoyment and opportunity in life." Addiction and denial become embroiled in a vicious cycle, continually fed by the irrational fear. In dealing with others, the sufferer operates with subverted socialization

skills. Frequently, the outcome is physical or emotional violence. Violence can be best defined, for the purposes of this analysis, as an “abusive or unjust exercise of power” (American Heritage College Dictionary, 2007). Thus, the violent individual or individuals abusively or unjustly exercise(s) power over other humans, other organisms, and the environment. Power, in this sense, is “strength or force exerted or capable of being exerted,” as well as “the ability or official capacity to exercise control.” Thus, power is “strength or force exerted to exercise control.” For the person entrapped within an addiction-denial cycle, violence is a form of displacement behavior, i.e., “a defense mechanism in which there is an unconscious shift of emotions, affect, or desires from the original subject [the addict himself] to a more acceptable or immediate substitute [other individuals, other organisms, or the environment at large]” (American Heritage College Dictionary, 2007).

12. In summary, we hypothesize the following relationships:

Evolution of rationality → Self-awareness →  
 Awareness of space-time positioning → Fear of the inevitable → Vicious cycle of addiction and denial →  
 Violence of all types and at all levels → Destructive worldviews reinforcing the violence.

13. The attempt to cover up the fear of the inevitable with displacement behavior manifested as violence is seen in various social institutions. We choose to discuss as examples two institutions that would appear, at first glance, to be at opposite poles with respect to the methods of inquiry each uses. These two institutions are science and religion.
14. Science may be defined as “the observation, identification, description, experimental investigation, and theoretical explanation of phenomena” (American Heritage College Dictionary, 2007). Science is a method or mode of inquiry that attempts to understand the universe and all of its components. “Science is a way of knowing about the natural world... At the heart of science is inquiry, a search for information and explanation, often focusing on

specific questions... Biologists use two main types of scientific inquiry: discovery science and hypothesis-based science. Discovery science is mostly about describing nature. Hypothesis-based science is mostly about explaining nature. Most scientific inquiries combine these two research approaches.” (Campbell et al., 2008). In hypothesis-based science, “a hypothesis is a tentative answer to a well-framed question—an explanation on trial. It is usually an educated guess, based on experience and on the data available from discovery science. A scientific hypothesis leads to predictions that can be tested by making additional observation or by performing experiments.” (Campbell et al., 2008). In addition, “a type of logic called deduction is built into hypothesis-based science... In deductive reasoning, the logic flows... from the general to the specific. From general premises, we extrapolate to the specific results we should expect if the premises are true.” (Campbell et al., 2008). Scientific hypotheses must be definable, testable, and replicable. Thus, only certain questions can be answered scientifically. As a consequence, science is constrained by limits. One of the human concerns with which the scientific process cannot deal is ethics or the study of right and wrong behavior. This is not to say that scientists cannot deal with ethical problems; in fact, the discipline of scientific ethics does exist, and rather obviously deals with questions of right and wrong as they apply to the sciences.

15. Science creates its most substantial problems for humanity as it becomes wedded to practicality, i.e., as it mutates into technology. Technology is defined as “the application of science, especially to industrial or commercial objectives” (American Heritage College Dictionary, 2007). Since industry consists of the “commercial production and sale of goods” and commerce is “the buying and selling of goods, especially on a large scale, as between cities or nations” (both definitions from American Heritage College Dictionary, 2007), then science is used as a means to exploit the planetary resource base for profit. This is science pressed into the service of business. Business operates to maximize profits, i.e., “the amount received for a commodity or service in excess

of the original cost" (American Heritage College Dictionary, 2007). Profits can be maximized by several means, all of which induce greater use and abuse of the resource base than would be otherwise the case. Thus, planned obsolescence, confusion of wants with needs, tying ownership to success, emphasizing convenience (e.g., through the production of throwaway items), and advertising in the home (commercial television) or school (educational marketing) are examples of techniques businesspeople use to increase consumption.

16. Probably the most insidious form of technology is that which puts biology to its service to create biotechnology. Biotechnology is rather benignly defined as "the manipulation of organisms or their components to produce useful products" (Campbell et al., 2008). Biotechnology is still in its infancy, but it is nonetheless evident that its ultimate goals are a good deal more nefarious than Campbell et al. (2008) indicate. In our opinion, the ultimate goal of biotechnology is to allow control of the bioevolutionary process by human beings, including that of their own species. If we are able to "progress" to this stage, then the human species would have the ultimate control over all other organisms, as well as itself, and the ultimate potential to visit violence on the living world. At this juncture, it is debatable whether humans will ever have this capability, especially before it brings its existence to a conclusion by some other easier-managed means, such as overpopulation, but the intent is evident. Science, then, even with its evidentiary underpinning, might be just as much involved in the collective addiction-denial cycle as is the next mode of inquiry to be discussed.
17. As mentioned above, in terms of the modes of inquiry used, science and religion would seem to exist at opposite poles. Science depends on the hypothetico-deductive method of inquiry, which in turn depends on provision of sensate evidence. Religion depends on faith. Faith is "belief that does not rest on logical proof or material evidence" (American Heritage College Dictionary, 2007). Thus, in science there is "mental acceptance of and conviction in the truth, actuality, or validity of something" (the definition of "belief") based on running evidence through

the hypothetico-deductive method and in religion that acceptance does not depend on proof or evidence. If pure science can be corrupted by technophilia, then religion would appear to have an even greater potential to fuel the collective addiction-denial cycle and lead to violence. Given that religion accommodates beliefs that do not rest on proof or evidence, it would seem possible to believe anything, and to base actions on such beliefs.

18. Bertrand Russell, the influential English philosopher, presented his views on religion in his famous book *Why I Am Not a Christian* (1957; first published in 1927, according to Boston, 1993). This controversial book presents an intriguing analysis of the basis of religion. He posited that, "Religion is based...primarily and mainly upon fear. It is partly the terror of the unknown and partly...the wish to feel that you have a kind of elder brother who will stand by you in all your troubles and disputes. Fear is the basis of the whole thing — fear of the mysterious, fear of defeat, fear of death" (Russell, 1957). He further opined that, "Fear is the parent of cruelty, and therefore it is no wonder if cruelty and religion have gone hand in hand" (Russell, 1957). Cruelty might be thought of as a kind of planned violence, to try to relate Russell's language to our own. Russell's opinion was distilled to its essence when he stated that, "We regard [religion] as a disease born of fear and as a source of untold misery to the human race." Farther into the book he indicated that, "It would seem...that the three human impulses embodied in religion are fear, conceit, and hatred." Fear, conceit, and hatred would appear to conspire to create violence. Russell (1957) again pointed out that, "Religion, since it has its source in terror, has dignified certain kinds of fear and made people think them not disgraceful."
19. Russell (1957) has not painted a very pretty picture of religion, and we are afraid that we can do nothing to improve this picture. Religion, resting on a foundation of fear, conceit, and hatred, and fostered by the idea that anything can be believed, would seem to have even greater potential to embroil people in the collective addiction-denial cycle than does science. It is to our opinion that science does not start out wrong;

it ends up that way when corrupted by greed in the marketplace. Religion, on the other hand, is wrong from the very beginning; it possesses no need to be corrupted by anything beyond itself. Nonetheless, both institutions can be put to the service of covering up the fear of the inevitable and both have the potential for creating serious violence along both the space and time continua.

In summary, we hypothesize that it is the evolution of rationality that has provided us the fear of the inevitable that we attempt to obscure by enmeshing ourselves in a collective addiction-denial cycle from which issues violence of all types directed at ourselves and the components of our social and natural environments. From this psychologically disturbed platform, we have constructed our dominant worldviews. Furthermore, we have designed social institutions that promote these types of behaviors.

## A PRIMER ON BEHAVIOR AND CULTURE

Given the pervasive nature of destructive worldviews, the violent behaviors they facilitate, and the social and environmental problems they have promulgated, a pivotal question facing our species is whether worldviews can be shaped that are constructive as opposed to destructive. If such is considered possible and worthy of effort, then this effort will have to neutralize the fear of the inevitable that appears to be a consequence of our rationality and the awareness it provides of the finite nature of our existence. In attempting to neutralize the fear of the inevitable, it has to be acknowledged that we will have to employ the same rational skills that provided us the fear in the first place. We have no other choice; there is no other means. That we are faced with problems that might be intractable to insoluble is implied by the recognition that what we have just said appears to be a paradox, in the sense of "a seemingly contradictory statement that may nonetheless be true" (American Heritage College Dictionary, 2007). That is to say, the same capabilities we have used to create our most pressing societal problems are the ones we will have to use to solve them.

Inasmuch as the most significant problems we face are buried within our collective psyches, it must be acknowledged that solving these problems will







be the most difficult process humanity has ever undertaken throughout its existence. Never have we acknowledged that we would have to deal with a species-wide psychological illness arising from the design of our minds. Thus, it will be necessary for us to accept that humans have been at once gifted and crippled by rationality. The bright side of rationality is going to have to learn how to master the dark side.

In this connection, it must be recognized that humans are peculiar animals, in part due to the extent to which they have evolved a culture. Development of this culture has been dependent on the evolution of rationality, for it is rationality that provides us access to the past and the future through the agency of cause-and-effect associations. Culture is usually defined in the anthropological sense as, "The totality of socially transmitted behavior patterns, arts, beliefs, institutions, and all other products of human work and thought" (American Heritage College Dictionary, 2007). The operative phrase in this definition is "socially transmitted behavior patterns," implying that culture is a function of society, that it involves behavior, and that patterns of behavior are somehow transmitted from some individuals in the society to other individuals in the society. What is not stated in this traditional definition is how the transmission is accomplished. Bonner (1983), in his book *The Evolution of Culture in Animals*, defines culture as follows: "The transfer of information by behavioral means, most particularly by the process of teaching and learning." Bonner contrasts cultural information with genetic information that is transmitted by the process of gametogenesis and reproduction. He also implies that the cultural transmission occurs from someone who has the information (the teacher) to someone who does not (the learner). This transmission depends, thus, on the human ability to record knowledge about the past, which is imparted by the teacher, and to use it as a means of determining how to approach the future, done by the learner.

It is fairly obvious, but not necessarily appreciated widely, that what knowledge is being transmitted deals substantially with behavior and the outcomes of behavior (i.e., the arts, beliefs, and institutions referred to in the above dictionary definition of culture). If it were not so, it would have to deal with structure and/or function, since structure, function, and behavior are the three aspects of the makeup of animals studied by biologists. Behavior is the focal point of cultural

transmission, because it is something capable of being changed within the time frame in which culture operates, i.e., the span of human existence, if it is based on learning (see below). Structure and function are aspects of human biology changed within the framework of geological time, so such features are largely unaffected by cultural evolution.

Given that behavior and its modification is the fuel for cultural change and transmission, it would be useful to determine just what is behavior. In our opinion, this term is usually incorrectly or incompletely defined, not only in dictionaries of the English language, but textbooks of biology as well. The fourth edition of the American Heritage College Dictionary provides a psychological definition of the term, namely, "The actions or reactions of persons or things in response to external or internal stimuli." This definition is deficient in at least one respect, if not two. First, it indicates that "things" can behave. The same dictionary defines this word in the usual usage sense as, "An entity, an idea, or a quality perceived, known, or thought to have its own existence," "The real or concrete substance of an entity," "An entity existing in space and time," and "An inanimate object." In this sense, anything identifiable as "an entity existing in space and time," including "inanimate objects" are indicated to be capable of behavior, which, obviously, is not the case. Interestingly, this dictionary definition also does not specify that any other animals besides humans are capable of behavior.

During much of his teaching career at Miami-Dade College in Miami, Florida, the senior author used the best-selling majors biology textbook in the world, starting with its first edition published in 1987 (wikipedia.org; accessed 21 July 2018). The last edition of this text he used appeared in 2008 (the 8<sup>th</sup>) and is the edition we have consulted in this essay (Campbell et al., 2008). In our opinion, the view of what constitutes behavior in this text is too broad. The definition provided in the review for the chapter on behavior (p. 1142) is as follows: "Behavior is the sum of responses to external and internal stimuli and includes muscular as well as nonmuscular activity." Campbell et al. (2008) suggested, thus, that the functioning of organs such as the digestive and excretory systems is behavior. We disagree. Thus, the functioning of these systems in the body of an animal does not constitute behavior. Such functioning can facilitate behavior, but is not, by itself, behavior. Behavior must be observable by some ordinary

(non-instrument-assisted) sensory means. Furthermore, behavior is more limited than what an animal does and how it does it, inasmuch as this can and does include an animal's functioning.

The glossary in *Biology: Concepts and Applications* (Starr, 1994), however, presented a very good definition of behavior. She stated that animal behavior (a redundant term, since only animals are capable of behavior) is, "A response to external and internal stimuli, following integration of sensory, neural, endocrine, and effector components." Behavior, thus, depends on the existence of nervous and muscular tissue, as well as sensory structures and hormones. Only animals possess these features (and not all animals; sponges do not, nor do any other parazoans). We would add that the behavioral responses are observable by some sensory means (see previous paragraph).

One of the basic themes in biology is that "structure and function are correlated at all levels of biological organization" (Campbell et al., 2008). It is important to point out that behavior likewise is correlated with structure and function, as is obvious from the definition Starr presented (reactions depend on the integration of sensory, neural, endocrine, and effector structures). Behavior also, as is the case with structure and function, has a genetic basis and is subject to natural selection (i.e., it can evolve). As it evolves, behavior remains correlated with structure and function, because it depends on these two aspects for its elaboration.

Starr (1994) also noted in her definition of behavior that it "commonly can be modified through experience" (i.e., it is subject to change through learning). It is this aspect of behavior that allowed culture to come into existence. Culture would have never evolved if behavior were only instinctive. Instinctive behavior is that which does not respond to experience. As (Starr, 1994) defined instinctive behavior, it is, "A complex, stereotyped response to a particular environmental cue that often is quite simple." This contrasts with learned behavior, defined by her as, "The use of information gained from specific experiences to vary or change a response to stimuli." An important step in the evolution of culture, therefore, was the development of learned behavior.

The general environment of an animal can provide the stimuli that will produce the learned response. Culture, however, requires additional elements, necessitating other steps in evolution. Beyond learning capability, culture requires that information be passed from one member of a species to another. As noted above, a more experienced member (having already undergone the learning) passes the information to a less experienced member (yet to undergo the learning). This, of course, is teaching. Teaching and learning represent cooperative behavior and, therefore, occur within the context of a society. In the biological sense, a society is, "A group of individuals belonging to the same species and organized in a cooperative manner" (Wilson, 1980).

To summarize the discussion to this point, it can be said that the appearance of culture has depended on the following evolutionary steps occurring within the animal kingdom:

1. Coordinated, observable neuroendocrine, skeletomuscular responses to external and internal stimuli (i.e., behavior).
2. Change in responses to external and internal stimuli through experience (i.e., learned behavior).
3. Cooperative, interdependent responses among members of the same species to external and internal stimuli facilitated by communication (i.e., social behavior).
4. Passage of information from more experienced members of society (teachers) to less experienced members (learners), resulting in change in the responses to external and internal stimuli on the part of the latter (i.e., culture).

As elaborated by Bonner (1980), several other steps preceded the evolution of behavior, which do not require discussion here.

## SLAYING THE BEAST WITHIN — RESTRUCTURING THE EDUCATIONAL PROCESS

The attempt to "neutralize the fear of the inevitable" to intervene in the vicious cycle of addiction to violence and its denial, thus, will have to be facilitated

by the process of teaching and learning. Furthermore, the attempt will have to occur within the context of the formal educational system, i.e., the hierarchical organization in which teachers (people who are educated to teach and are more experienced) impart knowledge and skills to learners, because cultural change can be accelerated therein. Nonetheless, as pointed out elsewhere (Wilson, 1991), the present educational system acts as a hindrance to change, because it is based on operant conditioning, a type of associative learning that produces graduates of the system who are wedded to the status quo, i.e., the system that has promulgated the addiction-denial cycle of violence. Operant conditioning modifies behavior by means of positive and negative reinforcement or a graded system between the two (Wilson, 1991). In the educational system it is the graded system that is used, and it induces learners to produce the kind of behavior that will result in "good" grades. Learners are taught, thus, to respond to external, not internal rewards. Grades represent external rewards, evaluations made by another person or persons. Grades accumulate into a set of credentials, used to insinuate oneself into the job market. The job market provides employment, at which employment one makes money. Money provides partial access to the ultimate measures of success, i.e., the quantity, and perhaps the quality, of what one owns, as defined by the purveyors of the myth that possessions equal success. Ownership is a goal never reached. One can never own too many things. The bumper sticker reads, "He who dies with the most toys, wins." The advertisements blare from the first day the television set is used as an electronic baby-sitter, "Buy, buy, buy more."

The coupling of ownership and success in life, even as it is promulgated in the formal educational system, of course, is a trap - a bottomless well into which we topple. For most people in society, especially in the super-consumptive United States of America, the ideal of ownership without limit is unattainable. The idea of purchasing what one has the money to pay for immediately is as outmoded as is bartering. Large and even small purchases are made on something called credit. Credit, of course, is a loan made to the buyer by someone with the money to do so in return for a premium in the form of interest. Interest represents a way the lender can make money on money. Thus,

providing credit is an easy way to become wealthy and powerful, because neither goods nor useful service is provided to the loan recipient. Contrariwise, this poor soul is ushered into a state of perpetual indebtedness; he is turned, essentially, into an indentured servant. For this stratagem to work, it is helpful to have an operantly-conditioned, gullible buying public that does not think much about the consequences of such behavior. Of course, the federal government provides a large-scale model for individuals, inasmuch as deficit spending is "living on credit" on a national level.

The consequences, however, do occur and are registered on the limited resource base supporting all planetary life. The brand of ownership practiced in the United States of America is particularly erosive. It represents a kind of doubly extractive method of resource exploitation. First, we exploit the resource base efficiently using the force of our corporeal size multiplied by our numbers, multiplied again by over consumptive, wasteful patterns of use, allowing profits to be made. Then we buy resources (goods and services in economic parlance) on credit, allowing money to be liberated from its connection to the resource base, so that it can give rise to more money for a select group of people. Credit represents, thus, a kind of profit on profit. From an environmental point of view, profit involves gaining more from the resource base than one ever will be able to or have the interest to replace. Again, it is helpful to have a consuming public not educated well enough to understand such realities.

In constructing such a super-exploitive economic system, we have elevated the individual and its desires and wants to a level of status above the society of which it is a part. Wilson (1980) identified this "flaw" in the structure of human society when he wrote: "To visualize the main features of social behavior in all organisms at once, from colonial jellyfish to man, is to encounter a paradox. We should first note that social systems have originated repeatedly in one major group of organisms after another, achieving widely different degrees of specialization and complexity. Four groups occupy pinnacles high above the others: the colonial invertebrates, the social insects, the nonhuman mammals, and humans. Each has basic qualities of social life unique to itself. Here, then, is the paradox. Although the sequence just given

proceeds from unquestionably more primitive and older forms of life to more advanced and recent ones, the key properties of social existence, including cohesiveness, altruism, and cooperativeness, decline. It seems that social evolution slowed as the body plan of the individual organism became more elaborate.”

Since humans commonly view themselves as apart from nature or, at the least, the single pinnacle of evolution, this explanation is probably one of the reasons Wilson was the recipient of such a firestorm of protest following the publication of *Sociobiology* (Wilson, 1994; Wright, 1994).

The current educational system, thus, functions to train students to play roles in society that maintain the status quo. The verb “to train” means “to coach in or accustom to a mode of behavior or performance.” Training, therefore, involves behavior modification to fulfill predesigned roles in society. To limit education to this function is to stultify it and to allow it to function as a major hindrance in any attempt to combat the problems we ourselves have created. In our opinion, any effort to successfully deal with these problems will have to be predicated on a wholesale reform of the educational process that will turn education from hindrance to facilitator.

At the base of the reform effort will have to exist a firm understanding of what education is supposed to be. In our view, education is the process by which we provide ourselves with the skills and knowledge needed to discover fundamental answers to the important questions life sets before us. Furthermore, it is the means by which we improve the conditions of life for ourselves in such a way to not sacrifice the ability of the planet to support life over the long term. Finally, it is the way we maximize the opportunity for critical and creative self-actualization for each human being brought onto the planet within the context of a sustainable society.

Interestingly, this view of education is much more consistent with the concept of biological success (i.e., perpetuation of genes) than is the view of education as training to maintain the status quo. Education, thus, is the cultural analogue of natural selection, that cultural mechanism that allows for adaptation to changing environmental conditions. Unlike the

directionless nature of organic evolution by natural selection, education based on use of the most adaptive features of rationality allows for planning for anticipated future conditions.

Inasmuch as the opportunities available in our view of education are today denied to so many, a commitment to education has to mean a commitment to change in prevailing conditions. It will mean transforming the current unsustainable societal system into a sustainable one. Bringing about such change, thus, is the major role of education, and, as noted above, the most profound task ever undertaken by humanity. As such, this view of the function of the educational process lies far from the typical role of education as the training indicated above. Education as training will have to become education as teaching and learning to effect beneficial change and a departure from the status quo.

Any effort to reform the educational process to create a sustainable society for humanity will have to deal with the following impediments, summarized from the preceding discussion:

1. Organic evolution does not automatically produce successful designs for survival and reproduction. It appears that human beings are beset by at least two major flaws in their biological makeup. One is that alluded to by Wilson (1980) when he stated that the “key properties of social existence, including cohesiveness, altruism, and cooperativeness” have declined in the face of the elaboration of the body plan of the individual organism. What he meant is that human society represents a pinnacle in the liberation of the individual from societal constraints, the very constraints that represent the adaptive value of the societal design, allowing pursuit of the egocentric existence. We are perplexed by the behavior of those who act in selfish ways, yet such people (career criminals and presidents of savings and loan associations, to cite two obvious extreme examples) might be viewed as having simply explored the limits of egocentrism.
2. The other flaw might lie in the nature of rationality, in that it has produced self-awareness. Such self-awareness seems to have reinforced the isolation of the individual within society, pushing

egocentrism to egomania, the obsessive preoccupation with oneself. Such obsessiveness with oneself has led to a number of attempts at rationalization (an interesting word that can mean both the process of using reason and the process devising self-satisfying but incorrect reasons for one's behavior; we are using the word, therefore, in the second sense) that depend on disabling rational capacity. This effort depends on denial that the capabilities provided us by rationality have value. Thus, we deny that there are lessons to be learned from the past (i.e., from the experience of those who have lived before us), we deny that there are reasons to be interested in the future (i.e., that we have any commitment to those that will follow us), and, finally, we deny that effects arise from causes (i.e., that what will occur in our future is a consequence of what has occurred in our past). In turning the capacities provided to humans by rationality around 180°, we have disabled them and, in so doing, have blinded ourselves to the consequences of this action.

3. One of the consequences of the disabling of rationality is the glorification of belief systems that do not rest on evidence, allowing their proponents to believe that anything is possible. Such belief systems provide, most substantially, for the continuation of the essence of an individual beyond that individual's death. The afterlife represents a way for the egomaniac to not only view himself as the center of the universe, but as such for eternity. The concept of the afterlife also functions as a major means by which human behavior can be shaped -- a kind of ultimate operant conditioning. Inasmuch as the criteria for the passage to heaven or hell are rather loosely defined, it is still possible, however, for a great deal of violence to occur under the umbrella of the "decent life." The concept of the afterlife represents one of the principal defense mechanisms humans use to allay the fear of the inevitability of death. The package of self-deception to which the idea of the afterlife belongs is well-constructed, including as well: (a) the concept of the soul, the essence of the individual capable of travel to the afterlife; (b) that of the miracle, an event that appears inexplicable by the laws of nature and, thus, held to be the

work of a supernatural being, (c) that of prayer, a reverent petition made to an object of worship (often at the last minute or as a last resort), (d) that of faith, belief that does not rest on logical proof or material evidence; (e) that of a deity, a supernatural being conceived of as the perfect, omnipotent, omniscient originator and ruler of the universe; and (f) that of adherence to dogmata, a system of authoritative principles, beliefs, or statements of ideas or opinions, especially those thought to be absolutely true, promulgated by one in authority and, therefore, considered to be unquestioned and unquestionable.

4. Religion, of course, is not the only "package of self-deception" in existence. Several other belief systems depend on the same abandonment of rational capacity (i.e., acceptance based on faith) in favor of a set of ideas that are more convenient and comfortable for their proponents. To cite a few examples, one can mention: (a) the conviction that the human population is the single exception to the rule of population ecology that "all populations face limits to growth, for no environment can indefinitely sustain a continuously increasing number of individuals" (Starr, 1994); (b) the idea that economic systems can operate independent of the planetary resource base to achieve unlimited growth, (c) the concept that politics acts to empower the powerless, and (d) the opinion that an education can be gained by osmosis. All of these ideas require suspension of the intellect and/or immersion in short-term thinking.
5. "Short-term thinking," of course, also represents a major impediment to attainment of sustainability. This is the concept that allows us to think that it is possible to gain immediate benefits without having to face long-term consequences. Again, we see the egomaniac at work, restricting the sphere of interest to the here and the now. Such an approach also requires suspension of the intellect, especially that part of rationality that allows us to plan (i.e., prepare for an anticipated future). Planning, if it occurs, is limited to the immediate future. Perhaps, one of the best examples of this type of thinking is the "election mentality" of elected representatives in this country, who organize their period of service in the context of the proximity of the next election. Politics played in this fashion involves a difficult

balancing act between giving the appearance of providing service to constituents while preparing to benefit from one's connection and influence beyond the period of governmental service (or, in some cases, while still in this period).

6. Another impediment is the working idea that rights accrue to the individual without the need to be concerned with the attendant responsibilities. To cite an extreme example, in the US when a person is arrested by the police, his "rights" are read to him. His "responsibilities," however, are not. To give a less obvious example, as professional educators, it is clear to us that many students move through the educational system operating on the idea that it is their "right" to gain the set of credentials offered by the educational institution without the attendant "responsibility" to engage themselves in the educational process. Educational degrees, in the extreme case, are provided on the basis of longevity, and, in fact, are provided by students to themselves (i.e., "I need to pass this course, because I am graduating at the end of this semester [as opposed to 'I need to work especially diligently on this course, because I hope that I can be graduated by this institution at the end of this semester']"). Placing the emphasis on rights to the partial or complete exclusion of any being placed on the attendant responsibilities will always create problems for humans and impede attempts to improve social conditions. Doing so is another indication of the widespread nature of egomania.

In light of the existence of these powerful impediments, perhaps it is most efficacious to think of the role of education in effecting the transition from unsustainable to sustainable society as one of providing therapy for the various psychological ailments with which most humans appear to be beset, including the authors of this essay.

## EDUCATION AS PSYCHOTHERAPY

If educators can convince themselves that the transition to the sustainable society will require the reform of the educational process, and that such reform will depend in turn on exposing the ways in which rationality is misused and abused to produce

centristic behaviors and attitudes (ranging from anthropocentrism to egocentrism) from which emerge a range of types of violence, the goal of such reform will have to be to devise means to use education as species-wide psychotherapy. Viewing the reform process in this light exposes the extremely difficult nature of the transition required. We can think of no more difficult problem educators or, indeed, people in general have faced.

Therapy, of course, is the "treatment of illness or disability" (American Heritage College Dictionary, 2007). Psychotherapy is defined in the source just cited as "the treatment of mental and emotional disorders through encouraging communication of conflicts and insight into problems." Kass et al. (1992) defined the same term as "a form of treatment for mental disorders that uses 'talk therapy' rather than somatic means to achieve symptom relief, behavior changes, and/or self-growth."

Education, on the other hand, is commonly defined as "the process of providing knowledge or training in particular areas or for particular purposes" (extrapolated from the American Heritage College Dictionary, 2007). We have discussed elsewhere (including previously in this document and in Wilson, 1991) the problems that arise from viewing education solely as a process of dispensation of knowledge and/or provision of training. Thus, education, as usually conceived, has no connection to psychotherapy. Psychotherapy, on the other hand, clearly has a connection to our view of the function of education as the process by which we learn to think and communicate (Wilson, 1993). As defined above, psychotherapy "encourages communication" to resolve conflicts and to provide insight into problems. It appears, therefore, that in seeking connections between the educational process and psychotherapy, the former will have the greater task of accommodation than will the latter.

In seeking the means of accommodation, it is perhaps profitable to examine the strategies of psychotherapy, in the same way that examining the disease model of addiction was used as a means of exposing the underlying mechanism for the violence humans visit upon themselves and the planet at large (see above). Glick and Spitz in Kass et al., (1992) pointed out in discussing the common approaches to psychotherapy

that all involve the use of “verbal and nonverbal communication between the therapist and the person who seeks help — the so-called talking cure.” They also indicated that instead of using drugs and other somatic treatments to alter brain functioning directly, “psychotherapy intervenes in the processes of the mind — the patterns of feeling, thinking, perceiving, adapting, coping, behaving, and relating that develop over time.” Moreover, “psychological treatments of emotional disturbances derive their beneficial or curative influence from complex processes of communication between suffering patient and healing psychotherapist. These processes usually include forms of emotional release as well as emotional learning based on new information and ways of understanding oneself and one’s environment. They take place within a confidential relationship with the therapist, who provides expert knowledge, support and acceptance, hope, safety, and a model for someone with whom to identify” (Glick and Spitz in Katz et al., 1992).

In discussing the intended outcomes of psychotherapy, Glick and Spitz in Katz et al., (1992) noted the following:

“In its broadest definition, psychotherapy has three main goals. First and foremost, it seeks to alleviate psychological pain. This pain is usually in the form of distressing feelings or emotions, including anxiety and depression, and/or in the form of symptoms, such as phobias, obsessions, compulsions, inhibitions, panic attacks, psychologically based physical problems, sexual problems, and mental ‘blocks’ that prevent accomplishment, emotional comfort, or happiness in many areas.

“A second, more ambitious goal includes the modification of distressing behavior patterns and problematic personality traits. These difficulties manifest themselves in the two major areas of life: love and work. Relationship difficulties, self-esteem problems, deep-seated insecurities, self-hatred, and self-defeating behaviors are among the targets of the various psychotherapeutic approaches.

“Most ambitiously, psychotherapy seeks to increase self-awareness and self-knowledge, insight that can lead to improvement in judgment, emotional

flexibility, maturation, and successful adaptation to the demands of life.”

In reading this description in the context of what has preceded it in this document, it appears obvious the nature of the reformation necessary to effect the transition to the sustainable society has a great deal in common with the approaches used in psychotherapy. A comparison between the goals of psychotherapy and education for sustainability is made below:

**Table 2.** Comparison of Stages of Psychotherapy and Education for Sustainability

<b>Psychotherapy</b>	<b>Education for Sustainability</b>
Alleviate psychological pain.	Alleviate the conditions that have led to the unsustainable society.
Modification of distressing behavior and problematic personality traits, including addiction-denial.	Modification of destructive behavior caused by embroilment in addiction-denial cycle.
Increase self-awareness and self-knowledge to ultimately lead to successful adaptation to the demands of life.	Increase understanding of the provisions of the “biological contract” to lead ultimately to the capacity to adapt to the requirements for living sustainably on the planet.

The methods that will have to be used to bring about the transition to the sustainable society are also similar to those used in psychotherapy. Both depend on use of the “talking cure,” the complex processes of communication between suffering patient [= student] and healing psychotherapist [= educator for sustainability]. Education for sustainability will also “intervene in the processes of the mind” in a way similar to that of psychotherapeutic methods.

“Psychotherapy is conducted with individuals, groups of patients, couples, or families ... Within each of these settings or formats, the most common psychotherapeutic approaches offered by trained mental health professionals fall within the following four broad categories: supportive, psychodynamic (psychoanalytic), behavioral, and cognitive” (Glick and Spitz in Kass et al., 1992). It is beyond the scope and the needs of this position paper to examine all these approaches in all the settings. Nonetheless, the kind of educational therapy we envision being needed would be delivered in small group settings of





**Figure 4.** A colony of *Riftia pachyptila*, the giant beardworms, living near a hydrothermal vent at great depth along the Galapagos Trench in the eastern Pacific Ocean. These annelid worms, which have no digestive tract, obtain their nutrition from the mutually symbiotic chemosynthetic bacteria harbored in the trophosome of these worms. These chemosynthetic or chemoautotrophic bacteria use hydrogen sulfide as an energy source to fix carbon dioxide and produce sugars (glucose) and elemental sulphur. These creatures illustrate how far life can exist on Earth from the direct rays of the sun and what means they use to do so.

15-20 people and likely would involve elements of all the categories of psychotherapeutic approaches. The goals of such therapy would be as follows:

1. To attempt to increase the understanding and appreciation of the student for the nature and extent of the provisions of the "biological contract."
2. To attempt to increase the understanding and appreciation of the student for the consequences of misreading the "biological contract."
3. To attempt to increase the understanding and appreciation of the student of the origin and nature of the mass addiction-denial cycle, the collective psychic trauma that has created it, and the consequences of its continued pursuit.
4. To attempt to increase the understanding and appreciation of the student of the biological relationship between structure, function, behavior, and culture of human beings.
5. To attempt to increase the understanding and appreciation of the student of the impetus for and the nature of the educational reform necessary to respond effectively to the imperatives created by the embroilment in the mass addiction-denial cycle and its consequential misreading of the "biological contract."
6. To attempt to increase the understanding and appreciation of the student of the concept of education as psychotherapy as a means of

dealing effectively with the problems created by immersion in centristic thinking and the behaviors that emerge from it.

7. To attempt to increase the understanding and appreciation of the student of the steps necessary to develop the understanding and commitment to the construction of a sustainable world.

## SOME FINAL WORDS

This paper has been written to attempt to identify why it is that we have embraced such destructive worldviews and why it appears so difficult for the educational process to have a measurable effect on the progress of the problems that issue from these worldviews. In the effort to devise educational programs to assist the alleviation of these problems, it is our view that we will have to confront the flaws in the human psychic and societal makeup and learn (in the ethological sense of the word) how to overcome them before we can ever hope to create workable and lasting solutions to the set of problems that threaten us with extinction by design.

## ACKNOWLEDGMENTS

We are very thankful to our friend and colleague Vicente Mata-Silva for his helpful review of this essay.



## LITERATURE CITED

- Bonner, J.T. 1980. *The Evolution of Culture in Animals*. Princeton University Press, Princeton, New Jersey, USA. ix + 216 Pp.
- Boston, B.O. 1993. *Bertrand Russell*. New Grolier Multimedia Encyclopedia, Grolier Electronic Publishing, Incorporated.
- Campbell, N.A., J.B. Reece, LA. Urry, M.L. Cain, S.A. Wasserman, P.V. Minorsky, and R.B. Jackson. 2008. *Biology*. Eighth edition. Benjamin Cummings, San Francisco, California, USA. xlvi +1,267 Pp.
- Chaffee, J. 1994. *Thinking critically*. Fourth edition. Houghton Mifflin Company, Boston, Massachusetts, USA. xxi + 642 Pp.
- Dawkins, R. 2016. *The Selfish Gene*. Fourth edition. Oxford University Press, Oxford, United Kingdom. xxxii + 462 Pp.
- Ehrlich, P., and A. Ehrlich. 1981. *Extinction: The causes and consequences of the disappearance of species*. Random House, New York, New York, USA. xiv + 305 Pp.
- Glick, R.A., and H.I. Spitz. 1992. *Common approaches to psychotherapy*. In Kass, et al. *The Columbia University College of Physicians and Surgeons complete home guide to mental health*. pp. 44-62. Henry Holt and Company, New York, New York, USA.
- Johnson, J.D., L.D. Wilson, V. Mata-Silva, E. García-Padilla, and D.L. DeSantis. 2017. *The endemic herpetofauna of Mexico: organisms of global significance in severe peril*. *Mesoamerican Herpetology* 4: 544-620.
- Kass, F.I., J.M. Oldham, and H. Pardes. 1992. *The Columbia University College of Physicians and Surgeons complete home guide to mental health*. Henry Holt and Company, New York, New York, USA. xv + 476 Pp.
- Linton, C.D., and E.H. Litchfield. 1979. *The quick reference handbook of basic knowledge*. The Varsity Company, Nashville, Tennessee, USA. viii + 879 Pp.
- Mayr, E. 1982. *The growth of biological thought: Diversity, evolution and inheritance*. Harvard University Press, Cambridge, Massachusetts, USA. 974 Pp.
- Miller, G.T. 1993. *Environmental science: Sustaining the earth*. Fourth edition. Wadsworth Publishing Company, Belmont, California, USA. 470 Pp.
- Orr, D.W. 1994. *Earth in mind: On education, environment, and the human prospect*. Island Press, Covelo, California, USA. ix + 213 Pp.
- Russell, B. 1957. *Why I am not a Christian*. Simon & Schuster, New York, New York, USA. xvii + 266 Pp. (original edition published 1927).
- Starr, C. 1994. *Biology: Concepts and applications*. Second edition. Wadsworth Publishing Company, Belmont, California, USA. xxix + 645 Pp.
- Wilson, E.O. 1980. *Sociobiology: The abridged edition*. Harvard University Press, Cambridge, Massachusetts, USA. ix + 366 Pp.
- Wilson, E.O. 1984. *Biophilia*. Harvard University Press, Cambridge, Massachusetts. 157 Pp.
- Wilson, E.O. 1994. *Naturalist*. Island Press, Covelo, California, USA. xii + 380 Pp.
- Wilson, L.D. 1991. *Toward a critical and creative thinking-based educational process - Reforming the current system*. Unpublished memorandum dated 2 December 1991.
- Wilson, L.D. 1993. *Learning to think and communicate: Key to a meaningful education*. Unpublished position paper dated 16 August 1993.
- Wright, R. 1994. *The moral animal. Evolutionary psychology and everyday life*. Pantheon Books, New York, New York, USA. x + 467 Pp.