

Illness and Death in the Universe

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The morgue attendant guided me to my mother's lifeless body residing inside a black bag at the hospital where she was pronounced dead. The coldness of the morgue was not only measurable in degrees of temperature but also felt with the heaviness of unsaid words during farewells. I glanced around the room to discover that in the seemingly perennial emptiness and intolerable silence, there were many more bags being filled with someone else's parents, children, or grandparents. The unyielding grip of death annihilated the possibility that this was part of a movie scene or the bewilderment of waking up from a bad dream. To make things worse, a fly landed on my mother's forehead while the staff member unzipped the bag. I felt trivial and lonely. Watching the fly moving across my mother's face only amplified the gloom. The only certainty of that moment: my life and my view of the essence of life would never be the same. The emotional resilience and spirituality hardwired into my neuronal circuits and pruned during my lifetime struggles were immediately depleted by grief.

Why Illness and Death in the Universe?

My mother's unexpected death unmercifully uncovered the landscape of our human frailties in the cosmic immensity and eliminated my Machiavellian stand in this complex world. Sadness eventually transitioned into the rationalization that our predicament of life and death deserves to be viewed through the lens of our biologic heritage in a larger and highly dynamic natural scene.

Our human history is a history of spaces, where geography has shaped our destiny. Our planet came to rest at the right distance from the sun and the stage was set for the occurrence of life in the Milky Way.¹ We are a collection of many

atoms that have become organized to be self-aware of our existence. The forces of evolution by natural selection underlie the adaptation, complexity, and diversity of life on the earth.² Humanity represents a small branch in an enormous and dynamic tree of life that emerged millions of years ago.^{1,2} Our "unique" human identity is blurred when we look through a historic mirror. Human genomes are not really human: we are hybrids of viruses, plants, animals, and extinct organisms.³ The anatomically modern human body harbors a collection of different types of some 10 trillion cells under the direct control of 23,000 genes.⁴ Similar to other members of the animal kingdom, our development involves a few fundamental processes: fertilization, cleavage, gastrulation, organogenesis, postnatal development, and gametogenesis.⁵ In our mammalian development, we also share the fact that every adult human organism eventually undergoes senescence and dies. Throughout all these stages, the microbial community living in the human gut, skin, and respiratory tract play a crucial role in modulating health and disease by combining genomes (microbiome).^{6,7} Therefore, from an evolutionary perspective, our human nature is that of an ecosystem where the interests of the human body and the commensal microbiota are aligned.⁷

Suffering diseases and dying have governed the history of humankind.⁸ The mystery and tragedy of human illness during our life trajectories relies upon the narrative accounts of our ancestral DNA.³ Our biologic fortune has been sculpted through ancient molecular battles, biochemical compromises, and trade-offs.^{9,10} A dynamic interplay among mutations, environmental factors, and epigenetic changes may alter cell behavior. In this sense, genes that make human bodies having superior reproductive success will become more common, even if they compromise the individual's health in the end.¹⁰

Humanity's transformation of the environmental framework of the earth has an important influence on human health.¹¹ The emergence of the cognition has paradoxically affected the same essential forces that have led to its existence in the first place.^{1,2} Vladimir Vernadsky, a Russian scientist, and the French philosopher Pierre Teilhard de Chardin developed the concept of a thinking layer or sphere of the earth or *noosphere* constituted by the interaction of human minds.¹² As predicted by them, the human brain has fundamentally transformed all spheres of earth's development including the *geosphere*, the *biosphere*, and ultimately the *noosphere*.¹¹ Contemporary human activity has accelerated this process by increased international connectivity in the form of information flow, trading patterns, human mobility, capital flow, cultural diffusion, and other large-scale forces. These global forces converge to bear on patterns of human health by historically unprecedented environmental and social transformations.^{13,14} Thus, in many ways, modern human history has provided important health benefits and increased longevity in our lifespan, but in many other ways, it has exacerbated a clash between our biologic ancestry and our surroundings, leading to new health challenges.¹⁴ My mother was one of those casualties trapped in an epidemiologic transition dominated by increasing rates of chronic diseases such as cancer and cardiovascular disease.

Incorporating Modern Science Literacy into Clinical Care

In the history of mankind, conceptions of life and death have traditionally pertained to the realm of philosophy and religion. However, at this point in time, our views of life and death must also be critically assessed through the knowledge acquired by the scientific revolution of the history

of the universe. Indeed, science literacy matters as much as other forms of culture and knowledge in modern human societies.

In the modern history of mankind, prominent scientists including Galileo, Newton, Darwin, and others employed logic and observation to develop a rational view of the universe and humanity's place in it. Galileo, considered by many to be the founder of modern science, confirmed the Copernican notion that the earth orbits around the sun rather than vice versa, which was considered heretical by the Roman Catholic Inquisition. Yet, Galileo's scientific observations conclusively transformed our understanding of the role of humanity in the cosmos. With modern clarity, a plethora of scientific facts and ideas that range from the origins of diversity of life on earth to the discoveries of billions of galaxies in the universe strongly suggest that the cosmos was not created only for the purpose and destiny of the life cycle of the human species.

Today, with the growing number of available technologies and human development, the number of scientific discoveries will only continue to disenthral previously accepted misconceptions of the position of humanity in the cosmos. As an example, on April 18, 2013, the Kepler Project at NASA announced that among many planet candidates orbiting stars, there are at least 2 planets (Kepler 62 and Kepler 69) with similar habitable features to Planet Earth.¹⁵ These findings suggest that life, in some form, may currently exist, may have existed, or may potentially emerge elsewhere in the universe in the future.

Modern medical knowledge requires scientific literacy. Knowing clinical medicine without a more conscious approach of critical thinking of our ancestral biologic heritage and of our stand in the natural world is incomplete. We must learn continuously the scientific revolution in physics, cosmology, evolutionary biology, paleoanthropology, and other disciplines to widen our understanding of the phenomena of life and death in the wider natural scene. Caring for the sick with the utmost compassion, respect for their belief system, and empathy, coupled with a competency in understanding our organic reality, may assist us in optimiz-

ing the patient-physician relationship. Moreover, these facts must be shared and discussed with ill patients and their families, particularly when assessing end-of-life interventions. This approach is not a departure from faith-based systems, cultures, and traditions. The noble Hippocratic aspiration of curing diseases and alleviating suffering requires a concomitant view where death is not seen as a medical failure. We must demedicalize death: it is a personal human event.

The death of a loving family member perhaps is measured in a different emotional and spiritual scale compared to the end of life of one of our patients. Yet, we must accept death as an inevitable part of our biologic animal life cycle; and ironically, it is an event that shapes and brings cohesion to many levels of life. In this sense, the fly and I understood each other's role in this natural world: there is no decay or disorder. We exist as part of a continuum process of biologic renovation under unswerving DNA control: *there is no death, only transformation*. Accepting this reality may be the highest form of spirituality.

In the personal realm, and as practicing clinicians, we must understand death and our infirmity with humility. A sense of cosmic humility stems from an understanding that we are made from the same materials and forces that make up galaxies. Realizing the shared biologic kinship and biologic antiquity with other forms of life and the mechanisms employed by nature assisted me in overcoming my despair and allowed me to mourn my mother's death with dignity. As Octavio Paz, 1990 Nobel Prize for Literature recipient, wrote in *The Broken Water Jug* published in 1955: "... life and death are not opposite worlds, we are part of a stem with twin flowers ..."¹⁶

Before my mother was buried, I kissed her for the last time. The history of life continues even after my mother's coffin was covered with dirt. Although our biologic heritage can be measured in the scientific timescale of a *molecular clock*,¹⁷ the memory of my mother, the honor of caring for the dying sick, and the empathy towards other individuals inside black bags at the morgue and their families, is timeless. ❖

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