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**9<sup>th</sup> GRADE BIOLOGY**  
**WRITING ASSIGNMENT / TAKE-HOME TEST**

Learning concepts and integrating them is an important part of studying biology. Perhaps more important, though, is the ability to develop new concepts. A scientist is any person who utilizes his or her ability to think critically: one who observes nature, acquires evidence, determines the validity of that evidence based on a thorough reasoning process, and enhances or adjusts one's views based on the new information.

Evolution is one of the most contentious issues in biology, not necessarily because people question its validity, but because of its implications about the status of humans in the universe. One method of studying biology, the systems view, accepts evolution as a fact but suggests that evolution does not demean or lessen what it means to be human. Under the systems view, the universe is a supra-system composed of sub-systems: Earth is comprised of ecosystems, which consist of organized populations and species, which can be broken down in to individual organisms, which themselves can be considered systems of organs, tissues, molecules, and atoms. Thus systems biologists see humans both as integrated sets of smaller systems and as essential parts of the larger system of nature.

You will analyze several passages taken from *The Systems View of the World: a Holistic Vision for Our Time*, a recent book by systems biologist Ervin Laszlo. I have ordered the passages such that first several focus on introductory topics, and progressively lead to describing the systems view of evolution and humans. Following each passage is a question to which you should write a comprehensive response. (More detail about what I expect is provided in each question). You may either hand-write or type your answers. In either case, answers should be well-written and thorough. I will base your grade on both content and writing quality.

I do not ask that you accept the systems view of the world (in fact, you will have an opportunity to argue against it if so desired), but that you carefully consider any theory that is logically presented before determining your worldview. Thus, in grading the "opinion"-style questions, I will NOT grade based on whether or not I agree with you, but rather, on whether you provide good evidence and arguments to support your conclusions.

1. Scientific study is often specialized. For example, many genetics labs study only one function of one gene in one type of organism. Laszlo writes,

“The unfortunate consequence of such specialty is that knowledge, instead of being pursued in depth and integrated in breadth, is pursued in depth in isolation. [...] The specialists concentrate on detail and disregard the wider structure which gives it context. The systems scientists, on the other hand, concentrate on structure on all levels of magnitude and complexity, and fit detail into its general framework. They discern relationships and situations, not atomistic facts and events. By this method they can understand a lot more about a great many more things than the rigorous specialists.”

What does he mean by this? What value do you think there might be in specialization? How might scientists keep the value that specialization offers without losing sight of the “big picture?”

2. Laszlo says,

“When the classical worldview was applied to medical science, the human body appeared to be a machine frequently in need of repair by factual and impersonal interventions and treatments. The problems of the mind were seen to be separable from those of the body and hence to be separately treated. When the systems view is the basis of a diagnosis the body is seen as a system of interacting parts, and body and mind are not separable. It is the health of the whole system that is to be maintained by attention to psychic and interpersonal as much as to physical and physiological factors.”

In the above paragraph, Laszlo suggests that modern medicine views the body as a machine consisting of un-integrated parts that need to be treated separately. Describe a case (illness, injury, etc.) in which treating only one part of the patient would be appropriate. Then describe another case (illness, injury, etc.) in which multiple parts of the patient might be affected. Also describe a mental health condition that might be caused or exacerbated by a physical illness. How might a systems doctor treat such a patient?

3. In the following paragraph, Laszlo discusses the progression of scientific thought.

“Early scientific thinking was holistic but speculative; the modern scientific temper reacted by being empirical but atomistic. Neither is free from error, the former because it replaces factual inquiry with faith and insight, and the latter because it sacrifices coherence at the altar of facticity.”

What does Laszlo see as the problem with early scientific thought? What does he see as the problem with much modern scientific thought? Do you think systems biology offers a solution to any of these problems? Explain.

4. Laszlo expresses his view of a master plan as follows:

“If this rather abstract scenario is a good analogue of evolution in the real world, we get meaningful answers to our question concerning the existence of a master plan in nature. If by such a plan one means something pre-established and realized by purposive manipulation, then the answer is that contemporary sciences does not know—and does not *want* to know—anything about it. But if by plan one means a recognizable pattern of development, then the answer is definitely *yes*. That things develop the way they do rather than in some entirely different way is, within limits, perfectly logical and foreseeable. Among these foreseeable characteristics of development are increasing coordination of formerly relatively isolated entities, the emergence of more general patterns of order, the consolidation of individuals in super-ordinate organizations, and the progressive refinement of certain types of functions and responses.”

Relate the first part of his paragraph to religious views of human origins, such as creationism or intelligent design. What is meant by “purposive manipulation?” Laszlo identifies several developmental patterns. Choose two such characteristics and provide an example of each occurring in nature.

5. The systems view of biology distinguishes between an overall deterministic outcome and the variable means by which such an outcome can be achieved.

“Thus there is a plan, but it is not a pre-established one. It sets forth the guidelines and lets chance play the role of selector of alternative pathways for its realization. There is purpose without slavery, and freedom without anarchy. [...]

There is freedom in choosing one’s paths of progress, yet this freedom is bounded by the limits of compatibility with the dynamic structure of the whole in which one finds oneself. [...]

In the world of organized complexity the arrow of time does not determine which pathway is taken by individual systems, only in what direction their paths converge. [...]

The functional autonomy of parts within a natural system adds up to the macro-determination of the whole.”

Describe a scientific example in which multiple pathways can lead to the same end. Is your understanding of human freedom, free will, or choice compatible with the idea that freedom is constrained by natural laws?

6. Laszlo contrasts guided goals with outcomes.

“Complexity of structure or function is not a *goal* of evolution; it is a *result* of it. There is no goal (or we know of none in the contemporary sciences), but there is a pattern all the same: the pattern of self-creating natural systems in interaction.”

Differentiate between a goal and a result. Do you think either (or both) imply a goal-maker? Explain.

7. Read the following sentence.

“As you cannot uncook a half-cooked egg, so you cannot unlearn a half-acquired truth.”

Among other things, I believe that Laszlo is indicating that upon making a new observation, one must either integrate that knowledge into one's accepted worldview, or one must modify one's worldview. But sometimes, people do neither. They may hold contradictory views, attempting to ignore that their treatment of the new fact is not consistent with their prior knowledge. Can you think of any examples of a person who believes in creationism or intelligent design ignoring evidence of evolution? Can you think of any examples of a person who believes in evolution ignoring evidence of creationism or intelligent design? What do you think about the quality of evidence for creationism or intelligent design as opposed to the quality of evidence for evolution?

8. In the following sentences, Laszlo briefly discusses the systems view on human origins.

“...the human being did not enter on the scene by a special act of creation but has always been part of this universe. Not as a human, of course, but as phenomena which harbored the potentials for becoming human.”

In this theory, from where did humans originate? Does the religious perspective offer an explanation as to the origins of the materials of which humans are composed?

9. In the following paragraph, Laszlo offers an answer to those who believe evolution reduces one's humanity.

“The systems view of the world is non-anthropocentric, but it is not non-humanistic for all that. It allows us to understand that we are one species of systems in a complex and embracing holarchy of nature, and at the same time it tells us that all systems have value and intrinsic worth. They are goal-oriented, self-maintaining, and self-creating expressions of nature's penchant for order and balance. The status of the human being is not lessened by admitting the amoeba as his kin, nor by recognizing that socio-cultural systems are his supra-systems. Seeing ourselves as a connecting link in a complex natural holarchy cancels our anthropocentrism, but seeing the holarchy itself as an expression of self-ordering and self-creating nature bolsters our self-esteem and encourages our humanism.”

Summarize the systems view of humans and what it means to be human. Do you agree with this assessment? Why or why not?