Waldorf Biology in a Reductionist Setting[1]

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Most biology teaching in the United States today is based on a reductive-analytic approach to the life sciences. As one well-respected biology textbook says in its introductory chapter (Raven et al. 2016):

> *Scientists often use the philosophical approach of* reductionism *to understand a complex system by reducing it to its working parts. Reductionism has been the general approach of biochemistry, which has been enormously successful at unraveling the complexity of cellular metabolism by concentrating on individual pathways and specific enzymes. By analyzing all of the pathways and their components, scientists now have an overall picture of the metabolism of cells.*

After breaking down the organism into its smallest entities, the many functions of biological systems are seen as

> *both determined and constrained by the principles of chemistry and physics. … Every level of biological organization is governed by the nature of energy transactions learned from the study of thermodynamics*. (p. 7)

Raven et al. conclude their introductory chapter on "The Science of Biology" with the following statement:

> *Biology as a science is broad and complex, but some unifying themes help to organize this complexity. Cells are the basic unit of life, and they are information-processing machines.* (p. 14)

This introduction is followed by a chapter on "The Nature of Molecules" and one on "The Chemical Building Blocks of Life." The textbook then devotes 335 pages to the biology of the cell and its genetic and molecular manifestations. All of this before the themes of evolution, plants and animals and, lastly, ecology are considered. Such an organizational sequence and emphasis in a modern textbook on biology will surprise no one who has taken such a course in the last 50 years. This is the way that students in high schools and universities across the country are introduced to this field of study. The reductionist approach maintains that the parts are not only prior to the whole, but are, lastly, more real. Any form of integrative, holistic thinking is given, at best, secondary status. This fragmentary view extends far beyond biology textbooks. It is deeply rooted in the habits and attitudes of the modern science in general. As the distinguished physicist David Bohm put it:

> *Of course, the prevailing tendency in science … tends very strongly to re-enforce the general fragmenting approach because it gives men a picture of the whole world as constituted of nothing but an aggregate of separately existent atomic building blocks, and provides experimental evidence from which is drawn the conclusion that this view is necessary and inevitable. In this way, people are led to feel that fragmentation is nothing but an expression of "the way everything really is" and that anything else is impossible. So there is very little disposition to look for evidence to the contrary. … Even when such evidence does arise… the general tendency is to minimize its significance or even to ignore it altogether.* (1981, p. 15)

Although such a reductionist view of the world has proven very effective at certain levels of existence, if taken seriously as the primary basis for viewing all existence, it leads to a picture of nature that is—in the words of the eminent philosopher and mathematician Alfred North Whitehead—"a dull affair, soundless, scentless, colorless, merely the hurrying of material, endlessly, meaninglessly" (1969, p. 54).

Whitehead also points to another kind of conclusion that can follow from the reductionist understanding of the laws of nature.[2]

> *The human body is a collection of molecules. Therefore, the human body blindly runs, and therefore there can be no individual responsibility for the actions of the body. If you once accept that the molecule is definitely determined to be what it is, independently of any determination by reason of the total organism of the body, and if you further admit that the blind run is settled by the general mechanical laws, there can be no escape from this conclusion.* (p. 78)

1 This excerpt is taken from Michael Holdrege's recently published book, *From Mechanism to Organism: Enlivening the Study of Human Biology* (Waldorf Publication, 2022), where it appears under the heading "Intermezzo." We are grateful to the author for his permission to reprint the excerpt here.

2 Whitehead is not saying that the above description represents his own view of the relationship between mind and body.

If we continue in this vein and take one of the fathers of modern genetics, Francis Crick, seriously, then when we are speaking of the human being we assume a complex system that is explained by the behavior of its parts (which, in turn, have to be explained by the properties of the "parts of those parts" and how they interact). To understand the brain, for example, we need to know not only the interaction of the neurons themselves, but these also need to be explained in terms of the ions and molecules of which they are composed. If we see this as a sufficient means for understanding the brain then we must agree with Crick that we are "*nothing but a pack of neurons*." In other words, our joys and sorrows, our sense of personal identity, our memories and ambitions are "in fact, no more than the behavior of a vast assembly of nerve cells and their associated molecules"[3] (1994, p. 3).

Seen from a pedagogical perspective, such a view—if taken seriously by students at the high school or university level—can lead to the conclusion that life is, in fact, meaningless. The obvious question for them becomes "What's the point in this life we live, if reality is only matter in motion?"

And even if they do not think things through to this ultimate conclusion, their picture of nature remains one of a lifeless interaction at the level of molecules. This has consequences for the way we relate to the world around us. In his thought-provoking article, "Beyond the Mechanistic World View," Douglas Sloan describes how the mechanistic picture of the natural world,

> *by removing the holistic view of a meaningful and valuable picture of nature has led to a relentless dismantling of nature… the view of nature as nothing but matter in motion also supports the exploitation and misuse of the earth through an unrestrained economism… The costs to the earth are now painfully apparent. The destruction of forests; the degrading of arable land; the pollution of lakes; the mass extinction of living species. … As long as nature is regarded as having no qualities—no inner life, no meaning, no living wholeness—taking it apart for our own immediate pleasure and economic advantage is obviously that much easier to justify.* (2018, p. 14)

Sloan goes on to describe the tragic consequences that this mindset leads to in the widely prevalent factory farming of animals, where the suffering of animals—above all cows, pigs and poultry—is almost never addressed.

> *Daily our culture inflicts cruelty and suffering on millions of animals of an intensity hitherto unknown. The animals are defined as "units of production" and are treated accordingly as useful pieces of machinery without feelings. Their entire lives are unrelieved wretchedness. A pall of suffering of living, feeling creatures hangs over our modern culture, and most of us are complicit in it, if only through willful ignorance of what is taking place. … The withholding of mercy to these fellow creatures bespeaks an appalling failure of imagination in thinking, a lack of empathy in feeling, and a weakness in moral willing.* (p. 15)

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Of course, the reductionist, mechanistic approach is only one possible way to investigate nature. The poignant question is whether this way of viewing nature suffices for grasping all levels of existence—or does it, already from the outset, exclude certain aspects of nature that are actually characteristic of living organisms. Might it be that this approach is not completely false, but just extremely one-sided and thus unable to think outside its own self-created box, which makes it incapable of recognizing different levels of existence, such as plant, animal, and human?

The eminent psychiatrist, Viktor Frankl, characterized this reduction of phenomena to what only fits into the narrow lens of the specialist as "*nothing-but-ness.*" Thus, for Francis Crick humans are—as cited earlier—"nothing but" a pack of neurons. Through limited perspectives such as this, as Frankl put it: "Human phenomena are thus turned into mere epiphenomena" (1969, p. 398).

E.F. Schumacher provides an original and insightful analysis of such issues in his book, *A Guide for the Perplexed* (1977, p. 17), where he speaks of the inability of reductionist approaches to distinguish between what he calls

3 That such a description undermines itself has been pointed out by numerous more reflective, philosophically-schooled individuals. In the words of Douglas Sloan (2018): "The paradox in such writing lies in the fact that the ideas, values, and positions advanced by these scientists and thinkers must also be regarded as 'electrochemical brain processes,' thereby losing any qualitative advantage over other ideas, values, and position, all reduced to the same level of electrochemical mechanism. Either these thinkers are making exceptions for their own ideas or they are unaware of the implications of the mechanistic view so deeply ingrained in the modern scientific mind" (p. 10). [See also Douglas Sloan's "Brief Reflections on Waldorf Education," later in this volume.]

"ontological discontinuities" or "jumps in the Level of Being"—such as the fundamental difference between a stone, a plant, and an animal. From a rigid reductionist perspective—he humorously observes—a dog could be defined as a "barking plant" or as a "running cabbage." As farfetched as this may sound, it is common in the realm of human biology, for example, to simply refer to the heart as "nothing but" a pressure-propulsion pump.

One attempt to deal with the challenge of "ontological discontinuities" can be found in the concept of "emergence," which points to the limitations of exclusively reductionist explanations when it comes to higher levels of complexity in nature. In the periodical, *Horizons,* published by the Swiss National Science Foundation, we find the following description of "emergence":

> *Emergence is one of the most puzzling but fundamental phenomena of the universe: the appearance of new characteristics at each higher level of complexity which cannot be predicted from the previous level. An example: The characteristics of life cannot be deduced from lifeless matter. However far we pursue research in physics and chemistry, this route will never enable us to predict the specific behavior of living organisms. It appears to be a generally valid principle that the (complex) whole cannot be traced back to its (simple) parts. This includes all stages of increasing complexity. At the level of the atom: Observing hydrogen and oxygen atoms in isolation gives no clue to the characteristics of a water molecule. Or, at the end of the scale: The characteristics of consciousness do not result from the extrapolation of behavior.* (Kiefer 2007)

Teaching the life sciences in a Waldorf high school includes an awareness that questions around reductionism, "nothing-but-ness," ontological discontinuities, etc., are not trivial. Fortunately, a great deal of significant research from a holistic/phenomenological perspective has been done in the life sciences over the past century. These efforts provide Waldorf science teachers with many new and exciting vantage points to draw upon as they try to nourish the "emerging capacities" of their students moving through the four years of high school. Many of these resources will be referred to in what follows, because they provide a means for fostering new kinds of thinking in our students, thinking that allows them to move beyond mere "nothing-but-ness" and linear causality into a more dynamic and multifaceted understanding of the nature of nature.

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