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Molecular Biology as a Potential Means to Undermine the Naturalistic Worldview in Science

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<한글요약>

생명현상에 대한 분자수준에서의 이해를 추구하는 분자생물학은 지난 반세기동안 주로 환원주의, 결정론, 그리고 진화론과 같은 자연주의적 세계관을 통해서만 주로 해석되어 왔다. 그 결과 분자생물학의 연구 결과들은 무신론적인 자연주의적 세계관을 공고히 하는 증거로 이용되어 왔으며 기독교 세계관과 갈등 관계에 있게 되었다. 하지만 최근 분자생물학에서 축적된 여러 연구 결과들은 자연주의적 세계관을 지지하는데 한계를 보여주고 있으며 도리어 유신론적 과학의 관점을 통해 새롭게 재해석 되어야 할 많은 영역들을 제시하고 있다. 따라서 최근의 비약적인 분자생물학의 발전은 기독교 세계관의 관점에서 볼 때 과학에서 팽배한 자연주의적 세계관의 토대를 약화시킬 수 있는 가능성을 보여주고 있으며 과학과 신학의 통합을 위한 새로운 기회들을 제공하고 있다.

Key words : molecular biology, naturalistic worldview, Christian worldview, natural theology, reductionism, determinism, evolutionism, teleology, intelligent design

I. Introduction

1. Molecular Biology and Its Capability in the Formation of the Contemporary Worldview

Molecular biology is the area of science dealing with the structural and functional characteristics of biological systems.Kimberly A. Mcgrath and Robyn V. Young, World of Biology (Farmington Hill, MI: The Gale Group, 1999), 518-519.

More specifically, it tries to clarify the biological phenomena in terms of the function of molecules within a living organism. This methodological development extended the horizons of biological science from the macroscopic level to microscopic one. So nearly every branch of life science has been affected by molecular biology. Broadly speaking, it is no exaggeration to say that almost all of the modern biological pursuits are inevitably related to molecular biological approaches. There is certainly a prevailing tendency for modern biologists to explain the biological phenomena through the action of biomolecules such as DNA, RNA and protein. In recent years, it has been uncommon to do biological research without explaining the molecular mechanism.

The advancement of modern molecular biology has revolutionized the diverse aspect of human life. Its development has considerably broadened our understanding about the living world from the microscopic level. In particular, this comprehensive understanding has been directly applied to the improvement of human health and welfare. We can say that the success of modern molecular biology has given a tremendous impact on our contemporary society. Furthermore, molecular biology has opened up a new perception, especially with regard to our comprehension of the "essence" of living organisms and human beings. From the molecular biological point of view, all phenomena occurring in living organismscan be explained by means of biomolecules, even if they are complicated mental functions such as

memory and violent behavior. In addition, the success of molecular biology, in the development of new drugs and for the cure of many intractable diseases, has contributed to the emergence of molecule-centered thought on the understanding of "life" and "human beings."

In the meantime, the general public has become more and more aware of the authority of molecular biology in the practical issues closely related with human well-being. As a matter of fact, molecular biology is not just the neutral mediator of detailed knowledge about the plants, animals, microorganisms, and human beings.

Richard T. Wright, Biology through the Eyes of Faith (San Francisco: Harper Collin Publishers, 1989), 42. It is now actively related with the development of a modern view on the fundamental nature of "life" and "human beings." Therefore, it can be said that molecular biology is one of the crucial factors in the formation of the contemporary worldview.

2. Molecular Biology and the Naturalistic Worldview

Ever since the controversy over the theory of evolution that began in the nineteenth century, biology has been regarded as one of the most hostile areas of science to the Christian faith.

Nancy R. Pearcy and Charles B. Thaxton, The Soul of Science: Christian Faith and Natural Philosophy (Wheaton: Crossway Book, 1994), 99. This trend is not an exception in the case of molecular biology. As the influence of molecular approaches becomes more and more pervasive in biology and science, theruling contemporary paradigm permeated in molecular biology has the absolute power in the formation of our basic conception regarding the essence of life and human beings. Generally speaking, the naturalistic worldview has governed the spirit of molecular biology from its birth. Actually, naturalistic presuppositions are the starting point for most scientists to discover new facts in science.

Naturalism provides a framework for most modern scientific inquiry.

It has the premise that naturalistic explanations are the way to know the final cause and object of the world. James Sire, The Universe Next Door: A Basic Worldview Catalog (Downers Grove: InterVarsity Press, 1997), 54-58. Ultimate reality is matter in this view. It designates the purpose and the value of nature as a "nothing," and sanctions the autonomy of the world including living things. Wright, 61. In the naturalistic context, there is littlefoundation for the meaning of life. Life, even human beings are just regarded as complex machines.

It is a widely accepted thought that the naturalistic worldview has been also validated by molecular biology. As molecular biology has been built up on the basis of naturalism, it has been used to solidify the naturalistic worldview in science. Consequently, naturalistic worldviews have culminated in the basic philosophy of molecular biology.

3. Molecular Biology and the Christian Worldview

It seems that molecular biology itself does not have any room for biblical implications because it has been severely affected by naturalistic worldviews. However,in reality, it has a great potentiality for theistic science. It is an open question that molecular biology can only be illuminated from the standpoint of naturalisticworldviews. As it was mentioned before, the molecular revolution in biological science has uncovered a fabulous complexity of living systems. From a biblical point of view, the facts found in molecular biological research are revealing the marvelously sophisticated entity of living organisms from the microscopic level. Therefore, the results of this research are inevitable reflection of God's purposeful and providential plans toward living creatures in molecular dimensions. Molecular biology is a human attempt to disclose the molecularblueprint of the Creator's activity veiled within living things. In this regard, it is necessary to reassess the recent advance of molecular biology in the light of a Christian worldview.

Recently, the proponents of "intelligent design theory"have argued

that the sophisticated structures and the specified information found in living organism cannot have evolved through naturalistic process. William A. Dembski, Intelligent Design: The Bridge Between Science and Theology (Downers Grove, InterVarsity Press, 1999).

In addition, they proposed the scientific models that can explain the origin of biologically complicated systems by design. Actually, much of the evidence in "intelligent design theory" is on the basis of information discovered by molecular biological research. This theory attempts to reinterpret modern molecular biology from the non-naturalistic perspective.

In this regard, this assay will discuss the potentiality of modern molecular biology as a means to weaken the naturalistic worldview in natural science. The main focus of this essay is that molecular biology is now providing a new perspective, which undermines the foundation of the naturalistic worldview severely embedded in science.

II. Molecular Biology as a Means to Solidity the Naturalistic Worldview in Science

In this section, this essay will survey the basic worldviews pervasive in modern molecular biology with intent to disclose the significant influences of naturalistic thought on it. The point of this section is that molecular biology has been mostly used as a means to solidify the naturalistic worldview in science. Its major contribution to the reductionistic, deterministic, evolutionary idea will be discussed in this chapter.

1. Molecular Biology and Biological Reductionism

Ever since the birth of molecular biology, molecular biologists have been captured by the reductionistic idea on life. For instance, Francis Crick, one of the pioneers of molecular biology, asserted that the ultimate goal of the

molecular approach in biology is to explain all biological phenomena in terms of physics and chemistry. Francis Hampton. C. Crick, Of Molecules and Man (Seattle: University of Washington Press, 1966), 10.

Correspondingly, the ethos of molecular biology has been severely affected by the thought of biological reductionists.

Reductionistic molecular biology has opened new horizons in explaining the molecular basis of complicated phenomena, like human diseases. To illustrate, the cause of some cancers and genetic disorders has been adequately explained by adopting the reductionistic methods to the action of genes. In this manner, most of human diseases are now being elucidated. Even though molecular biology has contributed greatly to an understanding of the molecular basis of life, the reductionistic tendency in it brought about the dangerous idea that living organisms are just molecules and atoms. The "methodological reductionism" pervasive in molecular biology has expanded its realm to the metaphysical aspect of life. According to Arthur Peacocke, the success of "methodological reductionism" in biology laid the foundation of "ontological reductionism," in which complex wholes of biological organisms are nothing but the sum of their component portions. Arthur Peacocke, God and the New Biology (London and Melbourne: J. M. Dent & Sons Ltd, 1986), 6-12.In this view, life can be easily regarded as an outcome of natural development processes through the interactions of molecules. In summary, reductionism, which originated from physical sciences, has also been validated by the success of molecular biology. Naturalistic implications of reductionism can easily penetrate to science under the influence of molecular biology.

2. Molecular Biology and Genetic Determinism

Genetic determinism is the thought that biological phenomena, including human behavior, are essentially decided by the function of genes. Recent developments in molecular biology, particularly concerning the structure and function of genes, have led to a proposition that genetic

mechanisms can explain the diverse aspects of human beings, even the complicated mental behavior. The advancement of molecular biology has also enormously accelerated the discovery of new genes that might be connected with incurable diseases or human mental behaviors.

As a result, the general public has become more and more aware of the role of genes in determining human diseases. Tobe sure, the completion of the Human Genome Project (HGP) has played a crucial role in propagating the idea of genetic determinism in the public mind. Frank Gannon, "Genocentric Promises," EMBO Reports 2 (2000): 91.

It is also worth pointing out that genetic determinism has broadened the domain of its influence into the area of human behavior and destiny. James D. Watson, who discovered the double-helical structure of DNA with Francis H. Crick, once claimed " In large measure, our fate is in our genes." James D Watson, " The Gene Hunt," Time (March 20, 1989): 62-67. According to his statement, our genes determine even our happiness and welfare. Dean H. Hamer, "The Heritability of Happiness," Nature Genetics 14(1996), 125-126.

This idea will eventually justify the modification of one's genes to change one's future.

Thus, genetic determinism is fundamentally based on the naturalistic worldview claims that matters are the final cause and purpose. From the biblical point of view, however, these extreme applications of deterministic thought to human actions are denial of the "image of God"given to every person. Genesis 1:26, 2:7.Therefore, the naturalistic worldview manifests in the genetic determinism that has been also supported by the development of molecular biology.

3. Molecular Biology and Evolutionary Thought

From the second half of the twentieth century, molecular biology has revolutionized the understanding of genetic theory on the complicated

phenomena found in living organisms. In particular, molecular biology has disclosed the genetic codes, which are substantially identical in all organisms, which seemed for evolutionists to open the possibility for unveiling the origin of life from the molecular level. Richard T. Wright, Biology through the Eyes of Faith (San Francisco: Harper Collin Publishers, 1989), 122.

Correspondingly, molecular change in genetic information can be used as potent evidence for evolution without difficulty. Particularly, DNA mutations are regarded as the source of evolution. Moreover, "the selfish gene theory", presented by British evolutionist Richard Dawkins, insists that organic evolution occurs through the action of "selfish genes" struggling to be inherited in populations by natural selection. Richard Dawkins, The Selfish Gene (London: Oxford University Press, 1976).

Darwinian evolutionism based on atheistic materialism has been using the information of contemporary molecular biology to strengthen its naturalistic worldview. This trend is also derived from the fact that the evolutionary paradigm is thoroughly embedded in modern biological pursuits.

For above-mentioned reasons, it can be concluded that molecular biology has significantly contributed to the reinforcement of the naturalistic worldview in contemporary science and culture through reductionistic, deterministic, eugenic, and evolutionary thought. As a result, molecular biology has been seemed to be in conflict with a Christian worldview because of its atheistic implications mainly originated from the naturalistic worldview.

III. Molecular Biology as a Potential Means to Undermine the Naturalistic Worldview in Science

As mentioned, the new understanding of the molecular phenomena of living organisms has been commonly used as a potent means to strengthen the naturalistic worldview in science. From a biblical point of view, however,

there is much evidence for disproving the naturalistic ideas concerning the essence of life and human beings in the field of molecular biology. The ordered complexity found in the molecular aspects of life is not a product of naturalistic processes including chance and time. Increasingly, molecular biology itself has a great possibility of dethroning the naturalistic worldview in science.

In this regard, this chapter deals with the limitations of the naturalistic worldview in interpreting new evidences found in modern molecular biology. These limitations will be discussed in a detailed way with reference to specificity of genetic information, inconsistency between gene and morphology, discontinuity of molecular data, complexity of molecular machinery of cells, and discrepancy between gene and phenotype.

1. Specificity of Genetic Information

In fact, there has scarcely been a more significant breakthrough in the entire history of biology than the discovery of the structure of DNA in 1953.Ernst Mayr, The Growth of Biological Thought (Cambridge: Harvard University Press, 1982), 825.

It was discovered that DNA chemical sequences define information for amino acids to produce specific protein. James D Wason, Gilman M, Witkowski J, and Mark Zoller, Recombinant DNA (New York: Scientific American Books, 1992), 32-35.

Even though the chemical sequence of DNA has inner informational meanings as well as outer material features, the universality of chemical-based genetic codes from bacteria to human beings has been used as strong evidence for the natural development of living organisms from the same origin. For instance, evolutionary biologist Richard Dawkins resolutely claimed that the finding of DNA structure and its chemical codes decisively blow out the belief

that living cells are essentially different from non-living materials. Richard Dawkins, River out of Eden (New York: Basic Books, 1995), 17.

For this reason, chemical evolutionary ideas on the origin of the specified genetic information have been dominated in the research of molecular biology without thoughtful consideration.

However, the explanation of DNA's information-conveying characteristics, owing to the development of molecular biology, has brought up the question of the ultimate origin of this information. William A. Dembski and James M. Kushiner, Signs of Intelligence (Grand Rapids: Brazos Press, 2001), 107-108.

In fact, naturalistic approaches have a definite limitation in interpreting the origin of specific genetic information. In order words, "the problem of origin of life is clearly basically equivalent to the problem of the origin of biological information."Ibid., 108.

This kind of question has also been raised in the camp of evolutionary molecular biologists, even if they might have a naturalistic worldview. To illustrate, George Williams, an influential evolutionary biologist, unexpectedly proposed an idea that life is carrying the immaterial component called "information." Phillips E. Johnson, Defeating Darwinism by Opening Minds (Downers Grove: InterVarsity Press, 1997), 79.

Evolutionary biologists have failed to realize that work with two more or less incommensurable domains: that of information and that of matter These two domains can never be brought together in any kind of the sense usually implied by the term "reductionism." The gene is a package of information, not an object. The pattern of base pairs in a DNA molecule specifies gene. But the DNA molecule is the medium. It is not the "message." Maintaining this distinction between the medium and the message is absolutely indispensable to clarify of thought aboutevolution In biology, when you're talking about things like genes and genotypes, and gene pools, you're talking about information, not

physical objective reality. John Brockman, The Third Culture (New York: Simon & Schuster, 1995), 42-43.

In this respect, it is quite reasonable to differentiate between the informative property and the material character of DNA. William Dembski, who is a mathematician,philosopher and one of the most active proponents of "intelligent design theory", conceptualized the notion of "complex and specified information(CSI)" found in DNA chemical sequences. William A. Dembski, Intelligent Design : The Bridge Between Science and Theology (Downers Grove, InterVarsity Press, 1999), 153-183

CSI means that genetic information not only has complex structures, but also has specified data. The sensible arrangement of nucleotides of DNA is required for the synthesis of proteins. Thus, genetic codes should be arrayed according to meaningful sequences in order to make functional proteins. Dembski also points out, "the great myth of the modern evolutionary biologist is that information can be gotten on the cheap without recourse to intelligence." Ibid., 153.

Of course, scientific naturalists may argue that there is huge evidence for a naturalistic origin of genetic information. For example, most of the DNA sequences on genome seem to be plainly repetitive and redundant. Moreover, these DNAs are currently not functioning even if they have similar information for protein synthesis. As a result, most parts of DNA sequences of chromosomes have been widely regarded as the vestige of natural evolutionary process. Thus, until recently, some molecular biologists roughly designated these nonfunctional or non-coding DNA portions as "junk DNA".More accurately, from the teleological point of view, junk DNA is a genomic DNA which function is not elucidated yet.

Intervening sequences between coding DNA regions are typical example of junk DNA.

But rapid advancement in molecular biologyhas been uncovering the

specified functionsof these junk DNAs. Now, it is becoming more and more evident that junk DNA sequences paradoxically playan important role in diversifying genetic information in combinationwith coding regions. Jerry Bergman, "The Functions of Introns: From Junk DNA to Designed DNA," Perspectives on Science and Christian Faith 53(2001), 170-177

Recent studies also indicate that non-coding genetic information has a far more plentiful and crucial role than initially presupposed. For example, non-coding RNAs have been found to have various roles such as transcriptional regulation, chromosome replication, RNA process and modification, and even protein degradation and translocation.

Gisela Storz, "An Expanding Universe of Noncoding RNAs," Science 296(2002), 1260-1263 ; Tamas Kiss, "Small Nuclear RNA: and abundant group of noncoding RNAs with diverse cellular function," Cell 109(2002), 145-148. These findings also raise the fundamental question: How is non-coding genetic information originally generated by natural process?

On the surface, complex genetic information has seemed to has evolved through natural process, but in reality, the intelligent language written in a DNA code is not identical with simple chemical matter.A superficial understanding has dominated the discussion on the origin and the meaning of genetic information from the standpoint of naturalistic worldview. Instead, a deep understanding on the basis of modern molecular biology requires an alternative perspective to naturalistic interpretation concerning the significance of genetic information.

For above-mentioned reasons, the more we know about the genetic functions using molecular biological studies, the less we can rely on the naturalistic worldview on the origin of life and genetic information. In fact, the elucidation of genetic information residing in chemical sequences of DNA is the starting point of molecular biological research. Consequently, molecular biology itself has a great potentiality to weaken the foundation of the naturalistic paradigm in science.

2. Inconsistency Between Gene and Morphology

1. Introduction "Homology" is the biological terms, which defines the similarity of characteristics found in living creatures. Neil A. Campbell, Jane B Reece and Lawrence G. Mitchell, Biology (Melno Park: The Benjamin/Cummings Publishing Company, 1996), 472.

Historically, homology has been defined morphologically and regarded as a result from an ideal prototype before the nineteenth century. Pre-Darwinian biologists considered homologous structures as a derivation from a common "archetype", implying a purposeful plan of the Creator. But, in the middle of the nineteenth century, Darwin thought that the best explanation for homology is that it results from common ancestry, not a manifestation from an original archetype. In the *Origin Of Species*, Darwin regarded homology as important evidence for evolution. Steve Jones, Darwin's Ghost : The Origin of Species Updated (New York: Random House, 2000), 154.

He conceptualized the evolutionary thought through the idea of "descent with modification." From that time on, as far as homology is concerned, all of the modern biologists have thought about it through the eyes of the naturalistic evolutionary worldview.

In a neo-Darwinian view of homology, homologous features are supposed tobe programmed by similar genes. In fact, most defenders of evolution became aware that the lack of understanding of the genetic mechanisms was the critical weak point of Darwinian theory.Issac Asimov, A Short History of Biology (New York: The Natural History Press, 1964), 73.In this context, modern molecular evolutionary biologists have been trying to elucidate the intricate mechanisms of homology from its genotype to its phenotype.

On the contrary, however, it is a more and more evident fact in molecular evolutionary biology that homologous structures are not determined by identical genes.

Gregory A. Wary and Ehab Abouhief, "When is homology is not

homology?," Current Opinion in Genetics and Developmental Biology 8, (1998): 675-680. Evolutionary biologist Gregory A. Wary says, "Many cases of evolutionary dissociations between homologous genes and homologous morphological features are now common."Ibid., 675.

Homologous structures found among several organisms are not necessarily formed by identical genesof each organism. Moreover, outward features controlled by the identical genes are not always homologous. In other words, non-homologous structures can be developed from identical genes. Neil Sabin, Clif Tabin and Sean Carroll, "Fossils, genes and the evolution of animal limbs," Nature 388 (1997) : 639-648.

One of the greatest unsolved questions in evolutionary and developmental biology is how cells can make different types of structures with identical genes. Scott F. Gilbert, Developmental Biology (Sunderland, Massachusetts: Sinauer Associates Publishers, 1996), 911.

From a biblical point of view, the evolutionary concept of homology has been validated not by scientific evidence, but by the naturalistic worldview infiltrated in biology and natural science. A paradigm shift of the concept of homology may be a starting point to undermine the foundations of naturalism in molecular biology. Phillip E. Johnson, The Wedge of Truth (Downers Grove: InterVarsiy Press, 2000), 13-18.

The naturalistic paradigm of evolution is now confronted with a critical situation to keep pace with the new discoveries of modern molecular biology. It is now evident that modern molecular biology has failed to verify the relationship between homologous structures and evolutionary processes called "descent with modification."

3. Discontinuity Shown in Molecular Evolutionary Study

_Most of the discoveries in the area of molecular biology have been naturally utilized to explain the continuous evolution of living organisms, since

naturalistic Darwinian evolutionism has been the ruling paradigm in biology. In this situation, "molecular evolution" has been developed in the realm of evolutionary biology. In the mid-1960s, Linus C. Pauling and Emile Zuckerkandl of California Institute of Technology introduced the term of "molecular evolution." They proposed the idea of "molecular evolutionary clock theory"on the basis of molecular data from several proteins. This theory can be defined as the hypothesis that the amino acid sequence of a specific protein carries variations with regard to time. Gordon C. Mills, "Molecular Evolutionary Clock: A Critique," Perspective on Science and Christian Faith 46(September 1994): 159.

In other words, the rate of mutations is accumulated in DNA or protein sequence and this data are used as a molecular clock to measure the evolutionary changes proportional to time. Thus, the evolutionary relationships among different species can be determined by comparing the sequences of a specific protein derived from each organism. Ever since the emergence of a new approach in molecular biology, evolutionary biologists have attempted to find a more efficient biomolecule than protein as a molecular clock. They have also tried to elucidate the evolutionary history from the origin of life and the phylogeny of living organisms, which is almost impossible in the study of paleontology.

For the last ten years, the most commonly used molecular clock is ribosomal RNA (rRNA). According to rRNA information, all living organisms on earth are classified into three groups: bacteria, archaea, andeucaryote. For the two decades, molecular studies using rRNA information have been the standard methods in evolutionary biology of plants and animals as well as microorganisms. Moreover, most biology textbooks have introduced the new "Tree's of Life" based on rRNA information. Laura Maley and Charles Marshall, "The Coming of Age of Molecular Systematics," Science, 279(1998), pp.505-506.

Accordingly, most evolutionary biologists began to anticipate that molecular evolutionary study could uncover the early evolutionary processes

on the origin of life veiled for more than a century since Darwin.

However, contrary to the expectations of evolutionary biologists, recent results in molecular evolution have failed to verify the continuous development of living organisms. Instead, some evolutionary biologists insist that a continuous phylogenetic tree of life has to be modified to reflect new data accumulated in this area. Harve Philippe and Patrick Forterre, "The rooting of the universal tree of life is not reliable," Journal of Molecular Evolution 49(1999): 509-523.

Actually, evolutionary biologists have tried to find a more efficientmolecular clock than rRNA. As a result, several phylogenetic trees have been drawn from various molecular clocks. Ideally, it is expected that phylogenetic trees have to show a similar pattern regardless of their molecular clocks. Nevertheless, there was no significant correlationamong several molecular phylogenetic trees derived from different molecular clocks. In particular, disagreements among phylogenetic trees became more and more evident in molecular evolution with the explosive accumulation of molecular data by genome projects. Elizabeth Pennisi, "Genome Data Shake Tree of Life," Science 280(1998): 672-674.

Thus, in recent days, molecular evolutionary biologists have argued that a continuous phylogenetic tree of life is based on false presuppositions about the origin and evolution of life. Elizabeth Pennisi, "Is It Time to Uproot the Tree of Life," Science 284(1999): 1305-1307.

They proposed that living organisms have not evolved from a single ancestral root, originally assumed by Darwin. Molecular evolutionary biologist Ford Doolittle of the University of Dalhousie mentions that " to everyone's surprise, discoveries made in few years have begun to cast serious doubt on some aspects of the tree of life." Ford Doolittle, "Uprooting the Tree of Life," Scientific American 282(2000): 90-95.

Actually, he presents a totally different tree of life: that various living organisms on the earth derived from multiple origins and were developed

through a complicated exchange of genes in the community of primitive cells. Ford Doolittle, "Phylogenetic Classification and the Universal Tree," Science 284(1999): 2127.

In fact, this new trend in molecular evolution is a reflection of the biological discontinuity found amongst various organisms and has resulted in the revision of the basic tree of life from its origin.

From a creationist's point of view, the molecular relationships among different organismsare discontinuous rather than continuous. In addition, molecular study is showing a uniqueness of individual species, far from verifying interconnectedness among them. This fact is providing a new perspective on modern molecular biology. The advancement of molecular biology has a great possibility to pave the way to reform the evolutionary paradigm, based on the naturalistic worldview on living organisms. In particular, rapid advancement in DNA sequencing technology has accelerated the accumulation of molecular data from various species, including human beings. Therefore, as molecular biology develops in the 21st century, the molecular biological data need to be interpreted from a new creationist's perspective.

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4. Complexity of Molecular Pathways of Cells

Over the past decade, molecular biology has disclosed the complex molecular interactions occurring in living cells. As a result, many of the components and mechanisms of cellular signaling pathways have been discovered to date. Guoqing Chen and David V. Goeddel, "TNF-R1 signaling: a beautiful pathway," Science 296 (May 2002): 1634-1635.

It is a well-knownfact for molecular biologists that each molecular component of a cell is dependent on whole functional systems or pathways to be functional. This also means that each component of a cell is indispensable for the overall function in living systems. The function of certain biological

systems is not a simple sum of each component. If one component is removed from a functional system, the whole systemis supposed to be completely shut down.

Michael Behe, one of the leading proponents of the intelligent design theory, conceptualized the notion of "irreducible complexity" found in biological systems" Michael Behe, "Darwin's Breakdown: Irreducible complexity at the Foundation of Life" in Signs of Intelligence: Understanding Intelligent Design (Grand Rapids: Brazos Press, 2001), 90-101.

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By irreducibly complex I mean a single system composed of several well-matched, interacting parts that contribute to the basic function, wherein the removal of any one of the parts causes thesystem to effectively cease functioning. An irreducible complex system cannot be produced directly by slight, successive modification of a precursor system, becauseany precursor to an irreducible complex system that is missing a part is by definition nonfunctional. Michael J. Behe, Darwin's Black Box: Biochemical Challenges to Evolution (New York: The Free Press, 1996), 39.

In light of the naturalistic worldview, each component of a certain functional system can be reducible to individually functional units. These units might be assembled to form more complicated systems by naturalistic processes. However, in reality,each part of a living system totally depends on the other part to be a functional entity. Each component of biological system is meaningful when it is closely related to the other parts. So it is very difficult to explain the origin of biologically complex systems through the naturalistic worldview.

Molecular systems of a living cell are not only "complex" but also "well-tuned." One of the most illustrious examples of "well-tuned" complex systems might be the molecular signaling mechanism regarding the processes

of cell death, which is called "apoptosis." It is the most abundant form of physical cell death controlled by systematic processes. Molecular biologists have revealed that cell death mechanisms are remarkably complex and marvelously regulated by several cellular components. For example, three molecular biologists were awarded the Nobel prize in physiology and medicine 2002, for their discoveries concerning genetic regulation of organ development and programmed cell death. Thus, it is also called "programmed cell death." Originally, the main function of "apoptosis" is to remove damaged or aged cells rather than letting them be cancerous. Phillip Bell, "Apoptosis: Cell Death Reveals Creation," TJ: In-depth Journal of Creation 16(2002): 90-102.

Interestingly, many cancers arise as an outcome of a collapse in the cell death pathways that control cell growth and survival. Geoffrey M. Cooper, The Cell: A Molecular Approach (Washington D.C.: ASM press, 2000), 523-524.

The breakdown of this well-tuned cell death system within a living cell ultimately results in intractable disorders such as cancer. Molecular aspects of biologically functional systems are interdependent and adequately controlled. There is no need to be supplemented or rectifiedto become a functional unit in these systems.

In summary, complex biological systems are not just intricate structures, but elaborate and harmonious beings. Furthermore, from the biblical point of view, complex and well-tuned biological systems require an intelligent Creator to explain their flawless wholeness. Michael Behe also proposed that irreducibly complex biological systems could have been generated as the result of "intelligent design," not of natural process.Behe, 187-208.

These organized systems cannot have originated by chance combined with long time. Thus the advancement of modern molecular biology, particularly in exploring the cellular components and signaling pathways, can be an important challenge to the foundation of the naturalistic worldview in science.

5. Irrelevance Between Gene and Specific Phenotype

Since the discovery of genetic principles by the Austrian monk Gregor Mendel (1822-1844), the notion of gene has been considerably influenced by the naturalistic worldview. For example, in 1905, Thomas Hunt Morgan(1866-1925), one of early pioneers in genetics, introduced the chromosome theory of genetic transmission, based on the materialistic conviction on the essence of biological phenomena. Richard Weikart, "Genetics," in The History of Science and Religion in the Western Tradition : An Encyclopedia, ed. Gary B. Ferngren (New York & London: Garland Publishing, 2000), 479. Needless to say, this idea was also bolstered by the discovery of the DNA structure.

Furthermore, according to the "selfish gene theory"presented by Richard Dawkins, gene is the unique driving factor of being able to produce a new species through the process of natural selection. In this view, genes are the ultimate and primary cause of every biological phenomenon including human complicated behavior. In this manner, when molecular biologists think of a specific character, they tend to think about genes, which causes a particular phenotype or character. Consequently, most molecular biologists have been impressed by resolute conviction of genetic (physical) cause and effect, even in immaterial aspects of biological phenomena.

According to genetic determinism, human beings should have far more genes than other simple organisms. As mentioned, the Human Genome Project (HGP) had been motivated by this thought, hoping that we could find many human-specific genes, especially related to higher human mental function. When the HGP was completed, it was the most astonishing fact for most molecular biologists that the number of human genes are quite less than had been anticipated. They had expected that more than a hundred thousand genes might exist on the human genome, but only thirty thousand genes have been found on it.

Jean-Michel Claverie, "What if there are only 30,000 human gene,?"

Science 291(2001): 1255-1256.

Furthermore, the human genome only has three hundred unique genes that are not discovered in the mouse genome. Ibid., 1257. This fact is definitely contradictory to the expectation of genetic determinists. Indeed, this strikes the "gene-centered view" of human beings with a mighty blow.

As mentioned, genetic changes and mutations have been considered as raw material for organic evolution by natural processes. In this perspective, genetic modifications are considered as a predominant factor in making a new phenotype. However, molecular biology has disclosed the fact that genes are not always the dominant driving force in biological phenomena. In some cases, the influence of genes in the formation of a specific phenotype is not as absolute as it has been expected to be. To illustrate, according to a recent report, a novel mutation that can be suppressed by environmental factors has been found. More specifically, Claudia Kappan, a molecular developmental biologist of the University of Nebraska, isolated a mutant mouse with a defect in a stage of cartilage development. Elizabeth Pennisi, "Good Diet Hides Genetic Mutation," Science 296(May 2001), 1011.

So this mutant mouse strain has a critical problem in its skeletal structure. In spite of this defect, it has been observed that this harmful mutation can be masked by good nutrition. Balanced diets can compensate for an abnormally expressed gene, which was involved in cartilage formation in this mouse. As s result, mutant genotypes of this mouse strain were completely suppressed by food. Environmental factors can make up for defective genes. This suggests that genetic changes are not alwaysabsolute factors in the formation of a specific phenotype. There has been much evidence in molecular biological research for disproving the significant influence of genes in the development of diseases. Jonathan Rees, "VIEWPOINT : Complex Disease and the New Clinical Sciences," Science 296 (April 2002): 698.

It no longer makes sense that genes are the ultimate force for phenotypic changes all the time.

Molecular biologists have succeeded in finding the genetic cause in

some cases of cancer. As a result, several oncogenes and their roles inoccurrence of cancer have been elucidated by the efforts of cancer molecular biologists. In the pathogenesis of cancer, the migration of tumor cells from primary organs to secondary organs is a crucial step during the development of malignant cancer. This process is generally called "metastasis."Actually, this metastasis step has been a major target for the cure of cancer. Motivated by genetic deterministic ideas, many cancer molecular biologists have attempted to discover what is called "metastasis genes,"which might play a decisive role in the progression of cancer. However, according to a recent report, for a long time trials to find "metastasis genes" have failed. There were no genes responsible for inducing metastatic capability. Robert A. Weinberg, an influential cancer molecular biologist of Massachusetts Institute of Technology, mentioned, "genes and genetic changes specifically and exclusively involved in orchestrating the process of metastasis do not exist." Rene Bernard and Robert A. Weinberg, "A Progression Puzzle: Metastasis Genes," Nature 418 (August 2002): 823. His statement suggests the limitation of genetic determinism in doing a molecular biological research. Genetic models of tumor progression are not as successful as they have been thought to be. James L. Sherley, "Metastasis: Objections to the Same Gene Model," Nature419(October 2002): 46.

Indeed, many aspects of human disease have little relationship with genetic factors. Richard Strohman, "Maneuvering in the Complex Path from Genotype to Phenotype," Science 296(April 2002):701-702

In addition,deterministic ideas also encounter a barrier in explaining the genetic causes of mental diseases. Many molecular neurobiologists have been trying to unveil the genetic basis of complicated mental disorders such as schizophrenia. If they could find the schizophrenia-causing gene, it might be a great breakthrough for the cure of human mental diseases. Actually, there were some neuroscientists who argue that schizophrenia susceptibility locus may exist on the human genome. So many researchers have tried to locate this gene on the human chromosome. However, contrary to their expectation, recent

results showed that genetic susceptibility to schizophrenia is not equally applicable to every case of it. Douglas F. Levinson, Claudine Laurent, Ann E. Pulver, and Peter A. Holmans, "No Major Schizophrenia Locus Detected on Chromosome 1q in a Large Multicenter Sample," Nature 296(April 2002): 739. Probable susceptibility genes identified in one group cannot be always repeated in other groups. Ibid., 741.

This also suggests that complex mental diseases are not mainly affected by genetic traits. It is extremely difficult to identify the genes that are related to complex diseases.Paula Kiberstis and Lesile Roberts, "It's Not Just the Genes : The Puzzle of Complex Disease," Science 296 (April 2002): 685.

In summary, many molecular biologists, particularly working in the frontier field of molecular biology of genes, have disclosed that "just" the genes are not enough to explain the complex dimensions of life and human beings. Biological phenotypes have multifaceted properties that cannot be ascribed to a single physical component, such as a gene, in view of naturalistic principles. The "genocentric view" on human diseases is now confronted with a philosophical crisis, in spite of the rapid progress of molecular biology. This situation needs a paradigm shift in molecular biology beyond the genetic determinism derived from the naturalistic worldviews.

In conclusion, this chapter has investigated the limitations of naturalistic perspectives in explaining the diverse aspects of life and human beings on the molecular level. As we know more about the molecular mechanisms of living cells, the foundation of the naturalistic worldview in natural science will be undermined. Therefore, it might be concluded that modern molecular biology does not absolutely support the naturalistic worldview as expected before. Instead, molecular biology can be used as a potential means to restore theistic implications, which once permeated biology and natural science.

IV. Interplay of Science and Theology in Molecular Biology

As it was mentioned before, contemporary molecular biology has been in conflict with the Christian worldview because of its atheistic implications, mainly derived from the naturalistic worldview. However, it has been also discussed that any further understanding of molecular biology is incompatible with the naturalistic presuppositions on life and human beings.

1. Theological Implications of Modern Molecular Biology

From the perspective of natural theology, design and purpose observed in nature are the evidence for God's intervention. Actually, God's work of creation depicted in the Bible implicates a perfect and wonderful design. Genesis 1:31

Generally speaking, natural theology was dominant paradigm in the history of biology before the advent of Darwinian evolutionism. However, there was no detailed research for mechanisms that could explain the marvelous design found in the living world in the camp of natural theology.Ibid., 53. The proponents of natural theology had not attempted to describe the physical aspects of orderliness and harmony of the biological world. On the contrary, many physical scientists tried to elucidate concrete mechanisms of the nature, and their findings have been mainly interpreted in naturalistic perspective. In this sense, natural theological approaches have not been validated by scientific research. As a result, Darwinian evolutionism has decisively abolished design and purpose in biology.

In this situation, the developments of modern molecular biology have uncovered the wonderfully complex and harmonious properties found within living organisms. Evidently, molecular biology is showing the design and purpose of the living world in terms of physical science.More importantly, this conclusion is not necessarily derived from religious belief. To illustrate, Michael Denton, a molecular biologist with no religious

background, says:

> Whether one accept or rejects the design hypothesis there is no avoiding the conclusion that the world looks as if it has been uniquely tailored for life: it appears to have been designed. All reality appears to be a vast, coherent, teleological whole with life and mankind as its purpose and goal. Michael J. Denton, Nature's Destiny: How the Laws of Biology Reveal Purpose in the Universe (New York: Free Press, 1998), 387.

Increasingly, it is obvious that molecular biology is a human attempt to disclose a prearranged blueprint of living things. From the standpoint of the Christian worldview, there are many discoveries in modern molecular biology that accord with biblical evidence for the providential design of God. Therefore, it can be said that modern molecular biology is now laying an empirical foundation for the doctrine of creation and natural theology.

2. Interplay of Science and Theology in Molecular Biology

In naturalistic perspective, molecular biology seems to be in opposition to Christian theology. However, there is a great possibility to relate molecular biology and theology from the Christian worldview. Recently, Ian Barbour has proposed a useful typology of the diverse relationships of science and theology. He conceived four models that relate natural science and religion: "conflict," "independence," "dialogue" and "integration." Ian G. Barbour, Religion and Science-Historical and Contemporary Issues (San Francisco: Harper San Francisco, 1997), 77-105.In the conflict model, science destroys the foundation of Christian faith. Consequently, scientific evidence is incompatible with theism. The independence model is a view that science and theology are dealing with totally different things with different approaches.

There is no common point between them. The dialogue model is a more constructive point of view. This model understands the similarity of science and theology as well as the differences in their presuppositions, methods, and concepts. In other words, this model emphasizes the complementary relationships between them. The integration model is a more systematic correlation between science and religion. In this view, both science and theology can be reformed by a close integration of the two disciplines. Ian G. Barbour, When Science Meet Religion- Enemies, Strangers, or Partners?(San Francisco: Harper San Francisco, 2000), 1-6.

Barbour's models can be applied to comprehend the interaction of science and religion in the realm of molecular biology. Regarding this typology, molecular biology has traditionally been in "conflict"relationship with Christian faith. As explained in the previous chapter, the foundation of Christian theology has been severely challenged by reductionistic, deterministic, eugenic and evolutionary implications of molecular biology. So, most Christians have mainly focused on the warnings of atheistic presumptions hidden in molecular biological research.

On the other side, some Christian scientists have attempted to relate molecular biology and theology. They consider molecular biology as a useful tool to heal the sick. Francis Collin, "The Human Genome Project: Tool of Atheistic Reductionism or Embodiment of the Christian Mandate to Heal," Science and Christian Belief 11(2000): 109. Actually, molecular biology has greatly contributed to the treatment of some intractable diseases. In this regard, molecular biology meets the Christian mandate to "love your neighbor as yourself," Matthew 22:39 NIV. So this view can be classified into the "dialogue" model between molecular biology and Christian faith because both of them are complementary.

Until recently, there has hardly been any constructive model to integrate molecular biology and Christian faith. However, both science and Christian faith could be integrated in a meaningful way when molecular biology is regarded as a potential means to undermine the naturalistic

worldview in science. In this approach, molecular biology is no longer a means to strengthen the naturalistic worldview in science. Instead, it has great potential to restore the teleological worldview in biology and science. The development of molecular biology can open new horizons in our understandings of theology. As a consequence of this new approach based on the biblical worldview, molecular biology will provide a comprehensive framework to integrate natural science and Christian faith.

V. Conclusion

Molecular Biology: A Gift from God

God has revealed Himself both in the Scriptures and in the created world, so there should be no conflicts between them. Nevertheless, almost from the beginning of molecular biology, it has seemed to be an enemy of Christian faith. In this respect, this essay has investigated the possibility of molecular biology to be a partner with Christian theology.

In the Christian worldview, molecular biology should not be amediator of the naturalistic worldview on the origin and meaning of life any more. The more we know about molecular mechanisms of living organisms, the less we rely on the naturalistic worldview on the destiny of living things. Michael Denton, a molecular biologist and not a creationist, describes the inconsistency betweenmolecular biological data and the naturalistic evolutionary theory:

There is little doubt that if this molecular evidence had been available one century ago it would have been seized upon with devastating effect by the opponents of evolution theory like Agassiz and Owen, and the idea of organic evolution might never have been accepted. Michael Denton, Evolution : A

Theory in Crisis (London: Burnett Books, 1985), 290-291.

Molecular biological research is now revealing the marvelously sophisticated entity of the living world from the microscopic level. God's providential plans are pervasive in molecular dimensions of living creatures. Moreover, recent developments in molecular biology evidently demonstrate how incorrect are the naturalistic assumptions on the origin and the purpose of life. In this sense, molecular biology can be designated as a gift from God to harmonize science and Christian faith.

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박춘호

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