The Viewpoints of the Buddhism toward Life Sciences

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Introduction

THOUGH there are many expressions to characterize the 20th century from various viewpoints, it can certainly be expressed as "the century of science and technology." In the first half of the century, the developments of physics and chemistry were remarkable and people's view for material was greatly changed. The typical examples were findings for "uncertainty principle" and "atomic bomb." In the latter half, life sciences leading by molecular biology have been developing rapidly and they engrave DNA (deoxyribonucleic acid) on the people's viewpoint of life. Topics such as "Completion of the plan for all human genomic DNA sequence" and "Clone sheep, Dolly" have been caught the people's hearts.

Many people predict that the life sciences will become in the center of science in the 21st century. Optimistic scientists as well as medical doctors stated that "Sick treatment will be renewed according to the individual genome analysis" or "The organ and tissue will be made freely by the clone technology."[1]

We must realize, however, that a way to "chaos" or condition filled with anti-value for human being is there, as well. Because life sciences are also based on the elementalism as well as the reductionism: the goal of life scientists is to substitute the life phenomena for word such as the material name and to express the relation between the phenomena by mathematical formula.[2] Such analytical approach of life sciences would be useful for our lives, minds and hearts? And, we could ethically-correctly apply the life operation technology, mind control technology and so on derived from there, to our society?

When we think about the present condition of life sciences and technologies, issues of science/technology itself and scientists/technologists themselves are becoming radical and "aporia." To solve the difficult issues, it is more adequate for us to change our stance to depend on Buddhist ideas rather than Western thoughts, because the latter have led modern science and technology to result in facing chaos or aporia.

In the present paper, after summarizing the progress of science and technology in the 20th century, some Buddhist viewpoints will be provided: “Nyo-jitsu-chi-ken” (to look at objects as they actually stand) and “En-gi” (an essential relationship to depend on each other among existences) are introduced to the issue of science/technology, while “Sho-yoku-chi-soku” (to satisfy with a little of gratification) is introduced to the issue of scientists/technologists. Finally, the author will refer to Goethe’s idea for the natural science different from Newton’s or Linne’s one, and will present his own idea entitled “A neurophysiological approach to drives.”

Developments of Physics and Chemistry during the First Half of the 20th Century

It could be said that rapid development in modern sciences was made in the 20th century, and there was a very striking development in the fields of physics and chemistry. Table 1 shows a list of the main Nobel prizewinners in physics during the first half of the century.[3]

Table 1 A list of the main Nobel prizewinners in physics.

1901	W. K. von RÖNTGEN
1903	M. CURIE
1918	M. K. E. PLANCK
1921	A. EINSTEIN
1922	N. H. D. BOHR
1932	W. K. HEISENBERG
1933	E. SCHRÖDINGER
1949	H. YUKAWA

As a matter of course, not only their names but also their achievements are well known in the world. Röntgen was the discoverer of the X-ray, and Mrs. Curie was the discoverer of the radioactive element “radium”: They became a pioneer to open the research field from the atomic level to the nuclear level at that time when the atom was presumed to be an extremity element of materials. Though the reason that Einstein won the prize was a novel theory on the photoelectric effect, he was rather famous for his “relativity theories.” His latter theories resulted in a paradigm shift from the general, classic idea on the space-time world since Newton’s era to the novel, unusual idea based on the principle of relativity. Moreover, Planck and Bohr laid a foundation of the quantum theory, and it was established by Heisenberg and Schrödinger as a quantum mechanics. The viewpoints derived from the quantum mechanics, which showed that "uncertainty principle" functions between the movement of material and its position, and that the ultimate existence of the material is expressed by the probability, had a strong impact on the contemporaries. Yukawa's "meson theory" was an original theory to predict an interaction by the meson working in the atomic nucleus between neutron and proton. As soon as the existence of the meson had been demonstrated, the elementary particle physics started to progress for further extremity.

Of course, the development of physics have not been necessarily made only by the people described above. And, it is needless to say that it had been attained by many scientists including the Nobel prizewinners in chemistry, who developed vigorous research and kept in touch each other.

Then, what was brought by the development of sciences, particularly of physics and chemistry? It is difficult to state in brief, but firstly it can be pointed out that several kinds of viewpoints derived from sciences changed scientists' view on the world. The old or classic world which surrounds our existence had been imagined as an "absolute space-time" where immutability as well as continuity were preserved, and the image was changed to the new or quantum world based on "relativity" and "discreteness." A great influence on scientists' view on the materials is the second point. It means that ultimate existence could not be made clear because of "uncertainty principle," whereas it became to be described at the level of elementary particles.

Since such recognition was at the macro- or micro-level, far from our usual level, whether it influenced on the viewpoint of the people who lived in the everyday level or not might be doubtful. However, they might have a vague feeling that the goal of such sciences would be in the veil, with observing that the progress of sciences continued to dismantle the materials by using the analytical and reductionismic approaches.

The author is the one who has an impression that the dismantling of materials will result in a certain type of diversity: it means that those investigations dismantling the materials are endless and have a possibility to prove fruitless. On the other hand, he is also interested in the scientific theories proposed during the development of sciences. For example, the equation of "$E = mc^2$" deserves comment. The left side shows energy while the right side does the mass times optical velocity squared. The equation provides us ideas that mass and energy have interchangeability and that they are equivalent. In other words, it provides the point of view that the matter with mass visually easy to catch is equal to the thing or event with energy visually hard to catch. When considering a vacuum condition like the space from such viewpoint, it can be thought that there exists nothing of the matter but happens nothing of the event. The viewpoint based on the relations of "thing" or "event" will provide a break-through beyond the general concept based on the existence or non-existence.[4]

Developments of Molecular Biology and Brain Science during the Latter Half of the 20th Century

It is seemed that the leading part of the science development has been replaced from physics and chemistry to life sciences including molecular biology and brain sciences during the latter half of the 20th century. Famous Nobel prizewinners in physiology and medicine are shown in table 2.[5]

Table 2 A list of the main Nobel prizewinners in physiology and medicine.

1962	F. H. C. CRICK, J. D. WATSON
1963	Sir J. C. ECCLES, Sir A. L. HODGKIN, Sir A. F. HUXLEY
1965	J. MONOD, F. JACOB
1975	H. M. TEMIN
1981	D. H. HUBEL, T. N. WIESEL, R. W. SPERRY
1987	S. TONEGAWA
2000	E. R. KANDEL

Watson and Crick are so famous because of their findings on the structure (model of a two-stranded helical molecule) of DNA, the biological molecule contained in cells which carries the genetic information. Their works took the lead enough to give the molecular biology the first rank in the development of sciences during the last half of the 20th century and the tremendous stream in the field of molecular biology spread more widely resulting in the main course of life sciences. They were followed by Monod's elucidation on the translation process of the genetic information from DNA to RNA, by Temin's finding of "reverse transcriptase" which transcribes RNA into a double-stranded DNA, and so on. During such progress, "the central dogma" has been established for all of the biological beings on the earth: It is, simply, the idea that DNA codes for the production of RNA, RNA codes for the production of protein, and protein does not code for the production of protein, RNA, or DNA. Thereafter, molecular biologists focused their interests on the expression processes of genetic information, and as a typical example of such process, the origin of antibody diversity was first demonstrated by Tonegawa.

On the other hand, the nervous systems including our human brains were studied mainly in the fields of neurophysiology and medical sciences where the analysis by observation was rather important than experimentation: In other words, the then brain science, although the name had not appeared yet, seemed to be based on "empiricism" rather than "experimentalism" during the first half of the century. However, with the rapid development of molecular biology during the latter half of the century, brain researches also developed and they were integrated to "brain sciences" mainly based on the experimentalism just like physics and chemistry. Hodgkin and Huxley described in physico-chemical and mathematical terms, the mechanisms by which nerves conduct electrical impulses, whereas Eccles termed the EPSP (excitatory postsynaptic potential) and the IPSP (inhibitory postsynaptic potential), and identified inhibitory neurons which play an important role in regulating the flow of information within the central nervous system. As for the functions of the cerebral cortex where is the highest center in the central nervous system, Hubel and Wiesel investigated the mechanisms of visual perception at the cortical level, Sperry pioneered the behavioral investigation of split-brain animals as well as human split-brain patients, and by using Aplysia, Kandel brilliantly demonstrated "synaptic plasticity" which has been thought as a underlying mechanism of learning and memory.

What kind of influence has been brought by the development of molecular biology and brain sciences? It is, needless to say, an influence on our viewpoint toward lives: a shift from the previous viewpoint (i.e. empiricism) based on natural history to a novel one (i.e. experimentalism) based on molecular biology. Since all of biological beings are designed by DNA and they cannot live without proteins which are very important functional molecules synthesized by the central dogma, it is natural that a "machine-like image" for biological beings has been imprinted in our minds. Furthermore, scientific approaches are proceeding more and more even in our brains where mind and heart are postulated to be situated, and "the last mystic fortress" will fall soon, like a candle in the wind.

The author also wants to point out the "dismantling of life" in the symbolic "plan for all human genomic DNA sequence," and the fuzzy theory of "functional localization in the brain." The reasons are as follows: The former project has just been completed and elucidated all of the base sequence which showed that human genome is consisted of approximately 3 billion of base pairs but there are only about 30–40 thousand of genes which correspond to useful proteins. How should it be right? In our real lives, we must use many kinds of proteins more than such estimated value. As Tonegawa demonstrated a diversity of antibody, the process of gene expression might include a variety of diversities, of which elucidation requires enormous time as well as fund. With progressing of brain sciences, the latter theory has been replaced one after another. For example, the visual centers were restricted in 2–5 areas of the occipital cortex, but they are now identified in approximately 30 areas of the frontal, temporal and occipital cortices. When we imagine other sensory, motor and associate centers on the distributed visual centers, the functional localization might be replaced by so-called "holism." Against the present direction of brain sciences which continue to dismantle our minds, we will never forget the excellent view stated by Sir C. S. Sherrington, a famous neurophysiologist awarded with a Nobel prize in 1932: "Man's analysis of his sensible world seems to have outstripped his analysis of his mind."[6]

Life Sciences in the 21st Century

It is easily able to suppose that the development of life sciences including molecular biology and brain sciences will be lasting in the 21st century. Because, apart from good or evil, sciences based on the analysis and experimentation have an essential nature to proceed in the direction of the resolution and to dismantle the materials as well as minds. This is probably an endless marching. Therefore, the more life sciences accelerate to search, the more we are exposed to an enormous accumulation of new knowledge.

For example, the function of a certain gene will be gradually elucidated after the completion of the human genome project. There are some scientists who speculate that single-gene genopathy (an illness which happens due to the mutation of single gene) will be solved before long and even poly-genes genopathy (an illness which happens due to the multiple mutations of poly-genes) will be settled by the next century. Differences will be explained according to the genetic structures, among not only our physical aspects such as faces and figures but also our spiritual aspects such as personality and intelligence. There are many people who sound the alarm toward the conditions that the genetic information is capable of being applied to employment, marriage, insurance premium and medical cost.

And, the “clone technology” is being watched with the keenest interest in the biotechnologies. A clone means a population of genetically identical individuals. In the case of plants, it has been relatively familiar as the tree can develop by taking a cutting. On the other hand, the animals’ clones were used to be realized through their fertilizations of reproductive cells, but recently some kinds of clone animals (sheep, bovine and monkey) have been produced by the nuclear transplantation of somatic cell into unfertilized egg without its nucleus. Thus there is only one step to approach the stage where the clone technology is applicable to the human being. In addition, it is stressed that several kinds of biotechnologies will bring great benefit in the fields of stockbreeding, medicine manufacture, development of anti-carcinogen and aging-inhibitor, regeneration of organs, restoration of extinct animals, and so on.

In brain sciences, new emphasis on combining information from different levels of analysis into integrated models of brain function and nervous disease has been made during the past “Decade of the Brain” (1990s) and the following “Century of the Brain.” So many patients suffering from Alzheimer’s disease as well as Parkinson’s disease, particularly, live in hopes that brain scientists will be sure to find the basic mechanisms of such diseases resulting in the development of novel therapies: It is very promising to make use of “stem cells,” which have the “totipotence” to differentiate into other types of cells and have been found even in the adult brain. Therefore, many scientists in the world are competing to find a new substance to stimulate its proliferation, differentiation, or migration of the stem cells. As for the field of so-called “neuro-computer,” advances in computers and neural networks provide new models of both nervous system functions and next generation-type of computer which has abilities of pattern recognition as well as parallel processing like our human brain.

At any rate, the development of life sciences will facilitate the spread of molecular biological viewpoint toward the life. The idea that lives are also consisted of machine-like materials based on molecules of DNA and protein may become a common sense. However, the more dismantling of the life progresses, the more diversity of species or lives are elucidated and also, the more dismantling of the brain does, the more diversity of minds appears. As a result, a certain type of paradigm shift may be required from the analytical or dismantling approach to lives and minds to synthetic or integrating approach to them. It must be important to take a serious view of the relationships or linkages among biological beings rather than their existences themselves.

Buddhist Viewpoints toward Issues Surrounding Life Sciences

It is easy to say that life sciences keep their situation in the center of sciences during this century, as described above. The life sciences progress so fast, and include so many bioethical problems that we must endure to watch their progress, although scientists as well as biotechnologists should take the responsibility themselves. To discuss such issues surrounding life sciences in order, we may just as well divide them into ones related to life sciences themselves and others related to scientists/technologists themselves.

As for the former, it is the first matter for argument whether our lives and minds could be elucidated by analytical methods based on the reductionism. How far such approaches are available for their goals of life sciences? Though the phenomena based on lives and minds will be able to be explained by the complex-assemblies of genes and proteins, such as "A certain disease is induced by a specific combination of mutations in several kinds of genes" or "It is the key role for our learning and memory that a specific regulation among several kinds of neurotransmitters and functional receptor proteins is promoted or suppressed by other kinds of substances," is it the final goal? Nobody says "yes," because as suggested by T. Yoro,[7] the scientific work is to transform the phenomena into the information expressed by the technical words or the mathematical formula, but at that time when the biological phenomena have been consolidated, the dynamic and changeable characteristics specific to biological beings are lost to sight. The second matter for argument is as to a close relationship between science and technology. Scientific findings promote the development of the technology, and vice versa. The relationship can be applied to the case of life sciences and biotechnology. During the mutual progresses, the new technologies for life-sustaining system and life-operating system have been developed with proposing novel bioethical problems on artificial abortion, artificial fertilization, genetic diagnosis, genetic treatment, brain death, organ transplantation, etc. We will also be facing the same issues on human clone, active euthanasia, death with dignity, and so on.

As for the latter, there are widely debated on the way of scientists/technologists and the way of academic society. It must be thought during the early period of science development that the aim of science is to find the truth and then act to behave as a scientist/technologist includes a private part to be joyfully moved by discovering the providence of the nature. Since then, however, to expand the scientific knowledge became the focus in the academic society. It means that the act to behave as a scientist or a technologist was a means to approach toward the final goal in the past, but the one is changed to the goal itself in the present: we cannot find out such a latter type of scientist/technologist suffering from the ideal relationships among science, his own life and society. Life sciences now become a big science and life scientists/technologists are concentrating upon the accumulation of knowledge. As Mahatma Gandhi quoted "Science without humanity is one of seven social sins" in 1925,[8] to abandon themselves wholly to such a competition may result in the gradual loss of their morality and humanity.

How can we lead such conditions to the right way for human beings, to avoid "the way of chaos" or "the way of evil" appeared during the development stage of the science and technology in the former century? It may be "aporia" not to have an answer. However, it seems very important for us including scientists and technologists to stop and to look at those issues surrounding life sciences and biotechnology, although we may be too busy to have time to do so.

In order to solve such difficult issues, we should change our stance to depend on Buddhist ideas rather than Western thoughts, because the latter have led modern science and technology to result in facing chaos or aporia. Buddhism, in particular Mahayana Buddhism is deeply discerned about the dignity of biological beings as well as human beings to attempt an essential solution against four kinds of sufferings, such as "Sho-ro-byo-shi" (sufferings from birth and living, diseases, aging, and death). Therefore, it can be said that Buddhism has many ideas to offer in the quest for answers to those issues. One of them is the idea of "Engi" which means an essential relationship to depend on each other among existences, and the other is the idea of "Nyo-jitsu-chi-ken" which expresses a perspective looking at objects as they actually stand. The former idea provides a stance to think much of neither "analysis" nor "reductionism" but "mutual-dependency" and "associativity" or "integration," whereas the latter provides a stance to make much of not "experimentation" but "observation." Such paradigm shift should be required for the modern science and technology, although they may not be held apart from "analysis," "reductionism" and "experimentalism."

However, its realization is so difficult that some groups of scientists/technologists are struggling for the establishment of a new methodology for their "complex-systems science."[9] When we see this trend in science and technology, Goethe's idea for the natural science different from Newton's or Linne's one comes into our minds. It is implied in the following "Basic attitude toward morphology": i) One grasps “the whole” of biological beings instead of reducing them to their elements like a mosaic; ii) One knows intuitively “the concrete” living vividly instead of its abstract like a mosaic; iii) One understands “the dynamic organism” instead of the static dead like a mosaic. To realize such ideas, Goethe also described “There is a very delicate experience (“zarte Empirie”) when the subject perfectly fits to the object and such a condition becomes truly a complete theory as it is. However, such a higher level of our mental ability will be realized in the era deeply enlightened.”[10]

We can certify here that “Basic attitude toward morphology” and “zart Empirie” proposed by Goethe are related to Buddhist concepts such as “En-gi” and “Nyo-jitsu-chi-ken.” Therefore, it is concluded that leading the “aporia” surrounding the current life sciences and biotechnology to a breakthrough depends on whether we will be able to get a way to realize such inspired conditions or not.

A Neurophysiological Approach to Drives

At the end, the author wants to make a proposal for solving the issues surrounding life scientists and biotechnologists, which is closely related to the drives. Dr. Y. Kawada described as follows: “An argument on the drives is one of the biggest themes in the present day. Because the modern civilization based on science and technology, which had started brilliantly with the aim of the sufficiency of the drives, is in the face of the global crisis. Our basic drives which essentially lead our lives to the peaceful, delightful and creative condition are now trying conversely to open the world of the bad dream filled with death and confusion.”[11]

It is the indication that deserves listening attentively. The science and technology started in order to suffice our many kinds of drives, but they have proceeded to release them without a limit. In addition, scientists and technologists who initially worked to make the ideal goals have been captured by their drives, particularly egoism. Therefore, it is important that we think over our drives to lead science and technology in this century to an original way.

How it will be able to face the problem of the drives that seems to be the root of the various global issues in the modern societies? Though the author wants to entrust it to philosophers’ or psychologists’ intelligence, he would like to present the following hypothesis as one of the brain scientists. The hypothesis is referred to as a neurophysiological “Sho-yoku-chi-soku” (to satisfy with a little of gratification) theory, because it is based on the dopaminergic system in the brain.

The dopaminergic system which uses dopamine as its neurotransmitter is seemed to be closely involved in the reward system or the emotion.[12,13] Wherever the system is stimulated, its nerve terminals release dopamine, resulting in a feeling of pleasure. One of the dopaminergic system, "A10 nerve system" is distributed very extensively: It originates in the mid-brain, and joins in the medial forebrain bundle which passes through the lateral part of the hypothalamus where is concerned with the appetite as well as sexual drive. Furthermore, it widely projects to the cingulate cortex where is closely connected to the limbic system such as the hippocampus and the amygdala, and also projects to the cerebral cortices, particularly to the prefrontal area of the frontal lobe. The characteristics of the dopaminergic system are as follows: i) Even if it is elicited, a feeling of pleasure is caused. ii) The neurotransmitter of dopamine is released from its nerve terminal. iii) Because there are no auto-receptors in the terminals which are located in the frontal lobe, the projecting system does not have a function of negative feedback. iv) So-called "the dopamine hypothesis" indicates that a lower concentration of dopamine in the frontal cortex is related to the depressive psychosis while its higher level is related to schizophrenic symptoms.

In addition, it is assumed that homeostasis is kept in the amount of dopamine in the brain. Because, when it is not kept, the abnormal conditions like the depressive psychosis or schizophrenic symptoms occur according to the lower or higher level of dopamine, respectively.

Based on the presumption, the following considerations become possible. i) If we can satisfy our instinctive drives (such as the appetite and sexual drive) at a lower level, the amount of dopamine released in the hypothalamus decreases. ii) According to the projection of the A10 dopaminergic system, it is reasonable that the amount of dopamine used in the cerebrum as well as the limbic system can be expected to increase. iii) Therefore, it is easier to make conditioning "mental drives" to the voluntary movements and/or creative behaviors by means of releasing dopamine frequently/largely in the forebrain regions.[14]

The author would like to propose again that this is a neurophysiological "Sho-yoku-chi-soku" theory. It suggests neither to suppress nor inhibit our drives, but to control the allotment of our drives. Though the instinctive drives are something a priori, the mental drives can be thought to be consisted of a priori as well as a posteriori part. A part of the human personality, the will and the creativity to make the root of humanity seems to be really based on the latter. We essentially have the root of humanity in ourselves. However, whether we can live it up or not, depends on the postnatal growing process. Thus, we, scientists and technologists, have to live up our roots of humanity, by practicing the neurophysiological "Sho-yoku-chi-soku" theory, and we should build "Science with humanity" offered by Mahatma Gandhi.

NOTES

[1] Yoshikawa Y. (2001), "Seimeikagaku yo ogorunakare (Life scientists, don't be full of conceit!)," *Daisan Bunmei*, January issue, Daisan Bunmei-sha, Tokyo.

[2] Yoro T. (2000), "Ikimono wo atsukaenakatta 20-seiki no Kagaku (Sciences of the 20th century which could not treat biological beings)," *Nikkei Science*, December issue, Nikkei Science-sha, Tokyo.

[3] *Dictionary of Scientists* (1994), Larousse, New York.

[4.] Sato F. (2000), *Kagaku to Kofuku* (*Science and Happiness*), Iwanami-Shoten.

[5.] ibid. (3).

[6] *Nobel Prize Winners* (Ed. T. Wasson, 1987), T. W. Wilson Co., New York.

[7] ibid. (2).

[8] Gandhi M. (1925), "Young India."

[9] Shimizu H. (1992), *Seimei to Basho* (*The Life and Location*), NTT-Shuppan, Tokyo.

[10] Takahashi Y. (1992), "Mo-hitotsu no Kagaku toshiteno Goethe Shizenkagaku (Goethe's natural science as another type of science)," *Riso*, vol. 649.

[11] Kawada Y. (1981), *Yokubo to Seimei* (*Drives and Life*), Daisan Bunmei-sha, Tokyo.

[12] Shepherd G. M. (1994), *Neurobiology*, Oxford University Press, New York.

[13] Oshima K. (1989), *No to Seiyoku* (*The Brain and Sexual Drive*) , Kyoritsu-Shuppan, Tokyo.

[14] Kogure S. (2002), A neurophysiological approach to the instinctive drives, 89th Indian Science Congress, Lucknow, India.