Philosophy and Methodology of Present-Day Science*)

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1. What is the present-day science?

What is, and how should we recognize, the present-day science? We know both ancient Greek science and modern science after the Renaissance, as being contrasted to the present-day science. There are opinions such that Greek science should not be taken as a science. Nevertheless, I think it is also the science and bears a great significance even in the present age. Namely, various thoughts developed in Greek science show their profound effects in the present-day science. It is not too much to say that all learnings have their common origin in Greece. For example, the fundamental thinking on atomic research, to which I have been devoting myself, is well-known to be stemmed from Greek thinkers. In fact, the modern and the present-day sciences have been effected decisively from the atomism developed in ancient Greek schools by Democritus, Epicurous and others, who proposed atom theories in which they conceived, beyond human sensual abilities, microscopic particles—atoms—as the constituents of the whole universe. In all events, Greek science is a science which played a great role in our human history. The history then greeted the Renaissance after the Dark Ages of medieval centuries. A new science which was created in the Renaissance, i.e., the modern science, possessed a new character different from Greek science as was symbolized by the words “knowledge is the power of mankind” of Francis Bacon, and contributed greatly to the advancement of humanity. In today’s science there remain still many characteristic phases inherited from the modern science; many people are, therefore, looking to the character of today’s science as merely a continuous succession of the modern science. I think, however, that the present-day science is not, and should not be, the Greek science nor the modern science; it has and should have a significance as a new phase of science. Science is now confronting a grave crisis from both internal and external causes; the reason for it is that today’s science has not yet cast off the traditional skin.

*) Translator’s note: This article was originally presented in the periodical newspaper of Nagoya University (Nagoya Daigaku Shinbun June 13, 1968, No. 300) edited by the students, reproducing the speech of the author at the annual festival of the University for undergraduate students. Later, after a slight correction in form by the author, this was included in a book Tetsugaku VI (Philosophy Vol. 6) published by Iwanami (Tokyo) in 1968 under somewhat different title (pp. 359~375). The present translation is based on the latter text.
of the modern science. The modern science turns, nowadays, to strike mankind with monstrous terror contrary to man's expectations that it would bring them the greatest felicity. What was the outcome of the birth of Greek science and the flourish of modern science in Europe? It was nothing but events of Auschwitz and Hiroshima, and furthermore the tragic Vietnam War of our days. Such a result is a destiny coming from the character of the modern science. The present-day science must proceed far beyond the modern science in order never to repeat these bitter experiences. In reality, however, the present-day science has in it a latent power capable of overcoming the limit of the modern science. Although it looks that the present-day science which we, the men of the twentieth century, are endeavouring to develop for the future is a continuance of the modern science advanced after the Renaissance, many of the indications imply that it is not the case. Therefore, we ought to bring up such a new power in order not to let the results of the present-day science be the tragedy of Auschwitz, Hiroshima and Vietnam as was the case of Greek and modern science.

The problem of clarifying the character of present-day science is closely connected with that of disclosing the philosophical and methodological implications inherent in the present-day science. Hence, I will begin our discussions with this point.

2. Marx, the source of the method of present-day science

In the twentieth century, there have been rapidly developed new learnings worthy of being known today as the present-day science in connection with the advancement of atomic physics. As a result, the present-day science has displayed its new view of nature different from that of the modern science, and has developed a new methodology of its own. However, in terms of the history of thoughts, the present-day science, or more precisely the thought and method of today's science, stemmed not in our century but from the thought and method established by Marx early in the nineteenth century. Today, it is often said that social sciences are rather undeveloped compared with natural sciences. In fact, natural sciences in our days have produced such terrible weapons as A- and H-bombs, bacteria weapons, chemical gases and so on, thereby throwing mankind into serious crises. They claimed that the cause of human crises lies in the ill-balanced development between natural and social sciences. For example, the Science Council of Japan recently began organizing discussions about desirable measures for the well-balanced advancement of both natural and social sciences. It is well known that one of the characteristic aspects of today's natural sciences lies in the use of huge experimental instrumentations which need an enormous sum as well as the large scale collaboration of researching staffs, thus afterwards being called big science. Moreover, especially since we
came into the twentieth century, it has appeared as an international trend of governmental policies, which have been giving too much importance to military researches, putting money only in natural sciences and, as a result, oppressing the study of social sciences on the other. Can we, however, say that the crises of mankind come from such an ill-balanced development between natural and social sciences, in accordance with the popular idea? I think this is not the case. Rather, the present-day science in a true sense was first established as a social science, already in the middle of the nineteenth century. It was *The Capital* by Marx. This is indeed a science worthy of being called the present-day science. Behind Marx’s *The Capital* there lies the dialectic materialism or its view of human history, and Marx discovered a highly lawful structure of human society by commanding profound logic of dialectics. In the twentieth century, the invariable significance of *The Capital* has been recognized more and more. Namely, the socialistic revolution succeeded first in Russia followed by the revolutions of China and other nations after World War II. Thus, a number of socialistic-republics have been established and Marx’s laws are being applied to their own lives. I know a famous scholar of economics who said that he made a better choice of nonconversion by witnessing recent dollar-crisis, although many economists have come to conceive that Marxism turned to be out-dated in confronting a post-War prosperity of capitalistic regime of the United States. At any rate, it is hardly deniable that in giving real perspective for the future, what have really been the motive forces of revolting human history, there are books such as Marx’s, *The Capital*, Lenin’s *On Imperialism* and Mao’s *On Practice* and *On Contradictions*.

### 3. The law of the atomic world—quantum mechanics

Turning our eyes to natural sciences, we see that Newtonian mechanics has the greatest significance in the modern development of science after the Renaissance. It was proved that Newtonian mechanics reflects the law of nature so profoundly that it has a great predictive power and governs the motions of arbitrary bodies in the world. As a result, the scientists in the nineteenth century were inclined to give an excessive value to Newtonian mechanics making their views of nature and the world narrow ones. At any rate, however, it had the greatest meaning in the modern science, and was one of those most highly developed learnings. Although the significance of Newtonian mechanics has not changed at all even today, a very important fact was disclosed in the beginning the twentieth century; that is, it does not govern all over the world, but have only a limited sphere of its applicability. This fact was first revealed by Einstein in the beginning of this century, when he discovered the theory of relativity, yet it was recognized more
deeply when we stepped into the atomic world; it was realized that the atomic world was not governed by Newtonian mechanics. The law of motion of matter in the atomic world was the quantum mechanics discovered by de Broglie, Schrödinger, Heisenberg and others.

4. All laws have their own limits of applicability

What was clarified by the present-day science that has been developed on a foundation of atomic physics? In the first place, it is that, however great the power of prophecy an advanced law have, it has a limit of applicability. It shows great powers only within the scope of applicability, but if one goes beyond this limit, it loses all its power at once. The motion of an electron in the atom is completely different from the motion of bodies we can see with our eyes. For instance, in our world a man is not able to enter a room through two entrances simultaneously, yet an electron comes in from two slits at the same time. The fact that the motion of an electron is far beyond our conception means that there exists for the electron another, entirely different law from that for visible bodies. To speak more physically, an electron possesses both particle-like and wave-like natures. The modern technological innovation owes very much to quantum mechanics which governs the atomic world, just like Newtonian mechanics was the foundation of the mechanical civilization in the nineteenth century. For example, without quantum mechanics one could never develop electronics using the semi-conductors, nuclear engineering of producing reactors, atomic bombs and so forth.

It had long been believed until the nineteenth century that Newtonian mechanics was a law governing all over the world. As a result, however, there became dominant the so-called mechanistical conception of nature, a point of view relating philosophically to metaphysical materialism; namely, if God would only give a first impulse, then the world should undergo a prescribed movement subjected to Newton's law after that. Standing on this point of view, only Newtonian mechanics is the Queen of all learnings, and all the rest could be derived from it. This is a view that regard not only the nature but also social phenomena as being essentially regulated by Newtonian mechanics. French materialism was typical in the sense that it took such a point of view as its back ground. In other words, the belief in Newtonian dynamics was so strong that it made this point of view dominant. During this century, a new world was discovered where Newtonian mechanics no longer holds true. The recognition of the fact that every law has its limit of applicability is really the first distinctive character of the present-day science.
5. Existence of infinite strata of matter each having its own law

On the other hand, there has been developed another conception that nature is composed of infinite strata which are different from each other qualitatively, and that every stratum is subjected to its own law. This conception is the foundation of the dialectic view of nature, and was first proposed by Engels in the middle of the nineteenth century. This we may regard as the second distinctive character of the present-day science. At the beginning of the nineteenth century, an idea that matter is composed of atoms was revived by Dalton in modern chemistry. Later on, it became clear that there existed another stratum named molecules as a basis of matter, besides the stratum of atoms. In this century, however, it has been discovered that an atom is also composed of a nucleus and electrons, and a nucleus is further built of neutrons and protons. We call those constituents of atoms elementary particles. Thus, the level structure of matter has been revealed step by step in that there are atoms in a molecule, elementary particles in an atom. Today, we feel it necessary to push our investigations standing on such a structural point of view presupposing that even the elementary particles might no longer be the ultimate of matter, although they are now regarded as being the smallest unit of matter. In the world bigger than individual molecules, there emerges at a certain point a series of high-polymers, a matter of new stratum which is different from usual ones qualitatively. For example, the protein molecules as the basic materials of living bodies, the cells composed of such proteins and others are the strata, respectively. Similarly, living bodies and specifically the human beings among them, too, may be considered as one or the other of the strata. When human beings organize together as a society, this is also a stratum. In other words, the human society belongs to one of the infinite strata in nature; hence, natural science and social science are related to each other in this sense. Turning our eyes to a much bigger region, the earth is also one of the strata, as well as our solar system. There are still a lot of stars like the sun, and they gather to form a nebula called the Galaxy. A nebula can be also regarded as a stratum, but there are lots of nebula in space. In the natural world there exist infinitely many strata, and they combine themselves into a complex network rather than forming a one-dimensional series from the large to the small. And in each stratum, there governs each own law which exerts the greatest predictive power within its limit of applicability. Newtonian mechanics was constructed essentially unifying the world of our visible bodies and heavenly bodies, it plays, within such a stratum a role of the highest law of nature. However, in the world of atoms, molecules and elementary particles, there existed different laws, i.e., the laws of quantum mechanics. The laws discovered by Marx in human society have also a
great power as such valid in the stratum of human society. In general, there govern respective laws for each stratum of nature. The aim of individual branch of science is to obtain the knowledge of such a law. Therefore, the existence of infinitely many strata in nature means, equivalently, that every law has its own limit of applicability.

6. Strata under mutual transformations, nature under evolution

The third important point that the present-day science has disclosed is the fact that these various strata form a evolving history, in which each of them is occurring, disappearing and changing to one another everlastingly.

The method of modern science that began at the Renaissance was the one by which one separated an object into pieces and studied each part in full detail. As a result, various learnings have been established such as physics, chemistry, biology, geology and so on. The specialization, so to say, under which each branch of speciality is investigated deeper and deeper, played certainly an important part as a method of the modern science. This point was emphasized also by Descartes. However, it has been shown by the progress of atomic physics in the twentieth century that those learnings separated into each other in the modern science should be synthesized again after all. Whereas Greek science was of a very synthetic aspect, such a character was lost completely in the modern science, and each learning has been pushed forward separately; the modern science made its way digging deeper and deeper in its speciality, almost losing the connection among each other. This tendency has been continuing even today. Although the progress of atomic science requires a unification of learnings to connect various branches of the present-day science on the one hand, yet almost all of scientists today have not gotten rid of the method of modern science on the other. Recently, in the field of the so-called big science, gigantic instruments are used and a large number of people should work together in a laboratory. Consequently an individual researcher in a huge organization misses his direction even on his own study, because he plays merely a part as a gear wheel in a complex machine. Even more, he throughly loses his perspective about the relation between other branch of science and his own, or between science and society. Such a pathological aspect of specialization in the modern science has continued even today, and still more we are able to say that it is promoted by the big sciences themselves. Although the present-day science has begun to have a highly unified character as never to be seen along the progress of atomic physics, yet its method has not at all been free from the method of modern science.

Thus, it is not too much to say that the most serious cause which has brought about the crisis to science and mankind today lies on this point,
notwithstanding that the progress of atomic physics in this century is actually playing a role to synthesize various learnings together. For example, in chemistry there had been an idea of immutability of elements as a basic principle of chemistry. It was a main task for chemistry to obtain new substances by combining and dissolving those various hundred of elements existing in nature. And it had been believed that atoms were, as the basis of invariancy of an element, indivisible and unchangeable particles, keeping their figure until today as God created it for the first time. But science in the twentieth century shocked the foundation of chemistry radically. As a result of the progress of atomic physics, it is that atoms themselves are destroyed and new atoms are made easily in the laboratory today. So the permanency of an element no longer holds true. On the other hand, it has become clear that when and how the various atoms were composed from elementary particles in the process of evolution of the universe. This is also the problem concerning the origin of elements.

The thermonuclear reaction in H-bombs and others occurs in the stars, and it plays an important role in the evolution of the stars. For example, the sun is burning owing to the mechanism of the formation of helium nucleus from four hydrogen nuclei. In ancient times, the heavenly fire was believed to be entirely different from the fire on earth, and to be a very mystic one since Grecian age. But today it is revealed that the heavenly fire is burning by virtue of nuclear reactions. In the process of the evolution of heavenly bodies, a stratum called the solar system is formed, and the earth is born. Upon the earth, complicated molecules are composed of atoms gradually, and finally an albuminous molecule, which would become the origin of life, is synthesized. Then, life is created, it evolves to generate mankind, and men gather themselves to form a human society, which develops in succession. Such a course of evolution of nature can be traced by the advancement of atomic physics. In our present knowledge the history of matter begins with elementary particles, which are, however, not in the same figures as God created in remote ages, but known to be created with their antiparticles in the laboratory. Hence, they were not created by God, but must be formed in some time of the history of nature. The conception that various strata in nature do not only coexist simultaneously, but also change to one another constantly, thereby creating new strata and forming the whole history of nature; this conception is rather close to the thought of Heraclitus in Greece that whole things change. This is the world view of dialectic materialism which Marx made his background when he wrote *The Capital* in the nineteenth century, and is also the conception of natural dialectic that Engels expounded upon the basis of achievement of natural science in those days. Such a conception has been confirmed further by scientific contents on the ground of the advancement of atomic physics.
in the twentieth century, and has been developed as the one providing powerful methods to push forward new learnings.

7. The germination of the dialectic view of nature in Marx

As I mentioned before, an original form of the dialectic view of nature was shown by Engels, a staunch friend of Marx, in his posthumous manuscripts *Dialektik der Natur*. However, in view of the history of thought, I would like to point out that there was already a germination of it in Marx’s early works. As last year happened to be just a hundred years after *The Capital* of Marx was published, a lot of papers were presented in remembrance of it, but they scarcely touched upon this fact in their articles. Marx generally known as a sociologist, worked out *The Capital* and others and as a philosopher, developed materialistic dialectics, yet it was a problem of atoms that he was interested in at the start. The title of his doctoral thesis was “On the Difference between Atom Theories of Democritus and Epicurus”. In Greek science the atom-theoretic way of thinking was represented by Democritus, whereas Epicurus was nominated as his successor. But Marx perceived, in his younger days, a grave difference between Democritus and Epicurus with his penetrating eye. Epicurus is popularly famous for the word “Epicurean” after his name, and as for his atom theory, he has only been believed as an expounder of the atom theory of Democritus. However, in reality, Epicurus’ atom theory is quite different in its elements from that of Democritus. Marx had a sharp insight into this point, and on this account, I think that his doctoral dissertation bears a great significance as a basis of the present-day science. A few years ago, Professor Shinsaku Aihara of Osaka University wrote a very suggestive paper entitled “On learnings” in a magazine *Tenbō.* It is said commonly that the cause of the crisis of science and mankind lies in the limping growth of the natural science over the social science. However, Aihara stated, in opposition to this, as follows; it is not the case, rather it would be ridiculous to think that only one side of culture could be highly advanced whereas another in the same society could not. Already, in fact, Marx’s *The Capital* achieved a great success, he says. I agree with him on this point, and still more I was deeply impressed by his following suggestion. Namely, usual Marxist-economicians or Marxist-philosophers scarcely appreciate Marx’s doctoral thesis; and many of those people are considering it as having no relation with Marxism since it was written in the age when he was a Hegelian-leftist, before he became Marxist. Aihara, however, pointed out keenly that all of the germs of his various social-scientific works such as

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*Editors’ note: *Tenbō* is a monthly journal published by Chikuma Shobö (Tokyo).
The Capital, of his materialistic conception of history and so on are included early in this doctoral thesis. I was moved profoundly by this suggestion, and found it true that a bud of the dialectic outlook of nature could also be contained in this first article by Marx, although I had thought it was developed chiefly by Engels and pushed forward further by Lenin.

8. The analysis of the concept of elementary particles

As is well known, for studying the elementary particles it is necessary to use huge experimental equipments such as synchrotrons and so on. However, it does not always go well by only using huge and expensive equipments. An essential point for any development of the theory of elementary particles is how to analyze the concept of elementary particles. We have been devoting ourselves to the study based upon such a point of view. Democritus in Greece and his successor Dalton in the modern science, conceived atoms as the unchangeable extreme of matter existing behind the transmutations of things. Nevertheless, in the present-day physics we went further toward smaller and smaller regions until we reached elementary particles. In so far as we consider elementary particles from the view of the natural conception of the present-day science formed with the progress of atomic physics, we should not regard it as an extreme of matter but as one of the strata like molecules, atoms, nuclei and so on; otherwise we would not be able to recognize the nature of elementary particles merely by looking at phenomena as they are. Standing on such a point of view, we have developed a theory that there would exist more fundamental particles behind elementary particles. We must throw away the conception about elementary particles that is to regard them, like Dalton or Democritus, as the ultimate of matter. We put the basis of our research on this point of which Marx discussed for the first time. Engels wrote in his Dialektik der Natur that the essential difference between modern atomism and previous one lies in that the former recognizes the existence of various different strata such as celestial objects, bodies, molecules and atoms and it is not the point that an atom is seen as an ultimate of matter. Lenin also wrote a famous phrase in his Materialism and Empirio-Criticism: “The electron is as inexhaustible as the atom”. However, the origin of these thoughts could again be traced back to Marx. If we read the letters exchanged by Marx and Engels, we find that Marx often mentioned that one should not regard an atom as an indivisible ultimate of matter. We can see that this thought had its origin in his doctoral thesis. It originates from his great insight into the difference between the atom theory of Democritus and that of Epicurus. The disparity between them is so subtle that it would be easily failed to be noticed by ordinary people. Democritus conceived that an atom should be the ultimate of matter
created by God; therefore, it is extremely perfect and it obeys only a rectilinear motion. On the other hand, however, Epicurus stated the view that the atom should never be perfect and it sometimes deviates from a rectilinear motion. Upon this difference Marx touched keenly. Namely, following the way of thinking by Democritus, an atom should take a form such as a sphere or a regular polyhedron since it is to be perfect. In fact, Platon thought that the atoms corresponding to four basic elements such as the earth, water, fire and wind, had shapes of different regular polyhedrons, because what God created should be perfect. As for heavenly bodies also, they thought, in Greek science, that all of them should obey circular motion because they were perfect objects. As they analyzed various phenomena only in terms of circular motion, they at last had introduced a notion such as epicycles, making the situations awfully complicated. Such a situation was drastically changed to a simple one at a stroke by the heliocentric theory of Copernicus. Later Galileo found, through his telescope, that the moon was not a complete sphere, but had a pitted face and was very ugly. As a result, it became clear that God could not create such an object. At any rate, as far as one follows the way of Democritus, one is forced to think that all things were created by God at first. On the contrary, if we think, like Epicurus, an atom is imperfect, we then begin with investigating the causes of imperfection, turning our eyes to the next basic stratum, and the imperfection of atoms is explained from its nature. By taking such a way of approach in all its phases, the present-day science has disclosed, as a result, the dialectic outlook of nature. On this account, Marx’s doctoral thesis can be seen as a source of thoughts lying behind the present-day science, a source from which The Capital was created and quantum mechanics was developed.

9. The philosophy of quantum mechanics

One may blame us for perverting the historical facts if we are talking about quantum mechanics has been developed by materialistic dialectic. On the interpretations of quantum mechanics the so-called Copenhagen’s one was dominant when, thirty years ago, Yukawa developed his meson theory, of which investigation M. Taketani of Rikkyo University and I helped him. The Copenhagen interpretation, prevailing in the science of Western Europe at that time, was essentially based on the philosophy of Niels Bohr, who is known as the founder of atomic physics or quantum theory.

Although I mentioned that the present-day science revealed the dialectic outlook of nature, nevertheless today’s scientists, not he alone, have developed the learning not by standing the dialectic view of nature consciously, but merely by the methodology of the modern science, since the
Renaissance age. But it becomes now impossible to develop the present-day science by an old view such as to regard nature, the ground of science, as merely a collection of separated objects. We were deeply impressed with this point in the course of development of Yukawa's meson theory. In this connection, Taketani published a paper entitled "Dialectics of Nature" in a journal Sekai-Bunka*) in Kyoto. In those days the Sekai-Bunka was introducing, e.g., the people's front led by France. This was the journal that survived to the last in a severe oppression in Japan, when there came an extreme world reaction under the influence of the first great panic after World War I. On account of publishing such an article in the Sekai-Bunka, he was arrested by the special high police and had to spend some months in a police cell. His article was really a remarkable one, being very unique and could be compared even with The Capital by Marx. As to the difference of the interpretation between Copenhagen's and Taketani's, we may say that the former is discussing the logics of quantum mechanics in its established form, while Taketani's three-stage theory of methodology or his interpretation of quantum mechanics is discussing it based upon a standpoint of practice to create new things and has achieved a unique development of the dialectic outlook of nature.

It seems very curious that such an important contribution did appear, not in a socialist country where the dialectic materialism is highly appreciated, but in a capitalist country, especially in Japan when militarism was thriving there. However, I am convinced that his work has the greatest significance as a method of present-day science. The philosophers of present-days in Japan used to set the limits of their region of speciality very narrow, and confine themselves to it without giving high appreciation to the works by Taketani. In the socialist countries, the textbooks of materialistic dialectics are presented from the research institute for philosophy in U.S.S.R., for instance, but they do not add anything unique to the methodology of the present-day science, they are rather scholastical. On the contrary, Taketani's work is very unique and contributed greatly to theoretical physics of Japan since the advent of meson theory. Although a sensation occurred among natural scientists also in other fields from ours and it had a great influence upon them, there are yet some philosophers trying to ignore it unreasonably. Taketani's three-stage theory had an important meaning in order to discover a new stratum in nature, to recognize the law which is essential there, and it was actually successful in developing modern physics. He discovered and elaborated his three-stage theory in the history of development of quantum mechanics, then he reexamined Newtonian mechanics from this point of view to clarify its significance for the present age. According to Taketani's analysis, the logic of quantum mechanics and that of Newtonian

*) Editors' note: cf. "Historical Introduction" to this issue for the role played by Sekai Bunka.
mechanics do not differ, essentially, from the logic of Marx's *The Capital*. In other words, Newtonian mechanics could have a modern significance only when we grasp it by an advanced logic. Just like *The Capital* is highly established as a social science, Newtonian mechanics is also a very powerful one obeyed by profound logic within its limit of applicability, although we would be failed if we regard it, like the scientists in the nineteenth century, as being valid all over the world. In the case of quantum mechanics, we would lose the perspective to future development unless we grasp it with a highly advanced logic of, say, Taketani's interpretation. I think that quantum mechanics, *The Capital*, and Newtonian mechanics would come to be really powerful theories not only to interpret the world, but also to change the world and nature when they are understood in terms of such an advanced logic. As for Taketani's three-stage theory, I would like to recommend you to read his collected works, published recently by Keisō-Shobō or a monograph entitled *Gendai no Riron-teki Sho-Mondai* (Theoretical Problems at the Present Age) from Iwanami-Shoten, in both of which his theory is presented in detail.

10. A new philosophy for the present-day science

The progress of the present-day science has been supported hitherto by the extension of the methodology of the modern science initiated in the Renaissance. However, if its development from now on should still be guided by this methodology, learnings will not only degrade themselves but also bring about a grave crisis for mankind. Nay, we can say that the degradation of learnings and the crisis of humankind in present days already stemmed out from this point. As I mentioned before, nineteenth century's science separated nature into physics, chemistry, biology, geology, etc., and took a way to specialization in each field. So it has been thought that there is no relation between natural science and social science. However, standing on the dialectic viewpoint of nature, the human society also should be regarded as one of the strata in nature. Various strata are connected to each other into one, and a unified nature and these strata have been created in the evolution of nature. In order to advance learnings and to make use of them for the happiness of mankind, we must combine again those learnings, separated into pieces by nineteenth century's science, on the basis of the new outlook of nature and new methodology elaborated in the present-day science. Until they are combined, I think, today's science could not be the present-day science in a true sense and could not play an important role in human history. Were it to be the case, the outcome of science would be nothing but such as but the Auschwitz, the Hiroshima and the Vietnam, which should never happen again. In the symposium, of which content is
presented as an opening article of this book.\footnote{A famous historian and thinker in Japan.} Goro Hani\footnote{Translator's note: See the footnote on p. 235.} pointed out that the thoughts, philosophies, learnings and arts cannot be entitled to be the present-day thoughts, present-day philosophies, present-day learnings and arts as long as they do not start with the Auschwitz; this is truly a sensible remark. Hani also stated there that he had never been moved so much as when he read for the first time *Dialectics of Nature* by Taketani, though he is not a specialist in natural science. I believe that what makes the present-day science to be the real one is nothing than the theory of methodology as developed by Taketani.

Further, the symposium includes the following discussions: It seems that history comes to the greatly dangerous turning point when we cast a glance over the trend of history, for example, the dollar-crisis which occurred recently. The situation is very similar to that around 1930. In that days Nazism rose later and brought about the cruel affair of Auschwitz by Germany, who had been glorying in her high level of culture. Fascism rose also in both Japan and Italy ending in World War II. The fact that there can be seen a resemblance between those days and today, means that the law of history piercing through them are the same. For example, in the case of Newton's law the globe or Mars would rotate on the same orbit as now, as far as God do give the same initial impulse to it. Their motion would be modified, however, depending on the way of getting the first impulse. Consequently, assuming both the period of the 1930's and today are governed by the same law of history, the same accident would happen again if the conditions are the same. But of course we never want such things to happen again. I think it is to prevent them that the world peace movements are taking their actions. Nevertheless, even those people known to be progressive historians in Japan are studying on the premise that fascism will certainly rise up again. Hani emphasized that it is extremely inexcusable. We should just think about what we have to do in order never to allow fascism. It is a duty of the true historians and of today's scientists to pursue such a direction earnestly. The present-day science should not be the same as the modern science after the Renaissance. On this account, it should take a new point of view worthy of its name, proceed on the basis of new methodology and never walk again the way of the modern science. As I mentioned previously, today's natural science has been monsterized more and more, and the scientist has been reduced to a status like the laborer in a large factory or the salaried man in a big enterprise, losing his perspective to the whole. When scientists lose their total perspective, however, not only would science bring about a crisis to mankind but also the learning itself would revert to the bottom. Reflect-
ing upon the fact that an outcome of Greek science and the modern science after the Renaissance were the experience of Auschwitz, Hiroshima and Vietnam, the present-day science has to take a new way. Namely, it must step forward by making as its own the new methodology and the philosophy, which originated from Marx and include the three-stage theory of Taketani as a zenith.