Scientific Contribution

In Pursuit of an Ethical Principle for Low-dose Radiation Exposure after 3.11

Fumika YAMAMOTO
Tokyo City University
E-mail: fyama@tcu.ac.jp

Abstract: The disaster that occurred in Japan on March 11, 2011 presented many confusing issues for Japanese society. As for the low-dose radiation exposure caused by the nuclear accident, due to insufficient scientific evidence, there seems to be a marked confusion on how to deal with it. 3.11 is often viewed as a "catastrophe" abroad. Life is always at stake during a disaster. Thus, bioethics should address the issue of 3.11, especially the issue of low-dose radiation exposure. This paper presents that point of view.

First, I consider the reason why bioethics in Japan has not dealt with the low-dose radiation exposure, and point out that conventional bioethical methodology has limits. Second, I briefly review how ethicists define the word "catastrophe" and chart the differences between previous catastrophes and low-dose radiation exposure. Third, I verify whether the conventional ethical principles of bioethics are effective for low-dose radiation exposure, then I clarify the reason why these principles fail to deal with the issue of low-dose radiation exposure. Finally, I propose a bridging ethical principle to put the precautionary principle into practice. In this process, I focus on the importance of the perspective of the Japanese word *Inochi*.

Keywords: 3.11, low-dose radiation exposure, evidence, catastrophe, four ethical principles, precautionary principle, Inochi, bridging ethical principle

Introduction

The disaster which occurred on March 11, 2011 in Japan, that is, the Great East Japan Earthquake and the nuclear meltdown as well as radiation leakage at Fukushima Daiichi Plant (henceforth, 3.11), presented many confusing issues to Japanese society. These issues took many forms, from issues in daily life to issues in politics and economics. As time passes, it seems that these confusing issues are gradually resolving, but the ethical confusion, which is the most severe issue, is not yet moving toward convergence.

What is the ethical confusion? The confusion derives from the application of conventional schemes of moral value gone awry. For example, according to an August 2013 public opinion poll[1], more than 30% of people answered, “We should immediately stop nuclear power.” As well that percentage swells to nearly 80% when combined with people who answered, “We should reduce nuclear power progressively.” Despite the opposition to the continued use of nuclear power facilities, the Liberal Democratic Party (LDP) continues to support nuclear power generation, as it gathers overwhelmingly political support generally. Furthermore, when it comes to nuclear policy, it is difficult to maintain unity within the party, because public opinion is divided on the issue. The simple scheme “conservatives are in favor of nuclear power, and reformists are opposed

to it" collapsed after 3.11. The present situation is no longer reflected in the conventional scheme.

Though most of the deaths from 3.11 were a result of the earthquake and tsunami, many people consider 3.11 a nuclear disaster. According to the poll mentioned above, over 90% of people replied "Nuclear accidents have not ceased at all" or "Nuclear accidents have somewhat ceased." When further asked about their reply, the majority of the respondents chose the response "Radiation leakage continues."

Radiation leakage inevitably raises the issue of low-dose radiation exposure. The Japanese public, then, has expressed strong anxiety and uneasiness regarding this topic, because the professional community and general public do not adequately understand the long-term effects of low–dose radioactive material on the human body.

Life, of course, is always at stake during a disaster, and the disaster on 3.11 is not an exception. Bioethics, which focuses on the moral complexities associated with an ideal way of life, should be able to address the moral issues emerging from 3.11, especially regarding low-dose radiation exposure. Unfortunately, in bioethics in Japan, with the exception of the symposium organized by the bioethics society[2], there has been little discussion and research. Why is this? What point of view is necessary in order to deal with concerns about low-dose radiation exposure? In this paper, I will attempt to answer these questions.

1. Why has bioethics not dealt with 3.11?

Everyone expects a healthy daily life, but bioethics literature

typically does not deal directly with this issue. Instead, its primary subject is pathological life or life in a hospital. For example, bioethics will consider a telling of serious illness (e.g., cancer) and the care after the diagnosis. From informed-consent and self-determination of the medical treatment to sedation and terminal care, life revolves almost entirely around the hospital. Neither beginning of life issues, such as assisted reproductive technology (ART), artificial insemination, in vitro fertilization, and surrogacy, nor end of life issues, such as brain death, euthanasia, and death with dignity, are familiar issues of everyday life. These issues usually arise in the hospital setting and are far from the daily life of many people. Needless to say, this is also the case with issues surrounding the most advanced medical technology, such as cloning and the study of induced pluripotent stem (iPS) cells or embryonic stem (ES) cells. Topics such as those noted above are the primary subjects covered in many standard bioethics textbooks.

The field which bioethics covers is not the same as that of medical ethics. Both deal with life, but there are differences. The medical field does not cover all of life, and as a matter of course, there is also life outside of medicine. “Medical ethics” would be enough if only life influenced by medicine was the problem, but it is not. The research field of bioethics covers the inside and outside of medical life. One feature of bioethics lies in associating life outside of the hospital with pathological life.

Let us take use the example of brain death, to illustrate the differences between bioethics and medical ethics. A physician or a dentist is permitted to confirm a person’s death in Japan.[3] So, to determine

whether a person is brain-dead or verify the validity of the criteria is the task of a physician or dentist, but whether a brain-dead person is actually deceased is beyond the scope of medical practice. The definition of death may not be determined only by the medical provider concerned. It is well known that brain-dead person, whose heart beats, can give birth.[4] Death is not just a problem facing the medical profession. Hence, the change of the concept of death would eventually force change in the entire culture related to death and the way people think about death. Such a perspective is required for bioethics, not for medical ethics.

Alvin Weinberg proposed the idea of "trans-science" in 1972.[5] Bioethics, including brain death and organ transplantation, also came into being around that time. This is not accidental. In other words, most of the issues that bioethics address are matters of trans-science which include the issues that cannot be solved without medical science and also the issues that cannot be solved only by medical science.

Nevertheless, currently the main focus of bioethics is certainly medicine and medical treatment. In this field, sickness rather than health, abnormality rather than normality, and impairment rather than being unimpaired are always the main subjects of concern. It follows from the theory that the typical methodology of bioethics is recognized as a method to broaden small number of specially affected lives to a large number of general lives. To put it another way, it is a method that reflects the positive aspects of life from the negative aspects of life.

However, after 3.11, the methodology that bioethics has unconsciously or consciously relied upon was suddenly no longer sufficient. This is likely the reason why bioethics has not dealt with 3.11.

For example, after the earthquake and the tsunami, the environment outside of the hospital, where healthy life should exist, turned into the ambulance. There, the person who should have been far from the death, died. Before the victims of the earthquake and tsunami became a topic in bioethics, they were *already* dead. Bioethics can handle the stages of dying life or near-death, but after-death becomes the domain of metaphysics or religion.

Moreover, the issues surrounding low-dose radiation exposure, brought about by the 3.11 nuclear disaster, nullified the distinction between being inside and outside of the hospital and what threatens healthy daily life. The hospital is the place to protect and isolate the sick, but the walls of the hospital are irrelevant when it comes to low-dose radiation exposure. It has made not only the hospital but the areas of everyday life places that might adversely affect the body. In other words, the distinction between general life and specially affected life is no longer valid.

Furthermore, it is too difficult to scientifically prove the effects of low-dose radiation exposure. Strictly speaking, after 3.11, children suffering from thyroid cancer are found in Fukushima[6], but it has not been proven that the cancer was caused by low-dose radiation exposure. It is said that, to date, no one has died of a cancer purportedly caused by the 3.11 nuclear disaster. It is difficult to discuss general conditions of everyday by using the conventional method of bioethics.

Between the two situations 'already deceased' and 'not yet deceased', bioethical methods of discourse that reflect upon the positive aspects from the negative aspects of life prove ineffective. This is the reason why

bioethics cannot cope with 3.11, and I suspect that this has also caused some of the ethical confusion.

However, historically, this is not the first situation that disturbs ordinary life. In general, extraordinary confusions are called "catastrophes" and catastrophes have occurred many times through the course of history. The original meaning of the word "catastrophe" is "overturning, sudden turn" in Greek[7], but even if turned over, it will usually recover little by little, because people cannot live a completely inverted life forever. Even if they could do so, what should we learn from the history of the catastrophe?

Indeed, nearly four years have passed since 3.11, and the affected areas are gradually on the road to reconstruction, and people in these areas seemed to have returned to their daily lives. However, this catastrophe cannot be handled in the same manner as conventional catastrophes, because this new catastrophe, low-dose radiation exposure, overlaps with the earthquake and tsunami, which are known short-term catastrophes that match conventional definitions. The 3.11 disaster is unquestionably the first time in human history that a disaster is comprised of multiple catastrophes.

Thirty countries in the world have nuclear power plants[8], so it is possible that a catastrophe similar to 3.11 could happen in the future. Keeping this sense of urgency in mind, let's consider the differences between new catastrophe and those previously known.

2. Low-dose radiation exposure as a new catastrophe

Strangely enough, 3.11 seemed to be taken more seriously overseas than in Japan. While the word “catastrophe” is used frequently abroad, in Japan the term is rarely used[9].

Reflecting its etymology noted above, the word “catastrophe” is often used to emphasize an extraordinary situation, but ethicists interpret catastrophe differently. For example, Jean-Pierre Dupuy conceptualizes “catastrophe” as something beyond control and prevention instead of a “risk”, since prevention is something that humans can control. Though we have sufficient reason to know when a catastrophe is about to happen, according to Dupuy, we still have trouble believing it. In order to resolve this, Dupuy claims that we need metaphysics of the following sort: “I put myself during post-catastrophe and saw events retrospectively which were inevitable, but which never occur at the same time.” [10]

The catastrophism of Dupuy implies criticism of the world risk society theory of Ulrich Beck, but, Beck’s related writing after 3.11 seems to be quite similar. Beck writes, “The danger of nuclear power can be minimized by techniques, but it is not possible to reduce it to zero.” [11] “The fact that the possibility of the accident occurring is low doesn't mean there is not a possibility….The issue that we are able to assume is not a problem, but the issue that we are not able to assume and must not occur is a problem.” [12]

In short, Beck admits that there is a risk that would occur even if we would not contemplate it in a conventional manner; therefore, he discusses how we should deal with it. Whether or not it is called “catastrophe” as Dupuy defines the term, Beck and Dupuy would both take the position that we must try to overcome the catastrophe from an

ontological point of view, thus criticizing our epistemological scheme.

Jean-Luc Nancy points out that when a catastrophe of any kind occurs once, the catastrophe will present a similarly tragic aspect as a result. He describes this phenomenon as "the equivalence of catastrophes", and states that any disasters, when they exceed a certain limit, are similar to the event which nuclear danger shows as a paradigm.[13] According to this theory, for example, even the traditional distinction between a natural disaster caused by a major earthquake and a man-made disaster such as a disaster resulting from an atomic bomb, is no longer valid, because the catastrophe itself ruins the distinction. Contemporary societies are made by the advanced correlation of the natural and the artificial. Therefore, it is difficult to eliminate the cause of a catastrophe from either one.

In fact, Beck provides a similar indication. In the introduction to *Risk Society* published shortly after the Chernobyl accident, Beck stated that catastrophe meant "the end of a highly developed society where human beings keep each other at a distance."[14] If catastrophe made all human beings victims, brought all human beings suffering, and deprived them of hope, even the concept of responsibility would not hold true. If there was no distance or distinction between things that are opposed to each other, for example assailant and victim, responsibility cannot hold true.

Ethical confusion is one possible aspect of a catastrophe, of which the Japanese may not be aware, and we might have already lost conventional distance or distinction. However, this paper attempts to continue to refine this issue, while remaining one step short of the

metaphysics of catastrophe. For this purpose, I organized the characteristics of low-dose radiation exposure in comparison with previous catastrophes into the following table:

Category of catastrophes	Causes	Phenomena of damages (visible or invisible)	Extent of damages(duration, affected areas)	Measures to undertake
①Natural disaster (earth -quake, tsunami, volcano, flood, typhoon, tornado, forest fire, etc.)	Explicit, Correlation between nature and social infrastructure	Visible, primarily physical damage and surgical damage	The damage when a disaster occurs is maximum, but temporary, Limited area	Physical measures, City planning, Medical treatment
②Pandemic (leprosy, plague, tuberculosis, Ebola hemorrhagic fever, etc.)	Explicit, Correlation between bacteria/virus and body/ sanitary environment	Symptoms are visible (antigen is invisible to the naked eye) primarily medical damage	Statistical prediction is possible, Short period(several months), Broad area	Epidemiologic measures (vaccine, quar -antine, etc.), Medical treatment (antibiotic drug, antiviral drug, etc.)
③Public nuisance (pollution, ground subsidence, water contamination etc.)	Explicit, Chemical material (organic mercury, cadmium, etc.)	Symptoms are visible, Physical damage, Medical and surgical damage	Damage ranges from slight degree to lifelong effects, Primarily local area	Removal of the causative agent, Medical treatment
④Environmental issues (global warming, acid rain, ozone layer depletion, desertification etc.)	Comparatively explicit, Stochastic cause	Visible in most by statistical survey	Damage ranges from decades to hundreds of years , Broader area than that of public nuisance, Potentially global	National and international regulation, Medical treatment
⑤Low-dose radiation exposure	Explicit, Radioactive material (iodine, cesium, strontium, etc.)	Not yet visible, (insufficient scientific evidence)	Difficult to predict, Fairly broad area, Possibility of the genetic damage?	Possible preventive measures （decontamination, food inspection, etc.）

Based on the table above, low-dose radiation exposure deserves to be called “a new catastrophe” for the following three reasons.

First, low-dose radiation exposure cannot be seen at all with the naked eye. Radioactive materials can be measured, of course, but they are not visible. Additionally, these materials do not cause any immediate pain.

There is a possibility that the radiation will cause cancer or heart disease in the following years or decades, but the catastrophe does not start at that time. Still, in the initial months and years following the initial event, we are already in the middle of the catastrophe. Because it is not visible, this catastrophe is not a catastrophe that will disrupt or overturn daily life as other catastrophes do; rather it is a catastrophe that will penetrate calmly into daily life.

Second, while the source is very clear, there is a lack of scientific evidence regarding the damage low-dose radiation exposure causes. As for low-dose radiation exposure, while there is evidence that radiation hormesis[15] can have a positive effect on the human body, there is also evidence of the Petokau effect [16]that states low-dose and long-term exposure is more dangerous on the body than high-dose and short-term exposure. Both negative and positive evidence can be found.

Third, because of the preceding two issues, there is uncertainty about what kind of preventive measures are effective. Food inspection and decontamination would be necessary, but they are only preventive measures for symptomatic treatment and would not solve the fundamental problem.

Furthermore, because the radioactive materials circulate through

the natural world, we cannot limit the range of when and where the influence would extend both temporally and spatially. Any measures taken would be a social rather than scientific decision.

A catastrophe with these characteristics is completely different from all past catastrophes. Currently, the catastrophe that is invisible, quiet, slow, and latent is ongoing.

3. Are there any applicable ethical principles for low-dose radiation exposure?

There is an ethical reason for the lack of scientific evidence regarding low-dose radiation exposure. According to the classification of evidence levels by the Agency for Health Care Policy and Research (AHCPR) belonging to the Department of Health and Human Services (DHHS), the highest evidence of clinical research is a randomized controlled trial (RCT) apart from meta-analysis.[17] However, an RCT, which is a long-term and prospective study about low-dose radiation exposure, is not permitted *ethically*. It is common sense that we should not allow people to undergo long-term radiation exposure for research purposes, even at a low-dose of radioactivity.

Because of this ethical reason, we may never know the correct scientific correct answers. Some physicians insist that as a second best alternative, being aware of such uncertainty, they should collect basic research about genes, chromosomes, cells, and organs.[18] However, any findings from this method of research must be confirmed through clinical research, even if the results of basic medical studies are properly collected

because of widely varying individual human differences. Otherwise, various objections will coexist, and we will only increase our confusion. Masaki Ichinose calls this situation "unassertibility."[19] Regarding the effects on the human body of long-term, low-dose radiation exposure, we are now facing this "unassertibility" about what is the correct evidence.

Under these circumstances, people live everyday life in the region (especially in and around Fukushima prefecture) where the exposure dose is slightly higher than the average in the rest of Japan. People continue to live while this enduring catastrophe continues to grow. Could we not consider, so to speak, the people currently living in and near the low-dose radiated areas of Fukushima the equivalent of subjects of clinical research? Were they considered de facto subjects of a cohort study? For example, according to the Fukushima Health Management Survey, about 5.1% of people among about 515,000 people were exposed to external-dose radiation exposure of more than 2mSv for four months after the accident.[20] Because the annual effective dose for the public assumes a 1mSv limit according to an International Commission on Radiological Protection (ICRP) publication (1990)[21], this number is definitely not low.

In spite of such circumstances, we are not able to make recommendations based on exact scientific evidence about safety. Moreover, it is not necessary simply to highlight the need for measures but to implement them practically. What can we say from an ethical point of view?

As for the ethical principles of clinical research, the three/four ethical principles, summarized in the *Belmond Report* and in *Principles of Biomedical Ethics*, are very well-known within the bioethics community.

These principles are Respect for Persons (Autonomy), Beneficence, Nonmaleficence, and Justice. But, it is difficult to apply these principles to the case of 3.11 for the following two reasons.

Firstly, these four principles have generally been applied to researchers, but in this case, even if the subjects are the equivalent of local citizens, who are the equivalent of researchers? Currently, the Fukushima Health Management Survey is in progress, but it is not clear whether this is a part of a compensation or a study. If it is the latter, as is clearly written in the *Belmont Report* and the *Declaration of Helsinki*, we need the proper informed consent (IC) of each citizen. Fukushima Prefecture and Fukushima Medical University may consider that this survey is retrospective and part of a program of surveillance of public health. However, this large-scale survey of radiation exposure, apart from the survey by the Atomic Bomb Casualty Commission (ABCC) in Hiroshima after the war, is the first health-agency solicited surveillance program in Japan. Therefore, it is necessary to demand the appropriate understanding of local citizens because this survey includes personal information such as blood testing.

The second reason relates to the essence of medicine and medical practice. They have progressed on the basis of urgency of particular cases, that is, individual issues. As for urgency, among medical researchers, there is an urgency to publish an original paper before anyone else. On the other hand, among medical practitioners, there is an urgency to help the next patient as soon as possible. In order to respond to this urgency, the four principles were formulated and generally adopted within the medical community in the context of medical ethics discourse. If we

examine them, their content is considerably vague. Nevertheless, we need not take issue with them, because the range where the principle is applied is limited to a particular case. Regarding this range, where the four principles are applied to medical research, attentions centers on the clinical research of a particular technology or material; in medical practice, however, where the four principles are applied to the treatment of patients, it is difficult to apply the same principles to cases that are not limited.

On this point, Beauchamp and Childress are also well understood. They deny the categorical imperative of Immanuel Kant and the utilitarianism of J. S. Mill as absolute principles, and consider the four principles as close to the prima facie duties/obligations of W.D. Ross.[22] Here, the four principles are totally different from the categorical imperative with universal validity. Therefore, it may be difficult to apply these principles to environmental degradation such as low-dose radiation exposure.

For example, even if we apply the Beneficence principle to this case, it is not clear what the best judgment is from a medical viewpoint. As for low-dose radiation exposure, as we have seen in the previous chapter, we cannot make a decision regarding what the best choice is because there is both positive and negative evidence. If applying the Nonmaleficence principle, emigration would be the best choice. Judgment, however, requires a perspective beyond medicine and would be very expensive. The risk-benefit evaluation would change according to whether it is applied to a short-term viewpoint or a long-term viewpoint, and it would depend upon whose viewpoint and the extent of the range. The Justice principle

refers to fairness in distribution, but will it really be possible to distribute risks between citizens and non-citizens? For example, if we seriously believe that 3.11 is an overall issue affecting the entire of Japan, each prefecture should undertake the handling of radioactive waste fairly, and it should be very natural that all prefectures consume the farm products of Fukushima. Moreover, because the Fukushima Daiichi Nuclear Power Plant is under the jurisdiction of the Tokyo Electric Power Company (TEPCO), it is natural that the citizens of Tokyo bear more risk than the citizens of Fukushima. But, it does not seem that anyone takes this as serious issue.

Briefly, in the case of 3.11, we are limited when making ethical remarks from the perspective of the four principles. Then, what can we say about the precautionary principle, which is always cited in reference to environmental issues? After studying the precautionary principle[23], which was adopted at the *Rio Declaration*, I find it applicable to the case of low-dose radiation exposure. This is because low-dose radiation exposure seems to have the "threats of serious or irreversible damage" and there is also a "lack of full scientific certainty."

When we put the precautionary principle into practice, however, the lack of the evidence will prevent the implementation of this principle. In the case of low-dose radiation exposure, we do not understand whether the "threats of serious or irreversible damage" are really true. Therefore, there are considerable differences in recognizing the threats. For example, in the case of global warming, we realize the threats as abnormal weather conditions that are already visible. In the Chernobyl nuclear accident, threats were visualized by the increased occurrence of cancer a few years

later. It can be said that in both cases, even if the evidence is stochastic, there are negative phenomena. Thus, we can say threats exist.

On the other hand, in the case of low-dose exposure, such threats do *not yet* exist. Because of this, there will be many people opposing the application of the precautionary principle at the present stage. Though, I hope it does not occur, there is a possibility that there will be an increase in cancers diagnoses around Fukushima over the next several years. Even after several decades or many generations, we cannot abandon the possibility that cancer, heart disease, and genetic diseases will occur more frequently. If that happens, then the precautionary principle must be persuasive and various measures can be taken, but by then it would already be too late.

The precautionary principle, in fact, is a very difficult principle to apply. What preventive measures are appropriate at the present stage when there is *not yet* a menace?

4. How should we understand the anxiety of *Inochi*? Finding a bridging ethical principle to put the precautionary principle into practice

Even if medical evidence is uncertain, some residents in the region who were exposed to low-dose radiation might feel severe anxiety and stress. Further, they also might fall ill. Their bodies are undermined by a low-dose of radiation exposure, and, as a result, their physical condition might deteriorate. It may be difficult to distinguish both of these scientifically, but from the point of view of bioethics, the current situation involving people with poor physical health is not negligible. In other

words, it might be possible to say that where there is no abnormality macroscopically; there is, however, abnormality microscopically. It is also possible that the person feels abnormal even if another person cannot see it. This is not a subjective, or trivial problem, or just malaise. Even if the problems are microscopic and the symptoms are subjective, it becomes persuasive as they accumulate. As clinical research called the case report about illness is accepted in medicine, we must compile a case report on a subjective malaise.

The issues above may seem similar to those in public health, but they are different on several points. The main purpose of public health, as symbolized by the new concept of "metabolic syndrome" and periodic health examinations, consists of the prevention of disease. In other words, it aims to maintain the health of each person by finding, as soon as possible, the aggravated disease that the individual may not be aware of. However, the problem here is when we have a case with subjective complaints, even if the disease does not progress. Public health stands in the macro perspective of the public, but the anxiety or disorder from the micro perspective of the individual is where public health misses, and it may become a crucial problem for bioethics.

The micro perspective of these otherwise healthy lives has not been regarded as important in bioethics literature. As mentioned in chapter one, the micro perspective reflects only the positive aspects of life, and that is nothing more than banal life.

There may be several other reasons why it has not been treated as important. In my opinion, terminology has played a major role. *Life* in English corresponds to two meanings in Japanese, *Seimei* and *Inochi*, but

they are used without being distinguished in English. Bioethics in Japan might have received this undifferentiated way of thinking from thinking with these terms in the context of English.

Both, of course, are sometimes used without distinction even in Japanese, but, both are clearly different in the following usages. The expression "cherish your *Inochi"* is very natural in Japanese, but we do not often say "cherish your *Seimei*". The expression "relay of *Inochi*" is used in brain death and organ transplantation, but "relay of *Seimei*" is not often said. In addition, "the birth of *Inochi*" and "*Inochi* of only a little more" are part of the vernacular, but if we say "the birth of *Seimei*" and "*Seimei* of only a little more", they are unnatural and have different meanings.

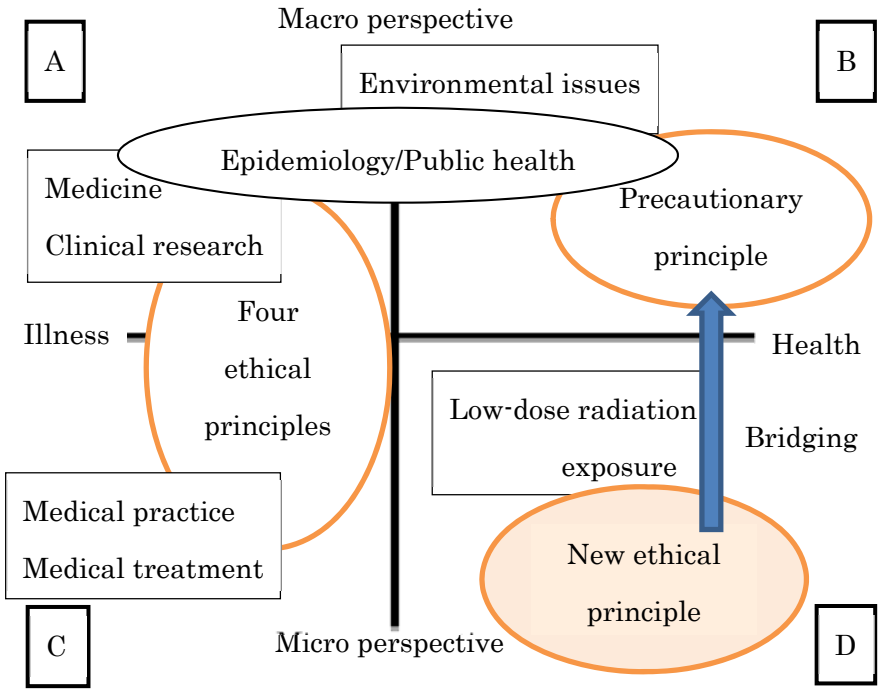
So, what is the difference between *Inochi* and *Seimei*? Considering the concept of *Inochi*, Masahiro Morioka has already conducted a minute analysis.[24]According to Morioka, in modern Japanese, *Inochi* basically has four meanings, that is, "the mysterious power or energy that keeps creatures and humans alive", "the period between birth and death, or the state of being alive", "the most essential part of an object" and "eternal life". Furthermore, he explains that two requirements must be fulfilled for something to be called *Inochi*.[25]One is that it must be a phase in which things are born, grow, give birth, age, and die. The other is that it must possess the characteristics of both finiteness and infiniteness.

This indication is very important in order to understand *Inochi*. However, when we grasp *Inochi* as a phase, there is a crucial point that Morioka misses, which is *how* the phase appears in relation with the person. *Inochi* is, as Morioka puts it, an observer-relative concept.[26] This

concept of "observer-relative" connotes whether the observer stands at the first person, the second person, or the third person.[27]By introducing the concept of person, we can easily understand the difference between *Inochi* and *Seimei*.

In my interpretation, the difference lies in whether a person is involved. Whereas *Seimei* is an expression meaning to understand life from the third person or impersonal perspective, *Inochi* is an expression meaning to understand life from the first person or second person perspective. Therefore, “cherish your *Inochi*,” as mentioned above, does not mean to express the importance of life in general. From the perspective of the first person, it is meant to express the irreversible nature of a particular individual life. Alternatively, it states from the perspective of the second person the importance of another particular life. If I translate *Inochi* into English, it might mean “life from one’s own perspective and/or one’s own value.” Not that life is neutral, but it is important to understand life with perspective and/or value, and that is also necessary for bioethics after 3.11.

In the following table, we will sort out these various perspectives.



A and C are the main stages of medicine and medical practice. The four ethical principles are applied to these domains. Public health and epidemiology are concerned with A and B from the macro-perspective. B is the main stage for environmental issues and overlaps with public health and epidemiology. The precautionary principle claims the prevention of B so as not to slip into the domain of A or C. However, "threats of serious or irreversible damage" must be recognized so that it is put into practice. If public health grasps the health of citizens statistically, then it will become medical evidence, and the precautionary principle will be put into practice based on that evidence. As confirmed in the three previous chapters, the precautionary principle has "not yet" been applied to the issues regarding low-dose radiation exposure, because threats do not exist on the macro level. Currently, to state briefly, low-dose radiation exposure is an ongoing

problem, calmly resting in the domain represented by D. D is the domain that has not yet been regarded as important by medicine and medical practice. In addition, D in the micro-perspective is not a domain where the precautionary principle can be applied directly. Low-dose radiation exposure is filled with the type of risk that can transform it from D to A or C at a certain stage, because anxiety and illness have already been reported. Thus, an ethical principle for domain D should be required before the evidence of low-dose radiation exposure builds.

To conclude, based on the above, what is needed for bioethics after 3.11 is a new ethical principle to precisely grasp the issues surrounding low-dose radiation exposure from a micro-perspective and to correlate it with the precautionary principle. In other words, it will be a bridging ethical principle that will be used to put the precautionary principle into practice. It is also the principle that will allow us to take into consideration the voices of citizens experiencing anxiety and stress. This could be expressed in various ways. For example, “Do not miss the fear of *Inochi*.”, “Care for the voices of *Inochi*.”, and “Mind individual *Inochi*.” Because low-dose radiation exposure is a new catastrophe unlike previous ones, a new ethical principle is required in order to properly cope with the situation.

Acknowledgement

This work was supported by JSPS KAKENHI, Grant Number 23520039.

Notes

[1] Hirotada HIROSE, 2013,"Fukushima Daiichi Genpatsu Saigai wo Miru Seron"［ Public opinion to see the Fukushima Daiichi nuclear power plant disaster］, *KAGAKU*, Vol.83 No.12.
[2] E.g., The Japanese Association for Philosophical and Ethical Researches in Medicine, Japan Association for Bioethics
[3] *Medical Practitioners' Act*, 1948, Article 19(2) and *Dental Practitioners Act*, 1948, Article 19(2)
[4] See, e.g., a case of Susan Torres at Wikipedia.
http://en.wikipedia.org/wiki/Susan_Torres
The case of brain dead women in pregnant is rare. According to the retrospective review by Suddaby et al., of 252 brain-dead potential donors from 1990 to 1996, 5 organ donors were in the peripartum period. Suddaby EC et al., 1998, "Analysis of organ donors in the peripartum period.", *Journal of transplant coordination*, 8:1, pp.35-9
[5] Weinberg, A.M., 1972, "Science and Trans-Science" *Minerva*, Vol.10 No.2.
[6] With a total number from 2011 to 2013, thyroid cancer has already been found in more than 50 children (average age 16.9 years old +-2.7 years old), March 31, 2014,
http://www.pref.fukushima.lg.jp/uploaded/attachment/65174.pdf
[7] See the definition for the term "catastrophe" at
http://www.oxforddictionaries.com/
[8] According to International Atomic Energy Agency (IAEA), 439 nuclear reactors are operating in 30 countries as of 2008.
http://www.iaea.org/Publications/Booklets/NuclearPower/np08.pdf
[9] See "Fukushima Daiichi nuclear disaster" at Wikipedia in English, French.
[10] Dupuy, J-P., 2002, *Pour un Catastrophisme éclairé: Quand l'impossible est certain*, Éditions du Seuil, pp.86-7.
[11] Beck, U., 2011, "Aus gegebenem Anlaß: Fukushima oder die Zukunft Japans in der Weltrisikogesellschaft.", *Risukuka Suru Nihonshakai: Ulrich Beck tono taiwa* (in Japanese), Iwanami.,p.2.
[12] ibid., p.10.
[13] Nancy, J-L., 2015, *After Fukushima: The Equivalence of Catastrophes*, Fordham University Press, pp3-4.
[14] Beck, U., 1986, *Risikogesellschaft: Auf dem Weg in eine andere Moderne*, Suhrkamp, p.7.
[15] See, e.g., Luckey T.D., 1991, *Radiation Hormesis*, CRC press
[16] See, e.g., Greaub R., 1994, *The Petkau : TheDevastating Effect of*

*Nuclear Radiation on Human Body and Environmen*t, Thunder's Mouth Press

[17] The Agency for Health Care Policy and Research (AHCPR) was established in December 1989 and reauthorized on December 6, 1999 as the Agency for Healthcare Research and Quality (AHRQ), http://www.bcshguidelines.com/BCSH_PROCESS/EVIDENCE_LEVELS_AND_GRADES_OF_RECOMMENDATION/46_AHCPR.html

[18] Brenner, D.J., 2011, "We don't know enough about low-dose radiation risk.", *Nature,* doi:10.1038/news.2011.206.

[19] Masaki ICHINOSE, 2013, *Houshanou mondai ni tachimukau tetsugaku* [Philosophy to confront the issue of radioactivity], Chikuma-shobo, p.210.

[20] Reconstruction Agency et al. of Japan, *Basic information about the radiation risk,* published February 18, 2014, http://www.reconstruction.go.jp/topics/main-cat1/sub-cat1-1/20140218_basic_information_all.pdf

[21] *ICRP Publication 60*, 1990.

[22] Beauchamp T.L., Childress J.F., 1989, *Principles of Biomedical ethics* 3rd ed., Oxford University Press, pp.49-55.

[23] The United Nations Conference on Environment and Development, 1992, *Principle 15 in Rio Declaration on Environment and Developmen*t, http://www.unep.org/Documents.multilingual/Default.asp?DocumentID=78&ArticleID=1163

[24] Masahiro MORIOKA, 1991, "The Concept of *Inochi*: A Philosophical Perspective on the Study of Life", *Japan Review*, 2:83-115,pp.87-88.

[25] ibid., pp.103-105.

[26] ibid., p.104.

[27] A person is supposed to have four aspects: subject, narrator, correlative of communication, and layer of memory.
Here, I use it to mean the correlative of communication.
Cf. Fumika YAMAMOTO, 2006, *Mushi to Ninshou* [Selflessness and person], Tohoku University Press, pp.35-48.