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Innovators' Legacy：The Wisdom of Trailblazers

New Ethics for an Era of Human Security and Well-being

[Part 1] Thoughts on the Post-COVID-19, Post-Ukraine Era (2 of 3)

#Innovation Creation #Sustainability

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In 1971, Koizumi graduated from the Department of Pure and Applied Sciences in the College of Arts and Sciences of the University of Tokyo, and in the same year, he joined the Department of Optical Instruments at Naka Works of Hitachi, Ltd. In 1976, Koizumi submitted his thesis to the Faculty of Science and received his doctorate in science from the University of Tokyo. He discovered and developed many new principles in fields such as the environment and medicine, and applied them in society. In 2000, Koizumi was appointed General Manager at the Advanced Research Laboratory. He became Corporate Chief Scientist in 2003, a Fellow in 2004, and has been working in his current role since 2017. Koizumi is a Fellow and a member of the RCAST Board, the Research Center for Advanced Science and Technology (RCAST) of the University of Tokyo, a Foreign Member of the Chinese Academy of Engineering (CAE), and Professor Emeritus at Southeast University. He has also worked as Director at the International Council of Academies of Engineering and Technological Sciences (CAETS), and as board member at various research institutes and foundations in the USA, Europe, Australia, and other countries. Recently, he published "Albert Einstein's Inverse Omega: Considering Education from the Perspective of Evolution of the Brain (Evolutionary Pedagogy)" (winner of Papyrus Award, Bungeishunju Ltd.).

Highlight

In today's society, which is notable for its volatility, uncertainty, complexity, and ambiguity (VUCA), what do we need to do to create a better existence for individuals, companies, organizations, and the state? In this series of articles, Hideaki Koizumi, Honorary Fellow of Hitachi, Ltd., who is active internationally in a wide range of cross-disciplinary research activities, such as brain science, education, science, and ethical issues, discusses this question from a wide variety of perspectives, including the theory of ideas, philosophy, technology, science, and art. The theme of Part 1 is the question of how we should understand the post-COVID-19, post-Ukraine era. The coronavirus pandemic swept across the world for over two years and had a profound impact on the society and economy of every country. Then, just as we were starting to overcome this crisis, the Russian government invaded Ukraine, which had knock-on effects on the global food supply and caused upheaval in global security frameworks. In a world that stands at a crossroads on many fronts, what will serve as the basis of a better existence for individuals, companies, and the state? What do we need to do to cultivate new possibilities?

Awareness of Our Planetary Boundaries

In the previous article, we gained an overall view of current conditions and problems in the world by focusing on "*in situ*" data and "primary sources of information." The COVID-19 pandemic and the Russian invasion of Ukraine continue to be serious issues requiring an urgent response. It is easy to become pessimistic when confronted by the reality of these challenges.

In this article, I would like to focus on how we can try to resolve these problems to build a more hopeful future and what specific actions we can put into practice to move in a more positive direction. This will help preserve our thin terrestrial biosphere and result in human security and well-being, as well as sound ethics and education; in other words, it will help secure the future of our children.

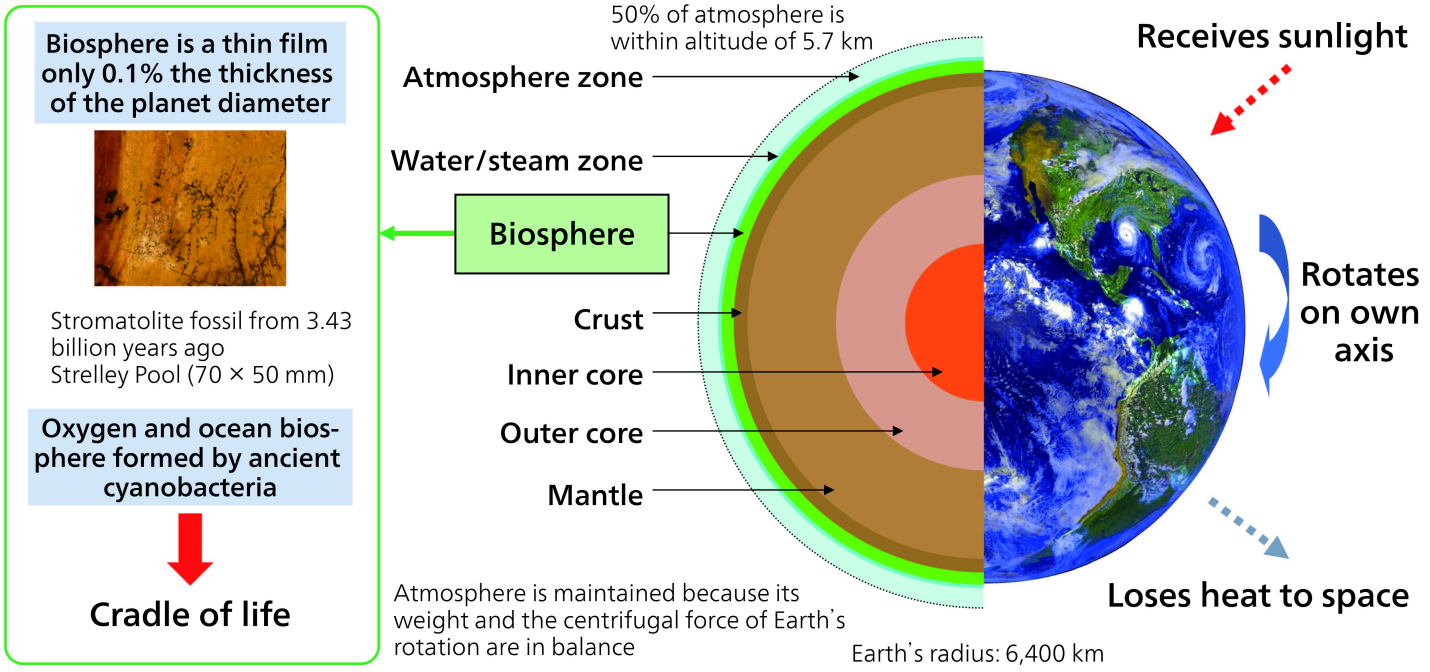
In the first article of this series, I explained how the threat of emerging infectious diseases is a structural problem. Next, I will show that to protect against such threats, in addition to responding to emergencies that occur, we need to change the old structures themselves. Particularly important is to clarify the core of how we think based on the essence of life to enable us to respond to problems before they occur.

If the nature of modern civilization has triggered the threat of emerging infectious diseases, then we must change our direction of travel. Especially since the start of the Industrial Revolution, Homo sapiens has forgotten how to live in coexistence with other species, and it is only one small part of nature. We have continued our self-centered development that ignores the workings of the natural world. Optimizing only our own lives without heed of resource and space limitations on our planet has resulted in climate change, the disturbance of regionally unique ecosystems, and the loss of biodiversity. First, we will think about the relationship between humans and the natural environment, and then I will offer some insights into inter-human relationships from the perspective of economics.

The atmosphere needed by organisms to live is spread across the surface of Earth. More than half of the atmosphere is within 6 km of the planet's surface. Even in Japan, which is located in a temperate zone, the tree line in the mountains is at an altitude of about 2.5 km, where the air thins, and we can become susceptible to altitude sickness. From the perspective of the entire planet, with a radius of 6,400 km, the biosphere in which living organisms can live is only a thin film, 0.1% of the diameter, clinging to the surface*1.

This extremely limited zone has provided the stage for the rise and fall of civilizations, where humans fight each other and compete with other species. Awareness of planetary boundaries, or the line between the planet and the biosphere, can help us maintain biodiversity. The conservation of biodiversity is not simply a matter of humans protecting nature, but rather, protecting the natural world viewed as a whole, of which the human species is one part ["Most Advanced Environmental Measurement," Hideaki Koizumi, Mita Press (1998) in Japanese].

Figure 1—Earth's Thin Biosphere



Source: "Most Advanced Environmental Measurement," Hideaki Koizumi, Mita Press (1998)
Photo by H. Koizumi, Courtesy of NASA

The fundamental cause of problems in the global environment is that the terrestrial biosphere is stretched thin across the surface of the planet. All living things coexist in this zone, which is thin like the film of a soap bubble. Evolution occurred in this limited space, giving rise to the three great lineages of Bacteria (such as cyanobacteria), Archaea, and then Eukaryotes (molecular phylogenetic classification). The Anthropocene epoch is one dominated by modern humans, one of the many lifeforms on Earth. Our evolution began about 3.5 billion years ago, when an organism called cyanobacteria started pumping oxygen into the atmosphere as a byproduct of its biological processes. This created the conditions for eukaryotes to evolve, and eventually led to humans. However, our human artifacts have now developed to the stage where they are damaging our thin zone of life. The terrestrial biosphere is composed of a multitude of lifeforms that function like small engines feeding into larger and larger engines, and which use the energy delivered to us via photons from the sun before discharging entropy into the freezing 3-K temperature of space. The planetary boundaries concept arises naturally from this.

In the 1970s, I worked at the Lawrence Berkeley National Laboratory (LBL), University of California, under the jurisdiction of the U.S. Department of Energy (established in 1977 by reorganizing the Atomic Energy Commission), as well as at the National Bureau of Standards (NBS) and US Army Corps of Engineers Hydrologic Engineering Center. I worked *in situ* in environmental fields while also working as a visiting researcher. This was the dawn of a new era, as we were becoming aware of global environmental issues and environmental assessments. Our paradigm was shifting after previously focusing on pollution issues (such as the Ashio Copper Mine incident and Minamata disease in Japan). Many research laboratories in the USA and Europe had expressed interest in polarization Zeeman atomic absorption spectroscopy, whose principles had been discovered and put into practical use in 1974*2. In 2013, the equipment from this time was selected for certification under the Heritage of Analytical and Scientific Instruments program.

I also conducted an international evaluation of the discovered principles and the performance of systems as a visiting researcher in joint research at the NBS.

NBS is located in the suburbs of Washington, DC, and it produces the NBS Standard Reference Materials (SRM) that are used worldwide to confirm the high accuracy and sensitivity of equipment. Analysis results from my work were officially adopted in the SRM for determining guaranteed values when analyzing trace metal elements in environmental water.

From the second half of the 1980s, global environmental issues became a hot topic worldwide, and in 1990, the National Institute for Pollution Studies in Japan was reorganized into the National Institute for Environmental Studies (NIES). Then in 1992, the United Nations Conference on Environment and Development (Earth Summit) was held in Rio de Janeiro. When I worked as Executive Committee Chairman at an international conference on the environment held in Sapporo in 1996, I was lucky enough to receive advice directly from Lord Lewis, who was chairman of an environmental pollution committee in the UK's House of Lords (Jack Lewis, Former Royal Society President, 1928-2014). [H. Koizumi, Ed., Proceeding of the Trans-disciplinary Forum on Science and Technology for the Global Environment: Measurement and Analysis, JST (1996)]*3.

This conference was also supported by President Norihito Tambo of Hokkaido University. President Tambo was an authority on the hydrologic cycle, and expanding from the concept of "global environment capacity," he had already started discussions on what we would now recognize as the concept of planetary boundaries.

It is important to shift from a "self-centered" mindset, which prioritizes only oneself, one's country, or the human race, and adopt "altruism," which gives consideration to the welfare of others as well. We must return to the idea that all living things coexist with each other. We should try to use the pandemic as an opportunity for humans to rediscover humility and a sense of appreciation, and remember the precariousness of our existence that transcends nation or race. To this end, we must look at the world not only through the eyes of Western philosophy, but also through Eastern thought and philosophies that prioritize nature above all.

***1 Definition of outer space**

"Outer space" is defined as an altitude 100 km and higher from the surface of the Earth. This is the generally accepted definition according to agencies such as the Fédération Aéronautique Internationale (FAI), where outer space is defined as altitudes where the friction of the atmosphere can be ignored (the United States Air Force defines outer space as a distance of 80 km or more from the surface of the Earth). Therefore, outer space is not such a huge distance above us. This has led to novel ideas such as a space elevator. Incidentally, it is not strictly true from a physics point of view that bodies in an orbiting spacecraft are weightless. The weight of an object in low orbit is basically the same as on Earth. A body floats in space because it is balanced by centrifugal force. This is like the phenomenon we see when we swing a bucket of water around our head without any water spilling out; it does not mean that the planet's gravity is no longer acting on the body. Recently, the National Aeronautics and Space Administration (NASA) has defined "deep-space" as the distance beginning 16,000 to 32,000 km away from the Earth.

***2 Research into environmental issues**

The Lawrence Berkeley National Laboratory (LBL), University of California, established the world's first Division of Environment and Energy. I worked as a visiting researcher at this Division from 1977 to 1978, and thanks to the presence of many Nobel Prize winners, I was able to learn new and exciting things. Of all the many joint research sites where I worked, the one that was closest to actual *in situ* conditions and had the strongest awareness of growing environmental issues was the Waterways Experiment Station (WES) of the US Army Corps of Engineers, located at Vicksburg, site of a famous battle in the American Civil War. During my long-term research in 1976, I analyzed extremely perplexing samples. I had come face-to-face with a miniature version of global environmental issues that went beyond just pollution; this was the beginning of an understanding that would receive global recognition in the 1980s. Environmental assessments of the military base were essential for long-term coexistence with local residents, and we worked day and night to conduct various analyses.

The United States Department of Defense (DOD or the Pentagon) operates about 800 military bases around the world. Their locations are determined strategically, and often urban areas of varying sizes form around them. For example, in Okinawa, military bases take up about 15% of the total land area of the main island. The restricted water area is 1.3 times the size of Kyushu and the restricted air area is 1.1 times the size of Hokkaido. WES plays a central role in conducting environmental impact assessments of military bases. They analyze a huge number of samples as the first priority in understanding interactions with the surrounding environment.

Academic research on the environment took a significant step forward in 1972 when the world's first environmental studies department was established at Yale University (the Yale School of Forestry & Environmental Studies, now the Yale School of the Environment). WES of the US Army Corps of Engineers pioneered environmental research even before this. One time, I happened to become friendly with Dr. Allan Bromley, Science Advisor to President George H. W. Bush, when he visited Japan. This led to my involvement in long-term joint research with Yale University in the environmental and neuroscience fields.

***3 Discussions transcending disciplines**

The Parliament of the United Kingdom of Great Britain and Northern Ireland is composed of an upper house (House of Lords) and a lower house (House of Commons). Parliamentary reforms in 1999 led to some changes in this system, but my experience there was before this, in the mid-1990s. The House of Lords had formed a pioneering committee exploring environmental and pollution issues (known currently as the Environment and Climate Change Committee), which was chaired at the time by Lord Lewis. I'll never forget the words of Lord Lewis, who said, "It's easy just to hold an international conference, but what's important is to produce new results that can lead to the next step forward." The "trans-disciplinary" concept included in the name of a 1996 conference and the theme of "human security and well-being" explored at the conference remain crucial guiding lights even now after 26 years have passed.

It is truly wonderful how disciplines can be connected together. In the first article, I described how a brilliant young researcher, Masaaki Kitajima, Associate Professor at Hokkaido University, showed that testing wastewater for viruses is a promising new method for combating pandemics. Associate Professor Kitajima belongs to an academic department that was established by President Tambo. I am often reminded of the wisdom of Lord Lewis's words about needing to leave behind brilliant organizations and talented people for the future.

Concept of "Human Security"

The actions of the Russian government in invading Ukraine embodied “self-centeredness” in even starker terms than the pandemic. Nothing threatens life more directly than war, and this throwback to darker times of history makes us realize again the importance of human security.

The concept of “Human Security” is used in international relations, meaning not only the physical and economic safety of individuals, but also something that assures peace of mind. This concept complements the physical security of the nation state as a whole, and became widely known after it was first proposed in a 1994 United Nations Annual Report (HUMAN DEVELOPMENT REPORT 1994: New Dimensions of Human Security).

Professor Emma Rothschild, who presided over the Center for History and Economics at King's College, Cambridge University, in the early 1990s, had already been promoting this idea from a slightly different perspective. Currently, she is working as a director at the Joint Centre for History and Economics, which links research bodies at the University of Cambridge and Harvard University, together with her husband, Professor Amartya Sen (winner of the 1998 Nobel Prize in Economics), and others.

I met Professor Rothschild when she visited Japan in 1994 to attend the Common Security Forum. At the time, the Common Security Forum was an independent international network, which had one of its bases at the aforementioned Center for History and Economics. This network enabled researchers and administrative officials from around the world to engage in dialog, research, and to disseminate information about fundamental common issues related to security and globalization, in a forum that transcended the boundaries of individuals and nation states.

Figure 2—Professor Emma Rothschild and Professor Amartya Sen

Photo by H.Koizumi

This photograph was taken late at night, after some enjoyable discussions, at the entrance to the Master’s Lodge of Trinity College, Cambridge University (Professor Sen is wearing a necktie with Japanese embroidery that I gave him as a present). In 2010, Professor Sen came to speak at a forum celebrating Hitachi, Ltd.’s 100th anniversary, despite feeling unwell. He gave a splendid lecture about the thoughts and actions of Prince Shotoku.

The Israeli-Palestinian conflict has been one of the most intractable issues in the world. The Oslo Accords, which took the world by surprise when first announced in 1993, had their origin in academic research conducted by the Common Security Forum. When researchers, including from the private sector, re-examined information *in situ*, they found information that greatly differed from what was commonly thought, which helped to deepen mutual understanding. This success was possible only because of *in situ*, primary sources of information.

After repeated secret negotiations in the forests of Northern Europe and using the Foreign Minister of Norway as an intermediary, the parties finally agreed to the Oslo Accords. The following year, Prime Minister Rabin and Foreign Minister (later President) Peres, and Yasser Arafat, Chairman of the Palestine Liberation Organization, all received the Nobel Peace Prize. Tragically, soon after, Prime Minister Rabin was assassinated and the conflict took new forms, so that today, peace seems as far away as ever. The main theme of the conference held in Tokyo was to discuss the background to the Oslo Accords by inviting various people who were actually involved in the preparations for the peace talks in Northern Europe. It was at the reception for this conference where I first met Professor Rothschild; I was seated next to her, and we had a lively discussion.

Soon after the conference, I was invited to Cambridge in the UK by Professor Rothschild, and then in 1996, I invited her to Sapporo for the Trans-disciplinary Forum on Global Environment, where I worked as Executive Committee Chairman. Through such an academic exchange, we deepened our understanding of each other [“Most Advanced Environmental Measurement,” Hideaki Koizumi, Mita Press (1998) in Japanese].

At the time, I was working on research and development about functional magnetic resonance imaging (fMRI) and optical topography (OT) at Hitachi Ltd.’s Central Research Laboratory, and was exploring how to establish a new “anthropology” (science of humanity) through an innovative methodology for brain measurement. This is because we had discovered the possibility of measuring the thinking process of living humans. Professor Rothschild’s expert fields of economics, philosophy, and history cannot be discussed without taking human nature into account. Through discussions and debate based on a trans-disciplinary approach, we were able to foster mutual sympathy from a variety of perspectives. One of these was matters related to “security.”

Human Security and Well-being

Professor Rothschild proposed the new concept of “Human Security” in the discussions leading up to the Oslo Accords. The fall of the Berlin Wall in 1989 eliminated the previous framework of conflict between East and West. To replace it, Professor Rothschild believed a new concept of security between all humans was required that went beyond previous Common Security principles, in order to prevent humans from fighting each other and to foster cooperation to confront common threats.

While I fully agreed with her ideas, I also questioned whether they would be enough. I found the answer on a journey I made to the UK at Professor Rothschild’s invitation. I had a layover at an airport in Denmark, and while I was waiting, I took a walk in a nearby park by the sea. I happened upon a group of elderly people who were each sitting alone on park benches, looking sad as they stared blankly at the sea. Northern European countries are well known for their strong welfare states, and it would seem as though their people should be able to live without worries, even as they get older. But the impression I got of these elderly people was that they were just aimlessly killing time by staring at the sea. It struck me that, for humans to live fulfilling lives, we need not only “human security,” but also “well-being.”

The philosopher Kitaro Nishida often used a dialectical logic that juxtaposed, contrasted, and combined two concepts, such as “thought and experience,” “art and morals,” and “logic and life,” to elevate them to a higher level of understanding. My idea was to similarly juxtapose and merge Human Security and Well-being to discover their common elements. I realized that “human security” not only means security in the sphere of international politics, but also means human peace of mind, while “well-being” is another way of saying a better way of life. Together, “human security and well-being” form a single paradigm that we should be aiming to achieve.

Since the concept of human security includes psychological aspect, it may seem at first glance to be a target or objective, but in fact, it is closer to being a means to an end. So, what is the true objective? I realized that it is “well-being.” Later, I understood that the background to this realization was the idea of “*Seizon* and Life Sciences,” which I learned from the late Dr. Taro Takemi*4.

Figure 3—At a Park in Sicily

Photo by H.Koizumi

This photograph reminds me of a scene I saw in the early 1990s in a Northern European country, which has a strong welfare state and provides medical and economic security for its elderly population. I remember seeing some old people sitting on a bench in a park, looking sadly over the sea. I realized that Human Security does not satisfy the psychological needs of people: Well-being is needed as well.
This photograph was taken in a park in Sicily, where I avoided photographing any elderly people.

Advocates promoted this concept continuously for more than 20 years, until recently, it appeared in overseas literature. The Engineering Academy of Japan has also officially declared “Engineering the Future for Human Security and Well-being” to be a basic principle. In its Mid-term Management Plan 2024 released in April 2022, the Hitachi Group highlighted “Planetary boundaries” and “well-being” as keywords for its business.

The COVID-19 pandemic, and then the Ukraine crisis, have forced us to recognize once more the importance of human security and well-being. Physical, direct safety that protects our lives from disease and war is a precondition for our existence as humans. Times of crisis can also inspire great works of art. Paintings such as Picasso’s Guernica can move us deeply by showing us the essence of things that are happening now, while music that inspires passion or provokes deep feelings of peace are very important to us as humans. Such psychological elements also make up a part of human security. Unless all these are present, well-being cannot be achieved.

***4 Dr. Taro Takemi (1904–1983) and his ideas of “*Seizon* and Life Sciences”**

My love affair with the work of Dr. Taro Takemi, who was President of the Japan Medical Association and President of the World Medical Association, started by complete coincidence.

In the spring of 1981, after previously only vaguely hearing his name in the media, Dr. Takemi showed up suddenly at the house where I grew up in Setagaya, Tokyo. I was wary of him, because he had been christened, “Taro the Brawler” by the media after many confrontational appearances with government officials on television and in the newspapers. However, with a gentle expression that was contrary to my expectations, he asked, “What are you doing these days?” At the time, I was in charge of MRI development, and when I told him this, he invited me to his house to explain.

A few days later, I went to Dr. Takemi’s house to explain MRI imaging to him. He immediately gave me some advice; “These are morphological images, but if you can also acquire functional images at the same time, you can revolutionize the field of medicine.” This advice later led to the development of magnetic resonance angiography (MRA), fMRI, and OT. From that moment until he passed away, Dr. Takemi taught me everything he could about his own experiences.

Dr. Takemi left the Keio University School of Medicine when he was young, declaring, “Current internal medicine is not real science.” Looking for science through medicine, he joined the Institute of Physical and Chemical Research (RIKEN), which at the time was pioneering research into atomic physics and elementary particles theory.

I admired Dr. Takemi so much that my family made fun of me, calling it a kind of sickness. Just before he passed away, Dr. Takemi told me, “We cannot call academic studies that cover everything about the nature of humans ‘science.’ But perhaps we may dare call it ‘*Seizon* and Life Sciences’” (science and arts for human survival and well-being). This idea seems fresh even in today’s era of VUCA, and it shines like a beacon through the darkness. My aim is to introduce his ideas little by little in this series of articles. (Dr. Taro Takemi and *Seizon* & Life Sciences—From Dr. Takemi’s Teachings and the Record of His Lectures , Interview: Taro Takemi and Me)

Germination of a New Universal Ethics

Japan is the only country to have suffered the horror of nuclear attack at Hiroshima and Nagasaki, and it was also afflicted by Minamata disease, which is often called ground zero for the modern world’s awareness of environmental issues. The discovery and practical application of the principles of polarization Zeeman atomic absorption spectroscopy first originated in the search for the mysterious cause of Minamata disease. Due to *in situ* requirements, the fundamentals of quantum mechanics (quantum transitions of electrons and nucleons, interaction between photons and other elementary particles) led to highly accurate and sensitive analysis of samples. Mercury was difficult to analyze because it is the only metal that is liquid at room temperature, and because of its high volatility, it volatizes during preprocessing. For these reasons, it took several days to accurately analyze mercury. The Zeeman mercury analyzer was first developed in the early 1970s. This analyzer was able to measure mercury of 1 ng (one billionth of a gram) in a time of only one minute, in tiny samples such as a strand of hair or 10 mg of sludge [Atomic Absorption Analysis for Mercury Using Zeeman Effect (PDF Format, 4.54 MB) in Japanese].

During the industrialization boom in Japan, inorganic mercury was pumped into Minamata Bay and the Ariake Sea in Kyushu, which had once been blessed with beautiful nature and bountiful seafood. The inorganic mercury was transformed into organic mercury such as highly toxic methylmercury by bacteria inside sludge, and this built up widely inside fish and shellfish. People living along Minamata Bay ate this seafood, resulting in the organic mercury moving to their brains and causing a wide range of serious neurological symptoms. Not only that, but pregnant women passed on the organic mercury to their fetuses via the placenta, causing miscarriages, or even if babies survived, they faced a lifetime of suffering from neurological symptoms as a patient of fetal Minamata disease (FMD). The affected seafood was sold inland, so the damage spread, and even now, it is said that some victims have not been officially recognized as suffering from Minamata disease.

The deep roots of this problem are demonstrated by the fact that it has not been limited to the Minamata region. The same problem has been repeated up to recent times, including in the Agano River region of Niigata, which has been called the second Minamata disease. Some indigenous people in the Brazilian Amazon and Canada are also, to this day, suffering from mercury poisoning. These tragedies were also a starting point for forming the concepts of “planetary boundaries” and “human security and well-being.”

As long as we are all living in this thin layer of life called the terrestrial biosphere, it is possible that we will unknowingly infringe on the rights of other people.

For example, if humans inadvertently consume mercury as I just described, they will excrete the mercury through urine, fingernails, and hair just like other animals. If we analyze a strand of hair from root to tip, we can understand when the mercury was unknowingly ingested, since it is recorded together with the growth of the hair. Biological evolution favors processes that help an individual survive. This natural process actually results in the tragic phenomenon of a mother passing on mercury to her fetus through her placenta.

Environmental and energy problems are so difficult because, for example, when manufacturing solar panels to make use of sustainable energy, we consume substantial amounts of energy and entropy in the manufacturing or recycling of the parts. Without taking a bird’s-eye view of the whole, we may end up optimizing only isolated areas instead of the entire system. It is essential for human society as well, we must form a view of the entirety in order to optimize society as a whole. For example, while everyone wants freedom, if we prioritize this value too much, then conflict with other people will inevitably arise. In the last article in this series, I will introduce anti-apartheid activist Ms. Mamphela Ramphele (currently co-president of the Club of Rome, at the time, Vice-chancellor at the University of Cape Town). She told me that, in her experience, while it was relatively easy to evoke a sense of entitlement, it was much harder to foster in young people the awareness of the obligations and responsibilities that accompany freedom. I found this to be a profound insight.

Compassion for other people and an altruistic heart are the building blocks of a sustainable society[*5].

In Buddhism, coexistence is called *tomo-iki* and is used as a broader concept that includes space and time. In commensalism, there is a difference in values between the self-centered pursuit of material benefits, and the search for spiritual satisfaction to achieve happiness through compassion for other people (altruism).

To optimize our entire worldview, we need to include changes over time in evolution and history, as well as boundary conditions related to geopolitical space.

The concept of biological evolution is particularly important in this context. The struggle for existence, or survival of the fittest, is the first stage of evolution where ethical considerations have not yet arisen. This phenomenon is ubiquitous across animals and plants, and originated in the very first stages of life, such as bacteria (it also applies to viruses, which fall outside the strict definition of life). The “empathy” to form societies is strongly expressed in modern humans (Homo sapiens). This was the first time the phenomenon of “altruism” clearly emerged.

The time has now come for us to re-examine the ethics of modern humans. New “ethics” and new “laws” need to be established based on “planetary boundaries” to enable the coexistence of so many lifeforms within the terrestrial biosphere. Above all, I believe that modern humans will need to aim for human security and well-being while showing consideration for other living things. One time, Dr. Takemi drew beautiful calligraphy characters for the phrase, “The Law of Survival” (*Seizon-no-Riho*). I believe that “The Law of Survival” is the new “ethics and law” that humans should embody.

Evolution includes random processes, as demonstrated by the neutral theory of molecular evolution. Such coincidences are sometimes called “historicity.” Since the concept of “universality” is emphasized in science, particularly in the natural sciences, sometimes this perspective of “historicity” is neglected.

In the current COVID-19 pandemic, explosions in infection rates have led to wave after wave of virus variants, which are caused by random mutations. The lifespan of a virus in its environment and the lifespan of a human are completely different, enabling us to witness extremely fast evolutionary change as the virus fast-forwards through generations. This is a microcosm of the evolutionary process.

In a similar sense, the Russian invasion of Ukraine can be seen as a sudden appearance of “historicity” that was in no way inevitable.

***5 Relationship between altruism and symbiosis**

The classic idea of coexistence that first comes to mind is symbiosis, as shown in the photographs below. I took these while on a dive in the coral reefs of the Society Islands (South Pacific). In the sea, many creatures coexist by helping each other. One famous example is sea anemones with poisonous tentacles, and the clownfish that have developed resistance to the poison. They have evolved this symbiotic relationship. The sea anemone hides and protects the clownfish, and in return, the clownfish circulates fresh seawater around the sea anemone.

Example of symbiosis in the natural world (photographs taken in the South Pacific)

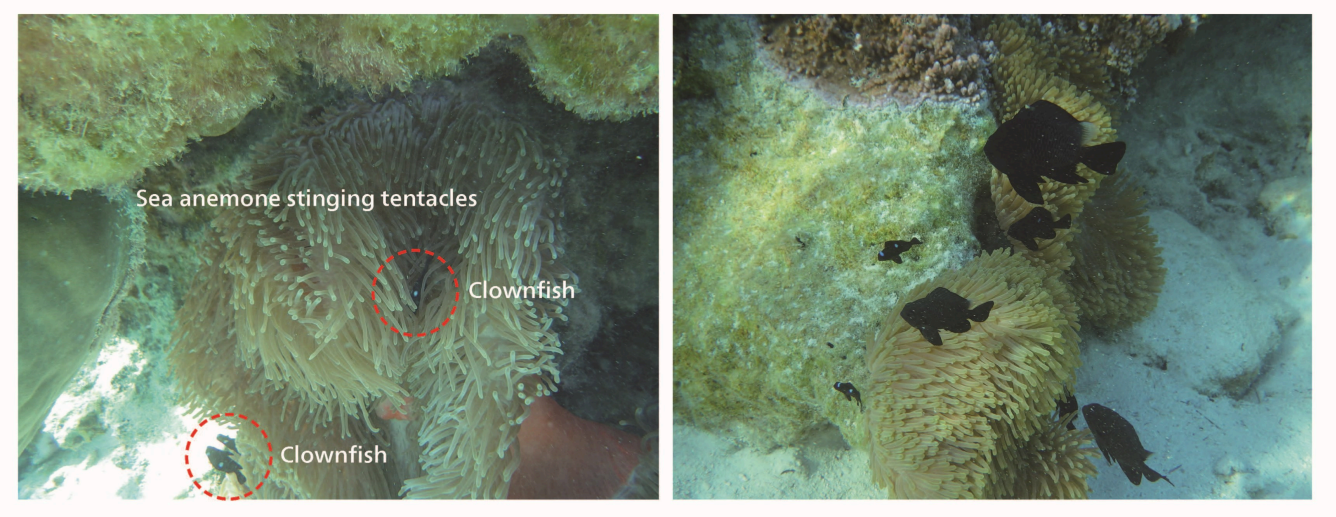


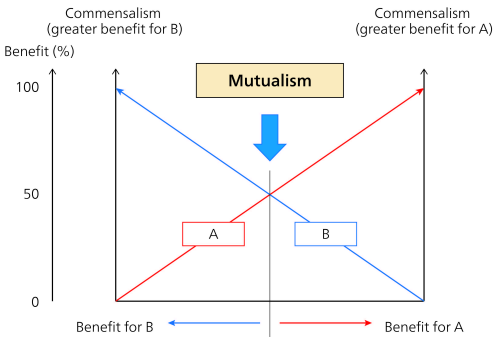
Photo by H.Koizumi

Cooperation between sea anemones and clownfish is a widespread phenomenon. At the center of the photograph, you can see a small blue spot. This is a clownfish, which the anemone is skillfully hiding from me.

Mutualism is one example of coexistence, and another is commensalism, where only one party benefits. With these concepts of coexistence in mind, I wanted to go to see the "*in situ* conditions" with my own eyes. The coexistence between sea anemones and clownfish is a very famous example of mutualism that we can read about in books. But we can learn much more when we go into the actual marine environment and see these lifeforms with our own eyes. Only then can we truly understand. While I was diving, I learned that even wild fish would swim along with me, and that my body was easily tossed around by small currents and knocked against rocks.

The figure shows the relationship between mutualism and commensalism as an example of coexistence in the natural world. Commensalism is when one side gets the majority of the benefit, and the other side derives less benefit or suffers a loss. Commensalism where the benefit of one party is much greater than the other is called "parasitism." Providing benefits to the other party is essential for coexistence between oneself and others. In the battle for survival in the natural world, commensalism is a frequently adopted strategy.

Mutualism and Commensalism



I tried to illustrate the relationship between the benefits of two parties (A and B, or self and others) in the simplest case of coexistence. Mutualism is at the center, which is popularly known as a "win-win" relationship. To achieve this, the perspective of "altruism" is essential.

Until Next Time

Since I wrote the first article in this series, there have been new developments in the COVID-19 pandemic and the Russian government's invasion of Ukraine. In Japan, we suffered through an eighth wave of coronavirus infections. As described in the first article, we still have not been testing enough patients for a wide variety of reasons. We have not been able to obtain an accurate picture of infection rates based on evidence. Tragically, the number of deaths is now a more reliable indicator than the number of infections, and this is a statistic that the media cannot ignore. The fatality rate in Japan exceeded its previous peak of 500 people per day.

As I mentioned in the first article, the number of infections and deaths will no longer be reliable in the future. Wastewater data and the excess mortality rate may become more realistic and objective evaluation criteria. Trial wastewater surveillance figures show that infections are about double the level reported by the media. For example, wastewater surveillance data published by Sapporo City shows that individual infections peaked during the seventh wave last year, and that the eighth coronavirus wave overlapped with an influenza epidemic (Sapporo City Wastewater Surveillance in Japanese, as of February 2023).

The basis for dealing with a pandemic is to delay the onset of the infection wave as much as possible. During this time, authorities prepare medical infrastructure, improve vaccines, implement vaccination programs, develop and approve new drugs, and take other actions to minimize the overall number of deaths.

In the USA, the initial response was not adequate, resulting in the tragedy of more than a million deaths from COVID-19 infection as of January 2023. Furthermore, a new variant of the Omicron strain called XBB.1.5 increased the death rate to 12,000 in the last month or so (28 days). This variant has spread in Japan as well, and infections are a serious condition around the world.

The population of China is 1.4 billion people, about 4.3 times higher than the USA. If China had the same fatality rate as the USA, it would have suffered about 5 million deaths, but when considering the different standards of the medical systems in both countries, fatalities would probably have been worse. China seemed to prioritize protecting human life even if it required economic sacrifices. After infections started spreading from Wuhan, it was thought that thorough testing and strict control of human movements had delayed the peak of explosive infection rates as much as possible. However, after facing a wide variety of challenges, China officially announced measures relaxing their strict restrictions on January 8, 2023. The government announced that 60,000 people died in the one month that included the end-of-year holiday (statistics from medical facilities only), resulting in a very unpredictable situation.

As I stated in the first article, scientific fact-finding should form the starting point of all endeavors. The academic field of fact-finding is Analytical Science, and I will link this to the concept of trans-disciplinarity that I will explore in the final article of part 1. Organizations like NIST, in addition to the CDC and NIH in the USA, will perform a critical role in preparing for future pandemics.

The Russian invasion of Ukraine also demonstrates an urgent need for a new "ethics and law," and to transform these ideas into real, functioning international organizations. Science is required here as well. In the next article, I would like to discuss this in more detail.

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