Open Letter 3

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The Emperor, beloved by all his people

October 26, 2022

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I would like to reiterate. We ask that His Majesty the Emperor please become the founder of a new Christianity.

I am not a researcher, but an ordinary person, so I do not work or live with these thoughts in my daily life. Therefore, I have extracted some sentences from the listed books, edited them, and used them as my message.

This is the third time that Almighty God has asked me to do so, and I would like to ask you to please do so.

I have the honour to be, Your Majesty's humble and obedient servant,

Sincerely,

The following text describes our reasons for asking.

This third letter to His Majesty the Emperor has been refused receipt by the Imperial Household Agency. This is my last letter to the Emperor, as I do not think he will receive it in the future.

Relationship between energy and matter (mass)

	Contingency It means "chance", "contingency," "uncertainty," "accident," etc. It can also mean "It also means" to depend on. "Contingency theory" is a Japanese term that translates to "environmental adaptation theory. This theory states that there are various environments in the world, and since there is no single best system, the system should change as the environment changes.	Double contingency This is equivalent to "double conditional dependence." To make a choice is a negation of the potential that could have been otherwise, and in that sense is a double negation. By experiencing the other as another self that is opaque to oneself, the potential denied in choice is preserved and stabilized as a mutually implied, but unrealized, possibility in both oneself and the other. Luhmann called this situation a double contingency.
1	ontology	epistemology
2	continue	change
3	design	optimization
4	relativity	symmetry
5	digital	analog
6	environment	system
7	cause and effect	cycle
8	finite (time)	infinity (space)
9	class	network
10	diversity	unique
11	death	resurrection
12	unification (harmony)	match
13	secular	sacred
14	body(substance)	soul(life)
15	experience	knowledge
16	object	word
17	value	meaning

18	phenomenon	cause
19	think	feel
20	until the end(until you finish)	as (much) as possible
21	theory of relativity	quantum mechanics
22	particle(quantum mechanics)	wave(quantum mechanics)
23	mass	energy
24	macro	micro
25	natural science(Approach from the nature side)	social science(approach from the human side)
26	luck	technology(probability)
27	(memory) self-awareness	(power of) imagination
28	evolution	creation
29	form	function
30	(past to present) ever	(from present to future) from now on

In this issue, I will try to decipher the dynamical systems theory from the table of dynamical systems theory by using the combination of "mass" and "energy". I believe that this combination shows a clue about the "solution to global warming," which is probably the most important concern of people around the world at the moment.

Dynamical Systems Theory in Psychology, Haruo Okabayashi, (Kaneko Shobo)
Energy: A Journey Through Energy, Kohsuke Furudate (Eiji Publishing Co., Ltd.)

(Emergent dualism) Dynamical Systems Theory

Let us approach emergent dualism with dynamical systems theory. The basic idea of dynamical systems theory is characterized by the fact that it cannot be decomposed. Dynamical systems (dynamic systems) such as organisms, brains, and societies, including human beings, cannot be decomposed and understood. This is because the functions and behaviors of the components of a dynamical system are determined in the context of the whole. The same element changes its behavior in the context of the whole, which in turn changes the whole. In the case of a machine, each component has a specific function, and even if the machine is disassembled, the function of each component remains the same.

In the case of a "living" system, however, the context determines the function of each component. In recent research, the expression "elements are interacting" is often used, but the level of merely interacting does not get to the essence of emergent dualism.

Let me explain what I mean by emergence. Emergence means that free movement in the lower levels of the hierarchical world gives rise to patterns in the upper levels, and that patterns in the upper levels become boundary conditions for the lower levels and indirectly define individual movements. The term emergence was proposed with respect to biological evolution. It is a concept used in evolutionary theory to refer to evolution and development that cannot be predicted or explained by prior conditions." (Tatsuo Hayashi, Philosophy Encyclopedia, p864, Heibonsha, 1971)

Dynamical systems theory refers to systems that change over time; in fact, it can describe time-based systems with certain characteristics. It is also a mathematical theory that predicts the future state of a system based on its current state and, without the use of mathematical formulas, is expressed by describing spatially or qualitatively how the state of the system changes.

A theory for understanding complex processes in nature must be a theory that satisfies the laws of chance and also includes the laws that relate them to the laws of necessity. In other words, only a theory of complex systems can be a system like consciousness, an important function of the human brain. The dynamical systems theory explains "emergence from disorder to order" in terms of complex systems. In particular, it directs our attention to the emergence of higher-order forms from interactions and cooperation among lower-order components. This process, called self-organization, can now explain change and continuity in physical, biological, and social systems.

The dynamical systems theory attempted to respond to attempts to describe complex changes in human behavior at a given point in time, with the emergence of behavior patterns that had not been seen before. Pioneering developmental researchers such as Darwin, C., Vygotsky, L.S., and Piaget, J., also addressed these issues. Just as in the history of evolution, new species have emerged that did not exist before, so in the life of a human being, new abilities, such as emotions, emerge that did not exist before. It can be said that all living things create new systems as they grow. In this way, the "living" system must be considered as a completely different type of system from that which can be treated by conventional science.

Why do we need theory?

First, I would like to consider why, in order to describe or study a phenomenon of interest, we need a theory to support that phenomenon. There are phenomena in our world, and there are facts behind those phenomena that are usually hidden. Researchers use analytical methods to find the facts behind the phenomena. From these facts, they then find common principles. Concepts are born from these facts, and theories are formed from a collection of concepts. A theory is like a story that explains the reason of the world through a collection of concepts.

Theories can predict outcomes or provide clues to explain or interpret facts. Theories can also organize the phenomena that occur and be the mother from which hypotheses are generated. The efficacy of theory allows us to avoid "wasted experience" and "tremendous trial and error. Having "theory" in one hand may prevent us from falling into "crawling empiricism" or "trial and error hell" by advocating experientialism or empiricism. Theory does not guarantee tremendous success, but it can help you sort out problems and avoid unnecessary failures that do not need to be experienced.

Quoted from "Theories of Counseling" by Yasutaka Kokubun (Seishinshobo, publisher) (Chapter 1, Introduction p17)

Five Energy Revolutions

Energy is a word that is familiar to us today, yet really difficult to understand correctly. Why is it so difficult? When discussing energy, we often fall into abstract and irreconcilable arguments, and everyone tends to define energy in a way that suits him or her. This is probably the cause of the problem. Science has become so subdivided into different fields that the usage of words has become far beyond the comprehension of the general public.

Our ancestors of prehistoric times recognized energy as an intuition and continued to devise all kinds of ways to make it a powerful item that would help us in the future. Their history began with fire and continues to the present day. Its history can be divided into five major categories, which are briefly described below.

The first energy revolution was the use of fire. The history of energy acquisition by mankind began with the awakening of the usefulness of fire. Cooking with fire enlarged the brain and accelerated human evolution. This was followed by the second energy revolution as we embarked on an agricultural lifestyle. By monopolizing the solar energy that poured onto the land, we were able to secure a steady supply of surplus food, which we then used to build cities and rise to civilization. The invention of the steam engine, a machine that converts energy, triggered the Third Energy Revolution. This broke through the limitations of mankind's own physical body.

Furthermore, the analysis of the mechanism of electricity and learning how to use it led to the Fourth Energy Revolution. Not only did humanity acquire the technology to convert energy at will, but it also overcame the limitations of the field in energy use by developing power plants and power transmission/distribution networks. Finally, the development of artificial fertilizers led to the Fifth Energy Revolution. Mankind has shattered nature's limitations in food production with the input of energy and promoted the industrialization of agriculture.

Thus, through the five energy revolutions, we humans have become free users of energy on a tremendous scale. Machines can now provide the power to replace human arm and leg strength. Our brain power, of which we are so proud, can be augmented by the power of information processing technology using electricity. Mankind now possesses the ability to handle at will a power that far surpasses that of our physical bodies. Humanity has also acquired a capacity outside the body for the brain that far surpasses that of the body. We who live in this way are now more than human beings; we are superhumans.

The human brain is, by its very nature, extremely greedy for energy. This insatiable appetite continues unabated even today, when we have access to energy on a scale far greater than the food necessary for the preservation of our species. It demands more energy to become smarter. The brain thinks of ways to acquire more energy.

Our brain's desire has not only created the ability to expand its capabilities outside of its own body and brain, such as power machines and information technology. It has also released nature's yoke of nitrogen fixation, and even the food that supports its own metabolism has become energy-soaked.

The first relationship between mankind and fire

About a 40-minute drive north of Baku, the capital of Azerbaijan, was the place we were looking for. In the local language, Yanar Dag means "burning mountain." The presence of an unquenchable flame has been an object of religious belief, and since ancient times it has been a sacred place for Zoroastrians (fire worshipers), for whom fire has been an important religious symbol. The only surviving Zoroastrian temple is located about 10 km southeast of Yanar Dag, and is believed to have been built in the 17th or 18th century.

The close relationship between the region and fire is also implied in the story of Greek mythology. It is the story of Prometheus, who stole fire from the heavens and gave it to mankind. The acquisition of fire laid the foundation for mankind's prosperity, but on the other hand, Prometheus, who had given fire, incurred the wrath of Zeus. As punishment, Prometheus was chained to a rocky mountain in the Caucasus and had his liver pecked out by an eagle. The story goes that Prometheus is immortal, so his liver regenerates at night and he continues to suffer the same torment every day.

The story of Promethean fire is believed to have a strong correlation to this region near Baku. It was probably through contact with the unquenchable natural fire in this land that mankind first learned the value of mastering fire. They must have felt that this land, which provided a constant supply of fire, which is difficult to make by oneself, was a gift from the gods.

Carbon cycles

If we look around at the fuels that produce fire on the earth, we find that not only firewood and charcoal, but also fossil fuels such as coal, oil, and natural gas are all organic compounds derived from living organisms. Fossil fuels are the result of the death of plants, plankton, and other microorganisms that flourished in ancient times and fossilized over a long period of time.

In fact, most of the fire we see on earth is the final form of our life. Fire is life itself, or perhaps it would be more accurate to say that fire is life incarnate. Fire is often significant in the spiritual rituals of religion and witchcraft. It can be said that since ancient times, mankind has captured the essence of fire.

We living organisms obtain energy for our daily lives by burning organic compounds stored in our bodies using oxygen taken in through respiration. The result of combustion is carbon dioxide. The carbon dioxide exhaled into the atmosphere is then reintroduced into the biological cycle through photosynthesis by plants, where it is fixed. When the organism dies, it is broken down by microorganisms, and the carbon that made up its body is released back into the atmosphere as carbon dioxide. The carbon dioxide thus returned to the atmosphere is then reintroduced into the living world through the photosynthetic activity of plants.

This daily circulation of carbon between the atmosphere and living organisms through respiration, death, and combustion is called the carbon cycle. The Earth is a closed system that does not exchange materials with the outside world, except for occasional meteorites and cosmic dust. Therefore, the total amount of carbon on the earth can be regarded as constant.

For animals that cannot photosynthesize, securing food is a matter of life and death. Microorganisms, insects, fish, amphibians, birds, mammals, and all other living creatures live desperately in a food chain of eat or be eaten.

Animals at the lower end of the food chain obtain the energy they need to survive by eating plants and fungi. Many fungi live in places where sunlight does not reach, such as underground or deep in the ocean, and obtain energy through chemical reactions. In the terrestrial ecosystems to which we humans are subordinate, solar energy captured by plants through photosynthesis is the largest source of energy.

Carnivorous animals at the top of the food chain are indirectly eating plants by eating herbivorous animals. In other words, the food chain of animals in the natural environment surrounding living organisms means that all animals are competing fiercely for the solar energy captured by plants. Of course, humans, as a species of animals, are also members of this fierce competition.

Humans have enlarged their own brains by using fire

If you were asked to name a few characteristics of humans as animals, what would you say? There is one major trait that humans should be proud of that is not well known. Of course, you and I both have them. It is the small size of our stomach and intestines in

comparison to our body size. It is well known that the brain requires a lot of energy to function. But the stomach and intestines are also organs that require large amounts of energy, just like the brain.

Most mammals that weigh about the same as humans have a brain about one-fifth the size of humans, while their gastrointestinal tracts are twice as long as ours. In other words, compared to other animals, we humans have a very large brain to body weight ratio and a much smaller gastrointestinal tract. A smaller gastrointestinal tract means that we are unable to digest food adequately, resulting in less energy being taken into the body. How did our ancestors solve this problem?

One is to take more nutritious food. The beginning of meat eating is a good example of this. Meat eating may have provided our ancestors with the wisdom that allowed them to use fire. The development of the brain and the shrinking of the gastrointestinal tract that we have acquired is thought to have been brought about by the invention of cooking. Cooking" is the process of pounding, chopping, grinding, and heating food. Cooking food dramatically reduces the burden on the gastrointestinal tract for its absorption.

Chimpanzees in the wild spend more than six hours a day chewing their food. Physical processing of food can dramatically reduce mealtime. A further critical change to food is in heating food. Heat can transform starches and proteins, dramatically increasing the nutritional value of food.

In modern times, humans rarely eat food without "cooking" it. Our ancestors invented "cooking" as a way to process part of the work of digesting food in the body's digestive system before eating.

The excess energy from "cooking" food was invested intensively in the brain, which determined the direction of our ancestors' evolution. By heating food and thereby indirectly introducing the energy of fire into our bodies, our brilliant brains were able to grow to a size that far exceeded the brain size allowed for raw food in the natural world. In other words, our brains instinctively tend to desire "more energy. This is because there is an underlying desire in our brains to be smarter.

Civilized society created by the brain

Let us take a bird's eye view of the civilized society that mankind has created. Isn't this where the essence of the human brain emerges? Society developed by increasing energy consumption. In particular, societies after the Industrial Revolution have achieved rapid progress and development of electronic devices by "giving" energy such as fossil fuels to machines rather than to human bodies themselves to power steam engines and automobiles, and to generate electricity.

It is in the nature of our brains to demand energy without limit. We have extended our digestible food to fossil fuels and uranium ore. And this glorious civilization we have created seems to be a monster that has dramatically increased the energy capacity of our digestive system and further enlarged our brains. The question now being asked is whether there is any future for a society that accelerates this kind of "brainification" dependent on external energy input. I believe that the energy-related problems of our time are fundamental questions that emerge by unraveling the relationship between humankind and fire.

Energy and Agriculture

Our brains prefer more energy. It is also sensitive to the fear of hunger. The agricultural characteristics of a good energy balance and the ability to store food that can be preserved were enough to attract our brain's attention.

As agricultural life became established in some areas, the population of farmers began to grow as a steady supply of surplus food became available. As the new labor force continued to cultivate new land, farmland steadily expanded. The agriculturalists gradually overpowered the hunter-gatherers in terms of sheer force of numbers. Thus, the basis of human life gradually shifted from hunting and gathering to farming.

With the advent of agriculture, humankind was able to capture the solar energy that poured down on the earth on an unprecedented scale. As the amount of solar energy that could be captured increased dramatically, the labor force, the energy at mankind's disposal, also increased in proportion to population growth.

This is an estimate based on research. At 12,000 years ago, when agricultural life had not yet begun, the world population was 5 to 6 million. Ten thousand years later, 2000 years ago, the world population had reached about 600 million. This means that the labor force at the disposal of humankind has increased approximately 100-fold since the beginning of agriculture. The effects of agriculture were enormous. The transition to an agrarian lifestyle, which brought about such non-linear changes, was the second energy revolution in human history, after the use of fire.

Darkness brought about by Agriculture

As the agricultural way of life became more established and widespread, a troubling problem arose. The problem was that people fought in groups to secure the solar energy that poured down on the land. In other words, the era of wars over the land, which continues to this day, has begun. The outbreak of war creates winners and losers. In ancient times, those who were defeated in battle were generally killed or enslaved to varying degrees.

In ancient societies, where labor was the number one source of energy at the disposal of mankind, there was tremendous value in enslaving people. Ancient civilized societies cannot be described without the existence of slaves. The upper class of citizens who led the civilization were able to obtain the sustenance they needed without having to engage in agriculture themselves by using the slaves of the lower class.

Life as an upper class person is an ideal environment for the human brain. This is because the brain is guaranteed to prioritize the use of energy taken into the body over muscles. The interest of the upper class human brain became directed toward philosophy and art, which are cultural activities not directly related to obtaining food.

The Story of Humbaba in the "Epic of Gilgamesh"

The story of Humbaba is found in the Epic of Gilgamesh. It is the oldest known story of mankind and an ancient heroic tale. It is also the world's oldest written record of the destruction of nature by mankind.

King Gilgamesh, the hero of the "Epic of Gilgamesh," was the actual king of Uruk, one of the leading city-states of the Sumerian civilization that flourished in southern

Mesopotamia around 2600 BC. Desiring to gain immortal fame by building a magnificent city, he and his ally Enkidu decided to go into the forest and cut down a large number of cedars of Lebanon. The forest had a watchman, the demigod Humbaba, who guarded the forest by order from Enlil, the supreme god of Sumer.

King Gilgamesh and Enkidu entered the forest of cedars of Lebanon with metal axes, the symbol of civilization. At first, they were struck by the beauty of the forest, but eventually changed their minds and began to cut down the cedars of Lebanon.

Awakened by the sound of felling trees, Humbaba became enraged at the sight of the invaders and attacked King Gilgamesh, spitting fire from his mouth. After a fierce battle, Humbaba was defeated and his head was chopped off. Thus, the forest lost its guardian god and all the cedars of Lebanon were cut down.

Seeing this, Enlil, the supreme god, became enraged and announced that he would "turn the earth into fire and burn the food with fire," warning of nature's retribution. And true to his word, the sky god Anu caused a starvation for seven years.

Once set in motion, the desires of human society are not easily stopped. Therefore, Enlil, the supreme deity, needed Humbaba to protect the forest. However, the bare limestone mountainsides that cover most of the upper Lebanon Mountains indicate that the prayers of the story's author were not heeded. Humbaba could not protect the forest because humans had killed him.

The civilized societies that mankind has built have involved extensive deforestation. Wood was used as building material for buildings and ships, and for baking pottery and bricks. It was also used as fuel in kilns for leaching metals. Let's look at this from an energy perspective. The use of forest resources is equivalent to the use of solar energy that falls on the land. From the perspective of land use, forest resources were also used exclusively for human convenience, second only to agriculture.

In the case of cedar trees, a typical building material, it takes about 40 to 50 years to grow to a size where it can be used as a building material. For cypress trees, it takes about 50 to 60 years. This means that each mature cedar or cypress tree has 40 to 60 years of solar energy that has been stored in the land. It is no exaggeration to say that technological progress in civilized society has been supported by the supply of energy

from the harvesting of forest resources.

The art of metallurgy, a symbol of civilized society, always required large amounts of charcoal due to the need to maintain furnaces at high temperatures. In the field of construction materials, fired bricks were invented to overcome the weakness of sun-dried bricks, which were vulnerable to rain, and baked gypsum was developed, in which gypsum is turned into cement by heating it. Charcoal and firewood were also consumed in the production of these materials.

The obvious environmental changes caused by deforestation could not have gone unnoticed by the ancient Mesopotamians. They were aware of the causal relationship between deforestation and desertification at some point in time and recognized the need for protection. Such awareness of the problem must have led to the creation of the Humbaba. However, they were unable to curb their desire for logging. This is the fear of the human brain, which always demands more energy. The humbaba, which was supposedly conceived to put a stop to their behavior, ended up being killed by the iconic symbol of civilization, the metal axe.

The mistake of clearing forests to the point of non-renewability and permanently altering the soil environment was repeated in the same way by civilizations around the world, not only the ancient Mesopotamian and ancient Greek civilizations. This was a major factor in the decline of many ancient civilizations. All societies that consumed resources faster than they could be regenerated were doomed in the long run to decline due to resource depletion.

Traces of Deforestation Seen in Japanese Temples

By the way, one might think that Japan, with its abundance of greenery, has nothing to do with such deforestation, but in fact Japan is no exception.

In Japan, the capital was relocated 21 times during the 200 years between the Asuka and Nara periods (circa 600-800 A.D.), from Emperor Suiko to Emperor Kanmu, and each time the nearby forests were cut down. Especially during the construction of the Heijo-kyo Capital, the building of huge wooden structures, led by Todaiji Temple, flourished. Combined with the casting of the Great Buddha statue at Todaiji, a large amount of wood was consumed.

As a result, natural forests with a mixture of coniferous and broad-leaved trees disappeared from the areas surrounding the capital, replaced by forests of red pine trees growing on thin land. The fact that the frequent relocation of the capital stopped after the construction of Heian-kyo is probably not unrelated to the rapid loss of forest resources in the areas surrounding the capital.

The perfection and diffusion of steelmaking technology created new problems

The year is 1709. An attempt to open the door to a new era began quietly in a blast furnace in the English Midwest. Abraham Darby, owner of a blast furnace in the Severn Valley, a region rich in coal and iron ore, began experimenting with the use of coal, which was abundant in the surrounding area, as an alternative fuel to wood and charcoal. Darby produced coke by dry distillation of coal to remove impurities. By burning this coke in a blast furnace, he created the coal-based iron manufacturing process.

Later, his son, Abraham Darby II, followed in his father's footsteps, and made further trials and errors in his search for the ideal coke, while at the same time working to improve the blast furnace to achieve mass production. His efforts bore fruit, and in 1735, he perfected the technology of iron manufacturing using coke.

In 1781, when the Derby family was headed by its third generation, Abraham Derby III, the world's first cast-iron arch bridge was built over the Severn Valley. In 1818, the Vulcan, a ship made of iron, was launched on the Forth Clyde Canal near Glasgow, Scotland. Iron began to replace wood in a variety of applications.

In this way, mankind was finally freed from the problem of limited growth due to depletion of forest resources that had plagued it since the birth of civilization. At the same time, however, the seeds of a new problem were sown: carbon dioxide emissions that would lead to global climate change.

Full-scale energy revolution

The invention of the practical steam engine is representative of the Industrial Revolution that began in England between the late 18th and 19th centuries. When one looks at the invention of the steam engine from an energy perspective, the first thing that comes to mind is that it marked the beginning of the coal age in earnest. But there is another reason to argue that the invention of the steam engine is truly revolutionary. It changed the form of energy.

In societies before the invention of the steam engine, humans used the energy they extracted in its original form without changing it. For example, consider cooking with fire or heating copper ore in a kiln furnace to melt copper. These use the thermal energy obtained from burning wood or charcoal to heat the foodstuff or copper ore. In other words, the thermal energy extracted from the wood or charcoal is used as-is as thermal energy. There is no change in energy form there.

So what does a steam engine do? In a steam engine, kinetic energy is extracted by moving pistons using the thermal energy of steam created by burning coal and heating water. There, the steam engine is converting the energy form from thermal energy to kinetic energy. The point where this energy conversion is realized is what makes the steam engine novel and innovative, different from any of the watermills, windmills, and other power machines invented by mankind up to that time.

Coal's value as a heat source for steam engines led to the use of coal. The main actor leading the third energy revolution during the Industrial Revolution was the invention of the practical steam engine, which made energy conversion possible, not coal.

Discovering ways to enable energy transfer and conversion

The fourth energy revolution began in Vienna, the capital of the Austro-Hungarian Empire during the Habsburg rule, at the 1873 World's Fair. In a corner of the glamorous Expo site, a man was preparing to display a power generator he had developed himself. He was a Belgian named Zenobe Gramm. The generator he had developed was the most powerful and stable output ever, and it was a work of which he was very proud.

While placing a generator next to the steam engine and wiring copper wire 500 meters away from it, a subordinate engineer accidentally connected the copper wire to another generator. When he operated the steam engine without realizing it, something unexpected happened. The armature of the generator connected by the copper wire started spinning. The genius engineer Gramm saw this and immediately realized what was happening. He realized that electricity could be used to easily transfer energy.

Although the steam engine was a great invention that brought about the third energy revolution, the place where heat energy was extracted and the place where the converted kinetic energy was consumed had to be the same. The use of electricity had the power to bring not only freedom in energy conversion, but also freedom from the constraints of place. This realization of Gram's was the decisive factor in ushering in the age of electricity. It was the moment when the curtain rose on the fourth energy revolution.

Will organic fertilizers bring peace in the Edo period?

During the Edo period (1603-1868), Japan enjoyed 265 years of peace and prosperity, despite a doubling of the population, making it one of the most remarkable societies in the world. In addition to the development of new rice paddies, the supply system of fertilizers was solid, and crop yields steadily increased, which contributed greatly to the stability of the society. From the satoyama near the villages, fallen leaves and undergrowth were regularly harvested to obtain compost.

In cities such as Edo and Osaka, a system was established whereby farmers from the suburbs would come to the city to sell vegetables, and on their way home they would receive human excrement to use as fertilizer. The human excrement was not collected for free, but was paid for as a valuable commodity. Takizawa Bakin, author of "Nanso Satomi Hakkenden," wrote in his diary that each adult received 50 eggplants in summer and 50 dried radishes in winter.

“Nanso Satomi Hakkenden" is a full-length novel written by Bakin Takizawa in the late Edo period.

The diary of Kempel, a German doctor who stayed at the Dutch trading post in Nagasaki during the reign of Tsunayoshi Tokugawa, the fifth shogun, and twice accompanied the head of the trading post on his visits to Edo (present-day Tokyo),

recorded the following. It is recorded that neighboring farmers eagerly searched for horse manure that had fallen along the roadside and brought it back home, and even collected old straw sandals and broken horse harnesses discarded by travelers to be used as compost. The Edo period was the ultimate recycling society.

From the mid-Edo period (around 1700) onward, fish manure, which was lighter and more nutritious than human excrement, became widely available. Wholesalers specializing in fish manure began to flourish, and the Boso Peninsula in Chiba became a major producer of fish manure, which was made by drying sardines and then grinding them into powder. The driving force behind the trade with Ezochi (present-day Hokkaido), made famous by the activities of Takataya Kahei, was the trading of fish fertilizer made from herring, which was abundantly available in Ezochi. Thus, as fertilizers became widely available on the national distribution network, agricultural productivity increased in areas with low population densities and low supplies of human and horse excrement, thus supporting population growth.

Completion of the ultimate recycling society

Fertilizer in Japan during the Edo period (1603-1868) consisted human excrement and fish manure, all of which are organic compounds derived from living organisms of the same period. No fossilized materials were used. In addition, since Japan was closed to the outside world during the Edo period and trade with foreign countries was limited, there was almost no procurement of food from overseas. These facts indicate that Japan in the Edo period was a perfectly recycling-oriented society that relied solely on solar energy, which fell daily at its feet, as its energy source. By recycling thoroughly, the Japanese of that time were building a sustainable, recycling-oriented society, which is the goal of today's society.

The recycling-oriented society of the Edo period (1603-1868) also nurtured the spirituality of the Japanese people. It is the spirit of diligence. Throughout the Edo period, land that could be cultivated was almost completely achieved. In agricultural production, human excrement and fish manure became widespread and were distributed throughout the country, so there was an ample supply of fertilizers. What could be done to further improve productivity? The answer is obvious: diligent work. Many agricultural books were published during the Edo period (1603-1867), and they always say that diligence is good. The teachings of Sontoku Ninomiya, who was active

in the late Edo period (around 1800) in Sagami Province, now Kanagawa Prefecture, are a typical example.

Why has Japan's population quadrupled?

The population of Japan in the late Edo period (1603-1867) was estimated to be about 30 million. What this means is that the population that the land of Japan can support, even in a completely recycling-oriented, cyclical society, would be about 30 million. Even during the Edo period, when the population continued to grow while building the ultimate recycling-oriented society, the decline in forests and mountains became more pronounced in the latter half of the Edo period, and the growth of the population was approaching its limits.

The current Japanese population of just over 120 million is four times the size of the population during the Edo period. How did the 90 million people increased after the Meiji period come to be fed? The first thing that comes to mind is the impact of food imports from overseas trade. Certainly, modern Japan is dependent on food imports. The food self-sufficiency rate on a calorie basis fell below 50% for the first time in 1989 and has dropped to 37% in 2018 results. This explains where it comes from for food equivalent to 60 million people, half of Japan's current population.

On the other hand, this fact also indicates that the remaining 60 million people who are not dependent on imported food are dependent on food supplied by the Japanese land. The population of 30 million people could be fed by Japan's land, which was developed to the utmost limit in the late Edo period (around 1800) to realize the ultimate recycling society, so 60 million people would mean a doubling of the population.

Hokkaido is one example of land that has been newly cultivated since the Meiji period, but I do not believe that this alone can explain the doubling of the population. How could Japan's land have nearly doubled in productivity since the Meiji period? To understand why, we need to know the story of another society that developed on the other side of the ocean. That is the path leading to the Fifth Energy Revolution.

Lord Crookes' Historic Speech

At the end of the 19th century, Sir William Crookes, newly appointed president of the British Academy of Sciences, was one of the leading scientists of his day, known for his discovery of the element thallium and his work on cathode rays. On the occasion of his election as President of the British Academy of Sciences in 1898, Sir William Crookes delivered what was later considered a historic address. In his speech, he pointed out that there was no longer any unimproved land left on earth suitable for agriculture, and that a large supply of fertilizers was needed to support a growing population.

He then warned that the supply from natural mineral resources, such as Chilean nitrate, would not be sufficient to meet the demands of the 20th century. According to his estimates, Chilean nitrate would be depleted as early as the 1920s and as late as the 1940s. So what should be done? Lord Crookes had an answer for the most important question that science would have to tackle in the future. His answer was that “we should develop a technology to fix nitrogen from the air.”

Fertilizer Identity

In the early 19th century, methods of chemical analysis were being developed in Europe, and various substances and elements were being discovered. The German chemist Justus von Liebig was the first to elucidate the nutrients in plants. Germany was a leader in chemistry at the time, and because German land was the leanest in Europe, there was a great interest in fertilizers, which led to Germany leading the world in fertilizer analysis.

Liebig used chemical analysis to determine that nitrogen, phosphorus, and potassium were the main components of fertilizers. He argues that nitrogen, phosphorus, and potassium can be applied directly without the use of composted organic matter. Substances that are not derived from living organisms are called inorganic substances. This was proven by the success of hydroponics without soil.

There are generally a total of 14 nutrients that have been revealed through such chemical analysis, including metallic elements that are used only in trace amounts. Among them, three elements, nitrogen, phosphorus, and potassium, which Liebig discovered through his analysis of fertilizers, are widely known as important elements

that have a significant impact on plant growth due to their high requirements. Today, they are also referred to as the three elements of fertilizer.

Technology for making bread from water, lime, and air

Of the three elements of fertilizer, nitrogen was the target for consideration for chemical synthesis. While phosphorus and potassium continued to rely on mineral resources, nitrogen was the only element that did not have to rely on mineral resources such as Chilean nitrate, because it was equally available to all in inexhaustible supply. Four-fifths of the air is composed of nitrogen. This is precisely what Lord Crookes pointed out in his 1898 speech.

At the time of Lord Crookes' speech, in the late 19th and early 20th centuries, mankind's knowledge of chemistry had advanced by leaps and bounds. It was already known how to synthesize ammonia by placing hydrogen and nitrogen in a reaction vessel, keeping the temperature low and the pressure high.

German scientist Fritz Haber won the race to develop the technology to produce ammonia. His experimental apparatus was designed to withstand the harsh conditions of a reaction vessel at 200 atmospheres, and he also devised a system to quickly separate the ammonia produced. Using this well-thought-out experimental apparatus, he tested a number of catalysts and found that osmium, a precious metal, could be used as a catalyst to produce ammonia in sufficient quantities to be industrialized. He also continued to research alternatives to the scarce osmium and concluded that a mixture of iron, aluminum, and potassium components found in Swedish magnetite was the most effective catalyst.

By 1911, the Bosch-led BASF team was producing more than two tons of ammonia a day from a temporary plant, and two years later they completed a full-scale plant in the southwestern German town of Oppau. Thus, in just 15 years after Lord Crooks' speech, mankind had acquired the technology to fix nitrogen. The nitrogen fixation technology, known as the Haber-Bosch process, which they perfected through their efforts, was called "the technology to make bread from water, lime, and air," and was highly praised at the time. Thus, the curtain rose on the fifth energy revolution, in which large amounts of energy were used to increase food production.

The Haber-Bosch process has brought

The result of these artificial fertilizers was an explosive increase in population. There was a certain limit to the amount of nitrogen that could be fixed in nature. The Haber-Bosch process has released the yoke of the natural world. By fixing nitrogen in the air one after another, the total amount of living organisms, including humans, that can survive on the earth at the same time has expanded dramatically.

By the mid-20th century, high-yielding varieties developed on the premise of ample fertilizer supplies became widespread, and grain yields from farmland increased dramatically. This "Green Revolution" supported explosive population growth: from only 1.6 billion at the beginning of the 20th century, the world's population exceeded 2.5 billion in 1950, and by the end of the 20th century it had surpassed 6 billion. The growth of the world's population over the past century, and especially in the half century following World War II, has been astonishing.

This is also the reason why Japan, which had promoted a recycling-oriented society to the utmost limit during the Edo period, was able to further increase its population after the Meiji period. After the Meiji period, Japan actively adopted new technologies and promoted a shift from a traditional recycling-oriented society centered on agriculture to a resource-intensive society centered on industry and mass consumption of resources, as in the West. The profits from exporting industrial products allowed Japan to import food, and the industrialization of agriculture, which began with the use of artificial fertilizers, increased the yield of domestic agricultural products, which in turn allowed for further population growth.

According to Vaclav Smil of the University of Manitoba, Canada, if the Haber-Bosch process had not been invented, two out of every five people living on earth today would not exist. Put another way, every human being alive today depends on the nitrogen atoms fixed by the Haber-Bosch process for 40% of his or her body. Every one of us alive today is a beneficiary of the Haber-Bosch process.

Energy Diversity

One of the reasons that energy issues have become so difficult is that it is difficult to get a clear and accurate picture of what energy really is in the first place. The human race's unparalleled intelligence has enabled us to imagine things that we cannot see or even touch, but when we try to describe these things in words, we inevitably end up with something abstract.

Galileo Galilei, a pioneer in the study of scientific energy, struggled with how to describe the forces that bring about motion in his study of the laws of motion and used a number of similar terms for force, including impetus, moment, and force.

Even today, the world of science still uses various expressions such as kinetic energy, potential energy, thermal energy, electrical energy, light energy, nuclear energy, and chemical energy. There are so many related units of measurement, starting with joules, calories, and ergs, but also kilowatt hours, which are commonly used in the electrical field, barrels of oil, and BTUs (British thermal units) for natural gas. This phenomenon occurs because energy can take many forms. As the best measurement methods were devised for each form of energy, the number of units to measure energy increased.

Etymology of Energy

Let us consider the origin of that word, energy. It is a word that we use in our daily lives without thinking about it, because it often contains profound insights from those who have gone before us. The word energy comes from the Greek word ergon, meaning "work." To this ergon, the prefix (en) was added to create the word energos, meaning "active state," which in turn gave rise to the word energeia, meaning "activity."

Based on this, the English word "energy" was created as a scientific term in the 19th century. In Japan, it was imported from Germany in the Meiji era (1868-1912) as one of the technical terms using cutting-edge science. This is the reason why the German reading "energy" has taken root in Japan instead of the English reading "energie".

We live in the modern age, and we know something that the Japanese of the early Meiji period, when they first encountered the word energy, did not know. That mass and energy are equivalent, i.e., an object is a mass of energy. This is a fact revealed by

Einstein's special theory of relativity, known as the world's most famous physics formula ($E = mc^2$). This formula was published in 1907, the 40th year of the Meiji era.

Aristotle's Dunamis and Energeia

Westerners, who have made great advances in science, understood energy in a firsthand sense before Galileo and Newton came along. For example, the ancient Greeks had the word Dunamis. The word means potential ability or skill. Aristotle, a giant of intellect active in the 4th century B.C., drew attention to this word.

The basis of his thought was to systematically summarize all movements and changes in nature. He notes that every movement or change has a beginning and an end. Among other things, he focused on the end. He saw the end as the state in which a thing has achieved its purpose through movement or change. For example, when he saw the transformation of a plant from seed to germination to flowering, he thought: "The seed expresses its intrinsic power. “The seed has achieved its purpose through the expression of its inherent power.”

Aristotle called the potential of these seeds Dunamis, and the state in which they reached their goal and became a flower was called Energeia, a word coined from Energos, the state of being at work. Dunamis eventually became the root of the English word Dynamic, meaning force or dynamic. The word Dunamis was also used to refer to the energy stored in a thing.

The Scientific Revolution by Galileo

Galileo Galilei appears on Italian soil. He conducted an experiment in which he rolled a sphere of the same size but different weights down a slope and found that the speed at which the sphere rolled was the same regardless of the difference in the weight of the objects. This discovery cracked Aristotle's authority, since it had been widely believed that the heavier the object, the faster it fell, according to Aristotle's laws of motion.

The goal of modern science was to formulate natural phenomena into mathematical formulas, and there was no room for the significance of existence and purpose of things, which are important elements that constitute Energeia. Rather, by thoroughly eliminating such elements, modern science attempted to clarify the providence of

nature. Thus, Aristotle's Energeia disappeared from the world of science, and a new journey began in search of who energy is.

From Newton (mechanics) to Joule and Lord Kelvin (thermodynamics)

In the beginning, modern science only observed mechanical kinetic energy, as exemplified by Galileo's experiments. The greatest achievements of this approach are the three laws of motion established by Isaac Newton and the “Law of Universal Gravitation,” the pinnacle of classical mechanics. The left-hand side of all these physical equations is "F". “F" for force. In other words, in the 17th century, when Newton was active, the term energy had not yet been established as a term in physics. It was not until the 19th century that the term energy was first used. It was used by the English physicist Thomas Young, famous for his experiments on the interference of light. It was recorded in his Lectures to the Royal Society, published in 1807. However, his usage was still limited to the explanation of mechanical phenomena.

It was not until the mid-19th century that the term energy came to be used as a description of something beyond mechanical phenomena. This was the era of James Prescott Joule, famous for Joule's law, and Lord Kelvin, who left his name on the absolute temperature K (Kelvin temperature), which is based on the temperature at which atoms and molecules stop moving (-273°C). It was during this period that the debate over energy finally expanded from the mechanical world to include heat. The first law of thermodynamics, the so-called "law of conservation of energy," established during this period finally brought the term energy to the forefront of history in the modern sense.

Joule repeatedly conducted experiments in which he passed an electric current through a conductor immersed in water and measured the change in water temperature. He discovered that the amount of heat Q per unit time generated by the current is proportional to the square of the current I and the electrical resistance R of the conductor. This is what is known as Joule's law. Once the relationship between current and heat quantity was proven, Joule's attention then turned to where heat comes from. At the time, the understanding of heat was not settled, and there were two theories: the "caloric theory," which held that it was a massless fluid, and the "kinetic theory of thermal," which held that it was motion. Historically, the "caloric theory" was the

dominant theory, but Joule thought that the "kinetic theory of thermal" was more correct. To verify this, Joule conducted an experiment in which he turned an impeller in water with the weight of a weight and precisely measured the temperature rise of the water due to the impeller's motion.

Thus, Joule concluded that heat is not matter but motion and asserted the equivalence of heat and motion. Joule's theory was based on the idea that heat and kinetic energy are forms of energy and can be converted into each other. In this way, the framework of the "law of conservation of energy" was formed, and the groundwork was laid for the use of the term "energy" beyond its mechanical usage. The new academic field thus established, in which heat is a form of energy, was named "thermodynamics" by William Thomson, later Lord Kelvin, a British physicist who was the first to recognize the value of Joule's experimental results.

From Maxwell (electromagnetic force) to Einstein (nuclear power)

In the same period, the work of Michael Faraday led to the discovery of the law of electromagnetic induction, which confirmed that kinetic energy can be converted into electrical energy. Thus it became clear that electricity is also a form of energy. Maxwell, who was good at mathematics, gave mathematical support to Faraday's theory by formulating the basic theory of electromagnetic waves based on Faraday's experiments into mathematical equations. He showed that the circulation of magnetic fields generating electric fields and electric fields generating magnetic fields causes space itself to vibrate, resulting in electromagnetic waves and the transmission of energy.

Furthermore, the speed of electromagnetic waves obtained from his calculations was almost identical to the speed of light, leading him to predict that light is a type of electromagnetic wave. This was later verified in an experiment by German physicist Heinrich Hertz, whose name would remain on the unit of frequency, confirming that light is also a form of energy.

At the beginning of the 20th century, when Einstein was active, the greatest challenge in physics was how to reconcile Newtonian mechanics, which described the behavior of objects, with Maxwell's equations, which described the behavior of electromagnetic waves. According to Maxwell's equations, the speed of all electromagnetic waves, including light, is constant at 300,000 km/s in a vacuum. However, based on Newtonian

mechanics, there is no limit to the speed of an object. It was Einstein's mind that provided the solution to this contradiction.

Einstein concludes that time and space can change in order to keep the speed of light constant. Thus was published the Special Theory of Relativity in 1905. In fact, this theory had a very important byproduct. He discovered that ($E = mc^2$) (E : energy, m : mass, c : light speed). He conducted a thought experiment in which he incident light on a stationary object from the left and right and observed it from a stationary state and from a moving state, respectively. He realized that when an object absorbs energy, its mass must increase. This great discovery surprisingly revealed that even mass is a form of energy.

Mass is the degree to which an object is difficult to move. In everyday life, mass is a concept often spoken of as "weight" (strictly speaking, the two are different). Although it may seem counterintuitive, weight and energy are the same. But the scientific fact is that energy can take the form of static mass as well as dynamic forms such as motion and heat. At this point, the debate over energy has completely transcended the framework of conventional mechanics.

Energy Characteristics

The world of science has revealed that everything in this world is made of energy. Objects, light, heat, and everything else is a form of energy. Energy is all around us. In fact, it is thought that the solar energy that falls to the earth alone is equivalent to more than 10,000 times the total amount of energy used by mankind. When you think about it, it seems unlikely that we will ever have a problem securing energy. With our smart minds, it is only a matter of time before the problem is solved. However, excessive optimism about such technological innovations will only lead people to stop thinking. In order to tackle the energy problem squarely and seriously, we need to understand the physics of energy and its limitations. This is what the study of thermodynamics has taught us.

First law of thermodynamics (Energy neither decreases nor increases)

The first law of thermodynamics is also known as the conservation law of energy. The fact that energy can be exchanged with each other indicates that energy does not disappear, but neither does it increase. The first law of thermodynamics reveals that nothing can be created out of nothing. All that mankind can do through technological innovation is to extract energy from that which holds it in a form that is usable by mankind. Thus, it was theoretically proven that a perpetual engine that creates energy from nothing is not feasible.

However, a question arises here. In a world where the law of conservation of energy works, new energy cannot be created from nothing. However, once energy is used, the energy itself should be stored somewhere or in some other form and never disappear. Thus, the question is whether it is possible to reuse it. This seemed like a possible realization of a perpetual engine.

Second law of thermodynamics (energy dissipates spontaneously)

The second law of thermodynamics is a law that describes a phenomenon that everyone knows empirically. It is the phenomenon that hot water eventually cools down, but cold water does not naturally get hotter. It should be obvious. It was Clausius who first realized the importance of this obvious fact. He focused on the fact that thermal energy has an irreversible direction, going in only one direction.

We live in a world where friction and resistance exist. There the conversion to thermal energy cannot be stopped. This means that in the world we live in, the energy at our disposal is destined to dissipate naturally. The second law of thermodynamics represents that universal fact. With the establishment of the second law of thermodynamics, mankind has come to understand, as a scientific knowledge, that the energy sources available to us are finite. Everything eventually dissipates as heat. The energy input is eventually transformed into low-quality energy, which is then widely dissipated. We are doomed to never be free from the second law of thermodynamics.

This understanding of the second law of thermodynamics is very important when considering energy issues. What the second law of thermodynamics teaches us does not

stop there. The second law of thermodynamics extends to every corner of our lives.

Emergence of Entropy

The second law of thermodynamics, which was created to explain the peculiarities of thermodynamics, would eventually give birth to a new term. That is entropy. When you hear the word entropy, you may be under the impression that it is a scientific concept that is even more obscure than energy. In reality, however, entropy is much more familiar to us than energy.

Entropy is a concept conceived by Clausius in 1865 to describe the energy loss that occurs in the conversion of thermal energy to kinetic energy. With the quantification of the irreversibility of thermal energy, the second law of thermodynamics, which deals with the question of the quality of energy, was completed.

The new physical quantity was named entropy, inspired by the Greek word (trope) for "conversion", since it is concerned with the conversion of kinetic energy to thermal energy.

It is no use crying over spilt milk. (What entropy represents)

Entropy was born in the mind of Clausius as a means of expressing the irreversibility of thermal energy. Although the invention of entropy was helpful in explaining irreversibility, it still could not explain why thermal energy had the direction of irreversibility in the first place. What entropy, a physical quantity, meant remained a mystery.

It was the Austrian physicist Ludwig Boltzmann, born in 1844, who elucidated what entropy truly means. Boltzmann, who studied the relationship between the motion of gas molecules and thermal energy, believed that thermal energy is the aggregate of random motions by tiny particles, atoms and molecules. He interpreted this as the higher the temperature, the more intense the motion of atoms and molecules, and the more heat they generate.

Eventually, he saw the need to integrate the relationship between the microscopic phenomenon, the motion of gas molecules, and the macroscopic phenomenon, thermal

energy, and adopted a probability and statistical perspective. In 1877, he wrote a paper in which he argued that entropy is a measure of the "messiness" caused by the random motion of atoms and molecules. This paper was groundbreaking in that it showed that if all atoms and molecules were in random motion, the overall state could be predicted with a high statistical probability, even though the individual motions were too detailed and complex to analyze.

His theory, built on his knowledge of probability and statistics, a new discipline, was a paper written on the premise of the existence of atoms and molecules, which at the time had not yet been confirmed to exist. The paper was so novel that it was thoroughly criticized, and Boltzmann gradually became mentally ill and finally committed suicide. Not long after his death, however, the existence of atoms and molecules was proven, and the correctness of his theories, which made full use of probability and statistics, was also proven. The discipline he pioneered was later called “statistical mechanics.”

The greatest realization that can be gained from studying entropy is the finite nature of resources. Why is energy considered finite when it is supposed to be conserved by the first law of thermodynamics? It is because energy is a matter of quality, and what we really need is a low-entropy resource among energy resources. Hence, the resource is finite.

Time was created by mankind

Among the many laws discovered by the development of modern science, none is more suggestive than the second law of thermodynamics, the law of increasing entropy. This cannot be emphasized enough. The core case that touches on this is the relationship between "time" and entropy, which has taken root in our daily lives. Time, as we think of it, is a unidirectional, irreversible process that proceeds from the past to the present and into the future. The British astronomer Arthur Eddington, active in the first half of the 20th century, called this the "arrow of time.”

We are able to sense the flow of time because of the existence of the second law of thermodynamics, which states that the world flows in one direction as things dissipate. However, such an irreversible flow can be recognized with certainty only in the macroscopic world, and its existence in the microscopic world at the atomic level is immediately questionable. Let us consider this by delving into the reality of thermal

energy.

What determines the dissipation and degradation of energy is the presence of thermal energy. Thermal energy is the aggregate of kinetic energy produced by the random movement of large groups of atoms and molecules. So what would happen if this motion were to consist of only one atom? Regardless of which direction it moves, an atom can only go in one direction. The motion of only one atom is kinetic energy, not thermal energy. In other words, there is no thermal energy in the microscopic world of a single atom or molecule.

In fact, the physical formulas of Newtonian mechanics and relativity, which describe kinetic energy, do not bind that time moves only in one direction. This is because the formulas are valid even when time is reversed. In other words, in the microscopic world, we don't really know if there is an "arrow of time" that travels past, present, and into the future. The reality is that even with the most advanced knowledge of modern physics, we still have not been able to derive an answer to the question of time. Surprisingly, the "time" that we are familiar with is in fact only something that appears for the first time in the macroscopic world.

To go a little further into this issue, and to put a bold spin on it, it can be said that the flow of time is something uniquely created by us living in the macroscopic world, especially by humankind. We, as living organisms, receive stimuli from the outside, make decisions and react to them within the range of freedom we are allowed. The existence of a sequence of events from receiving a stimulus to reacting to it is the reason why we are able to sense the existence of time.

It can be said that because humans were able to record the flow of time and create "time" using the exceptional brain power that evolved with the acquisition of fire, we are now able to believe in our own existence. Descartes' statement, "I think, therefore I am," may be a true statement of this.

Furthermore, by recognizing the flow of time - past, present, and future - people have come to know that they can create their own future at will. By creating time, mankind also gained the power to create the future. In this way, we can see that "time" is an existence that is familiar to us, but at the same time, it is something truly profound. It is also supported by the second law of thermodynamics, or the law of increasing entropy.

Global Environment and Thermal Energy

Indeed, as a result of humanity's massive use of energy, the amount of anthropogenic waste heat energy exhaled into the atmosphere is increasing at an accelerating rate. In fact, the effects of this phenomenon are becoming more apparent in urban areas where populations are concentrated, and the effects of man-made structures are also contributing to the high temperature phenomenon commonly known as the "heat island effect.

However, global warming is a different story. The sun beams down on the earth more than 10,000 times more energy than is used by humans. Therefore, the impact of waste heat energy itself released by human activities on the global environment as a whole is considered to be extremely small.

By far the largest impact on climate change and global warming is the greenhouse effect associated with the increase in the greenhouse gases carbon dioxide and methane. This is because the presence of greenhouse gases clogs the great flow of energy that the earth receives from the sun and eventually releases into space.

There are three ways heat can be transported. They are conduction, radiation, and convection. The greenhouse effect is tied to thermal radiation. Thermal radiation is the transfer of heat when an electromagnetic wave emitted from one object is absorbed by another object. Since heat is transferred by electromagnetic waves, heat can be transmitted even in a vacuum, and we living organisms on the earth are the greatest beneficiaries of this phenomenon. What would happen if the Earth did not have a greenhouse atmosphere?

The heat that warms the ground and oceans during the day will quickly leave the extreme cold of space at night due to thermal radiation from the Earth's surface. This is the reason why the temperature difference between day and night on the Moon, where there is almost no atmosphere, is well over 200°C.

However, the Earth has an atmosphere that contains enough water vapor, carbon dioxide, methane, and other gases that are greenhouse gases. Since the atmosphere retains a certain amount of heat, the earth's environment is stable at a temperature range that is conducive to the survival of living organisms.

Thus, greenhouse gases are indispensable for our living organisms, but the amount of solar energy that falls on us is so enormous that even a slight imbalance can clog the flow of energy released from the earth into space and accelerate global warming. That is why there is concern that carbon dioxide, one of the greenhouse gases, is increasing due to anthropogenic activities.

The Mystery of Dissipative Structures

Our existence is a miracle. If the world is moving in the direction of increasing chaos and disorder according to the second law of thermodynamics, how is it possible for living organisms, which are the very essence of order, to be born and evolve? This was one of the most difficult questions in science. Many people have tried to prove the existence of God by doing this. The study of the structure brought about by the flow of energy provided the answer to this conundrum.

A system like the earth that continuously receives energy from the outside and finally releases it is called an open or nonequilibrium system. In a world with such energy flow, a structure with a specific order may locally emerge in a one-way process from order to disorder. A good example is hurricane, which spontaneously arise and grow by capturing the heat of the tropics. The hurricane receives its energy supply from the warm waters of the tropics and creates a swirling structure. Eventually, as hurricane make landfall or move to areas with higher latitudes and lower sea water temperatures, the energy supply from the sea water is reduced, and when it is no longer possible to maintain the structure, the typhoon naturally dissipates. The ultimate example of this order is us, "living things.

Ilya Prigozhin, a scientist born in Russia in 1917, discovered through his studies of open systems through which energy flows that order can emerge locally. He named it "dissipative structure. This discovery explained that in open systems, such as the Earth's environment, which continuously receives energy from the sun, order in the form of living organisms can spontaneously arise.

Prigogine's great work on dissipative structures earned him the Nobel Prize in Chemistry in 1977 and gave us scientific confidence in our own existence. We organisms are born into the great flow of energy produced by the sun. By greedily absorbing the energy released by the sun through photosynthesis and predation, we not only passed

on our lives to the next generation, but also gradually began to ascend the ladder of evolution. We are living, or rather being kept alive, in the great flow of energy.

Civilization is a dissipative structure itself

As we consider the dissipative structure that Prigogine carved out, we realize that it also contributes to our thinking about the future of our civilization. This is because the civilization we have built is the very structure of dissipation that has emerged in the great historical flow of time.

The story of mankind's rise to civilization and prosperity was brought about by the accumulation of knowledge. The accumulation of knowledge is first made possible by the invention of language. The invention of language made it possible for individual experiences and skills to be passed on from generation to generation, whereas previously they had to be dispersed after only one generation. Myths and folktales passed down orally in many parts of the world are a way of transmitting experience and knowledge to the next generation through words. They used rhyme, rhythm, and repetition. Homer's epic poems are a prime example of this.

The transmission of skills was supported by repetition of actual work in addition to verbal explanations. An extremely interesting ritual has been handed down to the present that hints at the way technology was handed down in ancient times. It is the "fire-starting ceremony" that takes place every morning at the Ise Jingu shrine. The fire is started each morning in a way that has remained unchanged since ancient times: a cypress board is frictionally ignited by a wick made from a mountain loquat. It is believed that this method was devised to ensure the transmission of the advanced technique of "fire-starting" to the next generation in an age when there was no written language.

Ise Jingu is a Shinto shrine located in Ise City, Mie Prefecture, Japan. Ise Jingu is the collective name for 125 shrines. The main deity, Amaterasu Omikami, is also compared to the sun. It is said that the origin of the shrine dates back to about 2,000 years ago, when Yamahime-no-mikoto built the Inner Shrine, the seat of Amaterasu Omikami, on the banks of the Isuzu River, in accordance with a command from Amaterasu Omikami.

Eventually, writing was invented, and later paper was born. The method of writing also changed from the rhythm-driven rhyming style, which retained a strong oral tradition, to a prose style that allowed for freer expression, and the transmission of knowledge from generation to generation became more precise and complex. Here the foundation for a multilayered accumulation of knowledge is completed.

For example, the full-scale development of philosophy, which is difficult to transmit orally, began when Plato wrote down the words of his teacher, Socrates, in the form of prose dialogues. Considering that Socrates did not write down his own words throughout his life, and that his disciple Plato chose the dialogic form for his writings, this period can be considered as a transition from oral tradition to documentation. As Plato's disciple, Aristotle, known as the founder of all learning, appeared on the stage of history.

All this accumulation of knowledge by mankind is expressed as an order-giving, or dissipative structure. When the accumulation of knowledge exceeds a critical point, civilization emerges and begins to shine. Human civilization emerges as a dissipative structure in the great flow of historical time. In order to maintain the dissipative structure, it requires a continuous supply of energy from the outside. If the energy supply is interrupted, the structure will disappear instantly. Urban civilizations that began in ancient Mesopotamia used an abundance of human energy to build buildings and roads, creating the urban order. However, as the land became desert due to soil erosion caused by forest loss, and as people began to abandon their cities, the order was lost.

In order to maintain a certain order in the real world, where the second law of thermodynamics governs, there must be a constant supply of energy from the outside. This is one conclusion that the dissipative structure argument draws. Human beings have continued to accumulate knowledge from the ancient world, where civilization originated, to the present day. In order to maintain and develop the accumulated knowledge as a "structure," more energy needs to be invested. This is the reason why the consumption of energy by mankind has been growing consistently and steadily from the past to the present. More energy input is required to maintain more complex and diverse "structures. There is no other way to maintain and develop our modern social civilization, which is built on the accumulation of knowledge, than to continue to increase energy consumption.

As long as quality energy is finite, these societies are unlikely to escape the fate of many ancient civilizations that eventually collapsed. How should we approach energy issues in order to realize a sustainable society?

The first thing to consider would be to refrain from innocent expectations of solving problems through technological innovation. We live in a modern age where we are witnessing the ever-evolving evolution of information and communication technology, and we have come to have the illusion that we can eventually solve all problems through technological innovation. The world of energy, however, is a world governed by the first and second laws of thermodynamics. Neither the technology to create energy from nothing nor the technology to reverse the deterioration of energy quality is feasible. In addition, the development of energy-saving technologies does not solve the problem at its root.

Therefore, the attitude we should take is to confront energy issues head-on at a deeper level, rather than to put off conclusions by easy solutions through technological innovation and other means. This is the first step toward thinking about energy issues. What does it mean to confront energy issues head-on at a deeper level? It means looking back at the history of humankind and considering why we have increased our energy consumption. Once we understand the reasons for this increase, we can get hints on how to reduce it.

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Prigogine's Achievements

In 1977, Ilya Prigogine was awarded the Nobel Prize in Chemistry. This prize is said to be one of the most important awards for research on a very difficult subject that science still cannot face with confidence and certainty.

At the time, Prigogine's work was perceived as an eccentric field outside the mainstream of science and was not viewed by other scientists as serious empirical

science. Those who came into contact with Prigogine himself, however, immediately realized that they had underestimated his work. Prigogine was simply ahead of his time.

The hope was that the new science, "complex systems theory," would revolutionize existing science and provide answers to many fundamental questions in biology, chemistry, and physics. The fundamental questions were, "How did life come into being?" How does the brain, with its billions of neurons, generate emotion, thought, and consciousness? These are just a few of the questions. Other questions include, "Is there something more than chance events at work in the evolution of organisms as Darwin posited?" "Is the whole more than the mere sum of its parts?" and so on.

Prigogine's great contribution to thermodynamic theory, as the Nobel Committee pointed out, was to extend the scope of this theory from thermodynamic equilibrium states to a much broader range, namely to nonequilibrium states. Non-equilibrium states occur when an influx of matter or energy, or both, occurs in an open system. Such an open system can exist only in connection with its external environment, which is why Prigogine called it a "dissipative structure.

Prigogine himself created various terms such as "dissipative structure" and "correlation pattern". Some of these have already become firmly established in physics. Moreover, Prigogine himself made such terms as "instability," "fluctuation," and "self-organization" permeate not only the physical sciences, but also the humanities and social sciences. The methods used to study the stability of the dissipative structure of Prigogine's generated tremendous public interest. For example, they made possible the study of extremely diverse problems, such as urban traffic problems, stability in societies created by insects, the development of biological order structures, and the growth of cancer cells.

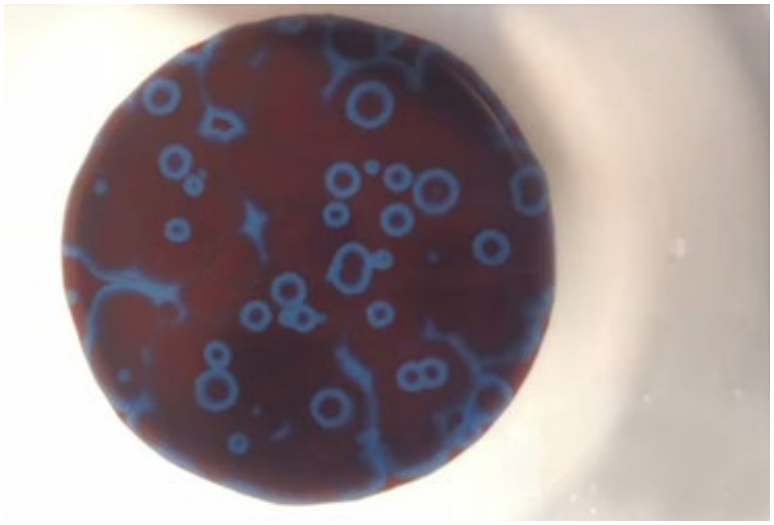
Self-organization in dissipative structures is common in the biological world, but it also occurs in the nonbiological realm, the best known example being the so-called "Benard vortex."

 # Benard's cell

Reference URL(https://www.youtube.com/watch?v=58acnTB2M18)

Another famous example of non-equilibrium thermodynamics in the non-living world pointed out by Prigogine and Harken is the “Belousov-Zhabotinsky reaction.”

Reference URL(https://www.youtube.com/watch?v=eXL6jhe8S-w)



Prigogine wondered early on “why order and structure exist in the world.” From now on, he argued, we need a science that studies how we choose our future, and the integration

of the natural sciences and the humanities was Prigogine's youthful desire. When I think of Prigogine's activities since his youth, it seemed that he was trying to synthesize physics and philosophy instead of making them two separate disciplines.

The latest findings, Jeremy England's "Dissipative Adaptation"

Biography of Jeremy England

Jeremy England's mother was the daughter of Polish Jews who survived the Holocaust, and his father was a non-conservative Protestant Lutheran. He was born Jewish in Boston and raised in the school town of New Hampshire. But it was not until he entered graduate school at Oxford University that he learned about Judaism, and he now considers himself an Orthodox Jew.

England earned a bachelor's degree in biochemistry from Harvard in 2003. After being awarded a Rhodes Scholarship, he studied at St. John's College, Oxford, from 2003 until 2005. He earned his Ph.D. in physics at Stanford in 2009.In 2011, he joined the Massachusetts Institute of Technology Physics Department as an Assistant Professor. In 2019, he joined GlaxoSmithKline as a Senior Director in artificial intelligence and machine learning.

This is a quote from the website, "Why life was born: A new theory that unravels the physics of life." (https://k-okabe.xyz/2017/10/01/biophysics-england/#_edn8)

This is a quote from the website, "A Conversation with Jeremy England, the Physicist Who is 'Redefining' Evolution." (https://wired.jp/2016/08/21/interview-jeremy-england/)

This is a quote from "Every Life Is on Fire: How Thermodynamics Explains the Origins of Living Things, Jeremy England, Kindle English edition."
(Using the web translation software "DeepL")

This is a quote from "Origin Upper and Lower (Novel) Dan Brown" (KADOKAWA Co., Ltd.).

For more than 150 years, since the publication of the theory of evolution by Darwin and others, we have recognized that evolution is true and natural selection is its driving

force. We are still struck by the qualitative differences between living and non-living things, and yet we still feel a pang of awe in the face of the fact that living things are made from the same lifeless raw materials as everything else.

We need to be a little more specific about what answers we can offer to the question, "Where did life come from?"

For example, in an attempt to understand the Big Bang, astrophysicists came up with a beautiful formula that describes an expanding universe at some point in the past or future. But when we try to go back to the moment of the Big Bang, the moment when time equals zero, or the singularity, the formulas all fall apart, giving us only a mysterious point-like object of infinite heat and density. The evolution of living organisms is just the same, in that it is impossible to look far into the distant past and see how evolution began. We don't know how the first life forms emerged from a sea of lifeless chemicals. It is impossible to see the first frame of this story.

To elaborate, if we look at two development paths with slightly different initial conditions, the differences will continue to grow over time. As a result, unless we have 100% control over the initial conditions, we cannot accurately predict future conditions. Development is always probabilistic, and future possibilities open up in abundance. What does a probabilistic worldview mean?

We think of the world as a single trajectory of a system consisting of an enormous number of molecules, but in fact the motion of those enormous number of molecules is extremely complex, so we thought that a probabilistic description would be better than following a trajectory. In other words, the idea is that the probabilistic description is rather the substance. This is the reason why the history of the world, from the beginning of the universe to the evolution of living organisms and everything else, has been so diverse and complex.

Can we make a movie about what happened by recreating, from data collected today, the puddle in which a special chemical reaction first occurred in the far distant past? And can we have the boyish hope that that film will prove to be an accurate and faithful recreation of what happened in the past? There are several reasons why such an approach is fanciful. The most basic reason is that there is no modern evidence of exactly what happened on Earth billions of years ago. And it means that we cannot look

for them in the future.

When all the clues at a crime scene or archaeological excavation are trampled, tampered with, and rearranged as appropriate, it leads to unreliable results in a scientific investigation. In the same way, the earliest signs of life must have been confounded to the point of unrepeatable. DNA, RNA, and proteins are macromolecules that are central to life in the cell. But all of these macromolecules are shattered in water on a time scale of less than a few million years. And it is folly to try to reconstruct the molecular origins of life as we know it by detecting its remnants.

England proposed a set of ideas based on a branch of physics called non-equilibrium thermodynamics to describe the stepwise process of life's emergence in a way that breaks it down into easily understandable units. Life, when viewed from a physics perspective, can be recognized as an omnibus of different phenomena with a particular but precise physical definition. From now on we thought that we could study them simultaneously as small, restricted outcomes of life's unique self-organization.

Central to this discussion is the idea of "Dissipative Adaptation." This "dissipative adaptation" implies that matter changes to its optimal form in order to respond to patterns in its surroundings.

In his book Every Life Is on Fire, Jewish Rabbi Jeremy England says this. "What lies behind the physics that gives rise to the phenomena of life is all too often downplayed by common sense." This is what Jeremy England describes as the breath of God rippling particles.

England thought the story of Moses' journey to bring the Israelites back from Egypt might be as follows. That is, to explain the transformation of objects into living beings, the story is about replacing the mechanical image of "enslavement" of obeying physical laws with "liberation," in which people choose their own way of life.

The serpent in this story, presented to Moses, reminds us of at least two things. First, that the seemingly mute natural world may actually be saying something meaningful, and second, that one can choose to do what the Creator does not want. He says that the significance of the serpent's appearance is that it tells us that there is meaning in the seemingly meaningless and that there is an ethical significance to what we "should" do,

not what we "can" do.

We cannot understand the events of this world only through scientific explanations. It may be that the existence of something like morality from the very beginning of life is the reason why we have been able to maintain biological life up to the present day. The emergence of life is not an everyday phenomenon.

It has been said that Jeremy England may have discovered something even more fundamental to evolution than natural selection. Something that drives development in inanimate as well as living organisms. It is something that leads mere matter to life, and then to life's more efficient use of energy.

Jeremy England argues that life needs to be described in terms of biology and physics. What physical conditions are necessary to ensure that life-like behaviors emerge in matter that did not initially exist?

In the previous section, I introduced Ilya Prigogine's achievement, "dissipative structure," but even Prigogine, who made such a discovery, states that "dissipative structure theory" alone does not explain the birth of life. This is because, at least in an open system in a non-equilibrium state, the kind of order and structure that emerges from chaos is entirely a matter of pure probability.

Even the slightest difference in temperature or microscopic introduction of foreign matter, the slightest difference in the initial values of the system is likely to drastically change the structure of the self-organization. Thus, the birth of life may be described as "God rolled the dice." In other words, God may be described as having created unique initial conditions that man could never have imagined.

Jeremy England began teaching at MIT. He began to delve deeply into the theoretical aspects of nonequilibrium statistical mechanics, which is very difficult to understand. He says that the abstract formulas seem to have hidden "meanings that do not appear on the surface," similar to the behavior of "something like life.

He states. It was a gradual process that started with a lot of faulty assumptions and culminated in the current theory." His bold and concise idea is called "Dissipative Adaptation," a mathematical expression of how all things adapt to their given

environment. From the emergence of early "life-like" things to the "evolution" advocated by Charles Darwin, it must be as obvious a physical phenomenon as a stone rolling down a hill. There must be some universality there that would be applicable extraterrestrially.

By the way, physics can only describe living things in terms of their "distance, position, time, number of particles, energy, temperature," etc., and we can hardly feel the breath of life in them. All living things are made up of atoms and molecules, and we may not be able to read any biological function or life into their physical description. However, if we can get rid of our "preconceived notions about living things," we will find that the laws of pure physics are at work there.

I believe that there are features of what physics describes that are clearly recognizable as being unique to living organisms. One of these is the “search for energy sources.” Other characteristics, such as detection and prediction, would be specific to life activity. There must be some universality there that would be applicable extraterrestrially.

So what physical steps are involved in "adapting to the environment," which is what all organisms are good at in evolutionary theory? In other words, how do they find, consume, and diffuse energy from their environment?

Ilya Prigogine's "dissipative structure theory" is indeed a physical phenomenon that is also found in biological activity. Jeremy England took the "dissipative structure theory" one step further and considered the following.

As energy (electromagnetic waves like sunlight) is poured into the earth from the outside world, it adds "heat" to the atmosphere and oceans. As the irreversibility of such continuous heat increases, the open system is forced to "evolve" in a certain direction. That form of evolution is a structure that allows matter to absorb and dissipate free energy more efficiently. In other words, we thought that the mass of particles would be encouraged to absorb more energy and self-organize in such a way as to create a structure suitable for the smooth flow of energy. That is, a group of molecules that orderly align themselves to become a structure that disperses energy more efficiently.

England's succinct explanation is that tornadoes, for example, are nature's mechanism for converting pressure into rotational force that dissipates, thereby obliterating

concentrated areas of high pressure. The same is true for finely undulating riverbeds, whose shape interferes with and dissipates the energy of fast water currents. Another example is snow crystals, whose multifaceted structure reflects light in all directions in a chaotic manner, dispersing the sun's energy.

When particles resonate against the flow of energy from the outside world, they are able to dissipate more energy into their surroundings. In other words, the mass of particles will naturally orient itself along the direction of the energy flow. This idea of England is very intuitive.

So matter creates its own order in order to better distribute energy. Nature creates small pockets of order to promote disorder. Such pocket-like systems have structures that enhance chaos, thereby increasing entropy. In other words, to efficiently create chaos, some order is necessary.

He described this set of conditions with a physical formula, which he called "**dissipative adaptation**". What this means is that in a heat bath, such as the atmosphere or the ocean, a mass of atoms will, over time, successfully resonate with the energy sources of mechanical, electromagnetic, and chemical "work".

To define this property more clearly, we must consider the difference between fine and coarse behavior in a collection of particles, and how the rarity and diversity of that behavior is determined by the interaction of countless combined fine fragments.

Thus, we have found that exploring the space of how matter can be put together is a process best understood by looking at it in terms of the flow of energy through it. Specifically, how the structure of a substance affects the absorption, deployment, and dissipation of energy.

A whole organism can be viewed as a single, unified phenomenon that stands on a hodgepodge of simpler parts. Dissipative adaptation means that a system composed of many parts changes its properties depending on the arrangement of those parts. In essence, Jeremy England argues, absorbed energy is optimized to consume more energy by changing the arrangement of the pieces over time. Life is not the core of a series of phenomena. The series of systems may be thought of as bringing life into existence in order to dissipate more energy.

Now, there is a jarring cacophony of piano notes, as if a child is hitting the keys in a mess. Rearrange the same notes, add order, and instead of coherent noise, it turns into Debussy's soothing melody. Despise chaos, create order, this is the basic programming of our brains. Humans have a tendency to do exactly this. We dislike chaos and prefer order. We feel the same pleasure in creating order that makes us want to put together a jigsaw puzzle or straighten a picture on the wall.

The need for order is engrained in our DNA, so it is no wonder that the greatest invention of the human spirit is the computer. Computers were originally designed to help create order out of chaos. In fact, the Spanish word for computer is "ordenador." It literally means "the thing that creates order."

Jeremy England also says that there are numerous and important parallels between machine learning (AI) and dissipative adaptation mechanisms that are currently being discussed. He predicts that phenomena similar to machine learning, done by computers, may be taking place in living organisms. In the last decade, the performance and versatility of so-called machine learning techniques have improved dramatically. We can now find ways to computationally accurately model complex relationships that were previously thought to be only possible by the human brain.

Face recognition and language processing are prime examples. The principle common to many of these applications is that a long list of numerical parameters describing how to map computational inputs to outputs is trained using a large data set of face pictures or text. The program's algorithm explores the high-dimensional parameter space and optimizes itself to find a selection of distinctive and outstanding parameter choices that allow the computational model to make high-quality matches with the data used for training. As one can see when one actually experiences the task of artificial intelligence, physical phenomena alone can perform tasks that seem intelligent.

Can we then assert that all driven multiparticle assemblies are a type of machine learning? Probably not, unless we overextend the definition of the term. However, when we compare them side by side, we find that the mathematical structures occurring in each case are similar in multiple ways. This suggests, says Jeremy England, that somewhere between these two poles there may be an as yet unexplored spectrum of possibilities, an evolved construct that does some useful computation in dispersion and regrouping.

We have been taught that the birth of life is a miraculous event born out of chaos, but the "miracle of the birth of life" expressed by "dissipative adaptation" is the result of the action of multiple layers of physical laws. But, I see, it may be very "natural" that the dissipation of energy creates order and structure in the soup of atoms in an open system.

Over time, the self-organized mass of atoms will evolve into more complex structures as probability dictates, and perhaps "something that behaves like life" will emerge emergently from among them. Defined in evolutionary terms, "**dissipative adaptation**" favors "things" that can diffuse energy more efficiently in a given system. The reason for reproduction, which is an essential part of biological evolution, may be explained as a way to increase the number of individuals that can dissipate more energy into the surrounding environment. According to England, the most efficient way to dissipate energy is to make duplicates of oneself.

In this light, physics and biology are not, at this point in time, disciplines that study the first steps in the birth of life yet. We can extract wisdom from phenomena in the world, but at this stage, we can only apply and use the phenomena that are actually occurring. Life phenomena are still miracles from the viewpoint of science. Even those of us who actually experience these miracles do not understand the first step.

The brain used energy to create "extra time"

Why has humankind increased its energy consumption? As we have seen, humanity has dramatically increased its energy consumption through five stages of the energy revolution, beginning with the use of fire. In fact, I believe that each of these processes has something in common. The key word is "time reduction.

The use of fire, the first energy revolution, reduced the amount of time spent chewing food in the form of "cooking". Chimpanzees in the wild devote more than six hours a day to chewing food. For us, a total of two hours is enough time for three meals. Having succeeded in reducing the amount of time spent eating, humans can now effectively use that time to weave clothes and make tools.

The second energy revolution, the transition to an agrarian lifestyle, created a surplus of food, which created a ruling class of society not engaged in food production and a class

of artisans with special skills, such as metallurgy. The transition to an agrarian lifestyle has led to a reduction in the amount of time spent on food production in society as a whole. By concentrating agricultural work on a few people, the free time gained by others became the driving force behind the rise of civilization.

The invention of the steam engine, the third energy revolution, was the driving force behind the Industrial Revolution and opened the door to the energy-intensive society that exists today. Steam engines worked dozens of times harder than people, oxen, and horses, and they never rested when they were tired. Naturally, people worked hard to improve machines that never complained no matter how hard they were used.

The fourth energy revolution, the use of electricity, broke down the barriers of distance. Telecommunications technology, famous for Morse code, took the world by storm in the mid-19th century as a means of high-speed information transmission, and telegraph lines were laid competitively along railroad lines in various regions. Telecommunications technology has continued to evolve since then, and together with the development of information processing technology represented by computers, it continues to play a central role in information communication networks such as television broadcasting, cell phones, and Internet technology in modern society.

The invention of artificial fertilizers, the fifth energy revolution, shattered the limitations on the supply of nitrogen to living organisms set by nature. With the invention of the Haber-Bosch process, mankind had the means to realize a massive increase in food production, and one after another, the industrialization of agriculture was promoted to increase the efficiency of agricultural production. Today, only 1.3% of the population of the United States is employed in agriculture. In addition, the time required to produce meat, such as beef cattle, has been dramatically shortened by the availability of large quantities of nutritious corn at low cost. As a result, the total time humans spend on food production has become less and less. The extra time created is the driving force behind the development of new industries such as the information and communication industry.

Let's organize the past activities of humankind. What has been the goal of mankind throughout history? I think it is "saving time. In other words, it is a history of finding value in "how much work can be done in a short period of time. Humans have acted in a way that prioritizes the brain's desire to freely use energy for a variety of activities. We

routinely seek to achieve great results with little physical exertion. The human brain's endless desire to acquire energy has resulted in the speeding up of time.

How should we deal with time?

What we should be keenly aware of now is how we can break free from the brain-driven way of thinking and realize a comprehensive way of thinking that is in tune with the body. If we listen to the voice of our own body and ask questions of our deepest psyche, it will not be impossible to change our lifestyle habits that will speed up the flow of time. Adjusting the pace of time in society as a whole may not be easy, but it is not impossible at all.

For a complex issue such as the energy problem, where the state of society is being questioned, things will not be solved by beating the world over the head with black and white questions. In order to solve the energy problem, we should all think about raising awareness of the silent voice of the body, centered on the issue of time perception by the human brain, and changing the norm for individuals and society, even if only gradually. It is not easy to reduce energy consumption in a society that sees the positive value in turning the hands of the clock faster. Perhaps we need to build a society in which we can find positive value in walking a little slower.

Dualism and Justice

In today's energy debate, it is sometimes argued that if carbon dioxide emissions cannot be kept below a certain level, the world will die. Such extreme statements evoke doomsday scenarios and undermine the perception of steady effort. Over-simplifying and over-stimulating the crisis can lead to problems that are far from being solved.

Just as our society is multidimensional and complex, made up of people from various backgrounds and perspectives, the global environment is also multidimensional and complex, and is not as simple as conventional dualism would have us believe. If you see someone trying to make everything black and white in a discussion of energy issues, saying this is good and that is bad, you should be skeptical of that person's argument. The answer to any question dealing with nature is usually found in the infinite range of colors between black and white.

Capitalism and Energy

After experiencing the Industrial Revolution in the 18th century, human society emerged from the long economic stagnation of the Middle Ages. We entered a new era of sustained economic growth in which the wealth created was reinvested to create even more wealth. The era of capitalism has arrived. Decision-making in economic activities in a capitalist society will be based on economic rationality. Economic rationality is a state of affairs that is considered profitable when judged according to economic value criteria. Generally, when a for-profit company makes an investment decision, the decision is based on this economic rationality.

From the 17th century onward, the increasingly free human mind, having seized its freedom as an individual, consequently lost the foothold to secure its own position and became strongly influenced by the unspoken rules that encompassed the entire society. Today, it is capitalism that sets those rules. Whether we like it or not, we live in a modern society under capitalism that has spread to the entire globe. In order to live a stable life, we need to follow the rules of capitalism, and this has come to have a great influence on our minds and decision making. This meant, in a way, enslavement to a new god, "capital," whose supremacy is economic growth.

The energy problems that pervade modern society are a product of the economic activities of humankind. And the economic activities of humankind in today's society are shaped by capitalism, which pursues economic rationality. Therefore, in order to unravel the energy problem, it is effective to analyze the relationship between human economic activities and energy by adopting the perspective of economics.

However, energy issues are generally very incompatible with economics, which deals with economic activities. This is not only because energy issues are closely related to environmental issues such as climate change. To begin with, it is not easy to accurately analyze energy from an economic perspective.

Decisions in economic activities in today's society are largely based on economic rationality. This is a perfectly natural way to carry out economic activities. There is an important prerequisite for the correct operation of this system. That is, that there is sufficient information to make decisions and that it is correct. In the energy debate, however, it is quite difficult to accurately capture this point. Hence, economics and

energy are inevitably incompatible.

James Watt's other great invention.

During this period, improvements in steam engines made it possible to extract energy more efficiently, but it was not easy to measure the return on investment of installing a steam engine. This was because there was no established method for measuring the capacity of steam engines.

James Watt not only invented the practical steam engine, he also devised a unit to measure the ability of a steam engine to do the work it does. That is the horsepower. This unit was defined based on the amount of work done per unit of time by a standard draft horse. Watt made his fortune by inventing the high-output, practical steam engine, and one of the reasons for his success was that he also created a unit to measure work capacity, the horsepower. This made it possible to "visualize" the amount of work done by a steam engine and to calculate the return on investment in a steam engine compared to keeping horses.

The poor can't afford manners (Only when basic needs for living are met can people spare the effort to be polite)

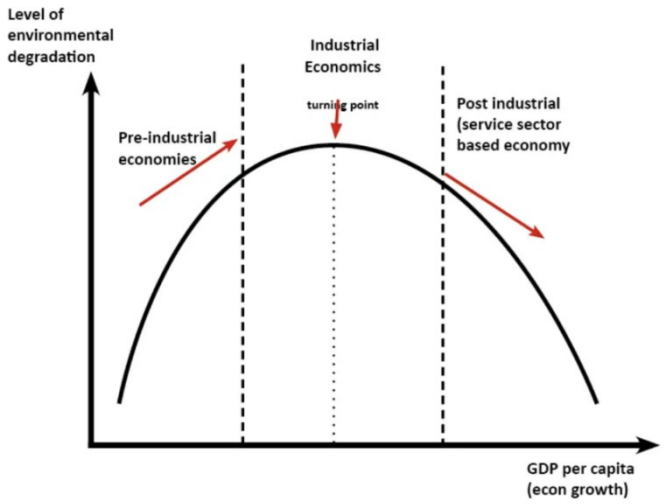
In the era when Watt was active, investment decisions for power machinery such as steam engines were based solely on the cost-effectiveness of the machine's energy output. Pollution problems, such as soot and smoke generated by operating machines, were outside the calculations of economic rationality and were not taken into consideration. As a result, while the factory owners who operated the machines made sufficient profits, the surrounding air was polluted and the pollution became more and more serious. In economic terms, this situation is called “external diseconomies.”

In light of the worsening pollution caused by "external diseconomies," human societies eventually began to take action. The installation of soot remediation equipment became mandatory by law, and the cost of pollution control was incorporated into the calculation of economic rationality. In economics, this is called "internalization.”

This is an extremely reasonable and correct course of action. It is one of the most effective ideas that humanity has developed to improve society. It is important to note, however, that “internalization” is not an unconditional process. “Internalization" can only be realized if the technology that enables pollution control has been developed and if the overall investment is economically rational, even if the cost of introducing the technology is "internalized".

Individuals and societies that are so occupied with making ends meet will have little incentive to invest in environmental measures, but individuals and societies with sufficient income and a surplus can afford to invest in the environment. In short, it is a matter of "Only when basic needs for living are met can people spare the effort to be polite.”

EKC : Environmental Kuznets Curve



Taken from the reference URL
(https://ideasforgood.jp/glossary/environmental-kuznets-curve/)

This phenomenon is known in economics as the environmental Kuznets curve. It takes the degree of economic development on the horizontal axis and the degree of environmental burden on the vertical axis. Until per capita income reaches a certain level, the environmental burden worsens. However, once the environmental burden reaches a certain level, it gradually improves, forming an inverted U-shaped curve. It is true that the environment has improved as the scale of the economy has increased and

the development of environmental technologies has been promoted, especially in developed countries.

The mood is depressing when we consider the energy problems of our time. There are debates about the ultra-long term storage of high-level radioactive waste, carbon dioxide emissions, and other issues that extend far beyond a person's lifetime. Can we even properly evaluate the environmental problems of projects that extend to the global environment and incorporate them into calculations of economic rationality?

In the global energy debate, to what extent is it fair to internalize the costs of environmental measures? It is not easy to reach a multilateral consensus on how the costs of internalization should be estimated, and the debate often turns contentious. Moreover, the division of the legal framework for internalizing environmental measures into administrative units, mainly the national government, makes it difficult. The development of the economy and the globalization of issues related to environmental burdens have made it very difficult to solve problems that have now become global in scale. This is because these problems will not be solved unless the entire world establishes and adheres to common rules.

In this light, it seems that there are no dreams or hopes for the future of humankind unless a one-world government is established. Is such a society really feasible? Or will we have no choice but to let the momentum of capitalism take us to the end of the road like a kite with a broken string?

Characteristics of the God called Capital

Whether we want it or not, the god of capital rules the world in the capitalist society to which we belong. The “god of capital” teaches only that "economic growth will save everything. The “god of capital” in today's society boldly promises prosperity in this life and shows no signs of anxiety. All that is required of us is to believe that the economy will continue to grow. Then merit will be gained in this life.

There is no next life in the “divine teaching of capital.” There is no looking back to the past, as all the money, effort, and time spent to date are sunk costs. All we believe in is the present and the future that lies ahead, where we are sure to grow.

It is only since the Industrial Revolution, which is only a couple of hundred years old, that this "ever-growing economy" brought about by the “god of capital” has become the norm in the world. The god of capital that descended during the Industrial Revolution was a completely new existence for mankind. It did not bow down to the natural world at all. He solved one by one with the power of capital all the outbreaks of starvation and the spread of pestilence that had afflicted mankind up to that time, and showed us the realization of a paradise in this world.

The "god of capital" had another major characteristic not found in previous deities. That is, the power of the "god of capital" increases as the economy continues to grow and grows in size. And the "god of capital" becomes even more powerful as it gains experience and is trained.

The "god of capital" first descended upon England during the Industrial Revolution and second upon the United States. In both societies, there was a fair amount of people who had accumulated a certain amount of wealth that made new investments possible. In addition, the systems of private property, including the patent system, were well developed, and a mechanism was in place to recover the cost of the upfront investment in the invention and development of new devices.

If there had been no effective patent system in place at that time, no one would have funded the research and development of James Watt, who was only a mechanical engineer, and his steam engine would never have been introduced to the world. With the advent of a society capable of mass consumption of energy and sustained economic growth, the "god of capital" was able to fully demonstrate his ability to learn and further strengthen his abilities, becoming a widely accepted presence in society.

In this way, the "god of capital" is an incarnation of energy that grows by absorbing energy one after another, a kind of monster. In short, the "god of capital" is the dissipative structure itself. When we realize that the true nature of the "god of capital" is a dissipative structure, we realize that even the seemingly strongest "god of capital" has a weakness. When economic growth slows down and the supply of energy becomes limited, the structure becomes unsustainable and collapses at the drop of a hat. Therefore, the "god of capital" continues to ask us human beings to continue the cycle of investment, believing that economic growth will be sustained.

The "god of capital" preached "Believe in economic growth," but he also prescribed a new commandment to be observed in order to accumulate merit. It is "Be diligent in making money." This is also a completely new precept that had never existed in human society before. Motivating such a change was the birth of Protestantism, a new religious denomination that emerged from the Reformation movement that began in the 16th century as a reaction against the Catholic Church. Among those called Protestants, Calvinists and Puritans were particularly ascetic. By extending their ascetic lifestyle to the secular world, they contributed to the creation of norms that were consequently most compatible with capitalist society.

They admonished against wasteful spending and regarded diligence as a virtue. They also positively affirmed the increase in wealth that resulted from such efforts. They regarded wealth as the reward for contributing to society and as the result of practicing love of neighbor. In particular, Calvinists believed in the predestination theory that the person who would be saved at the final judgment was predetermined. They believed that the only way to show that they were valuable to God was to create more wealth through ascetic labor, and this was the means by which they became convinced that they were predestined to be saved. This led them to be even more ascetic about making money.

The "god of capital," which did not yet have the power to be called a god, grew driven by the emergence of new believers who led a life centered on hard work and frugality, and who regarded maximizing lifetime income as their ethical obligation. As wealth accumulated in society, the "god of capital" grew in power, eventually taking over their belief system and acting as if he himself were a god.

How to make the most of humanity's "visionary abilities"

Canadian biologist David Suzuki says that "visionary abilities" has propelled humans to a dominant position in the biological world. We possess a uniquely brilliant brain. With the power of our brains, we created something called "time. And instead of living haphazardly in the flow of time, we are now able to take a bird's eye view of the future and plan our actions based on our past experience and knowledge.

Although it is difficult to say that solutions have been found at this point, the existence of environmental problems, such as climate change, is widely shared and recognized by human society. The current situation, which at first glance appears to be full of problems, is in fact a testament to the "foresight" of humankind. Humanity has moved forward by recognizing problems and solving them. As long as we have this ability, there is no need to be overly pessimistic about the future. A world where people feel that nothing is wrong in their daily lives may be more dangerous to humanity. We should have more confidence. So, how should we exercise our own "foresight" in acknowledging the energy problems that lie ahead in today's society?

Humbaba revived in modern times

Here we are reminded once again of the story of Humbaba in the Epic of Gilgamesh. The people who lived in ancient Mesopotamia could not stop cutting down trees, even though they knew that the loss of forests in the upper reaches of the river would cause salty sediment to run off and accumulate in the cultivated land downstream, eventually rendering the land unusable. The history of these ancient civilizations is in fact exactly the same story as the crisis facing modern civilization, which is feared to be losing land eventually due to climate change caused by the continued mass consumption of fossil fuels.

In recent years, large-scale wildfires and floods have become more frequent in many parts of the world. Japan is no exception, with more and more heavy rains and heat waves, and it is no longer unusual to hear the words "once in 50 years" or "for the first time in recorded history" in the news these days.

We are all beginning to share a firsthand sense that the climate is changing. Will we once again smash Humbaba, who has risen in our time as the protector of the global environment we now have, with the axe of an increasingly sharp civilization? Or will we be able to coexist with Humbaba this time? The answer to the question of what is the most important issue that humankind should seriously address is now clear. We must put aside our doubts and move forward.

Despite the recent uproar over the coronas, which resulted in a simultaneous global shutdown of economic activity to the point of almost suffocation, it became clear that the resulting reduction in carbon dioxide emissions was nowhere near the level required by

the Paris Agreement.

In the current outbreak of infection, the movement of people around the world began to stop around mid-February 2020, and on March 11, the World Health Organization (WHO) recognized the situation as equivalent to a pandemic. The outbreak continued to spread, leading to an unprecedented global economic shutdown in April and May, when more than 90% of global passenger air travel demand was lost.

According to a report compiled in September 2020 by the World Meteorology and Climate (WMO) under the leadership of UN Secretary-General Antonio Guterres, in cooperation with relevant organizations around the world, estimated daily carbon dioxide emissions in early April 2020, when the global economy came to a near standstill, fell 17% compared to the daily average of the previous year This is a decrease of unprecedented scale. This is an unprecedented reduction in emissions on a scale never seen before, and it is calculated to have reduced the daily discharge to a level equivalent to that of 2006.

However, in order to achieve the Paris Agreement's goal of a 2°C reduction, CO2 emissions in 2050 must be reduced from 30 billion tons per year in 2006 to 10 billion tons per year, or one-third of the 2006 level. In other words, the recent outbreak of infections has once again confirmed that it will not be possible to achieve the CO2 emission reduction target with ordinary efforts.

Recently, there is a tendency to believe that wasteful spending is acceptable because it leads to stimulating economic activity. This is the very supremacy of economic growth that allows the "god of capital" to run amok, and it seriously lacks the balance between environmental protection and economic growth. Moreover, it is not in the spirit of the original capitalism. The original spirit of capitalism, as Max Weber explained in detail, was the creation of wealth through the virtues of hard work and frugality that ascetic proletarianism possessed.

Frugality was originally an important component of capitalism, along with hard work. In fact, thrift is extremely effective. Some people even count thrift as a source of energy. We need to use things carefully and for a long time, turn off lights and air conditioners in rooms we don't use, and eliminate leftovers. Simply by reducing wasteful spending like these, we are making a substantial contribution to reducing energy consumption.

Of course, frugality doesn't always make everything work, and you may feel trapped if you overdo it.

Still, there is no doubt that thrift is one of the key words for the coming age. The Japanese language has a wonderful word for these times. It is the word "mottainai" ("mottainai" in Japanese). Wangari Maathai of Kenya, the 2004 Nobel Peace Prize laureate, popularized it worldwide. In a sense, the word "mottainai," which has been rediscovered by the Japanese, is a very human word. That is the good part.

“Mottainai" encourages us to practice frugality in a very natural way, without taking it too seriously as a way to protect the environment. In order to change the state of modern society, which is based on the mass consumption of energy, it is equally important to have not only a big mechanism to force the brain to change its mind through a philosophical discussion, but also a small mechanism that anyone can do easily and naturally to get the body moving.

The words "give and take" and "mottainai" used in everyday life have great potential to advance environmental protection.

Humans are the one and only beings who have risen to civilization through the accumulation of wisdom and created a huge dissipative structure. And mankind has the "visionary abilities.” Finding and improving issues is what humanity is best at. We now live in a society with a huge dissipative structure based on the massive use of energy. We are all aware of its advantages, disadvantages, and challenges. If we know it, all we have to do is to keep trying to improve it.

On the Existence of God

References

"Why do scientists believe in God?,” Ichiro Mita (Publisher, Kodansha)
(Author's bio: Professor at the Faculty of Science, Nagoya University since 1992, Professor Emeritus at Nagoya University since April 2006, and Professor at the Faculty of Engineering, Kanagawa University; concurrently Program Officer at the Kavli Institute for the Physics and Mathematics of the Universe, University of Tokyo since 2007. He is a deacon in the Catholic Church and his baptismal name is Anthony.).

"What Prigogine Thought" Kazuo Kitahara (Publisher, Iwanami Shoten)
"Etsuro Sotoo, Challenging Gaudi" by Masumi Hoshino (Publisher: NHK Publishing Co., Ltd.)

The existence of "God," long considered by mankind to be the Creator of all things, is being denied. What had been regarded as the domain of God, beyond the reach of human knowledge, is being explained by scientific theories one after another, and many people now believe that it is possible to create this world without relying on the existence of God. In fact, however, not a few scientists believe in the existence of God. Many eminent scientists, whose names are known to many people, speak passionately about God and faith. Even theoretical physicists who deal with cosmology and particle theory, which seem to be encroaching on the realm of the divine, do so.

According to a United Nations survey, 80% to 90% of the world's 300 scientists who have made significant achievements in the past 300 years believed in God. When we use the term "God" here, we are specifically referring to the God of Christianity, which many Westerners believe in, and its predecessor, Judaism. Japanese people, many of whom do not have a specific religion, seem to find it odd that scientists believe in God, even more so than Westerners. I believe that learning how Western scientists think about God will help us to understand the thoughts and ideas of Westerners, and will be meaningful for Japanese people as they become more internationalized.

Now, in the "God" section of 'Kojien', it is written as follows. (He is the omnipotent and omniscient Absolute who created the universe and mankind and controls the operation of the world in monotheistic religions such as Christianity and Islam.)

"Kojien" is a medium-sized Japanese-language dictionary published by Iwanami Shoten.

A search for "God" in the Kojien dictionary is followed by words such as "universe," "mankind," and "operation of the world," which are used when talking theoretically. When such words are listed in a row, one suddenly feels a sense of tension. The majority of Japanese, who are only aware of God's existence when they "ask God for help," will feel a gap in their thinking, saying that they are not thinking that strictly.

But as we see here, this is really how it is thought, or at least has been thought, in Christianity, Judaism, and Islam. For those who believe in these religions, God is not just a "ask God for help". Religion is what we think the world we live in is like, or in other words, what creates our worldview, and God is at the center of that worldview. In this sense, many Japanese may still be said to be non-religious.

Christianity, Judaism, and Islam have the Bible or Holy Bible, which is a written record of what God is. Believers read and study them from an early age and confirm the existence of God by going to church or cathedral with their families. Such activities have continued for more than 2,000 years. For many Japanese, this must be a wonder.

Today, students are taught in school that the universe began with the Big Bang and that humans evolved from primitive organisms. Under such circumstances, how can they seriously believe in the existence of God as Creator? What is even more puzzling is that many of those who try to use "science" to explain what until now could only be attributed to "God's work" also believe in God. They are physicists who study the universe and the beginning of matter, and life scientists who study the beginning of life. Ordinary Japanese people may think this is nothing but a contradiction when they hear such things.

At a time when many in the intelligentsia were studying theology, many natural scientists were also clergy. There, the relationship between scientists and God was generally simple. What advanced science was a genuine urge to know more about a loving God. However, as a result, a brilliant scientist like Copernicus, who would find himself in contradiction with the Bible and the Church's decrees, was also conflicted between faith and research.

“The universe is a second Bible, and the words of this book are mathematics."

This is a well-known quote from Galileo, but it is actually an abridged version; he actually said.

“Philosophy is written in this magnificent book called the universe. This book is always open to us. But we cannot understand this book unless we first learn its language and learn to read the letters in which it is written. It is written in mathematical language, and its letters are triangles, circles, and other geometric figures. Without these, man

cannot understand any part of it. Without them, man wanders in a dark labyrinth."

Galileo believed that to know why God, the Creator of all things, created the universe in this way, one must read "Another Bible" written in the language of "mathematics.

How does the Catholic Church value science?

In 1979, late in the 20th century, at a Roman Catholic Church ceremony celebrating the 100th anniversary of Einstein's birth, Pope John Paul II said the following

Einstein and Galileo were two of the greatest scientists of their times. While Einstein is celebrated, Galileo suffered greatly. It was the people inside the Church and the Church institutions that caused this. This gave people the idea that faith and science were in conflict. So the Church self-criticized itself, and theologians, scientists, and historians jointly investigated the "truth of the Galileo case. And it demanded that whichever side was in error, they openly admit that they were wrong.

It was a declaration that the Church would finally admit that the Galileo trial was a mistake, self-criticize itself, and investigate the truth of the Galileo case. 1981 saw the establishment of the Commission to Investigate the Galileo Case, and in 1992, following its report, Pope John Paul II issued a final statement.

Galileo, with his intuition as a brilliant physicist, and his practical devising of various methods, understood why only the sun could serve as the center of the world as it was then known, so to speak, as an astronomical system. The error of the theologians of the time who insisted that the earth was central was to think that our understanding of the structure of the physical world was in some sense determined by the literal meaning of the Bible.

With these words, the Pope apologized to Galileo and restored his honor. At that time, 350 years had passed since Galileo's death. Some people wondered if an apology made 350 years later would have any meaning. The church itself probably did not think deeply about such a long time ago. However, there were accusations that the Church, which should proclaim the Word of God, should not forever avoid touching the mistakes of the past as if they were a boil, in order to keep up with the development of the science that God created! In fact, without this apology, many scientists would have left the

church. It is the same for me. I would be considered a "heretic" because my life, which I have dedicated to science, would be considered a "heretic".

In his statement, John Paul II acknowledged that the Church's error was in adhering too closely to the "literal meaning of the Bible. How, then, has the Church, upon reflection, come to think about this now?

Galileo once said the following. “Both Scripture and nature arise from the Word of God, the former being the statement of the Holy Spirit and the latter the faithful executioner of God's commands. Therefore, the two truths cannot be in conflict with each other. It is the task of the commentator to find the true meaning of the biblical chapters and verses so that they are consistent with the natural scientific conclusions we are convinced of by the inevitable proofs.”

In his statement, John Paul II made it clear that these words of Galileo were correct. In other words, the Pope acknowledged that the way we read the Bible should change with the progress of science.

Since the 20th century, the Catholic Church's official conferences on “theory of evolution” have included the following

 # Pope Pius XII's proposal issued on August 12, 1950

“The Pope's statement on the doctrine of evolution does not forbid its study and discussion insofar as it is a theory that explores the origin of the human body as arising from a pre-existing creature. This is because the Catholic faith commands us to believe in the direct creation of the human spirit by a heavenly host." Pius XII states that evolution is a theory of the origin of the "body" and that the "spirit" is directly created by a heavenly host. This is because the spirit cannot be understood by science.

 # In the words of Pope John Paul II to the Pontifical Academy of Sciences on October 22, 1996

"Today, more than half a century after Pius XII's encyclical was issued, new discoveries have allowed us to accept the theory of evolution as more than a hypothesis."

 # Words of Pope Francis at the October 27, 2014 meeting of the Pontifical Academy of Sciences

“When we read the creation account in Genesis, we run the risk of thinking that God is a magician equipped with a magic wand that can do anything. But it is not like that. God created living creatures and, by an inner law which He gave to each, each evolved to be what it truly is."

The Catholic Church also entered the debate about the Big Bang Theory at an early stage. Moreover, contrary to the intuition of most of you, the Church endorsed the Big Bang theory, and in 1951, then-Pope Pius XII issued a statement that "the Big Bang does not contradict official Catholic doctrine." On another occasion, Pius XII also stated that "the discoveries of Lemaitre and others are scientific proof of God's creation."

To reiterate the Big Bang theory a little, it is the idea that something incredibly tiny, super-hot, super dense, and microscopic caused a massive explosion at the time of the creation of the universe, which expanded to the scale of the present universe. This first something Lemaitre called the "primordial atom. Later, this something came to be called a "singularity. But what it is and how it came to be cannot be explained by the Big Bang theory. The Church focused on that and tried to find in that first something the final place of God, who had been forced to retreat one after another by science. So unless it is explained, God is immortal.

At that time, Hawking was already on his way to constructing a "Godless Universe. Unaware of this, the Catholic Church paid him the greatest tribute for proving the Singularity and confirming the existence of God, and in 1975 he was awarded a gold medal with the image of Pius XI, founder of the Pontifical Academy of Sciences, engraved on it. And in 1981, Hawking was also invited to an international conference organized by the Academy of Sciences, where cosmologists from around the world gathered at the Vatican.

When Pope John Paul II, the head of the Academy, saw Hawking in his wheelchair in the hall, he personally knelt on the floor to welcome him. John Paul II was the Pope who, in 1979, declared the fusion of science and religion by apologizing to Galileo. But according to Hawking's recollection, the Pope told him during this meeting. “It is all very well to study the evolution of the universe after the Big Bang, but we must not

explore the Big Bang itself. It is the moment of creation and the work of God!”

However, Hawking had already spoken at the conference about an “Alternative Proposal To The Big Bang’s Singularity Theory: The Hartle-Hawking State” of affairs. This was published in 1983 and posits that there was no "beginning" to the universe.

Hawking recalls it this way. “I was relieved that the Pope did not know what I had said. I don't want to suffer the same fate as Galileo."

In 1979, John Paul II made the following remarks at a conference in which he apologized to Galileo. The Big Bang itself must not be explored. It is the moment of creation, the work of God. But it is perfectly acceptable to study the evolution of the universe since then."

These words of John Paul II are an obstacle to the "quest for knowledge" of scientists. I also thought it was an unbecoming statement for them to make. It is not hard to imagine that Pope John Paul II would have been upset by Hawking's "Alternative Proposal To The Big Bang’s Singularity Theory: The Hartle-Hawking State" of the universe, which came out of the blue.

There is no record that tells the story of how the church reacted, but it was like a coup d'etat by a "friend" who had proved the existence of the singularity, and the shock was great. However, from what has happened since then, it seems that the church was not hurt too badly.

At the end of his book "On the Origin of Time: Stephen Hawking's Final Theory," he wrote this sentence.

“Why do we and the universe exist? If we can find an answer to that, it will be the ultimate triumph of reason--because then we will know the mind of God."

Differences in the Treatment of Science in Japan and Europe

It was when Kazuo Kitahara (Prigogine's Thoughts, author) visited Brussels, Belgium to study abroad. It was an article in the newspaper "Le Monde" that he picked up at that time. In the paper, a philosopher, a lawyer, and a scientist were having a heated

discussion over Jacques Monod's "Coincidence and Inevitability" (Misuzu Shobo publisher), which was published at the time.

In it, I remembered that somehow it seemed rather strange that the molecular biologist Jacques Monod was writing as if he were responding to a theologian and philosopher. Because in Japan, it is generally believed that discoveries in molecular biology, which is pure science, are only made in the laboratory and have no impact on everyday life. Scientists may make new discoveries in the lab, but once they step away from the lab, they return to their daily lives. In short, research and daily life were used separately. This atmosphere is probably the same even today.

So it seemed somewhat odd that in "Coincidence and Inevitability," Jacques Monod wrote so obsessively about ideological matters outside the realm of natural science. In Europe, however, the new discoveries of science were considered as something that shook the foundations of individual existence. It occurred to me at the time that the motivation for learning, so to speak, may be subtle but qualitatively quite different between Japanese culture and European culture.

Christianity is still in the midst of progress!

Since the beginning of time, the world's religions have remained humanity's most important social norms, guides to civilized societies, and the starting point of our morality and ethics. Should modern religions preserve their traditional traditions, or can they evolve and once again serve as humanity's guides? And is religion meaningless in this age of overwhelming scientific power?

There is only one way for Christianity to survive in the coming age of science. We must stop rejecting scientific discoveries. We must stop openly condemning verifiable facts. We must draw on our vast experience - millennia of philosophy, personal exploration, meditation, and reflection - to become deeply connected partners with science.

We must do our best to help mankind create a moral framework, so that new technologies can bring unity, enlightenment, and development. We can only hope that science will regain its true form and that science will accept the help of religion. Religion is good for human evolution. Religious societies thrive better than non-religious societies because people cooperate better with each other. This is a

scientific fact.

What does the Sagrada Familia symbolize?

The Sagrada Familia may be a turning point in history, just like the Pantheon in Rome. The current Pantheon in Rome was rebuilt by Emperor Hadrian around 120 AD. In 380 A.D., Emperor Theodosius proclaimed Christianity the state religion of the Roman Empire. In 392 A.D., he banned all religions other than Christianity in the Roman Empire, and the Pantheon, which tolerated polytheism, was positioned as a heretical religious institution that was forbidden. Naturally, religious activities could no longer be conducted in the building, and people began to leave and it fell into disuse.

Belief in the Roman god gradually waned and the object of worship shifted to Christianity. Perhaps because of the splendor of its mystical interior spaces, it was never destroyed. In 609 A.D., it became a Christian temple, a Catholic religious institution, known as Santa Maria Rotunda. And it continues to be used today, nearly 2,000 years after its creation.

The Sagrada Familia is a structure with one foot in the past and the other in the future, a solid bridge between a dying faith and a rising one, and if so, the Sagrada Familia will play an unimaginably important role. The Sagrada Familia is precisely this place where Gaudi combined God, science, and nature. This Sagrada Familia seems to be the cathedral of the future, a cathedral directly connected to nature. The official name of the church is "Sagrada Familia Church of the Atonement" in Japanese. It is dedicated to the "Holy Family" of Jesus, the Virgin Mary, and Joseph, his adoptive father, and is a church for the poor to atone for their sins.

About Sagrada Familia Church of the Atonement

The World's Largest Spanish Church Building

The Sagrada Familia is a massive Roman Catholic church in Barcelona, Catalonia, Spain. Its official name is The Basílica de la Sagrada Família. Designed by Spanish architect Antoni Gaudi and still under construction, it has already been registered as a UNESCO World Heritage Site.

In November 2010, Benedict XVI (then Pope) visited the church for worship and celebrated a Mass officially recognizing it as a Roman Catholic church. In the 128th year since construction began, it became a "basilica," a higher level church different from a cathedral.

Construction of the Sagrada Familia began in 1882, on March 19, 1882, under the direction of architect Francisco de Paula del Villar. However, when Villar resigned in 1883, Gaudí was appointed chief architect and took the construction project in his own direction. After his appointment, Gaudí changed his style to Gothic Modernism, a combination of Gothic and curvilinear Art Nouveau styles. The appearance is characterized by the absence of straight lines, right angles, and horizontality in the design elements.

Gaudi was actively involved in the construction project until 1923, in his last days at the age of 76, but it could not be completed during his lifetime; on June 7, 1926, on his way to mass, Gaudi tripped and fell over a step and was hit by a passing tram, resulting in his death. Gaudi's remains are buried in the Sagrada Familia.

The construction of the Sagrada Familia, which relied solely on private donations, was delayed and halted by the Spanish Civil War; in July 1936, revolutionaries set fire to the basement and broke into the work area, destroying some of Gaudi's original drawings, plans, and plaster casts, and it took 16 years to It took 16 years to piece together the fragments of the original blueprints.

Construction resumed intermittently in the 1950s. Subsequently, advances in computer-aided design, computer numerical control (CNC), and other technologies have allowed faster progress, and half of the building was completed in 2010. The project's greatest challenge is to construct ten spires. They symbolize important characters from the New Testament.

In the 1980s, it was said that it would take about 300 years to complete the project, but due to advances in information technology and other factors, it is now expected to be completed in 2026, the 100th anniversary of Gaudi's death.

New Testament Scriptures of interest

I (Shimizu) have extracted some verses from the New Testament that caught my attention. I briefly explain why.

Quotes from The New Testament(Diglot Bible)

The Diglot Bible is a bilingual New Testament in Japanese and English.

MATTHEW

The Crucifixion　Chapter 27, verses 40-43, page 92.

and saying, “You who would destroy the temple and rebuild it in three days, save yourself! If you are the Son of God, come down from the cross.”
So also the chief priests, with the scribes and elders, mocked him saying,
He saved others; he cannot save himself. He is the King of Israel; let him come down now from the cross, and we will believe in him.
He trusts in God; let God deliver him now, if he desires him. For he said, ‘I am the Son of God.’”
And the robbers who were crucified with him also reviled him in the same way.

These were the words of the people toward the crucified Jesus Christ, and I believe that these were their actual feelings. I believe that they chose to live within their own position as human beings, rather than relying on a "miracle" by God.

The Great Commission　Chapter 28, verses 18-20, page 97.

And Jesus came to and said to them, “All authority in heaven on earth has been given to me.
Go therefore and make disciples of all nations, baptizing them in the name of the Father and of the Son and of the Holy Spirit,
teaching them to observe all that I have commanded you. And behold, I am with you always, to the end of the age.”

This expression is what appears in the Table given at the beginning of this article. I am sure there are many more combinations, but for now I have noted the ones I noticed.

MARK

The Request of James and Jhon Chapter 10, verses 43-45, pages 134-135.

"You know that those who are considered rules of the Gentiles load it over them, and their great ones exercise authority over them.
But it shall not be so among you. But whoever would be great among you must be your servant,
and it whoever would be among you must be slave of all.
For even the Son of Man came not to be served but to serve, and to give his life as a ransom for many."

This section discusses the attitudes of public officials and politicians who represent the bureaucracy. They have a lot of authority over the lives of the people. They are truly what we can call "life." How to exercise authority, I believe, is to imitate Jesus Christ.

LUKE

A Sinful Woman Forgiven Chapter 7, Section 50, page 191.

And he said to the woman, "Your faith has saved you; go in peace."

The teachings of Jesus Christ state that it is a faith with a "system of salvation.

The Load's Prayer Chapter 11, verses 9-13, pages 208-209.

And I tell you, ask, and it will be given to you; seek, and you will find; knock, and it will be opened to you.
For everyone who asks receives, and the one who seeks finds, and to the one who knocks it will be opened.
What father among you, if his son asks for a fish, will instead of a fish give him a serpent;
or if he asks for an egg, will give him a scorpion?

If you then, who are evil, know how to give good gifts to your children, how much more will the heavenly Father give the Holy Spirit to those who ask him!

As Jesus Christ says, "ask, seek, knock at the door," a spontaneous attitude is important. We are told to listen to others, use our eyes and hands to find things in the natural environment, and send signals from hidden and unseen places to make the object take action and remove obstacles. The difficulty level is gradually increasing, but in this way you will get what you want.

Not Peace, but Division　Chapter 12, verses 49-53, page 217.

“I came to cast fire on the earth, and would that it were already kindled!
I have a baptism to be baptized with, and how great is my distress until it is accomplished!
Do you think that I have come to give peace on earth? No, I tell you, but rather division.
For from now on in one house there will be five divided, three against two and two against three.
They will be divided, father against son and son against father, mother against daughter and daughter against mother, mother-in-law against her daughter-in-law and daughter-in-law against mother-in-law.”

This may describe the "dissipative structure" that is occurring on the earth. Dissipative structures are the activities of living organisms, which are able to exist by maintaining a thermodynamically nonequilibrium state.

Who Is the Greatest?　Chapter 22, verses 28-29, page 251.

“You are those who have stayed with me in my trials,
and I assign to you, as my Father assigned to me, a kingdom,

Jesus Christ has dominion. Jesus Christ does not rule the world. I am saying that those who believe in Christ have dominion over the world. I think he is talking about the lordship of space and time.

JOHN

The Word Became Flesh Chapter 1, Sections 1-5, 265 pages.

In the beginning was the Word, and the Word was with God, and the Word was God.
He was in the beginning with God.
All things were made though him, and without him was not anything made that was made.
In him was life, and the life was light of men.
The light shines in the darkness, and the darkness has not overcome it.

This representation is part of what appears in the Table given at the beginning of this section.

I am the Father Are One Chapter 10, verses 25-38, pages 304-305.

Jesus answered them, "I told you, and you do not believe. The works that I do in my Father's name bear witness about me,
but you do not believe because you are not among my sheep.
My sheep hear my voice, and I know them, and they follow me.
I give them eternal life, and they will never perish, and no one will snatch them out of my hand.
My Father, who has given them to me, is greater than all, and no one is able to snatch them out of the Father's hand.
I and the Father are one."
The Jews picked up stones again to stone him.
Jesus answered them, "I have shown you many good works from the Father; for which of them are you going to stone me?"
The Jews answered him, "It is not for a good work that we are going to stone you but for blasphemy, because you, being a man, make yourself God."
Jesus answered them, "Is it not written in your Law, 'I said, you are gods'?
If he called them gods to whom the word of God came---and Scripture cannot be broken---
do you say of him, whom the Father consecrated and sent into the world, 'You are blaspheming', because I said, 'I am the Son of God'?
If I am not doing the works of my Father, then do not believe me;
but if I do them, even though you do not believe me, the works, that you may know and

understand that the Father is in me, and I am in the Father”

The chart shown at the beginning of this section represents the relationship between the Father and the Son. It says, "If you do not believe in me, believe in my craft." also represents the emergent phenomenon.

Your Sorrow Will Turn into Joy　Chapter 16, verses 23-24, page 326.

In that day you will ask nothing of me. Truly, truly, I say to you, whatever you ask of the Father in my name, he will give it to you.
Until now you asked nothing in my name. Ask, and you will receive, that your joy may be full.

It expresses the administration that Jesus Christ possesses. It means that if we do things the way Jesus Christ showed us, our wishes will come true. If you just wish blindly, you will end up with an empty wish.

ROMANS

The Promise Realized Through Faith　Chapter 4, verses 13-16, page 451.

For the promise to Abraham and his offspring that he would be heir of the world did not come through the low but through the righteousness of faith.
For if it is the adherents of the law who are to be the heirs, faith is null and the promise is void.
For the law brigs wrath, but where there is no law there is no transgression.
That is why it depends on faith, in order that the promise my rest on grace and be guaranteed to all his offspring --- not only to the adherent of the law but also to the one who shares the faith of Abraham, who is the father of us all,

A promise by faith cannot be other than by faith because it is a promise between God and man. To whom does the world belong? I believe that "righteousness by faith" takes precedence over "the law.

Dead to Sin, Alive to God　　Chapter 6, Section 2-4, pages 454-455.

How can we who died to sin still live in it?
Do you know that all of us who have been baptized into Christ Jesus were baptized into his death?
We were buried therefore with him by baptism into death, in order that, just as Christ was raised from the dead by the glory of the Father, we too might walk in newness of life.

I believe that the emergent phenomenon, as represented in the table shown at the beginning of this article, represents living in a world that includes a system of salvation.

Slaves to Righteousness　　Chapter 6, verses 16-18, page 456.

Do you know that if you present yourselves to anyone as obedient slaves, you are servants of the one whom you obey, either of sin, which leads to death, or of obedience, which leads to righteousness?
But thanks be to God, that, you who were ones slaves of sin have become obedient from the heart to the standard of teaching to which you were committed,
and, having been set free from sin, you have become slaves of righteousness.

Again, I believe that the emergent phenomenon, as represented in the table shown at the beginning of this article, represents living in a world that includes a salvation system.

Marriage Metaphor　Chapter 7, Section 1-6, pages 456-457.

Or do you not know, brothers (for I am speaking to those who know the law) that the law is binding on a person only as long as he lives?
For a married woman is bound by law to her husband while he lives, but if her husband dies she is released from the law of marriage.
Accordingly, she will be called an adulteress if she lives with another man while her husband is alive. But if her husband dies, she is free from that law, and if she marries another man she is not an adulteress.
Likewise, my brothers, you also have died to the law through the body of Christ, so that

you may belong to another, to him who has been raised from the dead, in order that we may bear fruit for God.
For while we were living in the flesh, our sinful passions, aroused by the law, were at work in our members to bear fruit for death.
But now we are released from the law, having died to that which held us captive, so that we serve in new way of the Spirit and in the old way of the written code.

Again, I believe that the emergent phenomenon, as represented in the table shown at the beginning of this article, represents living in a world that includes a salvation system.

A Living Sacrifice　Chapter 12, Section 1~2, pages 471-472

I appeal to you therefore, brothers, by the mercies of God, to present your bodies as a living sacrifice, holy acceptable to God, which is your spiritual worship.
Do not be conformed to this world, but be transformed by the renewal of your mind, that by testing you may discern what is the will of God, what is good and acceptable and perfect.

I think it writes about the importance of being aware of the social self.

Submission to the Authorities　Chapter 13, Section 1-4, pages 473-474.

Let every person be subject to the governing authorities. For there is no authority except from God, and those that exist have been instituted by God.
Therefore whoever resists the authorities resists what God has appointed, and who resist will incur judgment.
For rulers are not a terror to good conduct, but to bad. Would you have no fear of the one who is in authority? Then do what is good, and you will receive his approval,
for he is God's servant for your good. But if you do wrong, be afraid, for he does not bear the sword in vain. For he is the servant of God, an avenger who carries out God's wrath on the wrongdoer.

Good and evil are derived from the ruler, but if you do good, you are not going against God or the ruler.

1CORINTHIANS

Divisions in the Church　Chapter 3, verses 16-17, page 490

Do you not know that you are God's temple and that God's Spirit dwells in you?
If anyone destroys God's temple, God will destroy him. For God's temple is holy, and you are that temple.

The Spirit of God lives within you, and it keeps you alive, believing in tomorrow. If the Spirit of God within you is broken, you will not be able to believe in tomorrow and you will die.

Spiritual Gifts　Chapter 12, Section 3-6, page 510

Therefore I want you to understand that no one speaking in the Spirit of God ever says "Jesus is accursed!" and no one can say "Jesus is Lord" expect in the Holy Spirit.
Now there are varieties of gifts, but the same Spirit;
and there are varieties of service, but the same Lord;
and there are varieties of activities, but it is the same God who empowers them all in everyone.

The power of the spirit is given to each individual by God Almighty in an optimized form, just as energy is expressed in various forms, e.g., physical, electrical, chemical, etc.

One Body with Many Members　Chapter 12, verses 27-28, page 512.

Now you are the body of Christ and individually members of it.
And God has appointed in the church first apostles, second prophets, third teachers, then miracles, then gifts of healing, helping, administrating, and various kinds of tongues.

The Japanese national system has maintained a society centered on the Emperor to this day. The Emperor is the symbol of Japan, amounting to a double contingency, and the people are the contingency.

The Resurrection of the Dead　Chapter 15, Section 22, page 519.

For as in Adam all die, so also in Christ shall all be made alive.

Original sin refers to the fact that, due to Adam's sin, "death entered into the history of mankind. However, Jesus Christ was resurrected by the grace of God so that we could have eternal life.

2CORINTHIANS

Paul Defends His Ministry　Chapter 10, verses 15-17, page 544.

We do not boast beyond limit in the labours of others. But our hope is that as your faith increases, our area of influence among you may be greatly enlarged,
so that we may preach the gospel in lands beyond you, without boasting of work already done in another's area of influence.
"Let the one who boasts, in the Lord."

We can do "help God with his work" that seems tremendously tedious and seemingly without reward because we believe we have a recommendation from Almighty God. Or, we can do it with priority over anything else.

GALATIANS

The Law and the Promise　Chapter 3, verses 21-27, page 559.

Is the law then contrary to the promises of God? Certainly not! For if a law had been given that could give life, then righteousness would indeed be by the law
But the Scripture imprisoned everything under sin, so that the promise by faith in Jesus Christ might be given to those who believe.
Now before faith came, we were held captive under the law, imprisoned until the coming faith would be revealed.
So then, the law was our guardian until Christ came, in order that we might be justified by faith.
But now that faith has come, we are no longer under a guardian,
for in Christ Jesus you are all sons of God, through faith.

For as many of you as were baptized into Christ have put on Christ.

It describes the role of the law. It is given a temporary role until man is justified by faith. The role of the law ends when faith in Jesus Christ is established. Faith has the function of extending into areas where multiple laws are in effect and uniting them into a larger whole.

EPHESIANS

Thanksgiving and Prayer　Chapter 1, verses 20-23, page 568.

that he worked in Christ when he raised him from the dead and seated him at his right hand in the heavenly places,
far above all rule and authority and power and dominion, and above every name that is named, not only in this age but also in the one to come.
And he put all things under his feet and gave him as head over all things to the church, which is his body, the fullness of him who fills all in all.

I believe it is represented in the table of dynamical systems theory shown at the beginning of this article.

PHILIPPIANS

Righteousness Through Faith in Christ　Chapter 3, Section 9-11, page 587.

and be found in him, not having a righteousness of my own that comes from the law, but that which comes through faith in Christ, the righteousness from God that depends on faith---
that I may know him and the power of his resurrection, and may share his sufferings, becoming like him in his death,
that by any means possible I may attain the resurrection from the dead.

Japan will not be a country that lasts forever unless its people, the members of the nation, belong to a world that will never end.

Straining Towards the Goal　Chapter 3, verses 17-21, page 588.

Brothers, join in imitating me, and keep your eyes on those who walk according to the example you have in us.
For many, of whom I have often told you and now tell you even with tears, walk as enemies of the cross of Christ.
Their end is destruction, their god is their belly, and they glory in their shame, with minds set on earthly things.
But our citizenship is in heaven, and from it we await a Saviour, the Lord Jesus Christ, who will transform our lowly body to be like his glorious body, by the power that enables him even to subject all things to himself.

We believe that by following the example of Jesus Christ, we can learn what is expressed in the table of the Dynamical Systems Theory shown at the beginning of this article.

COLOSSIANS

Thanksgiving and Prayer　The Pre-eminence of Christ
Chapter 1, verses 11-22, pages 592-593.

May you be strengthened with all power, according to his glorious might, for all endurance and patience with joy,
giving thanks to the Father, who has qualified you to share in the inheritance of the saints in light.
He has delivered us from the domain of darkness and transferred us to the kingdom of his beloved Son,
in whom we have redemption, the forgiveness of sins.
He is the image of the invisible God, the firstborn of all creation.
For by him all things were created, in heaven and on earth, visible and invisible, whether thrones or dominions or rulers or authorities---all things were created through him and for him.
And he is before all things, and in him all things hold together.
And he is the head of the body, the church. He is the beginning, the firstborn from the dead, that in everything he might be pre-eminent.
For in him all the fullness of God was pleased to dwell,

and through him to reconcile to himself all things, whether on earth or in heaven, making peace by the blood of his cross.
And you, who once were alienated and hostile in mind, doing evil deeds,
he has now reconciled in his body of flesh by his death, in order to present you holy and blameless and above reproach before him,

Jesus Christ was born before all things of this world were created. It is safe to say that all things have the attributes of the Son. All things manifest the attributes of the Son. I believe that part of this is expressed in the table of the dynamical system theory given at the beginning of this article. Reconciliation with God was made through the death and resurrection of the Son, Jesus Christ. In other words, it is the transfer of God's skill to human beings.

Paul's Ministry to the Church Chapter 1, verses 25-29; Chapter 2, verses 1-3, pages 593-594.

of which I became a minister, according to the stewardship from God that was given to me for you, to make the ward of God fully known,
the mystery hidden for ages and generations but now revealed to his saints.
To them God chose to make known how great among the Gentiles are the riches of the glory of this mystery, which is Christ in you, the hope of glory.
Him we proclaim, warning everyone and teaching everyone will all wisdom, that we may present everyone mature in Christ.
For this I toil, struggling with all his energy that he powerfully works within me.

For I want you know how great a struggle I have for you and for those at Laodicea and for all who have not seen me face to face,
that their hearts may be encouraged, being knit together in love, to reach all the riches of full assurance of understanding and the knowledge of God's mystery, which is Christ, in whom are hidden all the treasures of wisdom and knowledge.

Love is the power that generates emergence, and it brings together the social self of the whole world to enrich the world and to ensure the realization of the Kingdom of God. Love is the instrument that materializes Christ in the world.

2THESSALONIANS

Thanksgiving　Chapter 1, Section 7-9, pages 609-610.

and to great relief to you who are afflicted as well as to us, when the Lord Jesus is revealed from heaven with his mighty angels
in flaming fire, inflicting vengeance on those who do not know God and on those who do not obey the gospel of our Lord Jesus.
They will suffer the punishment of eternal destruction, away from the presence of the Lord and from the glory of his might,

It shows that Jesus Christ will appear in the "dissipative structure." Although there are difficulties as a real problem of global warming, let us not flinch and move forward, hoping in the foresight of human beings.

HEBREWS

The Supremacy of God's Son　Chapter 1, Section 2-4, page 641.

but in these last days he has spoken to us by his Son, whom he appointed the heir of all things, through whom also he created the worlds.
He is the radiance of the glory of God and the exact imprint of his nature, and he upholds the universe by the word of his power. After making purification for sins, he sat down at the right hand of the Majesty on high,
having become as much superior to angels as the name he has inherited is more excellent than theirs.

I believe it is represented in the table of dynamical systems theory shown at the beginning of this article.

The end