

# Biological Systems and Chemical Substances

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I have given up my work as a scientist and am not working in a laboratory. When I was however there was a problem that I had a question about. In experiments, various chemical substances are administered to living creatures. My question is about how those chemical substances influence biological systems. I only came here to talk about environmental hormones because Dr. Mori insisted. Dr. Mori is working with genesis. I also was involved in research of the system of genesis. I believe you are aware of the well-known inducing substance that has been around for a long time now from run-of-the-mill textbooks, where when a certain chemical substance acts on a group of cells, they become for example brain or central nervous system cells. If one investigates such chemicals, he can ultimately discover what sort of substances these are. We however found previously that anything would do.

As for this concept, you don't always need a certain chemical substance. If stimulation is provided, for example brain cells will be created. In terms of the simplest substances, we found that substances such as formic acid would do. When administered, there is no doubt that a certain substance is working, but it was known that chemical reaction is caused by the standby status of the other even when I was in a laboratory.

If this is investigated further, one will come to understand the structure of chemicals substances related to living creatures extremely well, and will see such substances continue one after another. While contemplating for example at the stage where we began to know the true nature of inducing substances when they develop and how much easier the things on which those chemical substances act, in other words the cells of living organisms, are to understand than the chemical substance are, my head almost exploded.

In other words, if you visualize the model of a cell in your heads, when you try to convert that into a molecular structure such as written chemical formulas, I'm sure you'll notice right away that we are dealing with something that is really unbelievable. The people from the pharmaceuticals industry brought a poster manuscript, and because I was involved in anatomy, I was asked if it is anatomically correct. The molecules are drawn so they can be seen. The model drawing shows how for example smooth muscle cells in the blood vessels bind with the receptors of smooth muscle cells. My reply to this question would be "no." If you want to know in what way it is incorrect, I would say the proportions are distorted. If you draw a molecule of this size, the cell would be about the size of Tokyo Prefecture.

When you however take into consideration the entire scientific society - I would now like to change the subject to a social theme - perhaps there was the idea that we have come to the subject, or that science had made an advancement if we accurately understand the structure of a certain chemical substance. If a certain chemical substance acts on a system such as the one we are now talking about, that itself is the system. When we come to understand the chemical substance taking this into account, we actually begin not to understand the thing on which the substance acts, as we understood about the true nature of the chemical substance. If we place our focus on understanding, a certain type of uncertain principle comes into play here. I call this the "uncertainty principle of living creatures." The more you know about the structure of agents at work here, the more unclear the thing on which the agent is working becomes.

The wall scenery we are now looking at will suffice as an example. If you look at the wall scenery with a magnifying glass that magnifies 10 times, it requires 10 times the effort. If you look at it with magnifying glass that magnifies 100 times, it requires 100 times the effort. Whatever can be seen clearly,

the same amount in other portion becomes out of focus. If for example you write "H<sub>2</sub>O" on the blackboard, it indicates a molecule of water. Because I am involved with anatomy, I can visualize a blow up diagram of a molecule of water. I have written the calculation in case of drawing a human body in proportion as this size in a book. If you write "H<sub>2</sub>O" on the blackboard at the size of 20 centimeters, when a human being is expanded to that size, his feet would be on the Earth and his head would touch the moon. The degree to which we understand this, in a certain sense, is why I abandoned the experiment.

What I was interested in is the subject that Dr. Aihara was talking about -- what the system originally is and whether or not living creatures are a basic system. And as we reach the present, neural networks become typical - as we just heard - and genes are also in such a network. In other words they are making a certain type of system. As a matter of course, their debate comes up to a certain degree.

Speaking of environmental hormones, many similar problems have come up in the annals of biology. In medicine, harmful effects of drugs are a typical example. Unlike environmental hormones, drugs initially have some sort of beneficial function. Harmful effects are produced when used as a drug. The most well known example of this might be thalidomide, which came up in the talk about the FDA a little while ago. You might say the FDA became really well known due to thalidomide. If you are wondering what finally became of thalidomide, there have recently been books, but thalidomide has come to be used as a specific medicine for treatment of Hansen's Disease. You are also probably aware that it is used for treatment of myeloma and AIDS.

What I thought was interesting about the discussion of environmental hormones was the fact that the harmful effects of this medicine came up from the first appearance. This has a lot in common with the talk about mutation. In other words, we have been taught that artificially generated mutations always have a harmful effect on organisms. The theory of evolution however says that organisms evolve by mutation, so I think maybe there are a few of you who may not understand what we're talking about here. This strongly resembles the talk about thalidomide. I therefore sometimes think, why aren't there people who say they have lived a long time by merit of chemical substances unconsciously released into the environment. This is theoretically possible, in other words, there are some problems concerning our understanding of this system.

Finally another thing I'd like to mention is, when contemplating such a concept, my theme is what the understanding of human beings, the outside world and the natural environment actually is. It is our brains that understand this, so I started thinking about research of the brain or the brain at some time. Natural science at a certain point makes outside understanding a problem. When the problem of a system relative to a certain substance is established for an understanding such as this, the subject is "not understand" from before, but "not understand" is evident from a certain aspect. If a certain portion of this is magnified, the remainder similarly is magnified by the same size. It is therefore hard to understand.

Aside from why it is like this, I would finally like to mention the similar current social situation, in other words, the correlation of information and society. I suppose you are all aware that society is currently referred to as the "information society." If you consider what information is, in this case, I think it is similar to a typical simple chemical substance. You may think I am speaking incoherently, and you want to know what the points of similarity are. My point is that a chemical substance is isolated and then it is usually a white powder contained in a bottle because it is a chemical substance. When the powder is administered to a living body, it has various pharmaceutical effects or causes harm.

Information is exactly the same, but the information has a nature similar to an isolated chemical substance. If you are wondering what is similar, it is the fact that it doesn't change at all. These themselves do not change. They are of course not living, so they are stopped. Concerning the fact that information has stopped, many people may be under an illusion. There are people here from NHK. Because NHK news changes every day, you may think the information changes every day. If this is videotaped, however, you

will see what I mean. Even a hundred years from now we can see the same news, therefore, television news is stopped today. The newscaster reading the television news will of course be in his grave a hundred years from now. He will probably have been reduced to molecules. Information is therefore fixed for living systems.

Therefore, as for the problem of environmental hormones and harmful effect of drugs, and the problem of what will happen when the agent I mentioned a little while ago works on the system of a living organism, all of these problems have similar structures as the problem we are currently thinking as information and ourselves in society. I suggest that this may simultaneously be related to the difficulty of understanding the subject of today, so for the time being, I will end my talk here. Thank you very much.