

Let's promote evolution-oriented chemistry with the shared character of “化” as the key

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The Japanese word “化学” (which is phonetically spelled as *Kagaku* and means “chemistry” in English) is uniquely appealing. This is probably because the character “化” reminds us of various things. For example, “変化” (phonetically *henka* or semantically “change”), “進化” (*shinka* or “evolution” in the same order), “化粧” (*keshou* or “make-up”), and “お化け” (*obake* or “ghost”). Expectations of an unexpected transformation make us not only look forward to it but also make us feel sort of scared.

According to the interpretation by Shizuka Shirakawa, a distinguished scholar of Chinese characters, “化” originally represented the death of humans, but it now commonly expresses any kind of change since all beings repeat the life and death cycle while changing. This character also expresses the natural cultivation of all creation as well as enlightenment through moral and thought.

For me expectations of an unexpected transformation are like an extension of my childhood memory where I was wondering “why do fireworks burst across the sky in beautiful colors such as blue and red once they are launched?” Around that time, I took some fireworks apart to find that they are made from black powder. I am still full of expectations of an unexpected transformation, although my interest has shifted to ways in which things transform.

The shift was triggered when I encountered the tricarboxylic acid cycle (TCA cycle) during my first year in college. Every chemical formula which I had learned in the chemical classes in my high school would be expressed in a straight line, such as $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$. In contrast, each fundamental part of the following reactions can be expressed as a cycle or a circular shape: Foods are absorbed into the body and digested into sugars, amino acids, and fatty acids, etc., and then the generated substances get oxidized with energy being derived, and at the same time basic ingredients of body components are supplied. And the relevant oxidation reaction progresses in stages so that ATP production can be deftly adjusted. It is, of course, enzymes that serve as catalysts there. I obtained such knowledge from the book titled “Dynamic Aspects of Biochemistry.” In this way and because of this encounter, my interest in chemistry was rapidly tilted toward living organisms.

In recent years, interest in technologies based on life sciences has increased, partly because there have been various issues related to energy, resources, and the global environment, just to name a few. And yet, it seems to me that such technologies have not yet been cleverly utilized. Without doubt, this is because only expectations have grown, despite a lack of matured concrete technologies so far. But it also seems to be due to a lack of insight into organisms.

The above-mentioned cycle is such an example. As a result of this cycle, organisms have long existed on our finite earth. There are marvelous cycles at various levels, ranging from cycles at the molecular level, such as the TCA cycle, to material cycles at the ecosystem level. Current technologies are all unidirectional, and even the so-called recycles in recent years have been far from being circular. Another interesting example is biological adjustment, serving as a system in which necessary things are produced in necessary amounts when needed.

The difference between modern technologies and activities of organisms is vividly represented by the different meanings in the following two Japanese words: “進歩” (phonetically *shimpo* or semantically “progress”) and “進化” (phonetically *shinka* or semantically “evolution”). These two words might be considered to have a similar meaning because the character “進” is included in both of them; but they don't. The progress (進歩) in human society has been measured in terms of convenience whereby a quantitative increase has been considered as good. On the other hand, the evolution (進化) of organisms is based on the continuity and has been expressed as the qualitative transformation (diversification) whereby any quantitative increase has not been sought after. The latter can be said to be similar to Shirakawa's interpretation of the character “化” as mentioned above. From “progress” to “evolution,” we should renew our awareness that human beings are indeed organisms, and I hope that chemistry may be able to embody the concept expressed by the character “化.”

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