

An Interview with the Recipient of the 31st International Prize for Biology

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Dr. Akihiko Nakano, professor at the University of Tokyo, Graduate School of Science and a member of the selection committee for the prize, interviews Dr. Yoshinori Ohsumi, recipient of the 31st International Prize for Biology.

Receiving the Prize

Dr. Nakano: Congratulations on receiving the International Prize for Biology. First of all, can I ask how you feel about winning this award?



Dr. Ohsumi: Most of the awards I have received have been from the field of medicine in recognition of the contribution our autophagy research has made to medical science, so I am pleased to receive the International Prize for Biology, which honors pure, basic research in the biological sciences. I believe the International

Prize for Biology is a very important award internationally because it recognizes basic research in biology—as evident from its selection of past recipients from the field of taxonomy, for example—and I hope the prize will become better known throughout the world.

Autophagy Research

Dr. Nakano: You received this award for elucidating the mechanisms behind autophagy, which is the natural degradation of cellular components, and establishing a new field in the life sciences. Could you give us a brief explanation of your research that will help scientists from a wide range of fields understand it?

Dr. Ohsumi: All of life is made possible by the wide range of roles that proteins carry out in our bodies. As scientists have come to understand the importance of proteins, a great deal of research has been conducted on the synthesis of proteins, which is in fact the product of gene expression. However, proteins are not simply created one after another in the body ad infinitum; rather, I believe we have come to understand that life is a balance of protein synthesis and protein degrada-

tion. Degradation necessarily means that something is broken down, making this area of research difficult. Many people have taken on this research over the years, but little progress has been made.

The organelle known as the lysosome was discovered in 1955, some six decades ago. The word “autophagy” comes from the word “auto,” which means “self” and “phagy,” which means “to eat,” so autophagy means “self-eating.” Christian de Duve coined the word in 1963, so although the concept has a history of over fifty years, not much progress had been made in its study. There is good reason for this. For a long time, nobody knew what is responsible for the degradative function of the lysosome or how it occurs; it was a “black box.” I did not start this research with any grandiose idea of leading the way in autophagy research. I just happened to be working in the botany lab at the University of Tokyo and focused in on the role vacuoles play in the cell. That was where it all started.

Encountering autophagy

Dr. Nakano: Were there any key events that led to your encounter with autophagy?

Dr. Ohsumi: I may not be so skilled at the style of research where you set up a definitive hypothesis and then set out to test that hypothesis. My style is basically to just examine some phenomenon and then through the process of observation build an understanding of things. That’s the way I like to work. The key to my discovery was the idea that if vacuoles have the degradation function, it would be most active during spore genesis. So if we watched the spore genesis process under the microscope, I thought we should be able to see something being transported into the vacuole, but we did not see



anything. So then I thought that maybe if we could stop the degradation process we might be able to see that “something.” When we have a look at a strain of yeast that lacks degradation enzymes in the vacuole, we finally discovered a very interesting phenomenon, which was autophagy. I do not know if my experiment was particularly clever, but in this case we hit the nail on the head. And you could say that this moment set the stage for the rest of my life. Nowadays, you can even see tiny molecules with a microscope, but with the light microscopes of those days you could only see vacuoles in yeast—you couldn’t see nucleus in the cell.



Looking ahead ten years

Dr. Nakano: These days, securing funding for research is so difficult. I think it is wonderful that you have conducted your research solely on yeast. In terms of the future, what do you consider to be the goals of your research a decade from now? Or do you prefer to work without explicit goals?

Dr. Ohsumi: I do not know if I would say that I have no goals, but even when you have figured one problem out a new problem presents itself. I think that is the nature of science. I do not even really feel like I understand all that much about autophagy. When something is broken down by autophagy, for instance, we do not yet really know how much of an effect that has on cell metabolism. I would like to try to answer these kinds of questions with experiments on yeast. Ten years from now, I would like Japan to have a lab about which it can be said, “Their work with yeast is prescient and makes a real contribution.”

The current situation surrounding science in Japan

Dr. Nakano: What do you think about the current situation of science in Japan?

Dr. Ohsumi: It seems like the number of people in Japan who enjoy research is decreasing. If a nation does not create an environment where people can enjoy doing research, that nation will decline. The number of people in the sciences who enjoy the research process is a measure of the cultural level of the nation. When I see scientists overseas, they seem to be having fun in their research activities. We cannot just tell our young people in Japan, “It’s hard now . . . but you just have to struggle through it.”

I also think that scientists themselves have to make an effort to educate the public, so that the idea that science is one of humanity’s cultural endeavors is recognized by the common citizen. This doesn’t mean

that scientists should simply describe in a narrow sense how immediately important their work is for society. Instead we need to make people understand that even though our research may not directly help society, it is still vital. Young people today say “I want to contribute to society” almost like a knee-jerk reaction, but I always

feel like asking them exactly what this “contribution to society” is that they are always talking about.

Message to the young generation

Dr. Nakano: How about ending with a message to the young generation?

Dr. Ohsumi: I would like young people to have the guts to take on whatever they feel like doing, instead of looking for stability or security. Isn’t a happy life one where you do what you want to do?

There is also a strong feeling among today’s young people that if they stumble or fall, their life is over. To me, research that is not challenging is not interesting, but something that is challenging is also dangerous, which is very hard for today’s young people to accept. Even at Faculty of Science of the University of Tokyo, the number of students who choose the path of research is dwindling. This is quite a critical situation. In the world of research, there is absolutely nothing wrong with hitting one or two stumbling blocks along the way, so we have to create a society that gives every researcher a second chance. I think we need to consider creating an environment where if someone fails they can come back and give it another shot.



Left: Dr. Yoshinori Ohsumi, Honorary Professor, Tokyo Institute of Technology
Right: Dr. Akihiko Nakano, Professor, Graduate School of Science, the University of Tokyo