Messages from Modern Inventors to the Next Generations

5. Mass Spectrometer, Mr. Koichi Tanaka, Shimadzu Corporation



"Mass spectrometry" means "to determine the weight of an object." It is crucially important to be able to determine the weight (mass) and structures of the proteins that make up living matter when diagnosing diseases and developing new drugs. Nevertheless, determining the mass of proteins, which are very small and consist of molecules, requires a variety of techniques.

Mr. Tanaka created the first invention in the world to make possible the "ionization of proteins without decomposition," which is necessary to determine the mass of proteins. For this accomplishment, he was awarded the Nobel Prize and recognized as the twelfth Japanese Nobel Laureate.

What inspired you to become an inventor/researcher?

When I was a child, I preferred to think and act for myself, rather than to do just what I was told to do, which is still the way I am now. Thanks in part to the instructional approaches used by my teachers, it was truly a pleasure to participate in a science class and especially experiments, in which I was pleased to discover what had been unknown or what I had not known, rather than to find out textbook results.

I was fond of science and experiments and grew up in a place rich in nature, all of which made me think of studying science in the future. Especially, in my childhood, new electric appliances and cars were being developed one after another, dramatically improving our daily lives, so it was no wonder that individuals attracted to science and experiments like me aspired to become engineers.

In addition, my father was a craftsman, who repaired carpenter tools together with my mother at

home, and I grew up seeing both of my parents working hard every day for their customers. I suppose that's also what inspired me more or less to become an engineer, instead of simply studying science and technology.

What specific ideas and difficulties have you faced as an inventor?

I invented a "mass spectrometer," which in fact resulted unexpectedly from one failure. The instrument was designed to irradiate proteins with laser to ionize* them, and until the invention of the mass spectrometer, no one had successfully ionized proteins without decomposing them because proteins are so vulnerable to heat that direct laser irradiation results in the decomposition of proteins instead of ionization. Therefore, I had been experimenting day and night seeking a substance (i.e., a matrix) that could weaken a laser beam so that laser irradiation did not result in the decomposition of proteins.

One day, I happened to make an unexpected matrix substance with a mistaken mixture of a powder and liquid that could have easily been discarded. However, I tried putting the substance on the laboratory equipment and finally obtained the result that I had desired. If you want to succeed in something new or to accomplish what no one has ever accomplished in the world, it is crucial to pursue your goal without fear of failure.

*Ionization means that materials are made positively- or negatively-charged.

What gives you joy as an inventor/researcher?

As a researcher, one thing I feel joy about is that a failure can lead to a success. I am pleased when I have nicely made use of what would otherwise seem to be a failure under normal circumstances to make a breakthrough.

Furthermore, customer satisfaction is also my pleasure. I engage in a variety of activities from basic research to actual product making to user instructions. And I get firsthand feedback from customers who have actually used my company's products. When the products are appreciated, I have a sense of accomplishment and fulfillment as my long-time diligent efforts have paid off.

In addition, now that mass spectrometers are used for the analysis of not only proteins but also drugs, it is necessary to have knowledge of medical and pharmaceutical sciences, as well as chemistry. Additionally, for the purpose of ion separation, mathematics is required to solve physics equations, and knowledge of electricity is required for the purpose of ion detection. The mass spectrometer itself is made up of machine parts, which requires a knowledge of parts. Therefore, in the field of mass spectrometry, there are unexpected findings and inventions resulting from a combination of various types of knowledge and ideas from different fields. That is exactly why I find it enjoyable to study the field of mass spectrometry.



Principle of Mr. Tanaka's Invention - "Mass Spectrometer"

(Illustration: Produced by the JPO based on the NMNS (National Museum of Nature and Science) website



Mr. Tanaka, at the time that he invented the mass spectrometer.

What message would you like to give to the next generation?

I suppose that some people who have been studying or conducting research at universities or thinking about their own future paths are worried about their future jobs. Such was the case with me, and I didn't know what I would be expected to do at companies when I was a university student. In fact, I had a career in chemistry, although my major in university was electrical engineering, and yet I believe that as a researcher and inventor, I drew on what I had learned at university. Given all that, I would say that it is important to understand that "your studies now could be useful in other fields."

Also, I suspect that in Japan today, there exists an atmosphere in which those who have different views from others should behave somewhat humbly. However, to start something new, I believe that an attitude like "I will not read between the lines" should also be embraced. Working on something, without reading the situation or without trying to be nice, can sometimes result in new findings.

In conclusion, as a child seeing my parents working very hard, I realized that one's efforts pay off! Following in their footsteps, I myself was determined to become such a grown-up, and I still want to be.