NEC Succeeds in Minute Sample Amount/High-Speed Protein Analysis on Nanobiochips

February 21 2005

NEC Corporation and the National Institute of Advanced Industrial Science and Technology announced that they have succeeded in the joint development of basic technology for a minute sample amount/high-speed protein analysis system, which is vital to the realization of prompt diagnosis of diseases such as cancer through high-speed retrieval and detection of disease-specific protein using newly developed nanobiochips.

The main characteristics of this technology are as follows:

1) By carrying out separation of the isoelectric point and molecular weight (two inherent characteristics of protein) on a nanobiochip and mass spectrometer respectively, short-time analysis of approximately one hour is achieved. This improves the analysis speed by 20 times that of the conventional method (two-dimensional gel electrophoresis).
2) As a compact chip is used in place of large amounts of gel, the size of the sample amount required for analysis is cut to one twentieth that of the conventional method.
3) Comparison with the conventional method is easily enabled as a two-dimensional map can be acquired from the two axes, the isoelectric point and molecular weight.

This system is composed of nanobiochips and a MALDI TOF mass spectrometer (*Note 1), and is realized by developing a special chip

structure that enables laser irradiation after isoelectric electrophoresis(*Note 2) and a method for drying and immobilizing protein in a separated state. Using this system, protein sample separation using isoelectric electrophoresis inside the fluid channel on the chip is carried out, the protein is then dried and immobilized in a state of separation, and using the isoelectric point and molecular weight protein contained in a minute sample amount can be sorted at high-speed by direct laser irradiation on the fluid channel. For example, through the quick detection of characteristic protein in patients, giant leaps can be made in improving the efficiency of the drug discovery process. Moreover, as the existence of disease-specific protein can be quickly detected by a minute sample amount, it is expected that this technology can be applied to prompt diagnosis of diseases that don't have a large effect on one's body.

As the sequence of a human genome (human gene) can be determined, proteome analysis (*Note 3) is attracting attention as a post-genomic analysis technology. With proteome analysis, protein is the object for analysis, and as functional information relevant to life activity, more so than genomic information, can be acquired directly, application to genomic drug discovery (*Note 4) and tailor-made medicine (*Note 5) can be expected. As a standard proteome analysis technique to date, two-dimensional gel electrophoresis (*Note 6) has been the conventional method used. This is a method that uses the isoelectric point and molecular weight to carry out two-dimensional separating and sorting of protein within the structure.

It is well known that not only is protein within a tissue different depending on the individual or organ, but also that it changes immensely depending on the time. Although many samples are required for proteome analysis, there is an issue with two-dimensional gel electrophoresis as the throughput is inadequate. This is because separation according to the isoelectric point and the molecular weight

are carried out through time-consuming gel electrophoresis analysis. In addition, there is an issue in clinical application as gel analysis requires a large amount of samples and this has a large effect on the patient's body. From this, it is evident that the development of next-generation proteome analysis technology, in which the protein can be analyzed at an accelerated speed using only a minute sample amount, is highly sought after.

NEC and AIST have been carrying out collaborative research to solve these issues, and have succeeded in the development of minute sample amount/high-speed protein analysis technology. NEC will continue to carry out aggressive research in this area, positioning it as next-generation proteome analysis technology within the bio IT solutions business, toward its early realization. NEC announced this research result at the 18th International Symposium in Micro-Scale Bio-Separations on February 16th that was held in New Orleans, Louisiana State, USA from February 11. In addition, NEC will exhibit this technology at Nanotech 2005, which will be held at Tokyo Big Sight, Japan from February 23.

Source: NEC