

Big data analysis of chinese breast cancer genomics

Exclusive interview with Professor Eric Y. Chuang of YongLin Biomedical Engineering Center

Do you know about the “YongLin Biomedical Engineering Center” at National Taiwan University (NTU)? What is the “Biomedical Engineering Center?” What exactly can it do for us? Why did NTU set this center up? Eric Y. Chuang, the director of the center and also a professor of the Graduate Institute of Biomedical Electronics and Bioinformatics at NTU, is here to give us an introduction to the “YongLin Biomedical Engineering Center.”

The “YongLin Biomedical Engineering Center” was set up with help from the donation by the YongLin Foundation under Mr. Terry Gou (Terry Gou, the founder of Foxconn). Mr. Terry Gou’s wife died because of breast cancer. The YongLin Healthcare Foundation was named after her and aims to set up a first breast cancer genome database in Taiwan, to promote research on breast cancer. Therefore, the YongLin Foundation and NTU together established the NTU YongLin Biomedical Engineering Center so as to promote the development of the biomedical engineering and medical device industry in Taiwan, to strengthen the exchanges and integration of talent and resources in the industry, and to push the industrialization of R&D achievements forward in the biomedical engineering field at NTU. The scope of work of this particular project



includes:

(1) Cooperating with breast cancer oncologists in Taiwan to collect breast cancer specimens with sufficient quantities for exome sequencing.

(2) Establishing a research platform for next-generation se-

quencing genome database of Chinese breast cancer patients. Breast cancer oncologists may use their personal accounts to review the patients’ genetic analysis reports

(3) Establishing a cloud consultation platform website for breast cancer patients, providing

health education and breast cancer information for female breast cancer patients of Chinese descent, and an individualized consulting platform for the breast cancer patients.

Why is it necessary for us to study breast cancer genes? What is the importance of genetic discovery in breast cancer? The earlier news about Angelina Jolie, a famous movie star, who received mastectomy to prevent breast cancer, left a deep impression and sparked a discussion on the importance of breast cancer gene detection. What people don't know is that, up to now, important breast cancer genes that are suitable for gene detection of breast cancer in Chinese patients have not been found. The breast cancer genes BRCA1 and BRCA2 that are clinically applied at present have a relatively very small probability of genetic mutation in Chinese patients, and the mutant gene BRCA1/2 is very rarely seen in most Chinese people. Though such a mutant gene has a very high probability of leading to breast cancer from Caucasian cohorts, the probability of its mutation has been found to be only 10% among breast cancer patients in Taiwan. In other words, there must be other genes causing breast cancer in Chinese patients that have not been found, and therefore, we urgently need a complete breast cancer gene bank for Chinese patients that can be used as a cornerstone for the research of cancer-causing genes in Chinese patients. For this reason, it

is quite important to find out the breast cancer prediction genes suitable for Chinese patients with a Chinese breast cancer genome database. The breast cancer genome database for Chinese patients in the Biomedical Engineering Center under the leadership of Director Eric Y. Chuang can meet such a requirement.

The breast cancer genome database can serve as an important reference in gene research for breast cancer oncologists. Breast cancer oncologists can come in contact with many breast cancer patients, yet researchers cannot perform gene analysis for every patient as gene analysis is a huge burden for research. If we have a breast cancer gene bank for Chinese patients, when a doctor finds some interesting cases, he only needs to analyze the genes of these patients, cross-compare them with other cases on the breast cancer gene bank platform, and have exchanges with other researchers or breast cancer patients through the Center's platform. It can accelerate the research and solve relevant problems in the process of researching breast cancer genes, and further discover specific genes causing breast cancer. Therefore, the establishment of the database enables us to find cancer-causing genes important to Chinese patients through relevant research efforts based on the comparison and confirmation of cancer genes, thus bringing forth a completely new milestone for the research of breast cancer genes with Chi-

nese patients.

In order to effectively make this platform achieve its necessary functions, the YongLin Biomedical Engineering Center, in setting up the breast cancer gene bank, has specially used "exome sequencing" experiments for the collection of breast cancer gene data with a large sample quantity. By now, you may have quite a few questions, in particular: Why would a project as simple as setting up a database need the establishment of a huge biomedical engineering center? We can just imagine: if a breast cancer researcher hopes to study the breast cancer gene sequence that he is interested in, in view that there are government regulatory restrictions on research, he needs to first go through administrative procedures to make the protocol in compliance with government regulations before he can lawfully obtain breast cancer tissues from patients. After that, he needs to spend a lot of time and money to obtain the gene sequences. Research laboratories may obtain different rates of correct sequencing due to differences in operator training and equipment. However, the breast cancer database of the YongLin Biomedical Engineering Center can effectively reduce this huge waste of research resources and enable breast cancer research experts to obtain a large quantity of high-precision sequences so that they can concentrate time and efforts on the research of breast cancer genes. Another question is: why should it use

exome sequencing technology? The basic requirement for a database is to be a repository with large amounts of information. We generally believe that the carcinogenic factors of cancer are generated by abnormal protein function due to the mutation of certain important genes. Exons are fragments of nucleotide sequence information of proteins, and sequencing changes in the exons will directly lead to protein mutation. Therefore, the sequencing of this genetic portion will be of greater value. In the human gene bank, exome sequencing accounts for only one percent. That means when the workload of each case can be reduced to one percent, naturally this will greatly reduce the work time and rapidly accumulate case data, thus achieving the purpose of establishing a database with sufficient and large quantities of information in a short period of time.

There are a number of large breast cancer genome databases in other countries now, but a breast cancer genome database for Chinese patients remains lacking. As there are gene differences among different races, compared with other foreign breast cancer genome databases, a breast cancer genome database dedicated to Chinese patients can more effectively eliminate the effects of genetic differences between races so as to precisely ascertain genes causing breast cancer in Chinese patients. Breast cancer patients may, through the consultation

platform of the Center, learn about and assess their individual risk of developing breast cancer or the causes for their breast cancer, and also seek effective prevention and therapy guidelines. Finally, in light of the gene characteristics, we can develop testing reagents, therapy guidelines and preventative methods, and even, having ascertained such genes, search among existing drugs or further develop new drugs for treating breast cancer.

“Precision medicine” is the trend in modern medical treatment, and targeted drugs or even more advanced immunotherapy will gradually replace traditional chemotherapy and radiotherapy, which have strong side effects and toxicities. All of this will be based on the research efforts of discovering cancer-causing genes and their mechanisms. Director Eric Y. Chuang of YongLin Biomedical Engineering Center is an excellent scholar, and particularly with a biomedical background, he has made outstanding achievements in integrating biomedical engineering information in a cross-disciplinary manner. The team led by Director Chuang is composed of excellent talent from the College of Electrical Engineering and Computer Science and from National Taiwan University Hospital. Director Chuang emphasizes that the breast cancer genome database is a huge information database and a discovery of possible cancer-causing genes by comparative analysis based on this huge database requires an outstanding

information processing capacity. Taiwan has excellent information technology people, and this is an extremely important advantage for Taiwan’s biomedical industry. The establishment of the platform of the Biomedical Engineering Center enables Director Chuang and his team to communicate with other researchers and patients on research achievements and questions, so as to join their efforts to realize the potential of curing breast cancer.

References

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