Scientist spotlight

Decoding unique Asian lifestyle and disease variants through collaboration and custom genotyping arrays

Introduction

Genotyping data from diverse populations around the globe are finally joining the European and Caucasian data that have long dominated biobanks and genetic databases. Researchers worldwide are advancing population genomics studies in focused ethnic or geographic populations to reveal new insights into the interplay between genotype and phenotype regarding the genetics of disease and lifestyle factors worldwide. The Applied Biosystems™ Axiom™ Genotyping Solution is designed specifically to enable researchers to optimize or customize arrays for unique ethnic populations and studies from small to very large. Precision medicine and translational researchers can select from over 900,000 variants and markers and can leverage imputation algorithms to capture additional population-specific variants.

We spoke to Tuan Cao, Co-founder and CEO of Genetica to learn more about the importance of customized genotyping for his research in disease and behavioral genetics in East and Southeast Asian populations.

Tuan Cao, Co-founder and CEO Genetica
Genetica provides direct-to-consumer gene testing services in Southeast Asia. The company decodes hundreds of genes and nearly a million variants to provide its customers with in-depth personalized reports on genetic factors in fitness and diet; child development; and prevention of critical illnesses such as cancer, diabetes, and stroke. Genetica offers their services at low cost to ensure broad access for the general population. Genetic data obtained from the consumer services is also being used to build a large database of genetic variants specific to Asian populations. The data will be used in population genomics research for a range of diseases and lifestyle factors. In October 2021, Genetica signed an agreement with Vietnam's National Innovation Center (NIC) to establish the largest gene decoding center in Southeast Asia. Genetica is considered one of the fastest growing gene testing companies in Asia.

Thermo Fisher Scientific: Why did you choose microarrays, and specifically Axiom arrays, for your work?

Tuan Cao (TC): When our original research group at UCSF and Cornell began working on genomics in Asians, we needed a technology that would be practical and efficient for genotyping very large populations and would also allow us to expand the variant content as we learned more. Thermo Fisher Scientific microarrays were well regarded at UCSF. At that time most genotyping databases were developed primarily from Caucasian populations. There was very little data about variants in Asian populations. We chose Axiom arrays because we needed a technology that could be readily adapted and scaled for our unique content. We incorporated variants from databases at UCSF; the UK Biobank; the University of California, Santa Cruz (UCSC) biobank; and additional extracted Asian-American data. The array we developed was one of the most extensive gene decoding chips for the Asian population at the time.

The Axiom solution is very flexible, which enables us to continue to refine and expand our chip content and our business. We first built a cancer database that is specific to Asians, then we mined that data to gather variant information and design reports for five health pillars: cancer, cardiometabolic disorders; mental health disorders; behavioral genetics; and lifestyle, nutrition, and fitness. Since the COVID pandemic began, we have also been developing a chip for genetic immunity to assess individual risk of viral infection.

We started Genetica to provide Asian consumers with genetic information that may be more relevant to their ethnicity in the five pillar areas. We believe broad access to personal genetic information is important. Microarrays can be very cost-effective, which enables us to offer that service. Our direct-to-consumer reports are now yielding enough genotyping data to build our own Asian variant database. We are also using artificial intelligence to query 27 million research publications to extract information about variants for the Asian population. The Thermo Fisher Scientific research and bioinformatics experts have been essential in collaborating with us to refine our chip content as we gather new variants. Without their close communication and support, it would have taken us years to get the first version of our gene decoding chip. We are now using the fourth generation.

The Axiom arrays also give us flexibility to expand our research. For population genomics, we are decoding almost a million variants using the Axiom 96-array plates. We are also planning to do more specific studies on our pillar areas. These studies might require thousands of samples run at the same time and at high throughput to get results quickly. We will design 384-array plates to do that. Thermo Fisher Scientific is the only company that can provide a broad range of throughput options.

Thermo Fisher Scientific: What challenges have you faced?

TC: When we started our research, we were limited to Asian-American variant data because it was readily available. The off-the-shelf Asian-American arrays encompass a broad range of health conditions. Our primary objective was to investigate variants that are specific to the Asian population and the health pillars we wanted to study. The research and bioinformatics groups at Thermo Fisher Scientific were excited to collaborate with us to develop probe sets and design a customized array. We collaborated with them to develop an algorithm to capture the variants we wanted.

We offered the first version of our Asian chip to Asian Americans but because we were building our chip for the Asian population, it made sense to go to an Asian country. The Southeast Asian market is underserved in terms of access to genotyping data for the general population. That is why we established Genetica in Singapore and Vietnam.

When we started selling directly to consumers, we had to explain the most basic aspects of our business, like how we can get DNA from saliva. We also spent a lot of time educating distributors how a genotyping chip that is specific for the Asian population might be more relevant for their customers than products that were built with variants from Caucasian populations. We proved the high quality of our data by demonstrating that our results were comparable to other established genotyping services. It was also important for hospitals and our corporate partners to know that Thermo Fisher Scientific is one of the world leaders in biotechnology.

Thermo Fisher Scientific: How do you anticipate your genomics projects impacting health care in Southeast Asia?

TC: Asian countries have a practical need for advanced technology. The governments are very supportive of genomics projects. The public is also curious and eager to participate. In collaboration with the top five hospitals in Vietnam, our research has revealed previously unknown variants for metabolic pathways, behavioral genetics, and genotype/phenotype relationships for some very rare diseases. We have greatly advanced our understanding of East Asian genomics and are one of very few groups that are studying behavioral genetics in Asians. Now we have established the first CLIA-certified genetic testing lab in Vietnam.

Thermo Fisher Scientific: What excites you most about the future of genomics in Asia?

TC: Asia has a very promising future in genomics. We are gathering genotyping data from East Asian and Southeast Asian populations including Vietnam, Korea, Taiwan, Japan, Singapore, Malaysia, and the Philippines. Microarrays will be important because the content can be adapted quickly. Microarrays are also much more cost effective for population-scale genomics than next-generation sequencing is. Phenotypic data is needed as well, particularly for pharmacogenomics, disease risk analysis, and behavioral genomics. On this side of the world people are eager to participate and provide samples because they want to contribute, so I believe genomics research will move quickly here. I hope that in three to five years, many breakthroughs in genomics will come from Asian populations, particularly in medical pathways and clinical trials to identify drug targets.

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