YAN-MEI ZHU

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I am sure we will come back to ethics and personalised medicine later when we have the questions from the audience. Now it is my pleasure to ask Dr Yan-Mei Zhu from the Genomics Institute in Beijing to join us. I think you have brought sequencing down to a very chap, affordable level.

Dr Yan-Mei ZHU

Actually, we created the trend for sequencing. We are not called the Beijing Genomics Institute, because seven years ago, we moved from Beijing to Shenzhen. Now we are a totally private organisation. The topic of my talk is the dawn of life: why? Several years ago, when I first visited the Nordic Museum in Sweden, I saw this long ruler, which is a 2m ruler. One side depicts 200 big events and the other one depicts 200 science and technology breakthroughs.

It has surprised me that last year, from the year 2000, the human genomics project has almost completely deciphered the genome. Actually, it has not completely deciphered it, but this project lasted 13 years and 1,000 scientists joined the project. It took USD 3.8 billion to sequence one human genome. Now everybody will ask what the relationship is between the gene and the disease. It is very closely related to us, and this includes birth defects and also infectious diseases, cancer and chronic disease. Every kind of disease is very closely related to your genes. These are not only genes from your parents, but also from gut bacteria.

I have outlined Moore's Law and everybody knows Moore's Law. It is about how revolutionary the IT area is. There is also the cost per genome. BGI was founded in 1999, and then we moved to Shenzhen in 2007. That is the second point. In 2010, we bought 128 sequences, so we created a market for sequencing. At that time, they occupied 40% of the market globally. Last year, we launched our own sequencer that reduced the cost of a genome to USD 1,000. In the last 15 years, the cost has gone from USD 3.8 billion to USD 1,000. We are very confident that in the next three years, we will reduce the cost to USD 100.

The chairman of bioinformatics at Singularity University, Raymond McCauley, gave a lesson to the MBA students. BGI opened a door to a new world. What is the new world? We just did a transformation from the industrial area to the life area. I would like to ask about the secret of changing the world. We know the world is changing, so what is the secret? Look back at 200 years of history. This kind of invisible product, like a service, changes the world. The first one is the private car. The Model T car made sure every family had a private car, because it was cheap. I think we still remember the slogan from Ford. Every family has a car.

The second is that information is now on a PC, like the Wintel system, and things like Google and smartphones changed the world totally. That is Moore's Law and you can quote that. In the next stage, that is why I mentioned Moore's Law, because that is the milestone for this century. That is why genome sequencing requires a super Moore's Law. This will totally and radically change and it is a paradigm shift. What is the secret? It is high production at low cost and it is high throughput, as we call it in sequencing, and it is accessible for everybody.

That is our target, to make genome sequencing affordable and accessible to everybody. We have a BGI triangle and BGI is a very unique organisation. We have a research institute and we publish papers in top journals, with over 40 papers in top journals, like Cell*, New England Journal, Nature* and *Science*. Up to now, we have already published

250 papers in these four journals. We also have the industrial side. We have our own clinical service company, and now it will be publicly listed. It is already valued at USD 10 billion.

On the other side, we benefit society, regarding the cost and the price of sequencing the genome, so we pay more attention to society. The core advantage of big data is large samples and core coverage of populations. We believe that high-quality data, forecast data, will be much better than deep learning and AI. We need these, but first, you need high-quality data. One person I have to mention is the former president of Imperial College London. He said, 'BGI is not only innovating. You are changing the way to innovate'. We integrated basic research, industry and popular livelihood, and we call it the BGI triangle.

We are already sequencing 5 million people, so because the time is limited, I will not elaborate too much. The first one is non-invasive pre-natal testing (NIPT). It is a disruptive technology and we already finished it with 1.6 million people. Now global healthcare has three big challenges. These include ageing populations, younger cancer patients, and the last one is serious birth defects, especially in developing countries.

How can we face the challenge? What can we do about that? I have to mention the story of Cyprus. In 1973, Cyprus initiated a national programme and they collaborated with funders, the church and the government. They just reduced thalassemia. As a developing country, they do much better than the UK or Italy. I think it is a time to be collaborative with each other, between developing countries and developed countries. That is a paradigm shift, as I mentioned.

There are many changes in this area. They need a new discovery, so funders should make a lot of effort, and technology should be developed, and even management should be changed. That is why we built up a very unique organisation, which is not like a company. The assessment of cost needs to change, along with policy and culture. I think there are so many changes that one country alone cannot face them. We should collaborate with each other.

The three most important "H" are Health, Happiness and Hope. I think it is time to initiate a war on disease. There is already the Cancer Moonshoot Initiative by Obama but these should not only be in developed countries. We should work together. That is the most brilliant thing in BGIs, not the sequencing, the cost and the speed, but the vision. Vision is a mix for all, for a brighter life. I think that despite the challenges and difficulties, we should work together. We should not forget not to be evil, but also always to be good.