

Interview Appendix

Interview Script for Professor Albert Yu Interview

1. Could you tell us more about the Hong Kong Biotechnology Organization's role in Hong Kong?

The Hong Kong Biotechnology Organization is trying to promote the development of biotech in Hong Kong. This is why we connect with Taiwan and Australia to promote the flow of information and flow of talent in both these countries. And we have good connection with China. Many of the biotechnologists that develop their product get their factory in Shenzhen. We need to do something. We want to do something. We are kind of committed to do something. But if the government wants to do something without an organization, to tie together all the people in the industry, it is very hard to create a critical mass. And this is why Hong Kong biotechnology organization is established. Because there is a need for this organization to help to move this industry again and also to promote Hong Kong as a biotech hub in Asia

2. What are some necessary steps and precautions that we must take for the safe application of this project?

You first need to transfect plasmid into mammalian cells. After getting the cell line transfected, you then may need to use an animal to study if this technology has any side effect. After this stage you then may go further and even go from animal to human to test this technology. It is a long way to all this and you have just started. It is just a small step. You need to consider the biosafety and bioethics because if you are transfer human or animal gene into plant, you don't have to think too much about biosafety. But the other way around, you really need to think about biosafety and bioethics. It's a long way to do something related to biotech, and you are just in the beginning. There is value; anything has value, if you go on to think deep. Anything is valuable right? Because understanding human being is great work.

You first start to prove that very good plant gene; some very good plant gene can be utilized by human cell to produce a protein, the protein very essential for many diseases. So there are many plant genes that have potential to treat human diseases then you have to prove that your technology is feasible. Then you use one or two example to prove that it works by saying that you have found the plant protein in the mammalian cell. And then you can interpret if this is the breakthrough but you are proving the concept that plant will be a good source. But instead of telling me that I want to treat obesity or overweight by using something invasive, injecting something into the liver foreign stuff into the cell, it is not

practical because if it is a cancer, people will understand that but nobody overweight will inject something into the liver.

3. Inducing plant gene into mammalian cells might help us to understand the difference between animals and plants. Do you think our project has this kind of research value?

To be honest metabolism in plant and human cells are well studied because the first thing we look at is metabolism and energy.

4. Is incorporating plant genes into non-plant organisms something new in scientific research?

No, because we keep on transferring gene from animal to fish and then to plant, we always do that. There is a lot of literature on that. Because I have mentioned already, the temperature resistance, the cold resistance gene has much use in agriculture. But In agriculture it is okay, because plant will die or something like that, but putting something back into human is that will be different you have need to look at the use to and into regulation and then you consider the ethics.

5. What side effects or unpredictable consequences do you think our project could cause?

So this project is kind of trying to change human species to be slower. Slower means less efficient, less efficient that means what? You are trying retarding the evolution. You are moving back the evolution. Ethically is it justifiable? I am not trying to pour water over your project. I think that you have to think about that. It is a good project, but you get to think about all this to convince judges around that you guys are group of very careful scientists. You are trying to find out a big technology and whether its feasibility Because with this gene, with the information that you have given me, you are trying to slow down human being, you are not trying to improve the competitiveness, whether they can survive better. if you slow them down there is a lot of side effects. They will think slower they might be retarded; you might even create Alzheimer disease. Or maybe reduce aging. You never know. That is why you need to very careful to think about this project. If you get the solution for all these questions then you can justify that this is a good project. Because Not too many people think about the using advantage or the goodness from plant kingdom to help human to survive.

6. Using plant genes to improve human health could be new kind of technology. Do you think plant genes could be useful in this way?

So if I want the value of this, you try to create a new technology and see whether you can transport this into something like human. It is still far away, but you are creating one thing, one simulation. And the potential application is not just reducing fat. It may be many other good things; so for example, you can make a search on what kind of plant have some very specific genes. That will help human, not just metabolism, but even disease. I have not much idea because I don't know anything about plant. You should look into the plant kingdom. There could be some many unique plant genes that will able to help for some disease to treat some disease and that will be gene therapy. But that gene is not in human, not in animal, but in plants, I have no idea about that. In that case is that I would try to transport plant gene into human to see whether it is feasible human is available to utilize the gene from plant to produce the protein or what so ever that is beneficial for human.

7. What are some things we need to consider if we want to commercialize a product?

Because when you are doing anything related to biotechnology, you are talking about the product, whether the product have competition in the market or something is already in the market that can be easily accessed. Now this is very important. You need to deal with commercialization and the product. Now, how competitive is this? This is the first thing that I would like you to think about. The second one is innovation. Whether this is very innovative or not. Because your project is from somebody else's idea right? UCLA's work. Then what is the innovation? If you want to get first prize, innovation and the originality, whether this is an original idea is very important. Thirdly you got to see how is the impact to the field . Now, what is the impact?

8. How do you think people will perceive our project?

You are dealing with weight, heavy weight, unless people they have genetically problem, they have getting heavy naturally, you may help to treat the disease. But if it is natural thing, they can reduce by exercise or by diet. I even saw some people putting something into their stomach to reduce the size of the stomach, to reduce weight and it works. If they something so easy to control weight, if it just up to determination, Do you need to have something so invasive. That is something you guys have to think about a reason why this is something we need in the society. Now everything has a value what is the value for this. Is not just to put together a technology to prove a concept. You are supposed to help the human kind.

9. Recently, a malaria vaccine was developed using synthetic biology. Do you think other biotechnological advances can be made through synthetic biology?

Synthetic biology is becoming more important every day because we need it. If it is not important there won't be competitions like this. They are trying to promote students to think about this new technology, this new view of science to do something. Synthetic biology is more applied science than basic sciences that integrates molecular biology and bio engineering and this is something very important because we need to integrate science from different field to eventually help people to find out or reduce the weight or whatsoever so it is very natural to involve in something like this. Synthetic biology is part of biotech, and biotech is the ultimate frontier of science so synthetic biology is very important.

10. Does synthetic biology reverse the traditional method of research?

I don't see that way. Science has a lot of freedom. Scientist can do anything. If you look at the trend in science first of all we work in the basic science. Everything is basic, but gradually we want more and start to think about technology, but now we are talking about system biology because we know that one single compound but we don't know how they run in the whole system to be able to find the use of this. So now we have the system biology. We know have to see how this knowledge integrates into this whole system. We don't only have molecular biology; we can even have computer science to integrate all this information together. Because we are not a single molecule, we are a system. And system change all the time. So putting together is the final goal. So synthetic biology will be very important to study this kind of systems. Because we need to combine different technology, different knowledge to synthesize it.

11. Can synthetic biology be used to discover a scientific fact?

Of course, you are creating new things, and you are creating new links. You are using some new technology to provide solution for many existing problems that has no solution.

12. How is synthetic biology and its development perceived in China and Asia?

First of all how many people in Asia and China will know about synthetic biology. The term is very technical and only people in biotech will know this term. Most people would not know. They might know what biotech is, but they probably don't know much about synthetic biology . It is very technical and public is not be able to

be at that level. But, I think Asian countries are eager to have new technology because we all know that technology will be our future to improve the quality of life. That is something that they believe.

13. Do you think there is enough regulation for the use of new biotechnology?

Well, technology is going very fast in the last few decades. Every country inject lot of money to do technology, but whether the policy can chase or go parallel with technology is something that we need to think about. There is a lot of policy even in FDA that is so outdated. They are using something with old standard to justify the new development. Sometime they will slow down the development and technology being translated into new product. As scientist we need to take a role to educate people. So this kind of competition is very important because it will arouse the awareness of the politicians to think about what is synthetic biology, what is the future, If they know little bit more, they will start to think they need new policy to develop.

14. What possible ethical and safety issues might arise from our project?

In general speaking, you will think human is more important than plant. Transporting human gene into plant is fine no problem because plant will say nothing. Plant will not say “ah you cannot put gene into my body.” So it’s very easy, but the other way transferring plant gene into human, how are going to people think about that? Because we can talk and we can express our feelings. You need to think about bio safety. You also need to think about the psychological issues on whether people will accept it. Think about even transferring organ from human to another person there is already a lot of bioethics whether we can do it or not. But if you are transferring a gene from another kingdom to us, you need to think about it very carefully. If we look at it as a technology breakthrough nobody will say anything about it. But if you are going to say it’s going to treat human disease, even product, you need a very good reason convincing reason that people will not have bad feeling about this.

