ETH Podcast - CRISPR - Feb2019 - Transcript

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Hantao Zhao: [00:00:02] Do I sound clear enough? OK?

Effy Vayena: [00:00:05] And I'm fine?

Jennifer Khakshouri: [00:00:06] And I'm fine too?

Effy Vayena: [00:00:08] OK.

Jennifer Khakshouri: [00:00:08] OK. So we'll start.

Jennifer Khakshouri: [00:00:12] Hi everyone. This is the ETH podcast. I'm glad that you're listening and I'm glad that my two guests are here today. We want to listen to a sound file quickly that was aired last November by a Chinese scientist.

Audio Clip: [00:00:29] Two beautiful little Chinese girls named Lulu and Lana came crying into the world as healthy as any other babies a few weeks ago.

Jennifer Khakshouri: [00:00:40] It's a scientist who told the world that he edited DNA of the embryos of twin girls and that the twin girls with the changed DNA that they were born.

Audio Clip: [00:00:51] Gene surgery is another IVF advancement.

Effy Vayena: [00:00:56] I was shocked like everybody else. I remember double-checking the news to see if it was a hoax or it was real news and called up a couple of people I knew they were on their way to that conference that summit in Hong Kong. And everybody like me were thinking that's not real. But then of course very quickly we realized that it was very real and so was the feeling of being shocked.

Audio Clip: [00:01:21] ...is another IVF advancement.

Hantao Zhao: [00:01:22] For my first thought I thought I am looking at news maybe in ten years it's like just when I was in high school started biology I still remember that there was a huge research on how to understand our human DNA and I was 10 years ago we didn't know which part of correspond which part. But right now they are already saying that they can gene-modify it it's it's just seems so unreal for me. And of course right afterwards I go online search a little bit. I understand this is really really something irresponsible and that was completely crazy.

Jennifer Khakshouri: [00:01:52] So we'll be speaking about how scientists can be stopped of crossing ethical boundaries where ethical boundaries are and also if or if not it was a coincidence that this happened in China for the first time. My name is Jennifer Khakshouri. I am the host of this ETH podcast. I'm glad to be here with two guests.

Hantao Zhao: [00:02:12] Hello everyone. My name is Hantao and I am current Ph.D. student of ETH and Disney Research. By training I'm a computer scientist but right now my research

concentrates on the interdisciplinary between artificial intelligence and the psychology. And I'm Chinese. So of course this topic intrigues me a lot and I'm very happy to talk with you two about Chinese science, CRISPR baby and all behind technology.

Effy Vayena: [00:02:40] My name is Effy Vayena. I'm a professor of bioethics here at ETH and my work is focused on ethical implications of emerging technologies. I've done a lot of work on the ethics of genomics how we apply them in the clinic in research and of course the further use of genetic knowledge to applications like CRISPR are part of my research interest. As in other areas of course I look at other types of technologies like data analytics and artificial intelligence. But it's interesting that these worlds are converging. And so the ethics of these emerging technologies are crosscutting. So I'm very glad to be here talking about this.

Jennifer Khakshouri: [00:03:21] Just another quick question: Hantao, on your website you say that you're 10 percent Chinese. What you mean by that?

Hantao Zhao: [00:03:29] I think I see myself - so I left China when I was 22 years old and...

Jennifer Khakshouri: [00:03:34] How old are you now?

Hantao Zhao: [00:03:35] Right now I'm 31. So during the past 10 years I've been traveling different countries in North America, in Asia, then in Europe of course that's been where I spend most of my time. I really see myself as a global citizen. I do not want to use very monotone definition to define myself. So meanwhile I see myself as an explorer. I see myself as like a combination of engineer and a little bit of artist. I really like the interdisciplinary research. I like the combination of things and that's why I say I'm not just purely one thing I'm a combination of a lot of things.

Jennifer Khakshouri: [00:04:11] And Effy couldn't you say in numbers how much of you are Swiss?

Effy Vayena: [00:04:15] Oh right so well I just celebrated being in Switzerland for 19 years. So I think that cuts close to a big chunk of my life being here. So I feel you know again like you like you a global citizen I grew up in Greece I lived many years in the U.S. in England then in Switzerland so I I feel a bit of everything. And it's interesting actually having different cultural stamps in you. As we grow up in different places get educated in different places work in different places that we absorb these different cultures. And when we think of those matters those differences come to play in an interesting way. So yes we are global citizens.

Jennifer Khakshouri: [00:05:00] So we spoke about what your first thoughts were when the news broke about the DNA that was changed, edited by the girls. Now two months later how do you see the whole thing? How big is it still that it gets more quiet? Did you find a way of putting it into context to say it's this way or that way or what does it do to you speaking about it now?

Effy Vayena: [00:05:23] So there was this uproar, right. Everybody was in the news all the time. We have a project we're looking at tweets and various topics and we could see the spike in our data during this time. So it became a topic for everybody. And at the time the topic was: We're all shocked. What are we going to do with it? Something is really wrong. This was the message. I think after that we kind of the dust the dust seemed to have settled a little bit and then it's interesting because the direction went towards OK. That was the wrong thing. Let's find a way to do this in the right way. Interestingly enough in this conversation that ensued from the uproar we didn't so much go back to the question should we be doing this anyway. It moved towards OK. Now somebody pushed us to think how to do this the right way. These are two different questions and I think right

now the the what I see more the emphasis is more towards should we how should we be doing it rather than should we do it anyway.

Jennifer Khakshouri: [00:06:31] Because the door is open in the sense and can't really be shut anymore?

Effy Vayena: [00:06:35] I think they're - not really. I think we could shut the door if we wanted but it's interesting that the scientific community jumped on that part so the procedural part so to speak the the pathway to translate that. The other interesting development in the meantime was that big organizations have come forward and want to create global committees to come up with statements. So for example the World Health Organization just announced a special council that aims - consisted of people and experts from different countries - and they want to come up with some formal statement or policy as to how we're moving forward.

Jennifer Khakshouri: [00:07:18] Shouldn't this happen quickly so that it really doesn't happen again because as far as I understood and I'm really not from the field at all it's not that difficult to use the CRISPR method. if you know what you're doing if you know DNA if you know things.

Effy Vayena: [00:07:34] It's not difficult to do something. The question is what exactly you are doing. Because one of the things that you also mentioned earlier is that we still have limited understanding. So even if we make a change let's say because we think that changes the right change we don't know what else we're doing at the same time and that is the major concern. So it depends what you mean by easy. Easy to do something. But what you are doing is not contained to the something that you try to do.

Jennifer Khakshouri: [00:08:08] And that means that these girls will...we don't know how they'll grow up. We don't know what will...

Effy Vayena: [00:08:13] We don't know. Exactly. And the main concern the immediate concern was precisely that. We don't know what is going on and what it is going to happen to these girls because we don't have enough knowledge to understand the other effects that such interventions have in the DNA of a human.

Jennifer Khakshouri: [00:08:34] So a big taboo was broken within the world of biology and genetics. What kind of taboos are there in your field, Hantao, in artificial intelligence? Because I see a certain connection. Tell me if I'm wrong because we don't know in the long run what could happen in many years when something is set loose at a certain point.

Hantao Zhao: [00:08:56] Very similar to what Professor Vayena just described it's like the unknown consequences that are we going to face. First thing immediately pop up in my head is the driverless cars. I mean whenever there is a car that is there's no one behind the wheel on the street if there's an accident with the car make the right decision or not. Would the car try to kill less people but follow the rule or do the opposite. There's so many things behind algorithms we are trying to improve. Yet we know very little especially with this current state of machine learning which is very different from the traditional artificial intelligence which concentrated on the logic. Machine learning basically just learn real world examples and try to mimic this and this mimicking sometimes is highly unpredictable.

Jennifer Khakshouri: [00:09:44] And how do you discuss the ethics of machine learning or of let's say cars that drive without a driver without a human?

Hantao Zhao: [00:09:52] Yeah. I think just like any other biology technique as well. We're

exploring and I believe that it is very important to have regulations and rules on any going on applications in the world. So things happen in the lab. I can not see it. We can be a little bit bold and a little brave if we can have everything under control in the lab environment which there is little connection with that in real society. But meanwhile this boundary this line between research and laboratory and the real world become very very blurred right now. Specially what we see with Facebook and Google research. I mean right now the research and development department is basically immediately linked to the business applications. That means any scientist's achievement can be seen by real people almost maybe sometimes days after they have been just invented.

Jennifer Khakshouri: [00:10:48] So that's a big danger the transparency of people who can look into labs and.... I also want to speak about pressure actually about the CRISPR baby and pressure. First I need you to help me how to pronounce the name correctly of the scientist who edited the DNA.

Hantao Zhao: [00:11:06] His name is He Jiankui. He Jiankui.

Jennifer Khakshouri: [00:11:08] And if I call him He. Is that OK?

Hantao Zhao: [00:11:13] Yeah.

Jennifer Khakshouri: [00:11:13] So what He did was I mean everyone on the same page here was extraordinary and broke a taboo. But I went back and looked at where he comes from and he comes from one of the poorest villages in China the very poorest and the only way to get out or to find a way out of the let's call it misery was by being brilliant in school and being a very good scholar and good at university. So there was a lot of pressure on him to succeed. There was a lot of pressure on being first probably. He was in a very competitive environment. Was that do you think that was something that made him do what he did you know wanting to be first like wanting to be the first in a race or you think it was something else?

Hantao Zhao: [00:11:59] I think that definitely plays a role. I mean all of what we're doing is really the combination of what we have experienced. For him he has experienced is this poor China and is the Chinese education which basically is not comparable to the Western world. That means that this is the first time maybe he experienced Chinese scientists can be forefront in this domain. But meanwhile this is totally wrong and I think that the biggest motivation he has had was also the business driven interests. As we know he has been wooved more than ten different companies in China which focus on the genetic technologies and with this kind of public exposure it will bring huge business influence on his companies or his business partners.

Jennifer Khakshouri: [00:12:49] You're nodding.

Effy Vayena: [00:12:51] Yes I do because I agree it's... Science is by nature competitive, right. Science is collaborative but it's also competitive. And there is a lot to be said for healthy competition and we want to encourage it because that's how we humans move on and do great things. But I do think often we kind of lose our sight of the big picture why we're competing and rather make competition the value. So of course it's great to be first but then at what cost? What kinds of steps one takes in order to achieve that being first. I think our global system - it's not the Chinese system necessarily - I think our entire global system in the scientific world has a little bit of thinking to do. How do we pursue and how do we push our scientists to do the next thing. For what reasons and at what under what conditions and at what cost? There we all need to think more carefully I believe. The other question of course at the same time we're thinking everywhere that science and innovation is going to translate into business. And that's something again that I think it's not a bad thing. We encourage that. We want healthy economies we want good businesses but we

have so many examples where that pathway has also created problems because there are certain things that could be translated and could become products and people can buy. And it's not a big deal. And then there are certain things that are very crucial to our well-being and to who we are including those kinds of services. I mean creating a human life it is not trivial and it cannot be treated the same way businesswise as you know produce a pair of shoes. And it is true that we have set the standards and we have acknowledged the difference, different research you do that to translate into if you know applications that produce shoes or bags or whatever and different rules and standards for doing experiments and then we apply on humans like drugs like interventions or use to produce humans in that case. So yes it's not new as we have thought about these but again this case reminds us of the difference between the domains and the problems that can come when there is this pulse from monetising technology and scientific knowledge.

Jennifer Khakshouri: [00:15:28] I do ... You both said that it's a global thing the competitiveness is not necessarily bound to a certain country or a certain culture but I read a few articles that were published in the U.S. by Chinese American people who said it's not a coincidence that this happened in China and that there is a big divide in ethical questions in China and in the West. How do you reply to that?

Hantao Zhao: [00:15:53] I think that way we should really look at what the roles of Chinese scientists in this world are. And I think one good metaphor we can use is really Chinese scientists are still students in front of the whole Western world. The modern Chinese education system wasn't established just slightly more than 100 years ago. And the best Chinese university in China the Tsinghua University was actually sponsored by Americans. As you can imagine that all these modern education system, the methodology of doing research everything Chinese has been doing right now it was learned from the Western world. That's why I think first of all we are still learning. There are so many things Chinese scientists need to learn to cope with, need to learn to follow. And meanwhile as right now China has so many investment in research development because politicians and the Chinese general public the they regard this as the engine of the country's economy boost. So with so much investment into that sometimes maybe the learning and the regulations can be a littel bit behind. I think that for this specific case this CRISPR baby actually the regulation was established already more than 18 years in China. So what He did was completely against the law and some rumors said that he will face criminal charges even. So at the same time I see it was more like a general education awareness. So the Chinese students to the extent of the whole world all the researchers we should know and understand the power that well having right now. It is sometimes very dangerous and we need to learn how to deal with that.

Jennifer Khakshouri: [00:17:40] Effy I know that you were in touch with some Chinese ethicists. How did that change your view on the whole topic of ethics and of east and west?

Effy Vayena: [00:17:50] Well the Chinese bioethicists on the topic of CRISPR they have condemned it the same way that you just explained and the same very similar way that many of us in the West reacted and they've published a paper also that they explicitly and clearly put out their views. So they feel there was regulation that was not adhered to. There was a ethical standards that they've been in place. I think also the Chinese bioethicists complained a little bit about stereotyping. Because it's in China it ought to be unethical and I think there we again have to be a little careful. Subscribing to stereotyping is it not it's not fruitful. It's not going to get us very far.

Jennifer Khakshouri: [00:18:34] Is not ethical either.

Effy Vayena: [00:18:35] Yeah. It's not it's not it's not right. First of all we in the West - and I speak as a very Western educated and culturally embedded person here - until very recently we have had done a lot of unethical things in research. So we are not innocent. Right. And that's not a hundred

years ago. That's up to maybe 20 or 15 years ago. Strict regulation kicked in. A lot of education kicked in to bring everybody up to speed as to what our ethical standards. So we lived with this for a long time and therefore we have probably more efficient methods in implementing the guidelines or the regulation than others who as you said they're newer in in this game. So we should be mindful of the fact that it takes time to learn how to deal with these regulations. The other thing we have to pay attention to in He's example we know now that there were several U.S. scientists involved with him. One is allegedly last author of the paper he submitted. Last author means he's the guarantor of the paper. He's the senior author on the paper and He is the junior author. He's the coordinating author he is the first. So that is puzzling to me because that's our standards then. So how come we then we are so quick to say the Chinese will do it the wrong way? China has a different culture to the Western world and in the global community we aim to be pluralistic so yes we'll maybe have differences but we'll have similarities and we'll learn from them or learn from us. So it's not that you know one has it right one has it wrong and you can say that very quickly. So all of this in the public discourse that came out it was it was very simplified. And I think it doesn't do us any any good to think about our colleagues this way. And the last point here is science is a global endeavour we don't do science here in Zurich and some other science in China and you know in isolation. We build on each other and that's how we move on. So I think the scientific standard ought to be a global standard. In many fields we're moving into this direction. So I think I would have liked to see more of these issues into the discourse rather than the bad guys versus the good guys.

Jennifer Khakshouri: [00:21:03] But speaking about the future what did we learn from this example and what will this you know what will bring out speaking about ethics and crossing ethical boundaries?

Hantao Zhao: [00:21:15] I think just just very like the education that I think Professor Vayena is very familiar with. All the medicine school students whenever they got the degree the first thing they need to do is also to have a lot of education about what you can do and what you cannot do. And I think this kind of education is that we've been missing in traditional engineer domains including y bio informatics and even computer science students. And I believe this is something that is irreplaceable and just by learning a technology is not enough for you to understand the consequences behind them. And this every researcher's and every professor's responsibility to tell the students what you can do and what you cannot. So I'm a little bit pessimistic about the regulations in that way. It is just like the CRISPR technology they are easily accessible and they are cheap. There is there is no way we can just add a monitor camera in every lab to monitor them 24 hours per day to see what they're doing on whether or not we need to build this self awareness, self discipline and let the scientist to be responsible about themselves.

Jennifer Khakshouri: [00:22:26] Especially if business and science are moving closer and closer. How can you prevent business people from corrupting or trying to corrupt scientists of doing things like CRISPR or in the field of artificial intelligence?

Effy Vayena: [00:22:41] Well exactly. I think those standards of ethics like the ones we're talking about here should not be confined to the research lab. I mean whether you should be ... it's the responsible thing to do something or not should extend to any activity and that includes the business activity. And here at least in genetics in medicine we have crossed that bridge and we say certain things are allowed or not allowed anywhere whether you are in the clinic whether in the business so because the consequences those things could have are any way negative no matter where you are in which building or in which with sector. So I think there we need to make sure that what is allowed or not is clear and it applies to both. The other thing I still believe very much that rules and laws have a certain power and I believe in them and I think we need them. But you can never prohibit something to the extent that is never going to happen. The only thing that can do that is if each

person learns of their responsibilities and is also in a culture the scientific culture that allows them to leave up to those responsibilities. And I think this is for me it's a long term planning. It's not the magic bullet that right now we fix it. But it is the way I think we should educate our scientists and create the scientific culture so we can achieve that when something happens doesn't shock us or it shocks us in a positive way because something was very successful.

Hantao Zhao: [00:24:22] Just one note to what Professor just said. I think yes sometimes that's what the law is for. We need to pay the price. To make people see that what kind of consequence you are faced. So to my knowledge He the Chinese scientist right now is already fired by his university in China and I believe his career as a scientist in China is completely over right now and I think this will set a good example for any followers who try to mimic his activity and this kind of irresponsible actions.

Jennifer Khakshouri: [00:24:52] But let's say there might be someone really crazy. Very rich - I mean there are some crazy rich people in this world - that will say OK he lost his job but I'll take him. I'll buy an island. Build up a little lab and have him enhance my genes or the genes of my children or do something. What about that? How can we handle that? I mean it's totally unethical. That's clear. But...

Effy Vayena: [00:25:19] I don't think we can prevent that from happening. I think we can have any kind of law. I don't think this is possible to say we you know we eliminate any possibility. And if there was a way to do that then it would be very bad for a lot of other things so I wouldn't I wouldn't promote that idea. I think I want to believe that this could be if there were to be a case it would be a very isolated case and they won't have any impact at the large scale. Again for me the question is how can we prevent people from thinking that this is a good idea to do something crazy something that the scientific community has not established and very importantly something that we as a society haven't decided is what we want to do. Because the scientists may have an idea when it has so said serious implications for society then we should decide together whether we want to go this way or not. The same with artificial intelligence. It's not just about you know putting somebody on an island with a few pipettes and then genes. You could put somebody on an island with some fabulous technology and they could produce something even worse than much worse than one or two people who maybe are sick or maybe have particular disorders. So the idea is again not to live with the fear of the island that's producing something crazy but to see how most of us, all of us are able to develop standards and live up to these standards. Here again we're not... we have some way to go.

Hantao Zhao: [00:26:53] I think what you just described is very similar to anything we have access to the real world that is both beneficial and dangerous. For example a knife. One can use a knife to cook the most delicious meals for the whole family but one can use a knife to hurt the others. And but this shouldn't stop us from providing and inventing good knives because there are so many things we can do with that. We just need to trust the humankind a little bit that there are only a very small percentage of people will do bad things with that.

Jennifer Khakshouri: [00:27:24] Does the ETH do anything differently regarding standards now since this CRISPR case last November? Do you know about that?

Effy Vayena: [00:27:32] No I don't think institutions do things differently. In Switzerland experimenting with embryos is anyway prohibited by law. So in our labs rthese things are not happening. ETH also like other international universities we're all looking at what's going on what's the next standard how we're going to make sure that we are having this culture, this ethical culture of research and that is not a new thing for us. We're also trying to make sure that our students have access to guidance teaching so they learn early on how many of those things are allowed or for what

reasons and what is good to see here is the response we have from the students is quite fascinating. Students want to talk about those things they want to learn what's going on. What are the arguments? Why should they think what they're thinking? Why is it bad to do gene editing?

Jennifer Khakshouri: [00:28:33] So there are still discussions on that topic between students and the professors.

Effy Vayena: [00:28:36] We do have those discussions. I mean I'm a little biased because my group works on this area. So people come to us and we have these exchanges, conversations. But I think in other departments as well and those in the lab were actually on the technology are part of the conversation very much.

Hantao Zhao: [00:28:53] Take for example my research domain. What I do involves a lot of real person experiment. So we invite people to come to our lab and conduct experiment on them. And of course the first thing we need to do before we do any of those things is to provide a consent form. So we need to that's the first thing my professor told me to do is you need to list all the consequence all the potential risks to the participants before you do anything to them. And this is the part of education to let us to know all this formality, all this regulations there's a reason behind them and we should follow these rules.

Effy Vayena: [00:29:28] And we have other obviously institutional processes like a lot of most research that carry certain risks is reviewed by an ethics review board, includes the requirements for consent. All of that sometimes might sound like a nuisance. Oh I got to fill out forms and I got to do those things. But what's behind that is that you need a few other people to look at what you are doing. Maybe there is something that you did not intentionally want to go wrong or to oversee but you have those standards checked. And this process is we've had for some time they are stricter when it comes to biomedical research or clinical research that has to do with humans. But there are processes that again had the purpose of preventing some of the wrongs. But again the reason we put them in place is because we have a bad history. There were lots of these things that happened without people knowing that been experimenting upon with a lot of risk taken and so over time we learned that we should avoid that and put processes in place that prevented from happening.

Jennifer Khakshouri: [00:30:42] So I'm extremely passionate person about literature. I read a lot. I love to read. I love stories. I love seeing where it takes people to where story takes people to and following this CRISPR story reminded me of literature just that unfortunately it's real it's a real thriller. I wonder also what will happen with the next bit of the story what we will think in 10 years or maybe in 30 years. Is there a possibility that in 30 years we will say, we will look back and say this is much ado about nothing and people will be gene editing right and left or is that impossible?

Effy Vayena: [00:31:23] Well predicting the future is certainly not my skill but I think we hope to be able to look back and say no matter what's happening when we're in the 30 years moment and look back and say we did it the right way. I think putting people at risk that you don't know what risk that is is something I don't think we should be proud of even even if things work out. And the reason is because we don't need us to get into a habit of putting human beings at the risks of that kind. I think this is about creating the right scientific culture and the right scientific culture has to respect humans. That's the kind of culture we want science to do things for as humans are we have a better life. We are healthy we feel good we flourish. Essential to this culture is that we're respected for being for being human so anything that's in the future even if we're all looking much better and stronger and smarter it has to be done in a respectful way for humans. And I think that's what I want hopefully to see.

Hantao Zhao: [00:32:38] Meanwhile I'm still very eager to see what this will lead us to. And I see

it as a very similar thing but of course in ethical level different is GMO the gene modified crops. I mean also twenty years ago people see that as the most devil thing ever. But meanwhile it helps the developing countries including my country China to be able to feed so many poor populations with very little agricultural resources. I'm still very optimistic about what technologies can lead us to.

Jennifer Khakshouri: [00:33:11] Thank you very much for being here, Effy Vayena and Hantao Zhao.

Jennifer Khakshouri: [00:33:16] Thank you for listening. I produced this podcast together with This Wachter's Audio Story Lab. My name is Jennifer Khakshoury. Music, mastering and sound design by Luki Fretz. And by the way you can listen to earlier podcasts that we've produced. We produced four episodes on entrepreneurship at ETH on all levels from student projects to spinoffs. Don't miss the next episode and subscribe to our podcast so that you get our podcast on your device wherever you are and wherever you go.