

Ignacio Chapela

Ignacio Chapela is an assistant professor at University of California Berkeley, who, with colleague David Quist, discovered that illegally grown, genetically modified corn contaminated traditional heirloom corn in Oaxaca, Mexico. That discovery touched off a major controversy, and illuminates many of the issues related to responsibility in innovation that most concern the Fondazione.

Jeff Ubois: Biotechnology is perceived as a field where the risks are very high and the outcomes are uncertain. There is a distributed responsibility for research that has unpredictable results, so what I thought we could do is talk, first, at sort of the general level about the field, then discuss your experience directly, and then try to draw some lessons we might apply to furthering what we are calling responsibility in innovation?

Ignacio Chapela: Biotechnology has many cases, not only my own, in which you can see really counter-intuitive situations, and that is good for research because when you get to situations that are counter-intuitive or untenable or bizarre, then you know that there's something interesting going on.

One question to start with is how did agricultural biotechnology become so powerful when the economic payoff is not there? There was a promise of an economic interest, in which case, you would be justified in saying, the whole situation is being driven by financial interest but now after so many years, we know that there isn't such a payoff...the fundamentals aren't there. Instead, it's a whole cultural development, that is, there's been a culture created and enforced by scientific establishment that now reaches over the whole society.

Jeff Ubois: Yes, let's talk about your experience in finding transgenic material in Mexico.

Ignacio Chapela: The situation starts from what was a long-term relationship with a group of indigenous communities in this area of Mexico, in Oaxaca, because for them, the question of genetic contamination was a very relevant, important question.

They want to keep their strains of corn there pure to avoid the influx of outside genetic materials into their local corn. This is something that has been happening for a long time because a contamination of native land raises of corn from industrial varieties, must have been happening for a long, long time, you know, at least since the 50's, 60's. But this type of contamination, with transgenic DNA, was different. It was perceived as being different. We can talk about whether it is different or not, but the perception was or is, that it is something qualitatively different.

So it starts, the simple, almost theoretical thought of "well, what if we had contamination happening here?" Because officially, nothing of the sort is happening. The Mexican government has laws in place that make it illegal to plant transgenic corn and farmers would not import and release seeds that could be planted in the field, you know? I have to admit, I was naïve about it, in thinking we were not going to find contamination back then.

Ignacio Chapela: And, the surprise comes when we find transgenic materials on the first try. We take a few months to be sure because the, you know, the import of the statement, we knew from the beginning, it was going to be really big, it was going to create scandal. So, I wanted to be really sure what we were saying. But, it took us, you know, several months until we were sure. And then, we prepared the manuscript, and we entered into this dynamic with the editors of Nature, the magazine. They're confronted with the paper, they receive it as a normal manuscript, they send it out for reviews. Their reviewers, again, are confronted with this paper. Just, I imagine

them opening their envelope or e-mail and finding this paper and saying, "OK, let's read it." They read it, and they say, "Great, this is a good paper," publish it.

There was one technical question that we needed to address. We addressed it. But, the interesting thing after that first response, it was very positive from Nature, was that as time went on and I just imagined the word was spreading in the background informally through the informal channels of the scientific establishment, the response of Nature grew colder and colder and colder...

Jeff Ubois: But they did publish it.

Ignacio Chapela: The day the paper hits the web, the discreditation campaign got going, also, on the Internet. The very same day is the day that all these letters start circulating and people start discussing about how bad it is and bad science, and how my students and I are just bad scientists and blah, blah, blah, blah, blah.

So, eventually, the Guardian of London found evidence that this was a well-coordinated, well-paid campaign run by this company, the Bivings Group, I don't know if you've heard this story? [Ed: see <http://www.guardian.co.uk/Archive/Article/0,4273,4412987,00.html> for a remarkable investigation into questionable PR practices] The campaign was paid for by Monsanto. What Bivings does is influence opinions with the Internet on behalf of their clients, without people being influenced, knowing that it's their clients who are doing it. So, they created fictitious characters who were posting to mailing lists online to feed a whole discreditation campaign. And, it became, you know, like a lynching, like an intellectual lynching.

Jeff Ubois: So it becomes all about science as consensus, as opposed to experiment and process and reproducible results.

Jeff Ubois: Did any of them try to reproduce the results?

Ignacio Chapela: Yes. The Mexican government established an initiative to try and find out what was going on. When Nature had responded positively to me, I decided that I was going to call them, to start calling people who would have to make decisions about this. So, I called Rockefeller Foundation, I called many people in the Mexican government, I called people I knew at USDA, anybody I could think of as policy-makers, people who would be sought by reporters, telling them what we were finding because my thought was, these people are going to be really blindsided. They will not know about this and the next thing that we know, we will have a reporter saying, "What do you think about the contamination problem in Mexico, Mr. Minister?"

They set up two labs, supposedly independent of each other. They went out and took samples. They started finding lots of positives, more or less at the same rate that we said. They started talking about it in international forums and everywhere, they said, "We're finding, we're confirming this, with findings."

Yeah, one of those government officials says, "Well, the first thing we did was to try and go and check whether he was right. And, of course, we have found that he was right, and we continue to find this." I go into detail about that because what happened next is really amazing, what just happened is here, is that in August of 2005, a paper comes up in the Proceedings of the National Academy of Sciences, PNAS, which is, again, a very prestigious journal from the national academy. I didn't know anything about this until I got a call from a reporter, a reporter from Science magazine saying, "So, what is your response to this paper in PNAS?" And, I said, "Which one?" And, she said, "You haven't read it?" And, I said, "No." So, she sent me the pre-print version of it because it was some days before publication. Do you know how they run the stories because they come out at the same time?

And, what this paper is, is a paper that says, "We've been there, we went back to these places and other places. We looked, we found nothing." In 2003, 2004. So, within one or two years,

the contamination seems to have disappeared, there's nothing there any more. So, that's a really interesting development that is still being processed by the people and the media and so on, that we will see a lot more coming up.

Jeff Ubois: You've had at this point, three labs have all gotten the same result. You went down, you got a certain set of results, too, and the Mexican Government Labs got the same results. And now, a couple of years later...

Ignacio Chapela: We find...we get this newspaper in PNAS saying, "No, there's nothing."

So, you're very welcome to look at it this way, these people who go out, they find something, they put in a paper to Nature. Nature rejects it. They go back home, rearrange, you know, massage the whole situation, write a paper that says exact opposite, submit it and they get it published within two months of submission. You know, this paper was just flung through the review system by PNAS. So, we're now in this very strange situation where the only two papers dealing with this question are in total contradiction with each other. One of those situation studies, counter-intuitive, so strange that it's worth looking at because they're finding out what the sources of these contradictions are, would be really, really interesting. And, also, going into lots of details about it.

The current situation is, we've prepared, David, Chris and I have prepared a manuscript that was just submitted recently for publication, where we show that there is no contradiction, that what happened was, that these people just simply defined the contamination away. They used a method in which the thresholds of detection will just define what we found as nothing. So then, they say, "There is nothing," by standards that we would have said there is something.

Jeff Ubois: Maybe now would be a good time to talk about adventitious presence - can you explain that concept?

Ignacio Chapela: Yeah, the concept of adventitious presence is when you find transgenic seeds, let's say, that were not put in there purposely; simply through...you find them there simply through the contamination process, that there is a certain amount of contamination that gets passed through the chain in transport. It's not intentional, it's not supposed to be there.

Jeff Ubois: What can we extract from this - what are the ways you would like to see the scientific community respond to issues like this? Scientific debate may get corrupted by PR, how do you get people to care with making a hysterical appeal? How do you keep the dialogue clean and focused on what's going on in the labs in Mexico?

Ignacio Chapela: I think in understanding this case there are lots of things that can be generalized, but also, things that are very specific to biotechnology. The reason why I think there is such a high tension here, is that there has been an absolute alignment of all kinds of factors that pushed for the promotion of biotechnology. There was a very central political decision to push for biotechnology back in the Bush/Quayle administration. That was 30, 40 years in the making before they could get to that point and at that point, they said, "This is what we're going to push for as a matter of national interest."

There is a group of scientists who are pushing very hard and one of the most important ones is Dan Kaufman from here, as well as Paul Berg, as well as Gene Watson, as well as Bruce Ames, and so on. There are actual people with names and so on, who were pushing to transform...the way they put it is, "Biology was the third science," not even worth studying because it was just so fuzzy and so, dealing with complex things that cannot be controlled. And biology needed to be brought up to the second level of sciences, like physics. First level, of course, is math, you know?

And, to do that, molecular biology was the answer, you know, we need to bring things up to the level where we can deal with them, you know, first principles with a controllable, more

reproducible things and so on and so forth. Microbiology was the promise to do that, from a scientific, kind of a logical perspective. So, you have the political aligning with economics...

Jeff Ubois: I have to read you something from our founder, Dr. Piero Bassetti, who points out that “innovators make history and those who make history always make politics...”

Ignacio Chapela: Yes. Normally, you have some independence between the innovation happening on one side, the politics happening on the other. And, within the politics, you also have independence between at least two poles in the U.S. Republicans, Democrats. When it comes to other types of innovations, you have some polarization. Here, they become aligned. Republicans, as much as Democrats, or Democrats more than Republicans, jump into the biotech bandwagon.

Jeff Ubois: Maybe excepting stem cells...

Ignacio Chapela: Even there, it's not clear who is for and against stem cell research and why.

The other element that is truly aligned is venture capital. Venture capital that needs to be repositioned somewhere else. Venture capital is looking for places to go where innovation is a driver and they're getting this consistent, you know, monotonous sound of politicians, of scientists, economists, everybody just repeating the same mantra. This (biotechnology) is where innovation is going to happen and this is what is going to lead us out of the looming recession and all that.

So, it is a field that is incredibly rarified by that, by the fact that it's just so enriched with positive reinforcement and so devoid of any polarization of opinion, any differentiation, any diversification of points of view, that it has become really monolithic, really overwhelming. You know, definition of a bandwagon. And so, either you jump on it and you're in it or you are being run over by it. How that could be extrapolated to innovation, in general, I don't know. I am not sure that, for example, the material signs for the electronics field had such a level of unification. But, you could argue that physics went through this because of nuclear weapons, exactly.

Jeff Ubois: I think that's actually very interesting, historically, an example of people who were just writing equations on chalkboards, all of a sudden feeling that they were responsible for incinerating a few hundred thousand people.

Ignacio Chapela: Well, **one of the net results of this focus in biology is a narrowing of the discipline.** Where, before, biology was really broad meant many different things, you've got many different groups, all competing for resources and prominence and ideas and so on. All of a sudden, there's this one channel and one channel only. And, the same thing happens with physics. I think from physics at the turn of the 19th...20th Century, to the physics of the 30's and 50's and 60's to now, if you don't do particle physics, you're not a physicist, anymore. When, before, physics was just so many other things.

So, a net effect of that is a narrowing of the discipline, which I cannot believe could have anything but a bad effect, in general. The way I feel about it, the way I think about it, is that what you do, is that you accumulate over centuries or at least decades, you accumulate from a diverse field, knowledge, practices, and so on, until the point where somebody comes up with the idea, this is what the application is going to be for, this field. And then, my metaphor is from wine making, where you have an incredible widespread collection of grapes with all these different flavors and so on and then you say, “I need my Schnapps’,” and then, you distill wine, you reduce the diversity, you lose a lot of information in the process and get your Schnapps’, but you cannot go back to the wine.

And, I think it's the same process here, that we have, again, that accumulation over many decades, even centuries of knowledge and so on and so forth. And, all of a sudden, the capitalization of that into a very specific channel, getting rid of everything else. And that, to me,

is the problem. If we could figure a way in which we could protect the people, the disciplines, the parts of discipline that are not winning...

Jeff Ubois: So, there is a loss of an intellectual diversity, or separation of intellectual diversity.

Ignacio Chapela: Yeah, and that, I believe is the role of the University. **More than anything, more than producing the next generation of weapons, the University should be, in my view, a place where you foster diversity, where you protect diversity.**

Jeff Ubois: That speaks directly to what the Foundation is trying to get at, is how do you create a culture in which people of slightly different viewpoints provide different perspectives.

Ignacio Chapela: Well, but this monolithic concentration makes it impossible. And that, to me, is the end of innovation.

Jeff Ubois: **Have you come across individuals or cultural institutions that are pushing values related to responsibility in innovation, that speak to, for example, grad students or people in the field of biotechnology, saying, "You're making ethical decisions in what you look at." Have you heard anybody who's pushing that idea?**

Ignacio Chapela: **Not really, but I think it'd be really good. I think it would be fantastic.** I know that two initiatives that come to mind is outside academia and on the more utilitarian front, is the Pew Charitable Fund where they have a big program on biotechnology and bioethics. Ethics or bioethics understood, you know, in the usual bioethics way, which is simply, justifying what's happening and seeing how it's happening, not whether it's happening or not. And then there is the John Templeton Foundation, which is putting a lot of money into an effort to connect science as a search for God, as an alternative to the traditional theological approaches to God and so on.

Jeff Ubois: Do you think that it's possible to start to change public opinion, to push the idea of responsibility in innovation out into the public?

Ignacio Chapela: **Well, I think there's no choice. You know, it's not an exaggeration to say there is a meltdown of credibility of the scientific establishment** and the regulation of innovation and the regulation of science, technology. People don't believe in it, anymore. People don't believe in what we scientists say, anymore. This is much clearer in places like the U.K. Over there, nobody gets surprised if you show up and say, "We've lost all credibility in a scientific meeting." And, the question is, how do you regain it? And, that's very, very hard.

So, to me, there is no...it's not a question of whether it will be desirable, it's a question of whether it's necessary. It *is* necessary, in places where there is still some credibility left for the scientific establishment, especially in places like biotechnology and nuclear physics, to save some face and save the possible futures. But, in other places, to regain it.

Jeff Ubois: How would you go about doing that? How would you know that you're not doing that, in terms of...I mean, the diversity argument that you offer, I think, is one piece of that. You show that the debate is actually, open and accountable.

Ignacio Chapela: Right. And, that you're making every effort possible to include the margins. You know, at a time when...I think it all depends on whether you recommend there is a crisis or not and whether the crisis is actually generated by what we're doing, rather than, you know, by natural forces outside our control. There are people who believe that what we're doing is great - we're just not doing enough of it, or we're not doing it well enough; whereas, other people believe, and I think more and more people are believing now that we're in a crisis of our own doing. If that is the case, doing more of the same is not the answer. So, the answers are going to be found in the margins. So, this agenda of protecting the margins, becomes not only cute and politically correct, but becomes a question of survival, a question of, you know, just necessary.

Jeff Ubois: **Do you think there are ways to observe innovation or think about innovation a probable downstream effects? Are there ways that you can think through what might happen and thereby, act in a more responsible way?**

Ignacio Chapela: **It is almost impossible, in most cases, to have that foresight. But, what we can absolutely do, in this step of climbing on to the public's fear, public space from the, let's say, the lab situation, biotechnology, the metaphor isn't even a metaphor, it's just what it is. From the organism in the lab to the organism in the public space, that jump into the public space, that interface is where I think we need to focus but we don't do anything about it. We just leave it to random chance, for the public to learn about it,** to deal with it, to learn to live with it, rather than what we could be doing, which would be to put some rationality into that, actually, to think about that process of moving from the private or the enclosed to the public, which would entail transparency.

It would take time. It would take inclusion of different sectors and as many people as possible, as much democracy as possible, and I can understand that that democracy in the sense of the U.S., one person, one vote, democracy doesn't work in that type of situation. But, at least representation and involvement of the public before it hits the public, before that innovation actually hits the public, would be critical because, then, the risks and the consequences that we cannot predict would be shared as a public decision, rather than a decision reached by a few, that has consequences for the many.

Jeff Ubois: Do you think there might be tools developed to measure the presence of responsibility in innovation or maybe use some scenario planning? What I'm looking for is either case examples, where you see people in your field who are trying to be responsible in their practice. What are the thinking tools that they have to do that? As you point out, guessing at unguessable consequences isn't feasible, but then you noted we could pay very close attention to the boundary between the public and the private. Could a peer review mechanism maybe be expanded in some way?

Ignacio Chapela: **That's a good idea. That's a very good idea. I never thought of that. What you could have, which would fit into the category of paying attention to that interface. I mean, to what extent you allow yourself to receive feedback from the outside world.**

Jeff Ubois: There is a tension between "I want to share my results," and, "I want to keep them private" -- Nature's not going to publish something that's been discussed elsewhere.

Ignacio Chapela: **If I were going to do something like this, I would try to focus on the...in the process of innovation and to what extent is that process inclusive of, or responsive or sensitive to public? If I'm thinking of something that's going to have public impact and, you know, working in a public university, I don't think we have a choice...**

Realize that we're operating in that context. **All the way from the generation of even ideas of questions, what questions do I address and which questions do I leave aside because that's the way everything happens. You choose to do one thing and not do the other. And, in that process, to what extent do you allow yourself to be influenced, fed by outside forces, is, to me, a really good measure.** And, I'm not saying that you need to just be working on immediate applications that people think are great. I'm thinking of, you know, people I admire as innovators and scientists who have these incorporated into their work, are people who are engaged in cultural practices, read things that aren't, necessarily, their own little field, have music in their lives, are engaged in all kinds of other things.

Jeff Ubois: You're fighting the barbarism of specialization, it sounds like right there.

Ignacio Chapela: Yes, exactly. And, I think to the person, **I don't know anyone that I feel is able to do what you're asking without having that engagement with human social public life at a deeper level.** So then, you're reading theater, you're creating music or engaged with all these things. The types of questions you are posing are very different.

Whereas if you are focused and totally isolated from culture from society, you end up in really weird places and are going to produce weird products that people are not going to like. I think it's almost for sure that will happen. So, the level of engagement and the level of...**when I say, to what extent you let yourself be influenced by the outside, it's not that I am letting people tell me what questions to ask in my science, and I would fight against it, I fight against that all the time. People come and tell me, "Oh, you should be doing that research."** And, I say, **"To hell with you! I'm going to do what I think is important."**

So, when I say to what extent I let myself be influenced, it's at a much, much more distant level, before the point where I am thinking what question will I ask tomorrow and which ones will I not? So, it's a training, I think, in humanity. It's a training in diversity of education, it's engaging scientists with the happenings of the world, which is, again, something that the University's supposed to be doing.

Jeff Ubois: But is there a reward system for that kind of breadth? The payoff is typically in being world's greatest expert in something narrow.

Ignacio Chapela: That's right. The reward system is not here for that.

Jeff Ubois: Do you think that sustainability is another framework around innovation that might be useful to talk about...you know, can we talk about the sustainability of an innovative process like you know, I think we've had this thread running through our session of agricultural biotechnology hasn't provided the financial rewards the people have expected. So, is there, maybe, a question of sustainability around some of the work or is that...?

Ignacio Chapela: Sustainability is, I think, a tricky question because it deals with...I think sustainability deals with symptoms, too. It deals with the immediate and then, tries to project it to the future. And, for that reason, I don't think it works really well as that criteria. And of course, we know it's all contested and it's impossible to pin it down in any kind of way. So, I don't know it's a good word for me.