Yi Lu Interview

Jay and Ann Schenck Professor Emeritus of Chemistry at the University of Illinois at Urbana-Champaign, Head of the Lu Research Group

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SPEAKERS
Paul Gilbert II, Yi Lu

Paul Gilbert II 00:04
Hi, my name is Paul Gilbert. I'm a graduate student representing the University of Illinois archives. And today I'm joined on zoom by...

Yi Lu 00:22
Hi, my name is Yi Lu. I'm currently a professor of chemistry at the Department of Chemistry at the University of Texas-Austin. From August of 1994 to August 2021, I was a professor of chemistry in the department of chemistry at the University of Illinois, at Urbana-Champaign.

Paul Gilbert II 00:42
Today is Friday, February 10, 2023. We are meeting on Zoom to discuss Dr. Lu and his eponymous group's contributions to the fight against COVID 19. So, Dr. Lu, or Yi, which one would you prefer?

Yi Lu 01:10
[What do] I prefer? Maybe Dr. Lu is a little bit easier. Yeah, go ahead. Yeah.

Paul Gilbert II 01:17
Dr. Lu, could you tell us in simplest terms, because I'm not sure if people are going to be too familiar with... have too strong of a science background when they listen to this in the future, what are some of the main areas of focus for you and your research group?

Yi Lu 01:41
My main focus is developing diagnostic tools as well, therapeutic tools for- this diagnostic tool for onsite, real-time and home detection and monitoring. In fact, for both environmental monitoring, but also medical diagnostics. Also, recently, we're have also explored and developed imaging too for medical, Biomedical Imaging. Including the COVID. targets. Yeah.

Paul Gilbert II 02:19
Speaking of COVID, do you remember the first time it appeared on your radar?

Yi Lu 02:26
Yes, I'm actually originally from China, so, I came here to go on my PhD degree. So, I still have many friends and family in China. In fact, I was scheduled to attend a meeting in April of 2020, in Wuhan actually, but of course, that was cancelled. So I did hear a lot about the COVID from, you know, not from the news, but also contacts from my, you know, people from China, so we actually organize a fair amount of effort to, you know, to buy masks and send it to them, because they really needed [it] at the time for that. But you know, in terms of, at the time, I didn't think, you know, it was just too remote, the, you know, how, how fast can it spread to the US, I actually didn't think that was, you know, going to be that fast or that, you know, serious. So, the first time obviously, we I become serious is one, you know, the news broke out that someone came and then I think it was some somewhere in either Washington or California someone got infected and then you know, immediately people surrounding that got infected that's really become much more serious as something that is not just in another country or you know, China is having suffering from that pandemic, but also it can be hit home at the US here.

Paul Gilbert II 03:59
Do you remember last week or so before or everything was shut down on U of I's campus? This would be around mid-March of 2020, or some of the emotions going through your mind at that time.

Yi Lu 04:14
I do not remember the exact date obviously; it's been a while. I don't have a good memory but definitely is really a mix of emotions and a lot of apprehension, you know, you know, just trying to gauge how serious this can be based on all the news, so basically, you know, I spend a lot of time on the web, and then checked on the social media to see what just, what's going on, but obviously read an email from university communications. So really kind of really kind of uncertainty, anxiety, apprehension together, but also honestly, I had a little bit hope that, you know, maybe it'll be over in, I don't know, a few weeks, maximum a few months. So, I always had this hope that this will go away. And you know, so I, you know, when we take lockdown, I was just prepared to for just, you know, a few weeks of lockdown. [I] didn't realize it's gonna be that long of time. Yeah. So, you know that's really something like in retrospect, you know that that was kind of you know, emotions yeah

Paul Gilbert II 05:31
Would you say the pandemic in any way change what things that you and your group focus on as research topics? Like was there a shift towards more of an emphasis on viral detection versus what you're getting up to in 2018, 2019?

Yi Lu 05:50
Exactly. I think that's very true. So, we, my lab is a chemistry lab, developing, as mentioned moments ago, diagnostic agents for many kinds of different targets, both environmental monitoring and medical diagnostics, but we're not really focusing on viruses exclusively. So we had, at the time about 20 members, but there was only one postdoc, actually, from coming from Argentina on a fellowship, she was interested in developing detection methods or onsite real time detection for adenovirus and only kind of viruses actually, you know, happening, you know, in cruise ships and, you know, tropical areas. So we do have one postdoc working on it, in fact, we were almost getting ready to finish the project, I

mean, the manuscript around the time in, I think, February or March of 2020, because that was just, you know, interested in helping people out on the cruise ships, so that, you know, they can actually quickly detect any of these viral breakouts, during those, you know, cruise ship, but also in tropical regions, where other virus breakout in those areas. That was for her fellowship, a project that we're working on. And obviously, we immediately pivoted and then focusing on "can we apply the technology to the virus detection of the SARS virus, SARS-CoV-2 viruses, because, again, we believe that we can make a difference, in helping people and to, you know, to deal with pandemics.

Paul Gilbert II 07:39
So, could you briefly explain what exactly DNA aptamers, if I'm pronouncing that word correctly, are and what makes them different from say, PCR or antigen detection methods?

Yi Lu 07:55
Yes. So, you pronounce aptamers correctly, it consists of DNA, but this DNA is different from, you know, other type of DNA that we all know, like a genomic DNA, or other types of RNA, these are the DNA that can fold into a three dimensional shape, that can adapt itself to binding specifically to targets of interest, all kinds of targets, small as molten metal ion, organic molecules like glucose, and as big as viruses and anywhere between, proteins, all kinds of ones. And the reason that the aptamer is different from other ones, it's that they can recognize not just a nucleic acid or RNA, but they can recognize a wide variety of other targets, in these cases. So, as you know, that even nowadays, you know, the typical of the standard or golden standard of detecting the viruses including SARS-CoV-2, is by PCR, right, information and it's a messenger RNA or RNA based detection. And so, basically, when you get a sample from saliva or you know swab from other you know, samples, you really break up the whole sample and break up the viruses and then you expose the RNA and then use PCR to do the detection, right? So, basically, this methodology is- and also there, you mentioned a moment ago about antigen detection, those will be there, whatever the component that you know, specific for, you know, like proteins or in from those viruses, but for both methods, they had to isolate, they had to break up the viruses to isolate the RNA antigen in order to do detection. So, therefore the method currently- using these two methods cannot differentiate between the live viruses, or dead viruses, but whether viruses infectious or not. So therefore, there's a really kind of a gap in our knowledge that, you know, we know their RNA and virus antigen detection, there could be someone may be infected now or some time ago. In fact, the biggest issue, this is the known, we know a lot about SARS-CoV-2 now all the viruses there, there's minimal or no correlation, you can say, between the level of RNA or antigen and infectability or contagiousness of the virus. In the earliest stage of when people get infected, their RNA levels are very, very low. And now, it's sometimes even non-detectable. So therefore, you know, a lot of people get a symptom, they thought, oh, I don't have SARS-CoV-2, but actually do, but it's not detectable, right. And then after a few days, and then they can be detected, but the problem is [that] can be very contagious. So that's why this, you know, we cannot prevent a lot of spread of viruses, because this detection method, so what different than our DNA aptamer method, we can actually detect not only the virus, we also can tell you whether the virus is infectious or not, we can differentiate infectious viruses versus non-infectious viruses. Let me go back to [my] previous [statement]; when people recover from the, you know, the COVID infection, their RNA levels can be very high for some weeks, even months, including antigens. They're not infectious, they're not contagious, but they have very high RNA levels. But our method, on the other hand, we not

only [can we] detect viruses, we can also tell you whether it's infectious or not, and how infectious it can be, because we- our methodology can detect only the infectious viruses. For example, if someone did a disinfection on the surfaces with bleaches or UV light or something, you see how that can contain a lot of RNA on the surfaces or in the human body as mentioned, when people recovered, but we will not be able to detect that we only detect the infectious viruses. So, there are a lot of false positives going on you can be you know, you the whole virus can be non-infectious. But RNA PCR methods can still tell they're viruses there, but it's actually the noninfectious [kind]. Our method can tell you they're not infectious anymore it's safe. And on the other hand, some other viruses not safe, they are infectious. So that's the biggest difference between our method versus most other methods.

Paul Gilbert II 12:55
Okay, so in summary, using DNA aptamers, you can tell whether or not someone is actively infectious or isn't versus other methods. An example of Coronavirus testing can only detect whether or not the virus is there.

Yi Lu 13:18
Exactly. So they cannot tell whether the viruses is infectious, alive, or not.

Paul Gilbert II 13:26
So, what was the process like of getting funds to develop this testing method? Was this a program that was already going on during the pandemic? Did you receive any funds from say, the CDC to support this research? I'm just trying to get an idea of how the sausage is made essentially.

Yi Lu 13:54
Right. So we had a fellowship grant to develop adenovirus [detection methods]. But when we appl[ied] this model to SARS, we ha[d] to look for new funding. Fortunately, there is a call for proposal from National Science Foundation called Rapid program. It's a program
(NSF) where [they can] quickly make a decision. You write a short proposal, they do a quick review. Unlike the normal grant cycle that can take six months or even nine months, this one's a decision was made. I forgot maybe less than two months. We were able to fortunately get a grant from [the] National Science Foundation to apply what we already developed into the SARS-CoV-2 detection.

Paul Gilbert II 14:52
And did you receive any assistance from either an office on campus or a specific person when it came to receiving this rapid funding?

Yi Lu 15:03
Well, I mean, I just went through the normal channel from the Office of Sponsored Research, you know, to follow the grant applications, you know, they assisted us to submit on behalf of that as an official, you know, entity of the UIUC. Yeah. Also, you know, [the] University- I'm on the mailing list for, you know, the grants opportunities for all kinds of different I think this is from VCR office, Vice Chancellor for research office, they have, you know, I think either weekly, or at least monthly, probably weekly, kind of a summary of all the grant opportunities. So for those, they provide information about what's available, and then what website and so on, so forth.

Paul Gilbert II 15:56
So in the article that was published on Illinois news, in September of 2021, towards the end of the article, there was discussion of you using this technology to detect other pathogens, besides the adenovirus and the SARS-CoV-2virus that has been plaguing us for the last three years or so. In that time, has the researchers behind that project been able to replicate the successes when it came to detecting other viruses? And if so, do you have a rough number on how many?

Yi Lu 16:48
Yeah, so I'm glad you asked. Because we just got another grant a year ago, for us to develop using the same technology to detect swine flu virus. Because as you know that, you know, the swine flu has been a big issue in the industry. And so they lost a lot of their workforce and revenue to a lot of farmers. Because, you know, the swine flu, once you detect it, now they have to kill all the swine and pigs and others. And the same issue where, you know, they could disinfect the whole farm very well, but the RNA is still present. And when you use the PCR, you say, "oh, there are still viruses there," but actually, those virus are already killed. And the you know, they're free of the live or infectious virus, but the PCR is still telling them, they still have RNA present, therefore, they have to kill all the pigs. But they really like our approach where we can differentiate the live viruses from [non]-infectious ones, we can detect them early, but more importantly, we can say those disinfectants {I believe Dr. Lu means deactivated viruses}, you know, that's not that's not going to cause any infection in that regard. So yeah, we got the and also, we also are in the process of applying this one for as you know, the Oh, the forgot the name of it, the chicken one. So right now, the chicken egg is very expensive, right. It's what's that Bird flu? It's called bird flu virus.

Paul Gilbert II 18:39
Yes, bird flu or avian flu.

Yi Lu 18:42
Avian? Yeah, yeah. So, we are we're also in the process of doing that, because that that a year ago, then, you know, just recently, people realize that this also has been an issue. So, we're trying to develop, again, a quick test for onsite real time detection for insofar as, you know, avian flu or bird flu viruses, because this has to become contained, you need on site real time detection. But not only that, you know, we also want to differentiate between infectious virus versus noninfectious for the same reason, we develop the SARS-CoV-2 [test]. So those are the two biggest kind of applications. Obviously, we're also interested to have other human viruses for other ones, as I mentioned, the initial idea was trying to help people in the cruise ships, so that they can, armed with our portable sensor, they can actually detect early and then find extra viruses to prevent outbreaks or control outbreaks.

Paul Gilbert II 19:46
And a subject of the work that you and your group did. I know many labs at least temporarily, shut down at the very beginning of the pandemic. Did yours ever shut down, or at the very least, reduce the number of people who could be in working on experiments early on?

Yi Lu 20:11

Absolutely. Oh, in fact, my lab is probably one of the lab that have been affected, shut down and socially distanced the most. Why? because we have one of the biggest labs in the chemistry department. Before the pandemic, social distancing was not an issue. We have a bigger lab [in terms of personnel], we have a small, limited number of space, students are working on the same bench, they share desks. Okay, we have a spirit of collaborations, but obviously COVID taught us that's not okay anymore, right? Because people health is number one. Research productivity is always second to human health. So, initially we did shut down like everyone else, but then after a period of time, the Department of Chemistry decided to employ rules so that only a certain number of people can be in the lab at the same time. There are certain minimum social distancing, that one had to maintain. So, the department had instituted very reasonable guidelines... Depending on the size of the lab, only certain group members need to be there to work at the same time. As a result of that, because my lab has a large number of students, we had to work in shifts. And so therefore, a lot of student who wanted to continue with their PhD project, thesis project or whatever project, they cannot do that, because they have to wait their turn in order to be in the lab to continue to do that. So yeah, definitely, my lab is quite affected by this shutdown...

Paul Gilbert II 22:17
So once things start to ease up, besides people essentially having to take turns, in terms of when they could come into the lab, were there other things that were done to promote increased safety or any funding that the U of I provided to facilitate that?

Yi Lu 22:39
Well, obviously, U of I provided masks, bleach, all the cleaning things. I don't know if that's what you mean, in terms of...

Paul Gilbert II 22:43
That is

Yi Lu 22:51
Yeah, so. And also, guidelines, I think they're definitely was a lot of confusion, a lot needed to be done to balance between the safety and the research productivity, and, you know, everyone was concerned about their health. But under the guideline, everyone's health is protected, now we can actually go back to the normal, you know, academic life. And that was definitely, you know, there was a lot of development in of course, communication, meetings, and stuff like that. I don't know if that answered your question? I don't know. I'm not sure.

Paul Gilbert II 23:34
Yes, that did.

Yi Lu 23:35
Okay. Okay.

Paul Gilbert II 23:42

So, how did the pandemic specifically affect your career goals? I mean, it must have been a lot to pick up and move your lab several hundred miles in the middle of a pandemic, even if it wasn't as scary as those initial couple of months.

Yi Lu 24:08
I honestly, did not change my career goals, because I know I enjoy doing research, teaching and service. I continue to do that. But I have to change the way to achieve the goals because the pandemic. I had to adjust [and] adapt to the social distancing. One of the biggest things is that I had to learn to deal with mental health issues. First of for myself, stress and anxiety but, more importantly, this really made me realize how important [it is] to help my group members deal with mental health or stress associated with that because I think they're affected probably the most, because all the things they are facing when they're just fresh out of college, coming to graduate school. So, I have to learn how to care about them, how to listen to them, how to work with them, to also accommodate them in terms of their needs. They need to take a break, you know, they need to have more help from me, more understanding, more passionate about their being. And so, this is something that was there before pandemic, but [has been] put in the center of my attention.

Paul Gilbert II 25:47
Did you have to cancel or postpone any projects as a result of the pandemic? Especially when the lab was operating under reduced capacity.

Yi Lu 26:00
Yeah, we definitely to postpone a lot of these projects, because of you know, the limited time in person in the lab. So, some of the projects will come out.. As you know, most professors, at least in science- our grants need to be renewed, right? Between three and four years. But if you don't make enough progress, you will not be able to renew them. So, we have to postpone some of these activities, because we do not have enough results. In other words, we could not fulfill the grant opportunity or obligation or goals or aims from the previous one. So yeah, definitely postponements. Cancellations? Not as much because we do have some new initiative, some ideas, we just postponed them... We just postponed the start of them.

Paul Gilbert II 26:58
Did you or anyone on your team, change how they use social media, as a result of this pandemic? I'm just thinking about how much of an issue misinformation, disinformation, and harassment was for people, broadly speaking, in the scientific and Health Sciences, community especially.

Yi Lu 27:29
Right. So, in terms of communication, between among the group members, we definitely have learned to use that much more effectively than before the pandemic. Zoom, we used Microsoft Teams for collaborations. In fact, during the complete shutdown, we continued to have group meetings, even though we don't have data, the collected data to present, but I worked with my group members to use that time, because we're not going to be in the building or in the lab, to do a lot of education training, tutorials, etc. We established book clubs to learn how to be efficient in terms of getting things done, we have established a seminar series for former alumni, to give a talk to our group members through Zoom

about their experiences, their biases, career connections, and so on and so forth. Anyway, in terms of social media, among our group members, we are definitely much better able to learn how to communicate{?} with that, versus during the pandemic. In terms of social media, communication from outside, you're absolutely right. Different students, different group members got exposed to different information, and so, those can be very concerning, but again, I personally do not, cannot control that number one, but I do not want to control I just leave it up to each student to their own personal choice to do that. But I do try to, in a tutorial, how to deal with misinformation, and you know, how to filter out the facts from misinformation. So, which have to do on the positive side, and how I try to learn how to deal with that.

Paul Gilbert II 29:47
So, this is something that I just thought about as a question and I wish I have run it by you beforehand. On the subject of harassment, I have heard of a number of examples of Asian Americans being the victims of racial discrimination and in some cases violence, being blamed for the COVID-19 pandemic, have you or anyone in your group experienced those acts of discrimination because of your racial or ethnic identity?

Yi Lu 30:36
Um, so I see in the news [instances of Anti-Asian hate, but] personally, I don't recall [personally experiencing discrimination]. Fortunately, I think UIUC has been pretty nice. I personally have not experienced that. And I'm not aware of my group members experiencing that, at least they if they did, they have not told me yet. Yeah, no, no one has told me about it. But thanks for that question, though. Yeah, it's something definitely I'm worried [about] for sure. And, but fortunately, I didn't personally experience that. Honestly, I only go back home, and work very hard, and then go to the office and lab. And that's kind of my typical life. And so, I do not go out as much as I should. And so that may have contributed to that. I do go shopping, go to Sam's Club and Meijer and stuff like that. But again, I do not do a lot of outside activities. That may also be one of the reasons I have not experienced that. But I have to be honest, yeah, I don't know, have any such experience myself. But thanks for asking.

Paul Gilbert II 30:58
Okay. I mean, thank heavens that you haven't had to go through that. Considering how much the pandemic has been a nightmare to everyone's mental health, just from our lives being disrupted. I feel like it would be especially rough if people were making your life even more miserable because of things that were outside your control.

Yi Lu 32:41
Thank you very much for that comment and understanding too. I definitely appreciate it's done something mentally, I definitely have had that kind of fear, or things like that, but physically or something. I have not experienced that. Yeah.

Paul Gilbert II 32:57
On the subject of the university community, what are your general thoughts about how the university as an institution, the University of Illinois, to be clear, has been in terms of guidelines and in testing protocols?

Yi Lu 33:21
Yeah, so first of all, I think the SHIELD team really deserves all the credit... I think being able to do the test quickly and be able to, you know, make decisions on that, that's really great. I also appreciate the Chancellor [Robert Jones]'s video meetings. I especially, like they have time marks, so you can go straight to 14:01 for that specific question, [it] really helped the communication. Overall, I'm really personally satisfied. Because all the effort. At the beginning, honestly, there was a lot of confusion, right? I think even the leadership or whatever team that was responsible [at the beginning of the pandemic] may be also confused too. Totally understandable from my personal point of view. I personally am very grateful and satisfied with how the Chancellor all the way to the department, for example, my department head and others dealt with that. With passion, with understanding, and communication as much as they know how to do that. But of course, in retrospect, we could do better at communication and all that, but everyone's learning.

Paul Gilbert II 35:09
Okay, so I have one more question for you, and then I'll yield the floor in case there's anything else that you want to discuss in the time we have left. Did you learn anything about yourself, or your work, or the members of your team as a result of the struggles that came about from this pandemic? As an example, President Killeen, when we spoke to him earlier this academic year, spoke about how surprised he was at the University community's ability to effectively flip a switch and hit the ground running when it came to coming up with everything that the community has provided to the fight against COVID-19, from SHIELD Illinois testing, to the emergency ventilators that were developed by the School of Engineering, and your work with the aptamers just name a couple of examples.

Yi Lu 36:24
Right. I learned a fair amount about how to deal with mental [health] issues. Previously, those were on the radar, I do think about it, care about it, but the pandemic really put this issue in the center. Myself, but more importantly, my group members, and how to better understand student struggles, and how to deal with them. Those issues are under the radar, sometimes, an undercurrent, but I think the pandemic really put it [mental health and wellness] in the center, and I became much more aware of that, much more caring, and also learning how to work with people. Some students just completely stopped communicating. We have to find a way to communicate, because the student, I wouldn't say refused, but declined to communicate me, so I have to go through their friends, friends of friends, neighbors, to communicate. Basically saying, "that's fine, that's fine. For whatever reason you do not [want to] talk to me, communicate with me directly, that's fine. But [I] just want to say, I do care about you. Take your time. You don't have to be in the lab. But I want to make sure [you know] the help is there. I am ready to help you, to understand you, whatever it takes." I think this is something that I was not very good at, to be honest. I'm still learning, but I'm definitely trying. learner how to do that. In terms of work, [this] reaffirm[ed] our initial goal. I think that even though a lot of laboratory tests are really good, you need that point-of-care or on-site, real-time detections, you know, for not only you know, SARS, but many other pathogens and other things. So really, we double our effort to develop better technologies so that people can use to help, you know, save a life and prevent future outbreaks in that regard.

Paul Gilbert II 39:09

Okay. Well as I stated, I have no more questions. Is there anything that you want to add before I end the recording?

Yi Lu 39:22
Oh, no, I just want to say thank you, and also your Archives team [for doing] this because it is kind of interesting history. And now we're only a few years away from it. It's just interesting, 10 years or some more down the line, what kind of view people have on this. So having this kind of recording, archiving is extremely important. I appreciate your efforts and effort from your team to do that.

Paul Gilbert II 39:53
Thank you for sitting with us. I'm ending the recording