

Carver Biotechnology Center Oral History Interview¹

SPEAKERS

Bethany Anderson, Bruce Fouke, Ted Brown, and Sam Kaplan

Wednesday, March 27, 2024, 3:00-4:27 pm CST

Bethany Anderson 00:02

All right. Today is Wednesday, March 27, 2024. My name is Bethany Anderson, and I am the Natural & Applied Sciences Archivist in the University of Illinois Archives. I am speaking over Zoom today with Bruce Fouke, Ted Brown, and Sam Kaplan about the history of the Carver Biotechnology Center, hereafter referred to as the CBC, at the University of Illinois Urbana-Champaign, and their respective roles in this history. I will be shifting the question-asking to Bruce a little bit later on in the interview to open up a conversation between him as the current Director of the CBC, and Ted and Sam, given their history with the Center's establishment and development. Thank you all so much for talking with me today. To start, I wondered if you could all talk a bit about yourselves and introduce yourselves and describe where you were born and where you grew up.

Ted Brown 01:05

If you want to start with the oldest first, I'll go. I'm Ted Brown. I was born and raised in Green Bay, Wisconsin. Lived an early part of my life there. My father took a job in Indiana, so for three years, I lived in Indiana, and then he took another job in Chicago, and I moved to Chicago. It was just about that time, I was getting ready to go to college, and we didn't have much money. I lived at home and went to Illinois Institute of Technology, which was a university in downtown Chicago. My dad had a job in Chicago, I mentioned that. I loved it, it was a great—it was the first time I'd ever been in a large city. And I just really enjoyed being a student at IIT. I discovered that I like chemistry very much, and I majored in chemistry at IIT. And I also joined the Naval ROTC program. This was 19—I began my college work in 1946, and Uncle Sam was getting ready to draft people into the military and I was A1, or whatever that label was, it was a dangerous level to have. But I was able to get in the Naval ROTC program, so I didn't get drafted. And I was able to get much of my college expenses covered by the Navy, during the time I was a student at IIT. The result of that was that when I did graduate, I had three years of active duty. It was just at the start of the Korean War. And I had a three-year military service to meet, so I spent the next three years as an officer in the Navy during the Korean War, mostly on a ship and the waters around Japan and so forth. But by that time, I decided I really did want to be a chemist. And when I got out of the Navy, I had the GI Bill to help me, and I was married and had kids. But I went to Michigan State University and obtained my PhD in chemistry there. And then looking around for something, I wasn't sure yet what kind of a career path I wanted to have. But I wanted to try

¹ This interview was sponsored by the Office of the Vice Chancellor for Research and Innovation.

teaching anyway, and I had a chance to come to Illinois, at the University of Illinois, in a sort of temporary, I should say, it was rather tenuous, tenuous would be the best word, position there. It turned out I really loved it. I love teaching, and I love doing research. And I was able to get myself onto the tenure track there at Illinois, and eventually became a tenured faculty member.

And so, I taught, of course, and I discovered I write, liked writing a lot. So, I wrote textbooks in addition to the research that I was doing. One of the other things that I rather liked about being on the university campus was that there was such a diversity of backgrounds of people, and I loved being in touch with so many different people from different backgrounds. And so, I got put on committees. I was actually one of those rare people who kind of liked to be on certain committees. I was put on a committee on the campus that Illinois called the Research Board Committee, a committee of faculty who, under the leadership of the graduate dean—with a budget for funding faculty, small projects for faculty and their research activities. That again gave me an opportunity to grow. Six or seven of us from across the campus and now I know a lot of people, and I enjoy that very much. I did that during the time I was, by that time I had made tenure. I don't know just how it came about, the Dean of the Graduate College at that time was Ned Goldwasser, a physicist, wonderful guy. And he had, he was both the Dean of the Graduate College and the Vice Chancellor for Research. He didn't like him having both jobs. So, they were looking for someone to take over that job. I was being badgered by them, by Ned, and also by John Cribbet, who was the chancellor at the time. Yeah, wouldn't you like to try being a dean? Well, I'd never been a department head or any other administrative thing. And just out of the blue, I decided, well, I'll give it a try. I took on this job of Vice Chancellor for Research, and Dean of the Graduate College, which made me the chairman of this research board that I just mentioned. And now I was right in the middle of being able to work with faculty across the campus in a lot of different things and that I think, gave rise to my desire to engage in, sort of, interdisciplinary activities.

And so, I became the Dean of the Graduate College. And it was in 1980, I kept my research going, of course, and so forth. But now I had an administrative job. That graduate deanship job made me now the chairperson of this Research Board Committee. And the whole idea there was to fund faculty research. I was in a great position to work with faculty in many different disciplines. I really felt that it was an opportunity to use the Graduate College and Ned Goldwasser, who was sort of my boss—Ned had moved up to being the Vice Chancellor for Academic Affairs, now they call them the provost—and we work together very well. We were, together, we decided that we should try to simulate interdisciplinary activities, that is, activities on the part of faculty groups that extend beyond the usual department heads. So, this was the origin, for example, of the biotechnology thing. It was obvious at the time, that biotechnology was a coming thing, it was a burgeoning development in biology. The faculty were interested in, and the campus as a whole saw a need for activities, especially laboratory facilities, which were extended across the campus and gave the possibility to faculty to take up some of these new technologies that were becoming available. And so, I think it was 1984 that I appointed a committee. I've forgotten what the committee was called.

Bethany Anderson 08:19

Yeah, it might have been called—is it the Biotechnology Initiatives Committee?

Ted Brown 08:25

Yes, that's right. Something like that. And it came, it was, I appointed the committee and... Yes, that's right, I should've had that up right here. Yeah, I appointed the committee. And then that committee was designed or charged with developing a campus-wide effort, and so we had contributions from people across all of the different colleges, agriculture, and so forth. And so that I would say that... and we needed some sort of leadership for it. It was not something that I could do as a graduate dean, I had plenty of other things to do. But at the meantime, I'd hired Sarah Wasserman, who was a spouse of a new person on faculty in psychology. She was a wonderful woman who really, she was an administrator. She had, I don't remember what her major was, it was in something like business administration or something, but Sarah was very good. And she became my lieutenant, as it were, with this effort. And so, she became charged with working with faculty groups, at least some of them as these things developed, and she began working with Sam and this idea of building up to a program in biotechnology in particular, developing the wherewithal to build laboratories which could be used generally across campus. I'm sure there'll be more talk about that later. I won't say any more about it. So, Sarah undertook that job. And then we had several other initiatives of the same sort.

Well, that particular initiative was, it was so obviously the right thing to do. It didn't take but a year after that, I've got the data here; the meeting, the establishment, the record of the Board of Trustees, in 1984. Now, I started this thing in '83, I think. In 1984, we went to the Board of Trustees and asked for funds to establish a, I forget what we called it, it was the Biotechnology Center, I guess it was, in the Graduate College, and it was a special unit of the Graduate College, and it was called the Biotechnology Center. And the main, it says here, this has come from the record of the Board of Trustees: "to related campus wide service facilities for the support of the biotechnology research for recombinant DNA analysis and experimentalist experimentation, and other monoclonal antibody analyses and preparations." These began to take hold. We furthermore furnished, or established, an industrial program with, for companies that were interested in these things. And they also were participants and began to help us with the funding for the instrumentation and so forth. And so, this is actually about where my part of this story ends, because in 1984, I was busy at work putting together the proposal for the Beckman Institute. It was another one of those interdisciplinary things, I was given the job of putting together a proposal eventually, which went to Arnold Beckman. And lo and behold, in 1985, he gave us \$40 million to build the Beckman Institute. And guess who got to be running that thing. So, I moved out of graduate college, and took on an entirely new career as the acting Director of the Beckman Institute, and Sarah stayed at the Graduate College. But it wasn't long before I hired her away from there to work for me at the Beckman Institute. So, but Sarah was very important, I think. And Sam would agree, in helping him past through all of the administrative jungle to get things done in the early stages of the Biotechnology Center. I'll leave it at that point.

Bethany Anderson 13:16

Thank you so much, Ted, for that background and overview. And I did have a quick question I wanted to go back to, because dates are really important, just to make sure we have we have some dates recorded. So, when did you first come to the University of Illinois? What year was that?

Ted Brown 13:31

In 1956.

Bethany Anderson 13:36

In 1956, okay. And then what year did you become the Dean of the Graduate College?

Ted Brown 13:41

Oh, 1980.

Bethany Anderson 13:45

1980. Okay. Just wanted to make sure we have those recorded. Thank you very much. I don't know, Sam, if you would like to go next and talk a bit about your background and where you grew up, and your education and so forth.

Sam Kaplan 13:57

Sure. I was born and grew up in Yonkers, New York, which is a suburb of New York City. Just north in Westchester County. I went, as an undergraduate, I started at Cornell University, in the College of Agriculture. I too didn't have any money, and the College of Agriculture at the time for New York state residents, which I was, cost \$52.50 a semester, not counting room and board. That's all I had to pay to get a quality education. And I was a biochemistry major in the College of Agriculture. After I got out of Cornell, I joined the Marine Corps, and was in the Marine Corps for several years, at 1955 through 59. And after I got out of the Marine Corps, I went back to college. I became interested in microbiology, which I did when I was an undergraduate at Cornell. And I applied to Yale University to work with a fellow by the name of David Bonner, B-O-N-N-E-R. And I was accepted at Yale. And I started my PhD program there. But after two years, Dave Bonner took a position as chair of the new department at the new University of California, San Diego. So, I followed him from Yale where I got a master's degree, to the University of California at San Diego in La Jolla, where I got my PhD in, let's see, what year would be that—that would be about 1968. No, I'm sorry, that would be 1963.

Then I did several years as a postdoctoral fellow in Cambridge, England, at the MRC labs, with Sydney Brenner. And after that, I took my first job at Case Western Reserve University in Cleveland, Ohio. And I was there for only five months. And the reason I was there for only five months was that they were supposed to have a new building with space, etc. And that never came through. When I got there, I had no laboratory. So, I immediately set about looking for another job. And I was offered a position at the University of Illinois at Urbana-Champaign, the department of Microbiology, by the chair L. Leon Campbell. And I accepted that position. I went to Illinois in 1968. And I was there, at Illinois, through the time I left, which was 1989. And I went from assistant, to associate, to full professor, and then chair of the department of microbiology, and ultimately Director of the School of Life Sciences, and the various biological science departments in it. I became Director of the School of Life Sciences. And while I was there, in 1984 or '85, is when the Genome Project was talked about. And at the time, the Genome Project, the Human Genome Project, was centered in the Department of Energy. The NIH took a dim view of such a project, maintained itself at arm's length from the Human Genome Project. And it wasn't until a lot of, actually, outside influence, brought the

Human Genome Project in 1989 to the NIH. But one of the things that came clear from the Human Genome Project was the need for certain centralized facilities. So, what was happening, the microbiological sciences was the advent of DNA sequencing, of the issues of restriction mapping of various DNA from whatever organism, the ability to do mutagenesis in vitro, I mean, all of this was happening on a worldwide basis. And all of it involved, I mean, the issue of plasmid biology, etc. All of it involved what became basic microbiological techniques. But yet, to access these techniques, across a variety of biological disciplines, for example, in, in agriculture, in medicine, these were people who were not trained as microbiologists. So, you had on the one hand, the need for all these microbiological techniques. And on the other hand, the user group who were not microbiologist. One way of bridging this gap was to have a facility, and the biotechnology facility, of a facility where all of these techniques and instrumentations can be brought together and used throughout the life sciences by people who were not microbiologists, and so the idea would be you would have a series of technicians who could carry out these various activities. And so, this is how the germ of the idea, at least amongst a number of the faculty, Illinois became established to have a Biotechnology Center, which would allow faculty from across campus microbiologist or not to be able to access these techniques through technicians at the Center. And so, although I left the university in 1989, one thing became very clear—that in about 1985 or so, we hired the first couple of technicians in the Biotechnology Center. At the time, it was not the Carver Center, it was just the Biotechnology Center, a couple of technicians. And in addition, on a recharge basis, which is formula for funding, money came in from the graduate school, plus, we would charge faculty a certain amount of money for them to have these techniques performed. And they could then contract through the Center to get various activities done, which they could then use for their research. That was the model that was envisioned and established, and actually started to work. And I left the university, so I can't comment anymore. And the rest is history. I've helped you out?

Bethany Anderson 21:42

Thank you so much, Sam. Yeah, that's really interesting context, especially to think about the Human Genome Project in the background here, what was happening in the larger scientific community as well. And the need for, you know, as you mentioned, a centralized facility or facilities for these purposes that could harness different techniques that folks across campus may not have access to otherwise. So, yes, it's really interesting.

Sam Kaplan 22:10

Some of the information which I sent you, one was a clipping of when the Biotechnology Center was formally established. And another was the glossy brochure, which was an inventory of faculty across campus who had expressed an interest and whose expertise was clearly outlined, and how they would contribute to the Center.

Bethany Anderson 22:39

That's a really great point. And something that would be great to come back to in a bit in a bit as well. But I did want to give Bruce the opportunity to introduce himself and discuss his background and education and so forth.

Bruce Fouke 22:51

Well, first of all, I just want to say I very appreciably continue to carry the baton that both of you have passed forward through time. And it's a very important, exciting opportunity that the Carver Biotechnology Center offers. So, I'll just, I'll start with the idea that my father was also on the GI Bill. And he took that to go to the University Chicago, which is where I was born, at the University of Chicago hospitals there. And then we left Chicago when I was young, and I ended up growing up in the state of Iowa. We moved around quite a bit, but my formative years were all in rural Iowa—North Central rural Iowa, Dallas center, in the middle of Dallas County, which is in the middle of Iowa, and other places. But ended up, you know, farming, we raised pigs and corn and soybeans, not too surprising. And then it was time to go to college myself, so I ended up, I got a civil engineering scholarship for Bradley University. And I was very excited about, I didn't know what I wanted to do, but I was always really good with my hands, you know, welding, planting, fixing, doing things. And I thought that from what I knew of life, that civil engineering was a good way to do it. And then I was a junior, and I took intro geology as an elective. And it turned out that the professor at Bradley actually got his PhD here at Illinois. And he was just on fire. The first lecture: volcanoes, sharks, ice sheets, coral reefs, how the earth works, and I got it from that first lecture. Walked across campus after the lecture, I walked across campus and changed my major to geology. And then I never looked back. So then from there, I went to the University of Iowa, I worked on coral reefs of the Bahamas for my master's there. Then I went to University of Chicago myself, again, and things were going just super and then my advisor left Chicago and went to Stony Brook University. He was someone I'd gotten very close to, and I also know the value of, you know, the personal relationships along with the excellence of the education. So, I left Chicago and went to Stony Brook and got my PhD with him there, and I studied ancient and modern coral reefs of the Southern Caribbean for that part of the journey. And then it was time to get married and do some postdoc.

I did a three-year postdoc in Amsterdam, studied ancient coral reefs around the world, and then got to go to UC Berkeley. I worked with Walter Alvarez on killing dinosaurs with asteroids. And then I did a postdoc at NASA Ames, and I worked on the Mars mission. And so again, following the footsteps of both, you know, Ted and Sam here in terms of cross-disciplinarity, and along the way, we were starting to have children and my wife's joke was it is time to get a haircut and a job, more or less. So, we did some serious applications. I was very thankful to be able to come to the University of Illinois Urbana-Champaign, and that was in 1997. And then my very first week on campus, I had the great, great, great good fortune to meet Carl [Woese] and Abigail Salyers. And it was my first week and you have the edifice called tenure in front of you. I was hired to study coral reefs as a geologist and no one had muttered the word microbiology, but I knew that was the way to go. So, I met Carl and Abigail that first week I was on campus, and they changed my life. And they made me an incredible offer, which I immediately said yes to. They said, well, why don't you pursue your ideas that you have about adding, blending in molecular microbial ecology into the heart and soul of what you do with coral reefs, and, you know, other kinds of natural deposits, and hot springs in Yellowstone? And so, Carl and Abigail took me on and became, you know, steadfast friends, and they were my personal mentors for 18 years. I was able to evolve from there keeping a base in geology, but then bringing in molecular microbiology, and molecular biology for other organisms, like in the end, humans and corals and things. My program evolved to include coral reefs, hot springs, oil and gas exploration, human medicine, space exploration... a whole variety of things.

Then Jonathan Sweedler, who was the director of the Carver Biotechnology Center—I'd had a grant with Jonathan. He called me and I had no idea I had been using the Carver Biotechnology Center for my work, as I was struggling, learning, you know, geologists who wanted to do microbiology. And then Jonathan said, I just think that your approach and what you're doing would just be perfect, you have enough knowledge of what's going on, would you consider applying? Because he had quite a pool, Jonathan was stepping down to move on to other administrative jobs on campus. I very sheepishly threw my hat into the ring, because I knew the stature of, you know, people who really knew what they were doing. And I was very fortunate to be selected. In 2012, I was selected as the Director of the Carver Biotechnology Center, and, and then it's just been an explosive evolution from there on top of everything else to come to where we are now. But, and again, I'm so appreciative because the spirit and the intent and the mission that both Ted and Sam set up for the Carver Biotechnology Center all those years ago, I can tell you, it was—the vision was square in the middle of exactly where we needed to be. And we've, what we've done now is, you know, we have the Carver Biotechnology Center, we have 36 full-time employees, a nice growth curve from the original two, I believe. Yeah. And we have, if you count everything, we actually help support about \$63 million a year in grant activity. We support on average, about 525 research projects annually. About half those are on campus, and half of those are off campus. And we work with PIs all the way from across the state, to across the nation, to around the world. And it's an incredible footprint and outreach, and the recognition point that we've been able to build with the Carver Biotechnology Center. What Ted and Sam have brought us to at this point, I'm just so excited to be part of it. But it's also, it was a revolutionary ignition of a starting point of what our campus you know, needed to be part of. Not only was it visionary, it was absolutely practical, you know, typical Midwestern approach, right? That you have the excellence and the need, and it's exactly what was needed and, and also this whole spirit of depending on our great colleagues on campus, the other faculty and staff. We have a faculty advisory committee of 12 people every year that we meet with regularly to get input and ideas. We currently now, we've grown now to have six core facilities. And they range from every type of thing you could think of. For an analysis of DNA, RNA and proteins. And then we also do bioinformatics. And each of those are headed by extremely experienced directors, we call them directors of each of the facilities. And they also, part of their mission statement is to keep on top of what's happening.

One of the ways that we are recognized for what we do is that we also have these close, just like what you know, Ted and Sam did very early, we have close working relationships with all these international companies that are driving the biotechnology. So, for instance, Illumina, which is one of the big sequencing platforms. Of course, it like Sam was talking about before, you know, the Joint Genome Institute and all these other places around the world, the Beijing sequencing facility. We're also very close with Illumina. And we operate on a beta testing relationship, more or less a center of excellence with them. And then with 10x Genomics, the ability to go in, we call it spatial biology, the ability to go in and do analyses of gene regulation and protein content at a fairly deep level on a physical resolution of about 50 nanometers within a histology section in three-dimensional space. And so 10x Genomics is one of the leading companies for that. And we've also now arisen to be a 10x Genomic Center of Excellence. And, in fact, we just had 10x Genomics send five of their representatives here just last week, and we held a big symposium at the Beckman Institute. We had people from every corner of campus, I think that we had over 80 participants, just from our campus alone. And then we had several people come from industry as well. So, I guess I

wanted to kind of lay the template of the growth factor, has been explosive. And you know, we see that growth capacity, we've only started. We've only touched the tip of the iceberg. We're actually formally a co-investigator with Rohit Bhargava, and the Cancer Center of Illinois. We're trying to become accredited to become a cancer center in Illinois. And we think that's going to happen within one to two years. When that happens, we are formally designated as the Cancer Center's core support facility. And with that, we'll also come a responsibility, and of course, we want to do this, to be a support core facility for all the cancer centers across the US. Because there's things that we still do here now that other centers don't do. That's why 10x genomics and Illumina and other companies are so invested in us. We literally are at the tip of the iceberg. And we owe great thanks to Ted and Sam for what they've done.

Sam Kaplan 32:50

I think it's incredible, I mean, what you guys have done. And the way this has mushroomed into an all-encompassing facility and a research center, which I think is just remarkable, quite remarkable.

Ted Brown 33:05

I agree. The part of it that's so, so wonderful is that it really is interdisciplinary. That is, you haul people in, and you get them engaged and pretty soon they're part of the team, you know, and it goes all over the campus. And it's sort of like a virus of some sort, that spreads enthusiasm and that willingness. And we see that all the time at the Beckman Institute, somebody's got a new idea every week or so up there. And that's, well, the place runs and I'm sure it's true of the Center. It sounds like that from what you're saying. It's a beehive of new ideas and people coming on board.

Bruce Fouke 33:50

Absolutely. And you know, also we're deeply engaged with the entire campus all the time. We help with hiring and retention. You know, each year on the cycles of faculty hiring, we're deeply ingrained with so many different departments across campus, they bring the candidates through, we spend time with them, they see what we offer, they're blown away. And it helps make sure they come to Illinois and accept our offer, right, and those kinds of things. But also, retention is something that's very important too. We also have outreach programs, you know, we've had things at the National Academy of Sciences where we have presentations and displays. We have things at the Field Museum. We actually were given part of the entire central corridor, where the elephants are in the Field Museum, we set up tables, then we did that in collaboration with the Carl R. Woese Institute for Genomic Biology. We have these great relationships that are deeply grounded now across campus and, and one of the things I enjoy so much too, is that, you know, to me, it just makes total sense. And again, it's what we're doing is exactly in the spirit of what Ted and Sam set up originally. I still to this day, I won't mention any names, but just a few weeks ago, I had a very prominent person who was a microbiologist from another very prominent university in the U.S., and came to visit, sat down in my office, we had a great conversation and the person said, well, before we go any further, I'm just wondering, why does Illinois have a geologist as the director of the Carver Biotechnology Center? And I just love that kind of question because it's, I mean, it's exactly what you're describing. It's that, you know, with the Beckman and well, so many other things, we have a thousand examples of Doppler radar, and, you know, Neosporin, and all the other things that have happened on this campus, right, and so it's completely what we do at Illinois. I think that's the core of it. But it's constantly exciting.

And you just don't know what the next, and we're always looking at new, new versions, new ways to craft and envision where each of the six labs are going and which labs need to be merged based on...

Ted Brown 36:03

I'd like to ask a question, if I might? Bruce, how do you work the appointments of people? I mean, are they faculty appointed, I mean, they're obviously appointed in department someplace, you don't have you don't appoint faculty in the Center, do you? They have to have a departmental home and then they work out of that departmental home?

Bruce Fouke 36:27

Yes, you know, again, Ted, I mean, again, the way the way that you structured Beckman, but you know, what's interesting about the Carver Biotechnology Center is that we don't employ any faculty. So, all of our employees, including the directors of each of the facilities, they are all... they're not faculty lines. Either people, academic professionals, and what have you. And so, you know, we have all the faculty, people who work with us as users, but we don't have anyone that we actually fully employ in that in that regard.

Sam Kaplan 37:00

You know, one of the questions that was posed in the list of questions that was presented was, was there any political issues that were involved in, you know, in either inhibiting the formation of the biotech center, etc. And I just wanted to respond, which I did, right, was that one of the things that at Illinois, that was very clear, was that the administration was always very favorably disposed to anything that would enhance the research activities on campus. And in the formation of the Biotech Center. Faculty were always on board. And there was never a political issue that in any way prevented any of these things from happening. It was really, it really worked well.

Ted Brown 37:57

It's a very interesting point, Sam, because the Biotechnology Center, while it is in fact, perhaps the single—other than the Beckman Institute and the Genomic Institute—the largest such activities on campus. They are models for all kinds of smaller entities which are constantly being developed. And they use these, the models that they've seen in the past come from these other places, which have grown up to be quite important. And that model works. It's a kind of a, put in here, turn the handle and look what happens.

Bruce Fouke 38:39

One question I have for both you to along this line is that I think that you, at some level, again, it was born in practicality, but also, I think both of you had these visions of what was going to happen, maybe, but one of the really strong points that you set up that I'm eternally thankful for, which there are many, is this idea of a blended support model. And, you know, where you had both user fees and, you know, state-wired fees, you know, through VCR and what-have-you. And I guess I was just wondering, that's turned out to be such a powerful entity for us. And I didn't know, is that something that just was just grassroots practicality? Or had you seen this working? Or how did you come up with that?

Sam Kaplan 39:22

From, from my perspective, at the time, and again, it has to do with the Graduate College and the Research Board. I mean, the Graduate College through the Research Board, really funded and provided money for a variety of activities, research activities across campus. And it was clear that in setting up and getting some of this equipment, we would need some funding, and the research board through the Graduate College was the ideal choice to approach. But on the other hand, faculty who needed to use these things, couldn't just, you know, do it scot-free, they all had grants, and they needed to, in some way, share the cost of the burden. It just naturally evolved as the proper way to go forward.

Ted Brown 40:21

I completely agree, Sam, it was an idea of pulling together, across. And you know, this other thing about, I think another question that comes up, and I don't know how you handle it—it's not necessarily something that should take, spend a lot of time talking about—but what do people have to do to be part of this effort of yours? And what, and what controls do you have over who is and is not a bona fide member of this group, because some people might join it just, you know, the advantages it gives them, but they're not willing to do the legwork that's required to be a good citizen of it, because these things don't run on their own. People have to roll up their sleeves.

Bruce Fouke 41:08

Absolutely, so no, it's great. I just want to start off with the answer. We were very adamant about two things. One, is that everyone who comes to the Carver has to obey the law of gravity. And two, they must have spent most of their life on Earth. Okay, so those are two things that we absolutely—no, I'm just joking. So, we actually, you know, Ted, it's a great question, the doors are wide open, you know, we do all the analysis ourselves. Now, we have a component of the labs, each one of the labs, where we do training, and we're very dedicated to training. We have workshops, we have one-on-one. And depending on the PI, the principal investigators, the PI's needs, most of the work is done, they say, okay, here's a, here's a specimen. And actually, it's coming to the point nowadays, where they're not even doing the separations. Like, they'll give us blood, and then we have to do the separations, right? We built another lab for that, because, you know, there's a there's a real movement, I still can't quite get my head around it. But there are a lot of junior faculty who are coming through a culture now where some of these basic things that we all, you know, it was bread and butter, right? If you have a molecular microbiology lab, you do these kinds of things, right. But some of the front-end things aren't being done anymore by some people in their labs. And so, we actually have built out laboratory capacity to actually handle samples, do separations, do extractions, and then go through and do the analysis. So, but you know, that that all being said, it's a matter of the one thing that has to be fulfilled, is that people have to have the capacity, if they're on campus, they have to be able to have a grant account to pay for it. So, we're not, we're not allowed to take cash, we're not allowed to take credit cards, things like that, the only way that we can be paid is through a grant account. That's really, there is no other measure. Everyone's welcome. And even, you know, we've worked with people before they get grants. So that's another thing is that you know, this structure that both of you built into it, where we have this blended model of state and user support. If your ears burn regularly, it's because I always tell what you put into place because that blended model has given us the ability to have some time, throughout the whole process. From the very beginning, to the grant writing, to the genesis of

ideas, to getting grants, to getting the data, to publishing... we have, we probably have more than 10,000 publications that we've now been part of in the Carver Biotech. But that blended model gives us the live, muscular flexibility. Part of the entire process where I know other biotech centers, it's not quite as dynamically structured, they're much more on only user support. I mean, the vast majority of our funds do come from user support, but there's this critical part of our budget that comes from the state and allows us to have that engagement. We are truly a research and service facility and allows us to be part of it. We help with grant writing, letters of support, and all the way through to co-PI's or just acknowledgments on publication.

Sam Kaplan 44:22

So how do off-campus entities approach you for getting things done?

Bruce Fouke 44:29

Yeah. So, then we have that's the only other track we have. Either as an on-campus, or campus system, you know, grant account for grants; the other one that is critical for off campus, and that's the only way to work with us. It's a technical testing agreement, a TTA. And so, we handle hundreds of those every year. And so that's the one and only segue. So, let's say that let's say that Eli Lilly comes to us with you know, some need or what-have-you. And then they come to us, and then we work with them and then we formally establish a technical testing agreement for each of these entities. And that gets approved by the comptroller in the state of Illinois. Then that is the proxy for an on-campus grant account. Those are the only two streams we have for funding, but you know, those are the things we work with. When we first get approached, we always, whether it's on-campus or off, we have it very well structured. Now we're the first contact. People will say to us, oh, I'm an expert in in transpose-ons and molecular biology. And I know how to do this, this, and I need this, this and this. Or, we have people like myself when I started, well, I'm a geologist, and I work with NASA, and I want to get some kind of DNA out of the water sample from a Yellowstone hot spring, right. And so, but we work with the whole spectrum of wherever you're at with the background, and then we have multiple meetings set up, what's needed. We bring in the technology ideas along with theirs, we blend it with the needed science, re-envision what the testable hypotheses are based on those discussions, and then we're off to the races. And so.

Sam Kaplan 46:06

If you had an integrator with Eli Lilly, now, you would recharge them, right?

Bruce Fouke 46:12

Yeah, so what happens is that they, they, they have a technical testing agreement, and then they actually, through that agreement, that's their channel to provide money to campus. And they pay that and then and then we charge them, then that TTA is an account that we use. So, the only two are the, it's called a C-folk, but it's a grant account on campus, or it's the technical testing the TTA. And those are the two things and then in each company then recharges money into that account.

Bethany Anderson 46:41

We've already covered a lot of really great ground here. But before we get too far into the present, and the future, I did want to ask a question of Sam, if that would be okay. So, I know you were the first director for the CBC. Could you talk a bit about, you know, those years when you were the director? And what were your priorities and your accomplishments at that time?

Sam Kaplan 47:04

Sure. Well, as at the time, I mean, there was... one was keeping the faculty interested, because, you know, it was rather a loose consortium of faculty across the campus who wanted the CBC. But at the moment, there was nothing, you know, available. So, one was keeping them interested. And so, we had lots of discussions, routine discussions about what would be taking place at the CBC, or called the Biotechnology Center. The other thing was our first hire was to get a technician. And this is where funds came in through the Graduate College to pay for a technician and to pay for, initially, equipment that we would need to, you know, whatever was going to be done. And so, the first few experiments that were actually done at the CBC were plasmid isolations, and restriction mapping, and some DNA sequencing. I mean, it was all, you know, relatively low key, because we were not up, we were not a \$64 million a year organization. I mean, but we were getting things done. And the faculty saw that we were actually accomplishing things for people across campus, which became very, very important. For example, we did stuff for people in the College of Agriculture, which, you know, was really very instrumental in people looking on the activities of the CBC very favorably. And so, that took place at a very low key for the first couple of years.

Ted Brown 48:59

The Graduate College had funds available to put into some of these programs. And Sam mentioned those. I mean, they would, we would budget a certain amount of money to help those, these embryonic centers. That Biotechnology Center was one of the obviously, perhaps the most visible one, but there was another one for example, in the cognitive sciences area, these people wanted to start a cognitive sciences program. And because this was, not a high-cost thing, but it did require money for seminars and for support of graduate students and things, so that's. I gave them money to do these things and, and to provide research assistantships and so forth, to actually get a program going because it was just the earliest days of cognitive sciences and, and we were actually early off the box in having us a cognitive science program, which we could do put right into place when Beckman Institute's started up.

Sam Kaplan 50:05

The thing I think people should really appreciate is that the research board, through the Graduate College, funded research across the campus. And even though many of these monies were generated off indirect cost rates that were, came through various grants, people in the history department, for example, could get money from the Research Board to visit a library or do their own research. I mean, the Research Board was really, very ecumenical in the sense that the search across the whole campus and it was just really, I found to be ingenious.

Ted Brown 50:54

It was really, this is a little bit off the topic, but when Arnold Beckman, this is even before he gave the money for the Beckman Institute, but he'd given some money to support the research, the research that was going on in the Graduate College, through the Research Board. And so, when he came to town, and I was the graduate dean at the time, I would take him around to meet some of the faculty who had gotten grants from the Research Board, that we that we labeled them, the more interesting ones, as Beckman research grants. And then we took Arnold to meet the faculty members. And one particular person, I took him to meet with a woman in Germanic studies, I think, and she had some money to pay for some... I don't know what, there was language studies and some sort of thing. And Arnold said, well, Arnold was a little bit, he was one of these people who had a very broad base, you know, he didn't, he wasn't going to say, oh, that's not science. I don't want to fund that kind of stuff. He said, well, tell me more about it. And he went and met this lady, and we had a hell of a good conversation with her. And he realized the research board was more than just scientists and engineers. It was people from all of the disciplines across campus. And I think it strengthened his view about Illinois as an institution.

Sam Kaplan 52:17

Yeah, I mean, this was so impressive. I mean, any university I've been at or associated with, I've never seen this specific model duplicated anywhere. I mean, now, it may well be, but I've not seen it. This, I think, was just a real straight job on the part of the university. The other thing I would like to add, and I did not know Sarah Wasserman ultimately went to the Beckman Institute, but she was really terrific. I mean, she, she had an insight into what we were trying to accomplish. And she'd always ask the right questions and pose the right topic. I mean, she was really great in promoting all these things.

Ted Brown 53:15

Yeah, Sarah was, and she was great. And, but she was also pretty, pretty authoritative. I mean, she put us, you know, if you were going to work with Sarah, you couldn't be lazy. She wanted things from you. And she wants you to get it done. And that that really, boy, I tell you what I got her... I hired her away from the Graduate College and over into the Beckman Institute, and she was invaluable over there for me as Associate Director.

Bruce Fouke 53:41

I think too, this is a good point to, you know, building directly on what you know, Ted and Sam just so beautifully shared with us. Just quickly, this idea of the, the succession, you know, Ted Brown being the, you know, the nascent godfather of the operation, getting things going and of course, Sam Kaplan stepping in to be the first director and really, you know, shore it up and make things happen. And then we had Lowell Hager, we had Bob Guinness, we had Harris Loon, and we had Stan Malloy, and we had Jonathan Sweedler, and then I'm the most recent serving director. And with that kind of a template, again, I just want to keep emphasizing the, the strength and the vision of this baton that both of you passed, I can tell you, it's shining bright, and it keeps getting passed forward. And we're in great appreciation for that. I thought I'd just mention, too, along this kind of, you know, timeframe for the Carver Biotechnology Center. In 1998, we got a Keck Foundation grant that allowed us to really invest in, seriously in, in the next generation in 1998 of

sequencing. So that was a benchmark. Now, Sam, was that something that you were part of? I know you'd left Illinois by that time.

Sam Kaplan 54:55

Yeah, I mean, we had the first primitive DNA sequencing, but as I pointed out, was that, you know, at the time, life was really slow. It took a few hundred thousand dollars and months to do a microbial genome. Now, you could do it in two days for \$500.

Bruce Fouke 55:21

That's incredible. It's incredible. And then a next benchmark I just wanted to mention was in 2005, and that's when the Roy J. Carver Charitable Trusts out of Muscatine, Iowa, that's when they made a very significant investment into the Carver. Again, it was, it was it helped with the sequencing, but also it became much more broad-based, and we were able to invest in and bring in technicians, and also instrumentation across the board to the DNA, RNA, protein kind of suite. And then again, in about 2009, we received some next-generation funding to continue the investment in in our sequencing capacities. And then now again, in 2024, we end up with six full operating cores, you know, 36 full-time technicians and staff employees. I wanted to point out to that we're still named the Roy J. Carver Biotechnology Center from that 2005 very generous contribution. But then, since 2005, up until the modern times, we've been able to continue to receive instrumentation support from the Carver Charitable Trust, which has been another absolute cornerstone, and that's been distributed over the years, just regular the investment after investment.

Sam Kaplan 56:41

That's incredible. Incredible.

Bruce Fouke 56:44

It's been, it's been bigger than life for us. And I just wanted to, you know, reinstall that again, you know, the foundation that both of you built, that was the foundation on which we were able to approach and be able to build these very long term relationships, you know, with the Carver Charitable Trust, with the Keck Foundation, and importantly to with all the, the international biotechnology industrial partners that we have.

Sam Kaplan 57:09

Fantastic.

Bethany Anderson 57:13

I just wanted to ask a quick question, just because this has been on my mind in thinking about the larger place of the CBC in the history of science, and the history of science on campus and more broadly. I wondered if you could all talk a bit more about biotechnology, and how you would define that and what was or how is biotechnology conceptualized, you know, in the 1980s versus today, if it's changed at all? I just wondered if you could reflect on that and provide your own definitions, that would be really interesting.

Bruce Fouke 57:51

Ted?

Ted Brown 57:53

I'm not, I'm not a biologist, so you guys have to answer that one.

Sam Kaplan 57:57

Initially, I mean, you know, any pharmaceutical company will tell you that biotechnology has been around for a long time. And as a matter of fact, if you, if you brew beer, or make wine, that's biotechnology. It's taking the basic principles of living systems, and making applications to other living systems, or to nonliving systems. So, I mean, in that regard, biotechnology is all encompassing. And I think today, especially with DNA sequencing, and the ability to manipulate genomes, and the ability, for example, the new NIH program with the brain, I mean, in terms of mapping the brain. I mean, this is all biotechnology. I mean, it has taking anything, in my opinion, in the life sciences, and making applications to both the living and nonliving world.

Bruce Fouke 59:08

That's beautifully stated, Sam, thank you. And also, I think that just to build upon that, you know, that the current portfolio of the Biotechnology Center, is that we have over 50% of our projects are funded by the National Institutes of Health. So, NIH over 50%, which is really important, but all the rest are, you know, National Science Foundation, Department of Energy, the list goes on, USDA. But, you know, it's important to remember just what a diverse footprint, but that footprint is still anchored in the life and medical sciences, right. And so, it's given us that ability to keep, you know, addressing and supporting. The National Science Foundation, a few years ago, had something about the Top 10 Big Ideas, I think, Big Ideas Top 10, something like that. And the heart and soul on every one of those basically was a requirement to do biotechnology. And so, it's exactly what Sam said. I think my job with the word biotechnology is much easier now. Because everyone has these smartphones and all these brilliant young people called students and postdocs, and what-have-you on this campus, incredible, always inspirational, much smarter than I am. And it's just a matter of keeping up with them. But there's a, there's a feeling, I think there's been a sea change in what the idea is, because I think now we live in a society where biotechnology, well, it's not really understood, exactly what it is. But it has to be had, and it's something we're part of, and I don't know what it is, but I must have it now. And it's the only solution for the future. Right? So, it's interesting that there's not necessarily a detailed definition in a lot of minds and hearts and souls right now. But there's a huge, broad acceptance and a basic buy-in that this has to happen.

Sam Kaplan 1:00:54

Bruce, can I ask you a question? How does the Biotechnology Center interface with graduate students? And the reason why I asked this is because oftentimes, graduate students, new graduate students are very naive in terms of what they know. But on the other hand, there's a lot of imagination there. And, and they often have ideas. And so, the question is, how do they, students, interface with the Biotechnology Center?

Bruce Fouke 1:01:29

And Sam, what you described, you know, the kind of this, this thruster engine of the science and technology moving forward, it's this incredible grouping called graduate students at the current moment, right, who are all the future to us. And so, what we do is, we work very hard with each and every PI that we work with. They know that there's multiple options, one option is to either have the PI and or their graduate students or postdocs be the people who interface with us and hand off samples, or PI hands off samples, that's kind of one model. The other model, which is the other end, is that the principal investigator, the faculty, they send their graduate students to us and we train them. And we give them extensive training.

Sam Kaplan 1:02:14

That's what I'm looking for, that's terrific.

Bruce Fouke 1:02:16

We spend a lot of time with that, Sam. And then the other, another portal for that is that we teach workshops. And we do that for hundreds of people, often on campus throughout the year. And those workshops are primarily attended by graduate students. And so, we have that feeder. And then the one thing I'll say, as further just, you know, enthusiastically saying you're right on, Sam, is that we also work very hard to make sure that this engagement with the graduate students, it's so important, because even the very accomplished and brilliant principal investigators, right. None of us can know all the things that are happening all the time in every way, right. And so that's, we found to be another just, such a positive form of engagement and communication. It's that when we bring the graduate students in the lab, and we train them have to go back and forth, they bring data back along with new capabilities that the PIs either did know a little, or knew nothing about. And it's that synergy where you just keep evolving all these research programs forward through time with this ongoing injection of the newest, latest and greatest.

Sam Kaplan 1:03:28

That's really interesting. I mean, I think that's terrific. Yeah. Yeah.

Ted Brown 1:03:34

I wonder how this plays into the formation of this new College of Medicine on the campus, because you have there an entirely new—not an entirely new obviously, but, but a very different sort of model—which brings in people from areas which you might not have thought of as being allied. But now it's clear that you have to include that stuff. And it looks, from all I can see, it'd be quite a success.

Bruce Fouke 1:04:05

Oh, you're exactly right, Ted, thank you. And what we've done is we've worked very hard with the Carle Illinois College of Medicine, so we're deeply ingrained there. Right now, we probably have something on the order of 60 or 70 PI's that are part of the College of Medicine. And we see that as another natural growth area for us as the college continues to, you know, to get traction and build. And that was also part of that relationship with the Cancer Center of Illinois. So, between the Cancer Center of Illinois and the Carle Illinois College of Medicine, that's just, that's such a momentous and immensely important, you know, group of entities that are driving forward the whole health initiative and we keep working to make sure that

the Carver is already in there as a corner piece. But we see the growth of that to be tremendous over the next few years coming up. So.

Sam Kaplan 1:04:58

Interesting.

Bethany Anderson 1:05:00

So, I wanted to touch on something you just said, Bruce, which is the kind of the changes with technology that have happened over time. So, I wondered if you could all talk a bit about the instruments, the instrumentation that the CBC has had, and how that's developed and grown?

Sam Kaplan 1:05:20

Well, I can tell you that originally, I mean, we had, you know, what was available was, we could do plasmid isolation and restriction mapping. And we had primitive, the original DNA sequences, but from what I hear being described, all of that is firmly outdated from what's available now.

Bruce Fouke 1:05:49

You know, it's hard to really get your head around what's going on, you know, our abilities within the Carver Biotechnology Center to do some of this, this core sequencing of DNA capacity, or RNA capacity that Sam was describing, you know. We can now do, like Sam mentioned, we can do entire genomes in hours within just the Carver Biotech Center, right. It's mind boggling, right? And, and then, you know, we're right on that cusp, you know, we get the latest and greatest from Illumina and others in terms of their cutting-edge instrument. And then we're the ones to use it the first, and then we, you know, give feedback, it gets modified, we do that with, you know, other companies like 10x Genomics, what have you. So, it's exactly what you're describing: the capacities, with each of the quantum leaps that now happen over and over and over, it's not like, you know, there's a timeframe, really. It's like, well, it's happening in weeks, you know, two months of when those things, you know, it's just hard to, it's hard to even grasp what's happening. But the thing is that we understand that, you know, the two core pieces of this that both Ted and Sam set up all those years ago, is that you have to have excellent people first, and you have to have the excellent instrumentation second, and those two things have to be hand in hand. And you put those together, and then you're at that cusp. We spend a lot of time and effort in finding and supporting our individual laboratory directors within the Carver Biotechnology Center. And so, we because we depend a lot on their input, and then that's where the input from the faculty advisory committee comes. And then also we have very open engagement. So, you know, our, the over 500 principal investigators that work with us, there's also constant engagement back and forth. It's very rare that something just gets dropped off, analyzed, and we send back a spreadsheet. That's very, very rare. And in those kinds of... we just recently had someone from the west coast, who runs a neurobiology laboratory and was interested in some of the spatial biology that we're doing which, at this moment, no other place in the world has invested in all the instrumentation needed. We're really the one shop that can do it. And he flew out here from San Francisco just to come to the lab for one full day. And then, you know, the scale of the projects, we're now getting a single project—I know Ted and Sam, this will blow your mind.

But I think, Bethany, this goes to your question of the, you know, where we're at, where things going, what it is. It's that individual projects we're looking at for the spatial biology, which requires DNA sequencing, it requires cytometry, it requires, you know, all the high throughput, TNX spatial genomics. It requires all of our bioinformatics, you know, all of our cores now are interfaced. That's the only way we could do that. But if you can imagine this, single projects, I'm not exaggerating, they can range from \$50,000 to \$200,000 per project. And so, that also, the economy of, scale of those, as we keep preparing for the future, at those kinds of scales, you know, it's a whole different throughput. The number of things we can handle at once is different for a project where, you know, individual projects, you know, over the years \$20,000... \$25,000, that was a big project right? Now, it's an order of magnitude, and we have to predict and budget and prepare very differently for you know, single projects that are \$250,000 in scale.

Sam Kaplan 1:09:29

Wow, fantastic.

Ted Brown 1:09:33

Bruce, I hope your health continues to be good because I can see that the damn place really needs you.

Bruce Fouke 1:09:41

I've just surrounded myself with incredible people. We just try to run like the wind together, you know. But I mean very seriously to both you, our appreciation, because there are ways that both of you set this up, that I can tell you a week doesn't go by when I don't think about the dedication, the struggles, the determination that you folks had to do. But the way you set it up, you've given us freedoms, like the engagement, multi-tiered kind of, multi-support. What that does for us now, I can tell you, it's bread and butter, and the Carver Biotechnology Center would not be in the position right now without the kind of vision and also just, you know, brute force practicality that you folks put together. So, thank you very much.

Bethany Anderson 1:10:27

Yeah, it's really amazing just to think about this freedom of the way the setup was, you know, established by Sam and Ted. And the interdisciplinarity. That's been really important to all of this as well. And so yeah, Bruce, you became director in 2012, correct, I believe? Yes, yeah. And so I was just kind of wondering if you, and you've already talked about this a little bit, but if you could talk a bit more about the organization of the CBC today in some more details and in where it administratively falls because it was originally part of the Graduate College, I believe, so it'd be interesting to hear about how that's changed over time.

Bruce Fouke 1:11:04

Yep. And I'll just start with the kind of overall campus structure. So, we've went from where Ted and Sam put it all together and made it happen, to now we are still under the umbrella of the Vice Chancellor for Research. But we're an independent line off of that. It's just, it's so important to us, though, because when we go and work with anyone from across campus, we aren't under anyone's umbrella except for the Vice Chancellor for Research. And so that means that, it's not that this is negative or anything, but that means that when we go to the table with big ideas, investment needs, these are what we have to go for. These are the kinds of grants we need to make sure we all work on. We're not doing it from an individual school, or

individual unit, or department. We're doing it from the campus. And so that has given us you know, on the same kind of tier as the Beckman Institute, on the same kind of tier as the Institute for Genomic Biology.

Ted Brown 1:11:55

Yes, that's one of the things that the Beckman Institute inadvertently started up. I mean, the whole notion of, it was a standalone unit, we're not a college, we're not a department, we weren't a school, we were a standalone entity. And, and we got away with that. I mean, there was a lot of fussing about that back in the days, and a lot of the department heads and schools... Sam was a very enlightened person, but some of those people in the administration of departments, and so forth got very upset about the fact that there was an entity that they couldn't trace a, you know, faculty line through and so on. So, it's important to have that capacity to, to maneuver.

Bruce Fouke 1:12:39

Yeah, no, it's... I can tell you, I mean, again, there's not a week that goes by that that independence, you know, my only direct oversight is the Vice Chancellor for Research. No one else. Yeah. And so that allows us again, to have the strength, the wherewithal, the connectivity with campus. Again, you know, the Carver Biotechnology Center, again, building from how you started it, that we have only one mission statement. That is the greater good of the campus of the University of Illinois Urbana-Champaign, the state, and the nation, and the world, right. So, the greater good is all we have to... and we have to be able to pay for it, right? So, but we don't get bogged down in all the other things. And that really...

Ted Brown 1:13:19

Who is the Vice Chancellor? Who is the Vice Chancellor for Research?

Bruce Fouke 1:13:22

Yeah, Susan Martinis.

Ted Brown 1:13:25

Oh, yeah. Susan. Sure. Yeah. She is good.

Bruce Fouke 1:13:26

She's a very skilled biochemist. And, yeah, I like her a lot. No, she's a visionary and incredible person. So yeah. And then, Bethany, I'll just speak briefly, so that that structure is so important, thank you. And then the other thing I wanted to point out is that the current structure of the CBC, of the Carver Biotechnology Center itself, so we have six cores. So, at the moment, we have DNA services, that's the high throughput sequencing of DNA and other RNA as needed. We have functional genomics. And it's interesting because functional genomics being able to go from sequence into activity and physiology directly is kind of how it was originally envisioned. We have cutting-edge instruments for that. But you know, as these things change with time, as the technology advances, the walls between things like DNA services and functional genomics is now kind of a blurry... it really doesn't mean much. So, you know, we're always looking at ways that those are going to be eventually coming together. We have proteomics, the analysis of proteins and metabolomics, the analysis of the metabolites and systems and, but you know, that fuzzy... that there is no

longer a wall between proteomics and metabolomics. These are basically one in the same and you're just analyzing across a spectrum of sizes. We've now, what we what we try to do looking forward to these kinds of things is, we see ways where we can keep the integrity of the cores as long as the biotechnology will allow it, in terms of is there a little separation, but maybe not a lot. And then what we try to do then is to make sure that we structure it so it's sustainable. So, like proteomics and metabolomics have now been administratively merged into one. But they still have two separate entities in terms of labs. So that's kind of a steppingstone we have, and then another brand new one that we're so excited about, and we call it cytometry and microscopy to omics. And so, it's the whole idea that you can do cell sorting and cell analysis, you can do counting and separation physically of cells, and whatever kind of solutions you want. We have that directly pipelined into our ability to do what we call spatial omics, spatial biology, to be able to, you know, go into a sample on an incredibly small 50-nanometer resolution, you know, analyze expression and proteins and what have you, within that context. And so, we've also invested in things like next generation, super resolution, confocal microscopes, that are all pipelined directly into capacities. And then these labs are in constant contact with each other. And as they, you know, develop the project and have new samples, then those samples are analyzed in a pipeline, and then they go through, we call it CMTO, the Cytometry Microscopy To Omics. And then, and then, you know, there are only a few meters away, and then you walk the sample up, and it goes right into the pipeline for our high throughput sequencing. And then our, the other core that's so important for all these entities is our bioinformatics core. It's called HPC Bio, High Performance Computing Bioinformatics. But bioinformatics is the analysis of all the data. And so, we have a robust team that's, you know, running that. We're in close collaboration with things like the Institute for Genomic Biology, the National Center for Supercomputing Applications, you know, basically, there's not an entity on campus, you know, Veterinary Medicine, you know, there's just no one's safe from us. Right, we, we are connected with everybody. That's just a that's a sketch of the current structure of what the Carver Biotechnology is composed of.

Bethany Anderson 1:17:15

Right, yeah. And I also wondered if you could talk a bit about SHIELD since we're just coming out of a pandemic, and, you know, the campus was really mobilized scientifically and administratively to deal with COVID-19. So yeah, and from a previous conversation, we kind of mentioned this. So, if you could talk a bit about your efforts during COVID, that'd be great.

Bruce Fouke 1:17:35

Well, during those during that dark winter of 2020 when everything was unraveling, and then we had to quickly move, you know, I can tell you, I've always been so thankful and proud to be a member of the Illinois campus for so many reasons. But there was never a moment I was more proud than, you know, January and February of 2020. Because our campus mobilized, from the most grassroots level you can imagine, but it was natural, and it was just made, you know, gosh darn Midwestern practical sense, right, because we already had all these relationships, we were already so deeply tied. And one of the ways that the collaborations have always been manifested is through the Carver Biotechnology Center. The campus got very, you know, very progressive, and we were one of the first ones out of the blocks in terms of having things put together. And that's because, you know, we had the intellectual drivers, you know, in terms of the leaders on campus who had been identified in the different departments, who already were working

with the Carver Biotechnology Center. And then we were on the, at the table for all the discussion. So, we were part of building the first lab of the Carle hospital, the first sequencing of the of the COVID. And then we moved everything down to Veterinary Medicine. And we were part of those moves. And then actually, employees from the Carver, because we had such a brain trust of capacity, we actually moved employees, we kept them on our salary lines, and we just had them move physically down to the Vet Med sequencing facilities and what have you. And then that was built out into the umbrella that was called Shield. And so, it was the overall capacity to have saliva testing, the high throughput sequencing, very quick analysis of either you have COVID or you don't, and what kind of COVID is it? And then of course, our bioinformatics group was well positioned to be part of all the bioinformatics computer analysis of the immense datasets that were being driven. And then, you know, there was a time period, I think it was March... the reason I remember this, I think it was March 5 or something, right? When everything was you were coming to the point where you know, the those first cases had been found out in Washington state, and then it was clear there were many more, and then I think was March 5 or so, something like March 9, that you know, the formal declaration of a pandemic was put out, and in that window of time, if you can believe it. There was a short period of time there were a big because of this, this Shield network that the Carver was one of the life bloods of, that our campus alone, the University of Illinois Urbana-Champaign, was completing 5% of all the COVID testing and the sequencing that was being done in the entire nation. An entire nation, 5%, just our campus, right. Now, of course, thankfully, that changed quickly. But you know, we were, we spearheaded the development of, you know, that saliva test that was given out and then it was freely, you know, shared with everyone. And then we ended up doing the COVID testing and sequencing for many universities across the US during and throughout that time period. So, that's a bit of a sketch of it. But again, you know, the long-term investment in what Ted and Sam had started, it positioned us perfectly to be agile and immediate, and be able to not only dedicate instrumentation and technique, but actually, personnel to be able to be devoted to that. For our approach was, at the Carver, come what may, whatever it takes, we're in. There's not, there's nothing, there's no question, whatever is needed, we do it, end of story. Right.

Ted Brown 1:21:14

One hell of a good salesman, Bruce.

Sam Kaplan 1:21:19

So terrific. Yeah.

Bethany Anderson 1:21:23

Well, what's next for the CBC?

Bruce Fouke 1:21:25

Wow, you know, I think that, you know, the campus' investment in the health, the whole, the whole health concept, you know, like, Ted and Sam had been bringing up the ideas of the current Illinois College of Medicine, the Cancer Center of Illinois, there's multiple other major, you know, initiatives going on. So, you know, that's one of the big growth sectors, but I'll tell you honestly, you know, that currently, we have, you know, six core facilities, but we actually have an additional series of satellite, small rooms that we

maintain and operate instruments in as well, that are scattered all the way from, you know, from engineering all the way down to interface with Vet Med and the Research Park and the whole thing. So, we're connected broadly across the campus. But there's just no doubt that the health, the health corridor that's going to be built out along University Avenue, to further develop that, you know, the Carver Biotechnology Center is front and center as a cornerstone of that. And so, we see the growth, I mean, literally, we, we are at the tip of the iceberg. I mean, we ain't seen nothing yet. We're getting prepared and positioning ourselves to be at that cusp, because we think that, you know, the need, the capacity is going to be there to grow. But what has to be done is we have to have a vision to do the growth with the models that Ted and Sam put in place originally, which is the structure of the funding, which opens doors for engagement, that goes from initial talks all the way through a high end, you know, top journal publication and changing how we do science in the nation and the world, right? So, we have that entire spectrum that has to be maintained, which is allowed because of certain kinds of structures.

Sam Kaplan 1:23:01

One last question—so on publications, is the CBC mentioned in the acknowledgement section as a contributor?

Bruce Fouke 1:23:13

Yep. So, we have, again, kind of two major flow pads for that point, Sam. One of them is that we get listed in the acknowledgments. We're very appreciative for that, it makes sense. But we've actually moved it to a whole another, the whole goal line has been moved again. And so we are, both our directors, you know, and also the technician staff within the Carver Biotechnology Center, they are stepping up to become actually full-on co-authors on the publications. That's how fundamental it is, so we have both paths running. And you know, we're talking, you know, total now, you know, tens of thousands of publications.

Sam Kaplan 1:23:54

To me that's important. Yeah.

Bruce Fouke 1:23:56

Oh, critical, critical. And, you know, that comes up all the time, Sam, every year when the Carver Biotechnology Center gets evaluated by campus and you know, other entities. It's just like it is in the academic units, right? I mean, the productivity in terms of the engagement and support of the students, support of the postdocs, the outreach to the greater community, and the measurement of the excellence according to the journals, the quality of the journals, and the number of publications. We're operating with the same standards. So okay.

Bethany Anderson 1:24:31

So, as we wrap up here, is there anything else that any of you would like to mention or have a question about that you'd like to ask each other?

Sam Kaplan 1:24:40

I'm set. This has been terrific.

Ted Brown 1:24:48

I'm hoping to get on campus one of these years, and I don't have very many years to do it, so I better get busy if I'm going to do it. Well, I would love to be back on campus again as a lecturer this fall, and I'd like to get there, so maybe I'll see you in September.

Bruce Fouke 1:25:03

Well, for both of you, I want you to know, I warmly welcome you, we will roll out the biggest red carpet you've ever seen. And we will bring you to all the facilities and you know, all the connecting points we've talked about across campus. Please let us know. And we would love to be a major co-host for you or host itself, it doesn't matter. If you want to come back to campus, we'll make sure that it's something you can really, you know, walk through every aspect that we've just gone through. So, and I also want to just you know, thank you both very much. I mean, that very sincerely from the heart, thank you.

Ted Brown 1:25:38

Thank you, you're very generous.

Bruce Fouke 1:25:40

We could not just, we could not do without you. So, thank you.

Sam Kaplan 1:25:48

Thank you, by all means.

Bethany Anderson 1:25:53

Well, thank you all so much for just being so generous with your memories of the founding of the CBC, and in sharing a bit about yourselves as well. Just really appreciate that, so thank you.

Ted Brown 1:26:07

Yeah, thank you very much for putting up with us.