John Crawford

Interview conducted by

Matthew Shindell, Historian

July 8, 2008

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John Crawford

Mr. John E. Crawford serves as Financial Advisor of Cebix Incorporated. Mr. Crawford serves as Principal Accounting Officer of NovaCardia, Inc. Mr. Crawford co-founded Cabrellis Pharmaceuticals Corporation in 2006 and served as its Chief Financial and Administrative Officer. Mr. Crawford served as Business Development Consultant at Lithera, Inc. He served as the Chief Financial Officer of Phenomix Corporation since October 2007. Mr. Crawford served as Chief Financial Officer of Conforma Therapeutics Corporation since February 16, 2006. He served as Chief Financial Officer of NovaCardia, Inc. from January 2007 to September 2007. From 1997 to December 2005, Mr. Crawford was a Consultant to life sciences and technology firms. During this time, Mr. Crawford served on the Board of Directors of several private companies and was a Consultant to Archimedes Technology Group, LLC. He served as Founding President of San Diego-based Corvas International, Inc. and held various positions within it from 1987 to 1999, including that of Chief Financial Officer and served as the first full-time executive of International Genetic Engineering, Inc. He was an Executive Officer of early-stage life science and technology firms since 1981. Since 1998, he has been a Consultant, Executive Officer and Board Member for several venture-backed and privately funded technology firms. He has 25 years of extensive experience in the areas of biopharmaceuticals and medical devices. He served as a Director of Lipid Sciences Inc. since May 17, 2006. Mr. Crawford serves on the Board of Directors of the Clearity Foundation for ovarian cancer. Mr. Crawford holds a BS degree in Mathematical Sciences from Stanford University and an MBA in Finance from the University of Chicago Graduate School of Business.

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THE SAN DIEGO TECHNOLOGY ARCHIVE

INTERVIEWEE: **John Crawford**

INTERVIEWER: **Matthew Shindell, Historian**

DATE: **July 8, 2008**

LOCATION: **San Diego, CA**

SHINDELL: So, this is July 8, 2008. This is an interview with John Crawford. The interviewer is Matthew Shindell. This is the San Diego Technology History Project. So, you can start pretty much wherever you want, but why don't you, if you'd like, start by telling us basically who you are, and what you do, in your own words. And, and then you can go from there to how you got involved in this sort of thing.

CRAWFORD: Okay. John Crawford. I live here in San Diego and have been here for twenty-one years. From an academic background, I majored in math and economics at Stanford, and took an MBA in finance from the University of Chicago. I spent about five years in a large commercial bank lending to high-leverage firms, mostly in the media industry.

SHINDELL: Can I interrupt you for just one second? Could you also give us say the years, say, the year that you finished your degrees?

CRAWFORD: I graduated 1976. Took the MBA in 1979. I was in the night program, so I worked at the First National Bank of Chicago from 1976 to 1981. My work there, as I said, was with high-leveraged lending to media firms, and that prompted my interest in venture capital and owner-manager situations, as I saw some very interesting jobs where managers had a lot of control over what they were doing, and but had to live sometimes month to month, but certainly year to year, not knowing whether they'd be financed and whether their companies would survive and so forth, which appealed to me. And, of course, the rewards of doing that appealed to me as well. So, I moved from there into venture capital. I came back to California at that point, having grown up in California in 1981. I went to work for the venture capital

unit of Atlantic Richfield for just a short time. I thought I'd be there for a while and maybe get some board experience and then eventually transition to a small company. But, one of my first opportunities there was to get Atlantic Richfield involved in this new science they were calling "genetic engineering," both offensively and defensively. Atlantic Richfield, as a fine chemicals producer, thought there might be some opportunities for producing these fine chemicals by other means than just refining them from petroleum, and also was concerned that this new technology might take markets away from them, including the energy market. And so, I got them involved through some UCLA professors. We assembled a group of professors from the different aspects of genetic engineering and got to know these guys pretty well, and we started talking about maybe the thing to do was for them to form a firm, and maybe ARCO could invest in it, or sponsor research with it. I soon went to ARCO and said, "Gee, I'd kind of like to do that. I know it's a conflict but, you know, do you mind?" And, they were very gracious about it and so I became the first employee of that firm called International Genetic Engineering. That was in 1981. We went public in 1986. That firm just stuck with the strategy of doing contract research and didn't retain proprietary rights in its products. It was the first profitable firm in the industry, a very small industry, and one of the first ten firms in the industry. That was to its credit, but the Street was looking for firms that had – the "Street" meaning Wall Street – was looking for firms that had proprietary interests and could really hit a homerun. If their product succeeded, that they would own it and all of the returns that could be gained from it, not just taking say a royalty stream from sponsored research. So, about a year after we went public I left and formed a firm down here with a group of Scripps investigators, this was in 1987. It was called Corvas. I was there for eleven years, full-time, was founding president. I assembled the financing and the strategy. I got some partners and so forth. I was with the firm a total of eleven years. The first two years I was CEO, taking it through two rounds of financing. And then, as it grew pretty fast and furiously, and I was really more interested in being part of something big and successful, and necessarily leading it, and I was finding I was spending an awful lot of time learning on the job. So, I worked out an arrangement with the board where we could hire someone else in and then I continued as CFO. That firm's focus was cardiovascular disease, strokes, heart attacks, and so forth. It went public in 1992 and had an up and down history as so many of these firms had, but in particular had a very promising stroke drug that was sponsored by Pfizer. That didn't, in the end, work out. The data were not strong enough to take it into Phase III, which was very difficult for the firm. It

had a couple of other anticoagulant or antithrombotic agents that also struggled in the clinic that were sponsored by Schering Plough. I left just for personal reasons in 1999, having worked very hard and wanting to spend more time with my three young sons. So, I consulted after that for about seven years. I worked for a number of firms, usually in an advisory capacity and usually as an acting CFO or actual CFO in helping them raise funds. During that time, that consulting period, I also worked on my own firm for a while, whose technology didn't pan out, as if often the case. There are a lot of nonsuccesses. I won't quite call them failures. For every . . .

SHINDELL: What was the technology that you were working on there?

CRAWFORD: In this case it was stereo-specific phosphorothioate oligonucleotides. They have to do with antisense technology. Antisense molecules have a stereo feature to them so when they're synthesized they aren't exactly as the natural ones would be, which do not have this stereo feature at each stage in their synthesis. The idea was that these would be more accurate and I think it's probably still a promising idea, just the chemistry behind it, which theoretically looked correct, did not pan out in the lab. We were not able to reproduce that adequately in the lab. So, without that there wasn't much to go on. You know, good concept, good idea, but didn't execute. So, in 2006 I went to work for Conforma, which had a technology platform on heat shock protein 90, or HSP90, which had some applications in cancer and other areas. I joined to take them public or help them with what we call the "liquidity event," or getting the initial investors to the point where they can sell their stock, whether that be by selling the whole company or by going public and then being able to eventually sell their stock into the public market. Fairly quickly we developed a couple of acquisition proposals, and one of those panned out and we sold the firm to Biogen Idec, which is a another local firm, or it's actually based in Boston but has a very large presence here in San Diego due to its own merger. There was a piece of that technology the firm didn't want. It didn't fit their profile. Quite sensibly they didn't want it. We placed that in a subsidiary and dividended it out to our shareholders and then our same venture capital investors invested in us. We had had some interest by other parties in that product and so we were actually able to sell that company as well about six months later. The Biogen Idec transaction was about a $250 million transaction. The second firm called Cabrellis had about $10 million invested in it, or exactly $10 million invested in it and we sold it to Pharmion, a much larger biotech firm, for $104 million, about six months later. From there I

went to NovaCardia, which was headed by Randy Woods, who had also been the third CEO at Corvas, so someone that I had worked with before. And, same objective, to take the company public or otherwise find an exit for it. We filed for a public offering, cleared the SEC, and were ready to go, but had also been talking about acquisitions, and at that point Merck made a strong indication of wanting to acquire us. So, we sold that firm for $350 million in Merck stock in 2007. Next, I joined this firm, Phenomix in 2008 and, or actually late 2007, October of 2007, and actually we've gone through two rounds with the SEC and would be prepared to go public but the public markets are closed to IPOs right now. So, we won't have that opportunity with this firm. So, we're looking at alternatives, as well, for exit. So, the career has been primarily CFO and financial roles, although I have been CEO a couple of times, and been acting CEO in a situation where I was on the board and there was difficulty with the management team. But, it has been very much from a financial perspective that I followed things.

SHINDELL: Okay. Let's go back for a second to your educational background. Your background is in mathematics and economics. Were you at all interested in the biosciences prior to discovering biotech and genetic engineering?

CRAWFORD: Actually not. My last class in biology was as a sophomore in high school. And, as I think so often happens your interest in a field is very much biased by your first experiences with it and how you learn about it. Teacher was poor, and my math teacher in high school was superb. And, I think that, as I look back, had a lot to do with the fields that I went into. Also at Stanford, the biology was the premed field. I wasn't interested in becoming a doctor, and you had to be a little wary about taking premed classes because the competition was just incredibly intense. So, not having any particular interest in biology, not knowing any better, it made more sense to take physics and, you know, geology and things like that.

SHINDELL: Uhm-hmm. So, you went into mathematics. Did you have a notion that you would be going on to economics when you first chose mathematics, or were you just sort of interested in math?

CRAWFORD: My interest was in business. And I figured I probably would go the MBA route. I was ambitious with respect to making money, not having grown up with very much. And, I was comfortable with math and figured, "Well, it doesn't hurt, you know. It's something I was relatively good at and . . ."

SHINDELL: So, you wouldn't say it was a love of pure mathematics? You were more interested in applied mathematics from the beginning?

CRAWFORD: Yes. In fact, I kind of skipped over something. I say I was a math major. It was actually called the Program in Mathematical Sciences. It was a four-discipline field with theoretical math, statistics, operations research . . . and there was another one in there. [Laugh] I forget. I guess computers, there were some computer science elements to it, and it also required the core physics program. So, it was a, like you say, an applied math program.

SHINDELL: And then with the first, the first group that you formed with the UCLA bioscientists, they had presumably never had a background in math or economics? Or, well, they had some math, obviously. But, you know, they had not done any biotech ventures prior to that? They had not tried to create any products?

CRAWFORD: None of them had any experience. Yeah.

SHINDELL: And, you didn't have experience with biology. So, what was that like, sort of crossing worlds with your background and theirs?

CRAWFORD: Well, first of all nobody had any experience. You know, Genentech had only been formed a couple of years earlier. Amgen was in formation at the time. So, nobody had experience. So, we weren't at a disadvantage in that regard. I like science, in general, and this applied math thing had given me exposure to several sciences. So, the biology appealed to me. I mentioned there were four, or six rather, UCLA professors. They were willing teachers and they even had some video tapes of, you know, basic gene splicing and stuff. So, I watched those, read a couple of simple books. I attended our weekly science meetings where we all got together and talked about different products they might attempt to develop. And, so I started to pick up the science. I love science. I respect it. I'm not afraid of it. And, I'm conceptual enough that I didn't really need to spend, you know, five years getting a PhD in the field to at least understand the basics of it and what made sense. And oddly enough, that turned out to be quite an advantage with respect to getting the initial clients that we had in that firm. Because, the heads of research in large pharmaceutical firms at that time were chemists. Chemistry was basically what the drug industry was based on. And, they knew about this genetic engineering. They were skeptical of it. They were afraid of it. They were somewhat, some of them I would have to say

were pretty cynical about it. That this was just pie-in-the-sky boloney. So, when I went out initially to speak with these guys about explaining our firm and that we were seeking research contracts, or could give advisory service for helping them get into the industry. These were some of the large pharmaceutical firms that we were approaching. I would go out alone, partly just because the other guys were teaching and busy, and kind of do the first cold call, and I could say to them, "Look, I'm in the same boat you are. I'm not a biologist or anything, but let me kind of explain from my perspective how I've come to see the science and where it can apply," and would go through just some of the basic aspects of, you know, the function of hormones, which they were familiar with, but how, how these biological actors might come into play on it and how we might derive chemically-based drugs from that eventually, and so forth. So, it was very non-threatening. Whereas, when they got in the room later with the scientists and MDs and the jargon started bouncing around, and, and they started getting hit with words that they didn't know, then you could just kind of see the tension levels kind of rising. But, I got the first level of comfort going and then by coaching my team at InGene to be aware of that and avoid the jargon, to understand that these guys were top notch. I mean, you know, the head of research at Merck is a pretty sharp guy. He just didn't know our field. Our objective was to get them comfortable with it and to see us as a resource for that comfort, and it worked. We got a lot good contracts doing that. This, the whole strategy was still a bit flawed in the sense that we didn't keep anything for ourselves, to speak of. But they, my lack of knowledge in the biology area and learning it from and outsider's perspective turned out to be an advantage.

SHINDELL: Did you – it sounds like you got a sense that there were two really distinct cultures there, the culture of say the academic biologist, the UCLA guys that you were working with, versus the culture of Merck heads of research and development, who also presumably have a background in science as well but are doing science in a much more, I don't know, corporate or industrial environment. Do you think that's the case, that there were two distinct cultures or . . .

CRAWFORD: Oh yes. And they, and they have changed quite a bit over the years out of necessity.

SHINDELL: How would you characterize that?

CRAWFORD: In a large company like that you'd have a chemistry division that

might be located in one town or one state, and they would go through and develop a whole bunch of these compounds that met criteria that had been set, and then they would be signed off and shipped to another group that might screen or further characterize, or try to develop animal models and so forth on them. And, the feedback and communication between those two groups was often minimal and was astounding to us coming from biotech. And not so much at InGene, but at Corvas, the second firm that I was involved in. We had, on the same floor, running down one side the chemistry group and running down the other side the biology and in vivo testing group. And, you'd have compounds synthesized with expected properties and then run through various quality control screens to make sure we had what we thought they were. Next the compounds went to in vivo pharmacology and to be tested in cell cultures and very often in mice, very rapidly. In a period of a week or two feedback coming back as to a compound was reacting and whether or not it was inhibiting the clotting function, for example. And then the chemist would take, you know, there might be ten compounds that had been sent over and two might have interesting properties, and they'd study what were the properties about that that might be conferring this activity. And then, they'd go through a cycle in chemistry where they would synthesize more of that class and then they'd cycle back through in vivo pharmacology. Well, that was not possible, not done, in the large companies at that time. They were distinct entities and the people hardly knew each other and they weren't communicating. And, that's one thing that I think had a lot to do with the rise of biotechnology was that chemistry and biology were eating lunch together in the lunch room, or running into other in the restroom, or were face to face with each other. And while sometimes we had some pretty significant cultural disputes and differences as to, to how things were done and who was really doing the important work, [Laugh] and so forth and so on, as scientists, as they got working together and began to realize that by working together they got some pretty interesting results, that encouraged everybody and built some momentum. This was taking place across the industry. It was this kind of marriage between sciences. In other words, chemistry, to my mind, had run the gauntlet in refinements. Improvements in the field were pretty marginal, you know, getting down to really fine points. And biology, while it was an exploding field, wasn't interacting with chemistry. What we began to call biotechnology, to my mind, was in large part a merger of two disciplines that hadn't talked much before. And, if you look, at DNA and the very basis for life, it's chemical molecules. It can be synthesized. So, that was, to me, the revolution in this thing. I mean, yes, just the biology aspect was a

revolution, but the merging of those two fields had a lot to do with it.

SHINDELL: Uhm-hmm. Now having, you know, multiple disciplines under one roof in a new biotech company or venture, it seems like that is sort of the key to this, this sort of new innovative process, but what is that the product of? Is it just the product of the fact that these are startup companies, and they're small, and so people are necessarily close together and working towards a common goal of making a thing profitable, or is it more a result of sort of a new philosophy of how to do things, of how science and technology . . .

CRAWFORD: Well, I think it's a mix of all of those. There is, in small companies, less focus on self-interest and more focus on team interest simply because there's a good chance the company won't make it. But, if it does make it, you make out very well. When you're working in a large firm you don't have impact as an individual, unless you're CEO or something, on the outcome of the firm. So, there tends to be a lot more of, "What about me?" in the big company process. In small companies, people are willing to make remarkable work commitments, and work long hours, with the sense that their work could really matter, that it's one of the only things that the company is doing so that there's a lot of attention to it. It's not one of fifty projects that might get scratched because of budget constraints. I mean, a couple of projects are the company. Scientists had the sense that they were going to be able to go forward with it, and own it, including presenting their work to the Board of Directors and to Scientific Advisory Councils and so forth. You could give them an awful lot of ownership in the work. And, you know, I think that's a lot of what all of us want is a sense of ownership in what we're doing. The small company does that in a much better way than, than a large company. And, that's not only the scientist but the financial guys, and human resources people, and everything. You have impact.

SHINDELL: Uhm-hmm. It's interesting, yeah. In academia, also, I think you wouldn't see, well you definitely wouldn't see financial people working side by side with scientists and, you know, chemists working as closely with biologists. Was it difficult for academic scientists, from your observations, to work in such close quarters or was it something that they adapted to fairly well?

CRAWFORD: It didn't seem – there was just so much enthusiasm, the sense of starting something that could be big that those other things kind of fell to the wayside. And I think, too, just the individual attention that you got, your importance

to the firm outweighed any, "Oh, this is, you know, biology versus chemistry." There was rivalry among the fields, rivalry among individuals and so forth, but to me not the politicking to the extent that you have in the large firms, where the best interests of the company weren't necessarily panning out.

SHINDELL: Uhm-hmm. Okay. So, your second company was Corvas, and that was your first San Diego company?

CRAWFORD: That's right.

SHINDELL: What year was that again?

CRAWFORD: We started in 1981.

SHINDELL: Nineteen eighty-one? So, biotech was sort of just getting off the ground here at that point, is that right? Hybritech was in 19 . . .

CRAWFORD: Nineteen eighty-seven. I'm sorry.

SHINDELL: Oh, sorry. So, that was a little bit later?

CRAWFORD: I get my, I – yeah.

SHINDELL: So, biotech was at least maybe . . .

CRAWFORD: I get my dates – I've been through almost a dozen firms. I guess it is a dozen firms now.

SHINDELL: I guess if you take Hybritech . . .

CRAWFORD: That was 1987.

SHINDELL: If you take Hybritech as the beginning of biotech here, then you were entering maybe within the first decade of biotech here? What, what was the biotech scene like here or would you say there even was much of a biotech scene?

CRAWFORD: Well, Hybritech largely was the scene. There were others. But, in '87 there were about twenty firms that were fully funded venture capital firms. It was a banner year for biotech down here. And, there were some good reasons for it,

including Hybritech. Hybritech was acquired by Eli Lilly in 1986 and Lilly began to make changes there. And, it was a very entrepreneurial culture that was suddenly in a big corporate environment. So, there was an awful lot of talent. I believe there was nearly a thousand people there, and there were several hundred who were college educated biologists, and chemists, and so forth. Mostly biologists. Hybritech didn't have much chemistry. Immunologists, that kind of stuff. And, Hybritech was sometimes cutting back or these people were just interested in doing it again with a younger firm. So, there was an enormous pool of talent down here. So, we had the academic institutions, UCSD, Scripps, and some of the smaller places. I don't know that the Burnham Institute had started at that point, the La Jolla Cancer Foundation was active. So, you had the academic component. You had a large labor force, especially at the sub PhD level. PhDs, experts in the field, you had to hire from outside, or might be available in one of the local institutions. But, for every one of those you hired you needed five or six other people, and that other talent was local. It was available. So, in terms of forming a firm down here it, it was a lot easier. There was a huge labor pool and a lot of academic talent to draw upon as advisors and so forth. There's also just an attitude or a culture and I think it's long been the case in California of going for it, of doing something. And finally, you had a quality environment here. San Diego's an attractive place to live. Housing prices are a little higher, but especially at that time all you had to do was go a little ways east and a family with three kids and so forth could get, you know, a decent single-family house and then have, you know, a mother or father, or maybe both, could have a very exciting career in the biotech industry with good compensation and that stock option, which just might be their key to riches. So, Hybritech had everything to do with the process down here. And, in fact, there was an investigator, I think at SDSU who did something called a begetting pattern, tying all of the early firms back to Hybritech one way or another. And, Corvas was also tie-able back to that because the second CEO, David Kabakoff had been vice president for R&D at Hybritech. And, when we looked to finding another CEO for Corvas, the first place you'd look. And, in fact, I spoke with David and worked with David for four days short of a year before the Board and I convinced him to come over to the company. And, of course, he's still a big figure in the industry here.

SHINDELL: So, it does, it does seem like the local talent is always moving from company to company and sort of, you know, splitting up in one place, meeting up in another. And, it also, in some ways the way that you've talked about it in this

interview, it seems as though the companies are sort of being built not necessarily to produce a product but in a way to be a product themselves to be sold. Is that unique or is that a fair characterization even?

CRAWFORD: I think it's, I think it's a trend. You can't deny that that's a trend, that nowadays, even earlier on in the '80s, the model measure of success was going public and being a successful company. And sometimes it was just going public. And, you know, then quite a number of those firms started doing poorly when they went public, so then you had to add on going public and being a successful public company. At first, when there was a buyout of a firm, even if it was at a good return to the investors, there was a bit of a stigma attached to that. Management hadn't guided the firm all the way, didn't have all the prestige or the cache, and that has slowly shifted to being a very respectable exit for companies. In many ways for investors it has become a preferred exit, because it's immediate in terms of cash return rather than having the additional risk of being a public company and getting a following, and product failure in the late stage, especially with the FDA's tightening of restrictions. And, even when a, when a company's gone public it may be two or three years, or even longer, before an institutional investor, a venture capitalist, can exit, can actually sell their shares. So, in more recent years acquisition has become a more acceptable alternative, and I would have to say in the last several years it's probably become a preferred alternative. Sarbanes-Oxley and the additional costs and burdens of being a public company have been a deterrent as well to that as a liquidity vehicle, or financial exit.

SHINDELL: And based on your own observations, do you think that this trend helps or hinders the actual eventual product development once these smaller companies are bought by bigger companies and maybe their research becomes a division of a larger company?

CRAWFORD: Oh, you know, if I really get kind of conceptual or theoretical about this, it's a shame that the bias for investors, and I've been a part of this too, is for later-stage programs that already in the clinic. They are "derisked" from the R&D standpoint, the research standpoint in particular. Products are advanced in the clinic from, say, early Phase I or pre-clinical, through maybe Phase II, which still is fairly modest in cost and then sold to large pharma. So rather than having a ten year development time frame, which makes it very hard for early investors to get a good return, you've got a three year development time frame. The victim in that is the

early-stage, creative, scientific developments, "platform technologies" as they call them. They're still there and some firms still are able to get funded with a basic concept, but there's fewer of them and the system, the FDA process, the demands of the investors behind the venture capital firms and so forth have shifted to more short-term thinking from long-term investment in a program.

SHINDELL: Do you think . . .

CRAWFORD: That's too bad. I mean, you know, the innovation isn't what it used to be.

SHINDELL: Uhm-hmm. And, do you think that that is a product of the trends of the industry itself, what sort of has set the precedent for being a profitable exit strategy, or is this a product of the market today, that the market maybe is different than, than earlier, people were more willing to take a more long-term risk back in the '70s and '80s? What would your take on that be?

CRAWFORD: Sure, I think the market is more short-term, and I think the perspective of the institutional investors, who are the ones who drive the behavior of biotech firms as stocks, have the perspective that rather than jump in an IPO of something conceptual and you don't see many of those anymore, "Why not wait? Fine, I may have to pay twice as much but let's wait until the technology has proven itself out better. I'll get in a little later, but if it's really promising I'll still get a good play on it, and I'll see that return in a year or two instead of sitting on it for five." As a consequence of that it's been harder and harder to start conceptual firms, platform-technology based firms because everybody's attitude is, "Well, let somebody else do that and I'll come in later when it, when it's been 'derisked,'" as they like to say.

SHINDELL: Uhm-hmm. Do you think that over time and maybe as a product of these shifts that we were just talking about that the relationship between the university and local biotech companies has changed at all? It seems like (Crawford: Yeah.) a lot of the early development . . .

CRAWFORD: There used to be quite a stigma for academics to be associated with a commercial firm. They were somehow compromising themselves or tainting themselves. They were money grubbers. The fellas that I was involved with in the

initial two firms suffered some by that, and especially if they were successful. I think there was a little envy on the part of their colleagues when they saw these firms like Corvas take off and get funded, and have pretty generous budgets, and be, you know, getting a lot of attention. Somebody who hadn't had the courage and the foresight to get involved with a firm and hadn't put the time and effort into it could very easily say, "Ah, well, I'm a pure academic, you know. He's compromising himself. He's more interested in his activity at his company than he is in being, you know, a true leading scientist." All that kind of stuff came into the picture. And, egos involved with these scientists are a very big part of it. I mean their intellect is on the line all the time and it's very competitive, very cut-throat competitive in many cases in these fields where things are happening fast. So yeah, there were some where there was some true friction there. Some left academia all together, others bridged, others backed away from the commercial firms and stuck with academia.

SHINDELL: Uhm-hmm. It seems like maybe because of the influx of biotech money and other sectors of industry as well into the biosciences at the university, maybe the structure of the biosciences in academia has changed as a result. From the biotech perspective, from outside of the university, does that seem to be the case?

CRAWFORD: Yes. I would think so, and in fact there's even been legislative biases toward that: That work sponsored by the NIH has to have vehicles for getting into the commercial environment now, and academic institutions like Scripps have to be able to show the NIH that they've got a licensing group and they do license things out. Part of the purpose of the NIH in fostering innovation and research is to develop our economy and so forth. If academia and the places where that money is going don't encourage it or at least don't fight it, [Laugh] then the will of the tax payers is thwarted. So, there's been pressure to do that. There's been this SBIR program, Small Business Innovation Research Grant Program, that's been very well funded by NIH and the National Science Foundation, and others, which provides for kind of a bridge between academic work and the other. Why don't we turn this off for a minute. I'll see if they need to use this room.

SHINDELL: Sure.

CRAWFORD: Go ahead and then I can interrupt it again.

SHINDELL: I see. All right. Okay. Were you in the middle of . . . [Laughter] I sort of

lost track of where we were. Sorry.

CRAWFORD: I think I had finished that point.

SHINDELL: Okay. Well, let me move on to a different question then. How about the sort of legal side of biotech? That must have been new to you, the whole patenting of biotechnologies, which was new to the sciences as well? What role do you think patents have played in biotech or how important have they been?

CRAWFORD: Well, they've been essential to the industry. I mean, the core value of what we have is the ability to have exclusive rights to it for a period, especially in pharmaceuticals. So, without that there would have been nothing. If it was all public domain, such as the academic work was, nobody would have funded it.

SHINDELL: And there were points at which it seemed like it might not be possible to patent some of the, you know, biological products that were being produced. Was the industry affected by those, that, maybe you'd say the fears that, that these things would not be patentable, or did they sort of take steps to try to ensure that they would be patentable?

CRAWFORD: Well, both. Especially with respect to biologicals and things like cell lines and so forth. There were questions about what was patentable and what wasn't. I think there were some technologies that weren't developed as much because of patenting concerns. But, we seemed to have worked through that. There was enough that came out of it that was patentable and we were able to do it.

SHINDELL: Uhm-hmm. And, let's see, where should we go from there? How about geography, if you have sort of a sense of how the geography of San Diego, Biotech Beach, what a lot of people called Biotech Beach, how has that affected the rise of biotech here? Some say that part of the reason that biotech has been so successful here is because of this sort of geographical clustering phenomenon, which is probably different from what you experienced when you were further north here in California? So, did that . . .

CRAWFORD: Yeah, we do have a critical mass of the academic institutions, the labor supply that was created by Hybritech, and the winding down of all the Hybritech activity so that we knew that there was a lot of labor down here. An attractive place to live. That had a lot to do with it. You bet.

SHINDELL: When you founded Corvas though, did you locate it to be close to Hybritech.

CRAWFORD: Yes. I was living in L.A., InGene was based in Santa Monica. And, I had three young children myself and wanted to raise them in an attractive place. I wanted to stay in California, because I had other family here. I was committed at that point to the biotech industry and San Diego made a lot of sense. It was an attractive place to live. There was a lot more activity that was going to happen down here because of all of these elements. And so, it was my place of choice. I said, you know, I'm going to form a firm and it's going to be in San Diego. And, in fact, before Corvas was funded we had started to form the firm, but before it was funded my wife and I moved down here with our kids, bought a house, because I was going to stay here and do biotech here. I don't think I would have done that in any other community. Housing would have been too expensive, and I don't think there were many other communities where I could have that much confidence that I would be able to find employment in biotech.

SHINDELL: Uhm-hmm. And, were there any key individuals down here that maybe drew you down here or made you feel that this would be a good place for biotech?

CRAWFORD: There was a, there was a community here and organizations that were fostering it. The CONNECT Program had a lot to do with that. And . . .

SHINDELL: Several people have brought up Bill Otterson with that group. Yeah.

CRAWFORD: Obviously, yeah. He was just starting that program as well and I was in touch with him, told him what I had in mind, what I had done, and he did provide some contacts and provided, or offered, I don't think I actually used it, but offered space at those trailers on Torrey Pines Road that they'd given him [Laugh] some space in and all. And he had a lot to do with fostering the early stage of "Hey, let's all work together," and created social events where you met each other. I started a group with another CFO called the Association of Bioscience Financial Officers here. We just happened to meet each other at the swimming pool. We did swim workouts together for a while and then discovered we were both CFOs and both had the problem that there wasn't a financial environment here. So, for ourselves and for the controllers and all that worked for us there wasn't enough of a forum to kind of educate and learn about these things. And, we talked about getting that together.

We learned that the Bay Area was already starting a group. So, we contacted them and said, "Hey, let's go national and we'll be another chapter." And so, we formed the local Association of Bioscience Financial Officers on that basis, which today is a national group and has about ten chapters and membership of maybe a thousand people and has all the CFOs of the industry, and meets annually at national conventions. In fact, they're every June and this last one was here in San Diego. So, the community was very, very open to that and has continued to be through Biocom and other organizations.

SHINDELL: Now, you've mentioned that, in, that in 1987 when you started Corvas was, you said, "a banner year in biotech here in San Diego for several reasons." Were there any other sort of "banner years" or turning points in biotech here, or maybe moments that sort of indicated the coming of age of a strong biotech sector?

CRAWFORD: Well, the group, the '87 group that formed, in large measure, a large percentage of those, you know, fully-funded venture-capital-backed firms went public in '91 and early '92. So then, you had firms that in their first round of financing got two and three million and then done a Series B and gotten five million or more, then suddenly they were doing an IPO. And, back in that day a thirty or forty million dollar IPO was a pretty good sum. It was a fair amount of money then. So now you had, I don't know, somebody will have statistics on this, but maybe a dozen firms in San Diego that year that went public that had, you know, a mandate from their investors to grow substantially. So, of course, I'm going to see things from a financial perspective, but I think that was probably a banner year. After that, it was more just, you know, regular course of business and more and more firms coming out, and one firm or another having a spectacular growth profile. Invitrogen's been an interesting firm to watch, and in fact with that industry the supply industry to biotech wound up growing here. I think those folks came out, the initial ones came out of Stratagene, which was a very bright play by an individual who saw that, "Hey, there's going to be a need for product, and specialized product, custom products, in this industry," and created that firm.

SHINDELL: And who was that?

CRAWFORD: Joe Sorge. Ultimately, they like to say that spawned Invitrogen and ultimately it was more successful. But, both were very successful, although I don't think that particularly contributed to the growth here of the industry in general. It

was . . .

SHINDELL: It was more of a response to the growth, right?

CRAWFORD: Yeah. It was response to the growth, and maybe a bit of a response to the nature of this community that you could do stuff like that. He was an investigator at, at Scripps I believe, he's an MD. I don't recall exactly.

SHINDELL: So, could you give me a brief rundown, maybe, of what all is involved in, in starting a biotech company, [Laugh] from your own experience here? What are the most important steps to this process?

CRAWFORD: The people. With respect to the scientific side, the people with the ideas and the caliber of research and respect of the community, and so forth, that they can draw interest from the investor community. But then also, a pragmatic and, a word that comes to mind, "mature" perspective on what can be achieved and how to go about it. People who can do that are pretty rare. Next you need the complementary people to them, the CEOs and other officers like CFOs, who can meet the scientists' need and understand them at the same time that you meet needs of investor and the venture capitalists and so forth. And then, have the vision thing. That's very, very big in the industry as well. And, the vision isn't one that is set in stone when the firm starts with the academic, but someone or some people, and this can be on the Board, it can be the CEO, it can be another person inside the company, or a mix of those who can track a changing landscape, can adjust the firm's goals, and see well into the future. I was very fortunate at Corvas that the founding scientist was a great visionary with respect to science and medicine.

SHINDELL: And who was that?

CRAWFORD: Tom Edgington.

SHINDELL: Tom Edgington.

CRAWFORD: He was willing to trust me to do what I could do. I had experience, but not a lot, maybe about five years when we started it. That was kind of risky to, at the age of thirty-two, trust me to being CEO of it, but nobody else had any more experience because of the nascent industry. But still, to trust and take chances on that and, you know, he was fairly assertive on opinions and so forth, and also

someone that you'd work with and discuss these things with, and all. There aren't many people that have started a firm and taken it all the way through to commercial realization, and that's true in the biotech industry as well as in other industries. These firms usually go through transitions. You know, if you look at something like Hewlett Packard, where it was literally started by Hewlett and Packard, and who were with it for the entire forty years of their career, and remained chairman and president during the whole thing. That's pretty rare in any industry. There have been examples of it, and I think it's even rarer today because we're much more specialized as a society and as a marketplace and the numbers of experts, the types of expertises that you need in these firms today is, is overwhelming, and the leadership need shifts as a company matures from research to clinical to marketing. And, one of the reasons I think Corvas was successful and had, had a good run for so many years and eventually reached a market cap of $700 million was that we did transition through three CEOs but I was there for the entire period of those transitions. So, there was a certain amount of stability as well, and I was willing to, was able somehow to transition these things, set myself aside a little bit and keep the organization stable but allow it to go through these transitions. And, it worked. Ultimately the science determines the product and, you know, the drugs that we put the most money in just didn't quite perform in the clinic. Actually, the trials in that case were successful, but Pfizer, the sponsor, and I didn't agree with them at the time but as I've gotten away from it I agree with them, that they weren't compelling enough to take on the multi-hundred million dollar Phase III trial. But, yeah, the transitions are a big thing and a lot of companies are destroyed in the process of needing to make a transition or failing to make a good transition.

SHINDELL: Overall do you think that this is a healthy environment for biotech?

CRAWFORD: San Diego?

SHINDELL: Yeah.

CRAWFORD: Oh yeah.

SHINDELL: Still today is healthy?

CRAWFORD: We've never had a large investment community down here. We do have a decent presence, you know, Domain, and Enterprise, and ProQuest, and some

of the venture firms are down here, Sofinnova and Sanderling. But, the money is really in the Bay Area and in Boston, and there tend to be satellite offices here. They tend to be very good ones. I think the investors down here have done very well within those firms, but it's kind of sad that we've never kind of developed a strong local presence. You know, Sand Hill Road in Menlo Park is where most of the money comes from.

SHINDELL: Uhm-hmm. So, we're in our last ten minutes of the hour now. So, I'd like to ask you these sorts of questions that we save for the end that are sort of your own evaluations of your career and your time in biotech. So, some of these you may have already touched on, but maybe you can elaborate on a little bit more. So, first of all, what do you think was the most important change in biotech, in San Diego biotech during your time here?

CRAWFORD: Well, I don't know about change. I would say what distinguished us from others, and of course I've only been in this community, but one of the advantages we had was a strong sense of community and cooperation within the community. While we may have been competitive with each other, sometimes in the marketplace say two firms that were both addressing cardiovascular products, or we may have been competing for funds with each other, there was always a spirit of cooperation and not one of rivalry and competition. There's some of that, and I think it was healthy, but within the community there was always a sense of working together and making it better in the community. I have always been comfortable in calling people, fellow CFOs, and CEOs, and so forth, getting advice on things, and I see people still doing that regularly.

SHINDELL: And how, how, if that distinguishes San Diego, how has San Diego fostered that? How is it that that sort of atmosphere . . .

CRAWFORD: Come back to Bill Otterson, and he's been well recognized for that. He was a great advocate for it. He was taking Interferon, which was one of the early promising drugs, and, you know, he could stand up in front of an audience. I think he even used to carry around an empty bottle sometimes and said, "You know, I take this drug and I would have been dead, you know, six or eight years ago if it hadn't been for this drug," and he'd disappear off the scene once in a while when his cancer flared back up. And just say, "You know, this is what it is," and then he'd come back and say, you know, "Well, biotech saved me again." I mean, and he was a very, very

effective guy. He knew because of his illness that he couldn't be a hard hitting CEO again and it had to be something where he could come and go a little bit, depending on how he was doing, and I think he always, at least the first year or two, figured that he only had a year or two left and was going to make the most of it. But, golly, how can you, and he was a charming guy, how can you turn down a, you know, a personality like that? How can you be selfish when you see someone doing that? And, there were other, a lot of other leaders in the community. I mean, when Ted Greene left Hybritech he formed a VC firm and fostered six or eight firms, including Amylin. And, another one, Pixis that was very successful and bought out very early on. So, there were, you know several leaders that had the same perspective. Ted Greene, while he had no interest in any of the firms that I was involved in, financial interest, was a resource to me. I could give him a call and say, "Hey, you know, I've got this issue. What would you do?" It might only be ten minutes but, you know, I'd get a response on that. Jim Bergman, one of the early venture capitalists in the industry at Enterprise Partners decided not to invest in Corvas, but told me he'd be happy to talk with me and, counsel me if I thought I would need it. And, I said, "You know, I'd like that," and I did call him a few times and he did respond, just because he's a nice guy who wanted to see the industry here succeed. And, there are lots of examples of that in the community. I do it too, for that matter.

SHINDELL: Oh. Let's see. I think that you've just told me then what made Biotech Beach successful. Is that what you would . . .

CRAWFORD: Yeah. I would say. Yeah.

SHINDELL: Yeah. And, have there been any, any major events here or, you know, any forces here that have threatened the success of this sector? What would be the major threats that you've witnessed?

CRAWFORD: I think the FDA has been a challenge and continues to be a challenge. Their rules aren't clear a lot of the time. For Big Pharma that's a problem but it's not nearly the problem it is for us because we bet on one product and if we don't have a clear path as to where we're going to go with it, if you go through a process of a year or two of clinical trials, you do your best to construct them as you think they should be, then you discuss them with the FDA and then they come back and say, "Oh gee, you know, we really wish you'd done this instead." That's pretty tough and that happens with a lot of firms. It's a political process and I can be too harsh. I mean

you're messing with peoples' lives with pharmaceutical development so you do have to be careful and all. But, I feel a lot of decisions that are taken by the FDA have to do with trends at the time, or the biases of the individual serving on advisory committees, and so forth, and it makes it pretty tough. Tougher than you'd like. The marketplace is also fickle, but somehow it makes it tougher when it's individuals, influential individuals on the panels that seem inconsistent. It's different than when a product is introduced and the market doesn't accept it. You know, like pulmonary delivery of insulin. Everybody thought that was going to be great and folks got it out there and spent a lot of money on the products and all and it just didn't work. It surprised the heck out of me, a lot of people, and a lot of big firms. But, that's something that is difficult to accept but easier to accept than a regulatory or administrative process that could have told you that yesterday, kind of thing.

SHINDELL: Has that been a problem in your career? Has this happened to you?

CRAWFORD: In smaller doses. Yeah. But, I've had enough colleagues in companies where it's destroyed the company. It may not be readily identifiable as that, but as you look at it, you know, what turned the company was an additional trial or additional steps that had to be taken that were not expected. It wasn't a failure to foresee. It was, you know, some external factor that, that emerged, that delayed something and then caused them to get dilutive financing and maybe caused management changes and began an unwinding process.

SHINDELL: Uhm-hmm. Okay. I, is there anything about San Diego biotech, the sector here, or the cluster, that you would have liked to have changed, that you thought wasn't working properly but could have been better?

CRAWFORD: Gosh, nothing comes to mind, at this point. There was a period when the press was very negative about the industry, and that did change eventually but there were a couple of reporters at the major newspaper that were very cynical. Reporting in generals tends to be negative. You focus on the negative. But, gee, there's been a wonderful development at a firm that, you know, was very newsworthy and very positive and there would be a "however" and that "however" - the negative little thing about it - would be drummed up and that would become the title. That occurred in the '87 to '89 and '90 period where it was very, very hard to see that kind of publicity for an industry that, I felt, deep in my heart was going to be very important to San Diego and not being embraced. I think, if anything, that may

have unified the industry a little bit more and helped these organizations like BIO and so forth, and Biocom, and CONNECT, get a stronger foothold here, and eventually the press coverage changed. That came around and . . .

SHINDELL: Was that just the idea that, that they had to form a group to sort of promote their own image, their own interests? Or . . .

CRAWFORD: Well, it was amazing to me how much influence a couple of writers had. And, when they were no longer writing on the industry and there was more positive stuff coming out then it, that felt better. But there was a particular period there of a couple of years where I think it was discouraging for all of us to see, to feel like we were being blasted in the papers, when in fact we were making a potentially great contribution to the economy here.

SHINDELL: Uhm-hmm. Did you experience any tension, yourself, between pursuing your own intellectual interests and the goals of say the, the people who were funding the companies or the projects that you were helping to develop?

CRAWFORD: Uhm . . .

SHINDELL: Or, were you always at a level sort of high enough where you could sort of escape?

CRAWFORD: Well, I was always at an officer level here. I kind of started the career, my career at an officer level, because, you know, like I said nobody knew what they were doing anyway. So, I might have been a little insulated from that. I mean, I did experience those kinds of things, but I always had access to the Board room, direct access to the Board. And so, I could at least express my opinion, eye-to-eye, with either the management team I was working with or the Board of Directors. I might not get my way, but there's value to knowing you've been heard, and having the opportunity to speak your mind.

SHINDELL: All right. And how, personally, did your experience with Biotech and with San Diego biotech in particular, change the course of your life, or affect the course of your life, I guess? It's hard to know how it might change it.

CRAWFORD: Oh, well, it's been my career and you know a very fulfilling one for me. I liked very much being in small environments. I grew up in a small town, and I

knew everybody, and worked in a large company where it didn't feel very personal. These firms are personal, for better and for worse, because sometimes you don't get along with people, or don't agree with them. But you're in there close with them and I think that was very, very key to me, this personal feel, this family feel. I don't know whether I answered the question well, or stayed on topic with it. But . . .

SHINDELL: That seems like a good answer.

CRAWFORD: That was, that was really key to me. Long hours, a lot of travel sometimes, a lot of pressure on my family. My wife has stood by me for twenty-eight years, who did not grow up in this kind of environment. When I was going to quit working for a major oil firm to go to work for what she called a "stack of resumes," [Laugh] namely the UCLA professors, it was, "I'll support you, but I'm skeptical about this." [Laughter] And, you know, especially with kids, and all it's a tough career choice. My wife's attitude was, "Well, if I have to I'll go back and get a job. I don't want to do that." And, one of the reasons that I did the consulting for many years had to do with wanting to spend time with my own kids and be away from the pressures of it as well. While my three sons were in high school I only worked part-time as a consultant. So to make these things work it takes an awful lot of commitment, and I will say sometimes people, you know, naturally they resent when a firm is successful and you make a lot of money on it and all of that, [Laugh] and sometimes they don't appreciate how much you've been through, how much risk there's been, how many times you nearly failed. You know how long and how many hours you've worked. Weekends, and you're kind of always on-call. And, these darn BlackBerries have made that [Laugh] even more the case.

SHINDELL: Uhm-hmm. Well, since it is, as you say, so, so personal compared to other industries, I would imagine that it has the potential to affect you personally a lot more than another career might have, that a lot of personal development occurs because of your work?

CRAWFORD: Oh, absolutely. Yeah.

SHINDELL: That, you know, you might not be getting otherwise? Or, you know, do you, do you find it – maybe this is too personal of a question. It's not really on my list. But, because of that personal nature do you find it difficult to not take your work home with you or to not make a division between say your, your home life and

your work life?

CRAWFORD: Well, I do take my work home with me. Although, I tend, especially when I had kids, to come back in and work at the office and it was often just ten minutes from home, rather than take it home. Because, at least when I was home I wanted really be there. And, I wasn't good at, you know, "Go away. I'm working." I just couldn't do that. I would, instead, spend some time home. And, my wife always insisted that I come home for dinner and have some time with the kids in the evening, even if it meant I needed to go back. I'm also a morning person, so it's not uncommon to get in at six or so to kind of make up that difference. And, the same thing Saturday morning, you know. I might come in for a few hours, if I really need to catch up on stuff. But, it is a part of my life and when the kids had moved on and we'd been successful, my wife and I sat down and said, "Okay, what are we going to do here? We like to work. This is a fun time in our careers." She's also in the industry, in finance. She works with very early stage firms, developing their infrastructure, and doing all the non-science, nonclinical stuff in a firm, from facilities to accounting to HR and so forth. And, we both decided, "Hey, we want to do this." We take the weekends off and do a lot of stuff. But, it's very much a part of our lives and we like it. You know, it is fun. It's very fulfilling and it's nice, now that our kids are grown up that we don't have that competition, that kind of angst of moments spent at work are moments not spent with the children. And, it's a whole lot easier when it's just a married couple [Laughter] as opposed to a family of five that you're kind of juggling.

SHINDELL: Uhm-hmm. So, this is sort of in the way of wrapping things up, but is there any question that I should have asked you, or anything, you know, you really would like to talk about before we really wrap things up?

CRAWFORD: Well I think, you know, for me I'm proud to have been a part of the community and build things, and I'm just proud that the spirit of this community has been so cooperative in the process. That fit very much with my personality and desires, and it's a neat thing when it happens. We're competitive with each other in a lot of ways, but we're so supportive, and this is across all of these organizations. The networking that takes place and the spirit of helping is terrific. And that, to me, is one of the pleasures of being in the community. It's a small community in the sense of number of people and you can be here for a couple of years and know most of the key people in the biotech community. Very open.

SHINDELL: All right. And then, one last question. Is there anyone you would recommend that we interview for this project that might not be on our list?

CRAWFORD: Well, I don't know who's on your list. I mean, the natural thing to do, I think, is to hit the highlights and the guys that have been prominent in the community. I mean, I'm sure you've talked with Ted Greene. He's kind of one of the granddaddies, if you will. And then, you know, some people like David Hale have been very influential. I think a lot of Randy Woods. I think he'd be a good guy to speak to. He's CEO of Sequel Pharmaceuticals now, which is a spin-out from NovaCardia. I was surprised a bit that I was selected. I mean, I've been in the community for a long time, but I am not a CEO and haven't been one for quite a while. And I, you know, I commend you for not necessarily for talking to me but for guys like me, getting perspectives of other than CEOs. I think some Scripps investigators might be interesting, or UCSD investigators that have been involved in the process and getting that academic perspective would be an interesting exercise to do. You know, some of the lawyers in town have been very influential in the process. Wain Fishburn at Cooley Godward comes to mind as a guy who's been involved with many, many firms through the years. But gee, Rich Mejia, who just retired as head of the local office at Ernst & Young for accounting, will have a lot of perspective on the industry. Some of those folks really, really key to the industry, were able to communicate with each other sometimes through attorneys and accountants, you know. "Who else has seen this situation?" And, they'll know and they may have to call them first and say, "You know, I want to tell this guy this, or he wants to call you," and they'll say, "Fine, have him call." In all they've, they've been good communication devices for us. I don't know what your list is, but I think some of the service providers would be important.

SHINDELL: Okay. All right. Well, if you don't have any, any other last statements --

CRAWFORD: No. That's fine.

SHINDELL: -- then we can conclude it. Thank you very much.

CRAWFORD: You're welcome.

END INTERVIEW

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The San Diego Technology Archive (SDTA), UC San Diego Library, La Jolla, CA.

The San Diego Technology Archive (SDTA), an initiative of the UC San Diego Library**,** documents the history, formation, and evolution of the companies that formed the San Diego region's high-tech cluster, beginning in 1965. The SDTA captures the vision, strategic thinking, and recollections of key technology and business founders, entrepreneurs, academics, venture capitalists, early employees, and service providers, many of whom figured prominently in the development of San Diego's dynamic technology cluster. As these individuals articulate and comment on their contributions, innovations, and entrepreneurial trajectories, a rich living history emerges about the extraordinarily synergistic academic and commercial collaborations that distinguish the San Diego technology community.