

Just FEPAC Accreditation and Forensic Chemistry Programs

Introduction [00:00:05] Now this is recording, RTI International Center for Forensic Science Presents Just Science.

Voiceover [00:00:19] Welcome to Just Science, a podcast for justice professionals and anyone interested in learning more about forensic science, innovative technology, current research, and actionable strategies to improve the criminal justice system. In episode one of our Strengthening the Forensic Workforce season, Just Science sat down with Dr. José Almirall, a Distinguished University Professor in the Department of Chemistry and Biochemistry at Florida International University, and Dr. Sarah Kerrigan, Professor and Chair of the Forensic Science Department at Sam Houston State University, to discuss the inception of the Forensic Science Education Programs Accreditation Commission, also known as FEPAC and chemistry programs in forensic science. Built on the foundation of the Technical Working Group on Education and Training in Forensic Science, or TWGED, FEPAC became an official standing committee of the American Academy of Forensic Sciences and awarded its first accreditation in February 2004. Since then, over 50 undergraduate and master's level forensic science programs have been accredited in the United States. Listen along as Dr. Almirall and Dr. Kerrigan discuss their roles as founding members and early adopters, training the next generation of forensic chemists, and the importance of expanding the number of forensic science Ph.D. programs. This episode is funded by the National Institute of Justice's, Forensic Technology Center of Excellence. Here's your host, Gabby DiEmma.

Gabby DiEmma [00:01:39] Hello and welcome to Just Science. I'm your host, Gabby DiEmma, with the Forensic Technology Center of Excellence, a program of the National Institute of Justice. This season, Just Science will discuss forensic science programs and NIJ funded research at universities accredited by the Forensic Science Education Programs Accreditation Commission or FEPAC. Here to guide us in our discussion is Dr. José Almirall, a Distinguished University Professor in the Department of Chemistry and Biochemistry and Director of the National Science Foundation funded Center for Advanced Research in Forensic Science at Florida International University, and Dr. Sarah Kerrigan, Professor and Chair of the Forensic Science Department at Sam Houston State University and Director of the Institute for Forensic Research, Training and Innovation. Sarah, José, welcome. It's great to have you on the podcast.

Sarah Kerrigan [00:02:28] Thanks, Gabby.

José Almirall [00:02:29] Thank you for having us.

Gabby DiEmma [00:02:30] José, I know you have multiple roles at Florida International University, or FIU. Can you tell us a little bit more about your professional background and what is involved in your current position?

José Almirall [00:02:41] I started working as a forensic chemist in 1986 at the Miami-Dade Police Department Forensic Laboratory, first in the drug section and then in the trace evidence section. I also taught the forensic chemistry graduate course at FIU, where I work now as an adjunct, and in 1998 I applied for and was offered an analytical chemistry faculty position at FIU. And that same year, FIU started a Master of Science in Forensic Science and a Ph.D. in Chemistry. Over the years, I've served as the graduate program director for the forensic science programs at FIU, as director of the International Forensic Research Institute, and in 2017, FIU was awarded the IU CRC, the Industry University

Cooperative Research Center, which is co-funded by the NIJ and the National Science Foundation, and that's the Center for Advanced Research in Forensic Science, or CARFS, which is - includes five universities. So I'm currently the director of CARFS and continue to manage a research group in the chemistry department at FIU.

Gabby DiEmma [00:03:47] And Sarah, you also wear multiple hats as chair of the Forensic Science Department at Sam Houston State University or SHSU. Tell us more about your professional background and your current role at SHSU.

Sarah Kerrigan [00:04:00] I received my original training in forensic science with the Met Police Forensic Science Lab in London in the late eighties, before it became part of the UK's forensic science service. Later on, I worked at the California Department of Justice after receiving my Ph.D. in Vancouver, Canada, and I also ran a state lab in New Mexico and operated an independent accredited lab in Texas until about ten years ago. As you mentioned, I currently serve as professor and chair of the Department of Forensic Science at Sam Houston State University and also serve as director of the Institute for Forensic Research, Training and Innovation.

Gabby DiEmma [00:04:41] I'd be interested in learning a little bit more about what made you both decide to pursue a career in academia and specifically a career addressing forensic science questions.

José Almirall [00:04:51] After graduate school, I never lost my interest in conducting research, even while working in the forensic laboratory as a practitioner. In fact, my first publication on the forensic analysis of anabolic steroids came about because of the need for the development of some analytical methods to characterize the then newly controlled class of drugs of anabolic steroids. And over the years, I collaborated with both academics and practitioners, and I was very fortunate that my laboratory encouraged scientific collaborations and publications of that work. But eventually I realized that teaching and research was really what I wanted to do full time, so that's when I applied to the chemistry department at FIU.

Sarah Kerrigan [00:05:36] Well, Gabby, for me it was really quite by accident. I relocated to Texas in the early 2000s, and at that time Dr. Sparks Veasey was running the program at Sam Houston State, but he'd worked at the office of the medical investigator as a medical examiner in New Mexico, which is where I had moved from. And so initially he just convinced me to engage with the students first as a guest speaker, then as a professor and he finally convinced me to run the program here. He was really a pretty incredible mentor, but I think I was really tricked into an academic job because I've really always thought of myself as a practitioner. However, thinking back to my Ph.D. studies in Vancouver, University of British Columbia, I remember my Ph.D. advisor telling me that I should become a professor, not a practitioner. And I, of course, dismissed that at the time, but as it turns out, he was right.

Gabby DiEmma [00:06:32] So what is forensic chemistry and why is chemistry referred to as the central science?

José Almirall [00:06:38] We say that chemistry is the central science because the study of chemistry is the study of the basic components of matter of everything and how those components interact and change, including the components of life. So the study of chemistry is central to the study of everything. Let me give you an example. It was a biochemist, Sir Alec Jeffreys, that first described DNA fingerprinting. And there was

another chemist, Kary Mullis, who first described the polymerase chain reaction technique, or PCR, both now widely used in forensic science laboratories, and Kary Mullis won the Nobel Prize in Chemistry in 1993. Forensic chemistry I would define as a subdiscipline of analytical chemistry focused on the application of analytical chemistry to solve forensic science problems. The most common application is the unambiguous identification of a controlled substance. In the United States, there are approximately 400 accredited forensic laboratories today that conduct approximately 2 million seized drug identifications every year. All of those identifications must be correct. In addition, forensic chemists also conduct materials analysis such as paint, fiber, glass analysis and comparisons. They conduct fire debris analysis, explosives analysis and a host of other materials examinations. And, of course, hundreds of thousands of toxicological analysis.

Gabby DiEmma [00:08:10] So you mentioned seized drug analysis and I'd be curious to hear your perspective on how seized drug analysis differs from forensic toxicology and how they are also highly related in terms of the current drug landscape.

Sarah Kerrigan [00:08:24] They're very similar in many respects. Obviously, toxicology involves drug identification and biological and sometimes very challenging matrices that the instrumentation that's used in toxicology is similar to controlled substances, but often a little bit more sophisticated just because of the low concentrations of the substances that we encounter in a biological fluid or tissue. And our extractions, of course, are a little bit more challenging. However, it's really important for the toxicology lab to communicate with the drug lab because they're at the forefront of what's being used on the street. And so in that sense, controlled substances and toxicology are really quite inextricably linked because the drug chemists typically know what's being used regionally and this drives the need for new testing in toxicology, in investigations such as impaired driving, drug facilitated sexual assault and medicolegal death investigation.

Gabby DiEmma [00:09:22] José, you mentioned fire debris analysis, and I'd be interested in hearing more about what is involved in the analysis of explosives and fire debris and how do you keep up with, or I know you also are part of developing, some of the new field, portable instruments and extraction techniques for fire debris analysis.

José Almirall [00:09:40] Yes, the fields of fire debris and explosives analysis is a very interesting one to me, because the sample that must be analyzed, for example, ignitable liquids is part of a very complex matrix in the case of a fire that has been extinguished. So you're looking for very small quantities of analytes in a very large, complex matrix. The forensic chemist must isolate the remnants of, for example, gasoline from charred debris from the fire. So that requires first identifying where to collect the sample, packaging the sample so that it is not lost in transport to the laboratory and then extracting the analytes in the lab so that they can be analyzed. We have done, as you say, some research in this area with an aim to extract the analytes right there at the fire scene and conduct the analysis right there at the fire scene using, say, a portable GC-MS, and that provides immediate feedback to the investigators and potentially minimizes loss of sample in transport and packaging.

Gabby DiEmma [00:10:49] So I'd like to hear a little bit more about FEPAC or the Forensic Science Education Programs Accreditation Commission, and I know that, José, you were involved with the inception of FEPAC. So can you tell us a little bit more about how feedback was formed and what its main objectives are?

José Almirall [00:11:06] We need to go back to the 1999 review of Status and Needs in Forensic Science, commissioned by the NIJ, which made several recommendations regarding improving forensic education in the U.S., including developing national education standards through a consensus process, and that became the TWGED, the Technical Working Group on Education, creating an accreditation program for academic institutions that offer degrees in forensic science and then, finally, that NIJ provide funding to forensic academic programs to conduct research and development. That was part of the recommendations of this review of status and needs. Then through a grant to West Virginia University by NIJ, the TWGED was convened and eventually published a guide for Academic Programs, including publishing minimum curriculum standards for a degree in forensic science. Before that, we didn't really have curriculum standards for forensic science degrees. The American Academy of Forensic Sciences took on the responsibility to manage the accreditation of academic programs and in 2003, began a pilot accreditation by establishing the Forensic Education Program Accreditation Commission, FEPAC. Thanks to a grant by NIJ to the AAFS and then FEPAC accredited those initial programs in 2004 and today, the rest is history. There are 31 undergraduate programs accredited and 20 graduate programs, all of them Master of Science in Forensic Science in the U.S.

Gabby DiEmma [00:12:44] And I know that both of your universities were early adopters of FEPAC, and so can you tell us a little bit more about your FEPAC Accredited forensic science programs?

Sarah Kerrigan [00:12:53] We began the process of accreditation shortly after my arrival at Sam Houston, and currently we've been through three cycles of accreditation for our M.S. degree and have graduated more than 150 students. Now, back in 2016, FEPAC issued a public statement in support of the development of doctoral programs in forensic science following the publication of the NAS report. So we're really looking forward to the accreditation standards being developed for those programs in the near future.

José Almirall [00:13:28] And at FIU, we were one of those original pilot programs that became accredited. So we're - we've been accredited now since 2004. We offered two accredited programs, an undergraduate certificate in forensic science, which students complete in addition to either a Bachelor of Science in Chemistry or a Bachelor of Science in Biology and then we also offer a Master's of Science in Forensic Science, which is interdisciplinary. So we normally have both chemistry and biology students in that program.

Gabby DiEmma [00:14:00] In your opinion, what are some of the advantages of FEPAC accreditation, both for your university and for your students.

José Almirall [00:14:08] For the university, the accreditation process forces the faculty and the leadership, the administrators, to undergo a periodical reflection on what our curriculum should be in order to meet the needs of the community. For students, they know that they are getting specialized training in disciplines that are important to the forensic laboratory employers such as quality assurance, for example, but specialized topics that would normally not be offered in a traditional chemistry or biology program.

Sarah Kerrigan [00:14:49] I think one of the major advantages of accreditation is that it provides confidence to the students that we're delivering a rigorous curriculum, have qualified faculty, and at the graduate level, we're contributing to the advancement of the profession as a whole. A contemporary curriculum is really important because we've got to

be able to adapt to new technologies, make sure we're providing sufficient hands-on lab experience to our students, and also adapt to new standards that are being developed throughout the forensic sciences. Now in our program at Sam Houston, we use curriculum mapping to track which specific courses in our degree programs cover standards from the various SDOs or standards developing organizations and OSAC proposed standards, the Organization of Scientific Area Committees for Forensic Science. And this is really important because covering those standards and the work that's being done related to forensic reform efforts ensures that our students and graduates are well informed on these issues and adequately prepared for the workplace.

Gabby DiEmma [00:15:55] And Sarah, you had mentioned the National Academy of Sciences or the NAS 2009 report and the need for more forensic science Ph.D. programs to advance the field of forensic science. So I know both of your universities do offer doctoral degrees in forensic science, and I'd like to dive into this topic a little bit more. So to start, tell us a little bit more about those doctoral programs.

Sarah Kerrigan [00:16:20] Our doctoral program is an interdisciplinary Ph.D. program. So our students specialize in multiple areas ranging from DNA to toxicology, anthropology, controlled substances, trace and other forensic science disciplines. Now we've got full time faculty with specialized knowledge covering all of those disciplines, and most of them have practitioner experience at some point during their careers. And I think this is important because it helps ensure that our students are well-prepared for not only the workplace, but also the challenges of the courtroom by learning from people who have actually gone to court and testified in the disciplines in which our students hope to work eventually. Now our students also have the opportunity to engage in unique projects and research through STAFS, which is the Southeast Texas Applied Forensic Science Facility. And that's our willed body donation facility and also the Institute for Forensic Research, Training and Innovation, or IFRTI, which promotes academic industrial partnerships. And so through those two institutes, both STAFS and IFRTI, our research within the doctoral program is extremely applied and hands on, and often involves lots of partnerships with state and federal agencies.

José Almirall [00:17:41] Our program at FIU is set up a little bit differently than Sarah's program at Sam Houston. While we also saw the need for the terminal degree in forensic chemistry at FIU and in 2004, we established a track within the Chemistry Ph.D. program, we found this program to be very popular among students. I think we've graduated now almost 100 Ph.D. forensic track students to date. Some of them work in academia as professors, some work for government as researchers, some work in forensic laboratories as practitioners. But what they have in common is the research activity, which is central to graduate education, and the establishment of a Ph.D. program or a Ph.D. degree in a field is another indication of the need for advanced, specialized knowledge creation in that discipline, normally through research.

Gabby DiEmma [00:18:36] Has your university received an NIJ funding for forensic science research, and what role has the NIJ research program played in shaping your program and contributing to its growth?

José Almirall [00:18:48] As I said before, research activity is central to graduate education. In fact, the TWGED curriculum guidelines as well as FEPAC standards, both require research in the graduate program curriculum. We've been very fortunate at FIU to have had faculty and students that have received many NIJ awards over the years. Including myself, we have benefited from several NIJ funding programs, including the

Research and Development Program and the Graduate Fellowships for our Ph.D. students.

Sarah Kerrigan [00:19:21] Gabby It's really similar for us at Sam Houston. We've really benefited tremendously from NIJ funded initiatives through both the GRF and the R&D solicitation that José mentioned. Now, we've been doing research in those areas in a wide variety of forensic disciplines. For example, we've been doing NIJ funded research on designer drugs and novel psychoactive substances or NPS for almost 15 years at Sam Houston, thanks to funding from the NIJ. But we also do work beyond forensic chemistry. We're very active in other disciplines. We've also had many NIJ funded projects related to DVI or disaster victim identification, missing persons cases. These often involve specialized projects that we do at our human decomposition facility or STAFS, and we were also doing research very early on on the use of massively parallel sequencing or MPS or next generation DNA sequencing on challenging samples from those types of investigations such as bone. We also do work on forensic botany and genotyping of cannabis to body fluid identification. We've also had NIJ funding on question documents projects, hairs, fibers, glass persistence and trace evidence and chemical profiling for intelligence purposes. So our faculty cover a wide range of disciplines through their NIJ funded research and those portfolios.

Gabby DiEmma [00:20:52] So you've talked a lot about some of the opportunities for student research, but what other opportunities are there for hands on learning and internships and partnerships with outside facilities and agencies for your students?

Sarah Kerrigan [00:21:08] It's really important to support our students and the ability to engage with operational labs is very important and it's integrated into the vast majority of our projects. They're heavily applied and they often involve work with state or federal agencies. Now both of our graduate programs at SAM, both the master's and the Ph.D., are research intensive, as José mentioned, and they involve lots of hands on lab experience in the first year. By that second year, the students are really expected to be working somewhat independently in the labs under sort of close supervision of their research advisor. But we do require an internship for both programs and in addition to that, we also have a doctoral practicum experience for our Ph.D. program. And that's a little bit different because it's really designed to allow a Ph.D. student that is very close to graduating the opportunity to translate their academic research in an operational setting. So several of our Ph.D.s. have taken advantage of that opportunity because it really relates to sort of technology transition, and it's part of our ongoing commitment to academic industrial partnerships at the institutional level, and it allows us the opportunity to develop deeper research ties with industry and provides an incredible networking opportunity for the students that take advantage of that doctoral practicum.

José Almirall [00:22:34] You know, that sounds great, Sarah. I did not know you had that doctoral practicum. I wish we had that in our university. It sounds like it's really useful for the students. We do send our doctoral students to do internships and research collaborations outside the university, but it's not as formal as your doctoral practicum. We do have our undergraduate students participate in internship programs, so every single undergraduate student that is undergoing their certificate program is expected to participate in an internship during the program. And we are very fortunate that we have five major forensic laboratories within one hour driving distance from the FIU campus. But our students have participated in internships all over the US. And then of course, as I mentioned, all of our master of science and forensic science students must participate in

research experience during the program that results in either a thesis or a report that is worthy of publication.

Sarah Kerrigan [00:23:34] Gabby, I'll just add to something that José said there, because one of the students that we have that's completing a doctoral practicum this summer is actually a student that is continuing some research that began at the center that Dr. Almirall directs at CARFS. So it's an example of how important those types of activities are. So this particular student will be completing her doctoral practicum at Signature Sciences this summer, and it's really a continuation of research that was originally funded through the NSF IUCRC that José mentioned.

Gabby DiEmma [00:24:13] It's always great to see academic research transitioning into practice because that doesn't always happen. So very good to have those connections with your local laboratories and internships are always a great experience. In general, do you find that students who actively engage in research are more likely to pursue graduate studies and to continue with research?

José Almirall [00:24:36] Absolutely. I mean, our undergraduate chemistry students are all required to spend one to two semesters in the research lab. That's part of the American Chemical Society certification for our degree. And then for many of them, once the research bug bites, they want to continue with graduate studies. So we see many of those students coming back and applying either to our graduate program or some other graduate program.

Sarah Kerrigan [00:25:04] I would agree. I mean, it's critically important because the research is really important in terms of fostering the creative problem solving that we face as professionals in forensic science. So graduate study, particularly a Ph.D., is essentially five years of very intensive and creative problem solving, and it forces students to think differently about those challenges that face us as forensic scientists while continuing to advance the profession at the same time. So what could be better than a Ph.D. in forensic science?

José Almirall [00:25:38] And if I could add something to that, you know, we're talking about research and the university that is research intensive like ours is at FIU, faculty are expected to support their research laboratories through external programs and NIJ has been the primary, sometimes the only, funding source for forensic science research in the U.S. for many decades. Without NIJ support, I am sure that we would not have the robust research enterprise that we have today in academic institutions and all of these graduates to go out and do wonderful things in the community.

Gabby DiEmma [00:26:11] Excellent. And I can attest that once that research bug bites, it's it is hard to shake it. Both of your programs prepare students for careers in forensic chemistry, but what types of job opportunities are available for recent graduates from these programs?

Sarah Kerrigan [00:26:27] We track our graduates very closely. About 60% of our M.S. and Ph.D. grads are employed in government labs, either at the state, federal, county or city level. But then we've had a growing number that are pursuing employment in the private sector. It's almost about 20% currently and that's really because more of the labs, the publicly funded labs, are outsourcing their work to the private sector. So that's really an area of growth for our graduates. Other graduates in our programs go on to pursue research, and many of our master's students actually transfer into the doctoral program

and roll their credits from the master's degree directly into the Ph.D. program and go on to continue with more research.

José Almirall [00:27:14] We have a similar distribution. We have about an even number of our Ph.D. graduates going into academia, government research laboratories, including the intelligence community and operational forensic laboratories, including private labs. And then our master's students are mostly going into operational labs because, you know, when a student comes in for advising, you know, the first thing I ask them is, are you interested in a teaching position or a research position? And if the answer is yes, then I say we'll go for the Ph.D. program. But if they're interested to work in the forensic laboratory, then you have a choice the Ph.D. program or the master's degree. And so it's up to the student to decide then what is the best program for them. So we have many of our master's students in operational laboratories.

Gabby DiEmma [00:28:08] That's great. And I'd be interested in hearing more about how your programs are structured in terms of mentorship. What does mentorship look like at your university?

José Almirall [00:28:21] Professors, faculty are expected to be the mentors of the graduate students, and then we also expect our graduate students to not only mentor the undergraduates in research, remember I said that all of our undergraduates have to participate, at least in chemistry, in a research experience. So I will have undergraduate seniors in chemistry spend one to two semesters, normally two semesters in my lab, and they're working very closely with a graduate student who is mentoring them. But we also asked the graduate students to teach because if they are considering a career in academia, they will be expected to teach. So they have to know what that's going to be like and get some experience. And we have another level of mentorship. For example, in my group, I've mentored about 10 post-doctoral fellows. Those are people who are really training to go to academia in the future. And so those postdoctoral fellows become mentors to the graduate students. Like Sarah says, you can have, you know, the full-time faculty doing mentoring, you can have the postdoctoral fellows doing mentoring, especially of the junior graduate students, and then you have the graduate students mentoring the undergrads and that really makes for a very dynamic, exciting research environment.

Sarah Kerrigan [00:29:42] Yes so our program, Gabby, most of our mentoring is from our full time faculty, although certainly more experienced doctoral students can serve as effective mentors for master's students. We also do allow our doctoral students to teach. They can teach lectures as doctoral teaching fellows, and that can, again, as José pointed out, really prepare them if they're looking for an academic job. However, because our in - within our department, we don't have an undergraduate major, our graduate students aren't really competing with undergrads for faculty attention. So intensive mentorship at the faculty level is something that our students can really benefit from because the undergraduate programs typically have a very large number of students. So we are a little bit fortunate in the fact that we only have graduate programs within our department.

Gabby DiEmma [00:30:35] Yeah, it sounds like there's a lot of great attention paid to each of your students and you're able to get that mentorship to continue the cycle of learning between your doctoral students, your graduate students, and then in some cases, also your undergraduate. I'd like to take a little bit of a turn in the conversation here and talk about some of the professional organizations that you and your students belong to and what conferences do you regularly attend to stay up to date and share research with the forensic science community?

José Almirall [00:31:07] Well, for me, I'm a member of the American Chemical Society. I'm a fellow of the American Academy of Forensic Sciences and I'm also a fellow of the American Association for the Advancement of Science, AAAS. So I try to attend. I can't always make all of the meetings every year because there are a lot of meetings. Like this year I wasn't able to go to the AAFS meeting in Seattle, but I also try to attend analytical chemistry conferences. There's one that I think is really good, it's called SciX and that's the largest analytical chemistry conference there is. So there's usually a pretty substantial forensic chemistry component to that meeting.

Sarah Kerrigan [00:31:47] I would really agree. I want to just highlight how important it is that forensic scientists participate in scientific meetings that are actually outside of forensic science. As it pertains to forensic science, though, the American Academy of Forensic Sciences is certainly the largest and most diverse professional organization in the United States because it's got more than 6000 members in 12 sections, including the most recent edition of a section for Forensic Nursing, so that provides a really tremendous opportunity for faculty, students and researchers to attend that annual meeting. For me, I think the discipline specific meetings are very important. So my background is forensic toxicology. So the Society of Forensic Toxicologists or SOFT, is a very important meeting for us in here in the United States and I was fortunate enough to be president of SOFT in 2011. So I really enjoy going to that meeting. And then TIAFT, which is the International Association of Forensic Toxicologists, is our international organization, which gives us the opportunity to share information with our international colleagues from across the globe and that's very important because so many of our drug trends actually begin in Europe. So again, by engaging with people outside of forensic science and in the basic sciences like analytical sciences and spectroscopy, but also with our international colleagues, it really enhances the participation in those national meetings through our own forensic science organizations here in the U.S.

Gabby DiEmma [00:33:31] I love how you guys mentioned both the more general, the natural sciences attending those and being members of those organizations is just as important as being members of your discipline specific organizations, because you really need that high level and that discipline specific view.

Sarah Kerrigan [00:33:49] It's critically important, Gabby, because we have to remember that before José and I were forensic scientists, we were just basic scientists in the lab sciences, in analytical chemistry or toxicology. So the science comes always before the forensic science.

José Almirall [00:34:06] I agree.

Gabby DiEmma [00:34:07] Scientists first, forensic scientists after. Can you both tell us a little bit more about your relationship with state, local and or federal forensic agencies?

Sarah Kerrigan [00:34:17] For us, collaboration with operational labs is a core value at Sam Houston State. So we've collaborated with state, federal and local agencies for more than 15 years and created the IFRTI to manage these partnerships and provide support for these types of activities. So these types of collaborations are pretty long standing for us. For example, the collaboration that we had with the Department of Homeland Security, Customs and Border Protection about 10 years ago resulted in a graduate research fellowship from NIJ to develop STR panels for marijuana genetic profiling. And since then, that project morphed into alternative markers using chloroplast DNA, using next gen

sequencing and looking for synthase markers to predict chemotype. And this still involves collaboration with CBP, but through the CARFS, through the NSF IUCRC that José described earlier, that project now involves more than four partners that are involved with students and faculty. That includes the FBI, DEA, CBP and Signature Science. So this is really just one example of the many academic industrial research projects that we've been involved in. But it sort of shows the cycle of how initial NIJ funding through a GRF can grow into a bigger academic industrial partnership and then end up at the NSF IUCRC, where it gains even more traction. So, you know, in terms of our other activities with state, local and federal agencies, because of our human decomposition facility, STAFS, we also engage in very specialized training and research with government agencies at STAFS. And that might include specialized studies using cadavers and improvised explosive devices, fire investigation or search and recovery of human remains. And that's integrated a great deal into both our teaching and research within both our master's and doctoral programs at Sam Houston State.

José Almirall [00:36:26] And if I could add, Sarah described a few excellent research programs and research projects that are going on at Sam Houston State and CARFS is really a great mechanism to engage that operational community in research and NSF funds many IUCRC centers that fund what they call use inspired research. And how we organize this is we have you know, currently we have ten IAB members that are composed of large federal laboratories, national laboratories, private industry partners, and they are asked, what are your most important research needs today? What are your pain points? And it changes all the time. And what CARFS can do is be very agile at funding seed projects like the one Sarah just described in response to their research needs. Now, what NSF would like is to continue that ecosystem of translating research into products and services that are eventually going to be used in the community, either as commercial products or as methods and that system has really worked well for NSF for more than 40 years. And CARFS is the only IUCRC that's devoted to forensic science research in the U.S.

Gabby DiEmma [00:37:53] That's very interesting. I didn't know that. And it's great that you're addressing those pain points and you have that ability to do that research in that capacity. You both have alluded to this a little bit in some of your previous responses, but post-graduation, what have your students been up to and how many have found work in forensic science at publicly funded laboratories conducting research? NIJ funded research and other to support the improvement of forensic science?

Sarah Kerrigan [00:38:22] So, Gabby, as I mentioned, most of our students do go on to work in operational forensic science labs, and our post-graduate success is really exceptional. It's greater than 95% at the master's level for more than 10 years and 100% at the Ph.D. level. And we measure that by looking at employment rates within forensic science within 12 months of graduation from the respective program. Now, most of them do go on to pursue careers in publicly funded labs, which makes me very happy, because that's where I spent most of my career and I - it makes me glad to think that our graduates are going back and giving back to publicly funded labs. And the majority of them tend to find work in DNA, tox, seized drugs and trace evidence from our program because we're very interdisciplinary in terms of our approach. Now, in terms of how that ultimately supports the improvement of forensic science, I think one of the most important things for me is that it's incredibly rewarding to see that as our graduates from both the master's and the Ph.D. program advance into leadership positions, they're all critically improving the forensic sciences and contributing to the improvement of the profession as they advance through their careers. But not only that, after they graduate and advance into those

leadership positions, we very often have the opportunity to engage with them in research projects when they become a lab director of a state system. And that's really incredibly exciting for us as professors and academics to be able to see our students achieve those levels and then continue to work with us in a very different way.

José Almirall [00:40:09] I agree again. We've had very similar success with our students that are graduating, some of them getting job offers even before they graduate. And we are very proud of all of our students and what they have accomplished. We still keep in touch with many of them, and in some cases we continue to collaborate with them. Later in this Just Science series on forensic education, you will be hearing from some of our FIU graduates.

Gabby DiEmma [00:40:35] This has been a great discussion. Are there any final thoughts you would like to share with our listeners?

José Almirall [00:40:40] Well, for me, I just want to thank you for taking the time to meet with us and to talk about forensic science education. For me, this is a topic that's very dear and near to my heart, education and research and chemistry. So I am very happy to talk about this any time, and thank you for inviting me.

Sarah Kerrigan [00:41:00] Likewise, Gabby. These are really important topics. I think it's great that we've been able to talk about not only the importance of the FEPAC accreditation, but also touch on these other important areas, such as the importance of academic industrial partnerships, whether they're through the NSF funded CARFS or through our own independent institutes that we have within our institutions. And I'm really excited that you're excited about the human decomposition facilities and my only recommendation is that you add an additional podcast just so we can talk about that topic.

Gabby DiEmma [00:41:36] I would love to schedule one just to talk about that. Thank you both so much for agreeing to be on the podcast.

Sarah Kerrigan [00:41:43] Thanks, Gabby.

José Almirall [00:41:44] Thank you for having us.

Gabby DiEmma [00:41:45] If you enjoyed today's episode, be sure to like and follow Just Science on your platform of choice. For more information on today's topic and resources in the forensics field, visit ForensicCOE.org. I'm Gabby DiEmma, and this has been another episode of Just Science.

Voiceover [00:42:02] Next week, Just Science sits down with Dr. Sarah Williams from Virginia Commonwealth University and Dr. Keith Morris from West Virginia University to discuss crime scene investigation and their FEPAC accredited forensic science programs. Opinions or points of views expressed in this podcast represent a consensus of the authors and do not necessarily represent the official position or policies of its funding.