

# FEARLESS



A TEXAS TECH PRODUCTION

Season 2 | Episode 5 | **Fiber of Life**

(Tractor starting)

(Acoustic guitar music)

Taylor Peters, Host: I WANT YOU TO THINK OF A SEED. ANY KIND WILL DO. DO YOU WONDER HOW SOMETHING SO SMALL CAN TAKE A TRANSFORMATIVE JOURNEY, BECOMING SOMETHING ENTIRELY NEW? NOTHING BUT WATER AND SUN CONTRIBUTE TO THIS COMPLETE EVOLUTION. IN THIS EPISODE, WE TAKE YOU ON THE JOURNEY OF A SMALL SEED. HOW EVEN BEFORE ITS PLANTED, IT HAS BEEN SHAPED, MODIFIED, CREATED TO BE A WARRIOR IN THE FIELD. FACING OPPOSITION IN WEATHER, INSECTS AND DISEASE, HOW RESEARCH ON CAMPUS IS GIVING THOSE SEEDS THE ARMOUR THEY NEED TO GROW INTO THEIR FULL POTENTIAL. AND HOW ANOTHER RESEARCHER IS TAKING COTTON WASTE AND GIVING IT A NEW LIFE. ONE THAT IS REUSABLE, BIODEGRADABLE AND COULD HELP SAVE OUR PLANET. THAT JOURNEY STARTS NOW ON FEARLESS.

(Music)

(Car unlocking and starting)

Navigation: Starting route to Fiber and Biopolymer Research Institute.

Peters: I'M LEAVING CAMPUS, HEADING EAST TOWARD MARTIN LUTHER KING BOULEVARD. ON THIS STIFLING SUMMER MORNING, I'M HEADED OUT TO THE F-B-R-I... THE FIBER AND BIOPOLYMER RESEARCH INSTITUTE. THERE ARE A FEW OFFICES HERE, BUT IT'S PRIMARY PURPOSE IS TO HOUSE THE ENORMOUS, FLOOR TO CEILING, COTTON EQUIPMENT THAT IS EASILY WORTH MILLIONS OF DOLLARS.

Eric Hequet on tour: It's where you begin to get organization because until this stage everything is...

Peters: THAT'S ERIC HEQUET... HE'S AN ASSOCIATE VP OF RESEARCH IN THE OFFICE OF RESEARCH AND INNOVATION. HE'S ALSO A HORN PROFESSOR IN PLANT AND SOIL SCIENCE. ERIC'S STORY IS FASCINATING... ORIGINALLY FROM FRANCE, HE HAS SPENT THE LAST 40 YEARS OF HIS CAREER IMMERSSED IN COTTON FIELDS ACROSS THE WORLD.

Eric Hequet, Horn Professor, Plant and Soil Science: When I was a student, one day my professor asked me to write a paper on cotton. I was doing my PhD in plant genetics. Never saw a cotton plant in my life, obviously it doesn't grow in Paris...

Peters: BUT HE'S A FAST LEARNER,

Hequet: I was ready to leave and the lady tells me, "Okay, the head of the cotton breeding program is here today, do you want to talk to him?" I said, sure. I talked to the guy for two, three hours. At the end of the discussion he said, "Okay, we need guys like you in Africa." I never thought for one minute. For some reason, I still don't know why I did that, but I just said yes. I came back

the following morning, signed a contract and left, without finishing my PhD, to be a cotton breeder in Africa.

Peters: AND THAT WAS THE BEGINNING. HE WOULD EVENTUALLY GO BACK TO FINISH HIS PHD, WHILE BALANCING HIS CAREER IN COTTON RESEARCH. WHAT STARTED IN AFRICA WOULD TAKE HIM TO BACK TO FRANCE AND EVENTUALLY TO LUBBOCK TEXAS.

Hequet: ...so, one day they just called me and they said, "Texas Tech is looking for somebody, you are the perfect profile. Do you want to meet?" I said sure. Met them in New Orleans during a cotton conference and I said, yes.

Peters: The rest is history, huh?

Hequet: Yeah.

Peters: LUBBOCK IS KNOWN FOR A LOT OF THINGS, TEXAS TECH,

(Band at Football Game)

BUDDY HOLLY

(Buddy Holly song)

Peters: AND OUR WIDE-OPEN SPACES... IT'S NOT A SECRET THAT THERE'S A LOT OF THAT HERE, BUT WE KNOW THAT LAND IS PUT TO GOOD USE. IN FACT, ERIC SAYS EVERYBODY KNOWS LUBBOCK...

(Music)

Hequet: Oh, basically around the world, everybody knows Lubbock. In the cotton industry, you can go anywhere in the world they know it.

Peters: AND HE SOON LEARNED ALL THE REASONS WHY. THE HUB CITY IS THE EPICENTER OF COTTON PRODUCTION. ACCORDING TO USDA, THE SOUTH PLAINS IS THE LARGEST COTTON PRODUCING AREA IN THE WORLD. IT CONSISTS OF JUST 19 COUNTIES AND SOME YEARS WILL YIELD MORE THAN 3 MILLION ACRES. BEYOND THAT, ERIC SAW POTENTIAL. HE SAW A FUTURE. NOT ONLY FOR PRODUCTION BUT FOR RESEARCH AND TO STUDY EVERY STAGE AND SEASON OF LIFE FOR THIS GLORIOUS CROP THAT FUELS OUR ECONOMY. AND HE GETS TO DO ALL OF THAT AT THE FBRI.

Hequet: You have nothing like that anywhere in the world. A place where you can go from seed cotton to a piece of fabric and everything in between. It just doesn't exist nobody has that anywhere in the U.S. in university settings, there's nothing that is even remotely close.

Peters: THE FBRI IS A MASSIVE BUILDING. IT HAS TO BE IN ORDER TO ACCOMMODATE EVERYTHING THAT LIVES HERE. ERIC ISN'T EXAGGERATING WHEN HE SAID THAT THING- WHERE YOU CAN GO FROM SEED COTTON TO FABRIC AND EVERYTHING IN BETWEEN.

(Walking)

Peters: THE CLICK FROM ERIC'S DRESS SHOES ECHOS DOWN THE EMPTY CONCRETE HALLS OF THE FACILITY AS HE GUIDES US ON A TOUR.

(Walking)

Peters: HIS CRISP, STARCHED SHIRT AND DRESS PANTS WOULD FIT IN PERFECTLY IN A BANK, OR ANY CORPORATE SETTING... BUT THIS IS HIS OFFICE, THE 1 TON METAL MACHINERY IS FAMILIAR.

(Walking and talking)

Peters: HE ENTHUSIASTICALLY DESCRIBES WHAT THESE MACHINES DO- FROM SEPARATING RAW COTTON, ELIMINATING THE SEEDS AND STEMS, TO CREATING THE THREADS AND EVEN DYING THEM. ERIC FOCUSES A LOT ON THE DISTRIBUTION SIDE OF THIS INDUSTRY- WORKING WITH PRODUCERS AND CONSUMERS. CREATING SPACE FOR THE RELATIONSHIP BETWEEN THOSE TWO TO FLOURISH.

Hequet: Our first customer is a producer; they need to be happy. They need to have a good yield. They need to make money. But just the beginning... Then you have consumers all around the planet, they need to be happy too. You have the three segments, all of them need to be happy if we want to keep selling our cotton not just the guy next door. You have your cotton you sell it, end of the story. No, it's just the beginning of the story.

Peters: BEFORE WE LEAVE, ERIC INTRODUCES US TO A MAN BY THE NAME OF NOURREDINE ABIDI. HIS OFFICE IS NEXT DOOR TO ERIC'S. AFTER A BRIEF CHAT, ERIC TELLS US THAT WE DON'T WANT TO MISS INCLUDING NOURREDINE'S WORK IN OUR PODCAST. HE TELLS US THAT WHAT HE'S DOING IS REMARKABLE. NOURREDINE IS ALREADY SUCCESSFUL IN HIS RESEARCH, BUT NOW HE'S WORKING ON SOMETHING THAT IS A REAL GAME CHANGER. SEE, NOURREDINE'S WORK BEGINS AT THE END.HIS STORY IS COMING UP IN JUST A BIT, ON FEARLESS.

(Music)

(Digging in dirt)

Peters: AT THE BEGINNING OF A SEED'S LIFE, THERE'S LUIS HERRERA-ESTRELLA.

Luis Herrera-Estrella, Director, Institute of Genomics for Crop Abiotic Stress Tolerance: Plants are extremely versatile.

Peters: HIS WORK HAS THE OPPORTUNITY TO CREATE BIG CHANGES FOR FARMERS ACROSS THE WORLD. HE'S A NATIONAL ACADEMY OF SCIENCES MEMBER – THE FIRST EVER AT TEXAS TECH – AND THE DIRECTOR OF THE INSTITUTE OF GENOMICS FOR CROP ABIOTIC STRESS TOLERANCE. IT'S A REALLY LONG TITLE THAT BASICALLY MEANS HOW CAN WE DEVELOP A SEED USING SCIENCE TO BE MORE TOLERANT IN EXTREME CONDITIONS.

Herrera-Estrella: Well, cotton is one of the main crops in West Texas and it is very well adapted to the conditions, the environmental conditions, of this part of the environment. It's very hot weather, little water, lot of light. So that helps us to establish experiments on the very natural conditions that will serve us to face the problems that we will have with climate change.

Peters: THIS WORK ISN'T SPECIFIC TO ANY ONE TYPE OF CROP. IT COULD MAKE A DIFFERENCE IN ANY TYPE, ANYWHERE. BUT IN THIS REGION, THE REALITY IS THAT WEATHER CONDITIONS CAN BE EXTREME- LIKE LUIS SAID, THE HEAT, THE WIND, THE DROUGHTS. HE'S LOOKING AT THIS FORMULA AND SAYING 'OKAY, WE CAN'T CHANGE THE WEATHER BUT WE \*COULD CHANGE THE CROP'. SO THAT'S WHAT THEY'RE DOING.

Herrera-Estrella: This year there is very little rain and that affects not only cotton production but the production of any crop. We need to do research to create plant varieties that can produce the same with less water. We are studying what are the mechanisms that different plant species use to make more efficient use of water so they can produce with half of the water.

AS YOU KNOW, THE LACK OF MOISTURE CREATES HARDER, DENSER SOIL.

(Digging in soil)

SO, MOST PLANT ROOTS HAVE A HARDER TIME EXPANDING TO FIND WATER DEEPER BELOW THE SURFACE.

(Irrigation sounds)

Herrera-Estrella: So, we are trying to understand why some plants have the capacity to penetrate very hard soils. Because if we understand those processes, then we can incorporate these traits into cotton and other crops to make them more water efficient. Which should be able to achieve the same productivity with less water.

Peters: THIS CAN BE APPLIED TO OTHER CROPS THAT ARE IMPORTANT TO WEST TEXAS FARMING. LUIS WAS RECRUITED TO THE TEXAS TECH CAMPUS IN 2018. LET ME JUST SAY THAT HE AND THIS WORK ARE A KIND OF BIG DEAL. ERIC HEQUET VOUCHERED FOR HIM, HE FOUGHT TO GET HIM HERE. WHILE ERIC WAS GIVING ME A TOUR

(Eric Hequet tour)

AROUND THE FBRI, HE TOLD ME ABOUT LUIS AND THE PROCESS OF BRINGING HIM TO TECH. LUIS HAS HIS OWN GREENHOUSE ON CAMPUS TO DO THIS RESEARCH, IT'S PRETTY MUCH SMACK DAB IN THE CENTER. HE SAYS WHEN HE WAS BROUGHT TO TECH, THERE WERE TWO FACTORS THAT MADE ALL THE DIFFERENCE TO HIM. SIMPLY PUT, HE SAYS THERE'S NOT A BETTER PLACE TO STUDY COTTON THAN THIS PLACE WE CALL HOME.

(Music)

Herrera-Estrella: This is a perfect natural experimental system because you have to face here all the extreme environments that any farmer in the world meets. The second aspect is that I like challenges. I saw more opportunities here to build a new institute. So, I think my contribution here is going to be more important because I can help mentor young scientists and I can help integrating a strategic plan to produce research at Texas Tech that is going to have a greater impact.

Peters: THESE BIG THOUGHTS, BIG PLANS ARE BREWING IN HIS GREENHOUSE. WHERE FOGGY WHITE PANED GLASS IS HELD TOGETHER BY SHINY METAL PILLARS. THIS IS REALLY POWERFUL WORK... BEING A FARMER IS FILLED WITH UNCERTAINTY, RAIN AND HEAT DON'T JUST MAKE A MINOR DIFFERENCE. IT COULD BE THE DIFFERENCE BETWEEN TENS OF THOUSANDS OF DOLLARS IN A SEASON. BUT THIS. THIS HAS THE OPPORTUNITY TO PROVIDE A STABILITY THAT FARMERS HAVE NEVER HAD.

Herrera-Estrella: If we can understand what are the genetic secrets for this adaptation, then we should be able to engineer plants to perform much better on the adverse conditions they see.

Peters: LUIS LIGHTS UP ABOUT THIS WORK. I BELIEVE THAT ITS BECAUSE HE IS THINKING BEYOND THE COTTON BOLL. HE'S THINKING ABOUT WAYS TO EXPAND HIS KNOWLEDGE, TO TEST THE LIMITS AND BRING ALONG THE NEXT GENERATION OF SCIENTISTS IN HIS FIELD. HIS GROUNDWORK MAY JUST BE THE PATH THAT THEY FOLLOW FOR THE NEXT GREAT INVENTION. BUT HE'S ALSO THINKING ABOUT THE HERE, THE NOW, THE WAYS THAT HIS DISCOVERIES CAN CHANGE A FARMER'S LIFE. HE SAYS THIS NEW BREED OF CROPS MAY BE ON THE MARKET IN AS SOON AS 5 YEARS. AND IN THE MEANTIME, HE'S COVERING A LOT OF GROUND IN THIS INDUSTRY.

Herrera-Estrella: One important thing is that we need to find ways to have a stronger interaction with the farmers. How can we have a more direct way to explain what do we do so that they understand what are going to be the possibilities in the future for their farms?

Peters: I TELL LUIS THAT THIS SEASON IS ABOUT BRIDGING A GAP BETWEEN RESEARCHERS LIKE HIM AND THE REST OF US. TO SHARE THE STORIES OF HOW PEOPLE THAT WE DON'T EVEN KNOW ARE DOING THEIR WORK TO CREATE A BETTER WORLD FOR ALL OF US, FOR THE FUTURE AND HE HEARS THAT.

Herrera-Estrella: I would love to have them visit our lab and show them the new technologies we are using and the type of projects we are doing. Come and visit and see what we do.

(Music)

(Walking through door)

Peters: Hello, how are you? How was your summer?

Noureddine Abidi: Good! Good.

Peters: AS A BOY GROWING UP IN MOROCCO, NOREDDINE ABIDI ALWAYS DREAMED OF BECOMING A DOCTOR. WHEN WE MET, AT THE FBRI, HE TOLD ME THAT IN HIS OPINION, THERE IS NOT A MORE HONORABLE LINE OF WORK. BUT MEDICAL SCHOOL ISN'T QUITE WHAT THE FUTURE HAD IN STORE. TODAY, HE'S THE MANAGING DIRECTOR OF THE FBRI. AND WHILE HE MAY NOT BE SAVING LIVES AS A DOCTOR, HE'S GIVING NEW LIFE TO A PLANT THAT'S CRITICAL TO THE AGRICULTURE INDUSTRY.

Noureddine Abidi, Managing Director, FBRI: To be honest, I never wanted to be a chemist.

Peters: IT'S FUNNY HOW LIFE DOES THAT, ISN'T IT... HOW, SOMETIMES, IT SEEMS TO KNOW US BETTER THAN WE KNOW OURSELVES. HE PURSUED HIS MASTER'S DEGREE IN CHEMISTRY IN MOROCCO, THEN WENT ON TO GET HIS PHD IN FRANCE, WHERE HE MET A FELLOW SCIENTIST WHO WOULD INTRODUCE HIM TO THE NEXT 20 YEARS OF HIS LIFE.

Abidi: I was trying to discuss with her and I was looking at the nature of making polymer and I was trying to make it in the lab. So, I came here for just for one year to work on cotton to see, compare a polymer that is made by nature, by plant. Before coming to Lubbock, I had never seen the cotton plant, the cotton boll. For me it was just clothes. I was really fascinated by that process so almost 23 years later and I'm still here.

Peters: AND IT'S A GOOD THING TOO.

(Music)

Peters: SO, THE LIFE OF A COTTON SEED GOES LIKE THIS... PLANTING SEASON IS IN THE SUMMER MONTHS- FROM MAY TO JUNE. AND ABOUT 5 MONTHS LATER, IT'S HARVEST SEASON. BUT DURING THAT TIME, IT CAN BE A ROLLERCOASTER OF UNCONTROLLABLE VARIABLES THAT WILL DETERMINE EVERYTHING.

Abidi: We have no control over the weather. So even if we can put the best seed in the soil and if it doesn't rain or it rains too much, or the cotton is subjected to heat stress...

Peters: TALK ABOUT TOUGH... AND THESE THINGS ALL IMPACT YEILD. AFTER COTTON IS STRIPPED FROM THE FIELDS AND PROCESSED... THE ONLY THING LEFT IS COTTON THAT WOULD OTHERWISE BE CONSIDERED DISCOUNTED, TRASH...

Abidi: After that I started to be interested in converting the lower quality cotton...

Peters: HE'S NOT INTERESTED IN LETTING ANYTHING GO TO WASTE, SO HE HAS DEVELOPED A WAY TO PUT IT TO GOOD USE.

Abidi: Cotton doesn't melt, if cotton could melt like polyester or nylon or acrylic and then spin it to a fiber. But it doesn't melt. So, we have to convert it into a gel. And with that gel now we have to find ways of making it into a product. One of them is a plastic. So, taking that, cast it, make a plastic from that, it looks very similar to plastic from a petroleum-based polymer...

Peters: YOU KNOW THIS PLASTIC...

(Plastic bag)

SIMILAR THE ONES WE GET AT THE GROCERY STORE.

(Grocery store checkout line)

Peters: BUT IN REALITY, THEY COULDN'T BE ANY MORE DIFFERENT...

Abidi: If you put it in the soil, bury it in the soil, and leave it in there for 30 days to 2 months, it's completely gone.

Peters: HE HAS CREATED A REPLACEMENT FOR ONE-TIME USE PLASTICS – A REPLACEMENT THAT IS COMPLETELY BIODEGRADABLE.

Abidi: The plastic is really creating a huge problem- I think you have seen this in the accumulation of plastics in the oceans...

Peters: THERE'S THE THING THAT'S CALLED THE GREAT PACIFIC GARBAGE PATCH. YOU MAY HAVE HEARD OF IT- IT HAS BEEN A PRETTY BIG DEAL AND IT HAS BEEN FOR YEARS. BASICALLY, IT'S AN ISLAND OF TRASH INCLUDING PLASTIC BAGS, BOTTLES AND OTHER FORMS OF SINGLE USE PLASTICS THAT ARE CAUGHT TOGETHER IN THE MIDDLE OF THE PACIFIC OCEAN.

National Science Foundation Video: Debris may hang out in that garbage patch not just for months but for years.

THIS IS FROM A VIDEO THAT THE NATIONAL SCIENCE FOUNDATION RELEASED IN 2022. NOUREDDINE IS INTENTLY FOCUSED ON PLASTIC BAGS.

Abidi: The problem is not the big piece of plastic; the problem is that the plastics by itself does not biodegrade. I will, with the reaction from sunlight, these will degrade into small pieces.

Peters: THESE ARE CALLED MICROPLASTICS.

Abidi: HE TELLS ME ABOUT A STUDY THAT RECENTLY TOOK PLACE IN CHINA. SCIENTISTS THEORIZED THAT BECAUSE TABLE SALT COMES FROM THE SEA, THAT THEY COULD CONTAIN TRACES OF MICROPLASTIC CONTAMINANTS... AND WHAT THEY FOUND WAS ALARMING.

Abidi: 90% of the samples they tested were contaminated with microplastics.

Peters: SEE, THAT'S WHAT NOUREDDINE IS ADDRESSING WITH THIS PLASTIC DESIGN.

Abidi: At 21 days you can see it's starting to biodegrade...

Peters: HE SHOWS US ONE OF THE LAB SPACES WHERE SOME SAMPLES ARE LAID OUT NEATLY ON A BLACK TABLETOP.

Abidi: 49 days there are some spots for microorganisms....

Peters: THERE ARE SAMPLES IN DISHES WITH NUMBERS WRITTEN IN MARKER- 21 DAYS, 49, 56... THE FINAL ONE IS ALMOST EMPTY.

Abidi: Yes, by 2 months its gone.

Peters: THEY'RE TESTING DIFFERENT THICKNESS SAMPLES RIGHT NOW. JUST BEHIND US THERE ARE THESE CONTRAPTIONS THAT REMIND ME OF PICTURES I'VE SEEN OF POLYGRAPH MACHINES- WITH A BRASS CYLINDER RIGHT IN THE MIDDLE HOVERING OVER A LARGE OPEN SPACE. IT'S COVERED BY A CLEAR PLASTIC WALL ON ALL SIDES. HE SAYS THIS IS THE REGULAR 3D PRINTER... OH. YEAH, THAT'S THE SECOND PART OF WHAT THIS GEL IS BEING DESIGNED FOR.

Abidi: So, I have this syringe and I'm modifying it to heat it and start printing the same.

Peters: NEXT TO THE 3D PRINTER, THERE'S AN EMPTY CARTON OF SOUR CREAM- HE'S USING IT TO FIND THE RIGHT CONDITIONS TO PRINT... TO TEST THE LIMITS OF WHAT THIS COTTON GEL CAN DO. THIS HAS ALREADY RECEIVED A PATENT... THE PATENT FOR THE PLASTIC BAG IS SO CLOSE HE CAN FEEL IT.

Abidi: It's just the review, you send all the information, then you have claims and an examiner, I think they put two or three, looking at those claims and the science. It has been published but not approved yet. It takes forever.

Peters: HE SAYS IT'S AN INTERNATIONAL PATENT, WHICH TEND TO TAKE A LOT LONGER. BUT HE'S PATIENT. HE BELIEVES IN WHAT HE IS DOING... AND SO DO I. ONCE IT'S ON THE MARKET, THIS COULD BE REVOLUTIONARY.

(Walking out of FBRI)

Noureddine: Thank you so much.

Peters: Okay, it was good to see you. Thank you.

(Music)

Peters: I LEAVE THIS INTERVIEW INSPIRED. INSPIRED BY A PERSON'S DEDICATION TO THIS GLOBAL ISSUE. AND HOW HE HAS TAKEN HIS OWN KNOWLEDGE, DEVELOPED IN A LAB IN THIS WEST TEXAS CITY OF 200,000 PEOPLE.... AND INVENTED SOMETHING WITH POSSIBLE GLOBAL IMPACT. I'M PROUD THAT THIS RESEARCH IS CONNECTED TO TEXAS TECH AND LUBBOCK AND THAT PEOPLE LIKE NOUREDDINE ARE REPRESENTING RED RAIDERS SO WELL. HE HAS TWO SONS THAT HE IS ENCOURAGING TO BECOME DOCTORS SOMEDAY. HE WILL ALWAYS BELIEVE IN THAT HONORABLE PROFESSION. BUT WHAT HE HAS DONE HERE IS TRULY EXTRAORDINARY AND COULD CHANGE THE WAY WE APPROACH SINGLE USE PLASTICS. THAT SEEMS LIKE HONORABLE WORK TO ME.

(Music)

FEARLESS IS PRODUCED BY THE TEXAS TECH OFFICE OF COMMUNICATIONS AND MARKETING. IT'S HOSTED BY ME, TAYLOR PETERS, WITH SPECIAL HELP FROM ALLISON HIRTH. EDITING AND SOUND DESIGN BY THOMAS BOYD. FEARLESS IS A TEXAS TECH PRODUCTION, FROM HERE IT'S POSSIBLE.

(Music)

HI EVERYONE, IT'S TAYLOR. DON'T FORGET TO LIKE, REVIEW AND SUBSCRIBE. WHEREVER YOU GET YOUR PODCASTS!