

Lisa Baermann – Senior Director of Fund Development & Alumni Relations

Lisa Baermann: Welcome parents and friends. I'm exciting to be sitting with you today and sharing Concordia's Masterclass. The idea came to us as we were visiting with Concordia faculties on Concordia fund projects. We realized just how many exceptional faculty members we have. They are experts in their fields: scientists, authors, composers, musicians. They shared their expertise everyday with our students in the classrooms. While we can learn a lot from those people outside of Concordia, we can learn a lot from our faculty members right here within our own walls. Concordia Masterclass was created as an educational experience just for you, our Concordia parents. We hope you enjoy!

Lisa Baermann: Welcome back to Concordia's Masterclass. Today we are sitting down with Dr. Peter Tong. Dr. Tong has been in Concordia for 10 years and as an anchor in our science department. We are really excited to speak with him, and today we are sitting with him in his classroom on the 5th floor of the high school building.

Thanks for being with us today!

Dr. Peter Tong – Big Data, Aerospace & Mathematics Teacher

Peter Tong: Thank you very much, Lisa, for doing this interview with me! Very much appreciated!

Lisa Baermann: I'm glad! I know you have a lot going on, and I know you are always running around, and you are always doing things with students. So I am glad to get you down in one place and have this time with you. There's so much to talk about though. Maybe, if you could, share a little bit about what you teach here at Concordia? What are the classes that you are teaching currently at Concordia?

Peter Tong: Currently I'm teaching Honors Precal, Big Data Analytics, and AP Statistics, but throughout the course of my career at Concordia, I've been teaching Algebra II, Precalculus, Honors Precal, Big Data Analytics, Aerospace engineering, Multivariable, Linear Algebra.

Lisa Baermann: You didn't intent to become a teacher when you went to school. Can you take us through your education?

Peter Tong: I went into electrical engineering just because all my other friends went into electrical engineering. So, I did that, and it was only in my third year of electrical engineering, I realized that is not exactly what I wanted to do, but I finished it anyway. My passion has always been in aerospace, has always been aviation. So, upon finishing my undergraduate engineering, I went to do my masters in mechanical engineering, specializing in fluid mechanics. What's interesting with that is, despite my lack of background, I got a very very supportive supervisor, professor Patrick Oosthuizen, took me under his wings, and grew me through my masters and mechanical engineering specializing in fluid dynamics.

Lisa Baermann: What drew you to teaching?

Peter Tong: Very interesting. So, this was, I finished my masters. I was working as a project engineer. The job was very interesting, but I did not find the satisfaction in it. So it was one day, I remember so clearly that it was the photocopy room, Jane Paul, my supervisor's wife told me, "Have you ever thought about teaching?" Because she has seen me working with students, and that's when I thought, "maybe I should give it a go." And that was more than 25 years ago, and I never look back. Every day in my teaching career is a okay day. Don't tell anyone that! It's my little secret! Every day is a play day for me.

Lisa Baermann: I think you have your own teaching philosophy. Would you share your philosophy on teaching with us?

Peter Tong: Sure! I believe in play. I like the students to explore learning that I want the learning to come from them. I use the philosophy that is developed by Allison King, To Guide-on-The-Side, you have to teach it, standing on the side, just guiding the students along. So, I really like that method of teaching, and to incorporate that for project-based learnings. It works very well. The satisfaction that I get is when the students developed the learning, and they are the ones who discovered the learnings by themselves.

Lisa Baermann: You can see when you look around in your room. There's a lot of students' things happening here. So would it be fair to say that one of your classroom goals or your classroom goal are that your students are actually very active, engaged in taking on the process.

Peter Tong: Yes. Because I want the learning to come from them. I want them to develop the learning themselves.

Lisa Baermann: How do you know that you have succeeded it as a teacher?

Peter Tong: Wow, that's a very deep question. I will only know if I succeeded as a successful teacher to the students, only years after they left me. When they are successful, when they have a job that they enjoy. For me, the goal is that when my students to be more successful than I am. That's when I know if I'm successful with the students, that they can be better than I am. That's when I know I have succeeded it.

Lisa Baermann: I think your classes have inspired a number of students. I know there are students going on into Big Data, you have students in engineering. Do you have any aerospace students?

Peter Tong: Oh! I have more than a handful of them. I have Aaron Teh who went on to do his aerospace engineering at Imperial College. I have Andrew Chen, who just finished his undergraduate at Notre Dame, got a full scholarship to do his PhD, direct entry, all he has to do is to complete some courses in master's level and onto PhD program. I have students who graduated with undergraduate and masters form Purdue University.

Lisa Baermann: It's pretty fun to see what they do, huh?

Peter Tong: Oh yeah, as long as they are more successful than I am. That's good.

Lisa Baermann: I think the Big Data and Aerospace Engineering are two of your signature classes here, and you pioneer those classes. What led you want to start Big Data and Why do you think it's so important?

Peter Tong: It all began during a parent teacher conference, and student expressed interest in, what we used to call back then, Data Mining. And I have the curiosity in that, and then that's when we went to the principal, Nick Kent, and say, "hey, there's a student interest in this topic I'm interested." He gave me the green light to go ahead to develop this course. But the problem with offering Big Data Analytic in high school is that there's no curriculum for it. No one in the world has ever done it, at least in the international school circuit.

Lisa Baermann: We are the only school that has a Big Data class?

Peter Tong: Well, back then, yes. So, along the students, I was developing it from ground zero. Nick Kent said, "you know what, I will give you the license to fail. Even so you won't lose your job." That's a very low sake for a very high reward. So, we developed the course from nothing, and that was eight years ago. With the support of the students, and the credits actually go to Concordia's administrators, who are very supportive. Since then, our students have been presenting on international conferences consecutively for the past eight years.

Lisa Baermann: You take them to the conferences where they're with graduate students and college students, and they are the only high school students presenting.

Peter Tong: Yes. So, they are presenting alongside, shoulder to shoulder with professors, masters, PhD students. So often I get the comments that say, "really? Those are high school students?" I say, "yeah."

Lisa Baermann: They are surprised.

Peter Tong: They are very surprised. Few of them actually have commented and said that "some of your students are actually better than our graduate students."

Lisa Baermann: What do our students think when they are there? What's their reaction participating in these types of events?

Peter Tong: Certainly, a big experience for them. Just very proud of the work they've done. What's really interesting is that for them to actually realize that the work that they are doing, and the presentational skills are alongside with other graduate students. That, I have to thank those teachers who have taught the students so well, bring up that to me, prior before coming up to me. I don't know what the teachers did when they were in Middle School. They did the right things, taught them on the presentation skills, on the research skills.

Lisa Baermann: It's interesting to me that eight years ago you started this Big Data Program, and then this year, on Friday, you are going to launch the website that hosts your online Big Data course. That was created by our students.

Peter Tong: Absolutely correct.

Lisa Baermann: I think that is amazing. I got a sneak peek at it a little bit. Can you share a little bit of your thinking behind it? What do you hoping to accomplish with it?

Peter Tong: So, a little bit of historical fact is that I started this course, pioneer this course back into 2014, eight years ago. There was no such a course, no such Big Data Analytic course, at least in the international schools around Asia. As we develop that, we shared it with Concordia Hanoi, who have that, and also, with another school in Doha, where our teachers move over and brought along the course as well. I'm trying to get this course out to as many people as possible, and just because there's no instructors out there, we can teach it. So, I thought it would be a good idea to actually develop an online version of it. And of course, you know, at Concordia, we have great amount of supportive colleagues, and one of them is LeeAnne Lavender, who helped me to develop the online version of the Big Data Analytics course. This year, I'm just so blessed and so fortunate. In my eight years of teaching Big Data Analytics, I have a dream team of students. I literally do have a dream team. They are so cohesive, and they are so supportive for one another. So, you will hear the person I'm talking about on Friday. Basically, it's a student project. They develop the course, the online version of Big Data Analytics, to be shared with everyone else around the world.

Lisa Baermann: Wow, that's amazing. Right here, pioneer at Concordia.

Peter Tong: In fact, in addition to that, I actually branch on to Middle School and Elementary School as well.

Lisa Baermann: I think that's an area that really might be interested in your course is that Middle School age group.

Peter Tong: Yes, so when I first started this course eight years ago, my vision is to bring Big Data Analytics, instead of saying K-12, is from 12 to K, start from High School, Middle School, and then to the Elementary School.

Lisa Baermann: I heard that you partnered with Michelle, your wife, to bring Big Data down to the ES level.

Peter Tong: Yes, so this was about three years ago, when we offered an afterschool activity to the Elementary School. I partnered with one of my other teachers, Craig Gingerich, known as the Batman, and I'm Robin. Along with Michelle, my wife, we developed this afterschool cocurricular activity for students. What we did then was to have the students, going around the campus, to collect different temperatures at different surfaces. We had Mr. Brian Lavender had a drone up, took an aero view of the campus, so we can map out our campus layout, and have the students to collect different temperatures at different surfaces, and stick them onto the bird-eye-view of the campus. So that was one of the things that we did. We also had the students strap on the pacer and heart monitor for them to measure their own biorhythm, the heartrate, when they are at rest, or running, and things like that. We also measured the size of their palms. We painted their hands and just to measure the different sizes. Just so that they can

gain and have an appreciation on what data is. In fact, we're actually looking at how to bring it down to the little ones, the EC students as well. Michelle and I are actually working on that.

Lisa Baermann: You also pioneer the aerospace engineering class here at Concordia. Can you tell us a little bit about the students' experiences here in aerospace?

Peter Tong: So, with this one, students learn from hands on experience. Instead of me teaching them the theories, I have them build the airplanes, from paper airplanes to balsa to building drones, because I want the students to actually learn the theories behind flies from hands on experiences.

Lisa Baermann: You worked at ATS Aerospace Inc in Canada on Supersonic Unmanned Aero Vehicle, the UAV. What was that experience like?

Peter Tong: Oh, it was an amazing. This was when I was a fresh graduate and very fortunate to be hired by ATS Aerospace, brought on to be aerospace engineer to design a Mach 2+ supersonic unmanned vehicle. So, with that, I was the main engineer to do the preliminary design of the supersonic vehicle for the Department of National Defense. I was also the engineer involved in doing the flight test to the predecessor to this coming year vehicle. So, very interesting job. I got to witness test flight, we do wind tunnel testing, very very interesting.

Lisa Baermann: So this experience kind of is coming to your classroom.

Peter Tong: Very naturally. So, this is one of the things that in my class that brings in a lot of practical applications experience, just because of my background and my exposure. Nothing better than hands on when students are learning something, and because I'm teaching science and math, a lot of times students want to know, "what do I do with this math? Why do I have to learn this topic? Why do I want to learn this aspect of physics?" That's when I can bring in practical applications. So, this is where it can be applied.

Lisa Baermann: You know that the airlines just announced that they are purchasing something like 30-supersonic planes, that are going to be in use starting in 2029. Sounds like they are betting on supersonic travel. What's your thought on that having kind of work in that field?

Peter Tong: Well, I'm actually a little bit surprised that they are bring the SST supersonic transport back, considering the fact that they have canceled the concorde.

Lisa Baermann: yeah! Is it a different technology?

Peter Tong: It's about the same. I have to look at the preliminary design of the new one that they are talking about. The shape is very much the same. You can't deviate that much from it.

Lisa Baermann: Where do you think your love of aerospace comes from?

Peter Tong: It all begins with a childhood experience. I remember walking the dog with my family, my dad. It was a rainy day, thunderstorm, and I literally got lifted when I was holding an umbrella. I was literally lifted above the ground, and just carried over for a few feet there. I thought, “wow, I actually flew!” Like Mary Poppins! As a child I always wonder about how things fly, and what we used to do as a family was, we used to just go to the airport and watch the planes land and take off. So, I always love flying, and I would actually fly for the sake of flying.

Lisa Baermann: Are you a pilot?

Peter Tong: No, I'm not a pilot.

Lisa Baermann: Have you thought about it?

Peter Tong: Yes, I have. In fact, I did apply to become a pilot, but because of my eyesight, I couldn't do it. And in fact, I did not make the test.

Lisa Baermann: Now though correct that in some cases, but when we were going through, they weren't correctable.

Peter Tong: That's right, you got to have perfect vision. So, there goes that one.

Lisa Baermann: Well, you can still get your pilot license for fun.

Peter Tong: I could. In fact, I have looked into that, but it's just not viable because you need to have so many hours a year to keep it alive. But having said that, this was about two years ago, we actually have access to an FIA approved flight simulator in town, in Shanghai here. There's somebody who was so generous to give us free simulation time. So, I've actually brought students to fly on a Redbird flight simulator. It's six degrees of freedom on a flight simulator. The students have the experience of flying.

Lisa Baermann: Pretty fun! Can you share a little bit about your PhD and how you apply that now as a teacher?

Peter Tong: So, I did my PhD with MRIT, Melbourne, Australia, and my PhD scholarship was funded by Department Science and Technology Organization, which is the civilian version of the Australian Defense. My research topic was on *How to Land an Airplane upon Engine Failure*. The initial topic was on Pursuit evasion problem, so where you have one plane chasing another like a cat-and-mouse game, but because it's defense, we can't really talk about it. It would not be publishable. So, instead what we did was we fixed the target on the ground, so it became a force landing problem. The idea was to, when the pilots encounter any emergency situation, what's the optimal way to just land the airplane. And it's interesting what I'm seeing now in the drone's development, a lot like DJI for instance, has got this

obstacle avoidance AI program build into the drones. When they encounter an obstacle, they can actually back off, or maybe able to fly around it. So, that was my initial project, my research topic for my PhD.

Lisa Baermann: You are very involved with the drones here at Concordia, in the High School level and the Middle School level. Can you share a little bit about what's happening in the drone CCA and club, and what you hope for the future there?

Peter Tong: The students build drones from scratch with no manual. They research from the internet; they go to forums; then they build the 450 drones. With the success we have, there's an interest from the Middle School division as well. But with that, what we do was we buy it off from the shelf of the drones, and again, I'm just so lucky to be at Concordia, because the students we have are very very passionate. So, this year, I have got two students, Shreyas and Marcus, who basically lifted off the program on their own. So, with the Middle school program, the two of them developed the weekly teaching. They did the PowerPoint for the nine weeks of course on how to fly a drone, and to build in the obstacle courses for it, and to even do swam, which means we have more than one drone flying in sink on that.

Lisa Baermann: What's your teaching method, and how do you know if a student has actually learned what you hoping to accomplish?

Peter Tong: Many times, we as teachers, we give out an assignment. In math, that has to do with a lot of questions. We grade them; we give them feedback; pass it back to them. What do they do with the assignments after that? Chances are they go into the recycle bins. I like to create assignments that are alive, something that they can take with them. For instance, when we were on the top of polar coordinates in Honors Precal. I have students, pick an entity for that choice. Two years ago, we did flowers. The students selected a flower of their choice, and they used polar coordinates or polar equations to present the flower mathematically. So, from the textbook, we tell them, "There's a question here. Now, can you plot that into this equation." So, it's going from Point A to Point B. Always give them an equation and "tell us what you think it looks like?" With this one, this is authentic learning. They picked the picture; they find the mathematical equations to it, and they plot it. Now how do they check if their answer is correct? This idea actually came from a student, said, "Well, what if you superimposed the graphs that they created back onto the original pictures." So, it built in a self-check system. I think, something like this is great, because that's when I know if they have really learned the material. They understand what is the effect of the parameter, that particular number would do to the equations. There's no way you can copy something like this. Yes, you can go get ideas; you can surf for ideas, but there's no way you can find an equation that will actually plot that particular picture. This project was two years ago. This year, the topic is *Under the Sea*. So, the students picked the entities like the seashells, the nautilus, the sea dragon, and they actually created polar equations that can mathematically produce that, and again, superimposed on it as well. To me, that is a very well thought of assignment. Especially, it's something they can take with them, and I like to encourage students to do projects like this, because it serves as a time standard for them as well. Be for the next teacher, of

the college app, or future professors, when they say, “So, what have you learned? Tell me something about the projects you have done.” And because we have done this now, years later, they can easily tell prospective, teachers, professors, and employees, and say, “oh, I was doing this back then.” And I encouraged them to post it on YouTube channel, create their own digital portfolio, because I want to create assignments that they can take with them. They put in a lot of hard work, so keep it alive, give it assemble, put it in their toolbox, onto their portfolio that they can take with them wherever they go. So, when I’m teaching, I like to create assignments in such a way so that students can take away with them, just like what Athena did with the videos. She spent a lot of time editing, and it’s an assignment that she can take with her. To the students from this year’s Big Data Analytics class, they created the online course. They can easily tell the teachers in the future, or prospective and professors, that they developed this Big Data Analytics course. Here are some student’s assignments where the students were able to take it with them. Daisy who’s a very artistic student created a picture book for her Big Data Analytics course. Rinka and Kelly created a picture book for their Honors Precalculus course. These books were created to help the next generation of respective students to understand the subject matter.

Lisa Baermann: I like that idea of creating that place to hold.

Peter Tong: Yes. Over here, you can see some of these projects here on Pascal Triangle. Students did the Pascal Triangle, the plinko board, and also, they presented at the assembly as well.

Lisa Baermann: You really empower your students to take on some pretty big projects. You don’t just come in there and say, do it for them, but you really give them the tools and supports, say, “We can do this.”

Peter Tong: One of my teaching philosophies is that I want to spark the ideas. So, I’m there actually to encourage them to do what they want to do. I have some ideas what they would look like. I don’t have the road map. My students are the ones who build and create the road map to success, and that is where I get my satisfaction from. You give them an idea and see how far it will go.

Lisa Baermann: I guess this is going back a little bit, back to aerospace, but what is important about aerospace study now, and what do you see coming in the future?

Peter Tong: I see the trending – drones. During my time, drones used to be 12 to 15 feet, but now I’m seeing drones going from this size to palm size. I think the miniature drones are where they are heading to. They got to be fast.

Lisa Baermann: In a military perspective? Or are you just in general?

Peter Tong: Just in general, they wanted to be fast, wanted to be small. From a commercial point of view, you want them to be the workhorse. Amazon has already been looking at drone delivery. So, you want them to be able to lift heavy cargos. In fact, last year during the Christmas tree lighting, we actually had the

drones to fly the tree things over the students. We actually have other plans for the upcoming one, for the upcoming Christmas tree lighting. Watch out for that one! Students are already developing plans for what to do with it.

Lisa Baermann: That's fun. As a scientist, sometimes we are told that faith and science are incompatible. As someone who has the faith, what do you feel about that?

Peter Tong: Because the world that we live in, and our limited knowledge, we can only explain so much using science. But faith is something that is way beyond. To explain what faith is, we are on different paradigm, on a different dimension to explain that, but we are not smart enough to explain things in that paradigm, in that dimension. So, if you talk about faith and science, I think it's two different conversations, because our limited understanding of how things work is only this much, but faith is much wider than that.

Lisa Baermann: Got any thought about Bitcoin and Data Mining?

Peter Tong: Speaking of that, that's an interesting one. In one of my Big Data classes, I have a student who actually did a project on what Blockchain is and was accepted for presentation as well. In fact, with that, we did this Big Data Analytics course, started eight years ago, at one point IBM Canada was very interested in us and even offered our students opportunities to develop online courses, or short courses, to be hosted on their website. That was one of the offices came from IBM Canada. Two, since you talked about Bitcoin and Blockchain, IBM Canada actually offered us the opportunity to put a note on our school as well. In fact, at one point we were actually looking at block chaining our High School transcribes.

Lisa Baermann: Really? Then they can be altered.

Peter Tong: That's right. You know, these days, we are looking for documents, how time consuming it is to look for a document and get somebody to somebody to somebody, but with blockchain, you can do it in much shorter time, and it's so much more effective, and efficient as well.

Lisa Baermann: So maybe there's another cost savings. There's always this give and take, trade off store.

Peter Tong: Blockchain is a very powerful tool, and idea to be out there to be block chaining information and transactions. For instance, say if you are an artist, a musician. You write the song; how do you know how many copies of LP and songs you have sold. How many times do you think your music has been heard? With blockchain, you can easily check all of that, and make sure that you are paid for all your royalties.

Lisa Baermann: One of my favorite projects that you have worked on was the AQI sensor project. I think it's such a cool project, and a cool story behind it. Would you share a little bit about our AQI project here?

Peter Tong: Sure, I'd love to. The person behind it is actually Joel Klammer. You know, Joel Klammer is our inhouse physicist. He knows everything. So, it was actually his initial idea, and the first product was done by him, and then we have students who are interested in it, improved on it, and developed a PCB board on the AQI sensor. It gathered some interests from the community, so we further developed it. The students took it to another step. So, with the AQI sensor, we managed to measure the PM2.5, the temperature, the humidity, and the carbon dioxide concentration as well. Now, this was very interesting, because as much as we were focusing on the PM2.5, the air quality, we had the CO₂ sensor on it as well. So, we deployed it to different classroom, all over campus. There were fifty of them around campus.

Lisa Baermann: Do we know what the AQI is in the closet, in the AC lower level?

Peter Tong: Oh yeah. The students actually wrote a software to collect all the data that is being monitored 24/7, but what happened is that to our surprised, as we were focusing on the PM2.5, the CO₂ were a little bit high on certain classrooms. That came to us, because we never expected the CO₂ that could be high, but what happened with this is that it prompted our director of operations back then to immediately change the air cycle on the campus. This is great work from the students, because when I first doing Big Data Analytics, we collected data and we analyzed it, and we got an outcome. But in this project, we acted on the data analytics and the outcome. With that, we changed the air filtration and also the air cycle on that, and that was very very worthwhile to find out that the CO₂ was a little bit high.

Lisa Baermann: So, the idea came from Joel, because we wanted to have a better, more accurate AQI evaluation across the campus. Then we had students who constructed all of these little units, and then deployed them, and now you analyzed. You continued to monitor the data coming in. It's pretty cool. Do you have any thoughts of where you like this to go in the future?

Peter Tong: Oh, I would like to have the big global data program, where we can actually deploy these sensors to different schools around the world, and together, collectively, collect all the data which we can share the information.

Lisa Baermann: You do have some really fantastic students who've taken the Big Data class. So, where have they headed to college, and what are they doing now?

Peter Tong: So, the student who helped me to develop this course back then, he went to do his degree in UC Berkley. He started out as an engineering student, but because his interest is in Data Science, and there isn't a Data Science program in UC Berkley. So, he got himself into the senate, and he proposed to have Data Science at UC Berkley.

Lisa Baermann: So, he started the program. He saw you do it here, so why not just start it in Berkley too then, right?

Peter Tong: The student took the experience he had when he helped to develop this course at Concordia, and just bring

it onto the next step, just UC Berkley. Of course, other students who went into the Big Data field to become data analysts, there were a few of them, like Grace Wei is working for a data analyst program company.

Lisa Baermann: And Athena is headed to Duke.

Peter Tong: That's right. Oh, speaking of Athena, she was my student last year, and she developed these short videos on how to use IBM Cognos Analytics. It's amazing. I've shown it to my associates in Big Data Analytics, professors, associates in IBM, they said, it's so professionally done, and it's just by our high school student.

Lisa Baermann: It's pretty cool. What are some of your hopes for Concordia in the future?

Peter Tong: For students to actually discover their passion, to bring out the colors of the students to be able to take it to a much further success level than we can.

Lisa Baermann: How do you think parents can help uncover or encourage the passion in their children?

Peter Tong: It's important that the parents support what the child interested in. That's very important, rather than what they want to do, and if they discover and realize that the student wants to go into a particular area, support them in any way they can. Look for mentors, look for teachers, who are in that areas as well, and try to bring them together on that. Because I think the next generations are much smarter than we are.

Lisa Baermann: Do you have any free time?

Peter Tong: I was just talking to Brian just now that in lately, I was actually discovering solutions in my dreams. So, I actually woke up in the middle of my sleep to write it down, in case I forget what the solution is.

Lisa Baermann: The solution to a mathematical problem?

Peter Tong: To whatever I was thinking! So I actually found solutions in my dreams.

Lisa Baermann: Pretty efficient use of time. Thanks so much for sitting down with us today. I really hope personally and selfishly that my daughter gets to have you for a class here. The students who have had you are certainly very fortunate, and I look forward what you do next.

Peter Tong: Thank you so much for this opportunity. One thing I believe for the students, learn all you can, who knows how far you will go.