Caspar (00:01):

If you're like me and you hear the word metabolomics, you start to think, well, what the hell is that? Luckily, our guest today is here to demystify this word and show us how this emerging but powerful tool can help usher in a more precise version of personalized medicine. This is the Story of Theriome with Paniz Jasbi. Doctor, thank you so much for coming on, and I hope I didn't butcher all those words together and make, make a fool of myself as we just spoke about how authentic and screwing up is something we we appreciate. But honestly, that word metabolomics, right? It's, it's it's metabolite omix. There's a lot going on there, and it, it is actually an exciting word in many ways. So demystify for us, what, what exactly does it even mean?

Dr. Paniz Jasbi (00:50):

Yeah, absolutely. And the demystification really, Casper is so easy. Metabolomic, as you said, metabolites and omics. What is an omic science? It is a, a complete set science. It is a totality of something. So when we say genomics, we are referring to the complete set of genes. When we say proteomics, we're referring to the complete set of proteins in a body, in a system, really could be anything. Let's say a human body. And when we say metabolomics, we're referring to the complete set of metabolites. And so metabolomics is essentially the study of the dynamic interplay of metabolites in your body or in a biological system in general.

Caspar (01:32):

And why is that important to personalized medicine? 'cause This is one of my pet peeves is everyone likes to say personalized medicine. It's a very key word these days, but when you dive into it, most of the conventional approach to personalized medicine is looking at some kind of marker that is personalized to you, and then going with something that is very unpersonalized in the treatment side. And again, that marker may be somewhat limited. So how is this more personalized than, than what most of it is out there already?

Dr. Paniz Jasbi (02:03):

Yeah. So with a lot of current products genetic testing is been, you know, of course touted as one level of, of investigation. And certainly it provides very deep insights that are important. And when combined with something like metabolomics can add increased in insights. But what we see metabolomics as, and it's very interesting to, you know, I I was reading the article you wrote yesterday on the death of a diagnosis. And in the end there was this quote by founding professor of Johns Hopkins that it's far better to know what kind of person has a disease than what disease a person has. And when you look at a person what is a person they are the complete set of their systems biology at a molecular level. Now, of course, you can talk about some metaphysical things in there as well, but at a molecular level, and it's a physical construct we have to understand a person through the central dogma of biology, which starts at the genome, and has r n a that is transcribed from that genome and some RNAs expressed as proteins.

Dr. Paniz Jasbi (03:11):

And they're translated into proteins. And those proteins undergo various changes in the body. And the metabolic byproducts of those changes are the metabolites. So when you look at a person as a hierarchy of these systems levels, you see the genome, the transcriptome, the proteome, and down through the metabolome. The metabolome sits at the lowest level. It is also nearest to the phenotype. So it is, it is immediately upstream from the environment and downstream from other levels of systems biology up to the genome. So it is quite literally, the metabolome is a level of systems biology. It is at the nexus of

those gene environment interactions. And when we talk about the greatest diseases and disorders and the greatest contributors to human mortality and morbidity, we're talking about incredibly heterogeneous disorders. Disorders that do not have their root purely in environmental factors and do not have their root purely in genetic factors.

Dr. Paniz Jasbi (04:14):

Most disorders are not genetic disorders. They're genomic disorders. They are omic disorders in the sense that they relate to all systems biology. Very few disorders have genes with such high penetrance that somebody who has that gene will necessarily develop that disorder. Most disorders, and as I've mentioned, the ones that have the greatest contributors to human morbidity mortality, those are heterogeneous disorders that are a combination of gene environment interactions. And again, the metabolome provides an, in an incredibly attractive level of investigation because it sits at that inter interac inter intersection of the gene and the environment.

Caspar (04:50):

So let's talk about that investigation. 'cause It really is fascinating and I love the idea of going upstream, whereas most people are looking downstream already and trying to guess the upstream in a sense. And that, again, to me, is not personalized or very scientific. It's throwing darts in the dark sort of thing and understanding the end result, but not understanding what the whys or root causes are. So with Theriome, what are you actually looking at within the metabolites and the metabolomics to, to start to get a better picture of the person?

Dr. Paniz Jasbi (05:27):

Exactly. Thank you. Yeah, it's a great question. So we, in addition to, you know 75 different demographic and clinical variables that we collect from our customers via self-report our metabolomics test which we have trademarked the Aristotle it is a test of sentinel acquiesce metabolites, specifically 126 acquis sentinel metabolites that are found in central cellular physiology. And we have strategically picked out these 126 metabolites to monitor as they provide for roughly 70% of monitoring of all human metabolism. When we talk about metabolism at least at the science and and research level, we talk about canonical pathways pathways such as the tca, a cycle or amino aal, tRNA, biosynthesis, pheno metabolism, whatever is canonized. That according to different databases, you have between 84 and 99 true pathways that have been studied typified and canonized in databases such as the small molecule pathway database or the keto encyclopedia of genes and genomes keg.

Dr. Paniz Jasbi (06:42):

And both are great resources. So of those typified pathways that are known to us in current science and technology, we are able to reliably monitor. And by reliably, I mean with at least two entries or more, we were able to reliably monitor roughly 70% of all human metabolism. And we do that using a dry blood spot test, which is an at-home collection method. Our customers receive a dry blood spot kit with a finger lancet and they apply a just a few drops of blood to the proprietary filter paper. They place it in our biohazardous aluminum foil pouch with a desiccant special desiccant inside to maintain aite integrity via transit, and they send it to our lab where we process it and we process it using gas chromatography mass spectrometry. So this is a, you know, very advanced analytical technology that although has many clinical applications and there are clinical mass spectrometry labs throughout throughout the country it is still not a mainstay healthcare device.

Dr. Paniz Jasbi (07:51):

Everything from the footprint of these machines to the specialized knowledge necessary to operate them requires usually a staff scientist, somebody with a PhD, if not multiple people with an h PhD, and maybe an engineer to monitor the system when it goes down and maintain it. So they are not currently feasible technologies that are readily deployed in hospitals and definitely not, you know, health clinics. And what we are offering is essentially a research level platform that we apply coupled to a very simple at home, minimally invasive and cost-effective sample collection method to reliably return concentrations of these 126 sentinel metabolites that are indicative of your central physiological processing. And again, I say 70% of your metabolism can be reliably monitored with our test.

Caspar (08:46):

Hmm. Now before I go into exactly what is the reading and how a person would interpret that and where you work in with that, I do wanna go in a little bit to the background of the Aristotle, because you said it was an odyssey to create and it was, you know, something of a journey for you. So take us through that journey and story of actually creating this, because I know a little bit about spectrometry and, and how other companies utilize that within ingredient analysis and everything like that. But, you know, utilizing that within something so finite, but so specific, that must have been a challenge.

Dr. Paniz Jasbi (09:20):

Absolutely, absolutely. So I started, I mean, I, I don't want to go <laugh> back to, well, I was born <laugh>. I, I started my first year of my doctoral program under the direction of, of a fantastic scientist by the name of Dr. Haiwei Gu. A true pioneer in our field. And, and somebody who I'm, I'm very proud to have, you know, his academic lineage. And we started with, you know basic investigations of metabolomics. And, and so we, we do, we have two arms in our, in our lab, really in all metabolomics laboratories, you have a method development arm where they're focused on creating assays. They're cr focused on creating panels, new detection methods, new, new methodologies to use various parameters of the machine to detect certain classes of metabolites. And we have the application arm whereby we we're using our developed methods to develop assays for cancers neurodegenerative diseases.

Dr. Paniz Jasbi (10:19):

And so my first paper was on breast cancer detection using Loch chromatography tandem mass spectrometry. So using MS two spectra essentially. And we found numerous biomarkers. We found numerous pathways that we had confirmed via ingenuity pathway analysis metabol analyst software tools as well as doing even our own factor analyses. And what I realized very quickly by my first study <laugh> was that a lot of the biomarkers that I'd found had already been found, and I had some new ones, and I had some differences in maybe directional change of the metabolite, or maybe very small differences in the effect sizes that we saw between the groups. But by and large, the metabolites and the pathways that were inferred had already been found, confirmed, or at least indicated via some bioinformatic analysis. And that continued to be a theme throughout my graduate education as I did my second paper on, let, I forget what it was, let's, I think it was Valley fever co mycosis, active valley fever infection from urine and plasma profiling.

Dr. Paniz Jasbi (11:35):

And then I continued and I found very few instances. For instance, if you do a, if you do a study on valley fever and it's never been done, you are necessarily the first person to, to produce that. We, we are

doing a study right now on Fibrodysplasia Chan Progressiva, S F O P, which is a disorder that turns basically the connective tissue and osfi it into bone. And it's very rare, eight to 13 people are estimated to have this currently worldwide, you're, you're going to be the first person to find a biomarker. But when you're looking at the major, again, major con, the, the usual suspects, we're gonna call those guys the usual suspects, C v d cancers neurodegenerative disorders, those are the usual suspects. So when you're looking at the usual suspects, the biomarkers are repeated over and over and over and over.

Dr. Paniz Jasbi (12:23):

The patents are tangentially related over and over and over and over. And you start to realize very quickly that and, and again, I, I noticed it my first paper, and by my 30th paper I was convinced that there is this massive, massive buildup of research knowledge that is not being translated to practice. There is so much we know, and there's so much of it that has, that has trickled over to practice. We have this ocean of knowledge, of, of not knowledge, sorry, of data. We have an ocean of data. We have, you know, lakes of, of, you know, hypotheses. We have, you know, puddles of knowledge and like an odd drop of wisdom. And that is really a shame because there is so much data that, that has been generated, that has been reproduced, that has been validated, that is currently not getting through that translational pipeline.

Dr. Paniz Jasbi (13:25):

So my doctoral thesis was, you know, first of all, love letter to metabolomics. And then this sort of I don't, I don't know if you want to call it this, this, this protest against the fact that our translational throughput is severely limited. And there's many reasons for that. There's the inavailability of at-home detection methods. That's why we choose things like the dry blood spot for metabolomics testing or upcoming bunny wipe for microbiota testing, we are choosing the at-home. You know, basically the, the, the roadmap to Theriome is encased in my dissertation. If you take a close enough look, you'll, you'll see it's all there. We, we, we lament the fact that there's no good kits really for reliable omics analysis. And so we're developing them. We realize that you know there's very little to no databases that have commit collected, multi-layer omics data, and without a layering of omics you're always going to have an incomplete picture of that person.

Dr. Paniz Jasbi (14:36):

And so of course, our goal is to continue to roll out tests such as a proteomic screen, an RNA-seq panel, et cetera through the up to the genome. And we also noted that there's, there's things that are out of our control that have really impeded this translational development. Some things like, like regulations that are by and large outta the control of, of researchers like me, unless we're, you know, called upon to give an expert opinion or something. Or even the scientific incentive of academia, which places very little value on translational work because it is often an intensive years long project. And if you are a tenure track faculty chasing tenure, your job is to produce papers. You want the 30 papers in five years, you do not want to have and maybe it's a cell nature science paper, but you do not, and maybe sometimes cannot spend two to five years working on this sort of validation effort.

Dr. Paniz Jasbi (15:32):

And so, of course, we, this has really impeded our, our effort, our, our, our understanding. And, and one thing that, you know, we are sort of leaving behind is this traditional model of frequent statistics. We are now tr moving to a model of, you know, like very advanced machine learning methods, as well as some nascent true deep learning methods and convolutional neural networks that are assisting us in our

data analysis and interpretation. So Theriome was really just the synthesis of a bunch of really good ideas, I think, that are designed intentionally to increase that, that throughput and open up that valve from, again, the, the oceans of data we have and the trickles of, of use of, of, of applications that we've developed.

Caspar (16:22):

Yeah, medicine's a interesting industry like that where you do have this ocean of data. You have, you know, an abundance of different options, solutions, so many different things out there. And yet reluctance in a system that continues to look at the same things over and over and just try and re kind of position the microscope on the same spot in the ocean, it seems like, and it's, it's frustrating at times. I, I'm sure you know this too, trying to launch something that's a little bit outside of the norm, let's say, of what people are looking at. I'm sure many doctors haven't heard of things like Theriome before or, or even the analysis of these things, but how is it being accepted now that you're putting it out there to the world by the medical community? Because I can imagine you're going directly first off to consumers in a sense, because this is an at-home test. So you know, you're trying to really convince, at least from the marketing perspective, that the end user should use this and gain some benefit out of it. But from the medical community, when you talk to other doctors, are they excited or are they kind of dismissive? Are they skeptical? What are they?

Dr. Paniz Jasbi (17:35):

It's, it's not necessarily the medical community that has, that I've had pushbacks on the customers have found it at the lower end of the spectrum, fun and engaging mm-hmm. <Affirmative> at the higher end of the spectrum. Some really deep insights that you know, they didn't share with me, but we, we found they didn't share in their survey data that they returned with their test, but we found nonetheless, you know, biological signatures of, of those conditions. And so it, it's, so for the consumers, it's been, oh, hey, this was a fun thing. And for others it's been like, wow, they, you, you're a metabolic oracle. For the doctors, they're very excited for this, actually, MDs that I talk to and dos do. They're incredibly enthusiastic about utilizing this both as a tool for their, their practice. And the, the medical economics of the Aristotle test are, are quite good, but also because they, they're driving patient satisfaction.

Dr. Paniz Jasbi (18:35):

They're driving patient perception of the quality of the care and the competence in their doctors, right? A study from the New England Journal of Medicine found that like 85% of, of cut of patients want to be offered every medical test possible, and 90% of patients equated the testing they received with the competence of their physician. And so you're boosting patient perception, you're boosting quality of care because you are giving them the most advanced metabolic test on the market full stop. And in addition to that, you're, you're decreasing patient conflict. You're engaging the patient to make clinical decisions with you. And that's something that has become, you know, a recent trend. And, and the mo, the most successful physicians I've seen, engage their patients in a competent manner to make their own medical decisions alongside the physician. And so this is a tool that has myriad benefits for, for the physicians.

Dr. Paniz Jasbi (19:33):

And I haven't received any, any pushback there. I have received some questions, not, not necessarily like offensive skepticism, but some questions from the research community as to our particular extraction process for metabolites from the proprietary filter paper or our methods for the G C M SS operation,

various parameters like the G c oven ramp or electron like the transfer line temperature, various, like idiosyncratic things that are important to the Spectris <laugh>. And some of them have been curious, genuine, curious about how we are using our AI method, which is 66 lines of code we've developed to apply to their own research. So some things, you know, I, I can't give away, like I cannot give away the extraction process from the filter paper, but I'm very happy to give away the exact mass spec methods we use, including to the detail of, of, you know, the auxiliary transfer line, the ramp that we set the amount of helium that we, or the amount of sample we inject, the flow rate of the helium. Every single parameter of how the separation and analysis is achieved on the platform is shared, not just with collaborators, but a a sort of labor layperson's version is shared with our customers. And I'm very happy we do consult with academic institutions to apply our bioinformatics statistics and AI pipelines in, in machinery to their pro to their projects. We have many academic projects and are in the early stages of, of preparing our first theory on papers for publication.

Caspar (21:18):

That's exciting. And, you know, pe people do love data, you know, especially if you're health conscious, it, it, it, it is something that it's a double-edged sword. I, I feel that, you know, too much data could be overwhelming to the person, especially if that data isn't truly overlapping. Let's say, you know, you see one thing and then another thing kind of counters it and everything. But if, if you really know how to assess it and look at the complete picture, data's a a wonderful thing. Now, what is it that, what is it the data is showing the end user here that, you know, will really get people listening to say, oh, okay, I'm starting to see why I'd wanna take one of these tests.

Dr. Paniz Jasbi (21:58):

Yeah, yeah. So what it's showing and how it's showing it Casper goes back to the size of this assay. It's 126 metabolites. So with one parameter, we may be able to show like half of one thing, you know, one parameter is associated to so many conditions. So if you're going to measure one blood metabolite, there's no guarantee that it's completely related to, let's say, multiple sclerosis. It could have a relationship to a Lyme disease. But when we add a, a metabolite set, we create an algorithm, a specific disease signature that has been found in the literature, and we're trying to replicate it and see if its presence is also in the metabolic profile of, let's say, a customer. What we do is we add more than one metabolite. So usually a model has various factors and then like an error term, right? And so each metabolite set from multiple sclerosis to, you know, leukemia, to depression and autism even that are in our, in our disease signatures, they have specific metabolites with specific coefficients related to their expression.

Dr. Paniz Jasbi (23:04):

And we match the known profile of, you know, shown in, in the scientific literature using only the most curated and high impactful research. We show that what percentage match you have with that profile, whether it's pheno, ketia, or Soto syndrome. And we also show a confidence in that match, which reflects basically the analytical rigor and fidelity that we achieved throughout the process. And we don't report anything that we have anything less than a 95% confidence in, which is analogous to a statistical level known as alpha which is like our cutoff cut margin. Now, how do we do this? We, we have, when you order our test, what do you get? It's a great question. You get a 12 key health domains, everything from your aging index to your mitochondrial health, to your integumentary health inflammatory score, environmental toxin exposure, et cetera.

Dr. Paniz Jasbi (24:03):

This is related in your report, and you get a score on a scale, excuse me, from one to 10, going from suboptimal to neutral to optimal. And we explain what that index is, what it measures, and what metabolites were in that set to be measured. Then we go onto the second page of the report, which is going to show very personalized recommendations. It'll say aging index score eight and eight might be pretty good. So you might not have too many recommendations that are personalized based upon the levels of metabolites we saw in addition to the 75 demographic variables we collected from our patients via survey. And these survey data range, everything from your usual patient intake, like height, weight, age, to you know, socio behavioral factors that can measure like depression, like the Beck Depression inventory is a part of our, our survey.

Dr. Paniz Jasbi (24:57):

So we analyze this and we say, according to your aging index of, of eight and the scores, your metabolic scores and your demographic info, this is the personalized recommendations we would make for you in your life. If you're reporting in your food frequency questionnaire that you're eating a lot of foods, for instance, very late at night in going to sleep, that might affect your mitochondrial health. So what we would do is probably recommend that you, Hey, we've noticed this pattern according to your profile and your lifestyle factors. We engage in a very specialized recommendation. Do not eat food after 7:00 PM because this study has shown that food ingested on a diurnal pattern of 24 hours after 7:00 PM causes x, y, and Z effects to the electron transport chain, for instance. And that's actually pretty much one of the examples that we have. And we do that for every single health domain, all 12 of them.

Dr. Paniz Jasbi (25:44):

And then the third part of this is your disease signatures. We have curated a database of 344 disease signatures that have been reported in the literature, specifically in blood. These are not urine signatures. These are not signatures in cerebral spinal fluid. These are not fe fecal signatures. These are blood signatures. And that's very important because the blood is a systemic source, right? When you look at like the feces, you're mostly looking at gastrointestinal issues. C S F would be an ideal sample to look at neurological conditions, but the blood is a systemic appraisal of your overall metabolic health. And so we have 344 disease signatures, and as I've mentioned, you get the first column was the disease signature. So it'll say something like, you know, let's say stage one breast cancer ductile, and then it'll say the number of metabolites that the literature has shown associated with that meta, with that condition in that metabolite set.

Dr. Paniz Jasbi (26:38):

And then it'll show the number of metabolites that we detected and matched the directional change reported in the literature, as well as approximated the magnitude of change reported in the literature between usually a control and affected group. And then we also report our, again, our confidence and making sure that we don't report any results that have a lower than 95% analytical confidence in that result. And so you may have something that, you know, I, I did this one for my father-in-law, and he had a bunch of, he had a bunch of disorders, <laugh>, and thankfully they all had like 20 to 30% overall matches. And so these would be, you know, as we explain in the report it's very clear, you know, these, these match percentages really are to be assessed longitudinally. So if you want to use the Aristotle as a compliment to your health assessments, then you should monitor, you know, your relative pa match percentages of these indicated disease states over time.

Dr. Paniz Jasbi (27:42):

And that's what the Aristotle provides, is this objective barometer of very important domains of health, specific health considerations of which you get personalized recommendations for every index or measure. And then the, the fourth part of the report, and this is the 130 page part of the report. Everything else is condensed within a handful of easily digestible bits of information. But the, the fourth part is 126 pages. And every metabolite gets, essentially its own like a scorecard. And what you get is the first column of, of your report will have your metabolite name. The second column will have your concentration found in your blood. The third column will, the third and fourth columns have the low and high levels on a scale. So you can see, hey, this is my concentration. This is what the concentration that is known in the literature implied in the literature to cause adverse effects.

Dr. Paniz Jasbi (28:35):

This is the concentration that is known in the literature, applied in the literature to cause adverse effects low and high. And then the last three columns are descriptions. So we also believe that education of metabolomics metabolites is a excellent gateway for people to remain engaged and continue engaging with their own health data. You are interested more in your levels of chemic acid, if you know, it was discovered by Japanese scientists in 1941 from mushrooms. And then right after that description of the metabolite and its identity and its significance in history, or its placement and pathways, we give a summary of the implications of low levels, should you have low levels, as well as the implications of high levels. And everything is cited with the most up-to-date accurate knowledge. Which we've curated, again, with very advanced means, not just manual curation.

Dr. Paniz Jasbi (29:22):

And so depending on the results the specific results and health implications that a customer has, their report comes complete with anywhere from 200 to 500 citations as needed. And it is, so it goes sort of, it's like a cake, right? And every layer is deeper and bigger. And that is how we manage data problems, right? Everybody loves data, everybody, we're swimming in a sea of data. And what we do is that we layer it, we tier our data such that the first part is like, Hey, here's a friendly snapshot of what's going on. Then it's,Hey, these are the, you know, it basically health domains that the metabolome of the plasma metabolome can, the, or I should say the blood metabol, it's whole blood, the blood metabolome can investigate. And then we go a level deeper and say, well, these are the disease states that are associated with your profile. And then it's, here's information on every single metabolite tested it's levels and it's individual meanings and significances.

Caspar (30:19):

There's obviously a level of comprehensiveness in this test, and you mentioned that complimentary to others. Do you see this as something, because a lot, a lot of people are looking at this especially in medicine, I know that there's so much out there now. There's so many new tests, there's more functional panel test, there's so much out there that it becomes quality over quantity. 'cause Quantity could, could become overwhelming to try and piece everything together. When you have thousands of tests, do you see this as something that starts to substitute those tests and gives you that overall picture that you'd really wanna get the snapshot of?

Dr. Paniz Jasbi (30:59):

Absolutely. Yeah. Currently in metabolomics, we do not test many of the blood parameters that physicians commonly rely on to make various diagnosis. For instance, where you behind me, you know, we're not, we're not looking at T N F alpha, we're not looking at c-reactive protein. We're not looking at

hemoglobin A one C, not yet, hopefully by the end of the year, we will build out a full proteomics assay as well, because these are proteins and these are larger molecules. And our metabolomics platform is, is designed to handle anything that's, you know, 1500 daltons or less. And so as we advance our layering up, we will get to the point where doctors can come to us to perform their regular complete blood panels. We already obviate the need for a physician's o a t. So if you, if a physician is running an organic acid test, we have every single one of them in our panel.

Dr. Paniz Jasbi (31:58):

If a physician is running an amino acid test, we have most of the ones in their panel, but in addition to a couple of other ones that usually cannot be monitored. So we, we've already sort of obviated the need for some of the tests. And as we increase our systems levels and we go all the way up to the proteome and then through to the genome we hope to be the sort of one-stop shop for complete deep molecular profiling. And we we're already doing that and have done that in our researcher. My, my co-founder and I Alex Moore, we, we had this idea, we were very frustrated with the state of translational science. And we had this idea in our, in our doctoral programs, and, and we are very frustrated also with the state of integrative omics analysis. To give you a a quick and dirty version most researchers who are trying to layer omics levels and do a complete bioinformatics analysis are really relying on simple correlational analysis.

Dr. Paniz Jasbi (32:57):

And very few researchers are, are using tools such as, you know, mm, vec that is looking at, you know, pattern co-occurrence between, if, let's say, if you do a 16 s test of the stool and then you do fecal micro sorry, fecal microbiomes and fecal metabolomics together, how do you, how do you assimilate that data? How do you reconcile them together and how do you get meaningful results? And most researchers, again, are using very simple correlational analysis that are ill fitted to really providing results. Correlation doesn't mean that they're happening together, but we are looking at co-occurrence patterns and, and probability indices that are, that are much more advanced and, and, and they're informed, or obviously these are performed by artificial intelligence machines. But you know, these are, these are tools that are, you know, developed by researchers and, and we're modified by others.

Dr. Paniz Jasbi (33:41):

And we use this already to look at co recurrence patterns of the fecal microbiota and the fecal metabolome of a group of college students. And I was just giving a seminar yesterday where I used this paper as a, as a case study. We were doctoral students, Alex and I, my co-founder, and we took this data science course on this microbiomes data science. And, and we took the course and the professor said, bring your own data to core to the class, and, and we'll do the projects and we'll learn the analysis and we'll code you analysis for this data. And hey, who knows, you might get something good and we could publish it. So Alex and I had, you know, he had his microbiome data, and we had, and I had my metabolomics data, and they happened to be from the same cohort, which was a sample of convenience from a, a college student study here at a s u.

Dr. Paniz Jasbi (34:25):

And we ran together and we found some very interesting things, specifically the consumption of phenyl alanine by a, a set of five gut microbiota. And we saw high concurrence of that interaction happening in the pro, most probably in the intestinal lumen, because phyl alene doesn't quite get in that easily into the mitochondrial matrix. So it comes in via tyrosine. And we showed, we showed this very synthesized

thesis of what is going on. And we produced this great figure, and we plugged in our implied, predicted changes in enzymes, the metabolite changes, as well as the microbiome changes to get a really deep sense of what's going on without doing any sort of really experimental technique other than just taking the samples and analyzing them in an associative way. And that study is published in scientific reports last year. It's the first study that investigated the microbiome and metabolomic profiles of high screen time. So the difference between the groups was that some college students had really abnormal <laugh> abnormally levels of high levels of screen time, and some had low levels, and we found a molecular signature of just that digital interaction. So let alone when you're looking for signatures for diabetes or cancer, right, there's signatures for digital interaction with screens that we've typified.

Caspar (35:37):

Yeah,

Caspar (35:37):

There's so much you could do here. And it excites me when you say things like one stop shop and really comprehensiveness of it all. You know, it's what I believe medicine should be doing. It should be providing all these solutions in an easier format. It's one of the reasons I remember back in the day, and, you know, now it's, it's, it's quite a, a dangerous thing to bring up. But Theranos and Elizabeth Holmes and the testing there, right? And listen, I mean, we, we used to do some you know, interesting testing. We're accused of being Theranos at one point. 'cause We take a drop of blood and analyze in different ways, and it, listen, that was her whole thing. She did very, you know non legit. But the idea behind it was kind of, you know, simplistic and logical. You, you don't need that much, I believe, to truly analyze if you do it in a advanced way, and you could pull a lot out of that, you know, you got billions of billions of cells in that one drop.

Caspar (36:28):

And, you know, you're doing it through the dried blood analysis and there's so much more yet to be done there. And that's the exciting part of everything that I think we need to embrace. A lot of people get scared at that idea and kind of wanna separate it, and you draw lots of blood and you have to go to the labs and you have to, it makes it so inconvenient. And I'm not saying it should be super convenient, and that should be the end game. It should be super accurate, number one, if you can make it convenient, amazing, great. 'cause You're gonna get more people involved in it. But, you know, how far do you think we are? You are, let's say, from, from getting to that point where, where you are closer to a one stop shop, checking a lot of different parameters and making it easier and easier to gain access to that.

Dr. Paniz Jasbi (37:14):

You know, I'd like to say in, I don't, I don't know, you know, Elizabeth Holmes and Theranos is a really interesting <inaudible> <laugh>.

Caspar (37:23):

Yeah. You

Dr. Paniz Jasbi (37:23):

Realize, and you, you have to understand that I, I watched that flame go up in, go up in flames during my doctoral program. I watched that really with a clenched fist and, and grinding my teeth knowing that

you know her. Hmm, okay. So she had a good vision of what it should be like. She had a however, her, her flaw, of course, was her willingness to commit fraud in order to she was impetuous her, her willingness to commit fraud in order to, you know, hurry this, this product along. Her biggest fraud, of course was the Edison box. This quite literally black box. I mean, it was literally a black box that didn't do what it was purporting to do. She was pushing the science and engineering well beyond what we're capable of, all in the pursuit of making a, a machine. Well, if you were really gonna do true health testing, you would have a, a room full of two or three machines that would take up the whole room.

Dr. Paniz Jasbi (38:35):

And her thing was like, we're gonna bring it all into this box, and there's no need to do that. There's no need to reinvent the wheel. And what we are doing is using, you know, very publicly curated and available databases in addition to our own informatics and bioinformatics pipelines. And we, we, you know, we have, we have many level layers that we, we plan to weave in to increase transparency. You know, not only do we report 126 metabolites and we use cited literature. So when you would go do a, a Theranos test for, you know, a blood test, they would take your thing. They wouldn't tell you what they were testing, they wouldn't tell you how they were testing it, and they would just say, you have this thing, let's say renal failure or not. And you would ask, well, how do you know?

Dr. Paniz Jasbi (39:22):

What in the blood did you, they said that that's our information. What we are saying is, this is exactly how we take your blood. These are the, these are the articles that have shown that dry blood spot testing is not only accurate, reliable, and convenient, but provides a great measure of, of metabolite integrity and fidelity. We provide that. We tell you exactly very detailed how we are analyzing your metabolites. We, we show you what metabolites were measured to come up with your aging index, what metabolites were measured for your mitochondrial index. And then we show you the study that shows that <laugh> and in and in the future, I mean, in everything is documented and transparent, not just because we are trying to dispel sort of the odious space that Theranos has left us with. And, and it doesn't help that I named the company theory.

Dr. Paniz Jasbi (40:18):

I understanding our first four letters are overlapping, but I really like the name The theory of omics theory owners. As I mentioned before we started, all we have in, in science is a theory or set of theories that are continuously revisited and revised. And so I think the name sticks, but we, we have documented that not just because we're trying to set ourselves apart from Theranos, but also because it's your data. It is your health information, and we want you to remain educated and engaged about it. So bringing the science and the literature and the proof and the evidence and the methods to the forefront is something we place great emphasis on. And in the future, we do plan to implement blockchain technology, a private blockchain technology, whereby your data will be stored securely for you, accessible only by you completely transparent, auditable, and immutable.

Dr. Paniz Jasbi (41:07):

And that raw data is not just numbers on an Excel sheet. That raw data will house your mass spectrogram, your, your sequencing information. You will, we will have the raw mass spec and sequencing data and other platforms data as we added on to your specific blockchain id. We, we are working to develop a lot that is, is going to hopefully make our systems and our processes transparent and beyond reproach, although we know that that's never gonna happen. And so we're always

committed to detailing and explaining as much as we can without giving away, you know, patents and traits and what whatever is patented we can talk about because nobody can, can use it. But if something is going through patenting or if something is a trade secret and there's very little of it, maybe 5% of our processes are like that.

Caspar (42:03):

Yeah.

Dr. Paniz Jasbi (42:03):

And but the truth of it is in that 95% that is completely transparent and open and, and we share, yeah. Enthusiasm.

Caspar (42:11):

Yeah. I think it's really cool to utilize technology in this way. Listen, I have a love hate relationship with AI and the, the thought of like AI kind of coming into medicine more and more, but we've utilized things here that, you know, at our own clinic that has AI with it. It's not to take over the job of the clinician or doctor at all, unfortunately. I do think that's where some people are trying to take it, right? There is that idea to it. But can you talk about how your AI works and then your just general thoughts about AI and healthcare?

Dr. Paniz Jasbi (42:45):

Absolutely. AI is a tool and like all tools, it should be developed to the extent necessary and applied as needed. And the overuse of a tool can, if any tool can be bad, and AI, because of its power you know, it's overuse or misuse can be catastrophic. And what we're not trying to do is replace the physician things. For instance, you know, that we we're getting close to ai. Most of the AI that, you know, works at least on the consumer level is a chat AI like chat, G P T mm-hmm. <Affirmative> the AI that, for instance, our bioinformatics department here at ASU develop, they're meant to scan an image of a, you know, PET scan, a CT scan, and assist in the, you know, radiographic interpretation of that. And we believe that, you know, current AI technology and we don't develop really AI so much so as tweak existing packages for our use cases.

Dr. Paniz Jasbi (43:44):

We are developing our own proprietary AI as we add more levels and as we, we need to increase our analytical capabilities. But what we use it for is a tool to aid the physician in, in making the decisions that she or, or he has to, has to face. And it is an added layer, an extra layer of, of caution. And diagnostic tests are, you know, incredibly important. They inform roughly three quarters of all clinical decision making. And when you look at our total Medicare, our, our medical expenditure as a nation, about 7% of total Medicare costs. So when we invest in diagnostic capabilities, we get an incredible return for our investment. And we, we don't believe in, yeah, the, the thought of replacing the physician is so scary. And, and we've put that on our, on our test reports.

Dr. Paniz Jasbi (44:31):

When we, when we give you your disease states, it's very clearly said that this is not meant to diagnose and you should be using this with a certified healthcare provider. And, and a lot of people you know, as I've realized, actually don't see MDs, they don't see, you know, a do, they don't see a a allopathic physician. A lot of people see a nutritionist and they take our reports to them. And so when we give

their recommendations, we always highlight the fact that they should do implement these interventions under the supervision of a healthcare professional. The healthcare professional, you can train an AI on data, but like we mentioned earlier, there's data, there's knowledge, and then there's wisdom. And AI can handle the data just fine, even better than us. There's no competition, no competition, but the knowledge and the wisdom that we get from translating the AI or translating data, AI cannot give us yet. AI can only analyze patterns essentially. And so the wisdom comes from the many years of experience, the many patients that that health provi healthcare provider has seen. The, the tacit knowledge, that deep entrenched silos of knowledge that this person has, that really cannot be equated to ones and zeros. That is something that Theriome will never try to replace.

Caspar (45:52):

No, that's good to hear because I, I feel like you know, a lot of telemedicine I've always said is, is basically becoming that, you know, Google, ai, healthcare chat bot that's already testing better than they are on MCATs and everything else, but <laugh>, there's absolutely a place, right? Because it is technology, it's neutral. That that's, it's how you use that then that really matters the most. And especially in healthcare, and, and you're right, the wisdom and knowledge is so necessary because you're talking about a human science here to literally the science of helping people heal. And it is that human touch to it. So I think it's, it's, it's essential that you utilize that and continue to take technology, use the best of it within the confines of a human science field.

Dr. Paniz Jasbi (46:37):

And you, and you said it right, you said human a a few times. We are not technologists, although we utilize the most advanced platforms and technologies, our highest priority is not technology. Thereby, we're not technologists. We are humanists and, and we understand the fact that human health should be in human hands, <laugh> more or less.

Caspar (46:58):

Absolutely. And I hope the rest of medicine you know, falls back in line with that thinking as well. But beyond the, the Aristotle that you created, you have another microbiome test, the Biome or Biome Me Test. And can you tell us about that and what brought you into that sort of testing and how that works?

Dr. Paniz Jasbi (47:16):

Right. So we had some experience, as I mentioned, my co-founder and I in our graduate experience, he is a microbiome scientist that is his, his daily. And so he is, you know, very well versed in sample preparation and sequencing methodology. And as I mentioned in our, in our grad school, we had layered our sciences before we had come together to use the most advanced tools to really get a picture of this integrated network of microbiota metabolites that before us had only been applied in a handful of papers in the literature. And never to a really interesting topic like screen time <laugh>. So we, we, we had already had a use case, and now we're developing the, we're applying the same methodology and pipeline to other really interesting factors in our research, whether that be intermittent fasting food insecurity or aging.

Dr. Paniz Jasbi (48:14):

We are continuously combining these two layers. And so what we're developing right now, what we call the biome test, is a test of your microbiome, your intestinal microbiota. It's a long read 16 SS test, which is will be at the time the most advanced microbiota test on the market. Most entities in this space are

using a short read 16 SS test with a long read 16 s test, the amplicon sequencing of the 16 SS region of the of the specificly. We are able to get L seven resolution species level resolution on many of our hits. And that is a huge impediment to current microbio species data science is that they don't get, they can't go past level six and they can't get species level resolution. And that really hinders a lot of the insights that patients are getting.

Dr. Paniz Jasbi (49:05):

So not only does it represent the, the most advanced microbiome test on the market when it, when it does come out but the integration of the biome test for customers who've taken both tests and we have both sets of data. The integrative report that we can provide is truly greater than the sum of its parts. It is a very gestalt report. And that synergy between the microbiome and the metabolome, we can really specifically alter, for instance, levels of harmful metabolites. Given the known composition of your gut microbiota, we can recommend very specific foods to eat, and very specific amounts that would either reduce the levels of those harmful microbiota or increase the levels of those beneficial microbiota in order to also regulate downstream your metabolic profile. And when you have a sense of two layers and, and it's, you know, a fraction of what we intend to build out you and the, all the demographic and, and clinical variables that we collect from our patients, you are already, already, without adding any other layers, you already, we, we will already represent the most advanced and, and deepest phenotyping service on the market.

Dr. Paniz Jasbi (50:24):

There is no other entity in this space that offers a multis testing, let alone you know, AI analysis reports of your two levels, your integrative omics analysis. It's, it's, it's not done. It, it is currently a, a technique that is reserved for research use cases. But we're, that's, that's the kind of the spirit of Theriome. We're all about bringing research level science and technology to the consumer.

Caspar (50:51):

Now, as a pioneer in, in personalized medicine, you got this stuff going on, like, where do you see the field going in five, 10 years? What do you, what do you see it, you know, becoming, I'm sure you gotta have a positive, optimistic outlook on it, right? It's not gonna continue down this rabbit hole of more drugs that are just based off simple genomic testing.

Dr. Paniz Jasbi (51:11):

Yeah. So I mean, when we talk about, you know, drug target identification, for instance, we can do that rapidly on a scale previously unseen, and this is the five or 10 year picture mm-hmm.

Caspar (51:22):

<Affirmative>

Dr. Paniz Jasbi (51:23):

Theriome will have the largest wealth of patient biological data. And that can be good or bad, right? If you've seen Westworld, maybe you've seen what it can be in the hands of, oh yeah, data is power and, and putting it in, in nefarious entities is, is, is dangerous. And that's why Theriome, we we're committed to never engaging in data brokering with outside entities. What we can do in five or 10 years, which is the, the beneficence of, of Theriome, is to not only be able to, you know, have this very advanced one stop shop, you know, we want to be the first line of testing for physicians and patients and customers.

Not only that, but we want to start influencing how research is conducted when we start creating this deep molecular profiling database that has the genome proteome, transcriptome, microbiome data and metabolome data on 30,000 people, let's say.

Dr. Paniz Jasbi (52:25):

Suddenly we're able to look at the human metabolism with the greatest eagle eye perspective that we've ever been able to, and no study has had this sort of resource at its disposal. So being able to take a look at such a wide angle, look at what's going on, and bird's eye view will be very capable of, of directing research. We, we would like to, you know, entities that are major funders of research in, in, in the United States. For instance, the N I H is the greatest funder of research in the United States, or the Robert woods Foundation. So gates Millennium Foundation, these are all grade contributors. And so we can take our data and say, according to what we're seeing, investigations of diabetes, when you're looking for diabetes, cure or, or treatment, these are the pathways. These are the metabolites, these are the proteins, the genes that are responsible according to everything that has been reported and collected by us.

Dr. Paniz Jasbi (53:20):

Everything that's been reported to us and collected by us indicates these things. And of course, when we find associations, those associations have to be confirmed with basic science. But Theriome will, with the wealth of data we provide, provide this human atlas of everything going on from a very large population to which our inferences can be generalized from. In addition to that, I see Theriome as you know, this. So some people, you know, have very hot beliefs about climate change and they can debate the science idiosyncratically or whatever, but there are a network of satellites that are flying around Earth that have been taking pictures of earth over years. And it's very hard to refute climate change. When you see from that perspective what has happened to oceans, rivers, lakes the melting of ice caps, it's, it's hard to defend against observational very immediate data.

Dr. Paniz Jasbi (54:21):

And so we, we have this, for instance, this this train derailment that happened in East Palestine, and you have this environmental contamination going on, and they clean it up supposedly and then they send legislators over to these people's homes in East Palestine. And you know, pee judge will have a glass of water from the sink and he'll say, see, I drank it, you're fine, but I drank it. I'm gonna go to my very exclusive Washington DC reservation Tonight is very different than you stay here, live here and drink it for another 20 years. So in these sorts of environmental catastrophes, if we are an entity that has been regularly testing in that community, and customers have been engaging our services and sending in samples, what we can do is say, here is the genomic proteomic, metabolomic, et cetera, profiles of these individuals in this community before the train accident.

Dr. Paniz Jasbi (55:11):

And here is the metabolomic profiles, one year, five year, 10, 20 years down the line. As you can see, there has been a biological sequela of consequences that have proceeded immediately after this point in time. And so we can provide an unbiased, impartial, and scientifically informed bird's eye view of so many health cases. And, and these are just a couple of things that I've been sort of thinking of, and I'm sure as we develop it and as we go forward, more use cases will become apparent to us. But really nothing like this has ever existed. A wealth of data and, and knowledge like this has never existed. So the, the, the possibilities to us are not gonna be immediately apparent, but we're working on it.

Caspar (55:59):

Yeah, A nice singular snapshot is, is a good thing. A number of them, you know, flipped together like a scrapbook, showing a pattern ensuing is much more important. And that's where I think a lot of people get it wrong in medicine. They take one snapshot, they may take another and say, okay, it did this, this, it's about the patterns and healing and disease take time. Both of 'em have to be looked at over a longer period of time. It isn't, you know, a short-term sort of fix that, that we're gonna turn things around. It's gotta be a long-term approach. So I really appreciate that. Dr. Japi. Where can people learn more about Theriome? You know, get the, the kit find the testing?

Dr. Paniz Jasbi (56:41):

Yeah, you can visit our website at www.therio.me. That's t h e r i o.me. You can also email us for more information at info info@thirio.me. Again, that's t h e r i o.me. And thank you so much Casper for having me on. It was a pleasure to sit down and talk to you about our mission, our vision, and our values and, and where we'd like to take it.

Caspar (57:12):

Hey, thank you for all your work, everything you're doing. I really enjoy this discussion and yeah, best of luck with everything in Theriome moving forward.

Dr. Paniz Jasbi (57:19):

Thank you, Casper.

Caspar (57:20):

You heard there's a lot of talk about personalized precision medicine, but so much of it has been hype rather than true substance. Dr. Jasbi and the groundbreaking work he's doing at Theriome are looking to change that. So check out their website at www.therio.me, and until next time, keep writing your own healing story.