CO-FOUNDERS

stories

AN UNPREDICTABLE WORLD:

ATRANDI BIOSCIENCES CO-FOUNDER KAROLIS LEONAVIČIUS ON BUILDING THINGS, AND LEAVING THE FUTURE OPEN

Karolis Leonavičius helped invent the technology at the center of our company, and he is the last person who will make it sound like a stroke of genius. There was no “the” moment, there was no late-night breakthrough by a single person, and no day the world tilted. There was accumulation of a thousand small things falling into place and hard work by talented people, until the technology simply worked. The co-founder and CTO of Atrandi Biosciences distrusts the neat story of invention, possibly because he has spent most of his life making tools and knows what it really takes.

Atrandi
BIOSCIENCES

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THE KID WITH LEGO BLOCKS

Long before any of it, before the Semi-Permeable Capsules (SPCs), before the instruments, before Atrandi was even an idea, there was a kid taking things apart. “I used to take things apart and build them back together, play with LEGO… a lot” Karolis laughs. “You could say, that I was probably one of those kids who sits in the corner, building something, while the others are off talking and playing in groups.”

He grew out of that corner, but the instinct underneath it did not. What stayed was interest in systems, in how parts combine to produce behavior that none of the parts contain on their own. “You assemble some components and you get properties, and unpredictable consequences you can’t see just by thinking about the sum of the parts.” And Karolis has a phrase for it: emergent properties.

He did not arrive at biology through loving the subject from the start. He arrived sideways, through chemistry, which he had chosen for an almost contrarian reason, because he couldn’t decide.

“In school, two things interested me, chemistry and electronics, and I jumped back and forth between them,” Karolis says. At that age, he says, you can’t see enough of the world to know what you actually want. So he chose chemistry precisely because it committed him to nothing. “I knew I couldn’t decide, and from chemistry you can branch into all sorts of fields afterwards. That’s what I liked about it.” He studied it first in Vilnius, then at Oxford.

What drew him, underneath the subject, was a single idea he still holds - that one person can have a disproportionate amount of impact.

> *“With the ability to make things, comes the ability to improve them, to refine them, to bring some change into your own life and other people’s. That idea always fascinated me. It’s probably a trait of mine that’s still there,” Karolis discusses.*

THE CORNERS NO ONE BUILDS FOR

The turn toward building tools came during his PhD, while working with embryos. He found himself with one foot in academia and one in engineering, and was, in his word, shocked. “The inefficiencies of academic research shocked me, specifically the products that dominate there,” Karolis says. “It was obvious quite early on, that an enormous amount could be improved, and that the companies already doing it were concentrating only on the most commercially demanded, most scalable, most popular fields, while whole areas with real potential sat untouched.” That gap became his territory. Not the obvious markets, like consumer goods or defense systems, where everyone already knows what to do and so everyone does it. “In biology you need a mix of backgrounds just to

understand what needs to be done, and not many people actually want to do it. It's a difficult field, and the markets are relatively small," Karolis explains. "Which is precisely why it appealed to me – one of the easier places to make a difference without competing against a thousand other companies."

There is a number attached to this, and it is older than the company. I asked Karolis what his life goal was, and he remembered school days.

> *"My life goal in school was to employ a hundred people," he smiles. "I watched so many capable people study and then fail to find jobs that used what they were good at… so many talents going to waste.*

So I set myself a fairly modest goal, by world standards. By Lithuanian standards, at least, meaningful work for a hundred people who could actually use their scientific and engineering skills. A simple, easily identifiable KPI," Karolis remembers.

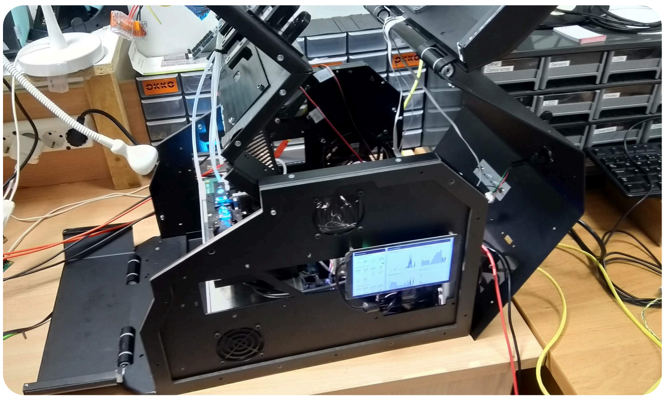
Did he make it? He isn't sure yet. Atrandi may have employed a hundred people across its history. Whether a hundred of them were the scientists and engineers he had in mind, he'd want to count properly. "We probably need a few more years before I can tick that one off," he laughs.

RESPONSIBLE ENGINEERS

If there is a romance to Karolis, it is an unusual one – he is truly romantic about finishing things. "When you release unfinished work into the world, there's always a lot of baggage to deal with afterwards, because we're responsible, the engineers," Karolis explains. Loose ends are the thing that won't let him sleep. Not metaphorically. "The feeling that there are unfinished ends," he smiles. "It nags me, and eventually it stops you sleeping, and not just sleeping, working properly on the projects. I want to release things that are finished, that meet people's needs, so fewer of them come back to us. That's why it matters for me to finish things – for the sake of practicality."

He frames this as a feature of the times rather than a personal creed.

> *"We live in an age where practicality and cost-efficiency matter, and will matter more and more.*



Fewer detached ideologies than there used to be, less experimenting for the sake of experimenting," he says. "I would be perfectly happy making one-of-a-kind tools for individual people, but it simply wouldn't be sustainable. There isn't much benefit in a tool only one person can use."

OXFORD, AND COMING BACK TO AN ALMOST FOREIGN COUNTRY

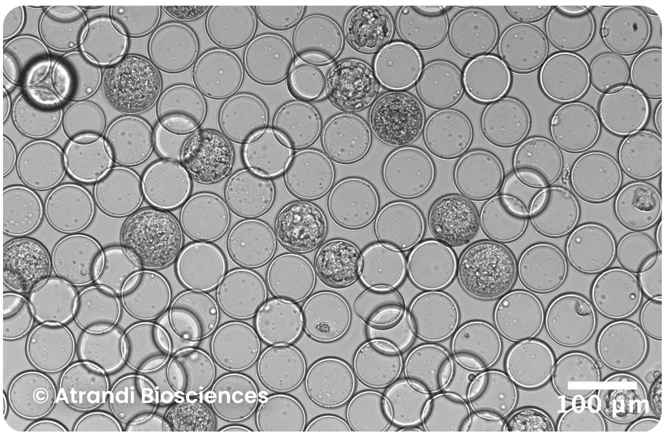
People tend to go "misty" about Oxford, but teaching, Karolis says, was not dramatically different than what Vilnius University had given him. A doctorate depends enormously on which lab you land in, and he landed in an extremely niche one. What Oxford University gave him was "a sense of how things look from a lot of different perspectives," he says. And a lot of room to wander into things outside his thesis: startup life, working with animals, clinical trials, business courses. "The cumulative effect was a working understanding of how people take an idea and try to give it meaning, scale it, make it real," Karolis explains.

It also gave him the question that comes after you've reached a goal: what now? His answer, even then, was not academia. "Back then, and I think it still holds," Karolis smiles, "academia didn't look like the most efficient way to do it. Too many inefficient processes." Industry and startups looked like the more modern, more efficient way to chase an idea. So he left. The more interesting question is not why he left Oxford, almost everyone leaves, the town is too small, but why he didn't stay in England.

He explains it like an engineer ruling out options: "England's value-generating industries were late-stage and settled, and none of them appealed to me. The corporate route meant waiting a decade to reach a position from which you could make meaningful change, with little growth along the way." And building a startup there was, simply, brutally hard – everything is very expensive, rent impossible, no way to survive without a salary even for a short period of time. Lithuania, by contrast, made sense for exactly the reasons it looked unpromising. The niche and markets he cared about were more logical to pursue somewhere small. "You could more or less live for free there without a job," he laughs, "and it's quite interesting, how society looks at unemployed people." Which is what the first years actually looked like in startup. And his family was there, but that is more complicated than it sounds. "When I came back it was practically an unknown environment to me. Apart from my family here, all my friends were either gone or doing other things. Coming back to Lithuania was the same as migrating to a foreign country," he remembers. There was no social world to return to, but there was the opportunity to create something.

NO EUREKA MOMENT

Here is the thing Karolis will not give you – the exact, eureka moment. Ask him about the Semi-Permeable Capsules, the technology now at the center of the company, and he will immediately take apart the premise of the question. There was no flash.



There was an accumulation of circumstances. “To form a Capsule you need a lot of incremental improvements. A lot of conditions all being met at the same time,” he says.

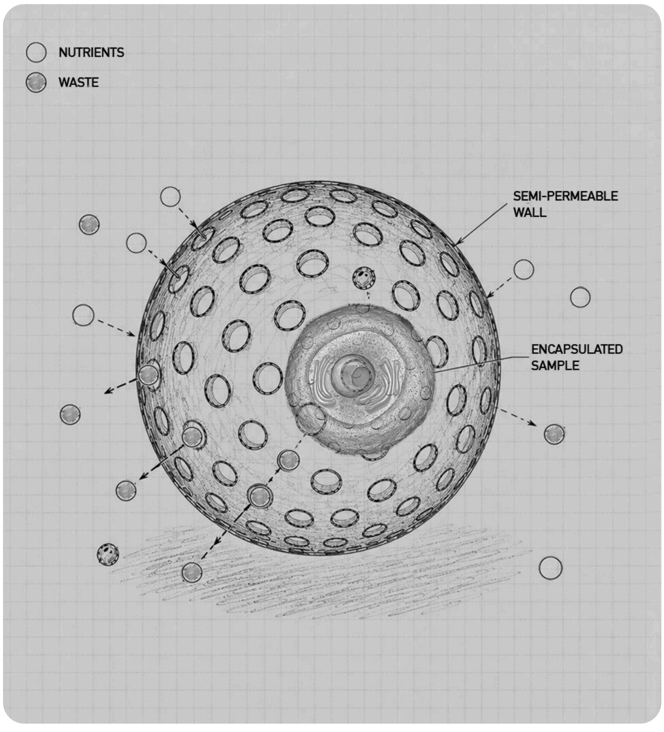
> *“Most of those conditions already existed: hydrogels were known, how to polymerize them was known, droplet microfluidics could already make the small compartments. What didn’t exist was a shell that would let DNA of a specific length and small molecules pass through while holding everything else in.”*

And he admits that he doubted beforehand if this is actually possible and doable. “It could easily have gone the other way. Either all the DNA passes through, or none of it does, and the reactions don’t work.” What happened instead was that short DNA moved in and out and long DNA stayed. The credit for seeing it and developing it fully is not his alone. “Greta noticed it, during her PhD.” Greta Leonavičienė, PhD, a co-creator of the Semi-Permeable Capsule (SPC) technology. Her project was related to a bacterial transcriptome and the observation that the shell-forming polymer behaved this way was hers, and so was most of what followed. “I threw out the idea that you might form these structures with hydrogels, that the phases separate, and the materials were familiar, the lab had worked with them before. But most of the work was Greta’s. The droplets, the fine-tuning, the whole “recipe”. After many experiments, long days at lab, refinement, we finally found the Capsule composition that worked.”

What made it matter was not, in his telling, technical brilliance. Core–shell structures of two phases had existed for a long time – the materials had simply always been wrong: impermeable, or insoluble, or not water-based, or incompatible with biology. The hydrogels they used were bio-compatible, and they had come from the world of embryos, and the one property nobody before (and until now) had – a shell, selectively permeable to different sizes of DNA. That happened to be exactly what the single-cell methods his colleagues had brought into the company needed. “Things clicked together,” Karolis remembers.

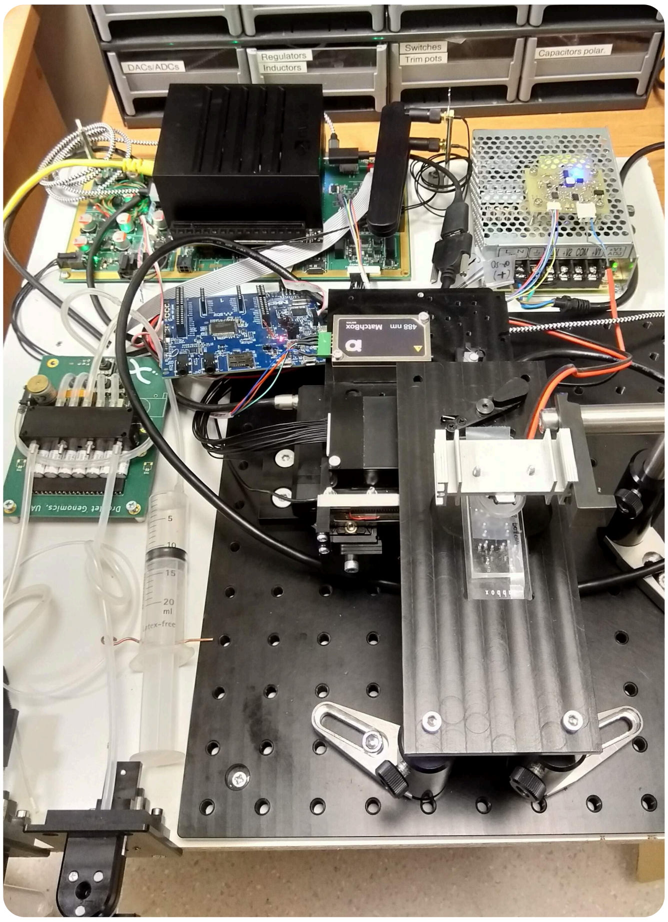
The deeper realization, the one he does call inventive, was simpler and perhaps even stranger. That you could replace a droplet, a sealed compartment everyone in the field was building around and fighting over the patents for, with a different kind of compartment that did the same job and owed nothing to anyone’s existing intellectual property. “In a way it’s the same function, but different concept entirely. From an IP standpoint, nothing is in common,” he explains.

When was it obvious this would have an impact? He pins it loosely to 2020 or 2021 – five or six years ago. “It took a while to tie up the ends and perfect the composition,” Karolis says. This is, it turns out, his theory of invention – mostly accumulation, and only occasionally, in a few specific places, something you could honestly call inventive. “Most of the other products are the result of good engineering, not inventiveness,” he says. “We do far less of the exploring. We’re more inclined to combine things, there’s just much less risk in that.”



THE THINGS THAT RESOLVE, AND THE THINGS THAT DON'T

What he remembers, when asked for a moment he'll never forget, is not a discovery. It is a piece of firmware. Early on, the survival of one of the instruments (and a good deal of the young startup's finances) hung on a module that read fluorescence. The sensible way to build it required large, expensive chips they had neither the money nor the people to develop.



So they did the unsensible thing – they used cheap, slow microcontrollers, the kind that normally sit in car infotainment systems rather than scientific instruments, and bet they could make them read a newer, emerging type of photon sensor that nobody was quite sure how to read. "It was completely unclear whether the problem was even solvable in principle," he admits and smiles. And then, one day, it was.

> *"We managed to write firmware that let the microcontrollers read the sensors and measure fluorescence. That was an incredible moment – I'll never forget it. It actually worked."*

It still works, the module is still in use. The emerging sensor they bet on those days has, over the decade, drifted toward becoming an industry standard.

There were others like it – a pressure system built on an unproven kind of pump that worked unreliably until, eventually, it didn't, high-voltage transformers they couldn't buy anywhere and so, absurdly, wound by hand for years before they found a supply of legacy parts. "Design decisions that got solved out of scarcity, or ignorance, or just pure luck and persistence," he says proudly. And then there are the ones that never resolved. He mentions a problem they spent more than a year on and never cracked – a manufacturing fault they could see but never explain. "You hold the samples in your hands. This one's good, this one's bad. And you can't say why." He suspects a cause, but it sits among the bigger unanswered questions. What is striking to me, is how little weight he gives to it – success or failure. "Mostly, I don't think about it. So much is happening at once. It's just part of the job," he smiles.

The big problems don't come with defining moments, there is no day where you decide to stop.

"Those situations last years and they're quite painful, not going to lie. During them you're exploring other ways to solve the same problem, and somehow, usually, you solve it. Even when you decide not to do something, you come back to it, later. This is just how I am."

AN UNPREDICTABLE WORLD

At the end, I ask Karolis to imagine what world does he think these tools we build might help create? His answer is the closest thing in the conversation to a creed, and it is, fittingly, an argument against certainty. "An unpredictable one," he says, and he means it as the goal, not the hazard. A tool that is merely an incremental improvement has an obvious purpose and an obvious future, and so it leaves no room for anyone to dream past it. A tool that is open-ended, that offers more possibilities than its makers can name, even ones that turn out to be impractical, keeps the drive alive, the chance to inspire someone to do more. "That leads to a future that's unpredictable. And that's the one I'd hope for," he smiles.

"Why should the future be unpredictable? Because it lets the future be better. If it's predictable, we end up at some status quo, some average, some ideology, enforced by the people who hold power, or who have the upper hand."

A predictable future, in his reading, belongs by default to whoever is already in a position to dictate it. The only thing that prevents that is the existence of factors no one fully controls – open tools, open questions, the genuinely new things. "Things that let the whole situation be redirected, unpredictably."
He built one of those things. He would rather you used it than remembered him for it. And the world he is hoping for is precisely the one he does not want to know is coming.