



**20 YEARS OF  
INNOVATION**

KAROLINSKA  
INSTITUTET



**“AT LEAST ONE MILLION BABIES WOULD NOT HAVE SURVIVED WITHOUT IT. SO YES, THERE’S PLENTY TO BE TRIUMPHANT ABOUT.”**

# The man who has saved the lives of a million babies

The Curosurf story is a tale of success. To date, the drug has saved the lives of around one million premature babies worldwide. And the story is far from over. Despite being 73, Tore Curstedt returns to the lab every day - the lab where he has developed a new variant of a drug that is set to help many more babies in the future.

The place: the neonatal department of Karolinska University Hospital on a grey afternoon in January. Curstedt’s eyes are gentle as he holds a premature baby. Taking great care not to disturb the tubes and sensors sticking out of the tiny body, he holds the little life closely to him as though letting the baby feel his steady breathing. In one of the photographer’s pictures, the baby raises its arm as if in triumph.

It’s nearly 40 years since the first doses of Curosurf left the lab. Today, between 300,000 and 500,000 premature babies are treated with the drug every year, and it has been given to an estimated four to five million babies since its introduction in 1992. At least one million of them would not have survived without it.

So yes, there’s plenty to be triumphant about.

This is not the first time Curstedt has been asked to tell this story. As he tells it one more time, he does so with modesty and humour:

“I came to Stockholm from Piteå in 1965. But as you can hear, I’ve completely lost my accent,” he says in a broad north Swedish accent, and laughs heartily.

The ambitious 20-year-old started his research when he was still training to be a doctor at the then Kemikum at Karolinska Institutet (KI). At the time, you could pass future Nobel medicine laureates Bengt Samuelsson and Sune Bergström in the corridors. Curstedt did his thesis on phospholipids.

#### **No cure was available**

Premature babies lack a particular substance at birth, called lung surfactant. Surfactant starts to

develop in the fetus at a very late stage, and not before around 10 weeks prior to birth. Without it, babies are unable to breathe and alveoli in the lung collapse.

This has been known since the end of the 1950s. However, by the beginning of the 1980s, nobody had succeeded in developing a cure.

Only when the idea of extracting surfactant from animals was tried was progress made. One of the first researchers to test the idea was Bengt Robertson, also a doctor and researcher at Karolinska Institutet.

As Robertson worked on cleansing samples, he sought help from Curstedt. Surfactant is primarily made up of phospholipids. By combining their knowledge of testing and purification, they both arrived at a substance that produced excellent results.



**“IT WAS WHEN WE WORKED TOGETHER THAT WE DID IT, AND ONLY BY COMBINING OUR DIFFERENT AREAS OF INTEREST.”**

“Neither Bengt nor I had got anywhere on our own. It was when we worked together that we did it, and only by combining our different areas of interest, which just goes to show how important co-operation is,” says Curstedt.

#### The missing ingredient

Hundreds of tests on animals were soon completed with the new substance and with the same successful results. As news of their success spread, the pair realized that they lacked the right contacts to take their work to the next stage. All that changed one afternoon when the phone in the lab wouldn't stop ringing. It was Rolf Zetterström, head of pediatrics at Sankt Görans Hospital in Stockholm.

“Rolf said that he'd heard great things about our tests, and that that day a baby had been born, extremely prematurely, who

probably wouldn't survive. Did we have some surfactant that he could use?”

Thanks to both parents and doctors granting their permission, and that it was a life or death situation, the substance could be used.

But having conducted so many tests, their test-tubes were empty. They were also worried for another reason: what would happen if the baby didn't make it?

“We looked at each other and realized that we could be accused of misconduct if the baby died.

But at the same time we knew we had recorded some great results, and how careful we'd been with our documentation. So there was just one question left: would we make it in time?”

#### The first baby

Years later, in 2016, Curstedt was nominated for a Lifetime Achievement Award from the European Patent Office (EPO). Fellow nominees include Nobel laureates and leading innovators from all over the world.

Curstedt's nomination was big news in Sweden, and the Curosurf story spread across the country. The following morning, messages of congratulation flooded Curstedt's inbox. But there was one email that stood out. And it started with the sentence: “I was the first one!” The sender was one Patrik Svensson, born 1983.

“And when we counted back to

that date, it was right. Patrik was the very first baby to receive our surfactant.”

That time, in 1983, they managed to purify just enough material to give the increasingly blue-looking boy a dose. And the results were extraordinary. Within an hour or so the boy's normal colour had started to return and he could breathe unaided.

“It was a dramatic moment. We didn't manage to document it in any way at the time, but when I met Patrik later he told me what his parents had told him about that day.”

Clinical trials of the substance were launched in the 1980s. A dozen clinics throughout Europe participated. The study soon proved so successful that it was discontinued early to allow more patients to benefit from the prospective drug.

But when Curstedt and Robertson approached Pharmacia to take the drug to market, they were turned down. The drug's potential was considered too insignificant for the drug giant – an estimated SEK 200 million a year.

“We were pretty disappointed. Neither of us wanted to start our own business.”

Robertson was in contact with a doctor in Parma in Italy who heard about our difficulties. The doctor knew two brothers who ran a small drugs company named Chiesi. And they wasted no time in expressing their interest.

“It was blind luck! Today, I'm glad that Pharmacia rejected us. Developing Curosurf in a smaller company prevented the product from getting lost in the crowd. This helped to position the drug better.”

Some 30 years later, Curstedt

and Chiesi continue to work together. A conference call is scheduled just a couple of hours after our interview. Today, Curosurf accounts for approximately 12 per cent of Chiesi's total sales, amounting to around EUR 218 million in 2018.

“We never would have enjoyed such long-term co-operation if we'd worked with a large company, which would have sold the product on in time.”

#### Next step: a synthetic version

Every year, around 300-500,000 premature babies all over the world are treated with Curosurf. But this number could be even higher, says Curstedt. Curosurf is still manufactured from animal lungs. Creating an entirely synthetic form of the drug would make it even more widely available.

“We knew this back in the 90s. And how to achieve it. But it wasn't until 2012 we succeeded with the help of Jan Johansson at Karolinska Institutet. We're now conducting the last study prior to it being ready, but it'll be 2023 before a new drug is registered.”

It's easy to be optimistic when you see such good results in the lab, he says.

“Optimism is great, but in my experience things take a lot longer than you think.”

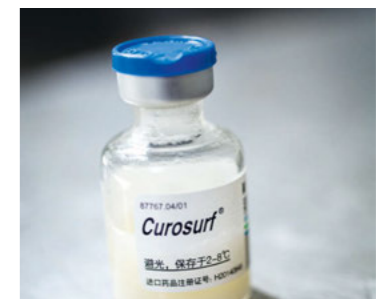
Despite his 73 years, Curstedt returns to the lab every day. Even though the synthetic variant of surfactant is ready, there is still room for improvement. Continuous improvement has always driven Curstedt.

“We've already made a number of changes that have made it even better. But this also means that we need to restart clinical

trials again. And this means that we have at least another 10 years before we can launch a new drug.”

Curstedt has received extensive recognition for his work, such as being included on the Swedish king's honours list; he has also received the Karolinska Institutet Grand Silver Medal and Region Stockholm's award for breakthroughs in clinical research.

“It would have been nice to have shared all the attention with Bengt, but he died in 2008. We won some awards together, but it would have been great if he'd still been with us today.”



#### QUICK FACTS

##### More on Curosurf

The drug Curosurf got its proprietary name through a merger of Tore Curstedt's and Bengt Robertson's name, as well as the substance surfactant: Curosurf = Curstedt-Robertson-surfactant.

The story of the discovery is described in an article written by Curstedt, Kajsa Bohlin and Mats Blennow, and published in *Läkartidningen*. See number 52, published 2009-12-21, or search for it on [lakartidningen.se](http://lakartidningen.se).

The journey from a research breakthrough to an innovation that improves the lives for people can vary in any number of ways. We have collected a selection of such journeys from Karolinska Institutet in the fields of Diagnostics, Medtech, Biotech, Digital Health, Social Innovation and Pharma. We hope that every one of them gives you an inspirational snapshot of the process that takes ideas to innovation.



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