Fifteen-year-old Christian from the town of Beuren in southwest Germany has been diagnosed with cancer. In the summer of 2011, doctors discovered a tumor in his pancreas. A combination of chemotherapy and radiation has given him new hope.

Our new Biograph mMR played a major role in Christian’s treatment. The combination of magnetic resonance imaging (MRI) and positron emission tomography (PET) technology enabled doctors at Tübingen University Hospital to observe the tumor’s shape and metabolism in detail and obtain vital information during the course of his therapy.
Certainty is the key factor. The therapy has been effective. "Luckily, the tumor’s gone," says Christian. Finally, life can return to normal. Now, it’s out of the hospital and back to school. "What I want is to finish school and start an apprenticeship." A joyful prospect a year after the big shock of the summer of 2011. At first, Christian felt ill. Then his eyes and face turned yellow. The diagnosis at Reutlingen Hospital: an advanced pancreatic tumor obstructing the bile duct. Christian’s mother remembers the fateful day: "I can’t describe it: tears, anger, rage, sadness – I couldn’t control my feelings."

**Examination with the Biograph mMR scanner**
The specialists in Tübingen launched their attack on the tumor immediately. "I had chemotherapy for the first four months, then radiation, and then chemotherapy for four more months," reports Christian. "After every second treatment, they stuck me into the tube to see how well the chemotherapy was working." The tube, as Christian calls the Siemens Biograph mMR, is an innovative combination of MRI and PET technology that helps physicians monitor the impact of chemotherapy treatments. The system can simultaneously display structures in the body and their metabolic activity.
July 9, 2012
10:34 a.m. — Having ice cream in Beuren
July 10, 2012
2:02 p.m. — Preliminary discussion at Tübingen University Hospital.

Diagnosis

Successful therapy

Examination

Trust
The question now is: does Christian’s pancreas still contain tumor cells? And if so, how active are they? In their examinations, the Tübingen cancer specialists never lose sight of Christian’s particular situation. “Children aren’t just small versions of adults. That means we have to consider a wide range of factors when evaluating their symptoms and determining the length of their examinations,” says Christian’s doctor, Professor Dr. Jürgen Schäfer.

For Christian, the past year has been an anxious one, full of uncertainty. “I often wondered if the tumor was getting larger or smaller,” he says. “If it was smaller, that was good, of course, and a sign the chemo was working. That motivated me to keep fighting.” But he wasn’t going to give up anyway. After the first shock, Christian promised himself he’d stay optimistic no matter what. Fortunately, the examination results boosted his confidence. The images from the Biograph mMR showed the radiologist both how the tumor’s size had changed during treatment and how its metabolism was developing – key indicators of its activity.

Today, the young patient has a very important appointment: together with his mother and sister, he’s come to Tübingen University Hospital to find out if his cancer treatment has been effective. In his patterned hospital gown, Christian lies down on a table in the examining room before entering the Biograph mMR scanner once again.
“I feel I’m well looked after in Tübingen. The doctors are very honest with me. And I think that’s good – because I want to know exactly what’s happening and why I’m doing all these things.”

The examination is over in half an hour. And a few days later, after a detailed evaluation of the images, Professor Dr. Schäfer has good news for his young patient. “Right now, it looks very good,” reports the head of pediatric radiology in the Department for Diagnostic and Interventional Radiology. “The functional and metabolic findings show that the therapy has been successful. The tumor is no longer showing increased metabolic activity.”

Greater certainty thanks to excellent imaging
At the last examination, small remnants of malignant tissue were still visible. But it’s now clear that they’re completely inactive. “This is exactly why we’re so happy to have this combination of morphological and functional findings,” says Professor Dr. Schäfer. “Since morphologically a very small remnant was still visible. But it’s no longer functioning, thank God.”

The doctors in Tübingen have been working with the Biograph mMR since March 2011. For Christian’s mother, it was clear from the beginning that she wanted to exploit this diagnostic opportunity for her son. “The doctors told us there was a new imaging system they could use to examine Christian,” she recalls. “I agreed immediately – and now I know for sure that the therapy’s worked.”
July 10, 2012
4:17 p.m. — Biograph mMR examination
“Our cooperation with Siemens is based on enormous trust, which has grown continually over the years.”
Professor Dr. Claus Claussen, Tübingen University Hospital has been using the Siemens Biograph mMR since March 2011. In your experience, which applications is the system most suitable for?

Professor Dr. Claussen: There are currently three fields of application for the Biograph mMR. About 90% of the applications relate to oncology, where we can identify what stage a tumor is in and monitor the course of treatment. The other fields are neurological diagnostics – in particular, neurodegenerative disease – and metabolic changes near the heart muscle. The Biograph mMR provides simultaneous, detailed images of the changes and processes taking place in living organisms. This is a tremendous advance. The simultaneous acquisition of MR and PET offers precise morphological and functional insights into the human body and makes it possible to pinpoint even the smallest pathological changes – for example, in the liver, the brain and bone marrow.

How long had you been dreaming about combining MRI and PET in this way?

Professor Dr. Claussen: Computed tomography became well established in the 1970s, and ever since we’ve been dreaming of visualizing anatomical structures and forms in combination with their functions. Dynamic computed tomography, which involves injecting contrast agents, was developed in the early 1980s. This enabled us to monitor blood flow in organs and tumors. Positron emission tomography (PET) made it possible to obtain images of specific metabolic activities in the body but afforded very poor spatial resolution. Results improved when CT and PET technologies were combined in PET-CT scanners. Then, about ten years ago, the enhanced contrast achieved in images of soft tissue by using MRI technology awakened hopes of further improvement – and today we have the Biograph mMR.

What is the special technical challenge of the Biograph mMR?

Professor Dr. Claussen: The strong magnetic field of the magnetic resonance imaging systems interfered with the operation of conventional PET detectors. That’s why new detectors had to be developed for use with magnetic resonance imaging systems. At our lab for preclinical imaging, Professor Dr. Bernd Pichler performed very important preparatory work before we and Siemens tried out and tested this new technology in a first combined MRI and PET head scanner. This example highlights how important it is for an industrial company like Siemens, which is geared to research and development, to leverage its customers’ potential and pursue open innovation through joint research projects.
Tübingen University Hospital and Siemens have been cooperating for many years to develop innovative imaging technologies. How would you describe this partnership?

PROFESSOR DR. CLAUSSEN: It’s based on enormous trust, which has continually grown over the years. We were one of the first university hospitals to conclude a cooperation agreement with Siemens. Since then, we’ve tested many new Siemens products. The experts were very skeptical at first about the leading-edge molecular MR process, but Siemens was convinced that the new technology would succeed, and that conviction is paying off.

Which patients profit most from the Biograph mMR?

PROFESSOR DR. CLAUSSEN: Above all, this new system benefits children and young people since radiation exposure during imaging is substantially lower than with conventional exam methods. This is an enormous advantage since we have to monitor the effectiveness of medications frequently, particularly with young patients, who are especially sensitive to radiation.

What new insights do you expect to gain for research?

PROFESSOR DR. CLAUSSEN: It’s still too soon to foresee the full potential of this hybrid MRI and PET technology. We have new therapy options and can now determine much earlier which therapies are effective – in terms of treatment quality, this definitely represents a big step forward. But it will certainly be years before we can measure this innovation’s full impact on healthcare.

If you could make a wish, what would you want from Siemens for the next generation of diagnostic imaging systems?

PROFESSOR DR. CLAUSSEN: Of course there are always things you can wish for – otherwise, we’d stop dreaming. The ability to visualize functional and physiological processes in living organisms is already an important advance. This was unimaginable just 20 years ago. However, we’re still just at the beginning, and that’s why I’d like the reliability of diagnostics to increase even more in the future. But the first step has already been taken. And that’s a major milestone for imaging and healthcare in general.
The two imaging technologies complement one another perfectly: magnetic resonance imaging (MRI) provides millimeter-precise images of the body's organs, while positron emission tomography (PET) displays, above all, the metabolic activity of cells. The Siemens Biograph mMR is the world's first device to combine MRI and PET imaging in an integrated system – enabling clinicians to simultaneously capture data on organ function and metabolism as well as any changes in organs in a single scan.

For patients, this means diagnoses in less time and with less radiation exposure. Instead of having to perform several separate scans, clinicians can now acquire all images in a single process – thus shortening patient waiting times. The integration of MRI and PET technologies also reduces the amount of radiation that patients are exposed to, compared to conventional imaging technologies.

Until now, two separate devices were required for these examinations because the operation of conventional PET detectors is impaired by the strong magnetic fields generated by MRI scanners. Previously, the images generated had to be superimposed using special software. This second step reduced precision since patients – and thus organ positions – often shifted between scans. The Siemens Biograph mMR features new PET detectors whose operation is not disturbed by the MRI's strong magnetic field. That's why the innovative system can capture all data simultaneously, recording even the smallest details and functional processes. Healthcare facilities also profit from the Siemens Biograph mMR: the system streamlines processes and cuts costs for floor space and operation by eliminating the need for a second system. And that's to the advantage of a growing number of patients around the world.

A pioneering achievement in medical imaging, the Biograph mMR combines two previously separate technologies in a single system.