community corner

# Genetic Mutation, Named for Toms River, May Shed Light on Blood Disorders

## Doctors have just published the case of an Ocean County baby in the New England Journal of Medicine

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Three years ago, Dr. Mitchell Weiss discovered a mutant from Toms River.

A mutant protein, that is.

Last month's New England Journal of Medicine carried an article about the discovery of a new mutation in a gene for fetal hemoglobin, the protein in unborn babies' red blood cells responsible for carrying oxygen.

Weiss, a pediatric hematologist at Children's Hospital of Philadelphia, pinpointed the genetic anomaly. In keeping with tradition in his field, it was named after his patient's hometown: hemoglobin Toms River mutation.

The story begins, Weiss said, with a blue baby.

In 2008, Weiss was rounding the wards at CHOP when he came across an unusual case. An infant from the Jersey Shore had just arrived at the hospital with an unexplained problem. Her skin had a purple-blue tinge, a condition called cyanosis, which indicates not enough oxygen-rich blood is reaching cells in the body.

"The list of things that can cause cyanosis is long," Weiss said. The neonatal intensive care unit at the hospital where the baby girl was born had done workups for the most common culprits, which included some frightening possibilities: congenital heart diseases, lung disorders.

Everything was negative. Not only that, she was happy and alert, though slightly anemic.

"So then they called us," Weiss said.

The most important clue came soon after.

"We're looking at this baby, and the grandmother comes up and says, 'My son had the same thing,'" said Weiss. The little girl's father was also born blue, said the grandmother. Doctors made a fuss and did a major evaluation. Nothing. Six months later, he was healthy.

That was a eureka moment, Weiss said, because "when you hear that, you think of a fetal hemoglobin problem."

Our bodies make different kinds of hemoglobin, he explained. While we're still in utero, one form of the protein is responsible for moving oxygen through our blood. After we're born, an adult form of hemoglobin gradually replaces the fetal kind. That's why symptoms of some blood disorders don't show up until well after birth.

"The babies are fine, but when the switch happens, they start to get sick," said Weiss.

In the Toms River infant's case, the family history suggested the opposite would be true: Whatever was wrong with the little girl's blood, it would probably resolve in a few months.

The doctors also guessed it was a genetic problem, passed from father to daughter. Samples from both were sent for DNA sequencing. By the time the results came back, the baby was better, "just as we had predicted, and just as her family had predicted," said Weiss.

The surprising news was that the genetic mutation that made her blue at birth – just one nucleotide in one strand of DNA, like a single wrong binary digit in computer code – had never been seen before.

For someone who studies hemoglobin, that's an exciting thing, Weiss said. He called his colleague and fellow hematologist, Dr. John Olson at Rice University.

Olson, who researches ways to make better blood substitutes, was able to recreate the baby's mutant hemoglobin in the lab. When Olson observed the manmade protein, the researcher's suspicions were confirmed: It wasn't picking up oxygen the way it was supposed to – not by a long shot.

A newly discovered hemoglobin mutation is not earth-shattering news, said Weiss. Hundreds have been found and recorded. "Hemoglobin Kansas, hemoglobin Milwaukee," he said. "It will be buried in the book."

The Toms River mutation is a notable one, though, because it was part of an intriguing medical mystery that was neatly and efficiently solved. Doc meets blue baby, learns history, makes prediction, finds mutation.

"It's kind of an interesting clinical story," he said. Just by observing symptoms and talking to family, he and his research partners had a strong suspicion of what was causing the problem. The tests proved them right.

"What this really says to me is don't let anybody ever tell you education's not going anywhere," said Olson. After all, he said, the researchers on the case had to have a working knowledge of the whole history of genetics and protein structure just to be able to make the prediction that a certain mutated section of a certain gene was making a baby sick.

"The accumulated knowledge that is required is incredible to me," he said.

And the Toms River case may have a legacy beyond becoming one more mutation in a hematology textbook.

If doctors can pinpoint the cause of cyanosis in a newborn to a genetic disorder that's expected to resolve itself, they can spare the baby and its family the fear of unknown complications and the trouble of tests, Weiss said.

"In other words, if you know somebody has this, you shouldn't get too excited and order invasive diagnostic testing," he said. "You basically want to leave them alone."

What's more, the new mutation is adding to scientists' understanding of the complex world of blood disorders.

Not only does the new mutation hurt hemoglobin's ability to pick up oxygen, it appears to also break down the hemoglobin molecules themselves, said Weiss and Olson, reducing red blood cell count and making the patient anemic. The two-pronged problem hadn't been seen in action before.

"This is starting to teach us things not just about medicine, but the biology of hemoglobin," said Weiss.

And the best part? The little girl from Toms River is now a healthy toddler.

"It had a happy ending," Weiss said.