

Wonder baby *Omar and Natasha Rajani with Zain at home in Toronto*

ronto, the journey to motherhood began ear after she and Omar were married in to. When they couldn't get pregnant on eir own, they tried prescription medicans, including Clomid, which prompts the owth of mature eggs. They also tried intraerine insemination and consulted with a turopath. Natasha got pregnant once but scarried a few weeks later. Feeling like ey'd exhausted their other options, they ded to try IVF last year. But even that proved appointing.

"Having to go in every morning to do od work and ultrasounds and then head to work was a bit taxing," Natasha says. "I ed to remain positive, thinking there is a ht at the end of the tunnel and that a baby ll be there at the end."

During her first go at IVF, she produced impressive number of eggs—more than lozen—but they weren't robust enough form embryos that were sufficiently althy to transfer. "The quality of embryos as not good at all," says Dixon, her physin at First Steps Fertility. One embryo was nost mature enough to transfer, Dixon says, so they went for it. "I knew it wasn't the best-quality embryo, but it was what she had." It didn't work.

When Natasha expressed a desire to try IVF again, Dixon wanted to improve her odds and proposed that she consider the Augment technique, which was being tested at the clinic. Because the procedure is so new, OvaScience says, it was offered to its first group of women for free so the company could study its effects. (OvaScience is now starting to charge clinics $15,000 to $25,000 for the Augment service.)

"I was ecstatic to know that there was something else we could try," says Natasha. Within three weeks, Dixon had removed a sample of tissue surrounding Natasha's ovary. That sample was then treated by OvaScience-trained lab technicians, who used a proprietary process to find and remove the egg stem cells and then punch out their mitochondria. "Anything present in an egg comes from these cells," says Tilly. "So it's logical to think of them as a natural source of eggs."

What makes these cells so enticing to scientists—and different from other fertility advances—is that they come from the mother herself. Mitochondria contain their own DNA, separate from a person's genome. In a recent controversial decision, the U.K. approved so-called three-person babies, where mitochondrial DNA from a healthy woman is introduced into the egg of a woman with mitochondrial disease. If that egg results in a live birth, it can raise ethical questions, biological concerns and conflicts about parenthood. With the Augment technique, however, the cells are all from the mother's ovaries.

The key to Augment is breaking down the egg stem cells and pulling out a concentrated solution of mitochondria. When embryos are formed, it's the mitochondria, some experts believe, that fuel the cell divisions that eventually produce the complex, multicelled organism that is a human baby.

"When you're 40, your eggs are 40," says Dr. Robert Casper, a professor of obstetrics and gynecology at the University of Toronto and an adviser for OvaScience. He performed the first procedures using the technique, including overseeing Natasha's cycle. "Adding mitochondria from the egg precursor cells is like putting fresh batteries into a flashlight," he says.

A similar discovery came in 2001, when Jacques Cohen, a fertility specialist at St. Barnabas Medical Center in New Jersey, did a study combining the non-DNA contents of younger eggs with older women's eggs. That process appeared to rejuvenate the eggs and resulted in about 50 babies born using the technique. But the FDA said the procedure was a form of gene therapy—which the agency regulates—and required additional studies on its safety. The studies were never done, and the technique was effectively scrapped altogether in the U.S.

The FDA's requirement for data is keeping Augment out of the U.S. as well—at least for now. OvaScience plans to perform about 1,000 cycles this year and hopes that the data will help make the case for the technique stateside. "There is always early skepticism, but we need to generate the data and have healthy live babies," says Arthur Tzianabos, the company's president.

Waiting for Data

THE LACK OF ROBUST DATA IS THE MAIN concern of Augment's critics. Some fertility scientists question whether mitochondria are indeed the silver bullet they seem to be. What's lacking, critics say, is convincing evidence that compares pregnancy rates of women undergoing Augment with those of women who have similar infertility problems but haven't used the technique. So far, no formal scientific trials have been conducted; the only data on the procedure comes from presentations by Casper and Dr. Kutluk Oktay, from Gen-ART IVF in Ankara, Turkey—both of whom are advisers to OvaScience.

"We're not yet sure the scientific model has proved what the outcomes would be if you use the mitochondria of a younger egg or from an egg stem cell," says ASRM's Davis. "It's a fascinating concept, but we just haven't seen the studies yet."

In the world of infertility, however, such data is historically hard to come by. For one thing, poor egg quality, which Augment addresses, is a leading cause of infertility, but there is still much that isn't known about why some women can't get pregnant. Meanwhile, a lack of regulation of most reproductive technologies—the ones that don't fall under the jurisdiction of the FDA as either drugs, devices or gene therapy—and the dominance of business-minded scientists have led to some new methods being rushed to clinics, often before their effectiveness has been fully proved. Fertility clinics have been required to report on their success rates only since 2012, and some still don't provide this data, so parents-to-be don't always have objective ways to gauge the quality of the costly services they're buying.

"The people providing these services are doing this as a business," says Dr. David Keefe, chair of obstetrics and gynecology at New York University Langone Medical Center. "Generally in science, we like people who are more disinterested to be doing the clinical studies."

Tilly counters those doubts with evidence from other species showing that these cells can do what OvaScience says they can. Egg stem cells extracted from the ovarian tissue of rats, mice, monkeys, pigs and cows, as well as from women, have developed into immature eggs—and in the case of mice and rats, those eggs have developed and produced viable offspring.

"Eggs get tired as women get older, and the tired egg doesn't perform as well in creating an embryo," Tilly says. "Mitochondria from egg precursors rejuvenate the egg to bring it back to a high-quality state."

That certainly appears to be the case with the Rajanis, and in the coming months, OvaScience will be able to tell whether that's the case with a host of other women too. "I kept telling myself one day we'd have a child, that hopefully in the end we would get pregnant," says Natasha. "And we did." ■

How It Works

1

A sample of ovarian tissue is removed in a 15-minute laparoscopic procedure



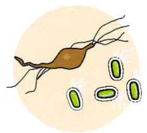
2

The tissue is mixed with an antibody that recognizes and binds to the egg stem cells



3

The egg stem cells are physically crushed to release mitochondria—the "batteries" that energize cells



4

The mitochondria are injected into an egg, along with sperm, during IVF



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