

At 19 days old, Zain Rajani looks like an ordinary baby boy. He is anything but.

His parents, Natasha, 34, and Omar Rajani, 39, of Toronto, spent four years trying to get pregnant. Now they've produced the first baby in the world born using a breakthrough in vitro fertilization technique that could dramatically improve the success rate of IVF.

The approach is still being tested—and is controversial to some, not least for its dependence on a type of human stem cell. Many experts, however, are excited by the potential of the technique, called Augment, because it relies on cells that are already present in a woman's ovaries. It uses the pristine stem cells of healthy, yet-to-develop eggs to try to help a woman's older eggs act young again. And unlike other kinds of stem cells, which have the ability to develop into any kind of cell in the body—including cancerous ones—these precursor cells can form only eggs.

The Rajanis, who spoke exclusively with TIME, say that's why Zain is here. In May 2014, in a quick laparoscopic procedure, scientists collected a sample of Natasha's ovary cells and distilled it to a clear liquid containing mitochondria from the egg precursors. Mitochondria are cells' energy source, acting almost like batteries that help them function. So when the liquid produced from Natasha's cells was combined with her eggs, it essentially recharged them, energizing the fertilization process. The result: four healthy embryos, one of which was implanted into her uterus and ultimately developed into baby Zain.

This process yielded a "night-and-day difference" in the number of strong embryos the couple produced compared with their traditional IVF cycle, says Dr. Marjorie Dixon, their doctor at First Steps Fertility, a private clinic in Toronto. That time, just 4 of the 15 eggs retrieved became fertilized, and though one was transferred, it didn't take.

Now Zain is the first in a wave of babies expected to be born throughout the summer using the same method. So far, nearly three dozen 30-something women in four countries have tried Augment, and so far, eight are pregnant. All of them have had at least one unsuccessful cycle of traditional IVF; some have had as many as seven. If Augment's early promise is borne out, it could transform the outcomes of the estimated 176,000 IVF cycles reported in the U.S. each year, whose costs start at anywhere from $15,000 to $20,000 per cycle.

The approach emerged in large part from a 2004 breakthrough by Jonathan Tilly, then a biologist at Harvard Medical School and now chair of biology at Northeastern University. He discovered that some cells from the outer surface of the ovary contain just what many women need: a more reliable source of mitochondria to support the poor egg quality that can make a pregnancy challenging.

"The technique addresses a void in IVF," says Tilly—the need to help women whose eggs can't be fertilized effectively. "We are taking patients with a 0% pregnancy rate, patients who have failed IVF because of poor egg quality, and getting them pregnant."

By making that possible, OvaScience, the company Tilly co-founded to bring the proprietary technique to patients, is embarking on what could prove to be a very profitable venture. Critics worry that it's a case of the fertility industry racing ahead without sufficient evidence of how well a procedure works; the method has not yet been approved in the U.S. But the scientists behind it believe they are poised to launch the next major evolution in IVF.

New and Improved IVF

AUGMENT'S SUPPORTERS HAVE A POINT. Zain's birth represents the first major advance in reproductive assistance since 1978, when Louise Brown, the first IVF baby, was born to headlines that declared the age of the "test-tube baby" had arrived.

Since that time, scientists have made incremental improvements to the process. They fine-tuned a recipe for the nutrient bath they use for fertilization, and they've improved the way they nurture the embryos. But taken together, these advances have nudged pregnancy rates upward by only a percentage point or two over the course of 35 years. As it stands, the IVF success rate is about 38% for women in their late 30s and 18% for women in their early 40s. And today the procedure looks very similar to the one used to produce Brown—complete with weeks of hormone injections and daily doctor's visits for blood tests and ultrasound scans.

Stem-cell-based techniques like Augment, co-developed by Tilly and Harvard Medical School aging expert David Sinclair, could change that. Women will still need the rounds of hormone shots to produce more than one egg during a cycle. But it will be possible, scientists think, to not only boost those eggs with stem cells—as Natasha's doctors did—but also to coax egg stem cells inside the mom-to-be into fully mature eggs, giving her a fresh, more viable supply that she can use to become pregnant, either naturally or with IVF. (That procedure may be available from OvaScience by the end of the year.)

"We could be on the cusp of something incredibly important," says Dr. Owen Davis, president-elect of the American Society for Reproductive Medicine (ASRM), who is not affiliated with OvaScience. "We could be on the brink of something that is really going to pan out to be revolutionary." But as with any major scientific breakthrough, regulatory questions, the need for more data and some vocal critics will first have to be addressed.

For Natasha, who works in strategic sourcing for a Canadian drug-store chain based in