

New technology enables parents to pick and choose

By Matt Crenson
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NEW YORK — They held a news conference not long after Adam Nash was born.

It was a small affair compared to the international media extravaganza that attended last month's alleged birth of the world's first cloned human.

Maybe that's because Adam's birth had nothing to do with UFO cults, virgin births or secret laboratories in unnamed countries. But unlike the allegedly cloned "Eve," Adam offers a very real glimpse into the future of human reproduction.

For one thing, Adam has actually been proven to possess the genes he was designed with. Even more important, those genes were not merely copied from another person's, but selected to give Adam specific traits.

"Cloning is a red herring," says Princeton University biologist Lee Silver, whose 1997 book "Remaking Eden" envisions a future time when parents will have the opportunity to fiddle with their children's heredity.

Silver explains that two powerful scientific fields are just beginning to collide in a way that will profoundly change human reproduction. As reproductive technologies are developed and refined, science's knowledge of human genetics is also exploding.

The combination of genetic knowledge with reproductive technology already allows parents to select some of the genes they pass to their children. Someday it may even enable the creation of human genes, and traits, that have never existed. It is possible that our children's children's children will be engineered to live longer and be healthier, stronger and more intelligent than any generation before them.

Adam Nash's parents already had one child when he was born in August 2000. Their daughter Molly suffered from a rare genetic disease called Fanconi anemia. The Nashes wanted to make sure Adam would not also inherit the genetic defect that caused his sis-

ter to be born with a host of birth defects, including missing thumbs and hip sockets.

But they also wanted to be sure Adam would share one of Molly's genetic characteristics. Because their daughter would die without a bone-marrow transplant, the Nashes wanted their children to have the same tissue type so Adam could serve as Molly's donor.

With the help of Dr. Yury Verlinsky, a geneticist at the Reproductive Genetics Institute in Chicago, the Nashes created several dozen embryos by in vitro fertilization and chose one with the proper genetic characteristics.

That embryo became Adam.

Verlinsky has used the same procedure to help parents carrying genes for cystic fibrosis, hemophilia and sickle cell anemia avoid having children with those diseases. He has ensured that older mothers, whose babies have a markedly increased risk of being born with Down syndrome, give birth to healthy babies. Recently he gave a 30-year-old woman with a gene for early-onset Alzheimer's disease the opportunity to bear a child who lacks the trait.

Verlinsky doesn't modify the embryos he implants. He merely creates a number of embryos by in vitro fertilization, screens them for some desired property — usually the absence of a particular genetic defect — then implants the one that best fits the criteria.

So far parents have used the procedure, which is known as PGD (for preimplantation genetic diagnosis) only as a means of preventing inherited diseases in their children.

Using the technology as an enhancement to make children taller or smarter is impractical, partly because PGD merely selects among genes the two prospective parents already possess. That means Junior's height and intelligence are limited by his parents' genetics.

Furthermore, characteristics such as height and intelligence are influenced by a large number of different genes, making it unlikely that the best ones will all come together in single embryo.

Verlinsky dismisses critics who accuse him of playing God, of creating "designer babies" and of trying to fool Mother Nature.

"We don't design nothing," he says in a thick Russian accent. "That's absolutely nonsense."



RICHARD SENNOTT / Minneapolis-St. Paul Star Tribune

Molly Nash, 6, holds her baby brother Adam while surrounded by her parents, Jack and Lisa Nash. Adam was conceived through in

fertilization after tests determined that he would have the right genetic characteristics to provide a bone-marrow transplant that would help his sister.

But what if scientists really could simply insert whatever genes they wanted into an embryo's DNA?

In animals, they can. Scientists have been putting genes into mice for more than 20 years by injecting DNA directly into developing embryos.

"It's more powerful in that, unlike preimplantation diagnosis, you can give the embryo traits that the parents themselves don't have," says Stuart Newman, a professor of cell biology and anatomy at the New York Medical College.

The technology has been used to create cows and goats that produce valuable drugs in their milk.

Medical researchers studying Lou Gehrig's disease have inserted a gene into rats that causes them to develop the degenerative condition.

And if their creators receive approval from the federal Food and Drug Administration, salmon that are genetically modified to grow faster may soon be on sale at U.S. grocery stores.

Today, inserting genes into embryos is a highly imperfect technology. For every individual mouse or cow that picks up the inserted gene and properly incorporates it into its own DNA, there are many more that don't. Some simply reject the introduced DNA. And because researchers have little control over where the new DNA will end up in the animal's genetic code, in many cases it ends up causing birth defects or preventing the animal from ever being born at all.

"They're getting better technically, but still there are a lot of mishaps along the way," Newman says.

Parents would not embrace a technology that produced far more failures and defectives than enhancements. But in the future, many of the technical obstacles to

genetic enhancement are expected to fall. What then?

"My view is that certain pathways shouldn't be taken," Newman said. "I would actually advocate a ban on genetic engineering of human embryos."

Researchers are already working with artificial chromosomes that could be inserted whole into a developing embryo, completely separate "volumes" the developing organism's genetic library, artificial chromosomes would not disrupt an embryo's existing DNA code. That, scientists believe, would prevent the majority of unexpected defects.

Most researchers believe it will be decades before doctors will be able to load genes into human beings as easily as we load programs onto hard drives on computers today from CD-ROMs. But when they do, the sky will be the limit.

Children could be engineered for resistance to cancer, heart disease, mental illness, AIDS and other human plagues. They could also be designed for superhuman strength, sunny disposition, flawless beauty or photographic memory. All it would take is an understanding of how genes control such characteristics and an ability to keep environmental factors such as emotional stress and nutrition from undermining their effects.

When that day comes, says University of Minnesota biologist Jeffrey Kahn, it would behoove us to have thought about which modifications are socially acceptable and which are not.

The latest cloning breakthrough may amount to no more than a silly hoax, Kahn says, but it raised issues that deserve consideration.

"The cloning story is sort of a harbinger," Kahn says. "It's time for us to realize that we don't have adequate controls over this stuff."