A Baby, Please. Blond, Freckles -- Hold the Colic

Laboratory Techniques That Screen for Diseases in Embryos Are Now Being Offered to Create Designer Children

By **GAUTAM NAIK** Wall Street Journal February 12, 2009

Want a daughter with blond hair, green eyes and pale skin?

A Los Angeles clinic says it will soon help couples select both gender and physical traits in a baby when they undergo a form of fertility treatment. The clinic, Fertility Institutes, says it has received "half a dozen" requests for the service, which is based on a procedure called pre-implantation genetic diagnosis, or PGD.

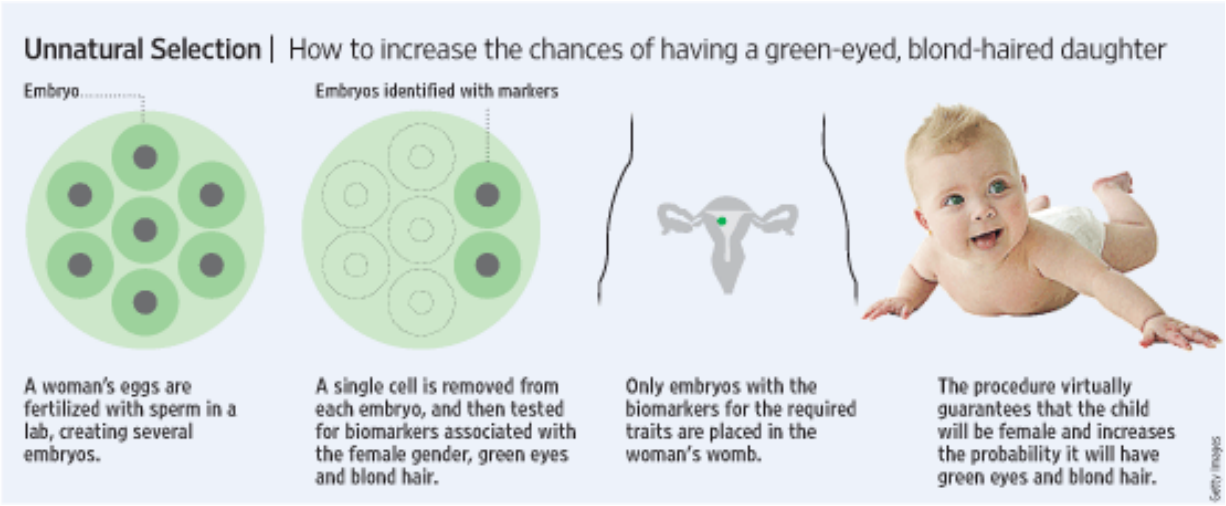
While PGD has long been used for the medical purpose of averting life-threatening diseases in children, the science behind it has quietly progressed to the point that it could potentially be used to create designer babies. It isn't clear that Fertility Institutes can yet deliver on its claims of trait selection. But the growth of PGD, unfettered by any state or federal regulations in the U.S., has accelerated genetic knowledge swiftly enough that pre-selecting cosmetic traits in a baby is no longer the stuff of science fiction.

"It's technically feasible and it can be done," says Mark Hughes, a pioneer of the PGD process and director of Genesis Genetics Institute, a large fertility laboratory in Detroit. However, he adds that "no legitimate lab would get into it and, if they did, they'd be ostracized."

But Fertility Institutes disagrees. "This is cosmetic medicine," says Jeff Steinberg, director of the clinic that is advertising gender and physical trait selection on its Web site. "Others are frightened by the criticism but we have no problems with it."

PGD is a technique whereby a three-day-old embryo, consisting of about six cells, is tested in a lab to see if it carries a particular genetic disease. Embryos free of that disease are implanted in the mother's womb. Introduced in the 1990s, it has allowed thousands of parents to avoid passing on deadly disorders to their children.

But PGD is starting to be used to target less-serious disorders or certain characteristics -- such as a baby's gender -- that aren't medical conditions. The next controversial step is to select physical traits for



cosmetic reasons.

"If we're going to produce children who are claimed to be superior because of their particular genes, we risk introducing new sources of discrimination" in society, says Marcy Darnovsky, associate executive director of the Center for Genetics and Society, a nonprofit public interest group in Oakland, Calif. If

people use the method to select babies who are more likely to be tall, the thinking goes, then people could effectively be enacting their biases against short people.

In a recent U.S. survey of 999 people who sought genetic counseling, a majority said they supported prenatal genetic tests for the elimination of certain serious diseases. The survey found that 56% supported using them to counter blindness and 75% for mental retardation.

More provocatively, about 10% of respondents said they would want genetic testing for athletic ability, while another 10% voted for improved height. Nearly 13% backed the approach to select for superior intelligence, according to the survey conducted by researchers at the New York University School of Medicine.

There are significant hurdles to any form of genetic enhancement. Most human traits are controlled by multiple genetic factors, and knowledge about their complex workings, though accelerating, is incomplete. And traits such as athleticism and intelligence are affected not just by DNA, but by environmental factors that cannot be controlled in a lab.

While many countries have banned the use of PGD for gender selection, it is permitted in the U.S. In 2006, a survey by the Genetics and Public Policy Center at Johns Hopkins University found that 42% of 137 PGD clinics offered a gender-selection service.

The science of PGD has steadily expanded its scope, often in contentious ways. Embryo screening, for example, is sometimes used to create a genetically matched "savior sibling" -- a younger sister or brother whose healthy cells can be harvested to treat an older sibling with a serious illness.

It also is increasingly used to weed out embryos at risk of genetic diseases -- such as breast cancer -- that could be treated, or that might not strike a person later in life. In 2007, the Bridge Centre fertility clinic in London screened embryos so that a baby wouldn't suffer from a serious squint that afflicted the father.

Instead of avoiding some conditions, the technique also may have been used to select an embryo likely to have the same disease or disability, such as deafness, that affects the parents. The Johns Hopkins survey found that 3% of PGD clinics had provided this service, sometimes described as "negative enhancement." Groups who support this approach argue, for example, that a deaf child born to a deaf couple is better suited to participating in the parents' shared culture. So far, however, no single clinic has been publicly identified as offering this service.

Like several genetic diseases, cosmetic traits are correlated with a large number of DNA variations or markers -- known as single nucleotide polymorphisms, or SNPs -- that work in combination. A new device called the microarray, a small chip coated with DNA sequences, can simultaneously analyze many more spots on the chromosomes.

In October 2007, scientists from deCode Genetics of Iceland published a paper in Nature Genetics pinpointing various SNPs that influence skin, eye and hair color, based on samples taken from people in Iceland and the Netherlands. Along with related genes discovered earlier, "the variants described in this report enable prediction of pigmentation traits based upon an individual's DNA," the company said. Such data, the researchers said, could be useful for teasing out the biology of skin and eye disease and for forensic DNA analysis.

Kari Stefansson, chief executive of deCode, points out that such a test will only provide a certain level of probability that a child will have blond hair or green eyes, not an absolute guarantee. He says: "I vehemently oppose the use of these discoveries for tailor-making children." In the long run, he adds, such a practice would "decrease human diversity, and that's dangerous."

In theory, these data could be used to analyze the DNA of an embryo and determine whether it was more likely to give rise to a baby of a particular hair, skin or eye tint. (The test won't work on other ethnicities such as Asians or Africans because key pigmentation markers for those groups haven't yet been identified.)

For trait selection, a big hurdle is getting enough useful DNA material from the embryo. In a typical PGD procedure, a single cell is removed from a six-cell embryo and tested for the relevant genes or SNPs. It's relatively easy to check and eliminate diseases such as cystic fibrosis that are linked to a single malfunctioning gene. But to read the larger number of SNP markers associated with complex ailments such as diabetes, or traits like hair color, there often isn't enough high-quality genetic material.

William Kearns, a medical geneticist and director of the Shady Grove Center for Preimplantation Genetics in Rockville, Md., says he has made headway in cracking the problem. In a presentation made at a November meeting of the American Society of Human Genetics in Philadelphia, he described how he had managed to amplify the DNA available from a single embryonic cell to identify complex diseases and also certain physical traits.

Of 42 embryos tested, Dr. Kearns said he had enough data to identify SNPs that relate to northern European skin, hair and eye pigmentation in 80% of the samples. (A patent for Dr. Kearn's technique is pending; the test data are unpublished and have yet to be reviewed by other scientists.)

Dr. Kearns' talk attracted the attention of Dr. Steinberg, the head of Fertility Institutes, which already offers PGD for gender selection. The clinic had hoped to collaborate with Dr. Kearns to offer trait selection as well. In December, the clinic's Web site announced that couples who signed up for embryo screening would soon be able to make "a pre-selected choice of gender, eye color, hair color and complexion, along with screening for potentially lethal diseases."

Dr. Kearns says he is firmly against the idea of using PGD to select nonmedical traits. He plans to offer his PGD amplification technique to fertility clinics for medical purposes such as screening for complex disorders, but won't let it be used for physical trait selection. "I'm not going to do designer babies," says Dr. Kearns. "I won't sell my soul for a dollar." A spokeswoman for Dr. Steinberg said: "The relationship between them is very amicable, and this center looks forward to working with Dr. Kearns."

For trait selection, Dr. Steinberg is now betting on a new approach for screening embryos. It involves taking cells from an embryo at day five of its development, compared with typical PGD, which uses cells from day three. The method potentially allows more cells to be obtained, leading to a more reliable diagnosis of the embryo.

Trait selection in babies "is a service," says Dr. Steinberg. "We intend to offer it soon."