“At What Stage of Pregnancy is a Fetus Able to Be Genetically Engineered?”

I am a high school student wondering about the process [of] genetic screening. I would like to know at what stage of pregnancy a fetus is able to be genetically engineered, or if the process must begin before a child is conceived. I would also like to know whether or not a normal gene has to be cloned from a donor in order to replace a problem gene in another. Any help would be greatly appreciated!

Just to make sure we are on the same page, *genetic engineering* and *genetic screening* are two different, but related things. *Genetic screening* involves testing a person for certain genetic diseases. This test can occur before the embryo is implanted into the womb as in the case of in vitro fertilization (IVF), it can occur during the pregnancy through a procedure call amniocentesis, and it can occur after a baby is born including into adulthood. Often with IVF, embryos are screened and the “best” ones are selected for implantation. Embryos need not just be screened for diseases, they can also be screened for gender and certain genetic markers. In some states pregnant women over 40 may be required to get genetic testing to determine if their baby has Down’s syndrome since the chances of Down’s syndrome increases when the mother is over 40. Most babies after they are born are tested for certain diseases such as phenlyketouria because, if they test positive, the parents need to keep them on a strict diet. Lastly, some couples might want to be genetically screened before they decide to get married. This was practiced in a particular group of American-Jewish people who had a high incidence of Tay-Sachs disease. If both people were carriers, then they may decide not to get married because they would likely have a child that would die from Tay Sachs (they

usually die at about age 5).

Genetic modification and *genetic engineering* are slightly different. *Modification* is done with plants and with some farm animals (although usually they use hormonal and breeding techniques for reasons outlined below). *Genetic engineering* in humans is still more theoretical than actual. The reason for this has to do with our lack of knowledge regarding the genome.

The theory goes like this: in the lab, we can replace segments of DNA with other segments of DNA in organisms like bacteria. So, what if we do this with human beings: replace unwanted DNA that codes for unwanted traits with DNA that codes for wanted traits. Sounds simple enough. Unfortunately—or fortunately, depending on your point of view—our genome is *not* that simple. There isn't just one strand of DNA that codes for eye color and another that codes for hair color. Our genes (genes are composed of lots of DNA) are very complex and the functions they code for are interwoven, often coding for multiple things at a time. Also, scientists are finding that DNA doesn't simply code for traits in a letter–to–letter fashion. Rather, there is apparently some interaction between two genes spatially in the genome.

As far as whether a normal gene has to be cloned from another, theoretically one can make segments of DNA in the lab. And scientists have been able to insert these segments into bacterial cells. However, replacement and insertion of a DNA segment in mammalian cells is a very different story, and has not been successful in laboratory settings to the extent of being able to conduct genetic engineering. I suppose if you wanted to genetically engineer traits into a human being, it would have to be at an early embryonic stage when there are only 6-8 cells to deal with. But even then, it is unclear whether we could use synthesized DNA or if we must receive large segments from a donor. This is very problematic because there is still the issue of expressing (i.e., flipping the "on

switch”) of the DNA in the organism.

Thanks for writing. Hope this is helpful.

Heather Zeiger

© 2010 Probe Ministries