

## **The Language of God by Francis S. Collins**

Pages 256-263, excerpted word for word

...for an objective observer to argue that this will not be, in the long run, a promising pathway toward treatment for a long list of debilitating and ultimately fatal diseases. It behooves us to look very carefully, therefore, at the moral objections to such a potentially beneficial process and assess whether they deserve the weight they are being given in some quarters.

I would argue that the immediate product of a skin cell and an enucleated egg cell fall short of the moral status of the union of sperm and egg. The former is a creation in the laboratory that does not occur in nature, and is not part of God's plan to create a human individual. This latter is very much God's plan, carried out through the millennia by our own species and many others.

Like virtually everyone else, I am strongly opposed to the idea of human reproductive cloning. Implanting the product of human SCNT into a uterus is profoundly immoral and ought to be opposed on the strongest possible grounds. On the other hand, protocols are already being developed to convince a single cell that has been derived from SCNT to be converted into a cell that senses glucose levels and secretes insulin, without going through any of the other steps of embryonic and fetal development. If such steps can result in tissue-matched cells that cure juvenile diabetes, why would that not be a morally acceptable procedure?

There is no question that the science in this field will continue to move rapidly. While the ultimate medical benefits of stem cell research remain undefined, there is great potential in them. Opposing all research of this kind means the ethical mandate to alleviate suffering has been trumped absolutely by other perceived moral obligations. For some believers, that may be a defensible stance, but it should be arrived at only after a complete consideration of the facts. Anyone who portrays this issue as a simple battle between belief and atheism does a disservice to the complexity of the issues.

### **BEYOND MEDICINE**

My morning newspaper recently included an analysis of various challenges facing the president of the United States. This particular story, coming at a time when things weren't going very well for the Commander-in-Chief, included a quote from someone identified as a political consultant and friend: "I've never seen the president burdened by the presidency. He's built to deal with really big events. It's in his DNA."

While the president's friend may have intended his comment as a contemporary witticism, it's entirely possible that he meant it.

What is the real evidence for heritability of human behaviors and personality traits? And will the genomics revolution lead us into new ethical questions because of it? How does one really assess the roles of heredity and environment in such complex human characteristics? Many erudite treatises have been written on this subject. But long before Darwin, Mendel, Watson, Crick, and all the rest, observant humans had already figured out that nature has provided us with a wonderful opportunity to assess the role of inheritance in many different aspects of human existence. That opportunity is provided by identical twins.

Personality Traits	Heritability Estimate
General cognitive ability	50%
Extroversion	54%
Agreeableness	42%
Conscientiousness	49%
Neuroticism	48%
Openness	57%
Aggression	38%
Traditionalism	54%

**Table A.1 Estimates of the Percentage of Various Human Personality Traits that can be Ascribed to Heredity**, from T.J. Bouchard and M. McGue, "Genetic and Environmental Influences on Human Psychological Differences," *J. Neurobiol.* 54 (2003); 4-45. Each of the traits listed here has a strict definition in the science of personality analysis.

If you have encountered a pair of identical twins, you will agree that they share remarkable physical resemblance, as well as other traits such as pitch of voice and even certain mannerisms. However, if you get to know them well, you will find that they have distinct personalities. Scientists have studied identical twins for centuries in order to assess the contributions of nature and nurture to a wide variety of human characteristics.

An even more unbiased careful analysis can be done on identical twins who were adopted to different homes at birth, and therefore had totally different childhood environments. Such twin studies allow an estimate of the heritability of any particular trait without in any way determining its actual molecular basis. Table A.1 shows some examples of the estimates of the proportion of a particular trait contributed by heredity, based on twin studies. For various methodological reasons, however, these should not be taken as precise.

These studies lead to the conclusion that heredity is important in many of these personality traits. That will not surprise any of us who live within families. We should therefore not be too shaken up by the fact that certain molecular details about the mechanism of heritability are beginning to be unearthed through the study of the genome. But we are.

It is one thing to say you have your grandmother's eyes or your grandfather's temper. It is another to say that those things came about because you have a certain T or C in a particular place in your genome, which you may or may not have passed on to your children. Though genetic research on human behavior holds the exciting promise of improved interventions in psychiatric illness, this research is also somehow upsetting, as it seems to tread dangerously close to threatening our free will, our individuality, and maybe even our spirituality.

We need to get used to this, however. The molecular definition of certain human behaviors is already happening. Several groups have published papers in the scientific literature indicating that the common variants in a receptor for the neurotransmitter dopamine are associated with an individual's score on the "novelty seeking" trait in a standardized personality test. This receptor variant, however, contributes only a very small proportion of the variability in this particular trait. While the result may be statistically interesting, it is essentially irrelevant for the individual.

Other groups have identified a variant in a transporter for another neurotransmitter, serotonin, that is associated with anxiety. That same transporter variant

has also been reported to correlate statistically with whether or not an individual experiences significant depression after a major life stress event. If correct, this would be an example of a gene-environment interaction.

An area of particularly strong public interest is the genetic basis of homosexuality. Evidence from twin studies does in fact support the conclusion that heritable factors play a role in male homosexuality. However, the likelihood that the identical twin of a homosexual male will also be gay is about 20 percent (compared with 2-4 percent of males in the general population), indicating that **sexual orientation is genetically influenced but not hardwired by DNA, and that whatever genes are involved represent predispositions, not predeterminations.**

Of the many aspects of human individuality that are most likely to cause controversy, none could be more explosive than intelligence. While disagreement about how to define intelligence and how to measure it remain a hot topic in social science, and while the various available IQ tests clearly measure a bit of learning and culture, not just general cognitive ability, there is clearly a strong inheritable component in this human attribute (Table A.1). At this writing, no specific DNA variant has yet been shown to play a role in IQ. It is likely, however, that there will eventually be dozens of such variants, once our methods are good enough to discover them. As with other aspects of human behavior, no single variant is likely to make more than a tiny contribution (perhaps one to two IQ points).

Could criminality even be influenced by inherited susceptibilities? In a way that is both obvious to everyone but not usually considered in quite this context, we already know this to be true. Half of our population carries a specific genetic variant that makes them sixteen times more likely to end up in jail than the other half. I am, of course, referring to the Y chromosome carried by males. The knowledge of that association, however, has not undermined our social fabric, nor has it been used successfully as a criminal defense by guilty males.

But putting that obvious point aside, it is indeed possible that other modest contributions to antisocial behavior will be identified in the genome. A particularly interesting example has already appeared, beginning with the observation of a single family in the Netherlands where the incidence of antisocial and criminal behavior among many of the males in the family stood out dramatically, and was consistent with the pattern of inheritance one might see for a gene on the X chromosome.

Careful study of this Dutch family revealed that there was an inactivating mutation in the gene for monoamine oxidase A (MAOA) on the X chromosome, and all of the males who had exhibited antisocial behavior carried the mutation. This could simply be a rare event with no broader significance, but it turns out that the normal MAOA gene has two different versions, a high expresser and a low expresser. While there is no overall evidence that low-expresser males have a higher frequency of interactions with the law, a careful study in Australia that looked at boys who were abused as children concluded that those who carried the low-expresser MAOA had a substantially higher frequency of antisocial and criminal behavior as adults. Here again may be an example of gene-environment interaction: the genetic susceptibility conferred by MAOA becomes apparent only when the environment experience of child abuse is added to the picture. But even in this situation, the findings were significant only on a statistical basis. There were plenty of individual exceptions to the rule.

A few years ago, I saw an article in a religious periodical asking the question whether individual spirituality might even be genetic. I smiled, thinking that now I had heard the ultimate in genetic determinism. But perhaps I was too hasty; it is not impossible to imagine that certain personality types, themselves based upon weakly inherited factors, may be more prone to accept the possibility of God than others. A recent twin study suggested just that, though as usual one must add the caveat that the observed effect of heredity was quite weak.

The question of the genetics of spirituality has recently achieved wide attention with the publication of a book called *The God Gene*,<sup>3</sup> by the same researcher who has also published findings on novelty seeking, anxiety, and male homosexuality. The book grabbed headlines, and even the cover of *Time* magazine, but a careful reading indicated that the title was wildly overstated.

The researcher utilized personality testing to deduce that a trait called “self-transcendence” showed heritability in families and twins. This characteristic was associated with an individual’s ability to accept things that cannot be directly proven or measured. The demonstration that such a personality parameter might have heritable characteristics is, in itself, not surprising since most personality traits do seem to have such properties. But the investigator went on to claim that a variant in a particular gene, VMAT2, was associated with a higher score on the self-transcendence scale. As none of his data has been peer reviewed or published in the scientific literature, most experts have greeted the book with considerable skepticism.

A reviewer in *Scientific American* quipped that the appropriate title for the book should have been *A Gene That Accounts for Less Than One Percent of the Variance Found in Scores on Psychological Questionnaires Designed to Measure a Factor Called Self-Transcendence, Which Can Signify Everything from Belonging to the Green Party to Believing in ESP, According to One Unpublished, Unreplicated Study.*

To summarize this section: There is an inescapable component of heritability to many human behavioral traits. For virtually none of them is heredity ever close to predictive. **Environment, particularly childhood experiences, and the prominent role of individual free will choices have a profound effect on us.** Scientists will discover an increasing level of molecular detail about the inherited factors that undergird our personalities, but that should not lead us to overestimate their quantitative contribution. Yes, we have all been dealt a particular set of cards, and the cards will eventually be revealed. But how we play the hand is up to us.

## **ENHANCEMENT**

The science fiction movie GATTACA depicts a future society in which the genetic factors for susceptibility to disease and human behavior traits have all been identified, and are used diagnostically to optimize the outcome of a mating. In this chill-.....