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K. John Morrow, Jr. is president of Newport Biotech Consultants and publishes this monthly newsletter.

He is a biotechnology consultant and writer in the field of molecular immunology. He offers his talents in speaking, writing and consulting in molecular immunodiagnostics and related fields.

In this issue

The Elusive Search for Genes that Control Intelligence

By K. John Morrow, Jr. President
Newport Biotech Consultants, Inc.

The nature-nurture argument over genes and intelligence has been going on ever since the 19th century with no resolution in sight. And it doesn't appear that the recent advances in DNA microarray technology provide a definitive answer to the question of how much of the spread in IQ scores we see in human populations is due to genes and how much is due to environment.

The tradition method for sorting out the relative contributions of genes and environment to IQ performance has been the twin study method, in which pairs of identical and fraternal twins, raised apart or raised together are compared. Since presumably the genetic makeup of identical twin is the same, then if differences in IQ scores were greater among the identical pairs raised apart, this difference would have to be due to environmental differences. On the other hand, if one compared identical twin raised together with fraternal twins raise together, and if the fraternal twins showed greater discrepancies in each pair, then this would presumably be due to the greater genetic differences between the fraternal as compared to the identical twin pairs. In both cases, by plugging in the proper formulae, one should be able to arrive at percentages of genes versus environment.

Such studies have been carried out over the last 100 years, and most suggest that both genes and environment make a contribution to the differences in IQ scores that we observe among human populations. Without going into a lot of discussion, suffice it to say that the work is

laborious, controversial, and has failed to nail down clear, definable, repeatable quantifiable data. Therefore we are left with the rather trivial and common sense notion that both genes and environment are significant contributors to IQ differences.

DNA microarrays are extremely powerful tools, as one can examine thousands of individual DNA sequences, looking for associations. Recent studies by Drs. L. M. Butcher, Richard Plomin and their associates at the Developmental Psychiatry Center in London have used this technology to try and identify genes that influence “g” or general cognitive ability, an umbrella measure of intelligence that is thought to show a strong heritable component. The team divided a large sample of 7000 individuals into high and low “g” groups and then screened them for the presence of 500,000 SNPs or single nucleotide polymorphisms, which act as “tags” for tracking genes that preferentially associate with the high or low “g” group.

The results of the study were underwhelming; after crunching the data, although the team initially identified six possible candidate genes, only one showed a statistically significant association.

It is important to take note of what these studies actually search for. They do NOT attempt to identify genes for proteins that allow proper brain function; we know of many of these and they were identified long ago. Rather the microarray studies search for alleles that differ in the general population and thus would be associated with the range of IQ differences that we see in individuals throughout the world. By analogy, we know of about 5 genes that affect the degree of melanin production and whose allelic differences are responsible for the range of skin color variation between African and Northern Europeans. Yet these genes have nothing to do with mutations for albinism or other classical skin color mutations.

Now, we know that the genes whose alleles differ between Africans and Northern Europeans tell us very little about racial differences, socio-economic concerns, pigmentation biology or much of anything very interesting in terms of race and human society. Could it be that the nature/nurture IQ debate that has been going since the time of Francis Galton back in Victorian England is the same overblown issue? If the most advanced technology for investigating the inheritance of intellectual differences has provided such a paltry yield, this suggests that we’re dealing with the same situation, in which allelic differences in a few genes make a modest and evanescent contribution to the range of intellectual performance that we see in our society.

A study discussed in a recent *Scientific American* article on this topic suggests an answer in the affirmative. Turkheimer, at the University of Virginia, compared how 839 pairs of twin performs on the National Merit Scholarship qualifying test. They found that genes played little role in the variance of scores among poor children and played a far stronger one in the affluent sample of twins. This suggests that poverty exerts an overwhelming environmental force that swamps out the genetic contribution to the IQ variation. Such observations explain why it is so difficult to nail down such differences with the microarray technology.

Finally, it not clear what can be gained from such studies. If we were able to isolate these factors, would they simply be affecting a superficial human quality, as in the example of the genes that affect skin pigmentation? Is it possible that such genes control very modest differences in

the production of neurotransmitters or some other factors in the brain? It is hard to see how such genes could provide deep insights into the human condition, or point the way to drugs or therapies that would improve intellectual performance.

Years ago, Aldous Huxley, author of *Brave New World*, the dystopic novel of a future in which all humans were genetically and behaviorally programmed to fit into a slot in society, was asked what he thought of the nature/nurture controversy. His response was that at long as our society did so little with the intellectual potential of its children, the argument was moot.

A conclusion worth pondering.

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