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Individuals and populations differ in gene activity levels, not just genes

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Much like how a person's genetic code differs from other individuals, the level at which those genes are activated in the body differs from one person to another, scientists have learned. And though some of those differences in gene activity are seen between different populations – Asians versus Europeans, for instance – more of those variations are due to individual-level factors, further obscuring the biological meaning of "race."

The findings could also have major implications for medical research, as differing levels of gene activity may affect one's susceptibility to developing a disease or one's response to a particular drug. The research was conducted at the University of Washington, and was led by Joshua Akey, assistant professor of genome sciences, and John Storey, associate professor of genome sciences and of biostatistics. Their findings appear in the March issue of the *American Journal of Human Genetics*.

"This is exactly what makes drug development so difficult, or why it's so hard to pinpoint an exact cause for a particular disease," said Akey. "People have so much variation both in their genetic information and in how those genes are activated and regulated. We need to have a much better understanding of human genetic and gene-expression variation in order to better treat complex diseases and develop more effective drugs."

The researchers examined data on thousands of genes from 16 people of European and African ancestry, cataloging the variations between those

individuals. They studied each person's levels of gene expression, which measures how much a particular gene is activated during the process of translating DNA into a substance called RNA, and from that into basic proteins. The more a gene is expressed, the more "messenger" RNA is produced, leading to formation of more proteins corresponding to that gene. Those proteins are the building blocks that make up living cells and tissue.

"The difference between genetic information and gene expression is like the difference between computer hardware, which are the genes themselves, and computer software, which tells the computer what to do on the hardware," explained Storey. "We looked at what's happening inside the body, beyond what's hard-wired into the genes."

Scientists have known for many years about genetic variation, in which individual letters in the genetic code change between individuals and between different populations. However, this study is one of the first to look at the variation in gene activity between individuals and populations.

The researchers found many differences in gene-expression levels, and that about 17 percent of those differences were due to population-level differences. The vast majority of the gene-expression variation was due to random differences between individuals, and was not tied to ancestral population or biological "race."

"It's important to remember that differences between population groups are much less abundant than those you would see if you just compared two randomly selected individuals," said Storey. "This means that populations have a lot more similarities than differences when it comes to gene expression."

Their findings may help us better understand how human populations are

structured and interrelated, and could also help explain evolutionary development of humans from our ancient ancestors to present day. The research may also help us understand why some people are more susceptible than others to complex genetic diseases.

Source: University of Washington