Please read the following articles, and answer the questions accordingly. **You should only answer in English.**

1.

(1) Please write a summary of approximately half a page. (25%)
(2) The authors aligned the DNA findings with the nature vs. nurture debate. From the article, what do you think was the stance of the authors? Support your answer with arguments. (25%)

Intelligence and the DNA Revolution: Scientists identify 22 genes associated with intelligence
By Alexander P. Burgoyne, David Z. Hambrick on August 22, 2017

More than 60 years ago Francis Crick and James Watson discovered the double-helical structure of deoxyribonucleic acid—better known as DNA. Today, for the cost of a Netflix subscription, you can have your DNA sequenced to learn about your ancestry and proclivities. Yet while it is an irrefutable fact that the transmission of DNA from parents to offspring is the biological basis for heredity, we still know relatively little about the specific genes that make us who we are.

That is changing rapidly through genome-wide association studies—GWASs, for short. These studies search for differences in people's genetic makeup—their "genotypes"—that correlate with differences in their observable traits—their "phenotypes." In a GWAS recently published in Nature Genetics, a team of scientists from around the world analyzed the DNA sequences of 78,308 people for correlations with general intelligence, as measured by IQ tests.

The major goal of the study was to identify single-nucleotide polymorphisms—or SNPs—that correlate significantly with intelligence test scores. Found in most cells throughout the body, DNA is made up of four molecules called nucleotides, referred to by their organic bases: cytosine (C), thymine (T), adenine (A) and guanine (G). Within a cell, DNA is organized into structures called chromosomes. Humans normally have 23 pairs of chromosomes, with one in each pair inherited from each parent.

A SNP (pronounced "snip") is a nucleotide at a particular chromosomal region that can differ across people. For example, one person might have the nucleotide triplet TAC, whereas another person might have TCC, and this variation may contribute to differences between the people in a trait such as intelligence. Genes consist of much longer nucleotide sequences and act as instructions for making proteins—basic building blocks of life.

Of the more than 12 million SNPs analyzed, 336 correlated significantly with intelligence, implicating 22 different genes. One of the genes is involved in regulating the growth of neurons; another is associated with intellectual disability and cerebral malformation. Together the SNPs accounted for about 5 percent of the differences across people in intelligence—a nearly twofold increase over the last GWAS on intelligence. Examining larger patterns of SNPs, the researchers discovered an additional 30 genes related to intelligence.

As a check on the replicability of their results, the scientists then tested for correlations between the 336 SNPs and level of education—a variable known to be strongly correlated with intelligence—in an independent sample of nearly 200,000 people who had previously undergone DNA testing. Ninety-nine percent of the time, the SNPs correlated in the same direction with education as they did with intelligence. This finding helps to allay concerns that the SNPs associated with intelligence were false positives—in other words, caused by chance. More substantively, the finding adds to the case that some of the same processes underlie intelligence and learning. The authors concluded that the results "provide starting points for understanding the molecular neurobiological mechanisms underlying intelligence, one of the most investigated traits in humans."

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As neuroscientist Richard J. Haier discusses in his excellent new book *The Neuroscience of Intelligence* (Cambridge University Press, 2017), other intelligence research is combining molecular genetic analyses and neuroimaging. In one study, using a sample of 1,583 adolescents, researchers discovered a SNP implicated in synaptic plasticity that was significantly related both to intelligence test scores and to cortical thickness, as measured by magnetic resonance imaging. In animal research, other researchers are using chemogenetic techniques to turn "on" and "off" neurons that may be important for intelligence.

Of course, intelligence is not solely the product of DNA—and no scientist studying intelligence thinks otherwise. The environment has a major impact on the development of intelligence or any other psychological trait. All the same, knowledge gained from molecular genetic research may one day be used to identify children at risk for developing serious intellectual deficits and those for whom certain types of interventions early in life may reduce that risk. This research is also providing a scientific foundation for thinking about how brain functioning might be manipulated to enhance intelligence.

The big picture to emerge from research on the neurobiological underpinnings of intelligence and other psychological traits is that the nature versus nurture debate is, once and for all, over. We are a product of both our genetic makeup and our environments, as well as the complex interplay between the two. Research aimed at better understanding this interplay will give scientists a richer understanding of the similarities and differences in our psychological makeup.

2.

(1) Please rewrite the following article into a paragraph that is comprehensible for elementary school kids in terms of both language and ideas. (25%)

(2) The author argued that diversity is an important piece of every community. Focus on one of the ways of defining a community (e.g. by race, sexuality, etc.) and discuss what could be the obstacles and potential solutions for promoting equality and diversity in a community defined in this way. (25%)

Why Diversity Is Important In Our Society

by Ryan Kirby on Sep 27, 2016

Diversity, for a long time now, has been becoming a part of our society.

Each day our society becomes more and more diverse; we meet more people daily and each one brings a new perspective about something into our lives. People everywhere have different opinions and ideas that we might never have thought of. Our lives are filled with people, each with different backgrounds and experiences, who we interact with every day. Diversity shows itself peeking out from the corner in many different ways: race, sexuality, culture, values, religion, gender, and an abundance of other ways. Diversity has not always been welcomed with open arms, but more and more we see people opening their minds to others' ideas.

So, diversity is a growing and (mostly) progressive part of our society, but what makes diversity important? Why should we be willing to take others' perspectives into account if we know we are right? Simply put, it's because you are not right. Well not always at least, no one is always right. But if we don't let others' ideas into our lives, we will never know how wrong we really might be.

Allowing diversity into our lives is how we find out all the brilliant ideas out there in the world. It is how we learn more about the world around us. By exploring other ideas, beliefs, and lifestyles with an open mind, we open ourselves to exercise creativity and problem solving by looking at things from other lenses. If we only

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take one perspective about events in the world, we will never understand the other perspectives behind them and therefore lock ourselves into a sort of closed-minded ideology that has only led to hate, prejudice, and tragedy throughout history.

Hate is a harsh word to use, yet it's used quite often in society as a way to express discomfort towards another group of people. It's often used because people don't fully understand a part of another group's ideology. This ignorance can lead to misconceptions which prevent diversity and encourage hatred. The sad part about this is that it becomes a cycle of life for close-knit communities. If everyone else in the community doesn't like a specific group of people, it takes a lot for a person to go against what their entire community thinks. Also, this gets passed down to the next generation and then again after that and so forth, until it is stopped.

Once diversity is accepted into societies they can begin to be more productive innovators, by trying to approach problems in different ways and from different perspectives. Whether it is comic book writers or if it is international peacekeepers, it is important to take into consideration other groups' perspectives on what you are doing. Also, once diversity is accepted, the society has a much higher chance to be internally and externally peaceful due to the lack of ignorance about other people. Having a diverse group of people is important in any community or society, and lacking diversity can cause huge misconceptions about other people, so it only makes sense to keep an open mind and open arms to anyone who you encounter.

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