

READING SECTION

All answers must be indicated on the MARK SHEET.

I Answer the questions below after reading the following passage.

Human intelligence is a puzzle. Although using IQ scores as a measurement of intelligence is controversial, some scientists believe we can use them to argue that intelligence is higher, on average, in some places than in others. And it seems to have been rising in recent decades. Why these two things should be true is also controversial. Recently, however, a group of researchers at the University of New Mexico have suggested the same explanation for both: the effect of infectious disease.¹ If they are right, it suggests that the control of such diseases is crucial to a country's development in a way that had not been understood before. Countries that have a lot of parasites² and pathogens³ not only suffer the weakening effects of disease on their workforces, but also on the personal development of individuals.

Christopher Eppig and his colleagues make their suggestion in the *Proceedings of the Royal Society*. They note that the brains of newly-born children require 87% of those children's metabolic⁴ energy. In five-year-olds the figure is still 44% and even in adults the brain—a mere 2% of the body's weight—uses about a quarter of the body's energy. Any competition for this energy is likely to damage the brain's development, and parasites and pathogens compete for it in various ways. Some feed on the host's body directly to reproduce. Some, particularly those that live in the stomach, can prevent a person absorbing food. And all parasites and pathogens provoke the host's immune system⁵ into activity, which prevents valuable energy from being used for more productive purposes.

There is a clear relationship between a country's disease burden and the average IQ scores of its people. The higher the country's disease burden, the lower the average IQ scores of its people. This is an example of an inverse correlation. To calculate the disease burden, the researchers used data from the World Health Organization (WHO). The WHO has developed the concept of a "disability-adjusted life year" (DALY), which is a measure of overall disease burden. The DALY measures not only potential years of life lost due to early death, but also years of healthy life lost by a person as a result of their being in a condition of poor health or disability.

The WHO is able to calculate the DALYs which are lost as a result of the impact of 28 infectious diseases. These data exist for 192 countries. The IQ scores came from work carried out earlier this decade by Richard Lynn, a British psychologist, and Tatu Vanhanen, a Finnish political scientist, who analyzed IQ studies from 113 countries, and from subsequent work by Jelte Wicherts, a Dutch psychologist.

At the bottom of the list of average IQ scores is Equatorial Guinea, followed by St Lucia. Cameroon, Mozambique and Gabon tie at third from bottom. These countries are also among those that have the highest infectious disease burden. At the top of the list of countries with the highest average IQ score is Singapore, followed by South Korea. China and Japan tie in third place. These countries all have relatively low levels of disease. America, Britain and a number of European countries follow behind the leaders.

The correlation between disease burden and lower IQ scores is about 67%, and the possibility that this strong statistical relationship occurred by chance is less than one in 10,000. Researchers are always trying to identify strong statistical correlations. They then hope to be able to explain the cause of these correlations. There may be many different possible causes, and researchers have to examine as many possible causes as they can, to give themselves a better chance of identifying the real cause correctly. As scientists say, "correlation is not causation"—identifying a statistical relationship does not explain why that relationship exists—so Mr. Eppig and his colleagues tried to eliminate other possible explanations.

Previous research teams have tried to suggest that income, education, low levels of agricultural labor (which is replaced by more mentally stimulating jobs), and climate (the challenge of surviving extreme weather might provoke the evolution of intelligence) could all be explanations for national differences in IQ scores. However, most of these possible causes are also likely to be linked to disease. By careful

statistical analysis, Mr. Eppig and his colleagues show that all of these alternative possible causes of the correlation either disappear or are reduced to a small effect, when the consequences of disease are taken into account.

Importantly, there is also clear evidence that infections and parasites, such as malaria⁶ and intestinal worms,⁷ have a negative effect on the development of the brain. A study of children in Kenya who survived the version of malaria that occurs in the brain suggests that one-eighth of them suffer long-term damage. In the view of Mr. Eppig and his colleagues, diarrhea⁸ is the biggest threat. Diarrhea strikes children hard. It accounts for one-sixth of infant deaths, and even in those it does not kill, it prevents the absorption of food at a time when the brain is growing and developing rapidly.

The researchers predict that one type of health problem will increase with rising intelligence. Asthma⁹ and other allergies are thought by many experts to be rising in frequency because the immune systems of young children, unchallenged by infection, are turning *against* the cells of the body that they are supposed to protect. Some studies already suggest a correlation between a country's allergy levels and its average IQ. Mr. Eppig and his colleagues predict that future work will confirm this relationship.

The other prediction, of course, is that as countries conquer disease, the intelligence of their citizens will rise. A rise in IQ scores over the decades has already been noticed in rich countries. It is called the "Flynn effect" after James Flynn, who discovered it. Its cause, however, has been mysterious — until now. If Mr. Eppig is right, the almost complete absence of serious infections in rich countries, as a result of vaccination,¹⁰ clean water and the proper treatment of human waste, may explain much if not all of the Flynn effect.

When Dr. Lynn and Dr. Vanhanen originally published their IQ data, they used them to suggest that national differences in intelligence were the main reason for different levels of economic development. This new study reaches the opposite conclusion. It is actually lack of development, and the many health problems this brings, which explains the difference in IQ scores. No doubt, in a vicious circle, those differences help to keep poor countries poor. But the new theory offers a way to break the circle. If further work by researchers supports the ideas of Mr. Eppig and his colleagues, they will have done enormous good by providing policymakers with yet another reason why the elimination of disease should be one of the main aims of development.

[Adapted from an article in *The Economist*, July 1st 2010]

注 ¹infectious disease: 伝染病; ²parasites: 寄生虫; ³pathogens: 病原菌; ⁴metabolic: (新陳)代謝の;
⁵immune system: 免疫システム; ⁶malaria: マラリア; ⁷intestinal worms: 回虫; ⁸diarrhea: 下痢; ⁹asthma: ぜん息;
¹⁰vaccination: 予防接種

(1) Choose the best way to answer each of the questions in accordance with the content of the passage.

1. Why are researchers especially concerned about the effects of parasites and pathogens on young children?
 - A Their developing brains require more energy than those of adults.
 - B Their immune systems are not yet as developed as those of adults.
 - C They have a higher rate of infection than adults do.
 - D They have a lower rate of recovery than adults do.
 - E None of the above
2. What was the concept of the DALY (disability-adjusted life year) developed to measure?
 - A The adjusted average life expectancy
 - B The daily rate of parasite infections in developing countries
 - C The inverse correlation between disability and health
 - D The potential years of active life lost as a result of death or illness
 - E None of the above
3. How does Japan's DALY score compare to other countries' scores?
 - A As high as Singapore
 - B As low as Cameroon
 - C Equivalent to that of South Korea
 - D Higher than that of China
 - E None of the above
4. Which of the following was NOT used by previous researchers to explain national differences in IQ?
 - A Climate
 - B Education
 - C Ethnicity
 - D Income
 - E None of the above
5. What is true of diarrhea according to the passage?
 - A It causes brain damage in one-eighth of children in Kenya.
 - B It increases with intelligence.
 - C It kills 25% of all babies.
 - D It prevents the absorption of food among children.
 - E None of the above
6. According to the study by Mr. Eppig and his colleagues, what is the correct sequence of cause and effect?
 - A Lack of development together with health problems leads to low national IQ scores.
 - B Low levels of income and education lead to low national IQ scores.
 - C Low national intelligence leads to lack of development and health problems.
 - D The challenge of an extreme climate leads to high national IQ scores.
 - E None of the above

(2) Which of the following statements agree with what is written in the text? Mark your answers true (T) or false (F).

1. An inverse correlation means that as X increases, Y decreases, or vice versa.
2. A number of studies suggest that there is a positive correlation between the frequency of asthma in a country and that country's average IQ scores.
3. The "disease burden" of a country refers to the cost of providing medical care to people who are ill.
4. The research of Eppig and his colleagues helps to explain why IQ has been rising in rich countries.
5. The research of Eppig and his colleagues largely supports the conclusions of earlier research by Lynn and Vanhanen.
6. The research of Eppig and his colleagues shows that lack of education is an important factor in explaining the national differences in IQ.