## TEST YOUR COMPREHENSION

1. Gene variants that increase the risk of alcoholism generally do so by
   a. 0.1–0.5%.
   b. 1–2%.
   c. 3–5%.
   d. 20–40%.
   e. 300–400%.

2. A genetically complex disease is one in which
   a. none of the associated genes has yet been identified.
   b. there is one gene with many different, complex variants that causes the disease.
   c. environmental agents cause complex alterations of disease-associated genes.
   d. multiple genes interact with environmental factors to produce the disease.
   e. multiple environmental factors alone cause the disease.

3. A psychiatric standard for diagnosing alcohol dependence is
   a. consuming alcoholic beverages at least twice a day.
   b. any form of alcohol abuse.
   c. alcohol abuse that disrupts family relations or job performance.
   d. a craving for alcohol.
   e. meeting at least three of a set of defined symptoms over a 12-month period.

4. Individuals carrying an aldehyde dehydrogenase (ALDH1) gene variant that reduces the rate of acetaldehyde breakdown
   a. die at an early age.
   b. suffer neurodegenerative conditions late in life.
   c. are less likely to become alcohol dependent.
   d. are more likely to become alcohol dependent.
   e. are more likely to abuse alcohol, but not to become alcohol dependent.

5. An example of an endophenotype is
   a. depression.
   b. anxiety.
   c. brain electrical activity patterns.
   d. heavy drinking.
   e. alcohol dependence.

6. Genetic factors account for roughly _____ of the risk for alcoholism.
   a. 1%
   b. 5%
   c. 15%
   d. 50%
   e. 90%

7. Compared to the brains of nonalcoholics, the brains of most alcoholics
   a. respond more slowly to a stimulus.
   b. respond more rapidly to a stimulus.
   c. show an excess of inhibitory processes.
   d. show an excess of excitatory processes.
   e. show identical electrophysiological properties.

8. For alcoholism,
   a. genetics is destiny.
   b. genetics is immaterial.
   c. genes and environment interact.
   d. genetic studies are the only route to effective treatment of the disease.
   e. genetic studies are fascinating but unlikely to be cost-effective for preventing or treating the disease.

9. Genetic findings related to alcoholism are envisioned to help
   a. prevent early-onset Alzheimer’s disease.
   b. prevent and treat other substance dependencies.
   c. in the treatment of other complex genetic diseases such as hypertension.
   d. insurance companies minimize risk.
   e. create a federal registry of potential alcoholics.

10. Regarding genetic profiling for alcoholism risk, scientists have an obligation to
    a. distinguish false claims from sound science.
    b. block use of this dangerous technology.
    c. prevent market forces from driving the use of these genetic technologies.
    d. prevent competition between groups working to improve genetic testing.
    e. speak out against this and other cost-ineffective technologies.
BIOLOGY IN SOCIETY

1. If genetic profiling advances enough to allow the prediction of the risk of alcohol dependence, what measures should be taken if a 12-year-old boy, living with both a father and older sister who are alcoholics, is found to be genetically at high risk of alcohol dependence? Before answering, you may want to consider what additional information would be helpful in coming to a decision. Ultimately, your answer needs to consider the balance between parenteral legal rights, best prevention practices for the child, and respect for the family.

2. A variant of the hTAS2R16 bitter taste receptor gene is linked to alcoholism. This gene variant is present in almost 45% of African-Americans and is uncommon in Americans of European descent. How can this information be misused in a racist way in drawing conclusions about alcoholism in blacks and whites? What is the correct interpretation of this finding in understanding the risk of alcoholism in these two groups?

3. Alcohol abuse places a huge burden on the nation. For example, in 2005, 40% of traffic fatalities involved alcohol. If effective genetic screens for susceptibility to alcohol abuse become available, should they be mandatory for all citizens over the age of 15? Should people who test positive for alcohol susceptibility be legally barred from alcohol consumption?

WRITING ABOUT SCIENCE

Imagine that Dr. Nora Volkow, Director of the National Institute on Drug Abuse (NIDA), knows that you are an unbiased expert on alcoholism. She has been receiving conflicting advice about the most effective way of spending limited funds to reduce alcoholism in the United States. Some experts tell her that the value of future genetic screens for potential alcohol susceptibility genes, each of weak effect, is questionable, particularly when current programs to limit alcohol consumption and to treat alcoholics give immediate returns. Dr. Volkow asks you to prepare a brief (2- to 3-page) position paper. She asks that you include a discussion of the current state of the field, when you believe a genetic screen will be available, and the effectiveness of genetic screening for prevention and customized treatment of alcoholism. Finally, she wants you to recommend whether substantial funds from NIDA should be committed to research into the genetics of alcoholism.

THINKING ABOUT SCIENCE

1. Why are endophenotypes considered more helpful than behavioral phenotypes in searching for genes associated with alcoholism?

2. To what extent is an alcoholic responsible for his or her condition? Your answer should consider genetic and environmental factors in alcoholism and the idea that there are different paths to alcohol dependence.

3. The CHRM2 gene encodes a form of the acetylcholine receptor, and certain CHRM2 variants increase susceptibility to major depression and alcohol dependence. What are some possible relationships between major depression and alcoholism in individuals with the CHRM2 variant? Does the co-occurrence of major depression and alcoholism in some individuals with the variant CHRM2 gene prove that alcohol dependence and depression have the same underlying physiological cause?