

CHAPTER 2

# Genetics and Evolution

## Multiple Choice Questions

1. What are electrochemical messengers that transmit information or impulses between nerve cells called?
  - a) Alleles
  - b) Neurons
  - c) Neurotransmitters
  - d) Hormones
  - e) Enzymes
2. Which statement below accurately describes human chromosomes?
  - a) Human cells typically contain 46 chromosomes.
  - b) Half of our chromosomes come from each one of our biological parents.
  - c) Chromosomes consist of a strand of DNA.
  - d) Chromosomes are arranged in pairs.
  - e) All of the above
3. Diana Fishbein's (2001) view that the people most at risk of offending are genetically loaded reflects the idea that no single gene is responsible for criminal behaviour, but rather the influence of genetics is which of the following?
  - a) Epigenetic
  - b) Dizygotic
  - c) Polygenic
  - d) Multigenic
  - e) Monogenic
4. Which of the following statements is true of monozygotic twins?
  - a) They develop from two zygotes that merge into a single zygote.
  - b) They may be the opposite sex of one another.
  - c) They possess exactly the same genetic material.
  - d) They are more commonly known as fraternal twins.
  - e) All of the above
5. Which term refers to the percentage of twins or paired individuals who match one another with respect to the presence of a specific characteristic?
  - a) Twinning rate
  - b) Matching rate
  - c) Zygoty rate
  - d) Agreement rate
  - e) Concordance rate
6. Most reviews of twin studies investigating the possibility of a genetic link to criminal

behaviour conclude which of the following?

- a) A genetic link does NOT exist because monozygotic twins generally exhibit higher concordance rates for criminal behaviour than dizygotic twins.
  - b) A genetic link does exist because monozygotic twins generally exhibit higher concordance rates for criminal behaviour than dizygotic twins.
  - c) A genetic link does NOT exist because dizygotic twins generally exhibit higher concordance rates for criminal behaviour than monozygotic twins.
  - d) A genetic link does exist because dizygotic twins generally exhibit higher concordance rates for criminal behaviour than monozygotic twins.
  - e) The evidence is unclear because monozygotic and dizygotic twins generally exhibit the same concordance rates for criminal behaviour.
7. The adoption study conducted by Mednick et al. (1984, 1987) found that criminal convictions were most common among adopted children with which of the following?
- a) A birth parent who was criminal
  - b) An adoptive parent who was criminal
  - c) Both a birth and an adoptive parent who was criminal
  - d) Neither a birth nor an adoptive parent who was criminal
  - e) None of the above
8. In the diathesis-stress model, a diathesis refers to which of the following?
- a) A pathological condition that develops as a result of too much stress
  - b) A genetic predisposition to develop a pathological condition
  - c) The environmental conditions responsible for triggering a pathological condition
  - d) The source or cause of stress in someone's life
  - e) None of the above
9. Of the following, who would be the most likely homicide victim as a result of family violence, according to evolutionary concepts like inclusive fitness?
- a) Brother
  - b) Grandparent
  - c) Parent
  - d) Spouse
  - e) Sister
10. Which term refers to a gene that comes in more than one form?
- a) Polygenic
  - b) Monogenic
  - c) Multigenic
  - d) Polymorphism
  - e) Digenic
11. Which of the following statements concerning adaptations is NOT true?
- a) Adaptations are shaped through the process of natural selection.
  - b) Adaptations are the result of conscious decisions by members of a species.
  - c) Adaptations may involve changes to a species' structure, physiology or psychology.

- d) Adaptations improve a species' ability to survive or reproduce.
  - e) An adaptation that is advantageous at one time period may be disadvantageous or maladaptive at another.
12. In the context of the so-called nature versus nurture debate over human behaviour, which of the following is an example of a possible influence that would be considered "nature"?
- a) Associating with antisocial peers
  - b) Carrying the low-activity MAOA allele
  - c) Maltreatment as a child
  - d) Living in a high-crime neighbourhood
  - e) None of the above
13. The differential-susceptibility model hypothesizes that people vary genetically with respect to which of the following?
- a) Their environmental sensitivity
  - b) Their physical fitness
  - c) Their personality traits
  - d) Their intelligence
  - e) Their interests
14. What is the model of gene–environment interactions that suggests the same individuals who will exhibit the greatest offending in "bad" environments will also exhibit the least offending in "good" environments?
- a) Alternative strategy
  - b) Frequency dependent
  - c) Diathesis-stress
  - d) Differential susceptibility
  - e) Environmental victimization
15. From the perspective of evolutionary psychology, what concept may account for the actions of individuals who help people who are genetically unrelated to themselves?
- a) Tit-for-tat fitness
  - b) Stranger-directed altruism
  - c) Reciprocal cooperation
  - d) Non-genetic altruism
  - e) Non-genetic cooperation
16. It is speculated that which process, which affects gene activity level without altering the genetic sequence, could be responsible for gene-environment interactions like the one Caspi et al. (2002) observed for MAOA?
- a) Multigenics
  - b) Polygenics
  - c) Polymorphisms
  - d) Monogenics
  - e) Epigenetics

17. Which evolutionary concept best explains the self-sacrificing behaviour of parents who rush into burning buildings to save their children?
- a) Natural selection
  - b) Inclusive fitness
  - c) Reciprocal cooperation
  - d) Intrasexual competition
  - e) Survival of the fittest
18. What is the specific set of conditions that existed at the time during which an adaptation emerged called?
- a) Period of natural selection
  - b) Evolutionary priming environment
  - c) Ancestral circumstances
  - d) Environment of evolutionary adaptiveness
  - e) Situation of susceptibility
19. Wiebe's (2012) remark that "if everyone cheated, soon nobody would cooperate," reflects the evolutionary view that cheating behaviour is which of the following?
- a) Low-ceiling strategy
  - b) Curvilinear strategy
  - c) Saturation-susceptible strategy
  - d) Proportionate strategy
  - e) Frequency-dependent strategy
20. According to the theory of Campbell (2002), women are less likely than men to engage in crime because they have an evolved psychological mechanism that causes them to do which of the following?
- a) Feel more empathy for victims
  - b) Feel more guilt when they violate their morals
  - c) Feel more fear over risky and dangerous actions
  - d) Consider their actions more carefully and act less impulsively
  - e) Both A and D
21. Fundamental to alternative strategy evolutionary theories of criminal behaviour is the idea that individuals exhibit gene-based differences in their traits, which are linked to which of the following?
- a) Reproductive strategy
  - b) Cooperative behaviour strategy
  - c) Food gathering strategy
  - d) Self-protection strategy
  - e) Food sharing strategy
22. According to some evolutionary psychologists, the traits that facilitate antisocial and criminal behaviour are associated with a reproductive strategy that emphasizes which of the following?
- a) Natural selection

- b) Parenting effort
  - c) Survival of the fittest
  - d) Mating effort
  - e) Cheating effort
23. According to the evolutionary psychology theory advanced by Kanazawa (2003), the shape of the age–crime curve for males reflects the rise and fall of which of the following?
- a) Child-rearing responsibilities
  - b) Participation in intrasexual competition
  - c) Need for resources (food, shelter, etc.)
  - d) Physical fitness and survival skills
  - e) Academic interests
24. According to the evolutionary psychology theory advanced by Kanazawa (2003), the decline in the age–crime curve for males occurs when men do which of the following?
- a) Secure employment and have reliable access to resources (e.g., food, shelter)
  - b) Become sexually active
  - c) Experience a substantial decline in their physical strength and abilities
  - d) Have their first child
  - e) Graduate from high school
25. Conditional adaptation evolutionary theories suggest the primary factor governing whether someone adopts a strategy involving antisocial or criminal behaviours is which of the following?
- a) The presence of certain gene-based personality traits
  - b) The age at which sexual activity is first initiated
  - c) The frequency of sexual activity
  - d) The number of offspring produced
  - e) The environmental conditions experienced
26. According to the evolutionary psychological theory advanced by Campbell (2002), the criminal behaviour of women is more likely than men to be motivated by the desire to do which of the following?
- a) Provide for their offspring
  - b) Enhance their personal status
  - c) Enhance their attractiveness to others
  - d) Enhance the status of their offspring
  - e) Have additional offspring
27. What is the main difficulty with drawing conclusions about the relationship of genetics and criminality on the basis of twin studies?
- a) Most twin studies were conducted in Scandinavian countries.
  - b) Dizygotic and monozygotic twins cannot be reliably distinguished.
  - c) The base rate of criminal behaviour is too low to reliably measure.
  - d) Monozygotic twins may be treated more similarly than dizygotic twins.
  - e) Most of the study results were politically driven.

28. What is monoamine oxidase A (MAOA)?
- A type of neurotransmitter
  - An enzyme that breaks down neurotransmitters
  - An allele
  - A rare genetic defect
  - The gene responsible for criminal behaviour
29. Which field studies how natural selection shaped and influenced mental processes and behaviours?
- Evolutionary psychology
  - Behavioural genetics
  - Epigenetics
  - Evolutionary physiology
  - Behavioural psychology
30. Meta-analyses pooling the results of twin and adoption studies to calculate the relative influence of heredity and the environment on antisocial and aggressive behaviour found which of the following?
- Heredity had little or no influence.
  - The environment had little or no influence.
  - Heredity and the environment were both influential but the effect of heredity was stronger.
  - Heredity and the environment were both influential but the effect of the environment was stronger.
  - Heredity and the environment were both equally influential.

### Short Answer Questions

1. Explain the difference between monozygotic and dizygotic twins in terms of their development and their shared genetic makeup. If a genetic influence exists, which type of twins should exhibit a higher concordance for criminal behaviour?
2. Draw a diagram of the  $2 \times 2$  research design used by Mednick et al. (1983, 1984) in their adoption study and label all the cells. Identify which group of participants (i.e., which cell) was associated with the highest level of criminal behaviour among the adoptees, which one was associated with the lowest level, and which two were associated with intermediate levels of criminal behaviour.
3. What did Diana Fishbein (2001) mean when she stated that individuals who are at risk of offending are genetically loaded?
4. Explain the nature versus nurture debate over human behaviour. What does it mean if there is an interaction between nature and nurture?
5. Why does Crawford (1998) describe altruistic acts that help genetic relatives as a “special

kind of selfishness”? Identify the evolutionary concept that applies to this type of behaviour.

6. Explain and distinguish parenting and mating effort reproductive strategies and identify which one is associated with traits likely to lead to criminal behaviour.
7. What limit exists on cheating behaviour that prevents it from becoming more widespread in the population? What is the term used to identify behavioural strategies that are limited in this manner?
8. Briefly outline Campbell’s (2002) evolutionary theory of “staying alive” and explain how it accounts for the gap between the amount of crime committed by men and women.

### Essay Questions

1. Describe the evolutionary psychology theory advanced by Kanazawa (2003) to explain the age–crime curve for males. As part of your answer, explain all relevant terms and concepts.
2. Describe the diathesis-stress and differential susceptibility models and explain how each one accounts for the interaction between genetics and the environment. As part of your answer explain all relevant terms and concepts.

# Answer Key

## Multiple Choice Questions

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|--------------------------|--------------------------|--------------------------|
| 1. <b>c</b> (p. 27)      | 11. <b>b</b> (pp. 34–35) | 21. <b>a</b> (pp. 38–39) |
| 2. <b>e</b> (pp. 21–22)  | 12. <b>b</b> (pp. 28–29) | 22. <b>d</b> (pp. 38–39) |
| 3. <b>c</b> (pp. 21, 28) | 13. <b>a</b> (pp. 32–33) | 23. <b>b</b> (pp. 43–44) |
| 4. <b>c</b> (p. 22)      | 14. <b>d</b> (pp. 32–33) | 24. <b>d</b> (pp. 43–44) |
| 5. <b>e</b> (p. 22)      | 15. <b>c</b> (p. 38)     | 25. <b>e</b> (pp. 39–40) |
| 6. <b>b</b> (pp. 22–24)  | 16. <b>e</b> (pp. 33–34) | 26. <b>a</b> (p. 42)     |
| 7. <b>c</b> (p. 26)      | 17. <b>b</b> (p. 36)     | 27. <b>d</b> (p. 24)     |
| 8. <b>b</b> (p. 30)      | 18. <b>d</b> (pp. 34–35) | 28. <b>b</b> (p. 27)     |
| 9. <b>d</b> (p. 36)      | 19. <b>e</b> (p. 41)     | 29. <b>a</b> (pp. 20–21) |
| 10. <b>d</b> (p. 28)     | 20. <b>c</b> (pp. 41–42) | 30. <b>d</b> (p. 29)     |

## Short Answer Questions

1. Monozygotic twins develop from a single egg and sperm from which one zygote that later divides; share 100% of their genetic material in common. Dizygotic twins develop from two eggs and two sperm which give rise to two separate zygotes; they share some, but not all of their genetic material in common. If a genetic influence exists, a higher concordance rate for criminal behaviour is expected for monozygotic twins. (p. 22)
2. See Figure 2.2 on p. 26 (p. 26)
3. The individuals at risk have multiple genes that collectively elevate their likelihood of offending; it ties in with the idea that any genetic influence on offending is probably polygenic in nature (p. 28)
4. The debate concerns whether the primary influence over human behaviour is biological factors such as genetic make-up (nature) or environmental factors, such as exposure to certain role models, ideas or experiences (nurture). If there is an interaction between nature and nurture it means the effects of one are made stronger or weaker depending on the state of the other. (pp. 28–30)
5. By acting altruistically in ways that help the survival of one's genetic relatives, an individual is increasing the chances of their own genetic material surviving and passing on to the next generation. (p. 36)
6. Mating effort: high investment of energy, time, and resources into reproducing, but little investment into raising and protecting one's offspring.  
Parenting effort: low investment of energy, time, and resources into reproducing, but high investment into raising and protecting one's offspring  
The traits associated with mating effort are likely to lead to criminal behaviour (pp. 38–39)
7. The more people who employ cheating behaviour, the less successful it is, and so the proportion of the population using this behavioural strategy never grows very big, i.e., the success of cheating behaviour is inversely related to its use within the population  
It is a frequency-dependent strategy. (pp. 40–41)
8. Campbell (2002) proposes that mothers are much more critical than men to the survival of their offspring (e.g., gestation, lactation, role as primary care-giver). The dependence of offspring on their mother and the importance of mother "staying alive" have led to the emergence of an adaptive psychological mechanism whereby women to experience fear at a lower threshold than men. The lower fear threshold causes women to avoid risky and



dangerous conduct such as violent and criminal conduct (pp. 42–43)

### Essay Questions

1.
  - Women make the largest parental investment so they are the “choosier” sex when it comes to selecting mates. Women have a preference for mates who have status, power, resource.
  - Males compete for female mates (intrasexual competition) so they try to make themselves attractive by acquiring these things women prefer. In an effort to acquire these things males sometimes resort to “extreme behaviours” such as theft to acquire resources or violence to acquire or protect resources, status and power.
  - Pre-puberty males are now sexually mature and so there is increasing intrasexual competition for females; they are much more likely to resort to criminalized behaviours; hence crime rates rise dramatically. Intrasexual competition (and therefore crime rates) remains high until the male’s first child is born. After the birth of the first child, benefits of intrasexual competition decrease as the male now has offspring and their genes will pass onto the next generation. There are also costs to continued intrasexual competition (e.g., injury, death) which could reduce the male’s ability to support/protect his offspring and ensure its survival. Due to this shift in the relative balance between the benefits and costs, males begin to withdraw from intrasexual competition following the birth of their first child, and so crime rates decline. (p. 39)
2. Diathesis-stress:
  - Assumes people vary genetically with respect to the presence of a diathesis
  - A diathesis is a genetic vulnerability or predisposition to develop a pathological condition which in this context is offending behaviour
  - The pathological condition (or offending behaviour) is only likely to emerge among people who are both genetically predisposed (possess the diathesis) AND who are exposed to certain stressful or negative environments
  - People who are genetically predisposed but manage to avoid negative environments do not offend
  - People without the genetic predisposition are not at risk of offending in either positive or negative environments

#### Differential-susceptibility:

- People vary genetically in their sensitivity (i.e., susceptibility) to environmental conditions so that some individuals are highly sensitive to their environment and others less sensitive
- Highly sensitive individuals attain the greatest benefits from positive environments and therefore exhibit the least offending in these conditions
- Highly sensitive individuals also experience the greatest harm in negative environments and therefore exhibit the least offending in these conditions
- Less sensitive individuals are not as affected by the environment regardless of whether it is positive or negative
- Consequently they exhibit more moderate levels of offending than highly sensitive individuals regardless of what type of environment they are in; they exhibit less offending in negative environments, but more offending in positive environments (pp.

30–33)