This exam consists of three components: 45 multiple choice questions (45 points), 5 definitions (10 points), and 6 short answer questions (25 points). Note that the definitions will only be taken from material after the second midterm. With the exception of the definitions the exam is cumulative, but there will be a somewhat greater weighting towards material covered since the last midterm. You will have two hours to complete the exam. Below are some sample questions.

Multiple Choice

1. Recombination events
   A. violate Mendel's first law of heredity
   B. violate Mendel's second law of heredity
   C. violate both Mendel's first and second laws of heredity
   D. violate rules of mitotic nondisjunction

2. None of the genes and signaling molecules in flies and mice found to be involved in learning and memory are specific to learning processes, but are involved in basic cell functions. This means
   A. one probably can not extrapolate these non-human animal studies to human learning and memory
   B. that only modern neuroimaging techniques are going to be capable of elucidating the genetics of learning and memory
   C. that because basic cellular function is very different for different species, it is going to be hard to make cross-species comparisons of the genes and signaling molecules.
   D. that learning and memory likely arises out of a complicated interacting networks of neuronal systems

3. Single base mutations
   A. may have no effect on an organisms
   B. may have a small effect on an organism
   C. may have a large effect on an organism
   D. all of the above

4. The proteome
   A. can only usefully be studied in conjunction with the phenome
   B. refers to the entire complement of proteins
   C. is what functional genomics is primarily interested in understanding
   D. is now most commonly studied using RNA microarrays

5. Endophenotypes are
   A) biomarkers of genetic liability
   B) genetically simpler than disease endpoints
   C) only used in non-human animal models
   D) two of the above

6. Nonshared environment
A. can not be measured in MZ twins
B. is essentially the same thing as the family environment
C. is not limited to measures of the family environment
D. is primarily important in the behavioural development of infants

7. Your textbook argues that broadly speaking with respect to personality, the decreasing order of effect/control on a trait is:
A) genes, unique environment, shared environment
B) unique environment, genes, shared environment
C) genes, shared environment, unique environment
D) unique environment, shared environment, genes

8. RNA microarrays
A. make use of SNPs
B. utilize microsatellites
C. monitor 1000s of genes simultaneously
D. monitor 100s of genes simultaneously

9. A knockout study of the mouse gene α-CaMKII that normally codes for a protein expressed in the hippocampus and forebrain found that mutant mice homozygous for the knockout gene
A. experienced general cognitive deficits
B. experienced short-term memory deficits
C. experienced deficits in spatial learning
D. experienced general memory deficits, but not spatial memory deficits

10. Finding that genes associated with an internalizing disorder will associate with other internalized disorders and genes associated with an externalizing disorder will be associated with other externalizing disorders suggests that the genetic effects in psychopathology
A) are broad, and like cognitive ability, controlled by "generalist genes"
B) are highly heritable, and like cognitive ability, controlled by a small number of genes
C) are narrow in their specific effects, and like cognitive ability, qualitative in nature
D) are broad, indicating that there should be no clinical distinctions between psychopathology types

11. Although schizophrenia runs in families, the particular subtype (catatonic, paranoid, disorganized) does not. This means that
A. if you have the genes, you will be schizophrenic
B. if you have the genes, you will be schizophrenic, but environmental factors will determine your subtype of schizophrenia
C. schizophrenia is not actually a single disorder
D. as a quantitative disorder, milder forms of schizophrenia will be more heritable because the abnormal is normal

12. Period and other genes comprise a core unit of the clock mechanism operating in parts of the suprachiasmatic nucleus (SCN); if the SCN is surgically ablated

A. this obliterates the normal sleep-wake cycle
B. this clock-shifts the normal sleep-wake cycle by about 4 hours
C. this causes non-human animal subjects to fall a "sleep-like" coma
D. the timeless gene, primarily found in the amygdala, takes over the clock mechanism function so that disruption is minimized

13. A Map Unit refers to

A. the relative distance between genes on a chromosome
B. the chromosomes that exchange parts during meiosis
C. the percentage of recombination
D. A and C

14. In terms of understanding the pathways between genes and behaviour, it is fairly safe to say that

A. we know more about the environment than the genes
B. we know more about the genes than the environment
C. the new field of molecular genetics is the best way to gain a full understanding of the gene/environment interactions in the pathways
D. QTL analysis has actually hindered the understanding of these pathways by suggesting so many separate gene contributions to basic behaviour processes

15. Findings from behavioural genetics suggest that the traditional Behaviorist approach that assumes that offspring resemble their parents because parents provide the family environment for their offspring, and that siblings resemble each other because they share that family environment is

A. mostly correct
B. correct for parent-offspring similarities, but not for similarities/differences between siblings
C. correct for MZ twin behavioural traits, but wrong for DZ twin behavioural traits
D. wrong for many behavioural traits

16. Single-locus polymorphisms can account for

A. much of the heritable component of obesity
B. the regulatory mechanisms of fat storage in the body
C. relatively few of the cases of obesity in the population
D. ghrelin's role in appetite control

17. Some have argued that environmental influences that affect behavioural development operate on a family-by-family basis. However, it is probably better to view environmental influences as operating on an individual-by-individual basis. This means

A. environmental effects are going to be relatively specific to each child, rather than general for all children in a family

B. the concept of shared environment is antiquated and should be eliminated from behavioural genetics

C. that family experiences are unimportant in child development

D. that two children growing up in the same family will be more alike than children growing up in different families

18. Passive genotype-environment correlations involve interactions between _____ and are typically most significant in _____ because they have _____ to modify their environment.

A. genetic relatives, adolescents, increasing ability

B. genetic relatives, children, limited ability

C. anyone or anything, adults, high ability

D. anyone or anything, children, no ability

E. non relatives, children, low capacity

19. Former U.S. Supreme Court Justice Oliver Wendell Holmes statement that, "those wishing long lives should advertise for a couple of parents, both belonging to long-lived families," is _____ by behavioural genetics research.

A. not supported

B. only modestly supported

C. strongly supported

D. only supported for people of Scandinavian ancestry

20. Behavioural genetics work on alcoholism is interesting because it is one of the

A. few behaviours that people falling within the autism spectrum disorder continuum do not seem to be susceptible to

B. few behaviours that is almost entirely under heritable control

C. few types of addiction for which earlier onset is actually less heritable than late onset

D. few behaviours showing evidence for shared environment that is shared by siblings but not by parents and offspring

21. Most tests of personality use _____ and _____ the role of shared environment.

A. peer reports, support

B. peer reports, discount

C. self-reports, support

D. self reports, discount

22. _____ accounts for at least 50% of all types of dementia.
A. Alzheimer's Disease
B. Multiple Infarct Dementia
C. Down's syndrome
D. Fragile X

23. The American Psychological Association doesn't yet have a policy on "at-home" genetic tests that are available to the public (there are currently over 1000 such tests). As we've discussed, a significant problem with these sorts of tests is that
A. the tests can be easily contaminated when used in a home environment, compromising the results and giving false positives.
B. the for-profit motivation of these tests suggests that companies will be giving false-positive returns to increase treatment business
C. interpreting medical genetics findings is a highly complicated and specialized field, which a patient's general family physician may not be equipped to deal with
D. all of the above

24. Relatives of unipolar depressives are not at increased risk for developing bipolar depression, but relatives of bipolar depression are at a 14% risk of developing unipolar depression (compared to 1% of controls). An implication of this finding is
A. shared environmental effects are actually much higher in depression than implied by behavioural genetics
B. current diagnostic criteria are accurate in their assessment
C. heritability is going to be higher for second-degree relatives than would be predicted
D. unipolar depression may be a subset of bipolar depression, not a separate modd disorder in and of itself

25. The "five-factor" model of personality assesses individuals for
A. outgoing behaviour, conscientiousness, egalitarianism, agreeableness, neuroticism
B. openness to experience, condescension, extraversion, awareness, narcissism
C. openness to experience, conscientiousness, extraversion, agreeableness, neuroticism
D. outspokenness, conservatism, extraversion, agreeableness, narcissism

Definitions

1. Ghrelin

2. Neurome

3. Evocative genotype-environment correlation

Short Answer

1. How is the concept of the extended phenotype relevant to the study of gene and environment effects? (2 points)

2. Differences within pairs of identical twins provide a conservative estimate of nonshared environments, because twins often share special environments that increase their resemblance but do not contribute to similarity among "normal" siblings. Here are some correlations for general cognitive ability and different sibling groups:

	Correlation
MZ twins	0.85
DZ twins	0.6
Nontwin siblings	0.4

Showing your calculations, determine the conservative estimate of nonshared environment. Then, again showing your work, calculate the special shared twin environment, and determine what a non-conservative estimate for the role of nonshared environment would be in general cognitive ability. (3 points)

3. Starting in the womb and continuing through adolescence, testosterone and estrogen play a leading role in brain development and, later on, in mood. Testosterone and estrogen have different effects on the brain's neurotransmitters, particularly in the hypothalamus and amygdala, both involved in emotional processing. At various points in an individual's lifetime genes are activated or suppressed with respect to the production of the sex hormones. During early development, testosterone and estrogen have the opposite effect on the neurotransmitter GABA: testosterone stimulates GABA transmission but estrogen inhibits it. In general terms, excess GABA can lead to seizures in infants and toddlers. Thus, estrogen's dampening effect on GABA is likely protective

in girls; boys are twice as likely to experience seizures and show a greater chance of developing depression during early childhood. However, during puberty the gender balance shifts, with girls becoming two to three times as likely as boys to experience depression, because girls' surging levels of estrogen boost cortisol, the stress hormone, and can reduce serotonin levels. Recent work by Dr. Tracy Bale and colleagues at the University of Pennsylvania suggests that testosterone levels in adolescent boys may now shield them from depression. Thus, young boys are more likely to experience depression than young girls, but adolescent girls are more likely to experience depression than adolescent boys. So, here's the question: with respect to studying the gene-to-hormone-to-behaviour pathways in personality disorders such as depression, what factors does this information imply that researchers need to pay particular attention to? (3 points)

ANSWERS

Multiple Choice

1. B 2. D 3. D 4. B 5. A 6. C 7. B 8. C 9. C 10. A 11. C 12. A 13. D 14. B 15. D 16. C 17. A 18. B 19. B 20. D 21. D 22. A 23. C 24. D 25. C

Definitions

1. Produced by stomach; modulates short-term appetite (hunger drive when stomach empty; satiation when stomach full).
2. Level of analysis taking place at the level of the brain, including neurons, neuronal interactions (e.g., synapses), neurotransmitters, etc.
3. Correlation found between anyone reacting to an individual due to that individual's genetic predispositions; when an individual, due to genotype, evokes reactions from others.

Short Answers

1. Should be some discussion of how an individuals will modify their own environment and that how this modification occurs is going to be, at least in part, due to their own genotypes. Estimates put the role of the genome on nonshared environment at about 25%, so we may need to re-evaluate the idea that variance due to heredity and environment can be neatly separated.

2. Conservative estimate of nonshared environment, using MZ data, is 1.0 – 0.85 = 0.15
Special shared twin environment: take DZ value of 0.6 and subtract nontwin sibling value of 0.4, for a value of 0.2.
Thus, a non-conservative estimate for the role of nonshared environment is 1.0 – 0.85 – 0.2 = 0.35.

3. There are a variety of issues, but broadly speaking this implies that one should not assume personality disorders are going to be the same for both sexes, that there may be different underlying causal factors for the same personality disorders in the different sexes, that the actual behavioural characteristics of a disorder may differ between the sexes due to the different underlying root causal factors, and that it is not just what hormones a body expresses that is important, but when the hormones are expressed that may be very important (any three of these four points would give fill marks).