Chapter 2. An Overview of Genetic Assessment

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. The first step in the genomic assessment of a patient is obtaining information regarding:
A. Family history
B. Environmental exposures
C. Lifestyle and behaviors
D. Current medications

____ 2. An affected individual who manifests symptoms of a particular condition through whom a family with a genetic disorder is ascertained is called a(n):
A. Consultand
B. Consulband
C. Index patient
D. Proband

____ 3. An autosomal dominant disorder involves the:
A. X chromosome
B. Y chromosome
C. Mitochondrial DNA
D. Non-sex chromosomes

____ 4. To illustrate a union between two second cousin family members in a pedigree, draw:
A. Arrows pointing to the male and female
B. Brackets around the male and female
C. Double horizontal lines between the male and female
D. Circles around the male and female

____ 5. To illustrate two family members in an adoptive relationship in a pedigree:
A. Arrows are drawn pointing to the male and female
B. Brackets are drawn around the male and female
C. Double horizontal lines are drawn between the male and female
D. Circles are drawn around the male and female

____ 6. When analyzing the pedigree for autosomal dominant disorders, it is common to see:
A. Several generations of affected members
B. Many consanguineous relationships
C. More members of the maternal lineage affected than paternal
D. More members of the paternal lineage affected than maternal

____ 7. In autosomal recessive (AR) disorders, individuals need:
A. Only one mutated gene on the sex chromosomes to acquire the disease
B. Only one mutated gene to acquire the disease
C. Two mutated genes to acquire the disease
D. Two mutated genes to become carriers

____ 8. In autosomal recessive disorders, carriers have:
A. Two mutated genes; one from each parent that cause disease
B. A mutation on a sex chromosome that causes a disease
C. A single gene mutation that causes the disease
D. One copy of a gene mutation but not the disease

____ 9. With an autosomal recessive disorder, it is important that parents understand that if they both carry a mutation, the following are the risks to each of their offspring (each pregnancy):
A. 50% chance that offspring will carry the disease
B. 10% chance of offspring affected by disease
C. 25% chance children will carry the disease
D. 10% chance children will be disease free

____ 10. A woman with an X-linked dominant disorder will:
A. Not be affected by the disorder herself
B. Transmit the disorder to 50 % of her offspring (male or female)
C. Not transmit the disorder to her daughters
D. Transmit the disorder to only her daughters

____ 11. In creating your female patient's pedigree, you note that she and both of her sisters were affected by the same genetic disorder. Although neither of her parents had indications of the disorder, her paternal grandmother and her paternal grandmother's two sisters were affected by the same condition. This pattern suggests:
A. Autosomal dominant disorder
B. Chromosomal disorder
C. Mitochondrial DNA disorder
D. X-linked dominant disorder

____ 12. A woman affected with an X-linked recessive disorder:
A. Has one X chromosome affected by the mutation
B. Will transmit the disorder to all of her children
C. Will transmit the disorder to all of her sons
D. Will not transmit the mutation to any of her daughters

____ 13. Which of the following are found in an individual with aneuploidy?
A. An abnormal number of chromosomes
B. An X-linked disorder
C. Select cells containing abnormal-appearing chromosomes
D. An autosomal recessive disorder

____ 14. The pedigree of a family with a mitochondrial DNA disorder is unique in that:
A. None of the female offspring will have the disease
B. All offspring from an affected female will have disease
C. None of the offspring of an affected female will have the disease
D. All the offspring from an affected male will have disease

____ 15. Which population is at highest risk for the occurrence of aneuploidy in offspring?
A. Mothers younger than 18
B. Fathers younger than 18

C. Mothers over age 35
D. Fathers over age 35

____ 16. Approximately what percentage of cancers is due to a single-gene mutation?
A. 50% to 70%
B. 30% to 40%
C. 20% to 25%
D. 5% to 10%

____ 17. According to the Genetic Information Nondiscrimination Act (GINA):
A. NPs should keep all genetic information of patients confidential
B. NPs must obtain informed consent prior to genetic testing of all patients
C. Employers cannot inquire about an employee's genetic information
D. All of the above

____ 18. The leading causes of death in the United States are due to:
A. Multifactorial inheritance
B. Single gene mutations
C. X-linked disorders
D. Aneuploidy

____ 19. Which of the following would be considered a "red flag" that requires more investigation in a patient assessment?
A. Colon cancer in family member at age 70
B. Breast cancer in family member at age 75
C. Myocardial infarction in family member at age 35
D. All of the above

____ 20. When patients express variable forms of the same hereditary disorder, this is due to:
A. Penetrance
B. Aneuploidy
C. De novo mutation
D. Sporadic inheritance

____ 21. Your 2-year-old patient shows facial features, such as epicanthal folds, up-slanted palpebral fissures, single transverse palmar crease, and a low nasal bridge. These are referred to as:
A. Variable expressivity related to inherited disease
B. Dysmorphic features related to genetic disease
C. De novo mutations of genetic disease
D. Different penetrant signs of genetic disease

____ 22. In order to provide a comprehensive genetic history of a patient, the NP should:
A. Ask patients to complete a family history worksheet
B. Seek out pathology reports related to the patient's disorder
C. Interview family members regarding genetic disorders
D. All of the above

Chapter 2. An Overview of Genetic Assessment
Answer Section

MULTIPLE CHOICE

1. ANS: A
   A critical first step in genomic assessment, including assessment of risk, is the use of family history. Family history is considered the first genetic screen (Berry & Shooner 2004) and is a critical component of care because it reflects shared genetic susceptibilities, shared environment, and common behaviors (Yoon, Scheuner, & Khoury 2003).

   PTS: 1
2. ANS: D
   A proband is defined as the affected individual who manifests symptoms of a particular condition through whom a family with a genetic disorder is ascertained (Pagon et al. 1993–2013). The proband is the affected individual that brings the family to medical attention.

   PTS: 1
3. ANS: D
   Autosomal dominant (AD) inheritance is a result of a gene mutation in one of the 22 autosomes.

   PTS: 1
4. ANS: C
   A consanguineous family is related by descent from a common ancestry and is defined as a "union between two individuals who are related as second cousins or closer" (Hamamy 2012). Consanguinity, if present in the family history, is portrayed using two horizontal lines to establish the relationship between the male and female partners.

   PTS: 1
5. ANS: B
   For adopted members of the family, use brackets as the appropriate standardized pedigree symbol ([e.g., brackets]).

   PTS: 1
6. ANS: A
   Pedigrees associated with autosomal dominant (AD) disorders typically reveal multiple affected family members with the disease or syndrome. When analyzing the pedigree for AD disorders or syndromes, it is common to see a "vertical" pattern denoting several generations of affected members.

   PTS: 1
7. ANS: C

In autosomal recessive (AR) disorders, the offspring inherits the condition by receiving one copy of the gene mutation from each of the parents. Autosomal recessive disorders must be inherited through both parents (Nussbaum et al. 2007). Individuals who have an AR disorder have two mutated genes, one on each locus of the chromosome. Parents of an affected person are called carriers because each carries one copy of the mutation on one chromosome and a normal gene on the other chromosome. Carriers typically are not affected by the disease.

PTS: 1

8. ANS: D
Individuals who have an AR disorder have two mutated genes, one on each allele of the chromosome. Parents of an affected person are called carriers because each parent carries one copy of the mutation on one chromosome and a normal gene on the other chromosome. Carriers typically are not affected by the disease. In pedigrees with an AR inheritance patterns, males and females will be equally affected because the gene mutation is on an autosome.

PTS: 1

9. ANS: A
It is important that parents understand that if they both carry a mutation, the risk to each of their offspring (each pregnancy) is an independent event: 25% disease free, 25% affected, and 50% carrier.

PTS: 1

10. ANS: B
Everyone born with an X-linked dominant disorder will be affected with the disease. Transmission of the disorder to the next generation varies by gender, however. A woman will transmit the mutation to 50% of all her offspring (male or female).

PTS: 1

11. ANS: D
A man with an X-linked dominant disorder will transmit the mutation to 100% of his daughters (they receive his X chromosome) and none of his sons (they receive his Y chromosome). The pedigree of a family with an X-linked dominant disorder would reveal all the daughters and none of the sons affected with the disorder if the father has an X-linked disorder.

PTS: 1

12. ANS: C
An X-linked recessive disorder means that in a woman, both X chromosomes must have the mutation if she is to be affected. Because males have only one copy of the X chromosome, they will be affected if their X chromosome carries the mutation.

PTS: 1

13. ANS: A
An individual with an abnormal number of chromosomes has a condition called aneuploidy, which is frequently associated with mental problems or physical problems or both (Jorde, Carey, & Bamshad 2010; Nussbaum et al. 2007).

PTS: 1

14. ANS: B
Mitochondrial DNA is inherited from the ovum and, therefore, from the mother. The pedigree of a family with a mitochondrial DNA disorder is unique in that all offspring (regardless of gender) of an affected female will have the disease, and none of the offspring from an affected male will have the disease.

PTS: 1

15. ANS: C
Some individuals or couples have unique identifiable risks that should be discussed prior to conception whenever possible. For example, women who will be 35 years of age or older at delivery (advanced maternal age) are at increased risk for aneuploidy.

PTS: 1

16. ANS: D
The majority of cancers are sporadic or multifactorial due to a combination of genetic and environmental factors; however, approximately 5% to 10% of all cancers are due to a single-gene mutation (Garber & Offit 2005).

PTS: 1

17. ANS: D
On May 21, 2008, President George W. Bush signed the Genetic Information Nondiscrimination Act (GINA) to protect Americans against discrimination based upon their genetic information when it comes to health insurance and employment, paving the way for patient personalized genetic medicine without fear of discrimination (National Human Genome Research Institute 2012).

PTS: 1

18. ANS: A
Most disease-causing conditions are not due to a single-gene disorder but are due to multifactorial inheritance, a result of genomics and environmental or behavioral influences. In fact, the leading causes of mortality in the United States—heart disease, cerebrovascular disease, diabetes, and cancer—are all multifactorial. Most congenital malformation, hypertension, arthritis, asthma, obesity, epilepsy, Alzheimer's, and mental health disorders are also multifactorial.

PTS: 1

19. ANS: C
Early onset cancer syndromes, heart disease, or dementia are red flags that warrant further investigation regarding hereditary disorders.

PTS: 1

20. ANS: A

Some disorders have a range of expression from mild to severe. This variability is referred to as the penetrance of genetic disease. For example, patients with neurofibromatosis (NF1), an AD disorder of the nervous system, may manifest with many forms of the disease. For instance, some patients with NF1 may have mild symptoms, like café-au-lait spots or freckling on the axillary or skin, while others may have life-threatening spinal cord tumors or malignancy (Jorde, Carey, & Bamshad 2010; Nussbaum et al. 2007).

PTS: 1

21. ANS: B
Assessing for dysmorphic features may enable identification of certain syndromes or genetic or chromosomal disorders (Jorde, Carey, & Bamshad 2010; Prichard & Korf 2008). Dysmorphology is defined as "the study of abnormal physical development" (Jorde, Carey, & Bamshad 2010, 302).

PTS: 1

22. ANS: D
Asking the patient to complete a family history worksheet prior to the appointment saves time in the visit while offering the patient an opportunity to contribute to the collection of an accurate family history. Reviewing the family information can also help establish family rapport while verifying medical conditions in individual family members. If a hereditary condition is being considered but family medical information is unclear or unknown, requesting medical records and pathology or autopsy reports may be warranted.

PTS: 1