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Evolution: Selection, Drift, and Speciation

Exam — Natural Selection

Comprehensive Pre-med style evolution questions on terminology, natural selection, genetic drift, speciation, and sources of variation

40 items — Printable Exam

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1 **In modern biology, which definition best describes evolution at the population level?**

A Change in an individual's traits during its lifetime

B Change in the number of individuals in a population over time

C Change in allele frequencies in a population across generations

D Development of new organs in response to environmental demands

E Any change in the DNA of a single individual

2 **What is the gene pool of a population?**

A All the genes present in a single individual

B All the phenotypes that appear in a population

C The total collection of different species that live in a habitat

D The total set of all alleles at all loci in all individuals of a population

E The subset of alleles that are dominant in a population

3 **Which statement correctly distinguishes microevolution from macroevolution?**

A Microevolution involves changes in single genes, macroevolution involves changes in non-genetic traits only

B Microevolution occurs in prokaryotes, macroevolution occurs only in eukaryotes

C Microevolution refers to changes in allele frequencies within populations; macroevolution refers to larger-scale patterns such as speciation and extinction

D Microevolution occurs by mutation, macroevolution occurs by natural selection

E Microevolution is random, macroevolution is directed

4 **Which statement best describes natural selection?**

A Random changes in allele frequencies due to chance events

B Non-random differential survival and reproduction of individuals with different heritable traits

C The ability of individuals to change their traits in response to need

D The deliberate breeding of organisms by humans

E Random mating between all individuals in a population

5 **In evolutionary biology, fitness is best defined as:**

A The physical strength and health of an individual

B The ability of an individual to survive relative to others, regardless of reproduction

C The contribution an individual makes to the gene pool of the next generation relative to others

D The total number of genes an individual carries

E The genetic similarity between parents and offspring

6 **Which process is the ultimate source of NEW alleles in a population?**

A Natural selection

B Genetic drift

C Gene flow

D Mutation

E Non-random mating

7 **Which of the following is a RANDOM evolutionary process?**

A Natural selection favouring a particular phenotype

B Non-random mating where females choose certain males

C Genetic drift changing allele frequencies after a storm randomly kills individuals

D Directionally increased survival of antibiotic-resistant bacteria

E Artifical selection by breeders

8 **Which scenario is the BEST example of genetic drift?**

A Predators preferentially catch slower animals, reducing frequency of slow-running alleles

B A drought favours plants with deeper roots that access water more effectively

C A hurricane randomly kills most individuals in a population, leaving survivors that are not genetically representative of the original population

D Farmers repeatedly breed cows that produce more milk

E Females prefer males with bright plumage, increasing those alleles

9 **In which situation is genetic drift expected to have the STRONGEST effect on allele frequencies?**

A A very large population (millions of individuals)

B A small isolated population founded by a few individuals

C A population experiencing strong directional selection

D A population with extremely high mutation rates

E A population with strictly random mating

10 **The founder effect is best described as:**

A Increased mutation rate in the founding generation

B A few individuals establishing a new population whose allele frequencies differ from the original population by chance

C Selection for traits that improve colonisation ability

D Introduction of new alleles to a population by migration

E The first appearance of a new allele by mutation

11 **The bottleneck effect occurs when:**

A A population size sharply increases, reducing genetic variation

B A large population is dramatically reduced in size, and the surviving gene pool is unrepresentative of the original population

C Selection strongly favours individuals at both extremes of a trait

D Mutations occur at a single locus

E Gene flow is blocked between populations

12 **Which is the best example of gene flow?**

A Random changes in allele frequencies in a small isolated population

B Individuals migrating into a population and successfully breeding with residents

C Mutations introducing new alleles within a population

D Natural selection eliminating maladaptive alleles within a population

E Random mating within a population

13 Which combination correctly matches evolutionary processes with RANDOM vs NON-RANDOM effects on allele frequencies?

A Mutation (non-random), natural selection (random)

B Genetic drift (random), natural selection (non-random)

C Gene flow (random), genetic drift (non-random)

D Mutation (non-random), genetic drift (non-random)

E Natural selection (random), non-random mating (random)

14 Which form of natural selection tends to reduce variation by favouring intermediate phenotypes and selecting against extremes?

A Directional selection

B Disruptive selection

C Stabilising selection

D Balancing selection

E Frequency-dependent selection

15 **In a population of birds, only those with the longest beaks can access a new food source, and they leave significantly more offspring. Over time, the average beak length increases. Which type of selection is this?**

A Stabilising selection

B Directional selection

C Disruptive selection

D Balancing selection

E Artificial selection

16 **A population of fish lives in a lake with two distinct habitats: dark, vegetated areas and bright, sandy areas. Very light and very dark colour morphs are well camouflaged and survive better, while intermediate-colour fish suffer higher predation. Which type of selection is occurring?**

A Directional selection

B Stabilising selection

C Disruptive selection

D Sexual selection

E Purifying selection

17 **What is an adaptation in evolutionary terms?**

A Any trait that appeared recently in a lineage

B A heritable trait that increases an individual's fitness in a specific environment

C Any behavioural response to the environment, whether inherited or learned

D A trait that arose only by genetic drift

E A trait that an individual acquires during its lifetime through use and disuse

18 Which situation best illustrates sexual selection rather than natural selection in general?

A Brightly coloured males have reduced survival but attract far more mates

B Individuals with thicker fur survive better in cold climates

C Individuals with better camouflage are less likely to be eaten

D Random storms kill individuals regardless of their traits

E Humans breed dogs with certain temperaments

19 Kin selection explains the evolution of behaviours that:

A Benefit unrelated members of the population equally

B Increase an individual's own survival but never its reproduction

C Reduce an individual's direct fitness but increase the reproductive success of relatives sharing its genes

D Only occur in species with no parental care

E Are entirely random in occurrence

20 Which statement best describes a species according to the biological species concept?

A A group of organisms that look identical

B A group of populations whose members can interbreed in nature and produce viable, fertile offspring

C A group of organisms that occupy the same habitat

D A group of organisms that share a recent common ancestor

E A group of organisms with identical DNA sequences

21 Which of the following is a PREZYGOTIC reproductive barrier?

A Hybrid embryos die before birth

B Hybrid offspring are sterile

C Two species of frog breed in the same pond but at different times of year

D Hybrid offspring have reduced viability in later generations

E Hybrid males are fertile but hybrid females are sterile

22 Hybrid sterility (e.g. mules produced by horses and donkeys are sterile) is an example of:

A Prezygotic barrier

B Postzygotic barrier

C Temporal isolation

D Behavioural isolation

E Mechanical isolation

23 **Allopatric speciation typically occurs when:**

A A population becomes reproductively isolated without any geographic separation

B Two species hybridise and immediately form a fertile polyploid species

C A population is geographically divided, and gene flow between the isolated groups ceases

D Different phenotypes within the same habitat mate non-randomly

E Mutations are completely absent in a population

24 **Which scenario best illustrates sympatric speciation?**

A A river changes course and splits a population of rodents into two isolated groups

B A small group of birds colonises a distant island and diverges from the mainland population

C Within the same lake, a subgroup of fish begins feeding in deeper water and only mates with others using that depth

D A new mountain range forms, separating a plant population into east and west groups

E Two closely related species occasionally interbreed to produce hybrids

25 **In plants, an instantaneous mechanism of sympatric speciation is often:**

A Genetic drift in a small isolated population

B The appearance of a new mutation in one individual

C Polyploidy that creates reproductive isolation from the parent population

D Gradual accumulation of small morphological changes

E Geographical isolation by mountain formation

26 **Which term describes the evolution of many diverse species from a common ancestral species when new ecological opportunities become available, such as on an archipelago?**

A Convergent evolution

B Adaptive radiation

C Genetic drift

D Stabilising selection

E Hybrid breakdown

27 **Homologous structures in different species are those that:**

A Have similar function but different evolutionary origin

B Have different function but share a common evolutionary origin

C Have identical function and identical DNA sequences

D Always arise by convergent evolution

E Are present in only one species

28 **Analogous structures in different species are those that:**

A Have similar function and are inherited from a common ancestor

B Have similar function but evolved independently in different lineages

C Have different function but identical DNA sequences

D Are always caused by genetic drift

E Can only be found in closely related species

29 **Which statement about natural selection and genetic drift is correct?**

A Both natural selection and drift always increase adaptation to the environment

B Natural selection is random with respect to fitness; drift is not

C Genetic drift can fix harmful alleles in small populations; natural selection tends to remove them

D Only genetic drift can change allele frequencies; selection cannot

E Natural selection always increases genetic variation

30 **Which of the following is NOT an assumption of Hardy–Weinberg equilibrium?**

A No mutation

B Random mating

C No natural selection

D Small population size

E No migration (gene flow)

31 **In a large population, an allele is selectively neutral. Which statement is most accurate about its likely evolutionary fate?**

A Its frequency will never change because it is neutral

B It will steadily increase in frequency because no selection acts against it

C Its frequency will change over time mainly due to genetic drift

D It will be removed immediately by natural selection

E It will immediately fix at frequency 1

32 **A cline is best described as:**

A A ring-shaped set of populations where neighbouring populations interbreed, but end populations do not

B A gradual change in a trait or allele frequency along a geographic gradient

C The sudden appearance of a new species in the fossil record

D A small, isolated population with low genetic variation

E A pair of species that occupy identical niches

33 **Which statement about evolution is CORRECT?**

A Individual organisms evolve during their lifetime

B Evolution always leads to more complex organisms

C Evolution has no specific goal; it is the outcome of processes such as mutation, selection, drift, and gene flow

D Evolution proceeds only when environmental conditions are stable

E Natural selection always produces perfectly adapted organisms

34 **The main reason antibiotics become less effective over time against bacterial populations is that:**

A Bacteria mutate in response to the presence of antibiotics because they need resistance

B Natural selection increases the frequency of pre-existing resistant mutants when antibiotics are applied

C Antibiotics induce new beneficial mutations at a very high rate

D Bacteria stop reproducing in the presence of antibiotics

E Antibiotics cause genetic drift to favour resistance

35 Which is the BEST example of a non-random event in evolution?

A A lightning strike kills a random subset of a population

B A flood randomly washes away individuals from a valley

C Predators more often catch slower prey, allowing faster individuals to contribute disproportionately to the next generation

D A meteor impact randomly kills many individuals

E Random assortment of chromosomes at meiosis I

36 In a ring species, such as some salamander or gull species, populations are distributed geographically in a ring around a barrier. Typically, neighbouring populations can interbreed, but the terminal populations where the ring meets cannot. What does this illustrate about speciation?

A Speciation can be a clear, instantaneous event with no intermediates

B Species boundaries can be gradual, and the biological species concept can be difficult to apply

C Hybridisation cannot occur between closely related forms

D Allopatric speciation cannot occur in nature

E Natural selection does not operate when gene flow exists

37 **Balanced polymorphism (maintenance of multiple alleles at a locus) can be promoted by which of the following mechanisms?**

A Strong directional selection favouring a single homozygote

B Heterozygote advantage, where heterozygotes have higher fitness than either homozygote

C Very strong genetic drift in a tiny population

D Complete dominance of one allele with no fitness differences

E Lethality of both heterozygotes and one homozygote

38 **Frequency-dependent selection occurs when:**

A The fitness of a phenotype depends on how common or rare it is in the population

B The fitness of a phenotype is independent of its frequency

C Allele frequencies fluctuate randomly due to chance

D Mutations occur more often in frequent alleles than rare ones

E Only rare phenotypes can survive

39 **Which statement correctly relates natural selection and mutation?**

A Natural selection generates new mutations when they are needed

B Mutations occur randomly with respect to fitness; natural selection then increases or decreases their frequencies

C Natural selection prevents all harmful mutations from occurring

D Mutations always increase fitness and are therefore selected for

E Natural selection and mutation are identical processes

40 **In general, natural selection is MOST efficient and powerful when:**

A Population size is very small and genetic drift is strong

B Population size is large and there is heritable variation affecting fitness

C There is no heritable variation in fitness-related traits

D The environment is completely constant and mutation rate is zero

E Individuals can direct their mutations according to need

#	Ans	Answer Text
1	C	Change in allele frequencies in a population across generations
2	D	The total set of all alleles at all loci in all individuals of a populat...
3	C	Microevolution refers to changes in allele frequencies within population...
4	B	Non-random differential survival and reproduction of individuals with di...
5	C	The contribution an individual makes to the gene pool of the next genera...
6	D	Mutation
7	C	Genetic drift changing allele frequencies after a storm randomly kills i...
8	C	A hurricane randomly kills most individuals in a population, leaving sur...
9	B	A small isolated population founded by a few individuals
10	B	A few individuals establishing a new population whose allele frequencies...
11	B	A large population is dramatically reduced in size, and the surviving ge...
12	B	Individuals migrating into a population and successfully breeding with r...
13	B	Genetic drift (random), natural selection (non-random)
14	C	Stabilising selection
15	B	Directional selection
16	C	Disruptive selection
17	B	A heritable trait that increases an individual's fitness in a specific e...
18	A	Brightly coloured males have reduced survival but attract far more mates
19	C	Reduce an individual's direct fitness but increase the reproductive succ...
20	B	A group of populations whose members can interbreed in nature and produc...
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26	B	Adaptive radiation
27	B	Have different function but share a common evolutionary origin
28	B	Have similar function but evolved independently in different lineages
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