

CAPITOLO 1

VERIFICA LE TUE CONOSCENZE

- 1 A
- 2 A
- 3 B
- 4 D
- 5 B
- 6 A
- 7 A
- 8 D
- 9 D
- 10 D
- 11 A
- 12 C

VERIFICA LE TUE ABILITÀ

- 13 A prima, B alleli, C segregazione
- 14 A mutazioni, B selvatico, C polimorfico
- 15 A autosomi, B ZZ, C femminile, D maschile
- 16 B D
- 17 B D
- 18 C D

METTITI ALLA PROVA

- 33 B
- 34 A
- 35 A
- 36 D
- 40 A
- 41 E
- 42 E
- 43 A
- 44 D
- 45 D
- 46 D
- 47 D
- 48 B

The wisdom of the rabbis

- Why the rabbis faced a dilemma?

A mother brought her 8-day-old son to the rabbi for ritual penile circumcision. The rabbi knew that the woman's two previous sons had bled to death when their foreskins were cut.

- How did he solve it?

Without any knowledge of our modern concepts of genes and genetics, the rabbis had linked a human disease (which we now know as hemophilia A) to a pattern of inheritance (which we know as sex linkage). Only in the past few decades have the precise biochemical nature of hemophilia A and its genetic determination been worked out.

CAPITOLO 2

VERIFICA LE TUE CONOSCENZE

- 1 C
- 2 D
- 3 C
- 4 D
- 5 B
- 6 A
- 7 B
- 8 C
- 9 B
- 10 B
- 11 B
- 12 D
- 13 A
- 14 B

VERIFICA LE TUE ABILITÀ

- 15 A cristallografia, B appaiamento, C tridimensionali
- 16 A guanina, B idrogeno, C dieci, D antiparallele
- 17 A complesso, B ori, C forcelle, D eliche
- 18 A B
- 19 A D
- 20 A C

METTITI ALLA PROVA

- 32 A
- 33 C
- 34 C
- 35 B
- 40 C
- 41 B
- 42 C
- 43 A
- 44 C
- 45 B
- 46 E
- 47 D
- 48 D

A structure for our times

- What happens in Michael Crichton's novel *Jurassic Park*?

In the story, the scientists isolated the DNA of dinosaurs from fossilized insects that had sucked the reptiles' blood. The insects, which had been preserved intact in amber (fossilized tree resin), yielded DNA that could be used to produce living individuals of long-extinct organisms such as *Tyrannosaurus rex*.

- Why does DNA's structure stir our society? It is what that structure symbolizes, which is nothing

less than the promise and perils of our rapidly expanding knowledge of genetics.

CAPITOLO 3

VERIFICA LE TUE CONOSCENZE

- 1 D
- 2 B
- 3 C
- 4 D
- 5 D
- 6 A
- 7 B
- 8 A
- 9 B
- 10 D
- 11 D
- 12 A
- 13 C

VERIFICA LE TUE ABILITÀ

- 14 A promotore, B sito, C 3'—5', D primario
- 15 A amminoacil tRNA sintetasi, B anticodone, C allungamento, D stop
- 16 A puntiformi, B frameshift, C silenti, D cromosomiche
- 17 B D
- 18 A D
- 19 B D

METTITI ALLA PROVA

- 33 B
- 34 A
- 35 D
- 36 C
- 41 A
- 42 A
- 43 C
- 44 D
- 45 E
- 46 B
- 47 A
- 48 B

Toxic avenger at the ribosome

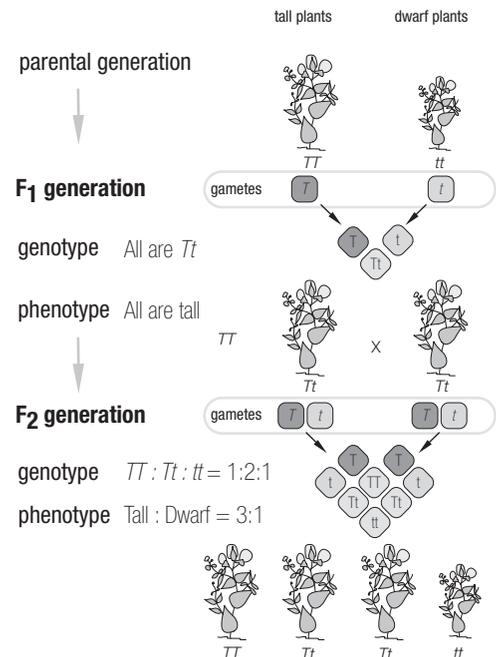
- What happened to Georgi Markov in 1978? A man—possibly a Bulgarian secret agent—brushed up against him and, seemingly by accident, poked him with an umbrella. Markov felt a sharp pain. Within a few hours, he started to feel weak. A high temperature, vomiting, and more severe symptoms soon followed. Two days later he was dead.
- What is ricin? A highly toxic molecule isolated from the seeds of the tropical castor bean plant, *Ricinus communis*.

The seeds of *Ricinus* have been used for centuries as a source of castor oil, a natural product once frequently administered to children to «clean out» the digestive tract.

Biology in English (pages B81-B86)

- 1A** a. *False* – His work had no discernible influence on the scientific community for about 30 years; b. *True*; c. *False* – This is the definition of character. A trait is a particular form of a character, e.g. white or purple flower; d. *False* – F₂ plants; e. *False* – The ratio of dominant-recessive; f. *True*; g. *False* – He had no knowledge of chromosomes or meiosis; h. *True*.

1B



- 1C** 1. To avoid self-pollination; 2. He had isolated each strain by crossing sibling plants or allowing self-pollination; 3. Yes.
- 2** 1: h; 2: d; 3: l; 4: a; 5: e; 6: k; 7: b; 8: j; 9: f; 10: c; 11: i; 12: g.
- 3** a. Diploid; b. True-breeding; c. Phenotype; d. Haploid; e. Parental generation P; f. Law of independent assortment; g. Second filial generation F₂; h. Pleiotropic; i. First filial generation F₁.
- 4** a. It is recessive because A and his husband do not have the condition, but they have a son that is polydactyl; b. *A-Pp*, *B-Pp*, *C-pp*.
- 5** 1: disease; 2: amino acid; 3: allele; 4: red blood cells; 5: capillaries; 6: oxygen; 7: parasite; 8: carrier; 9: malaria; 10: plasmodium.
a: *ss*; b: Both *Ss*; c: $\frac{1}{2}$; d: $\frac{1}{8}$.

- 6 a. The first fly was homozygous recessive, while the second was heterozygous, as the diagram shows and in which we can see that the probability of each phenotype is 50%.
b.

	I	I
L	Ll	Ll
I	ll	ll

- 7 a. Genotype: $RrTt$.
b. Phenotype: Yellow fruit, tall.
c. $RrTt \times rrTt$.
d.

	rT	rt
RT	RrTT Red fruit, tall	RrTt Red fruit, tall
Rt	RrTt Red fruit, tall	Rrtt Red fruit, short
rT	rrTT Yellow fruit, tall	rrTt Yellow fruit, tall
rt	rrTt Yellow fruit, tall	rrtt Yellow fruit, short

- 8 a. mitosis (meiosis); b. recessive phenotype (dominant); c. mitosis (meiosis); d. wild allele (pleiotropic allele); e. law of assortment (law of segregation); f. Mendel (Morgan); g. characters (genes); h. Y chromosome (X).
9 a. *False* – The phenotype appears much more often in males than in females; b. *True*; c. *False* – This disease appears only if X chromosome is present; d. *False* – Daughters who receive one mutant X chromosome are heterozygous carriers; e. *True*; f. *True*.
10 1: Fruit flies lay many eggs and have large numbers of offspring (high fecundity); 2: The fruit fly life cycle is short and determined by temperature so it is possible to have results very quickly; 3: They have clear features and there are obvious differences between males and females; 4: They have very small size so little space is required (ease of culturing).
11 a. (T =tall, t =short, S =smooth, s =wrinkled)

	TS	Ts	tS	ts
TS	TTSS Tall smooth	TTsS Tall smooth	TtSS Tall smooth	TtSs Tall smooth
Ts	TTsS Tall smooth	TTss Tall wrinkled	TtSs Tall smooth	Ttss Tall wrinkled
tS	TtSS Tall smooth	TtSs Tall smooth	ttSS Short smooth	ttSs Short smooth
ts	TtSs Tall smooth	Ttss Tall wrinkled	ttSs Short smooth	ttss Short wrinkled

The phenotypic ratios are as follows: 9 tall smooth; 3 tall wrinkled; 3 short smooth; 3 short wrinkled.

- b. Case 1 (T =tongue-rolling and t =non-tongue-rolling):

	T	t
T	TT Tongue-roller	Tt Tongue-roller
t	Tt Tongue-roller	tt Non tongue-roller

The genotypes and ratios are $1 TT : 2 Tt : 1 tt$.
Case 2

	T	T
t	Tt Tongue-roller	Tt Tongue-roller
t	Tt Tongue-roller	Tt Tongue-roller

All the children will be tongue-rollers.

- c. Case 1

F_1 generation: $PpSs$, all wild-type.

$PpSs \times PpSs$

	PS	Ps	pS	ps
PS	PPSS	PPsS	PpSS	PpSs
Ps	PPsS	PPss	PpSs	Ppss
pS	PpSS	PpSs	ppSS	ppSs
ps	PpSs	Ppss	ppSs	ppss

16 combinations of gametes in this dihybrid cross result in 9 different genotypes. F_2 in a ratio of 9 : 3 : 3 : 1 in phenotypes.

Case 2

The genotypes are: $PpSs$, $Ppss$, $pPss$, $ppss$; the ratio is 1: 1: 1: 1; the phenotypes are: wild eye, long wing; wild eye, short wing; pink eye, long wing; pink eye, short wing; the ratio is 1: 1: 1: 1.

12. Across

1. CODOMINANCE, 4. GAMETE, 5. GENOTYPE, 7. MONOHYBRIDCROSS, 10. GENE, 12. ALLELE, 16. CHROMOSOME, 17. TESTCROSS, 18. PHENOTYPE, 19. PUNNETTSQUARE.

Down

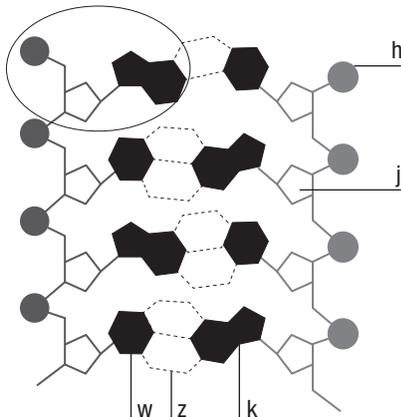
2. DROSOPHILA, 3. RECESSIVE, 6. DIHYBRIDCROSS, 8. HETEROZYGOUS, 9. CHARACTER, 11. DOMINANT, 13. LINKAGEGROUP, 14. HOMOZYGOUS, 15. TRAIT.

13

- 1: genetic material; 2: bacterium; 3: virus; 4: bacteriophage; 5: DNA; 6: protein; 7: reproduce; 8: trace; 9: ^{32}P ; 10: phosphorus; 11: ^{35}S ; 12: sulfur; 13: phosphorus; 14: sulfur; 15: separate; 16: inject; 17: reproduce; 18: separately; 19: agitated; 20: dislodge; 21:

bacterial cells; 22: spun; 23: heavier; 24: bottom; 25: pellet; 26: lighter; 27: supernatant; 28: pellet; 29: supernatant; 30: radioactivity; 31: sulfur; 32: supernatant; 33: did not enter; 34: phosphorus; 35: pellet; 36: entered; 37: DNA; 38: protein.

- 14** a: True; b: False; c: True; d: False; e: True; f: False; g: True; h: False; i: True; j: True.
15 a: Nucleotide;

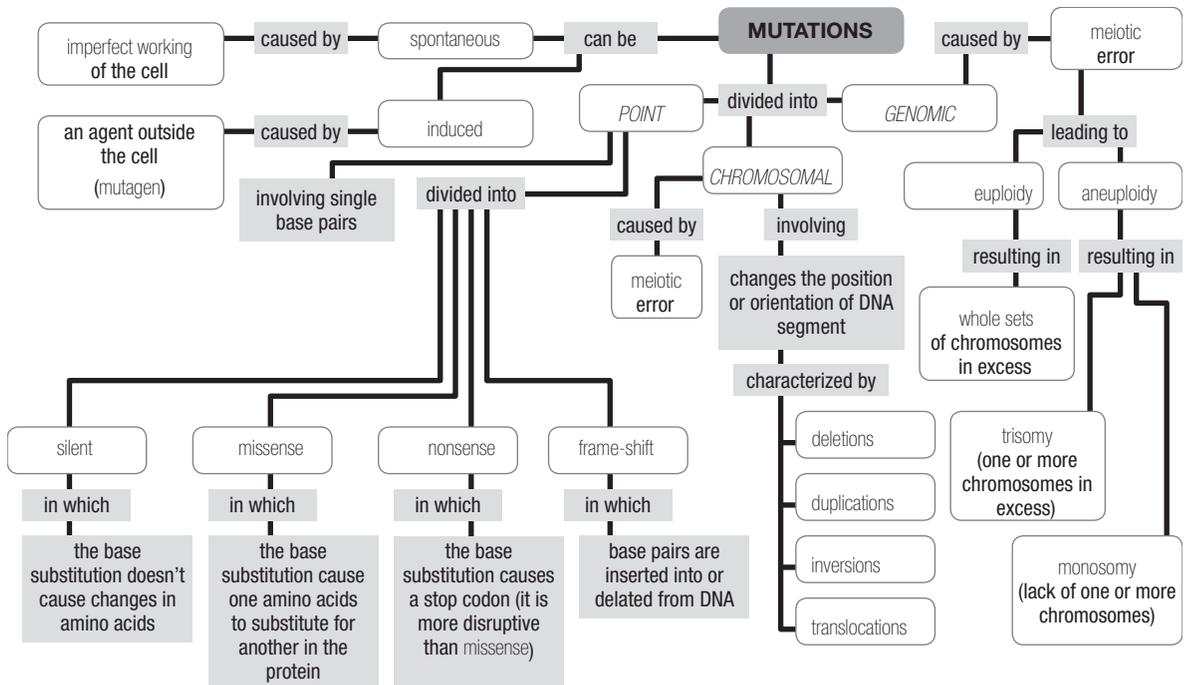


b: Phosphate; c: Deoxyribose; d: W: thymine, K: adenine – Because there are only two hydrogen bonds between molecules; e: Z: cytosine – Because there are three hydrogen bonds between molecules; f: Phosphodiester bonds that are covalent bonds, between the

third and fifth carbon atoms of adjacent sugar rings; g: The direction of the nucleotides in one strand is opposite to their direction in the other strand; the asymmetric ends of DNA strands are called 5' (*five prime*) and 3' (*three prime*) ends, with the 5' end having a terminal phosphate group and the 3' end a terminal hydroxyl group.

- 16** a-3, b-2, c-7, d-4, e-1, f-9, g-5, h-8, i-6.
17 a: 3'-ATTCCG-5'; b: 3'-TAAGGC-5'; c: 3'-TGGAAT-5'; d: 3'-GCCTTA-5'; e: 3'-CGGAAT-5'.
18A 1: nucleus; 2: cell membrane; 3: cytoplasm; 4: DNA; 5: mRNA; 6: tRNA; 7: mRNA; 8: ribosome; 9: polypeptide.
18B a: Transcription; b: Translation; c: Transcription is the first stage of the expression of genes into proteins. In this enzymatic process RNA is synthesized using a DNA template in a process made up of three stages: initiation, elongation and termination, at the end of which the mRNA is moved out of the nucleus. The mRNA contains the instructions to make one single protein.
18C 1: cytoplasm; 2: tRNA; 3: enzyme; 4: ATP; 5: transcription; 6: mRNA; 7: first; 8: polypeptide; 9: subunits; 10: ribosome; 11: start codon; 12: added; 13: 5' → 3'; 14: stop; 15: codon; 16: protein; 17: released.

19.



CAPITOLO 4

VERIFICA LE TUE CONOSCENZE

- 1 C
- 2 A
- 3 B
- 4 B
- 5 C
- 6 D
- 7 A
- 8 A
- 9 A
- 10 D
- 11 B
- 12 B
- 13 D
- 14 D

VERIFICA LE TUE ABILITÀ

- 15 A ambiente, B Griffith, C plasmide, D crossing-over, E breve
- 16 A mobili, B trasposoni, C antibiotici
- 17 A regolatore, B induttore, C regolatrici, D promotore
- 18 B D
- 19 B
- 20 C D

METTITI ALLA PROVA

- 34 A
- 35 D
- 36 B
- 37 C
- 41 D
- 42 A
- 43 B
- 44 E
- 45 A
- 46 C
- 47 C
- 48 D
- 49 D
- 50 C

Mutation of a bird virus results in human infection

- What was the new virus that killed a 3-year-old boy in Hong Kong in 1997?

The little boy had been infected with H5N1, a flu virus previously known to infect only chickens. The boy's day care provider had kept chicks for the children to play with, and several of the chicks died.

- Which other pandemics made it possible for an animal influenza virus to infect people with a single gene mutation?

The «Spanish flu» epidemic of 1918, which may have started with a single soldier, spread to Europe with U.S. troops fighting in World War I. The resulting pandemic led to 40 million deaths worldwide. Flu pandemics in 1957 and 1968 killed a million people each.

CAPITOLO 5

VERIFICA LE TUE CONOSCENZE

- 1 C
- 2 B
- 3 A
- 4 B
- 5 C
- 6 C
- 7 B
- 8 C
- 9 A
- 10 B
- 11 A
- 12 D
- 13 C
- 14 D

VERIFICA LE TUE ABILITÀ

- 15 A 6 miliardi, B telomeri, C regolatrici, D maturazione
- 16 A introni, B splicing, C ribonucleoproteine, D dominio
- 17 A omeotici, B l'identità, C bithorax, D homeobox
- 18 A C
- 19 C D
- 20 B D

METTITI ALLA PROVA

- 35 A
- 36 A
- 37 D
- 38 B
- 43 A
- 44 D
- 45 C
- 46 A
- 47 A
- 48 C
- 49 C
- 50 C
- 51 B
- 52 E
- 53 D

Endangered genomes

- How many cheetahs are there in the world today? Are they declining? Why?

There are only about 12 000 cheetahs in the world today, almost all of them in Africa. Some of the decline in their numbers is due to human intervention. For instance, farmers have hunted them down because they were (mistakenly) blamed for killing cattle.

- Are they able to survive adverse conditions? With their homogeneous genomes, cheetahs lack the genetic variability. For example, cheetahs are very susceptible to diseases because they lack the genetic diversity that might allow them to mount an attack on new pathogens.

CAPITOLO 6

VERIFICA LE TUE CONOSCENZE

- 1 A
- 2 D
- 3 B
- 4 D
- 5 C
- 6 A
- 7 D
- 8 C
- 9 B
- 10 B
- 11 A
- 12 C
- 13 A
- 14 C

VERIFICA LE TUE ABILITÀ

- 15 A forbici, B *EcoRI*, C ligasi, D coesive
- 16 A impronta, B polimorfi, C elettroforesi su gel, D lunghezza
- 17 A virale, B ORF, C amminoacidiche, D regolatrici
- 18 C D

Biology in English (pages B161-B164)

1.

Influenza virus	HIV virus or AIDS
a. It enters by endocytosis .	It binds to the host cell and then it enters through fusion of its envelope with the host's plasma membrane.
b. Once inside the virion is released by the fusion of the viral and vesicle membranes and the capsid breaking.	After fusion, the virus releases RNA, its genetic material, into the host cell.
c. The virus carries its own enzyme to replicate its RNA genome; this RNA-dependent RNA polymerase enzyme uses RNA as a template ; the newly synthesized viral RNA strand is used as mRNA to make more copies of the viral genome by complementary base pairing.	Viral RNA uses reverse transcriptase to make complementary DNA (cDNA) then it degrades. Reverse transcriptase synthesizes the second DNA strand, cDNA enters the nucleus becoming integrated into the host chromosome and forms a provirus. When activated proviral DNA is transcribed to viral RNA and exported to the cytoplasm where it is translated into proteins.
d. New viruses assemble by budding and are released.	An assembled virus buds from plasma membrane.

- 19 D
- 20 B D

METTITI ALLA PROVA

- 34 D
- 35 B
- 36 A
- 37 B
- 41 B
- 42 C
- 43 B
- 44 A
- 45 C
- 46 E
- 47 B
- 48 C
- 49 A
- 50 E
- 51 E

Baby 81

- Why is DNA useful to identify people? With 6 billion base pairs of DNA packaged in 46 chromosomes, each one of us is unique. The eukaryotic genome contains many repeated sequences, and between individuals the repeat frequency may differ, offering one way to differentiate individuals. Differences in a single base pair due to DNA replication errors or random mutations also distinguish individuals from one another, and these differences are inherited. It is now possible to analyze these differences in DNA (amplified by PCR) to identify people.
- In the end, who were Baby 81's true parents? When DNA from the nine sets of contesting parents was analyzed and compared with that of Baby 81, the only parents whose sequences were consistent with being passed on to the baby were the Jeyarajahs. On February 14, 2005, the judge ruled that the Jeyarajahs are the true parents of Baby 81.

- 2A** a-lytic, b-lysogenic, c-bacterial cell, d-prophage.
- 1** A prophage is a molecule of viral DNA which has been integrated into the bacterial chromosome.
- 2** In the lytic cycle the virus reproduces immediately, killing the host cell; in the lysogenic cycle the viral DNA is integrated into the cell's genome and stays there for many replications until some conditions start a lytic cycle.
- 3** It usually happens when the host cell gets stressed or damaged, because while it is growing rapidly the phage exploits it to produce as much progeny as possible.
- 2B** 1-c, 2-g, 3-d, 4-i, 5-f, 6-a, 7-h, 8-b, 9-e.
- 3** 1-conjugation-A, 2-transformation-C, 3-conjugation-B, 4-transduction-D.
- 4** a. A spontaneous or induced genetic mutation.
b. Bacteria have short generation times and they can evolve rapidly in response to environmental changes. They can also transfer resistance genes from one cell to another by conjugation.
c. They are situated in small circular DNA molecules called R plasmids.
d. When conjugation is initiated, an enzyme cuts one of the strands of the plasmid; this strand is transferred to the recipient cell in a 5'-terminus to 3'-terminus direction through the conjugation tube. The remaining strand is replicated independently of the conjugative action.
- 5.**

Statement	The <i>lac</i> operon	The <i>trp</i> operon	Both
a		X	
b			X
c	X		
d	X		
e		X	
f		X	
g			X
h	X		
i			X
j	X		

- 6A** 6-*lac* Operon, 5-Operator, 4-Promoter for *lac* operon, 1-Promoter for the regulatory gene, 3-Regulatory gene, 2-Structural loci.
- 6B** Operon is a mechanism to control the transcription of proteins by which prokaryotes

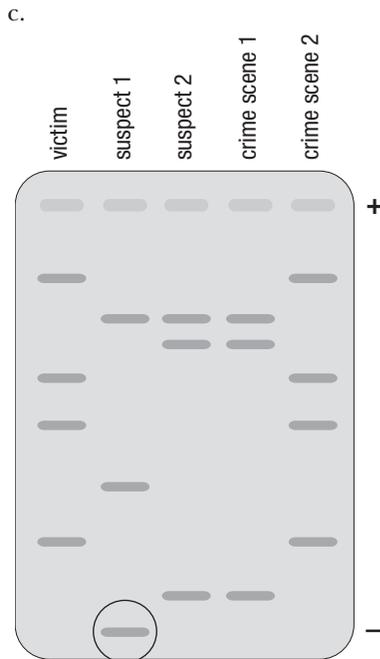
conserve energy and resources by making proteins only when they are needed.

- 7** a: P; b: E; c: E; d: P; e: E; f: B; g: E; h: E; i: B; j: P; k: P; l: B; m: B; n: E; o: E.
- 8** 1-e; 2-g; 3-b; 4-h; 5-c; 6-a; 7-l; 8-f; 9-d; 10-i.
a. Transposons are cellular parasites which simply replicate themselves. The resulting replications can lead to the insertion of a transposon at a new location, which can cause serious consequences.
b. The insertion of a transposon into the coding region of a gene results in a mutation and this phenomenon is the cause of several human genetic diseases such as haemophilia and muscular dystrophy.
- 9** a. Because in mammals one of the X chromosomes is inactivated in a random way in each cell. The cat is probably heterozygote and in some cells X^O allele is expressed, while in some other cells X^B is expressed.
b. No, because male cats have only a single X chromosome (XY) that does not undergo X-inactivation: coat color is determined by which allele is present on X, and they will be either entirely black or orange. Very rarely a male tortoiseshell cat is born, but these animals typically have an extra X chromosome (XXY) and are often sterile.
c. It is an example of whole-chromosome effect.

10

5'...	G	C	T	T	G	A	A	T	T	C	G	A	G	C	T	T	A	A	G	G	3'...
3'...	C	G	A	A	C	T	T	A	A	G	C	T	C	G	A	A	T	T	C	C	5'...

- 11** a. It is the DNA sequence that signals for the origin of replication.
b. The operon is necessary to express the gene that we want to insert (e.g. GFP).
c. When the bacteria are put in a culture medium the antibiotic ampicillin, only the transformed ones can live because they are resistant, so it is possible to separate the genetically modified bacteria from the others.
d. Using UV light, bacterial colonies appear fluorescent.
- 12** a. DNA was cut by a restriction enzyme.
b. The mixture of DNA fragments is placed in a gel made up of agarose polymer suspended in a buffer. An electric field is applied across the gel; the negative charged DNA moves toward the positive end of the field, with smaller molecules moving faster than larger ones.



d. It is Suspect 2, because its DNA was found also on the crime scene; the other DNA on the crime scene was of the victim, while Suspect 1 DNA was not present.

13. Across

2. LYSOGENIC, 4. CHROMATIN, 10. TRANSFER, 12. APOPTOSIS, 15. OPERON, 16. INTRON, 20. TRANSDUCTION, 21. TRANSCRIPTASE, 22. REPRESSOR, 23. TELOMERE, 24. TRANSPOSONS.

Down

1. BACTERIOPHAGE, 3. NUCLEOTIDES, 5. PROTEASOMES, 6. MUTATIONS, 7. DELETION, 8. PSEUDOGENES, 9. DIFFERENTIATION, 11. SEMICONSERVATIVE, 13. PURINES, 14. FRAGMENTS, 17. DEGENERATE, 18. SILENCERS, 19. TRISOMY.

CAPITOLO 7

VERIFICA LE TUE CONOSCENZE

- 1 A
- 2 A
- 3 B
- 4 D
- 5 D
- 6 C
- 7 C
- 8 B
- 9 C
- 10 D
- 11 A

- 12 A
- 13 C

VERIFICA LE TUE ABILITÀ

- 14 A pool, riproducono, equilibrio
- 15 A fitness, B relativo, C frequenza, D caratteri
- 16 D E
- 17 A D

METTITI ALLA PROVA

- 29 A
- 30 D
- 33 A
- 34 D
- 35 C
- 36 D
- 37 D
- 38 B
- 39 D
- 40 B
- 41 C
- 42 D

Snake eats poisonous newt – and lives!

- What is tetrodotoxin (TTX)? How does it work? Tetrodotoxin is a potent neurotoxin; it paralyzes nerves and muscles by blocking sodium channels.
- The ability to produce neurotoxins in the skin is energetically costly for an organism? To improve its performance in one area, an organism typically experiences reduced performance in some other area—there is a trade-off between the benefits of an adaptation and what it costs the organism that expresses it.

CAPITOLO 8

VERIFICA LE TUE CONOSCENZE

- 1 B
- 2 D
- 3 A
- 4 D
- 5 A
- 6 D
- 7 D
- 8 C
- 9 A
- 10 C
- 11 B
- 12 D
- 13 C

VERIFICA LE TUE ABILITÀ

- 14 A morfologica, B biologica, C alleli, D riproduttivamente

- 15 A geografiche, poliploidia, vegetali
 16 A comportamentale, ambientale, gametico, accoppiamento
 17 A D
 18 B D
 19 B C

METTITI ALLA PROVA

- 33 B
 34 B
 35 C
 36 D
 39 B
 40 C
 41 E
 42 D
 43 C
 44 A
 45 D
 46 A
 47 A

Sex stimulates speciation (among other things)

- May sexual selection also increase the rate at which new species form?

Evidence for this effect of sexual selection comes from comparing the number of species found in sister clades, that is, clades that share a common ancestor. Because they share a common ancestor, sister clades have been evolving independently from one another for the same length of time. The rate at which species have formed in the two clades can be estimated by comparing the number of species in them today.

- Why does sexual selection stimulate the divergence of a lineage into many species?

A likely reason is that random mutations result in different plumage elaborations in different parts of the range of a species.

CAPITOLO 9

VERIFICA LE TUE CONOSCENZE

- 1 D
 2 B
 3 A
 4 C
 5 B
 6 C
 7 A
 8 D
 9 C
 10 D

- 11 A
 12 C
 13 A
 14 B

VERIFICA LE TUE ABILITÀ

- 15 A articolati, B conservato, C opponibile, D ruotare
 16 A due milioni di anni, B cranico, C nascita
 17 A olduvaiana, B sudoccidentale, C lame
 18 A D
 19 B C
 20 A C

METTITI ALLA PROVA

- 34 B
 35 B
 36 D
 37 A
 41 D
 42 E
 43 B
 44 A
 45 D

Hobbits of Flores island

- How old are the fossil hominids discovered on Flores island?

Radioactive dating indicated that some of the fossil hominids were shockingly recent (a mere 18 000 years old).

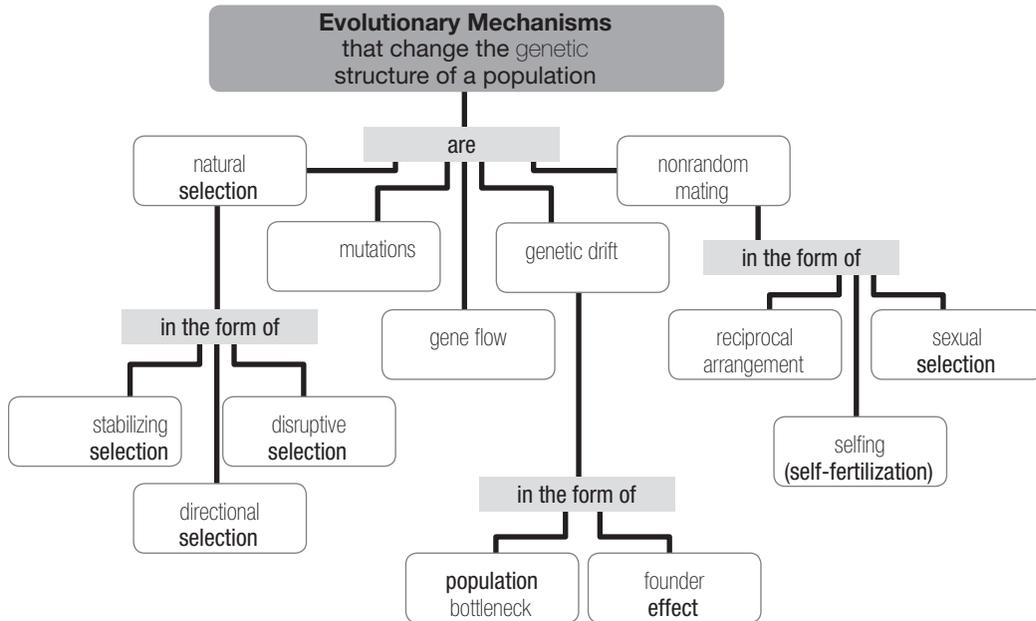
How did the ancestral *H. erectus* colonize Flores?

- *H. erectus* colonized Flores during a period of glacial expansion, when sea levels were about 150 meters lower than they are today.

Biology in English (pages B233-B240)

- a. Probably because most of the population in Tasmania is formed by the colonizers' descendants who mated with each other; the frequency in the population is different as a result of the limited sample of people.
 - b. It is the founder effect.
 - c. They can inform people about the probability to show Huntington's chorea. Now there are genetic tests that can be performed at any stage of development and it is possible to conduct genetic screening in the families that have someone who suffers from the disease.
- a. $p^2 = 1/3250 = 0.00031$; $p = 0.018$
 - b. $q = 1 - p = 1 - 0.018 = 0.98$
 - c. $2pq = 0.035$ (probability of being a healthy carrier)

3A



- 3B** a. Because each of a large number of genes may mutate, and chromosomal rearrangements may change many genes at the same time.
 b. When only a few individuals survive an event that causes large losses within a large population, thus producing random changes in allele frequencies.
 c. Sexual selection.
- 4** b. 1-thrum, 2-picks up, 3-pin, 4-deposited, 5-tall.
 a. 6-pin, 7-picks up, 8-thrum, 9-deposited, 10-short.
- 5** a-False: They can be neutral and even advantageous if environmental conditions change, b-False: They fertilize flowers of the other type, c-True, d-True, e-False: There must be no gene flow from populations with different allele frequencies, f-True, g-True, h-False: It does, i-False: They contain less genetic variation, j-False: Of genetic drift, k-False: This is gene flow, genetic drift results in random changes in allele frequencies, l-True.
- 6** 1-generations, 2-cause, 3-species, 4-proteins, 5-Evolution, 6-offspring, 7-individuals, 8-reproduction, 9-population, 10-adapted, 11-traits, 12-phenotype, 13-genotype, 14-genes, 15-increasing, 16-produce, 17-frequencies, 18-environment, 19-reproductive, 20-probability.
- 7** a. 1-c, 2-d, 3-a, 4-b.

- b. Neutral mutations, sexual recombination, and frequency-dependent selection can maintain considerable genetic variation within most populations. Neutral alleles do not affect the fitness of an organism, sexual reproduction gives origin to countless genotypic combinations that increase a population evolutionary potential, a polymorphism can be maintained by frequency-dependent selection, genetic variation can be maintained by genetically distinct subpopulation over a geographic area.
- 8** a-Disruptive selection, b-Sexual selection (intersexual), c-Stabilizing selection, d-Sexual selection (intersexual), e-Sexual selection (intersexual), f-Disruptive selection, g-Directional selection, h-Sexual selection (intrasexual).
- 9** 1-e, 2-a, 3-g, 4-l, 5-b, 6-i, 7-d, 8-k, 9-f, 10-h, 11-j, 12-c.
- 10** prevent, cause, is not, maintain, impeding, allowing, evolve, changes, allopatric, mixed, lead to, divergence, appearance, millions, morphologically, can, may.
- 11** 1-c, 2-e, 3-a, 4-b, 5-d.
- 12** a.

Horse (female)	64	32	32
Donkey (male)	62	31	31
Mule	63 (32+31)		

b. The odd number of chromosomes in the mule at meiosis, that is 63, prevents pairing and causes the mule to be infertile.

c. They are considered different species since their offspring are infertile.

- 13** Sedentariness-a, Sexual selection-b, Species abundance-c, Specialized diets-e, Kind of pollination-d.
- 14** a. They are gradualism and punctuated equilibrium.
b. Charles Darwin and Niles Eldredge with Stephen J. Gould.
c. Gradualism is a model of evolution according to which most speciation occurs slowly, gradually and in a uniform way. When evolution occurs in this way, it is usually by the steady transformation of a whole species into a new one, slowly and continuously over long periods of geological time. Punctuated equilibrium is a hypothesis predicting that a lot of evolutionary change takes place in short periods of time tied to speciation events. In punctuated equilibrium there is a period of very little change, during which species exhibit little net evolutionary change, remaining in an extended state called *stasis*. Then one or a few huge changes occur, often through mutations in the genes of a few individuals, being generally restricted to rare and geologically rapid events of branching speciation called cladogenesis.
- 15** a. It is adaptive radiation.
b. It is the proliferation of a large number of daughter species from a single ancestor and it results in an array of species that live in a variety of environments and differs in the characteristics they use to exploit those environments. It begins when genetic differentiation evolves in response to differences in the environments they inhabit and the resources they use.
c. In the islands, because they lack many groups of organisms found on the mainland, so the ecological opportunities that exist on them may stimulate rapid evolutionary changes when a new species colonizes them.
d. 1-finches, 2-beak, 3-dimension, 4-gene, 5-protein, 6-muzzle, 7-development, 8-vertebrate.
- 16A** 1-False: Only a plaster replica, 2-True, 3-True, 4-False: Bipedalism preceded increased brain size, 5-False: Valgus knee, pelvis and leg bones, 6-True, 7-False: It was an astounding result, 8-False: It became a household name, 9-False: The name was taken from a song, 10-True.
- 16B** a. It showed mixed and changing characters,

so an evolution of *A. afarensis*.

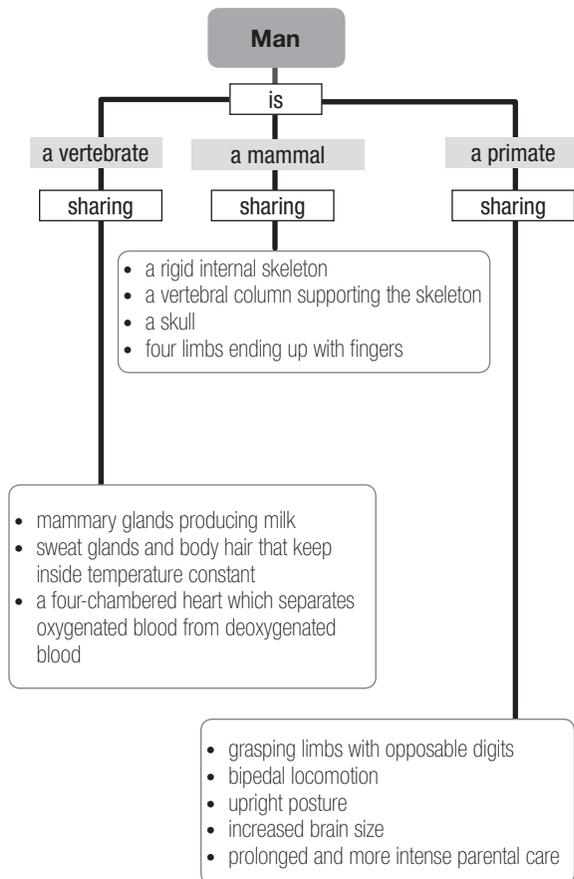
b. Because they found no duplication.

c. By examining the pelvis and leg bones they found that they were almost identical in function to those of modern humans. They also found a valgus knee.

16C

Primitive features	Modern features
<ul style="list-style-type: none"> • Small skull capacity • Small brain • Small femoral head • Short femoral neck • Gorilla-like jaw 	<ul style="list-style-type: none"> • Upright posture • Valgus knee • Function of pelvis and leg bones • Decreasing humerus-femur ratio • Shortening arm • Lengthening legs

17



- 18** 1-larger, 2-language, 3-signals, 4-emotional, 5-learning, 6-abstract, 7-gene, 8-KE, 9-speech, 10-deficits, 11-brain, 12-disorder, 13-lips, 14-location, 15-chromosome, 16-factor, 17-on, 18-key, 19-passing, 20-generation.
- 19** a. The "Out-of-Africa Theory" (on the left) and the "Multiregional theory" (on the right).
b. The "Out-of-Africa Theory" postulates that

humans similar to modern men left Africa 50-60,000 years ago to settle in the world and they replaced other more ancient hominids. The "Multiregional theory" upholds that modern men evolved in different populations in Asia and Europe but they did not originate different species because of interbreeding among groups.

c. Because mitochondria have a proper DNA different from the nuclear one and it is passed Down through the maternal line.

20. Across

5. HOMINID, 7. NEUTRALALLELE, 8. SELFING, 10. EXTINCTION, 11. SEXUALDIMORPHISM, 15. POLYPLOIDY, 18. HYBRIDZONE, 19. GENEPOOL, 20. ALLOPATRIC.

Down

1. SYMPATRICSPECIATION, 2. PHYLOGENETICTREE, 3. FITNESS, 4. POPULATIONBOTTLENECK, 6. GENEFLOW, 9. NONRANDOMMATING, 12. SPECIATION, 13. GENETICDRIFT, 14. FOUNDEREFFECT, 16. PANGENESIS, 17. COEVOLUTION.