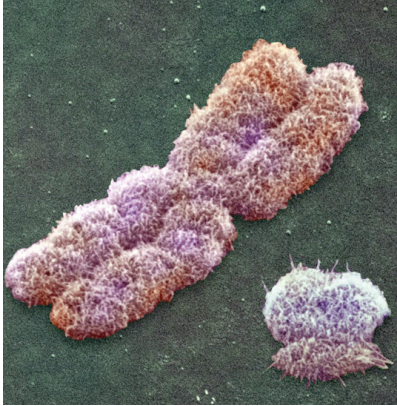


**This is not a "practice test"; these questions illustrate the style of questions used in Biology 022 but do not necessarily reflect the expectations for any particular Term Test.**

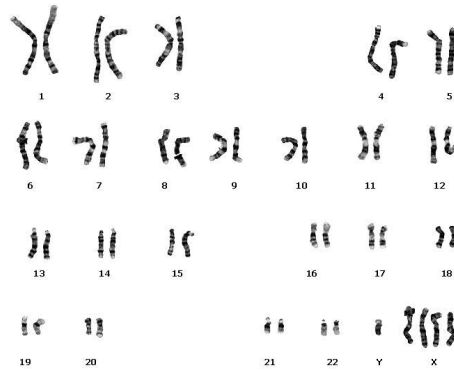
**Answers will be posted on WebCT on October 22.**

1. Which of the following images of chromosomes was made by fluorescence light microscopy?

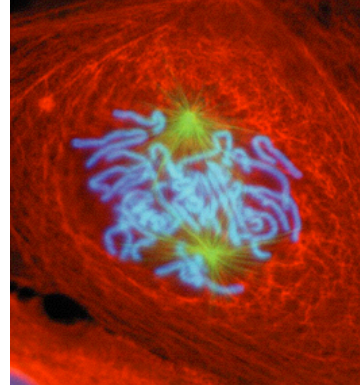
A.



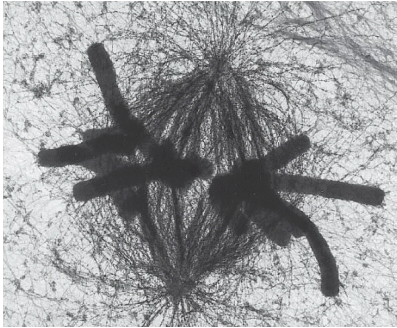
B.



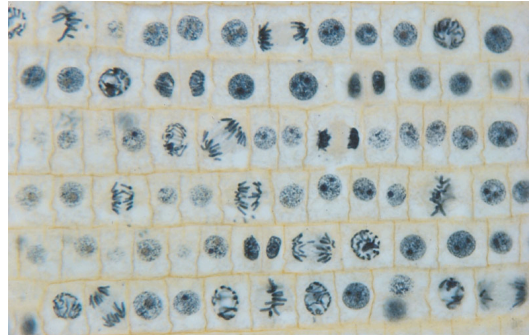
C.



D.



E.



2. Typical eukaryotic cells fall into the size range of

- A. 1 to 10  $\mu\text{m}$ .
- B. 10 to 100  $\mu\text{m}$ .
- C. 1 to 10 mm.
- D. 10 to 100 mm.
- E. 10 to 100 nm.

3. Eukaryotic cells responsible for the synthesis of large quantities of protein for export (e.g. keratin for fingernails) would be expected to have relatively abundant

- A. DNA.
- B. golgi.
- C. rough ER
- D. smooth ER
- E. mitochondria

4. Cells lining the squid eyeball are firmly secured, one to the next, by

- A. gap junctions.
- B. tight junctions.
- C. plasmodesmata.
- D. tonoplasts.

E. cell walls.

---

5. Typical members of the Domains of Bacteria and Archaea are similar in that they are both prokaryotic. However, they are different in that only the Archaea have a(n)

- A. association of DNA with histones.
  - B. circular chromosome.
  - C. nuclear envelope.
  - D. uni-cellular body.
  - E. cell wall.
- 

6. The cancer drug Taxol interferes with the separation of sister chromatids during anaphase of mitosis. A potential mechanism of Taxol's action is inhibition of

- A. kinetochore motor proteins.
  - B. signals that prevent apoptosis.
  - C. formation of cyclin/CDK complexes.
  - D. actin contraction along the cell plate.
  - E. tubulin polymerization in intermediate filaments.
- 

7. Recall that Tom dissected a gall on the stem of a goldenrod plant in class. Before being stimulated to divide in response to insect infection, the cells of that mature stem were likely in \_\_\_\_\_ of the cell cycle.

- A. G<sub>0</sub>
  - B. G<sub>1</sub>
  - C. S
  - D. G<sub>2</sub>
  - E. M
- 

8. A "nucleosome" is a

- A. pore in the nuclear membrane allowing mRNA to pass into the cytoplasm.
  - B. network of interlaced intermediate filaments supporting the nucleus.
  - C. structure resulting from the association of DNA with histone proteins.
  - D. concentrated area of ribosomal RNA within the nucleus.
  - E. central region of chromatin within prokaryotic cells.
- 

9. The replication of large, linear, chromosomes presents two significant problems:

- i) How to replicate fast enough to allow cells to divide rapidly during early development, and
- ii) How to deal with the resulting shortening of chromosomes.

The need for speed is achieved primarily by replicating

- A. simultaneously from several origins.
  - B. both DNA strands in the same direction.
  - C. with two replisomes at each replication fork.
  - D. with two different polymerases (Pol I and Pol III).
  - E. semi-conservatively; such that "new" DNA needs to be only half "new".
-

10. The replication of large, linear chromosomes presents two problems:

- i) How to replicate fast enough to allow cells to divide rapidly during early development, and
- ii) How to deal with the resulting shortening of chromosomes.

The shortening of chromosomes is counteracted by telomerase adding something to the chromosome ends. What does it add?

- A. DNA to replace the missing RNA primer.
  - B. DNA onto the 5' end of one strand.
  - C. DNA onto the 3' end of one strand.
  - D. Extra Okazaki fragments.
  - E. An RNA template.
- 

11. Meiosis II is sometimes referred to as being "just like mitosis". However, this notion obscures the important differences between these two types of cell division. Meiosis II is not "just like mitosis" in that only cells dividing in Meiosis II

- A. divide replicated chromosomes into daughter cells.
  - B. have half the usual number of chromosomes for a given organism.
  - C. ensure daughter cells each have the same number of chromosomes.
  - D. give rise to daughter cells with identical genotypes.
  - E. will eventually give rise to gametes.
- 

12. Before taking this course, many people believe that all chromosomes are shaped like the letter "X"? However, a given chromosome could only appear in the shape of an "X" if its centromere was near the center and if it was also

- A. paired with a Y chromosome.
  - B. highly packaged (e.g. metaphase).
  - C. "squashed flat" during DNA replication.
  - D. being pulled to opposite poles by microtubules.
  - E. crossing over with its homologue during meiosis.
- 

13. Several *in-vitro* fertilization laboratories in the United States now offer a service by which couples can specifically select an embryo that is a close tissue match to a child that they already have. (In the event that one sibling might need a transplant from another in the future.) Such tissue matching would screen for appropriate

- A. complementary base sequences.
  - B. numbers of Barr bodies.
  - C. sex chromosomes.
  - D. pairing of homologues.
  - E. histocompatibility (HLA) haplotypes.
-

For Questions 14 and 15, refer to the data in the Table below.

Hair colour in a species of wild rat has been discovered to be under the influence of a gene, called B, having three alleles: brown (B1), red (B2) and white (B3). Data from experimental crosses is shown below.

Note that the males and females in crosses 1, 2 and 3 are known to be homozygous.

Cross	Male	Female	Offspring
1	Brown	Red	All brown
2	Brown	White	All brown
3	Red	White	All red
4	Brown	Brown	3 brown: 1 red
5	Red	Red	3 red: 1 white
6	Red	Red	All red
7	Brown	Red	1 red: 2 brown: 1 white

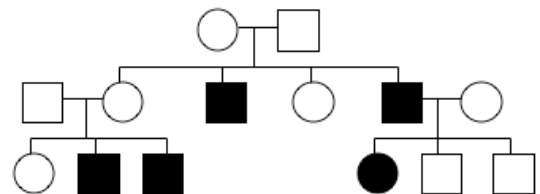
14. Based on the experimental data in the Table above, the genotype of the male in Cross 6 is

- A. B2.
- B. B2 B1.
- C. B2 B2.
- D. B2 B3.
- E. either B2 B3 or B2 B2.

15. The 1:2:1 ratio in Cross 7 indicates that

- A. the B1 allele is codominant.
- B. both parents have the same genotype.
- C. the B3 allele is recessive to both B1 and B2.
- D. the brown offspring all have the same genotype.
- E. there are two genes controlling coat colour in this Cross.

16. What is the most likely mode of inheritance for the trait shown in this pedigree?



- A. autosomal recessive
- B. autosomal dominant
- C. sex-linked recessive
- D. sex-linked dominant
- E. None of the above.

17. Consider your maternal lineage: your mother, her mother and her mother (back to your great-grandmother). Now consider Creutzfeldt-Jakob disease, a rare but fatal type of human "Mad Cow" disease caused by a mutated gene on Chromosome 20. If your great grandmother was homozygous for the mutation, what is the likelihood that you have inherited this mutation from her?

- A.  $1/2$
  - B.  $1/4$
  - C.  $1/8$
  - D.  $1/16$
  - E.  $1/32$
- 

18. Carlos and Wei-Mei are planning to have a baby. They met two years ago at a Research Symposium about a disorder called trimethylaminuria (TMAU). Affected people lack a liver enzyme that normally breaks down trimethylamine (TMA). As a result, gaseous TMA is excreted in sweat and people tend to smell like (rotting) fish. Wei-Mei has an affected son from her first marriage and Carlos has an affected aunt (his mother's sister). No other family members are affected. People marrying into the family (ie. Carlos' father) are assumed to be homozygous normal.

What is the likelihood that Carlos and Wei-Mei will have an affected child?

- A.  $1/4$
  - B.  $1/6$
  - C.  $1/8$
  - D.  $1/12$
  - E.  $1/24$
- 

19. Consider a trihybrid plant (AaBbCc) in which each of the three genes is on a different chromosome. How many different gametes would this plant produce?

- A. 2
  - B. 4
  - C. 6
  - D. 8
  - E. 9
- 

20. If the trihybrid plant from the previous question (AaBbCc) were to fertilize itself, what would be the proportion of trihybrids among the seeds produced?

- A. none
  - B.  $(1/2)^2$
  - C.  $(1/2)^3$
  - D.  $(3/4)^3$
  - E. All
- 

21. Consider a trihybrid organism (AaBbCc) in which all three genes are on the same chromosome. How many different recombinant gametes would such an organism produce?

- A. 2
  - B. 3
  - C. 4
  - D. 6
  - E. Can't predict without knowing "cis" or "trans" linkage arrangement.
-

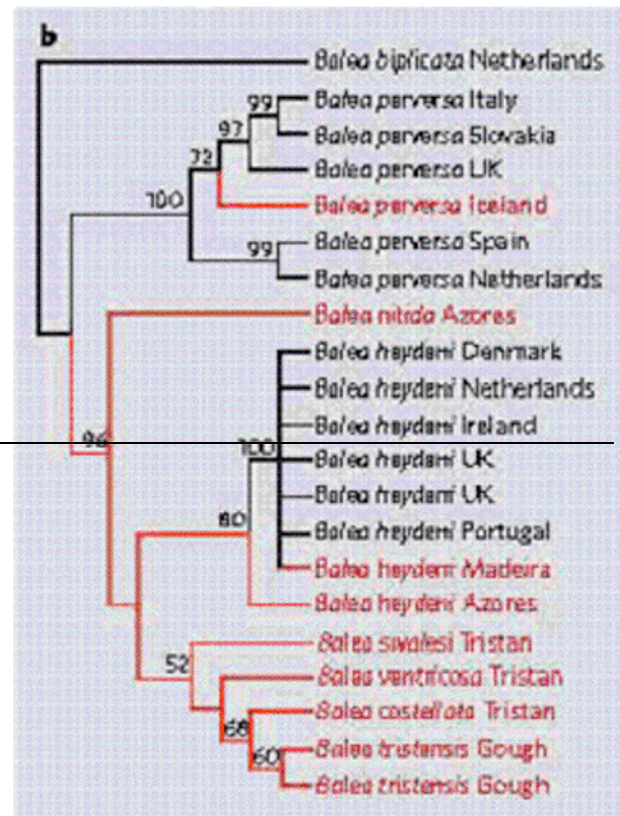


25. If a species is gynogenetic, the incidence of males in the population will be

- A. 0%
- B. 25%
- C. 50%
- D. 10%
- E. 100%

26. In this phylogeny based on molecular genetic data, the population from Portugal is most closely related to the one from

- A. Spain.
- B. the UK.
- C. Tristan.
- D. Gough.
- E. Italy.



27. An example of successful breeding between species has been demonstrated in

- A. different breeds of dogs
- B. some species of Darwin's finches
- C. Asian and African elephants
- D. 10% of birds
- E. B and D only are correct.

28. Although the species concept is central to Biology, developing a robust definition of species is challenging because

- A. species are units of convenience.
- B. not all organisms reproduce sexually.
- C. we cannot demonstrate gene flow in fossil populations.
- D. evolution is constantly producing new species in an ongoing process.
- E. All of A, B, C and D are correct.