

Let us Practice

Exercise I

Match the disease with their pathogen.

| List I | List II |
|---------------------------|----------------------------------|
| A. Ergot of rye | 1. <i>Plasmopara viticola</i> |
| B. Damping-off disease | 2. <i>Phytophthora infestans</i> |
| C. Late blight of potato | 3. <i>Pythium debaryanum</i> |
| D. Downy mildew of grapes | 4. <i>Claviceps purpurea</i> |

Codes :

| | A | B | C | D |
|-----|---|---|---|---|
| (a) | 3 | 2 | 4 | 1 |
| (b) | 4 | 1 | 3 | 2 |
| (c) | 4 | 3 | 2 | 1 |
| (d) | 2 | 3 | 1 | 4 |

Many of the world's fisheries are severely depleted. The goal of sustainable harvesting in a fishery is to harvest only a constant proportion of the total population, for instance 30%. Unfortunately, the harvest size has often gone up or stayed constant even as the total population size has crashed.

Here is simple model of a fishery :

$$H = N \times E \times G$$

H = Harvest size (number of fish caught)

N = Total population size (number of fish)

E = The harvest effort (the number of days spent fishing times the number of boats fishing; in other words, the units of E are boat-days)

G = Efficiency (the proportion of N caught per boat per day).

Which management approach is most sustainable and will not cause the population to crash in the long run?

- As N decreases, increase G by using either sonar to find the fish more easily, nets with smaller mesh sizes, or other advances in technology
- As N decreases, increase E by allowing more boats to fish or more days of fishing

- As N decreases, increase H
- As N decreases, set a level for H and keep it fixed at that level
- As N decreases, either E or G can change, but their product must remain constant

3. Match list I with list II and select the correct answer using the codes given below the lists.

| List I | List II |
|------------------------------|--------------|
| A. <i>Ficus bengalensis</i> | 1. Fibre |
| B. <i>Melia azadirachta</i> | 2. Pesticide |
| C. <i>Cocos nucifera</i> | 3. Latex |
| D. <i>Hevea brasiliensis</i> | |

Codes :

| | A | B | C | D |
|-----|---|---|---|---|
| (a) | 1 | 2 | 3 | 2 |
| (b) | 3 | 1 | 2 | 3 |
| (c) | 3 | 3 | 1 | 2 |
| (d) | 3 | 2 | 1 | 3 |

- If in a test-tube mRNA of *Rhizobium*, tRNAs from pancreas of goat and rRNA from sunflower are taken and sufficient number of amino acids and ATP are put, then the polypeptide synthesized will be of the nature of (3rd NSEB)
 - body cells of goat
 - Rhizobium*
 - Both (a) and (b)
 - sunflower
- Foetal sex can be determined by amniocentesis. This test looks for (3rd NSEB)
 - sex chromosomes in metaphase
 - Barr bodies
 - kinetochore
 - chiasmata
- NaCl is harmful to most crop plants. A scientist at the University of Toronto genetically modified plant so that it could be grown in dry parts of the world where the available water has a high level of NaCl. This genetically modified plant copes with the high levels of NaCl by transporting salt

- into its vacuoles where it accumulates to abnormally high levels. Which feature would be observed in the genetically modified plant when compared to a non-modified plant?
- The leaves in the modified plant are more yellow in colour
 - The modified plant has salt crystals on the surface of its leaves
 - The cytosol (the material between the plasma membrane and the vacuole membrane, excluding the organelles) in the modified plant has a lower osmotic pressure
 - The cytosol in the modified plant has a higher osmotic pressure
 - The osmotic pressure is the same in both plants
7. Natural fibres such as cotton and wool are widely used in clothing. Cotton is primarily composed of and wool is primarily composed of
- protein; protein
 - protein; carbohydrate
 - protein; waxes
 - carbohydrate; protein
 - carbohydrate; waxes
8. When certain bacteria are treated with an effective antibiotic, some cells do not die. What is the best explanation for this occurrence?
- The antibiotic causes mutations for resistance to arise
 - Genes conferring resistance are already present in the population
 - The antibiotic prevents mutations for resistance from arising
 - The antibiotic reduces competition from other bacteria, increasing chances for survival
 - The antibiotic kills all of the resident bacteria, as well as resistant strains that may colonize
9. A mycorrhiza is a mutualistic association between a fungus and a plant's roots. Which statement best characterizes this association?
- The fungus provides nothing to the plant; the plant provides food to the fungus
 - The fungus secretes toxins to kill the plant; the plant provides minerals to the fungus
 - The fungus provides minerals to the plant; the plant secretes toxins to kill the fungus
 - The fungus provides minerals to the plant; the plant provides food to the fungus
 - The fungus provides minerals to the plant; the plant provides nothing to the fungus
10. The excessive use of antibiotics is a concern to the medical community. The concern is that antibiotics will no longer be as effective in treating disease because
- humans are evolving a resistance to some antibiotics
 - viruses are not killed by antibiotics
 - some bacteria are evolving resistance to antibiotics
 - antibiotics are very expensive
 - antibiotics cause mutations
11. Along with nicotine, cigarette smokers receive tars, phenols, hydrocarbons, arsenic, and many other chemicals. All of the following are effects of inhaling tobacco except
- narrowing or hardening of blood vessels in the heart and brain
 - stomach ulcers, due to an increased acidity in the stomach
 - a higher frequency of respiratory infections (e.g., colds, pneumonia)
 - a higher risk of cancer, including cancer of the lungs, mouth, larynx, bladder and kidneys
 - stimulation of the central nervous system, including increased alertness
12. Which of the following is true of all cancer cells? The rapid growth and division of cancer cells is caused by
- bacterial infection
 - breakdown of normal gene regulation
 - viruses
 - changes in the intracellular hormone receptors
 - toxic chemicals
13. Which statement about animal stem cells is false?
- Stem cells are relatively undifferentiated cells that can divide to produce more differentiated tissue cells
 - Stem cells can be found in tissues that need frequent cell replacement, such as skin, the inner lining of the intestine, and the blood system
 - Dividing stem cells can produce cells that differentiate to replace cells lost to injury and age, e.g., stem cells in bone marrow produce red and white blood cells
 - Scientists are able to grow stem cells in the laboratory
 - Recent studies have shown that stem cells from one kind of tissue cannot be made to differentiate into cells of another tissue

14. Prions which have been reported to cause mad cow's disease, Alzheimer's disease, etc, are
 (a) a class of bacteria
 (b) fungi
 (c) proteins
 (d) yet unidentified viruses
15. In eye donation, which one of the following parts of donor's eye is utilized?
 (a) Iris (b) Lens (c) Cornea (d) Retina
16. The goal of the polymerase chain reaction is to
 (a) speed up protein synthesis for the production of new drugs
 (b) create many copies of a DNA sequence which is initially very rare
 (c) create many copies of messenger RNA molecules
 (d) investigate the properties of organisms which normally grow at very high temperatures
 (e) create DNA probes
17. A hospital technician, while doing some routine culturing of microorganisms in a lab, noticed a bacterial colony growing on a culture medium containing three different antibiotics. He identified the bacterium as one that did not cause a human disease, but he still reported his observation to the hospital administration. Which statement is correct?
 He was worried because
 (a) he had no way of killing this bacterium now that it was resistant to antibiotics
 (b) resistance to antibiotics could be transferred to disease-causing bacteria by transduction or conjugation
 (c) the bacterium might feed on the antibiotics and, therefore, be able to grow in people taking these antibiotics
 (d) there should be no bacteria inside a hospital
 (e) if people accidentally ingested the bacteria with their food, they would become resistant to the antibiotic
18. Chemotherapy is
 (a) buying chemicals in a shop
 (b) use of chemicals for killing a pest
 (c) treatment of a disease using chemicals
 (d) study of chemistry of cells
19. Match the names of biologists given under column I with their contributions listed under column II. Choose the answer which gives the

correct combination of alphabets of the two columns.

| Column I (Biologist) | Column II (Contribution) |
|-------------------------|--|
| A. Sir J C Bose | 1. Discovery of the first antibiotic |
| B. Prof. H G Khorana | 2. Development of immunization technique |
| C. Prof. Maheshwari | 3. Pulsation theory of ascent of sap |
| D. Louis Pasteur | 4. Artificial synthesis of gene |
| | 5. Plant embryology |

Codes :

- | | | | | |
|-----|---|---|---|---|
| | A | B | C | D |
| (a) | 5 | 4 | 3 | 1 |
| (b) | 3 | 4 | 5 | 2 |
| (c) | 3 | 4 | 5 | 1 |
| (d) | 5 | 4 | 1 | 2 |
20. In some autoimmune diseases, capillaries may become damaged resulting in and high levels of albumin proteins and blood cells appearing in the urine. Which region of the nephron contains capillaries that, when damaged, could cause this appearance in urine?
 (a) Renal glomerulus
 (b) Proximal convoluted tubule
 (c) Nephron loop
 (d) Distal tubule
21. Some plants contain nitrogen-fixing bacteria *Rhizobium* in their root nodules. This relationship is known as
 (a) an amensalism (one participant harms the other)
 (b) a commensalism (one participant benefits but has no effect on the other)
 (c) a mutualism (both participants benefit)
 (d) interspecific (between species) competition
 (e) competitive exclusion (competition between species for a limiting resource in which one species completely eliminates the other)
22. A man and a woman each carry the allele for phenylketonuria, an inborn error of metabolism. If the couple has a normal child, without phenylketonuria, what is the probability this child is a carrier of the disease?
 (a) 0.33 (b) 0.50
 (c) 0.67 (d) 1.00

23. Which of the following chemicals is the best candidate for a new selective herbicide (weedicide)?

- (a) One which inhibits a key enzyme in animals but which inhibits no enzymes in plants
- (b) One which does not inhibit any enzymes in animals but which inhibits an essential enzyme in some plants
- (c) One which does not inhibit a key enzyme in animals but which inhibits a non-essential enzyme in plants
- (d) One which inhibits an enzyme found in animals and bacteria

24. Quebec premier Lucien Bouchard had his leg amputated because of an infection known the "flesh-eating disease." This disease seems to have become a problem in Canada because of

- (a) recent contact between humans and rodents
- (b) travel between Africa and Canada
- (c) the transmission of a virus from chickens to humans
- (d) the evolution of antibiotic resistance
- (e) contaminated hamburgers at fast food chains

25. *Chlorella* is a suitable plant for an astronaut in space travel because

- (a) it provides oxygen to the astronaut and carbon dioxide released is utilized for its food manufacture
- (b) it supplies abundant food to the astronaut
- (c) it is a single celled autotropic plant
- (d) its growth is quite rapid during space flight

26. DNA fingerprinting has become a familiar forensic tool and has been cited in recent criminal trials. It is possible to do DNA fingerprinting with even a very minute sample of DNA because

- (a) DNA contains only four different types of nitrogenous bases
- (b) there are large quantities of DNA in each cell of the body
- (c) DNA determines a very specific polypeptide chain
- (d) one can use the polymerase chain reaction

27. Which of the following is a correct pair of bacterial disease and its causal agent?

| | |
|---------------------------------|---------------------------------|
| I. Citrus canker | - <i>Xanthomonas citri</i> |
| II. Tundu of wheat | - <i>Cornebacterium tritici</i> |
| III. Blight of rice | - <i>Xanthomonas oryzae</i> |
| IV. Angular leaf spot of cotton | - <i>X. malvacearum</i> |
| V. Anthrax of cattle | - <i>Bacillus anthracis</i> |
| VI. Whooping cough | - <i>Bordetella pertussis</i> |

- (a) I, V and VI are correct
- (b) V and VI are correct
- (c) III and V are correct
- (d) All are correct

28. A scientist grew some plant cells in a liquid culture medium in the light. When he looked at the culture, it appeared green. He then added some sugar to the medium and turned off the lights. After a few days, the culture appeared white, but when he examined a few drops of the culture under the light microscope using the 10× objective, he counted twice as many cells per millilitre than had been present before he turned the lights off. Which is the best explanation of these results?

- (a) The plant cells died, and the cells seen under the microscope were bacteria that had used the sugar for food
- (b) Because plant cells contain mitochondria, they used the energy from respiration to continue growing in the dark
- (c) In the absence of light, chloroplasts turn into mitochondria and can use sugar for respiration
- (d) In the dark, energy can be produced by chloroplasts as long as they have a source of sugar
- (e) In the light, photosynthesis results in proteins being stored in the chloroplasts, and this protein can be broken down in the dark to release energy for cell growth

29. Down's syndrome is caused by

- (a) gene mutation
- (b) change in the number of chromosomes
- (c) change in structure of chromosome
- (d) change in sequence of genes on chromosome

30. Microinjection of desired genes into fertilized eggs results in

- (a) cloned animals
- (b) free martins
- (c) transgenic animals
- (d) recombinant mammals

31. Allergy condition caused by pollen grains of certain flowers causing inflammation of the nose is called
 (a) bronchitis (b) rhinitis
 (c) pharyngitis (d) laryngitis
32. Vaccines produced through genetic engineering are safe as
 (a) they contain antigen only from coat of pathogen
 (b) they are least active form of virus
 (c) they are attenuated form of pathogen
 (d) All of the above
33. Syphilis is caused by
 (a) *Escherichia coli*
 (b) *Rhizobium*
 (c) *Treponema pallidum*
 (d) *Clostridium*
34. The technique used for the identification of active genes in a cell is called
 (a) southern blotting, which marks out the DNA
 (b) northern blotting, which marks out the RNA
 (c) RFLP, which marks out repeated DNA sequences
 (d) DNA cloning, which marks out amplified DNA segments
35. Match the following columns.

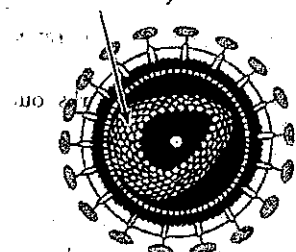
| Crop | Centre of Origin |
|--------------|---------------------|
| A. Coffee | 1. Brazil |
| B. Pineapple | 2. Central Asia |
| C. Maize | 3. Ethiopia |
| D. Wheat | 4. Tropical America |

Codes :

- | | | | | |
|-----|---|---|---|---|
| | A | B | C | D |
| (a) | 4 | 1 | 2 | 3 |
| (b) | 3 | 4 | 1 | 2 |
| (c) | 3 | 1 | 4 | 2 |
| (d) | 3 | 1 | 2 | 4 |
36. Elderly people are advised to get influenza (flu) vaccinations every year. Each year, a different type of flu vaccine has to be made. This is because
 (a) different viruses attack people of different ages, so each year as the population ages, a new vaccine must be produced
 (b) antibodies to the flu vaccine do not survive very long in the blood
 (c) vaccines are unstable and cannot be stored for more than one year
 (d) the body learns to destroy the antibodies made against the vaccine, so a new type of vaccine is needed for each vaccination
 (e) flu viruses change their genetic constituents so rapidly that vaccines against them rapidly become obsolete
37. There is no risk of rejection during corneal grafts thereby eliminating the need of tissue-typing or for immuno suppressant drugs. This is due to
 (a) constant lacrymalization of cornea naturally reduces in-built immunological response
 (b) avascularization of the cornea
 (c) the molecular and cellular structure of cornea gives it an in-built immuno suppressant capacity
 (d) All of the above
38. One day, you wake up with a sore throat and a runny nose. Your doctor takes a swab from your throat, sends it to a lab, and telephones you the next day to say that an antibiotic will not help you get better. Which of the following is the most likely reason for the doctor's statement?
 (a) Having waited a day, it is too late to take an antibiotic
 (b) You need an antiseptic, not an antibiotic
 (c) You need to be vaccinated instead of taking an antibiotic
 (d) You are infected by a virus
 (e) An antibiotic only eliminates the symptoms of infection and does not cure the infection itself
39. The technique of transferring DNA fragment separated on agarose gel to a synthetic membrane such as nitrocellulose, is known as
 (a) Northern blotting
 (b) Southern blotting
 (c) Western blotting
 (d) Dot blotting
40. The problem of erythroblastosis foetalis will occur if
 (a) both father and mother are Rh⁻
 (b) both father and mother are Rh⁺
 (c) father is Rh⁺ and mother is Rh⁻
 (d) mother is Rh⁺ and father is Rh⁻

41. Which of the following is false with regard to stem cells?
- Stem cells are generic cells which become the various tissues and organs that make up a human
 - Stem cells are sometimes called the body's master cells and are found in embryos
 - A total of 200 odd specialized stem cells provide all the different parts of the human body
 - None of the above
42. The function of nitrogen fixation in *Anabaena* (cyanobacterium) is performed by (1st NSEB)
- thylakoid
 - heterocyst
 - phycocyanin
 - phycoerythrin
43. Monoclonal antibodies are important medical tools today due to one of their following properties (1st NSEB)
- Amazing specificity of matching antigens
 - High sensitivity for detection
 - Diverse specificity for several antigens
 - All of the above
44. Vegetative propagation through cell or tissue culture is known as
- macropropagation
 - cloning
 - micropropagation
 - asexual propagation
45. Farmers need to apply less nitrogenous fertilizers to fields if one of these plants are present
- Rhodophyceae
 - Spirogyra*
 - Azolla* sp.
 - Weeds

Exercise II

1. Gene therapy for deleterious mutations in blood cells is becoming possible by introducing normal genes into blood cell precursors in the laboratory and re-injecting these cells into the patient. Which of the following would not be associated with this kind of gene therapy research?
- Attempting to place the normal gene in a vector which will help the gene integrate into a chromosome
 - Utilizing virus vectors which have some of their own genes removed
 - Utilizing a suitably modified HIV virus
 - Preventing transmission of the mutation to the next generation
 - Finding gene transfer methods for treating other genetic disorders, such as cystic fibrosis
2. Which one of the following statements regarding gene mapping is true?
- Most genes in the human genome have been mapped
 - Distance on a physical map is usually expressed in centiMorgans (cM)
 - Gene mapping can be used to show genetic heterogeneity within a disease
 - Short tandem repeat polymorphisms (STRPs) are useful markers for mapping because they are not polymorphic
3. In this diagram of HIV, what is the function of the structure indicated by the arrow?
- 
- Protects the bacterial cell
 - Carries the genetic information
 - Protects the nucleic acid
 - Binds to host cell
4. One aspect of genetic engineering involves the modification of proteins to improve their function. Which statement would not be a logical goal for researchers in this field?
- Increase the hydrophobicity of a protein so that it will function in the aqueous environment of the cells cytoplasm
 - Improve the binding of a specific substrate to an enzyme
 - Modification of an enzyme active site to increase the rate of catalysis
 - Increase the stability of a protein so that it may function at a higher temperature
 - Change the amino acid content of the protein to improve its value as a more nutritious food for animals or humans

5. SQUID (Super-conducting Quantum Interference Device) is helpful in the study of
- electrical potential of different part of brain
 - electrical potential of different part of heart
 - weak magnetic fields in different parts of brain
 - weak magnetic fields in different parts of heart
6. Suppose a product is developed to cure cystic fibrosis. Many people want this produced immediately. Who do you propose the science community will test this product on first?
- An eight years old child with severe cystic fibrosis
 - A mildly effected 28 years old mother with a two years old child
 - A 28 years old man, with severed scared lungs and plugged digestive tubes
 - A newly diagnosed baby with mild symptoms
7. Microorganisms commonly causing diarrhoeal diseases are
- Escherichia coli*, *Shigella* species, *Campylobacter* and *Bacillus pertussis*
 - Clostridium tetani*, *Giardia*, *Entamoeba histolytica*, *Salmonella*, *Shigella* and *Escherichia coli*
 - Escherichia coli*, *Giardia*, *Shigella*, *Campylobacter* and *Salmonella*
 - Neisseria*, *Treponema*, *Escherichia*, *Giardia*, *Shigella*, *Campylobacter* and *Salmonella*
8. Which statement about genetically modified (GM) foods is false?
- Scientists have used genetic modification, in various forms, as a means of improving crop yields, crop quality, and pest resistance for many years
 - Genetic modification includes products made by artificial mutagenesis and by non-natural crosses between unrelated species
 - A major difficulty in labelling foods as 'GM-free' is that it is virtually impossible to measure genetically modified DNA or protein molecules in most food made from GM crops
 - The recent decision by McCain Foods to stop processing GM potatoes means that they will eventually use less pesticides to produce the potatoes that are required to make fries
 - A major environmental concern with GM crops is that engineered genes will escape into the environment, resulting in the origin of 'superweeds' (aggressive undersirable plant species)
9. Efforts to repeat the cloning of Dolly (the sheep) have been unsuccessful. The scientists who claim to have cloned Dolly have been challenged to produce additional evidence that Dolly is really derived from an adult cell (as originally claimed), rather than a foetal cell which might have contaminated the experiment (as the sceptics suggest). Which of the following could provide evidence that Dolly was created from an adult cell, rather than a foetal cell?
- Dolly's DNA fingerprints
 - The heterozygosity of random pieces of Dolly's DNA
 - The melting point of Dolly's DNA
 - The length of Dolly's telomeres
 - Dolly's biological clock
10. You are moving to Africa and you have heard that the green fever virus disease is common there. Before you leave, you visit your doctor for advice. Which of the following is your doctor most likely to recommend? You should
- take a large supply of antibiotics with you
 - wash your food in an antiseptic before you eat it
 - get vaccinated against the disease
 - not worry as viruses only cause diseases in plants
 - get regular blood tests which will use the light microscope to look for virus particles
11. In Canada, recent outbreaks of meningitis, caused by a virus, were controlled by immunization with a vaccine. Unfortunately, AIDS caused by the HIV virus has not yet been controlled by a vaccine because of the
- cost of development and production of vaccines
 - availability of effective antibiotics
 - high degree of variability in the HIV virus
 - complex structure of the HIV virus
 - lack of antigenic proteins on the HIV virus
12. Which statement is correct?
- Appendicitis can lead to the condition known as peritonitis, in which parts of the liver are destroyed
 - Heartburn is caused by the acidic contents of the stomach escaping into the thoracic cavity
 - Hepatitis is a condition where there are insufficient bile salts to dissolve cholesterol; the cholesterol then forms large crystals