

**DR. A.G. ARIJO**

[www.preparationforetest.weebly.com](http://www.preparationforetest.weebly.com)

# BIOTECHNOLOGY



**DR. A. G. ARIJO**

**THIS INCLUDES**

Quick Review  
Practice sheets  
Answer keys

## DR. A.G. ARIJO

**Amniocentesis:** A diagnostic procedure in which a small amount of amniotic fluid is withdrawn from the amniotic sac to detect the genetic abnormalities.

**Adenovirus:** A vector system that is used in gene therapy (especially for genes that you want to be active in the lungs).

**Agrobacterium:** a type of soil-inhabiting bacteria that is capable of introducing DNA from plasmids in the bacteria into the genome of plant cells. Often used in genetic transformation of plants.

**Allele:** one of several alternate forms (DNA sequences) that resides at the same locus on the chromosome and controls the same phenotype (although with potentially differing effects).

**Amino acid:** a building block of proteins. Each protein consists of a specific sequence of amino acids (with the sequence of amino acids determined by the sequence of the underlying DNA). There are 20 types of amino acid molecules that make up proteins.

**Antibody:** a type of protein, produced by certain blood cells in mammals and birds, that specifically recognize a foreign antigen.

**Antibiotic:** a chemical substance that can kill or inhibit the growth of a microorganism.

**Antigen:** a molecule, usually a protein or polysaccharide (sugar) that induces the production of specific antibodies against itself. Molecules on the surfaces of viruses and bacteria are antigens.

**Beta galactosidase:** A protein that metabolizes the sugar, lactose, into two smaller sugar molecules. Used with a chromogenic analog of lactose, beta galactosidase can be used as a reporter gene to confirm the presence/expression of a transformation experiment.

**Biodegradation:** the process whereby a compound is decomposed by natural biological activity.

**cDNA (complementary DNA):** a single-stranded DNA molecule which is complementary to a specific RNA molecule and synthesized from it. Complementary DNA's are important laboratory tools as DNA probes and for isolating and studying individual genes.

**Chromosome:** a condensed structure found in the cell nucleus that contains the genes of that cell. Chromosomes are composed of DNA wrapped in proteins. They can be seen with a microscope during certain stages of cell division, when they appear as rod-like structures.

**Cloning:** asexually producing multiple copies of genetically identical cells or organisms descended from a common ancestor (compare with gene cloning).

**Codon:** a triplet of nucleotides in a DNA or RNA molecule that codes for one of the 20 amino acids in proteins, or for a signal to start or stop protein production. Each gene that codes for protein is a series of codons that gives the instructions for building that protein.

# DR. A.G. ARIJO

**Complementary:** the opposite or "mirror" image of a DNA sequence. A complementary DNA sequence has an "A" for every "T" and a "C" for every "G". Two complementary strands of single stranded DNA will join to form a double-stranded molecule.

**DNA (deoxyribonucleic acid):** the substance of heredity; a long linear molecule composed of deoxyribose (a sugar), phosphate, and one of four bases, adenine (A), thymine (T), guanine (G) and cytosine (C). DNA contains the genetic information necessary for the duplication of cells and for the production of proteins. In its native state, DNA is a double helix composed of two complementary strands.

**DNA probe:** a single-stranded DNA molecule used in laboratory experiments to detect the presence of a complementary sequence among a mixture of other single-stranded DNA molecules (same as Gene Probe).

**DNA profile:** the distinctive pattern of DNA restriction fragments or PCR products that can be used to identify, with great certainty, any person, biological sample from a person, or organism from the environment.

**DNA sequencing:** determining the order of nucleotides in a specific DNA molecule.

**Dominant:** a phenotype that is expressed in organisms that are either homozygous or heterozygous for the corresponding allele.

**Electrophoresis:** a method of separating substances, such as DNA fragments, by using an electric field to make them move through a "gel" at rates that correspond to their electric charge and size.

**Embryo transfer:** implantation of an embryo into the oviduct or uterus.

**Enzyme:** A functional protein that catalyzes (speeds up) a chemical reaction. Enzymes control the rate of metabolic processes in an organism; they are also the active agents in the fermentation process.

**Fermentation:** The biochemical process of converting a raw material (such as glucose, a sugar) into a final product (such as ethanol)

**Functional genomics:** the field of study that attempts to determine the function of all genes (and gene products) largely based on knowing the entire DNA sequence of an organism.

**Gene:** the fundamental unit of heredity; a bundle of information for a specific biological structure or function.

**Gene cloning:** isolating a gene and making many copies of it by inserting the DNA sequence into a vector, then into a cell, and allowing the cell to reproduce and make many copies of the gene.

**Gene library:** a collection of DNA fragments (carried on vector molecules) which, taken together, represents the total DNA of a certain cell type or organism.

**Gene mapping:** determining the relative locations of different genes on a chromosome.

# DR. A.G. ARIJO

In the process, genetic markers located at or near important genes are identified.

**Gene regulation:** process of controlling the synthesis or suppression of gene products in specific cells or tissues.

**Gene splicing:** joining pieces of DNA from different sources using recombinant DNA technology.

**Gene therapy:** introducing a normal, functioning copy of a gene into a cell in which that gene is defective.

**Genetic code:** the language in which DNA's instructions are written. The code consists of triplets of nucleotides (codons), with each triplet corresponding to one amino acid in a protein structure or to a signal to start or stop protein production.

**Genetic engineering:** the manipulation of genes, composed of DNA, to create heritable changes in biological organisms and products that are useful to people, living things, or the environment.

**Genetic erosion:** the loss of genetic diversity caused by either natural or man-made processes.

**Genetic pollution:** uncontrolled escape of genetic information (frequently referring to products of genetic engineering) into the genomes of organisms in the environment where those genes never existed before.

**Genome:** the complete genetic repertoire of an organism.

**Genomics:** the field of study that seeks to understand the structure and function of all genes in an organism based on knowing the organism's entire DNA sequence and extensive reliance on powerful computer technologies.

**Genotype:** The specific combination of alleles present at a single locus in the genome.

**Germ cells:** the sex cell(s) of an organism (sperm or egg, pollen or ovum). They differ from other cells (somatic) in that they contain only half the usual number of chromosomes. Germ cells fuse during fertilization to begin the next generation.

**Germplasm:** the sum total of all hereditary material in a single (interbreeding) species.

**Green Revolution:** an aggressive effort between 1950 and 1975 where agricultural scientists applied modern principles of genetics and breeding to improve crops grown primarily in less-developed countries.

**Hemoglobin:** a very well-characterized protein that carries oxygen within the blood of animals.

**Herbicide:** a chemical compound that kills targeted plants (weeds).

**Heterozygous:** situation where the two alleles at a specific genetic locus are not the same.

## DR. A.G. ARIJO

**Homologous:** stretches of DNA that are very similar in sequence, so similar that they tend to stick together in hybridization experiments. Homologous can also be used to indicate related genes in separate organisms controlling similar phenotypes.

**Homozygous:** situation where the two alleles at a specific genetic locus are identical to one another

**Hybridization:** bringing complementary single strands of nucleic acids together so that they stick and form a double strand. Hybridization is used in conjunction with DNA and RNA probes to detect the presence or absence of specific complementary nucleic acid sequences.

***In vitro*:** outside the living organism; in a test tube.

***In vitro fertilization*:** fertilizing an animal egg with sperm in a test tube or culture dish (not in the uterus or oviduct), and then implanting the fertilized egg back into the uterus or oviduct.

***In vivo*:** within the living organism

**Locus:** the position on a chromosome where the gene for a particular trait resides; a locus may be occupied by any one of several alleles (variants) for a given gene.

**Marker:** a detectable genetic variant, such as one of the ABO blood types, antibiotic resistance, or different DNA fragment patterns. Markers located near genes of interest can be used to deduce the presence or absence of deleterious genes; other markers can be used to detect the presence of an organism in the environment.

**Messenger RNA (mRNA):** the ribonucleic acid molecule that transmits the genetic information from the nucleus to the cytoplasm, where it directs protein synthesis.

**Microarray:** a large set of cloned DNA molecules spotted onto a solid matrix (such as a microscope slide) for use in probing a biological sample to determine gene expression, marker pattern or nucleotide sequence of DNA/RNA. See also **DNA Chip**.

**Mineralization:** the conversion of organic compounds into inorganic (mineral) ones. For example, the conversion of an organic solvent, like ethanol, into carbon dioxide (CO<sub>2</sub>) and water (H<sub>2</sub>O).

**Monoclonal antibodies:** antibodies derived from a single source or clone of cells, all recognizing only one kind of antigen.

**Mutation:** a permanent change in the genetic material involving either a physical alteration in the chromosome or a biochemical change in the underlying DNA molecule.

**Pathogen:** a specific biological causative agent of disease in plants or animals.

**Phenotype:** a biological characteristic or trait possessed by an organism that results from the expression of a specific gene.

**Plasmid:** a small, self-replicating molecule of DNA that is separate from the main chromosome. Because plasmids are easily moved from cell to cell or to the test tube,

## DR. A.G. ARIJO

scientists often cleave them with restriction enzymes and insert foreign DNA, and then transfer the recombinant DNA plasmid molecule (as a vector) into other cells.

**Polymer:** a chemical compound or mixture of compounds formed by polymerization and consisting of repeating structural sub-units.

**Polymerase Chain Reaction (PCR):** a technique to amplify a specific DNA sequence *in vitro* using a DNA replicating enzyme, specific oligonucleotide primers, and repeated cycles of heating and cooling. PCR often amplifies the starting material many thousands or millions of times.

**Recessive:** a phenotype that is expressed in organisms only if it is homozygous for the corresponding allele.

**Recombinant DNA:** a hybrid DNA molecule produced in the laboratory by joining pieces of DNA from different sources.

**Restriction enzyme:** an enzyme that recognizes a specific nucleotide base sequence (usually four to six base pairs in length) in a double stranded DNA molecule and cuts both strands of the DNA molecule at every place where this sequence occurs.

**Restriction fragment length polymorphism (RFLP):** the presence of two or more variants in the size of DNA fragments produced by a restriction enzyme. These different sized fragments result from an inherited variation in the presence of a restriction enzyme's target sequence. RFLP's are used for gene mapping and DNA profiling.

**Retrovirus:** a type of virus that can insert its DNA into the genome of its host cell. This ability has been used as a basis for genetic transformation of animal cells.

**Rhizobium:** the group of bacteria that form symbiotic associations with legume plants and are responsible for fixing atmospheric nitrogen into a form that can be used by plants and animals.

**Screening:** a method to identify specific cells (or clones of cells) expressing a specific phenotype (trait), such as the ability to turn "blue-gal" into a bluish color.

**Sequence tandem repeat:** A highly polymorphic region of DNA that can be used to produce a unique DNA profile for a given individual.

**Somatic cell:** cells in the body that are not involved in sexual reproduction (that is, not germ cells).

**Stem Cells:** Self-renewing cells that with proper growth conditions can be made to differentiate into a number of different cell types with specific biological functions.

**Tissue culture:** growing cells, tissues, or tissue fragments (from complex, multicellular organisms) on a nutrient medium in a dish, test tube, or flask.

**Totipotent:** a cell that is capable of regenerating an entire adult organism by itself.

**Totipotent Cells:** Cells from the Inner-cell mass that can give rise to a complete individual.

## DR. A.G. ARIJO

**Transcription:** the transfer of information from specific sequences in a DNA molecule to produce new strands of messenger RNA, which then carry this information from the nucleus to the cytoplasm (where the messenger RNA is translated into protein).

**Transformation:** introduction of an exogenous DNA molecule into a cell, causing it to acquire a new phenotype (trait).

**Transgenic:** an organism that has been transformed with a foreign DNA sequence.

**Translation:** synthesis of protein using information contained in a messenger RNA molecule.

**Vaccine:** a preparation of killed or living attenuated microorganisms or part thereof, that are administered to a person or animal to produce artificial immunity to a particular disease.

**Vector:** a type of DNA molecule, usually a plasmid or virus that is used to move recombinant DNA molecules from one cell to another.

**BGH:** Bovine Growth Hormone which has been artificially introduced into various animals to improve productivity.

**Nutra Sweet:** Genetically engineered bacteria which are used to produce phenylalanine, an organic compound to make a sweetener called Nutra sweet.

**SCID:** Sever combined immunity deficiency disease. A kind of genetic problem in which gene becomes mutant and can not produce Adenosine Diamanase enzyme. In absence of this enzyme, bone marrow can not produce WBCs which is why immune power of body decreases.

**DNA finger printing:** A genetic technique which is used to collect individual's genetic information.

**Cystic Fibrosis:** A genetic disorder in which lungs become susceptible to infection and digestive system can not absorb fats and minerals.

**Huntington's disease:** A kind of genetic disorder in which victim looses volunteer control over muscles. The diseases usually appear at 40-50 years.

# DR. A.G. ARIJO

## PRACTICE SHEET

1. Animals are not yet being genetically engineered.  
(A) True  
(B) **false**
2. Gene therapy replaces defective genes with healthy genes.  
**(A) True**  
(B) false
3. DNA polymerase starts the replication process.  
**(a) true**  
(b) false
4. It is not possible to alter the genotype in plants and animals.  
(a) True  
(b) **false**
5. Polymerase chain reaction is nonspecific.  
(a) true  
(b) **false**
6. Clotting factor VIII treats hemophilia.  
**(a) true**  
(b) false
7. Atrial natriuretic factor treats cancer.  
**(a) true**  
(b) false
8. The polymerase chain reaction can create millions of copies of a single gene.  
**(a) true**  
(b) false
9. It is possible to make a mammalian gene that lacks introns.  
(a) true  
(b) **false**
10. Viruses are often the vector of choice for animal cells.  
(a) True  
(b) **false**
11. A vector is the means by which rDNA is introduced into a host cell.  
**(a) True**  
(b) false



## DR. A.G. ARIJO

12. In vivo gene therapy procedures use \_\_\_\_\_ to introduce genes directly into patients.

- a. viruses
- b. laboratory-grown cells
- c. synthetic carriers
- d. **all of the above**

13. During \_\_\_\_\_ therapy, cells are removed from a patient, treated, and returned to the patient.

- a. ex vivo
- b. **in vivo**
- c. in vitro
- d. any of the above

14. Bovine growth hormone has been used to produce larger \_\_\_\_\_.

- a. cows
- b. fishes
- c. pigs
- d. **all of the above**

15. PCR is used mainly to

- a. detect viral infections.
- b. **diagnose genetic disorders.**
- c. diagnose cancer.
- d. A.O.T

16. Because a DNA probe is single-stranded, it \_\_\_\_\_ a complementary DNA strand.

- a. seeks out
- b. **binds to**
- c. both a and b
- d. neither a or b

17. Transgenic organisms are organisms which

- a. have mutated genes.
- b. **have foreign genes inserted in them.**
- c. are free living organisms whose genes have been modified.
- d. all of the above.

18. PCR is carried out in order to

- a. identify the evolutionary relationship of organisms.
- b. determine the nucleotide sequence of human genes.
- c. conduct molecular paleontology (Study of fossils).
- d. **all of the above.**

## DR. A.G. ARIJO

19. After the primers bind by complementary base pairing to the DNA strand, the DNA polymerase copies the \_\_\_\_\_.

- a. target DNA
- b. **mRNA**
- c. rDNA
- d. none of the above

20. Vaccines for \_\_\_\_\_ are in experimental stages.

- a. Chlamydia
- b. malaria
- c. AIDS
- d. **all of the above**

21. Proteins produced by biotechnology include

- a. human growth hormone.
- b. insulin.
- c. Lectoferin
- d. **all of the above.**

22. Human lung surfactant treats \_\_\_\_\_ in premature infants.

- a. jaundice
- b. **respiratory distress syndrome**
- c. both a and b

23. Biotechnology is used to treat \_\_\_\_\_.

- a. diabetes
- b. hemophilia
- c. SCID
- d. **All of above**

24. The second enzyme needed for preparation of rDNA is DNA \_\_\_\_\_.

- a. ligase
- b. oxidase
- c. **transcriptase**
- d. none of the above

25. The introduction of foreign DNA into vector DNA to produce rDNA requires \_\_\_\_\_ enzyme(s).

- a. one
- b. **two**
- c. three
- d. four

26. Plasmids that are used as vectors

- a. **have been removed from bacteria.**
- b. have had a foreign gene inserted into them.
- c. both a and b.

## DR. A.G. ARIJO

d. neither a or b.

27. Genetically-engineered bacteria are also released into the environment to

- a. clean up pollutants.
- b. increase the fertility of the soil.
- c. kill insect pests.

**d. All**

28. Genetically-engineered bacterial products include

- a. drugs that promote human health.
- b. vaccines.
- c. nucleic acids for laboratory research.

**d. A.O.T.**

29. A protoplast is

- a. a plant cell that had the cell wall removed.**
- b. an animal cell that had the cell wall removed.
- c. both a and b.

30. DNA \_\_\_\_\_ is a cellular enzyme that a seal breaks on DNA molecules.

- a. transcriptase
- b. ligase**
- c. polymérase

NUMBER	CORRECT OPTION
10987654321	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

**DR. A.G. ARIJO**
