

Cheat Sheet

Chapter 20 Questions

1. What is DNA technology?
2. What is biotechnology?
3. What is nucleic acid hybridization?
4. What is genetic engineering?
5. What is DNA sequencing and what was the first automated procedure?
6. How do next generation sequencing techniques work?
7. What are techniques with a high rate of nucleotides sequenced per hour called?
8. What is third generation sequencing?
9. What is DNA cloning?
10. What are plasmids?
11. How does gene cloning work?
12. What is a cloning vector?
13. What are restriction enzymes (restriction endonucleases)?
14. What are sticky ends?
15. What is gel electrophoresis?
16. What is the polymerase chain reaction (PCR)?
17. What is an expression vector?
18. What is the addition of carbohydrate groups to proteins called?
19. What virus is used to insert recombinant DNA into mammalian and insect cells?
20. What is electroporation?
21. What bacteria is used to get DNA into plant cells?
22. What is a nucleic acid probe?
23. What is in situ hybridization?
24. What is reverse transcriptase polymerase chain reaction (RT-PCR)?
25. What is quantitative RT-PCR (qRT-PCR)?
26. What is the systems approach?
27. What are DNA microarray assays?
28. What is RNA sequencing (RNA-seq)?
29. What is in vitro mutagenesis?
30. What is the CRISPR-Cas9 system?
31. What is a gene drive?
32. How is RNAi used to silence genes?
33. What are genome-wide association studies?
34. What are polymorphisms?
35. What is a single nucleotide polymorphism (SNP, pronounced “snip”)?
36. What is a stem cell?
37. What does totipotent mean?
38. What is nuclear transplantation also known as and what is it?
39. What are *Rana pipiens* and *Xenopus laevis*?
40. Why are cloned animals prone to defects?

41. Where can pluripotent stem cells be derived from?
42. What is the difference between reproductive and therapeutic cloning?
43. What are induced pluripotent stem (iPS) cells?
44. What is a genetic profile?
45. What is gene therapy?
46. What causes one type of severe combined immunodeficiency (SCID)?
47. What is tyrosinemia?
48. What is eugenics?
49. What is imatinib (Gleevec)?
50. What is tissue plasminogen activator (TPA)?
51. What is a transgenic animal?
52. What is antithrombin?
53. What are short tandem repeats?
54. What are genetically modified organisms (GMOs)?
55. Which countries are the main growers of GM crops?

Chapter 20 Answers

1. Techniques for sequencing and manipulating DNA
2. Manipulation of organisms or their components
3. Base pairing of one strand of a nucleic acid to a complementary sequence from a different nucleic acid molecule
4. Direct manipulation of genes for practical purposes
5. Determination of nucleotide sequence of DNA molecule. DNA cut into fragments, each fragment sequenced. Dideoxyribonucleotide (dideoxy) chain termination sequencing, one strand of fragment used as template for synthesis of complementary fragments that are further analyzed
6. Fragments amplified to yield enormous number of identical fragments, specific strand of each fragment is immobilized, complementary strand synthesized one nucleotide at a time, electronic monitors identify which nucleotide is added (called sequencing by synthesis)
7. high-throughput
8. Newest methods, sometimes DNA not cut into fragments or amplified, single strand of DNA molecule passed through nanopore in a membrane, identify bases by the way each interrupts an electric current
9. Preparing well-defined segments of DNA in multiple identical copies
10. Small, circular DNA molecules that replicate separately from main genome (in bacteria)
11. Foreign DNA inserted into plasmid, which becomes a recombinant DNA molecule, plasmid returned to bacterial cell to form recombinant bacterium, which divides (gives plasmid to all of offspring)
12. DNA molecule that can carry foreign DNA into host cell and be replicated there
13. Enzymes that cut DNA molecules at specific locations (recognize short DNA sequence, or restriction site, and cut both DNA strands at precise points within site), methyl groups added to adenines or cytosines within restriction sites protects DNA from enzymes, cutting yields restriction fragments
14. Single-stranded ends of DNA fragments that have been cut in a staggered manner, with help of DNA ligase can be used to insert genes into plasmids
15. technique used to separate and visualize DNA fragments, gel made of polymer (e.g. polysaccharide agarose) used to separate mixture of nucleic acid fragments by length (anode, or positive electrode, draws negative DNA molecules from wells, larger molecules move slower through gel than smaller one)
16. technique for copying a desired gene; Heat denatures strands of DNA, which is cooled to allow annealing (hydrogen bonding) of single-stranded DNA primers. Heat-stable polymerase extends primers. Key to automating PCR was discovery of heat-stable *Taq* polymerase, named after *Thermus aquaticus*, a bacteria that lives in hot springs. Today, polymerase of archaea *Pyrococcus furiosus* used (called *Pfu*, more accurate, stable, and expensive than *Taq*)

17. Cloning vector that contains highly active bacterial promoter just upstream of restriction site where eukaryotic gene can be inserted in the correct reading frame
18. Glycosylation
19. baculovirus
20. Brief electrical pulse applied to solution containing cells, creates temporary holes in plasma membrane
21. soil bacteria *Agrobacterium tumefaciens*
22. Complementary molecule to specific mRNA, can either be RNA or DNA
23. Fluorescent nucleic acid probe solution added to embryos, marking mRNA molecules
24. Turns sample sets of mRNAs into double-stranded DNAs. Reverse transcriptase from a retrovirus synthesises complementary DNA of each mRNA. poly-dT (short complementary strand of thymine deoxyribonucleotides) added to poly-A tail, used as primer for synthesis of DNA strand. Second DNA strand constructed by DNA polymerase, double-stranded DNA result called complementary DNA (cDNA)
25. Enhancement that uses fluorescent dye that only fluoresces when bound to double-stranded PCR product, machine measures number of light flashes
26. Study of the expression of large groups of genes
27. microarray consists of tiny amounts of a large number of single-stranded DNA fragments representing different genes fixed to a glass slide in a tightly spaced array or dots (also called DNA chip). mRNAs reverse transcribed into cDNA, fluorescent label added to cDNA, cDNA binds to dots (shows what genes are expressed in certain cell)
28. Sequencing cDNA samples from different tissues/stages in order to discover what genes are expressed. mRNA samples are isolated, fragmented into relatively uniform fragments, converted into cDNAs. cDNAs are sequenced, computer program reassembles them
29. technique where specific mutations are introduced into a cloned gene, mutated gene returned to cell in a way that disables normal cellular copies of the gene. If mutation destroys function of gene product, mutant cell may reveal function of product
30. Cas9 is protein that helps defend bacteria from viral infection, acts together with "guide RNA" made from CRISPR region of bacterial system. Cas 9 is nuclease that cuts double-stranded DNA molecules, can cut any sequence to which it is directed (takes orders from guide RNA by binding it, cuts both DNA strands where genome is complementary to guide RNA)
31. Engineering new allele that is more highly favored in inheritance to get rid of bad alleles ("drives" new allele through population)
32. Synthetic double stranded RNA molecules matching the sequence of particular gene triggers breakdown of gene's mRNA or blocks its translation, quicker than CRISPR-Cas9 but reduction of gene expression is only temporary
33. large-scale analyses where researchers look for genetic markers (DNA sequences that vary in the population) to determine what gene is responsible for what
34. Variations in coding or noncoding DNA sequences among population

35. Single base-pair site where variation is found in at least 1% of the population. Although usually in noncoding regions (do not contribute to disease), are often inherited with certain diseases
36. A relatively unspecialized cell that can both reproduce indefinitely and differentiate into specialized cells of one or more types
37. Can give rise to all the specialized cells of the organism
38. somatic cell nuclear transfer, removes nucleus of egg (creating enucleated egg) and replace it with nucleus of differentiated cell
39. frogs that were experimented on with somatic cell nuclear transfer
40. Differentiated cells have methyl groups that are not correctly removed during cloning
41. Blastula stage, or blastocyst stage in humans, called embryonic stem (ES) cells, reproduce indefinitely, can differentiate into many different cell types
42. Purpose is to create new individuals , purpose is to generate ES cells to cure disease
43. Differentiated cells transformed into type of ES cell by using retrovirus that introduce extra, cloned copies of four “stem cell” master regulatory genes.
44. Set of genetic markers such as SNPs
45. Introduction of genes into an afflicted individual for therapeutic purposes.
46. Bone marrow cells do not produce vital enzyme
47. fatal human genetic disorder where liver metabolizes tyrosine
48. a deliberate effort to control the genetic makeup of human populations
49. Small molecule that inhibits one tyrosine kinase (overexpression of kinase, a result of a chromosomal translocation, causes chronic myelogenous leukemia (CML))
50. If administered shortly after heart attack, helps dissolve blood clots and reduces risks of subsequent heart attacks
51. Animal with a gene from a different individual, created when eggs removed from female of recipient species and is fertilized in vitro, cloned desired gene from donor injected directly into nuclei. Some cells integrate the DNA (the transgene) into genome
52. Human blood protein that prevents blood clots
53. Tandemly repeated units of two- to five-nucleotide sequences in specific regions of the genome. Number of repeats is highly variable, can be used to identify person whose DNA it is
54. Transgenic organisms, acquire one or more genes from another species by artificial measures
55. United States, Argentina, and Brazil (80% of acreage)