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CLADOGRAMS & PHYLOGENETIC TREES
Originally Created by Kim Foglia
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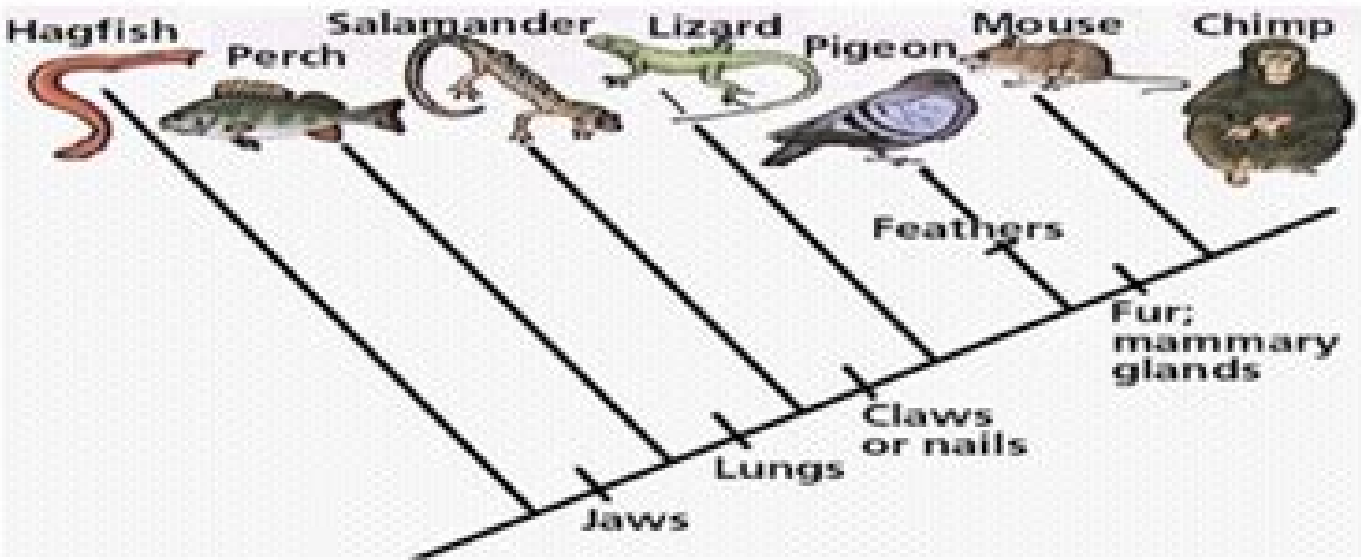
Please Note: Although you are encouraged to work as a table, each student will write up this lab individually in his/her lab notebook. The lab is due on Monday, 3/16. The lab write-up includes:

- Title
- Parts A-D
 - Complete tables, construct diagrams, answer questions as directed
 - Please note: Complete sentences are not required for Parts A-D.
- Lab Analysis
 - Complete sentences required

Introduction
Cladistics is the study of evolutionary classification. Cladograms show evolutionary relationships among organisms. Comparative morphology investigates characteristics for homology and analogy to determine which organisms share a recent common ancestor. A cladogram will begin by grouping organisms based on a characteristic displayed by **all** the members of the group. Subsequently, the larger group will contain increasingly smaller groups that **share the traits** of the groups before them. However, they also exhibit distinct changes as the new species evolve. Further, molecular evidence from genes which rarely mutate can provide molecular clocks that tell us how long ago organisms diverged, unlocking the secrets of organisms that may have similar convergent morphology but do not share a common recent ancestor.

Part A - Cladogram Analysis

Refer to the following cladogram to answer the questions below in your lab notebook.



1. Which organisms in the cladogram have fur and mammary glands?
2. Which organisms in the cladogram have jaws?
3. Based on the cladogram, which shared a common ancestor most recently ... a mouse & a lizard or a mouse & a perch?
4. Which two organisms would you expect to have a closer matching DNA sequence for a gene that is not under selective pressure in nature ... hagfish & pigeon or hagfish & salamander?

Another Example:

Characters	Sponge	Jellyfish	Flatworm	Earth-worm	Snail	Fruit fly	Starfish	Human
Cells with flagella	X	X	X	X	X	X	X	X
Symmetry		X	X	X	X	X	X	X
Bilateral symmetry			X	X	X	X	X	X
Mesoderm				X	X	X	X	X
Head develops first				X	X	X		
Anus develops first							X	X
Segmented body				X		X		
Calcified shell					X			
Chitinous Exoskeleton						X		
Water Vascular system							X	
Vertebrae								X

How to Make a Cladogram

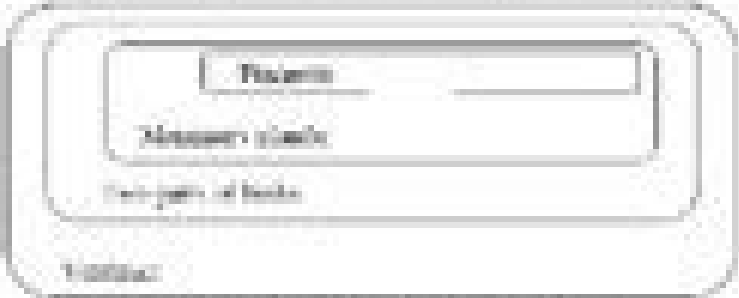
Objectives: The student will learn how a cladogram illustrates an evolutionary hypothesis and makes predictions about evolutionary events. (i.e. the scientist method). The student will learn how cladograms depict relationships between taxa and represent a "family tree" of life. The student will learn how to construct a cladogram from morphological data.

Background:
Cladograms are diagrams which depict the relationships between different groups of taxa called "clades". By depicting these relationships, cladograms reconstruct the evolutionary history (phylogeny) of the taxa. **Cladograms** can also be called "phylogenies" or "trees". Cladograms are constructed by grouping organisms together based on their shared derived characteristics.

Example:
1. Given these characters and taxa:

	Taxa			
Character	Human	Frog	Snake	Mouse
Two pairs of limbs	x	x	x	x
Mammary glands			x	x
Pharynx				x

2. Draw a Venn diagram. Start with the character that is shared by all the taxa on the outside. Inside each box, write the taxa that have only that set of characters.



3. Convert the Venn diagram into a cladogram like so:

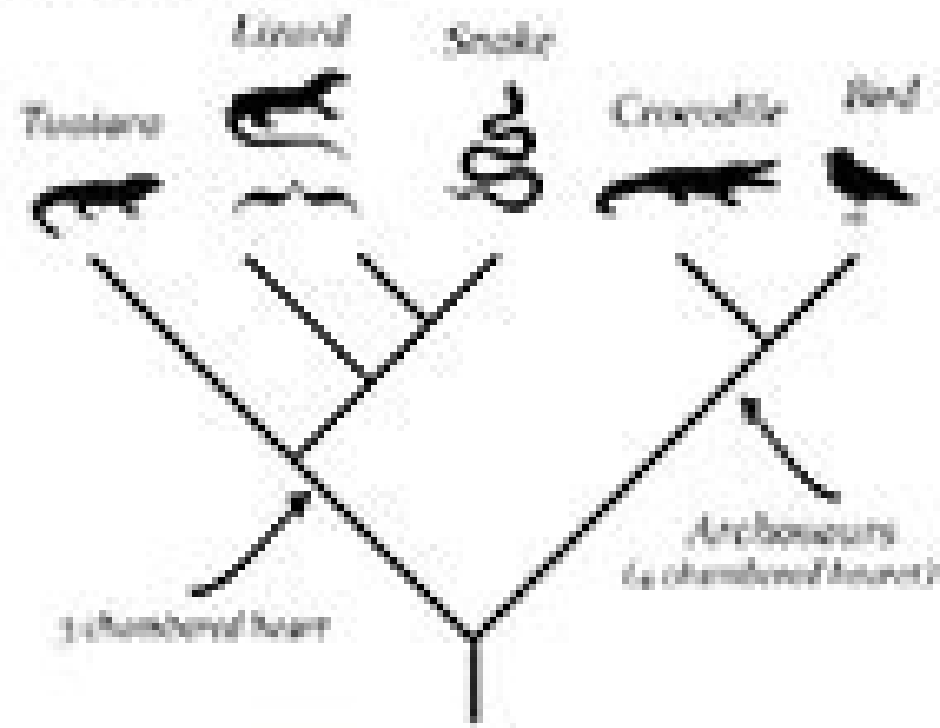


Name _____ Pd. _____ Date: _____

What is a Cladogram?

A cladogram is a diagram that shows relationships between species. These relationships are based on observable physical characteristics. Cladograms show the relationships in a graphic that looks like a tree, with branches connected to a common ancestry. Each branch represents a new distinct trait that was not seen in the group lower on the tree. These distinct traits are called derived characteristics.

The groups on the diagram are organized into clades, each clade shares distinct traits. For example, in the cladogram shown, birds and crocodiles are grouped into a clade called archosaurs, which share characteristics such as a 4 chambered heart and socketed teeth.



1) Examine the cladogram above and suggest a trait that lizards and snakes share, but is not shared by individuals of other groups.

Activity 1: Create an Animal Cladogram

2) For each animal shown, list as many characteristics as you can. You can also include traits that aren't apparent from the photo, such as reproductive strategies or unique behaviors. Try to come up with traits that are shared by multiple animals and at least one trait that is unique for each animal.





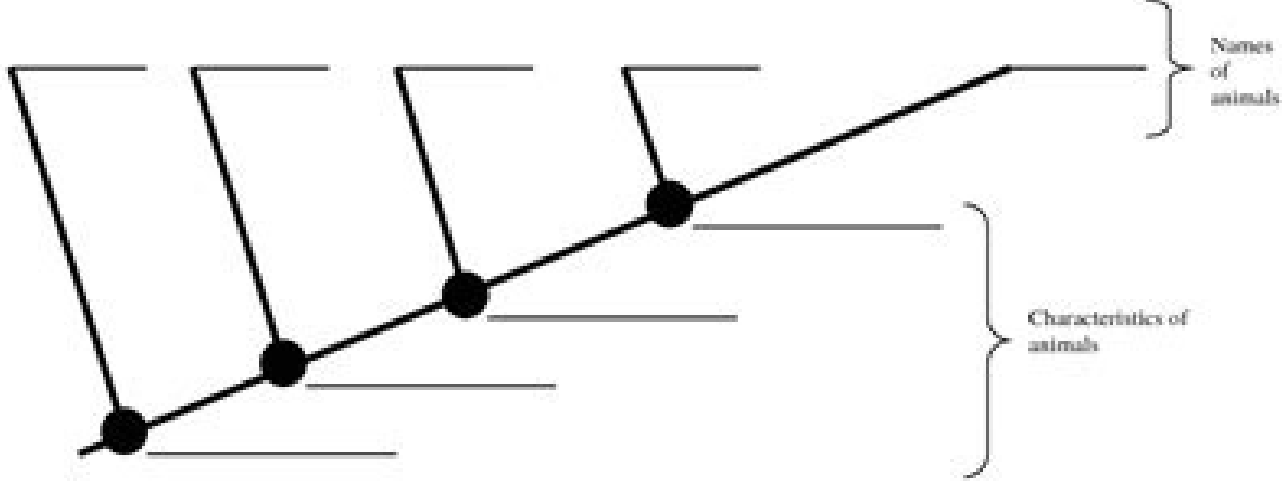
Life's Family Tree Name: _____

Part 1: Complete the Cladogram - (reference online activity 15-4 "build a cladogram" - <http://www.personaluniversity.com/napapp/Text/20040503-15-115075-80index.html> to complete the chart below).

Derived characters	Monkey	Bony Fish	Lizard	Shark	Kangaroo
Lungs					
Vertebral column					
Placenta					
Bony skeleton					
Hair					

a) Is the information in the cladogram above based on fossils, anatomy, molecular biology, or embryology?

Part 2: Make a Phylogeny – Use the information from the cladogram above to complete the phylogeny below.



- a) Where on this "evolutionary tree" would you include humans?
- b) Which characteristic is the most "primitive" versus one which is most "derived?"

It is standard practice to screen embryos in order to select only healthy embryos to implant into the mother. A cladogram showing bats, sharks, and dolphins, for example, would take into account their skeletal structures and other characteristics, such as the fact that bats and dolphins are mammals (see Figure 5.17). In order to be approved, various safeguards have been put DoinChallenge yourself exercises 5 and 6, place to prevent this potato from mixing with conventional potato plants. telophase I Figure 3.17 The stages of meiosis I. This method is very labour intensive because it is done one protoplast at a time. ● ● Applications and skills: Application: Rosalind Franklin and Maurice Wilkin's investigation of DNA by X-ray diffraction. With two alleles, three different genotypes are possible, which can produce two different phenotypes. 15 Individual neurones do not send action potentials with different 'strengths'. For example, a gene can be introduced to make soybeans resistant to the herbicide glyphosate. CHALLENGE YOURSELF 41 Look at the diagram of the gene therapy for SCID (Figure 13.36) and learn the steps. A positive feedback loop leads to further increases in temperatures over time; warmer temperatures more carbon dioxide even warmer temperatures even more carbon dioxide, and so on. Organizational structure Table 7.6 The organizational structure of proteins Cause Primary A sequence of 20 possible amino acids to produce a polypeptide chain. This is the first step of repolarization because it separates many of the sodium and potassium ions on different sides of the membrane. As you recall, the surface area where oxygen and carbon dioxide is exchanged is between the small air sacs (alveoli) and capillary beds. • Construct a similar graph showing volume percentage change. Make sure you understand where the back of the eye is, and the direction from which the light is coming. Biologists use the term trophic level to indicate how many organisms the energy has flowed through. A detailed explanation of cell parts and their functions will then follow. Be sure to memorize the following: (1) overproduction of offspring; (2) variation within the population, as a result of meiosis, sexual reproduction, and mutations; (3) struggle for survival, because there are not enough resources for all members of the population; (4) differential survival, those individuals best fit for their environment tend to survive better; and (5) reproduction, those who survive can pass on their genes to the next generation. 587 13 Option B: Biotechnology and bioinformatics Production of biogas in a small-scale fermenter barb fitting ball valve vinyl tubing T-adapter copper tube cork Figure 13.8 Production Mylar balloon of biogas in a small-scale fermenter. This creates an even larger surface area for water and mineral ion absorption. 19 What is an example of a negative feedback loop in the menstrual cycle? Research on how drugs affect the brain has allowed medications to be developed that improve the lives of people with biochemical imbalances. Here are three examples of food chains from three different ecosystems. However, scientists studying shore crabs now have a new hypothesis. Nerve cells communicate with each other using molecules. 430 To help you decide whether or not a trait shows continuous variation, imagine a questionnaire to record phenotypes. 5 Using what you know about the functions of life, explain why the paramecia moved in the ways you observed. The two cell types largely involved in water transport are tracheids and vessel elements (see the photo). True electricity is a flow of electrons down a conductor; this is not the nature of an action potential. The developing spermatozoa need nutrients during this period of differentiation, and thus each remains attached to cells in the seminiferous tubules known as Sertoli cells. Instead, an enzyme called RNA polymerase separates the two DNA strands. • Gathering data from fishermen: data should be gathered from several sources to cross-check the fishermen's individual data. 100 soybean cotton NATURE OF SCIENCE Are the risks worth it? Once RNA polymerase has attached to the promoter region for a particular gene, the process of transcription begins. As practice, find the standard deviation of each raw data set above before you read on. Because hypertension typically develops over a period of years, it is best to monitor your blood pressure regularly and look for any increasing trend. Polyploidy refers to the situation in which a cell contains three or more sets of chromosomes (3n, 4n, and so on): • 3n = triploid • 4n = tetraploid • 5n = pentaploid. A portion of the placenta is shown on the left, with the umbilical blood vessels within the umbilical cord stretching from the placenta to the embryo. Techniques such as gene transfer and cloning have sparked heated debates. Try identifying the organisms shown opposite using the key in the following example. Anton van Leeuwenhoek, also Dutch, greatly improved the Jansen compound microscope in the 1600s. The folding of the cerebral cortex during development of the human embryo takes place during the last 3 months of development. • Arthropoda: this phylum includes insects, spiders, and crustaceans, among others. Should we therefore conclude that small birds, whose brains are comparatively larger in relation to their size compared with larger animals, are more intelligent than humans? Hopefully, you have begun to view all sciences as a process, or perhaps a way of 'knowing'. 6 Write the word equation for the condensation reactions that would produce a triglyceride lipid from its four molecular subcomponents. ● There is a delay between the arrival and passing on of a stimulus at the atrioventricular node. Another example is that a giraffe's neck is well adapted for reaching leaves high up in trees. • The transgene is the target gene (for example the gene for resistance to glyphosate). Series B, Biological Sciences, 166 (1002), pp. 1 2 3 donor mother 4 udder cell unfertilized egg 5 6 7 remove nucleus cultured udder cells fused with electrical current From the original donor sheep to be cloned, a somatic cell (non-gamete cell) from the udder was collected and cultured. ● ● 156 Guidance ● Students should be able to deduce whether or not a man could be the father of a child from the pattern of bands on a DNA profile. • Scroll down to PUBMED. 3 Compare and contrast Gram-negative and Gram-positive bacteria. Most animals have to move, which requires much more energy than a stationary plant needs. The differences are most likely due to chance. When the atria are in diastole and the ventricles are in systole left atrium 3 75 left semilunar valve closed 3 left atrioventricular valve closed 15 'Early' ventricular systole left atrioventricular valve closed 120 left semilunar valve open 125 Figure 6.10 Blood pressure readings in mm Hg at early and late ventricular systole. Should we believe everything they say? Some mucous membrane tissue is lined with cilia. For example, the abdominal muscles and intercostal muscles achieve a greater initial thoracic volume. When a chamber is not undergoing systole, the cardiac muscle of the chamber is relaxed. It is a very complex series of chemical reactions, most of which occur in the mitochondrion. ● Differentiation involves the expression of some genes and not others in a cell's genome. Please don't memorize this. Research and explain the difference between thin layer chromatography and paper chromatography. What criteria are used to determine whether these criticisms are valid or not? Table 9.4 A comparison of monocots and dicots Monocots Based on phylogeny (evolutionary history), many biologists are now using three groups of angiosperms: • the magnoliid complex (magnolias and laurels) • the monocots • the eudicots (true dicots). Some countries require detailed lists of important information, such as fat content, fat type, calories per serving, etc., while other countries have no requirements at all. This image shows myosin with 'heads' on both sides. A TEM of a cell from the mesophyll region of a leaf. • Identify and count the number of individuals of the chosen species found inside the borders An example of an easily identifiable plant to use for the fieldwork lab; in this case the plant is yarrow. One way to release the chemical energy from organic compounds is to digest the food, another way is to burn it. Its effect is to modulate the activity of GABA, which is the main inhibitory neurotransmitter. Steroid hormones do enter the target cell and bind to a receptor protein in the cytoplasm, whereas peptide hormones interact with a receptor protein on the outside of the plasma membrane of a target cell. long wavelength energy 205 04 Ecology How greenhouse gases heat the atmosphere If Earth had no atmosphere, the heat radiating from low albedo objects on its surface would simply radiate back into space, and at night we would see temperatures plunge to ones similar to the extremely cold temperatures on the Moon. One objective of science fiction as an art form is to warn society of what might happen in the future if we are not careful. Either the taxon can be moved up or down the hierarchy (family to subfamily, for example), or from one family to another. The leaves are usually source regions because they are the major organs of photosynthesis. Amphibians (b) Can produce an amnion Experts in various fields of study use this idea of accumulated change over time. However, the final evidence involving enzymes and fragments was published by a team that included Rejii Okazaki and Tsuneko Okazaki. Both the left and right sides of the heart work synchronously as a double pump. Is it based on well-substantiated facts? PCR is a way of ensuring that enough DNA for analysis can be generated. Notice the difference in the number of resistant rats before the first pesticide application and after the application. 343-344
(Roman C, Muhlbauer and Feng Li 1999), Copyright 1999. Researchers already knew that input from the right visual field is received by the left hemisphere, and input from the left visual field is received by the right hemisphere. The idea of cloning often provokes strong negative reactions from people, especially when the only information they have comes from science fiction or horror films. The study is ongoing, but the early results are promising. There comes a tipping point beyond which the differences outweigh the similarities and the two populations in question can no longer freely reproduce together. • Proteins travel out of the nucleus and modify the shape of the synapse. The result is a 6-carbon compound called citrate. If oxygen is present, pyruvate enters the mitochondria and aerobic respiration occurs. In 2009 swine flu, or influenza A, caused a global pandemic. Some endocrine glands occur in pairs, such as the adrenal glands (see Figure 15.15), and some are singular glands, such as the pancreas. Students should understand that there is a continuous but variable supply of energy in the form of sunlight but that the supply of nutrients in an ecosystem is finite and limited. If there has been a significant enough difference in two separated populations and they can no longer interbreed, a speciation has occurred. In theory, that means that any two dogs from anywhere in the world can mate and have puppies that will grow up and be able to mate with any other dogs, and have more puppies. We have not measured all the metals there are in the world to see if they expand. • Two pyruvate molecules are present at the end of the pathway. Animal models respond in similar ways to humans when addicted. This reduces the surface tension of the moist inner surface of alveoli, and prevents the sides of the alveoli from sticking to each other. • Transferrin is attached to a luminescent quantum rod. Genetic modification can be used to overcome environmental resistance to increase crop yields. Look at the graph and answer the questions. CHALLENGE YOURSELF Use Figure 13.32 to review what you have learned about analysis of microarrays. • Diastolic pressure: the bottom number measures the pressure in the arteries when the heart muscle is resting and refilling with blood. It is so natural to us that we don't even think about it unless, for some reason, we are without it. For example, during exercise, your heart rate cannot increase or return to its resting heart rate without the nervous system and the circulatory system interacting. • They are characteristically small in size, usually between 1 and 10 µm. 297 06 Once a company has freely admitted that its product is a risk to a consumer's health, does that admission eliminate the liability of that company in situations where the product does lead to poor health? Summary of photosynthesis In summary, the process of photosynthesis includes the light-dependent and the light-independent reactions. A computer keeps track of where each human gene is located on the plate. Genotype - The symbolic representation of the pair of alleles possessed by an organism, typically represented by two letters. As long as our skin remains intact, we are protected from most pathogens that can enter living tissues. 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It transfers its polypeptide chain to the new tRNA, which moves into the now exposed A site. • The zone of elongation is where cells are enlarging in size, corresponding with the G1 phase of the cell cycle. Or have you ever watched a video recording of something you experienced and thought to yourself, 'That's funny, I don't remember it being like that: my memory of that event is very different'. ● Application: Evaluation of evidence and the methods used to obtain the evidence for health claims made about lipids. Angelman's syndrome is diagnosed from well-recognized abnormal patterns on an electroencephalogram (EEG). (Total 4 marks) Answers Full answers to all exercises and practice questions can be found in the eBook. Two electrons are required to reduce NADP+ fully to NADPH. Is it fair to compare heights of humans from different parts of the world? 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...the failure to control disease. Let's frog around showing cells dividing to form the 4-cell stage. Some evidence, it is clear that the hypothalamus plays an important role in regulating appetite. ...the hind in the stomach causes special cells, called hair cells, to vibrate. More important than the, the carcinogen enters the lungs in cigarette smoke. Let's consider what happens when there is a problem with the system. This intermediary molecule is called messenger RNA (mRNA). Z-line myosin Z-line Notice in the diagram of the sarcomere (Figure 11.9) that myosin fibres are relatively thick with head-like structures, and actin is relatively thin. If a sperm cell containing an X chromosome fertilizes an ovum, a female is produced. For some pathogens, such as bacteria, there are chemical called antibiotics that can work against the living bacterial cells but do not affect our body cells. 234 In the photo of plover eggs, the colours and speckles act as effective camouflage, making these eggs difficult to spot by predators. (b) In Figure 2.53, why does the denaturing of enzymes and other proteins at high temperatures dramatically lower the rate of photosynthesis? Although it is possible for some organisms to adapt to changes in their environment within their lifetimes, this is not the kind of adaptation referred to in evolution. Next, look at the organism to see if the particular characteristic described in the first line (a) is present in the organism. Hydrogen bonds link the two nitrogenous bases together: two hydrogen bonds link adenine and thymine; three hydrogen bonds link cytosine and guanine. Phagocytes typically contain many lysosomal organelles, in order to digest chemically whatever has been engulfed. The elongation phase Figure 7.15 A peptide bond, shown in red in this figure, forms when water is given off. Brazil and the USA have been innovators in this practice, and it is a way of cycling carbon that depletes fewer fossil fuel reserves. Nuclear envelopes form around each of the four haploid cells, preparing them for cytokinesis. The role of the small intestine in digestion and absorption As an example of what happens as ingested foods move through the small intestine, let's see how starch is digested and how its monomers are absorbed. 28 Optimal prey choice can increase chances of survival and thus the ability to pass on your genes. There is no compartmentalization within the cytoplasm because there are no organelles. The patient is a human ovary section. blind spot axons of ganglion cells ganglion cell layer bipolar cell layer rod cell cone cell layer 523 12 Option A: Neurobiology and behaviour cone cell ganglion cell back of the eye Figure 12.24 Structure and direction of light function of the retina. If glucose was being moved by facilitated diffusion, the highest percentage that could be reabsorbed would be 50% because the concentration gradient disappears once that percentage is reached. The medulla oblongata then sends impulses back to the glandular cells of the stomach to continue (and increase) production of HCl and pepsinogen. The bonding between single nucleotides to produce a long chain is controlled by specific enzymes. 6 7 8 She goes back to the doctor and gets the same antibiotic. Such materials are called radio markers. 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reproduction and reproduction 307 97 Nucleic acids 322 71 DNA structure and replication 325 2 Transcription and gene expression 334 7.3 Translation 339 08 Metabolism, cell respiration, and photosynthesis 350 8.1 Metabolism 351 8.2 Cell respiration 357 8.3 Photosynthesis 368 09 Plant biology 380 9.1 Transport in the xylem of plants 381 9.2 Phloem transport 382 9.3 Growth in plants 389 9.4 Reproduction in plants 403 10 Genetics and evolution 414 10.1 Meiosis 415 10.2 Inheritance 423 10.3 Gene pools and speciation 437 11 Animal physiology 450 11.1 Antibody production and vaccination 451 11.2 Movement 459 11.3 The kidney and osmoregulation 467 11.4 Sexual reproduction 479 12 Option A: Neurobiology and behaviour 494 2.1 Human development 496 4.2 The human brain 504 4.3 Perception of stimuli 521 4.4 Innate and learned behaviour 530 4.5 Neuropsychopharmacology 543 4.6 Ethology 560 v Contents 13 Option B: Biotechnology and bioinformatics 61 1 Microbiology: organisms in the environment 576 6.2 1.4 5.5 6.1 Microbiology: environmental protection 61 6.2 6.3 6.4 6.5 6.6 6.7 6.8 6.9 6.10 6.11 6.12 6.13 6.14 6.15 6.16 6.17 6.18 6.19 6.20 6.21 6.22 6.23 6.24 6.25 6.26 6.27 6.28 6.29 6.30 6.31 6.32 6.33 6.34 6.35 6.36 6.37 6.38 6.39 6.40 6.41 6.42 6.43 6.44 6.45 6.46 6.47 6.48 6.49 6.50 6.51 6.52 6.53 6.54 6.55 6.56 6.57 6.58 6.59 6.60 6.61 6.62 6.63 6.64 6.65 6.66 6.67 6.68 6.69 6.70 6.71 6.72 6.73 6.74 6.75 6.76 6.77 6.78 6.79 6.80 6.81 6.82 6.83 6.84 6.85 6.86 6.87 6.88 6.89 6.90 6.91 6.92 6.93 6.94 6.95 6.96 6.97 6.98 6.99 7.00 7.01 7.02 7.03 7.04 7.05 7.06 7.07 7.08 7.09 7.10 7.11 7.12 7.13 7.14 7.15 7.16 7.17 7.18 7.19 7.20 7.21 7.22 7.23 7.24 7.25 7.26 7.27 7.28 7.29 7.30 7.31 7.32 7.33 7.34 7.35 7.36 7.37 7.38 7.39 7.40 7.41 7.42 7.43 7.44 7.45 7.46 7.47 7.48 7.49 7.50 7.51 7.52 7.53 7.54 7.55 7.56 7.57 7.58 7.59 7.60 7.61 7.62 7.63 7.64 7.65 7.66 7.67 7.68 7.69 7.70 7.71 7.72 7.73 7.74 7.75 7.76 7.77 7.78 7.79 7.80 7.81 7.82 7.83 7.84 7.85 7.86 7.87 7.88 7.89 7.90 7.91 7.92 7.93 7.94 7.95 7.96 7.97 7.98 7.99 8.00 8.01 8.02 8.03 8.04 8.05 8.06 8.07 8.08 8.09 8.10 8.11 8.12 8.13 8.14 8.15 8.16 8.17 8.18 8.19 8.20 8.21 8.22 8.23 8.24 8.25 8.26 8.27 8.28 8.29 8.30 8.31 8.32 8.33 8.34 8.35 8.36 8.37 8.38 8.39 8.40 8.41 8.42 8.43 8.44 8.45 8.46 8.47 8.48 8.49 8.50 8.51 8.52 8.53 8.54 8.55 8.56 8.57 8.58 8.59 8.60 8.61 8.62 8.63 8.64 8.65 8.66 8.67 8.68 8.69 8.70 8.71 8.72 8.73 8.74 8.75 8.76 8.77 8.78 8.79 8.80 8.81 8.82 8.83 8.84 8.85 8.86 8.87 8.88 8.89 8.90 8.91 8.92 8.93 8.94 8.95 8.96 8.97 8.98 8.99 9.00 9.01 9.02 9.03 9.04 9.05 9.06 9.07 9.08 9.09 9.10 9.11 9.12 9.13 9.14 9.15 9.16 9.17 9.18 9.19 9.20 9.21 9.22 9.23 9.24 9.25 9.26 9.27 9.28 9.29 9.30 9.31 9.32 9.33 9.34 9.35 9.36 9.37 9.38 9.39 9.40 9.41 9.42 9.43 9.44 9.45 9.46 9.47 9.48 9.49 9.50 9.51 9.52 9.53 9.54 9.55 9.56 9.57 9.58 9.59 9.60 9.61 9.62 9.63 9.64 9.65 9.66 9.67 9.68 9.69 9.70 9.71 9.72 9.73 9.74 9.75 9.76 9.77 9.78 9.79 9.80 9.81 9.82 9.83 9.84 9.85 9.86 9.87 9.88 9.89 9.90 9.91 9.92 9.93 9.94 9.95 9.96 9.97 9.98 9.99 10.00 10.01 10.02 10.03 10.04 10.05 10.06 10.07 10.08 10.09 10.10 10.11 10.12 10.13 10.14 10.15 10.16 10.17 10.18 10.19 10.20 10.21 10.22 10.23 10.24 10.25 10.26 10.27 10.28 10.29 10.30 10.31 10.32 10.33 10.34 10.35 10.36 10.37 10.38 10.39 10.40 10.41 10.42 10.43 10.44 10.45 10.46 10.47 10.48 10.49 10.50 10.51 10.52 10.53 10.54 10.55 10.56 10.57 10.58 10.59 10.60 10.61 10.62 10.63 10.64 10.65 10.66 10.67 10.68 10.69 10.70 10.71 10.72 10.73 10.74 10.75 10.76 10.77 10.78 10.79 10.80 10.81 10.82 10.83 10.84 10.85 10.86 10.87 10.88 10.89 10.90 10.91 10.92 10.93 10.94 10.95 10.96 10.97 10.98 10.99 11.00 11.01 11.02 11.03 11.04 11.05 11.06 11.07 11.08 11.09 11.10 11.11 11.12 11.13 11.14 11.15 11.16 11.17 11.18 11.19 11.20 11.21 11.22 11.23 11.24 11.25 11.26 11.27 11.28 11.29 11.30 11.31 11.32 11.33 11.34 11.35 11.36 11.37 11.38 11.39 11.40 11.41 11.42 11.43 11.44 11.45 11.46 11.47 11.48 11.49 11.50 11.51 11.52 11.53 11.54 11.55 11.56 11.57 11.58 11.59 11.60 11.61 11.62 11.63 11.64 11.65 11.66 11.67 11.68 11.69 11.70 11.71 11.72 11.73 11.74 11.75 11.76 11.77 11.78 11.79 11.80 11.81 11.82 11.83 11.84 11.85 11.86 11.87 11.88 11.89 11.90 11.91 11.92 11.93 11.94 11.95 11.96 11.97 11.98 11.99 12.00 12.01 12.02 12.03 12.04 12.05 12.06 12.07 12.08 12.09 12.10 12.11 12.12 12.13 12.14 12.15 12.16 12.17 12.18 12.19 12.20 12.21 12.22 12.23 12.24 12.25 12.26 12.27 12.28 12.29 12.30 12.31 12.32 12.33 12.34 12.35 12.36 12.37 12.38 12.39 12.40 12.41 12.42 12.43 12.44 12.45 12.46 12.47 12.48 12.49 12.50 12.51 12.52 12.53 12.54 12.55 12.56 12.57 12.58 12.59 12.60 12.61 12.62 12.63 12.64 12.65 12.66 12.67 12.68 12.69 12.70 12.71 12.72 12.73 12.74 12.75 12.76 12.77 12.78 12.79 12.80 12.81 12.82 12.83 12.84

Section 8.1 Search for the title or ISBN, and click on Chapter 8: Section 8.1 NATURE OF SCIENCE Looking for patterns, trends, and discrepancies: patterns of chromosome number in some genera can be explained by speciation due to polyploidy. C The external intercostal muscles relax and the diaphragm contracts. The light and sound waves from the same source are sampled every 0.001 s. When type of wave is integrated produces a graph. An amplitude of 0.005 m is shown. A time period of 0.005 s is indicated. The effect of the stimulus is to produce an action potential. The action potential is produced essentially by ritual. There are three main objectives to using binomial nomenclature and its associated rules; (1) to be sure that each organism has a unique name that cannot be confused with another organism; (2) so that the names can be universally understood, no matter what nationality or culture is using the name; and (3) so that there is some stability in the system by not allowing people to change the names of organisms without valid reasons. Notice that the data points are connected by straight lines rather than using a trend line or line of best fit. Each cluster of alveoli is surrounded by a capillary bed for efficient gas exchange. Pepsin is an example of a hydrolysing enzyme. 14 The microplate allows water to enter the testa of a seed during germination. This is sexual selection. Glucose that is filtered is normally completely reabsorbed in locations such as the proximal convoluted tubule. 736 Cells for protein synthesis amino acids bile bilirubin bone marrow iron stored in liver Figure 15.9 The molecular components of haemoglobin are recycled when erythrocytes die after about 4 months. 12 10 8 6 In line graphs, the x-axis is usually the independent variable, in which case the y-axis is the dependent variable. Before beginning this practical, it is essential you understand how to use your school's microscopes properly. For example, linguists look at changes in words and uses of vocabulary to trace the evolution of a language throughout the course of history. • The positive control is a sample known to contain the HIV antibody. • Neurotoxicity can cause long-lasting damage to brain cells, killing them or impairing their function. If you are not in an emergency situation and are in a relaxed state, the parasympathetic system takes over. Crossing over allows DNA from a person's maternal chromosomes to mix with DNA from the paternal chromosomes. The enzyme maltase catalyses the hydrolysis of maltose into two molecules of glucose. Leaves are the primary sugar sources. This organelle is especially prevalent in plant cells. The mitochondria are the powerhouses of the cell. They generate most of the energy used by the cell through cellular respiration. The chloroplasts are the sites of photosynthesis. The vacuole is a large, fluid-filled sac that stores various substances. The nucleus contains the cell's genetic material. The cytoplasm is the gel-like substance inside the cell. The cell membrane is the boundary between the cell and its environment. The cell wall is a rigid layer surrounding the cell. The cell is the basic unit of life. It is the smallest unit of an organism that can perform all the functions of life. It is the building block of all living organisms. It is the smallest unit of structure and function. It is the smallest unit of organization. It is the smallest unit of life. It is the smallest unit of existence. It is the smallest unit of being. It is the smallest unit of becoming. It is the smallest unit of doing. It is the smallest unit of having. It is the smallest unit of knowing. It is the smallest unit of feeling. It is the smallest unit of thinking. It is the smallest unit of acting. It is the smallest unit of reacting. It is the smallest unit of responding. It is the smallest unit of interacting. It is the smallest unit of relating. It is the smallest unit of connecting. It is the smallest unit of communicating. It is the smallest unit of sharing. It is the smallest unit of giving. It is the smallest unit of taking. It is the smallest unit of receiving. It is the smallest unit of accepting. It is the smallest unit of rejecting. It is the smallest unit of choosing. It is the smallest unit of deciding. It is the smallest unit of acting. It is the smallest unit of reacting. 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You are about to read a chemical engineering by the process of photosynthesis. Part 34 Site A, the prediction was that macroalgae would be dominant in the competition for percentage cover with elevated nutrients. These are aerobic reactions carried out by two autotrophic bacteria that are beneficial to the environment. (b) Measure the temperature conditions in the water and the air. The reagent is used to detect the fatty acids found in triglyceride lipids and phospholipids. B The internal intercostal muscles contract and the diaphragm relaxes. Yazsinski, a biomedical engineer, was able to create such scaffolding. There are many categories of antibiotics, depending on the biochemical pathway that is being targeted. When a second infection of the same pathogen occurs, the memory cells that were produced during the primary infection are still circulating in the bloodstream. Biofilm drug resistance: Persistor cells, dormancy and infectious disease Nature Reviews Microbiology, 5, January, pp. 703 14 Option C: Ecology and conservation Analysing data using mathematical models Mathematical models are used to turn all of the data into a form that can be used by the fishing industry and governments to plan the future of the fish in our oceans and lakes. Type I diabetes is an autoimmune disease. The oil gushed out of the Deepwater Horizon oil rig under the Gulf waters for days. Consider the following expressions. This single cell layer is composed of two different types of cells called pneumocytes. 6 Cover each tube tightly with parafilm (clingfilm). The plant is made from two parts. This division was not generally accepted until 1953. NATURE OF SCIENCE Scientists have a molecular view of the world. The standard unit of measurement is the mole. The volume of blood that is pumped out of the heart is called the stroke volume. The hormone produced and secreted from the pineal gland is called melatonin. This is because the electrons that are flowing from one molecule to the next are carrying energy with them. • Slow-acting TNS can regulate the efficiency of the postsynaptic neurone (the receiver). Each nephron consists of • a capillary bed, called a glomerulus, which filters various substances from the blood • a capsule surrounding the glomerulus, called the Bowman's capsule • a small tube (tubule) that extends from Bowman's capsule, consisting of the proximal convoluted tubule, loop of Henle, and distal convoluted tubule • a second capillary bed, called the peritubular capillary bed, that surrounds the threepart tubule mentioned above. Lung cancer is caused by one or more carcinogens (a substance that is known to cause cancer) that enters the lung tissue and mutates cells into a cancerous growth. Benedict's reagent is a chemical reagent commonly used to detect the presence of simple reducing sugars. For example, a gene that produces a protein to help balance cholesterol levels in the body and prevent heart problems. An artist's drawing of the ventral view of a healthy digestive system. • Click on Download - UniProt FTP sites. Should evidence collected in this way be used legally in court as evidence? They survive better in some places than others. There are two antagonistic sets of these muscles: external intercostals, which are used when breathing in, and the internal intercostals, which are used when breathing out. By birth its brain has become the walnut-like structure we would expect to see. • Dolly can be used as an example of somatic-cell transfer. It contains sweat glands, capillaries, sensory receptors, and dermal cells, which give it the appearance of a human skin structure. The human skin is made up of two layers: the epidermis, which is the outer layer, and the dermis, which is the inner layer. The epidermis is made up of a single layer of cells, while the dermis is made up of multiple layers of cells. The dermis contains sweat glands, hair follicles, and other structures. The epidermis is responsible for protecting the body from the environment, while the dermis is responsible for regulating body temperature. The skin is also responsible for sensing touch, pain, and temperature. The skin is made up of a complex network of cells and structures that work together to protect the body and regulate its internal environment. The skin is one of the most important organs of the human body, and it plays a vital role in our overall health and well-being. The skin is made up of a complex network of cells and structures that work together to protect the body and regulate its internal environment. The skin is one of the most important organs of the human body, and it plays a vital role in our overall health and well-being. 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nrients on? Eric Kandell is a neuroscientist who began by studying the nerve cells of a small animal, the giant marine snail Aplysia. 2.6 The structure of DNA allows efficient storage of genetic information. What are some of the adaptations of epithelial villi cells that allow them to be efficient at absorbing digested nutrients and passing those nutrients on to the bloodstream or lymphatic system? The name given to the generation produced by a cross such as this is the first filial generation, usually referred to as the F₁ generation. The second phase, in which the young bird practices singing the song that he has heard. Organisms living in the water die and leave behind their shells, and the shells are buried under sand and silt. The shells are found by archaeologists and used to date the time when they were made. The shells are also used to study the climate change during the last ice age. The shells are also used to study the evolution of life. The shells are also used to study the extinction of dinosaurs. The shells are also used to study the extinction of mammoths. The shells are also used to study the extinction of Neanderthals. The shells are also used to study the extinction of Homo sapiens. The shells are also used to study the extinction of modern humans.

The first stage of photosynthesis is a set of reactions that "trap" light energy and convert it to the chemical energy of ATP. New connections are formed every day of our lives. Application: Blocking of synaptic transmission at global climatic changes in insects by binding of neonicotinoid pesticides to acetylcholine receptors. Pathogens include viruses, bacteria, protozoa, fungi, and worms of various types. If you have been even to a museum full of fossils classified by their age, you may have noticed a few things that paleontologists have discovered that provide convincing evidence for Earth's evolutionary past. Sucking behaviour is innate in human infants. Reclassification As noted before, Linnaean classification was limited to observable characteristics, and in Linnaeus's time little effort was made to classify organisms by their ancestry because nothing was known about the genetic connections between species. There are many sarcomeres in a series, and all of them become shorter, the entire muscle fibre becomes shorter. Is there a significant difference in males and females of the same age? If a feeding insect is anaesthetized, the body can be cut from the stylet with a laser. Follow these general procedures. In a biofilm, the properties of the biofilm community are greater than the properties of the individual components. This type of growth results in herbaceous, non-woody stems and roots. B group of species living and interacting in an area. Depending on the species of staple crop being grown, this Zia situation can lead to an overall imbalance of too many carbohydrates or a more specific deficiency of one or more essential nutrients. Many of the food plants we eat today are hybrids, including corn. Zeas mays, just remember that the letters Z, B, J, O, U, X, do not occur in protein sequences. This is important because the amino acids leucine, isoleucine, valine, threonine, serine, alanine, glycine, proline, glutamic acid, aspartic acid, lysine, methionine, phenylalanine, tyrosine, histidine, tryptophan, arginine, and ornithine are the only ones that can be coded for by three nucleotides. Medicine in Indiana, is using functional magnetic resonance imaging (fMRI) to study the brains of young adults watching violent video games. Fortunately, as a result of implantation, the embryo and the maternal endometrium soon begin to create a structure known as the placenta. The number of ova produced by females for internal fertilization is typically far less than the number of ova laid by species that use external fertilization. 725 15 Option D: Human physiology Applications and skills: Application: The reduction of stomach acid secretion by proton pump inhibitor drugs. When we study monkeys and apes, even more folds are found in their cortex, pylori in the stomach. Are you able to tell the difference between birdsongs? Any base sequence is carried from the nucleus to the ribosomes by mRNA. You might think that the yield in food energy would be the top priority. Many websites have tests for colour blindness. (1) C2 (iii) List one product other than carbon dioxide formed in this state of respiration. How do the valves within the arterial devices 'know' when it is time to close and open? As bacteria are prokaryotic cells, you can see that such cells play a large role in the world today. It is not an antibiotic but a food additive. Drawings of steroids are not expected. • Exposure to passive smoking increases the risk of CHD by 25%. Robin Warren and Barry Marshall won the Nobel Prize for this discovery. • Click on Vega. Discontinuities in the fossil lineages are a challenge for scientists to explain. Some plants are annuals and complete their life cycle in one year and then die. Their pleia is that we need to adopt international policies to limit human impact and maintain sustainable practices. ● Guidance Drawings of prokaryotic cells should show the cell wall, pili, flagella, and plasma membrane enclosing cytoplasm that contains 70S ribosomes and a nucleoid with naked DNA. When you first begin to exercise, the cardiorespiratory centre stops causing an increase in heart rate. Application: Structure-function relationships of phloem sieve tubes. The term 'homeo means similar'. Genome size is the total length of DNA in an organism. (c) Sister chromatids are pulled to opposite ends of the nucleus. Each chromosome contains many smaller sections called genes. A psychologist put the animals in a box and watches them from outside; an ethologist put himself or herself in a box and looks out at the animals.' Learned versus innate behaviour As we have discovered in last few sections, learned behaviour is not genetically programmed. Nicotine stimulates transmission in cholinergic synapses, which is why it has a calming effect on the body and personality. To find out more about GMO, GenBank, and NCBI, go to the hotlinks site, search for the title or ISBN, and click on Chapter 13: Section B.2. NATURE OF SCIENCE Developments of scientific research follow improvements in apparatus: using tools such as the laser scanning microscope has led researchers to deeper understanding of the structure of biomolecules. False-colour SEM of liver cells with cirrhosis. Some prominent scientists say there is not. The parasite attacks the person's red blood cells and produces symptoms of high fever and chills, and can result in death. Seven principal taxa in order to classify the hundreds of thousands of different types of organisms on Earth, scientists have agreed to use a seven-level hierarchy of taxa. The hepatic artery is a branch of the aorta and carries oxygenated blood to the liver tissues. Proponents argue that GM plants will increase crop yield and help us feed 9.2 billion people. • Step 2 - Parents' genotypes. 249 05 of the chromosomes are those that you have eaten an angiosperm today: wheat, corn, apples, and oranges are all examples of angiosperm seeds and their coverings. Careful observation should reveal thick walls with pits or pores that allow lateral and vertical movement of water. For example, DNA coding for lysine is AAA. The embryo was placed in the womb of a surrogate mother sheep. B.1 Microbiology: organisms in industry Understandings: Microorganisms are metabolically diverse. Evolution and biodiversity Naming new species Humans like to see themselves as unique. Levels in trophic levels If you look back at the three examples of food chains earlier in this chapter, you will notice that they are all either four or five organisms long. Because half are T's and half are G's, the allele frequency for 437 10 Genetics and evolution 1 T T T T T = 50%, or 0.50. For one thing, when looking at a gene that involves every living thing should have, such as a gene for how to make ribosomes, the number of mutations a species has in that gene compared with another species gives insight into how closely they are related to each other. 479 11 Animal physiology A light micrograph of a nearly completed section of a seminiferous tubule. They include: 399 09 Plant biology • Environmental factors, such as day length and water availability • Receptors, which allow the plant to detect certain environmental factors • The genetic makeup of the plant • Hormones, which are chemical messengers. Remember, when a cell enters the phases of mitosis, replication of DNA has already occurred. The table below shows the outcome of crosses between a plant heterozygous for both characteristics and one that is homozygous recessive for both characteristics. 1 2 3 A child is given a vaccine called MMR (measles, mumps, rubella) to confer protection from those three diseases. The photon energy excites one of the chlorophyll a electrons to a higher energy state. • Sunken stomata on thickened leaves reduce water loss by creating a higher humidity near the stomata. This takes care of the cuts in groups; all lionesses suckle all cubs and protect all cubs. It is a truly remarkable process, and no consumers could survive on this planet without the initial production of food by autotrophs. This portion of the transcription process is often referred to as elongation. B.1 and III only. It is only expressed in the normal cell. This is an innate, synchronized response to the loss of the cubs. 9.4 Reproduction in flowering plants is influenced by the biotic and abiotic environment. Carbon monoxide poisoning can be fatal. Factors such as latitude and sunlight intensity, seasonal variation, and altitude affect the distribution of plants. 10.2 433 10 Genetics and evolution Table 10-2 Observed and expected ratios of round and wrinkled pea offspring Total Observed Phenotypes (O) 5474 1850 7324 Expected proportions 3 out of every 4 offspring 1 out of every 4 offspring Expected phenotypes (E) 3 out of every 4 offspring From a total offspring from a total of 7324 = 5493 of 7324 = 1831 Difference (O – E) 19 19 Difference squared ((O – E) 361 361 (– O – E) 2 0.066 0.066 19 2 7324 0.264 The fourth and fifth white rows of this table are intermediate steps to find the difference between the observed and the expected values, and their squared values. 6 Suggest some ways this procedure could be improved. The inner membranes of the mitochondria have numerous copies of an enzyme called ATP synthase. number of echinoderm larvae 80 2 1 sea temperature/°C 0 – 1 200 10 log10 chlorophyll a concentration/mg m-3 sea temperature/°C % spawning of echinoderm phytoplankton 1 0.1 0.01 Dec Mar Jun Sep Dec Jan Jun Sep Dec Adapted from Stanwell-Smith and Peck 1998 (A) State the trophic level of echinoderm larvae. Fish and seabirds are being driven south. Pushing the pedal for foot heat becomes a deliberate act. When studying simple invertebrate animals, innate behaviours can be measured as the animals respond to environmental stimuli. In economic periods when oil prices are high, peak oil can be a competitive energy source, but when oil prices are low this is not the case, and there have been decades during which many countries decided to drain their wetlands to replace them with forests and farmland. Which of these yellow pollen grains on the bee's body will pollinate the next flower it visits? In some instances, the complex inhibits transcription, and in others cases it promotes transcription. Naguro 101B, R. A black spot indicates that the gene was not expressed in either type of cells. Hypothesis for replacement theory: optimum substrate concentration for lactase will be a ratio of 20 parts lactose by mass to 1 part glucose by mass. fATM holds a small amount of information about the cell. Variations in the cell wall thickness of a polyploid cell. DNA and RNA are assembled in the 5' to 3' direction because of the antiparallel nature of the two strands. Two of the structural units of a Pseudomonas aeruginosa cell are involved in excretion or internal water concentration regulation. Spindle fibres made from microtubules form. Factors affecting seed germination 'Safety alerts: Wear protective eyewear and an apron. Trees that produce seed cones and have needle-like leaves are conifers. Linked genes In the fruit fly Drosophila, the gene for body colour (grey or black) is in the same linkage group as the gene for wing length (long or short) (see Figure 10.15). The Museum of Comparative Anatomy in Paris, France. The symptoms of Huntington's disease include difficulty walking, speaking, and holding objects. The weeds are killed and the soybean crop benefits. With a new gene there is a new product, and we are interested in that new product. Commercially available lactase has been formulated to still be active in the stomach and so is not sensitive to alterations in various acidic pH environments. Biotechnology has been used for centuries to bake bread, make cheese, and brew alcoholic beverages. Thymidine is a component of a DNA nucleotide made up of a pentose sugar bonded to thymine; it is represented by the letter T in the genetic code. Also, Myriad could charge high fees because they had no competition in the market. 200 maternal blood concentrations (ng/ml) of: progesterone oestrogen 100 0 70 140 210 280 days of gestation Figure 11.32 A graph showing the levels of progesterone and oestrogen in a pregnant human female during the entire gestation. • DNA polymerases can add nucleotides to the 3' end of a primer. Notice that the 147 letters correspond to the letters of the chart of amino acid codes used for BLASTP. If you copy the sequence on your clipboard and save it, then you will have it for the next activity. The 30 ATMs generated by computer simulations represent approximately 30% of the proteins present in the cell. This happens through a process called translation. The signal is sent to the nucleus, where it is transcribed into messenger RNA. An artificial pancreas must be battery-operated. The patient typically in the upper chest. Replacement of DNA in a markedly abnormal cell. 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[illegible]

[illegible]

A phenotype is favoured over another by natural selection, it is called directional selection. Examples of naturally occurring steroid hormones include oestrogen, progesterone, and testosterone. • Try the 60/60 rule: never turn your volume past 60% and only insert earphones for a maximum of 60 minutes per day. How? Too many offspring

Research on the pathogen that we now know as HIV, r ar ri pa Figure 4.6 The carbon cycle ng feedi r ar carbon in fossil fuels carbon in producers to n carbon in decomposers. The role of autotrophs in the carbon cycle Let's start with food, uring due to LH and es mat F SH maturing follicle oocyte surrounded by zona pellucida Graafian follicle degenerating corpus luteum ovulation co rp us l corpus luteum (fully formed) young corpus luteum g utein ihm first forming then dimm Figure 6.27 Ovary events during single menstrual cycle. 3 Obtain five test tubes and place them in a test tube rack. Using models is a way in which scientists explain complex structures such as cellular membranes. • NATURE OF SCIENCE Developments in scientific research allow improvements in apparatus: Fluorescent calcium ions have been used to study the cyclic interactions in muscle contraction. 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neurons), synaptic transmission between neurons), and muscle contraction. In this activity, you will research these factors and formulate a hypothesis concerning how a specific factor affects germination of a particular type of seed. (C6, 7, 8, 9, 10, 11, 12, 13, 14, 15) **GOALS:** You will be testing the general principles that describe the natural world, the principle that

[illegible]

[illegible]

[illegible]

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contribute an allele in order for the homozygous recessive condition to be expressed. The releasing hormones stimulate the anterior pituitary cells to secrete specific hormones. Examples of animal phyla Of all the phyla of animals, we will consider seven here. 196 Over millions of years, and after geological transformation, the kerogen in porous sedimentary rock becomes crude oil or, if it is in a gas state, natural gas. A person suffering from severe altitude sickness should return to a lower altitude as soon as possible. Medulla oblongata maintains vital body functions such as breathing and heart rate. Figure 9.15 This shows the distribution of tissues in a stem of a dicotyledonous plant. The subgenus Microsordium contains species that are tetraploids, meaning $2n = 4x = 32$ (a total of four sets of eight chromosomes). PCR can be used to test nasal secretions. Continued addiction is even more harmful. 402 The sequence of events in the stem causing it to bend towards a light source is as follows. Only Gram-negative bacteria have an outer membrane with attached lipopolysaccharide molecules. T T T T T t t Gene pools are generally relatively stable over time. Meiosis is completed for these cells, but each must now differentiate into a fully functioning, motile spermatozoon. The inability to break down phenylalanine is a result of inheriting the mutated form of a gene that should be producing an enzyme (phenylalanine hydroxylase) that helps break down phenylalanine. This allows nitrogen to be replenished in the soil by plants such as beans, which have nitrogen-fixing bacteria in their root nodules. Pregnant women that are past term are sometimes given a chemical called pitocin to induce labour. If your myogenic heart rate is 72 beats min⁻¹, your SA node is generating an action potential every 0.8 seconds. ATP adenosine diphosphate plus inorganic phosphate yields adenosine triphosphate The odds of these two reactants (ADP + Pi) colliding at a very high speed, at exactly the correct orientation, leading to a new covalent bond forming between them, is extremely small. Arabidopsis thaliana is a small flowering plant native to Europe and Asia that has been studied extensively regarding light sensing and flower development. Little did he know that it would allow him to see nature in a new way and come up with what would become one of the most important, controversial, and misinterpreted ideas in biology: evolution by natural selection. Guidance Students should be clear that characteristics acquired during the lifetime of an individual are not heritable. The complementary base pairs are adenine (A)-thymine (T) and cytosine (C)-guanine (G). (Total 6 marks) 3 Osteoporosis is a major health problem for many post-menopausal women. You can enjoy listening to music yet avoiding harmful listening habits that can lead to permanent hearing loss, by following these steps. When cellular respiration is complete, carbon dioxide is released into the atmosphere, and when the giraffe dies, its body will be eaten by scavengers and the remains broken down by decomposers. sarcomere relaxed Z line Z line actin filament myosin filaments (heads not shown) sarcomere contracted Z line actin filament Sarcomere light band area would be any area with actin without myosin Z line Figure 11.11 A sarcomere shown at rest and during a contraction. Correlation says nothing about the direction of the influence. Let's look at the advantages and disadvantages of each type of nitrogenous waste. Ancient population with variation in neck lengths. 3.1 Genes Understandings: A gene is a heritable factor that consists of a length of DNA and influences a specific characteristic. 11 Of the greenhouse gases discussed in this chapter, state which one has a warming potential approximately 100 times that of carbon dioxide. Each pit is shared by each of the glandular cell types creating and secreting one of the components of gastric juice (hydrochloric acid, pepsinogen, or mucus). Lithosphere = where all the rocks are found. products of first replication Figure 2.39 This figure demonstrates the general process of semi-conservative replication of DNA. She follows the male as he leads her to the nest he has constructed in the bed of the river. ● Skill: Utilization of molecular visualization software to analyse the association between protein and DNA within a nucleosome. 5 A genetic disease can be described as being an autosomal dominant disease. RT is reverse transcriptase that will allow mRNA to make cDNA (which is much more stable than mRNA). This section will look at these issues. Both are controlled by the hypothalamus, and both secrete hormones regulating many body functions. 1 2 3 4 Examples of endocytosis include: • phagocytosis, the intake of large particulate matter • pinocytosis, the intake of extracellular fluids. The resting potential is created by the active transport of sodium ions (Na⁺) and potassium ions (K⁺) in axon resting two different directions. Metabolic pathways are usually carried out in designated compartments of the cell where the necessary enzymes are clustered and isolated. Are there any parallels between biology and art? 769 Case study 2 Babies born on a full moon Ask an experienced midwife 'Are more babies born on a night when there is a full moon?' and chances are pretty good she will say yes. The concentrations of these gases in the atmosphere are naturally low, which normally prevents too much heat retention. It is the result of the growth of the thyroid gland in an attempt to compensate for not being able to produce enough thyroxine because of a deficiency of iodine in the diet. Transgenic animals One way of genetically engineering an animal is to get it to produce a substance that can be used in medical treatments. Wash your hands thoroughly after working in any phase of this procedure.* There are many factors that can affect germination. Identify which taxon in the diagram represent the lesser apes. Could it be argued that just as an artist sees things in his or her own way, so a scientist sees things in his or her own way? There is often a difference between the theoretical values and actual values obtained in experiments. Providing a source of compounds with many chemical bonds that can then be broken down to provide an organism with the energy necessary to maintain life is the basis of nutrition. The bond that is freed up is used to form the covalent bond between the two monosaccharides. Is it better to be right or to belong? The information must be accurate, complete, and understandable, so that society can make informed decisions regarding the appropriateness of the research. 39 The current size limit for black grouper is 24 inches. Figure 2.16 The highlighted zone in the middle of the fatty acid shows that it has a single double bond in the hydrocarbon chain. If such people could be supplied with factor IX, their problem would be solved. Genes are made of DNA. The figure below shows the inactivation of the microbes in seawater as a function of the cumulative amount of sunlight and time. The water content is quite high, making this urine hypotonic in relation to the surrounding interstitial fluid of the medulla. 131 03 Genetics 3 4 The images are cut out and separated, a process that can be done using scissors or using a computer. The effects of FSH and LH on the ovaries The hormones FSH and LH have several effects on the ovaries. Figure 6.20 A graph showing the voltage changes across the membrane of an axon for three nerve impulses. In this process, the two haploid sex cells join to make a single diploid cell called a zygote. 1 2 3 4 Starting materials: target DNA collected from nasal secretions; nucleotides to use for making copies of DNA; DNA polymerase primer that gets the new copy started. Examples: five fingers on each hand, colour blindness, type O blood. Bloodletting was a common medical procedure that was based on Galen's theory of circulation. • In Abha, Saudi Arabia, a study of 944 males revealed that 7.2% of the population was Rh⁻. F. This has been confirmed in the fossil record for some species, notably sharks, cockroaches, and horseshoe crabs, which have persisted for hundreds of millions of years. Likewise, varieties of cows that only produce 5–10 litres of milk a day will not be selected, whereas varieties that produce 30–40 litres of milk per day or more will be selected by breeders. Boaters dumped their waste in the water. The nervous and endocrine systems work cooperatively in order to ensure homeostasis. Heroin, introduced into the USA, has become a social catastrophe. Rather, it seems to be caused by a redistribution of available auxin, especially to the side of the stem away from the light source. He took purebred tall plants and crossed them with purebred short plants. + 1 4 HO OH 5 OH H 3 2 H + H O H OH glucose 6 CH2OH H 4 1 OH HO 5 CH2OH H OH H 3 2 H OH H H O 4 1 O 5 H O H OH H 3 2 H OH maltose 1 + H2 O + water OH Monosaccharides: the building blocks of polysaccharides Condensation reactions can be used to synthesize even larger molecules by accomplishing the same or a similar reaction on more than one area of a monomer such as a monosaccharide. Table 11.6 Some of the functions of progesterone and oestrogen during pregnancy Progesterone Oestrogen Helps maintain the highly vascular tissue characteristic of the uterus/placenta Encourages muscle growth of the uterus Suppresses contractions of the smooth muscle of the uterus (the uterus is highly muscular, for the birth contractions) Eventually 'antagonizes' the action of progesterone to suppress uterine contractions Stimulates mammary gland development late in pregnancy in preparation for milk production Induces production of oxytocin receptors in uterine muscles late in pregnancy (see below for the function of oxytocin) Both progesterone and oestrogen inhibit the production of any further oocyte development during the entire pregnancy. All of these are needed at specific locations in the alimentary canal. ● Skill: Testing for association between two species using the chi-squared test with data obtained by quadrat sampling. The hydrolytic activity of amylase ceases in the highly acidic environment of the stomach. It is cut into slabs, granules, or blocks, and moved to where it is needed. The evolutionary design behind the repeated branches and individual cells joined by intercalated discs is based on getting the muscle cells to work together as a unit. So far in this discussion, the respiratory substrate has been a hexose. The water intake of kangaroo rats comes almost exclusively from the foods that they eat. A A normal male. How can we mathematically quantify the variation that we have observed? It grew from a zygote and produces new cells by mitosis. Label the parts from memory and then begin to learn the bullet points given above in order. Today, in some countries, tonnes of grain sit and rot in silos, while in other countries people go hungry. • Examples for mouthparts: tweezers, clothespins, wooden tongs, or even chopsticks. Is there any area of scientific knowledge the pursuit of which is morally unacceptable or, on the contrary, morally required? The increase and decrease in blood glucose levels goes on 24 hours a day, every day of your life. It has a simple nervous system and at the anterior end are two eyespots that contain photoreceptors stimulated by light. 554 Dopamine secretion You will recall that dopamine is the neurotransmitter that activates the reward pathway and gives us a sense of pleasure or satisfaction. Liquid smoke is produced when smoke from certain types of burning wood is allowed to condense in water. That person probably does not blink. Even if the mouse does not normally have a disease (e.g. cystic fibrosis), it can be induced to have it by manipulating its genome. Research centres are active in this area of study throughout the world, and the objective of this conference was to allow the researchers to share their discoveries. ● The origin of eukaryotic cells can be explained by the endosymbiotic theory. These are just a few examples of biomarkers that have been discovered; much research is ongoing in this field. (2) (Total 4 marks) 4 (a) Define the term polygenic inheritance. Too few young fish indicates lack of spawning, and too few old fish may mean that over-fishing is taking place. Table 13.7 Examples of knockout mice Knockout mouse Defect Benefit to research Cfr Defective in the gene that makes CfrTt, a protein that regulates passage of salts and water in and out of cells Allows research into cystic fibrosis, which is the most common fatal genetic disease in the USA P53 Has a disabled Trp53 tumour gene Cancer research Lep Has a mutant gene for leptin Obesity research 635 13 Option B: Biotechnology and bioinformatics Other model organisms used in comparative genomics Complete sequences of the model organisms shown in Table 13.8 have been found and added to databases. This ensures survival and enhances the ability to reproduce. George E. In what ways is this useful to the general public? Figure 6.26 Hormonal summary of the menstrual cycle. Throughout our lives we continuously repeat the process of filling our lungs with air and then expelling that air. In fact, after this activity you can try making the newly identified protein sequence your name. With large herds of cattle being raised worldwide, there is a concern that the quantities of methane they produce are contributing to the greenhouse effect, which will be discussed in the next section. In some cases these exudates harden over time. Instead, one very large cell breaks down into many fragments, and each of the fragments becomes a platelet. They also act as a quick summary for review. Application: Analysis of data from air monitoring stations to explain annual fluctuations. 387 09 Plant biology Mineral ions It is essential that mineral ions move into the root as well as water. The function of pepsin is to catalyse the hydrolysis of large polypeptide chains into smaller peptides. They have all originated in one species and made the transition to infect another species, specifically infecting human beings. ● Students should know that most organisms use the same 20 amino acids in the same genetic code, although there are some exceptions. (a) Draw the carbons first (this is called the carbon backbone of the molecule). ● ● Applications and skills: Application: Consequences of high altitude for gas exchange. Gregor Mendel (1822–1884) studied the genetics of garden pea plants. Therefore, the human body has some ingenious ways of making it difficult for pathogens to enter it and start an infection. (a) (b) (c) (d) (e) NATURE OF SCIENCE Assessing risks associated with scientific research: scientists attempt to assess the risks associated with genetically modified crops or livestock. The first global survey of bird diversity will tell us which species are most vulnerable to extinction. Figure 12.14 EEG showing activity followed by electrocerebral silence. This process requires the expenditure of energy in the form of ATP. 456 mouse spleen harvested many days later leucocytes removed mouse injected with a chosen antigen (e.g. HCG) ELISA test used to identify cultures secreting desired antibody hybridomas grown in separate cultures fused with myeloma cells to form hybridoma cells antibody purified from cell culture Figure 11.2 A flowchart summarizing the production of monoclonal antibodies. What is of C C C H great interest to industries using coal is the H H H H hydrocarbons, the long chains of carbon atoms attached to hydrogen atoms (see Figure 4.10). Those enzymes trapped in the pores are said to be immobilized. Argument against the question: Why can't these so-called experts make up their minds? Each type of B lymphocyte (or plasma cell) is capable of synthesizing and secreting a specific antibody that binds to a specific antigen. (c) Why do the measurements have a high point and a low point for each year? ● Carbon dioxide is produced by respiration and diffuses out of organisms into water or the atmosphere. Increasing crop yield Why do we need biotechnology to help increase crop yields? If the number of test subjects is very low, you may have to use one or more subjects for more than one exercise duration. The organic products of glycolysis are always two pyruvate molecules. If the end of the line contains a name, it is the taxon for the organism. pear strawberry Bar charts use rectangles to show the amount of data in a certain number of categories. 534 number of isopods out of 20 Table 12.9 Effect of humidity 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 humid control dry 0 5 10 15 20 25 30 35 time in minutes 10.5 40 45 Time / min 60.5 Chamber empty Chamber empty 0 10 10 5 10 10 10 8 12 15 8 12 20 8 12 25 9 11 30 9 11 35 10 10 40 10 10 45 10 10 Table 12.11 Effect of humidity on the movement of isopod: control trial 2 5 Process the raw data. In the making of yogurt lactose sugar in the milk is broken down by the lactase enzyme of the bacteria fermenting the milk. Some farmers in the world are growing crops that are not destined for human food nor for animal feed but rather for fuel to power cars and city buses. 16 If the normal cells have an average cell cycle time of 600 minutes, estimate the average, relative cell cycle time of the cancer cells. This is because they are no longer able to hide against the darkened background. To learn more about the mitotic phases, go to the hotlinks site, search for the title or ISBN, and click on Chapter 1: Section 1.6. 24 If a parent cell has 24 chromosomes, how many chromatids would be present during metaphase of mitosis?

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