

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

Life Sciences

Support for Grade 12 Teachers

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STRATEGIES TO TEACH TERMINOLOGY

1. In every lesson identify new terms/concepts and write it on the board.
2. Learners will take down terms/concepts at the back of their notebooks noting the correct spelling.
3. Learners must define/write down the meaning of these words from listening to the educators lesson/finding meaning from the dictionary or textbook.
4. Break down the concept/term where possible- give the meaning of the prefix and suffix e.g. photo(light) synthesis(to build up).
5. Use the concept in a sentence.
6. Educator checks that learners have done the above, on a daily basis e.g. asks any learner to define a concept.
7. By the end of the year ALL learners have a comprehensive GLOSSARY of ALL terms /concepts.
8. ASSESSMENT: Biological terms to be included in all daily assessment tasks. Develop crossword puzzles. (Use various websites from internet e.g. eclipse)
9. Learning terminology also helps in answering MCQs and matching questions, etc.

TERMINOLOGY – Term and meaning

Term	Meaning/Definition
chromatin	Tangled network of chromosomes located within the nucleus
chromatid	The individual threads that form a chromosome
centromere	Structure joining two threads of a chromosome
nucleolus	Structure in the nucleus responsible for forming ribosomal RNA
nucleoplasm	That part of the protoplasm within the nucleus
cytoplasm	That part of the protoplasm outside the nucleus.
ribosome	Structure that is the site of protein synthesis
Gene	Segment of a chromosome that controls each characteristic
hereditary	Characteristics that are passed from parents to offspring
DNA	Nucleic acid that is a constituent of chromosomes
Helix	Natural shape of a DNA molecule
RNA	Type of nucleic acid that occurs as a single strand / nucleic acid that contains uracil
nucleotide	Building blocks of nucleic acids consisting of a sugar, a base and a phosphate
replication	The formation of an exact copy of the DNA in a cell
template	The original strand upon which a new strand is developed
complementary strand	The new strand that is made based on the sequence of nucleotides on the template
cytosine	The base that pairs off with guanine
thymine	The base that pairs off with adenine
uracil	The base found in RNA and not DNA
Hydrogen bonds	The chemical bonds which link base pairs in the DNA molecule
enzyme	A protein that speeds up a chemical reaction / a catalyst
codon	The three adjacent bases found on a DNA or m-RNA molecule
anticodon	The three adjacent bases found on a t-RNA molecule that will determine which amino acid will be brought to the ribosome
transcription	The synthesis of m-RNA from a DNA template
translation	The process of converting the information carried by m-RNA to the correct sequence of amino acids to form a particular protein
synthesis	Building up of separate parts into a whole
Condensation reaction	When large molecules are made from simple molecules with the release of water
Amino acid	The basic building block of a protein molecule
Peptide link	A link between two adjacent amino acids
monomer	A single unit that makes up a larger molecule

polymer	A large molecule which is formed from many small molecules (monomers)
mutation	A sudden and relatively permanent gene / chromosomal change
Mitochondrial DNA	The type of DNA found only in the mitochondrion
genome	All the genes present in an organism

TERMINOLOGY – Provide the term

Term	Meaning/Definition
	Tangled network of chromosomes located within the nucleus
	The individual threads that form a chromosome
	Structure joining two threads of a chromosome
	Structure in the nucleus responsible for forming ribosomal RNA
	That part of the protoplasm within the nucleus
	That part of the protoplasm outside the nucleus.
	Structure that is the site of protein synthesis
	Segment of a chromosome that controls each characteristic
	Characteristics that are passed from parents to offspring
	Nucleic acid that is a constituent of chromosomes
	Natural shape of a DNA molecule
	Type of nucleic acid that occurs as a single strand / nucleic acid that contains uracil
	Building blocks of nucleic acids consisting of a sugar, a base and a phosphate
	The formation of an exact copy of the DNA in a cell
	The original strand upon which a new strand is developed
	The new strand that is made based on the sequence of nucleotides on the template
	The base that pairs off with guanine
	The base that pairs off with adenine
	The base found in RNA and not DNA
	The chemical bonds which link base pairs in the DNA molecule
	A protein that speeds up a chemical reaction / a catalyst
	The three adjacent bases found on a DNA or m-RNA molecule
	The three adjacent bases found on a t-RNA molecule that will determine which amino acid will be brought to the ribosome
	The synthesis of m-RNA from a DNA template
	The process of converting the information carried by m-RNA to the correct sequence of amino acids to form a particular protein
	Building up of separate parts into a whole
	When large molecules are made from simple molecules with the release of water
	The basic building block of a protein molecule
	A link between two adjacent amino acids
	A single unit that makes up a larger molecule
	A large molecule which is formed from many small molecules (monomers)
	A sudden and relatively permanent gene / chromosomal change
	The type of DNA found only in the mitochondrion
	All the genes present in an organism

TERMINOLOGY – Provide the meaning

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Helix	
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nucleotide	
replication	
template	
complementary strand	
cytosine	
thymine	
uracil	
Hydrogen bonds	
enzyme	
codon	
anticodon	
transcription	
translation	
synthesis	
Condensation reaction	
Amino acid	
Peptide link	
monomer	
polymer	
mutation	
Mitochondrial DNA	
Genome	

HYPOTHESIS TESTING INVESTIGATIONS

Definition:

A hypothesis is a testable statement about a relationship involving two variables.

How to state an hypothesis

1. There must be two variables (dependent / independent)
2. State the relationship between the two variables.
3. It must be testable.

Notes:

- A hypothesis is a suggested solution to a question or an explanation of a phenomenon.
- The hypothesis needs to be tested before one can draw any conclusions.

- In planning the investigation you need to test various factors / variables, one at a time so that any result obtained can be attributed to that factor / variable alone and no other factor / variable
- A scientific investigation should have an EXPERIMENT and a CONTROL.

Scientific investigation = Hypothesis testing

Observation of phenomena

Ask question of phenomena

- through observation identify phenomena and formulating a question
- list all possible variables (factors)

Formulate Hypothesis

"Cause" and "effect"

LO1 AS1

Formulate a hypothesis (prediction) that follows the criteria
- explain all aspects of an observation
- be the simplest possible explanation
- be expressed in such a way that predictions can be made from it, and
- be testable by experiment

Plan/design Investigation

- identify the variable to be tested (dependent variable)
- identify the factors to be kept constant
- identify the independent variable
- list appropriate apparatus
- plan sequence of steps
- set appropriate control

Experiment | Control

LO1 AS2

Collecting data
- Select instrument/method that is most appropriate for collection of data in an investigation
- Scaling, measuring quantities, systematic counting, matching, differentiating, describing objects / mechanisms/ processes, taking pictures, identifying problems and causes
- Identify factors that can influence your reliability and validity

Results

Recording results/ findings
- Record results in the form of tables, drawings, descriptions, pictures etc.
- Identify patterns in the results
- Identify and record irregular observations

Re-organise data
- Plotting graphs (line, bar graphs, histograms and pie charts),
- Constructing flow charts ,mind maps ,and concept maps, etc.

Conclusion

LO1 AS3

- explain the relationship between the variables (how and when the dependent variable changes over time/ concentration changes) (pH, light, carbon dioxide, etc.) during the experiment
- identifying and explaining trends/patterns from graphs (line graphs, histograms, bar graph and pie charts) flow charts, descriptions, etc.
- doing calculations
- identifying and explaining anomalous results
- explains the data
- acknowledges uncertainty in data
- Suggest specific changes that could improve the apparatus and technique

Support hypothesis
Hypothesis is not rejected

Does not support hypothesis
Hypothesis is rejected

Repeat

Revise, modify, adapt or generate new hypothesis

Designing Scientific Investigations

The scientific method generally has the following steps:

1. State the problem (purpose)
2. Develop a hypothesis
   - Consider the independent variable
   - Consider the dependent variable
   - How the 2 variables above are related
   - Which factors need to be controlled
3. Plan an investigation
   - Materials to be used
   - Method
   - How data will be collected, recorded, analyzed and represented
4. Set up and carry out the investigation (procedure)
5. Make observations and record information (data) e.g. in a table
   - Translate / reorganize the data e.g. draw a graph (bar, pie or line graph/s) from a table
6. Analyze and discuss the data (data analysis)
   - Look for trends / patterns and relationships between the two variables
7. State conclusions
   - Should the hypothesis be rejected or not
8. List any shortcomings / limitations of the investigation

Example

The following example of a scientific investigation illustrates the above concepts:

- A researcher made the following observation: potted plants covered with a black plastic bag did not grow well
- He asked the following question: What prevented the plants from growing well?
- His hypothesis: Light is essential for plant growth.
- AIM: To determine whether light is essential for plant growth
- In planning the investigation, he set up TWO sets of 50 plants as follows:
  - EXPERIMENT: 50 plants placed in a greenhouse
  - CONTROL: 50 plants placed in an identical greenhouse, blackened so that no light could enter.
- The plants in both the experiment and control received the same soil, amount of water, temperature etc. – in other words, they were given the same requirements / these factors were controlled
- NB. The experiment and control differed in only one factor / variable i.e.in the experiment plants were given light and the control plants were NOT exposed to light
- He measured the length of the aerial parts of the plants over a period of time in the experiment and in the control
- He recorded these results in a table and constructed line graphs
- He found that those plants placed in light (EXPERIMENT) grew taller
- He found that those plants placed in darkness (CONTROL) remained the same size
- His conclusion : Light is essential for plant growth and hence his hypothesis was correct for the type of plant that he investigated.

Assessment

A learner wanted to determine whether ferns prefer to grow in shade or in direct sunlight. He planted the same number and type of ferns on both the north (direct sunlight) and south (shaded) sides of the school's buildings. He also watered the plants regularly.

1. Write an hypothesis for the learner's investigation. (2)

2. After he designed and conducted the investigation, what results would indicate that the hypothesis mentioned in Q1 is not rejected. (2)

3. Which group of plants in this investigation would represent the control? (2)

4. Why did he use the same number and type of ferns? (2)

5. Identify each of the following types of variables/factors :-

   5.1 independent (1)

   5.2 dependent (1)

6. Describe TWO possible shortcomings of this investigation. (2)

7. Describe how the investigation could be made to be done so as to avoid the shortcomings described in Q6 above. (2)

(14)

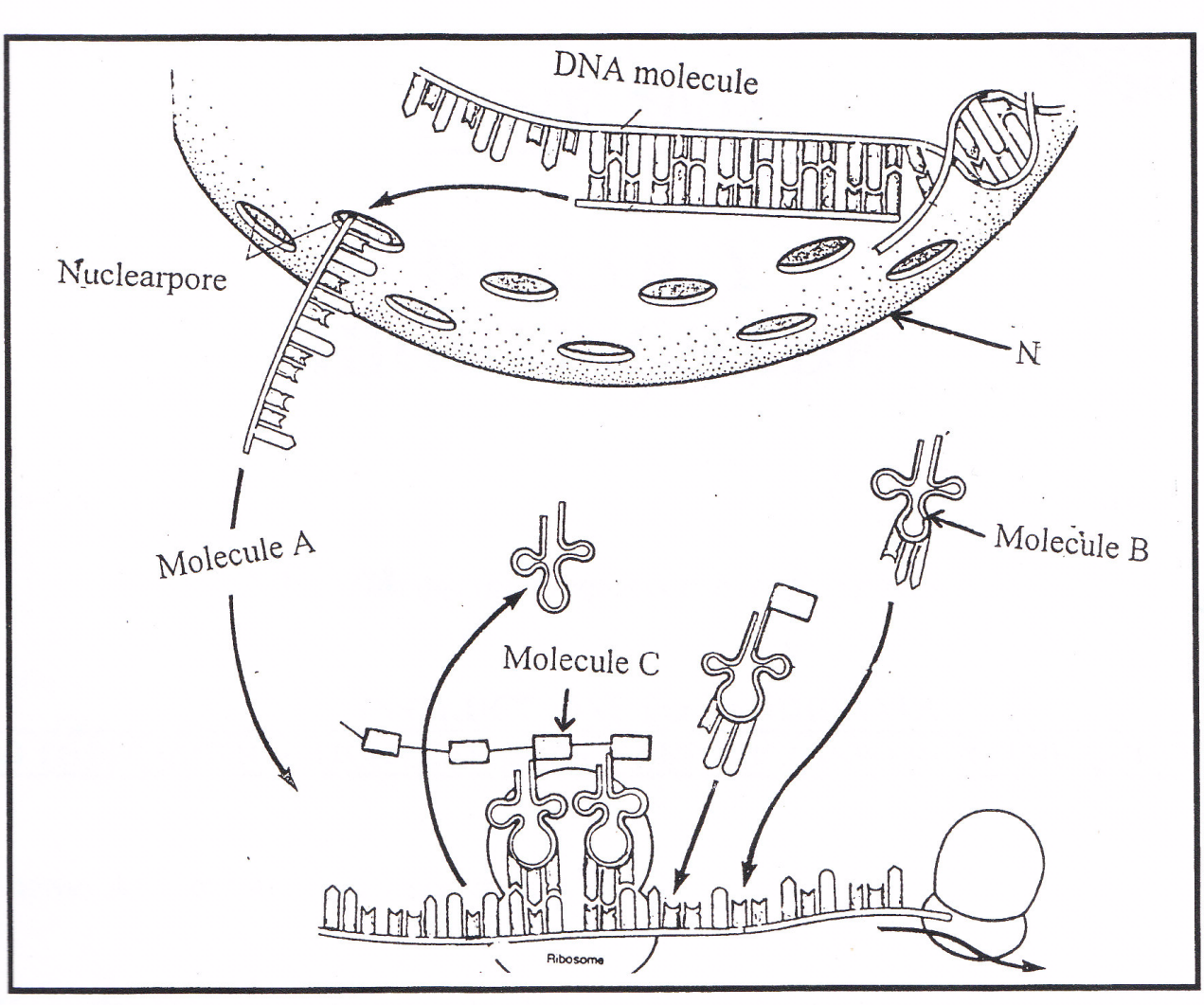
PROTEIN SYNTHESIS

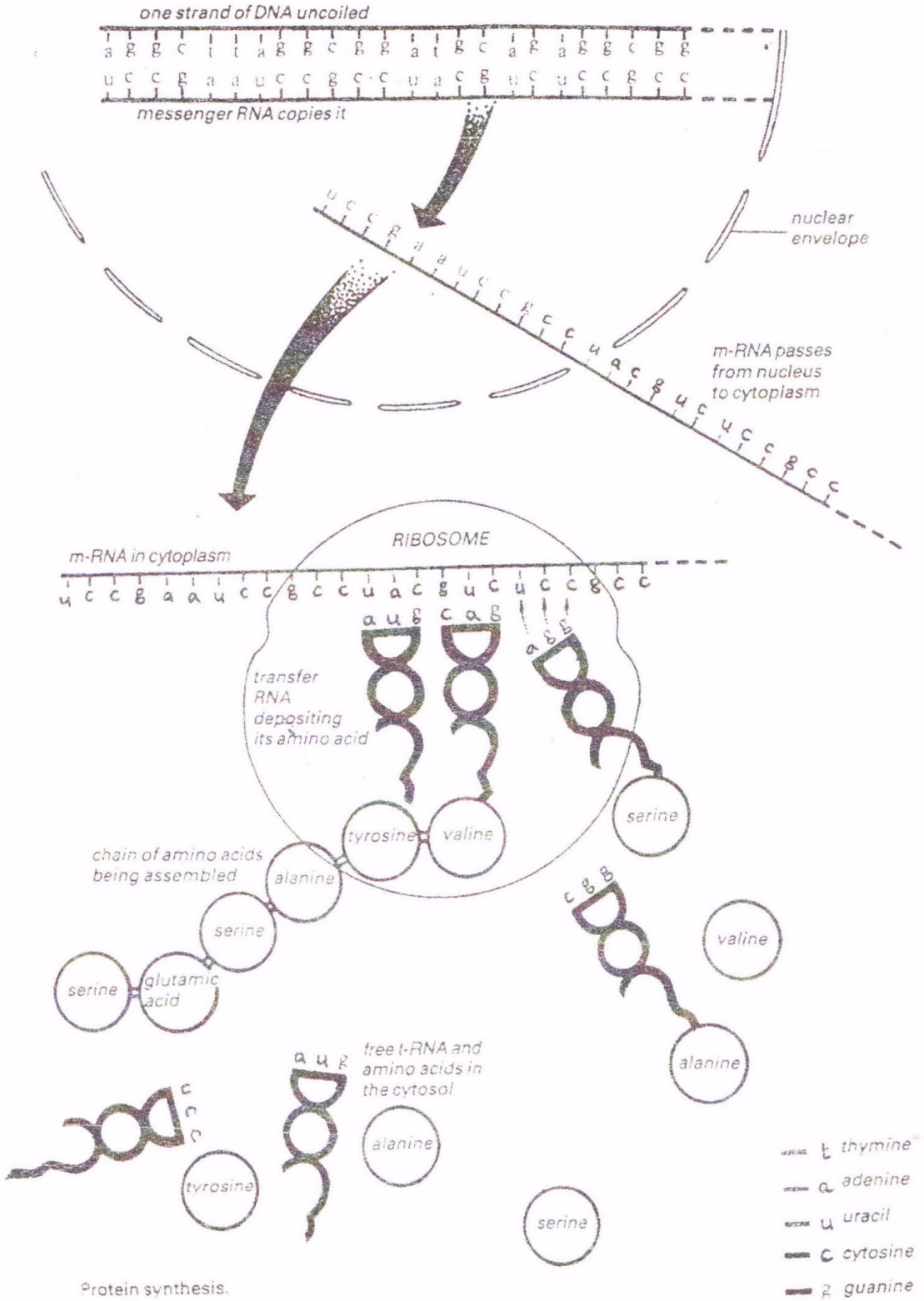
QUESTIONS – to be done before the section

1. What is an amino acid?
2. What is the structure of an amino acid?
3. Where are amino acids found?
4. Name the bonds formed between amino acids
5. Where does protein synthesis occur?

Learning Diagram

Hint: Molecule A is carrying a code out of the nucleus via a nuclear pore.





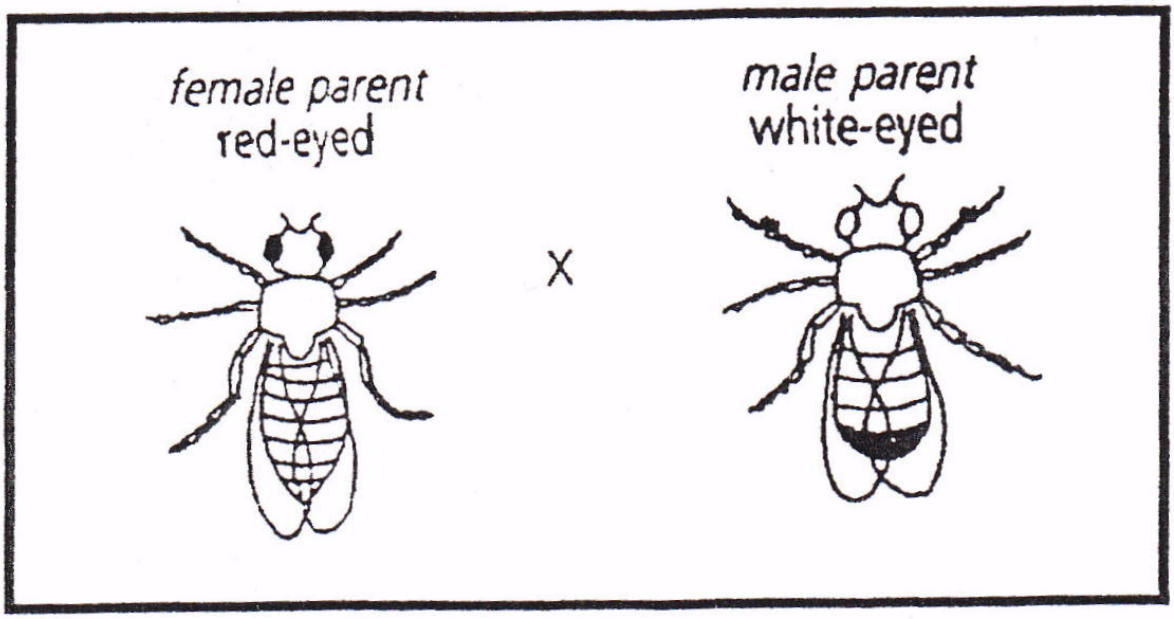
Protein synthesis.

DNA unwinds and splits
One DNA strand acts a template
Free nucleotides arrange to form m-RNA according to the DNA template
m-RNA strand is complementary to the DNA template i.e. A-U; C-G
This process is called **TRANSCRIPTION**
m-RNA moves through the nuclear pore into the cytoplasm and wraps itself around the ribosome
Each t-RNA brings a specific amino acid to the ribosome
amino acids are arranged in a specific order according to the CODONS on the m-RNA
The amino acids are linked by peptide bonds to form a particular protein
The entire process is controlled by **ENZYMES**
This process is called **TRANSLATION**

GENETICS

1. A Problem

In a certain species of fruit fly, the allele for red eyes (represented by R) is dominant to the allele for white eyes (represented by r). A heterozygous female fly was crossed with a male (pictured below):-



Show how the possible phenotypes and genotypes of the F1 generation for eye colour may be obtained by means of a genetics cross. (6)

2. Marking Guideline

P_1 phenotype x ✓
genotype x ✓

Meiosis

G x ✓

Fertilization

F_1 genotype ✓
phenotype ✓

OR

gametes		

1 mark for correct gametes
1 mark for correct genotypes

P_1 and F_1 ✓
Meiosis and fertilization ✓ max **(6)**

3. Activity: Mark This Pupil's Response According To The Marking Guideline Provided

Pupil's Response

P1	Genotype:	RR	x	rr
	Phenotype:	red	x	white

Meiosis

G	R	x	r

Fertilisation

$\mathbf{F_1}$	genotype:	Rr
	phenotype	only red-eyed flies; red-eyed flies and white-eyed flies

4. Pedigree Diagrams

Steps to follow when completing a pedigree diagram

a. Study any key and opening statement / s provided to look for:-
   i. dominant and recessive characteristics
   ii. phenotypes

b. Write in the phenotype of all the individuals as given in the problem

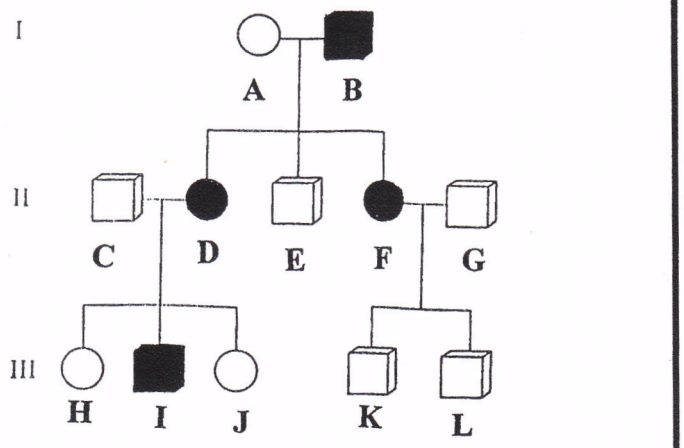
c. Fill in the genotype of all the individuals with the recessive condition – it has to have two lower case letters

d. For every individual in the diagram that has the recessive condition, it means that each gene was obtained from each of the two parents. So, work backwards and fill in one recessive gene for each of the parents

e. If the parents showed the dominant characteristic, then fill in the second letter which has to be a capital letter

f. Any other individual showing the dominant characteristic will most likely be homozygous dominant (two capital letters)

5. The pedigree shown below represents the typical inheritance pattern for Huntington's disease. The disease is a lethal (deadly) genetic disorder caused by a dominant gene, which affects the nervous system. Study the pedigree and answer the questions that follow.



Key:

Squares	– males
Circles	– females
Shaded	– affected individuals
Unshaded	– normal individuals

Use the symbols **H** and **h** where necessary to answer the following questions.

5.1 State the genotypes of each of the following individuals:

a. B (2)

b. C (2)

c. F (2)

d. H (2)

5.2 State the phenotypes of each of the following individuals:

a. A (2)

b. D (2)

c. I (2)

d. K (2)

5.3 What percentage of males in the third generation is affected by Huntington's disease. (2)

[18]

6. Sex-Linked Inheritance

Study the following genotypes and phenotypes which show how colour-blindness is inherited. X and Y represent sex chromosomes.

Individual	Genotype	Phenotype
M	X^BX^B	Normal female
N	X^BX^b	Carrier female. (Does not suffer from colour-blindness but can pass gene for colour-blindness to children)
O	X^bX^b	Colour-blind female
P	X^BY	Normal male
Q	X^bY	Colour-blind male

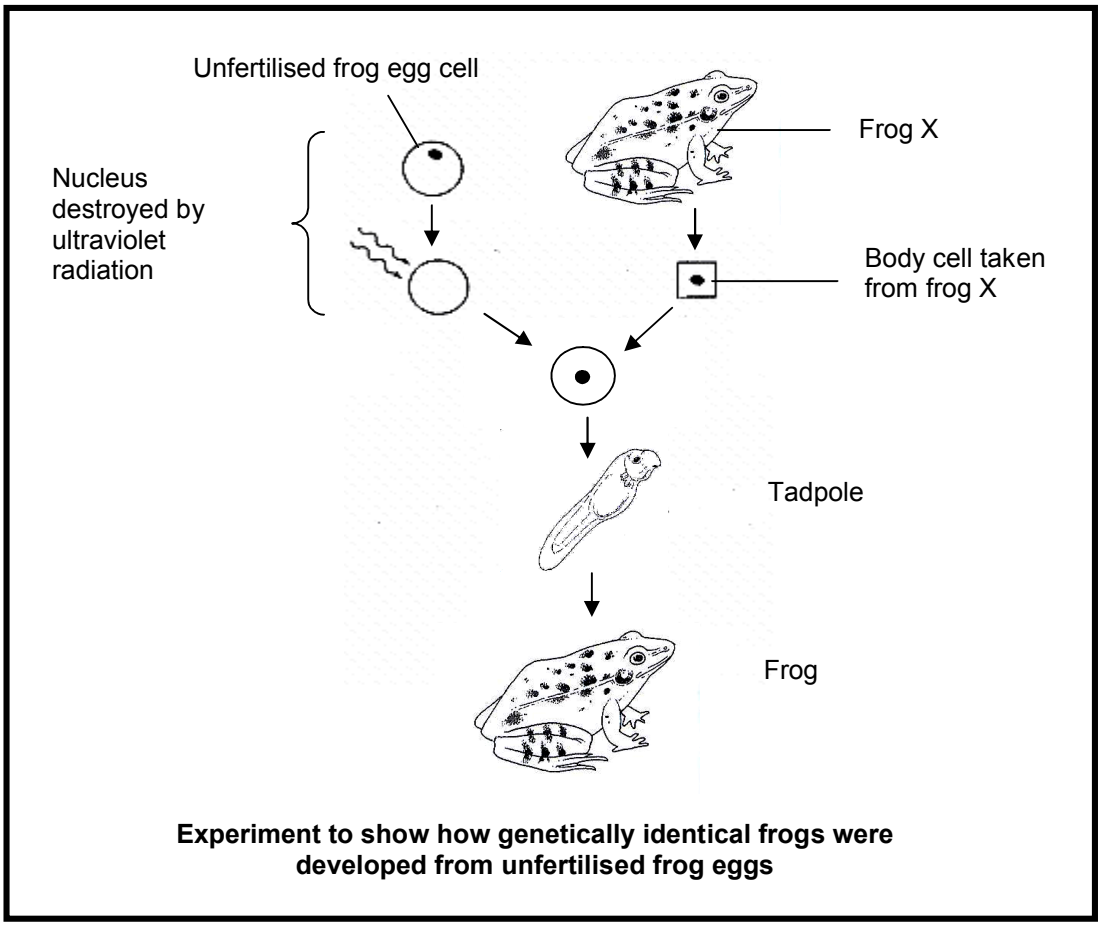
6.1 Which letter, B or b, represents the gene for colour-blindness?
6.2 Refer to individual N and explain if the gene for colour blindness is dominant or recessive.
6.3 Is the male or the female the carrier of the colour-blind gene?
6.4 What is the name given to the X and Y chromosomes?
6.5 Individuals O and P have a son and a daughter. Show the crosses by using a punnet square to show the genotypes and phenotypes of the children.

CLONING

A 'clone' is a group of genetically identical organisms

Examples: Dolly – sheep; Futi – milk-producing cow; super crops

The Process



Experiment to show how genetically identical frogs were developed from unfertilised frog eggs

- An unfertilized egg cell is used
- with a haploid nucleus
- The nucleus is destroyed
- A diploid nucleus from a body / somatic cell is removed and replaces the haploid nucleus in the egg cell
- This cell now acts like a zygote even though no fusion took place
- The 'zygote' develops into a new organism
- which has all the characteristics of the diploid organism / cell from which the cell was obtained

Advantages of Cloning

- Producing individuals with desired traits (better yield e.g. increased milk production and resistant to diseases)
- Organisms produced in a shorter time
- Could save endangered species
- Could produce body parts for organ transplant
- Produce offspring for organisms that cannot have offspring

Disadvantages of Cloning

- Objection to interfering with God's / Supreme Being's creation / nature
- Reducing the gene pool by reducing variation / Reduces genetic diversity
- Cloned organisms may have developmental / morphological problems
- Costly process
- May generate more experimental waste through unsuccessful cloning
- May lead to killing of clones to obtain spare body parts
- Cruelty to animals

Follow-up: Discuss ways in which cloning and vegetative reproduction is similar and different.

GENETIC MODIFICATION (GM)

GM is a type of technology that alters the genetic make-up of organisms such as animals, plants or bacteria.
Genetic engineering is the transfer of a gene from one organism to another.
Combining genes from different organisms is known as recombinant DNA technology, and the resulting organism is said to be "genetically modified", "genetically engineered" or "transgenic"

1. Genetically Modified Foods

1.1 Some Examples

FOOD	PROPERTIES	MODIFICATION
1. Soy beans	Resistant to herbicides	Herbicide resistant gene taken from bacteria inserted into soy beans
2. Sweet corn	Produces its own insecticide (a toxin to insects, to reduce insect attacks)	Insect-killing gene added to the plant. The gene comes from the bacteria *Bacillus thuringiensis*
3. Rice	Genetically modified to contain high amounts of Vitamin A	Three new genes implanted: two from daffodils and the third from a bacterium

1.2 Advantages of Genetically Modified Foods

a. <u>Crops</u>

- enhanced taste and quality
- reduced maturation time
- increased nutrients, yields and stress tolerance
- improved resistance to disease, pests and herbicides
- new products and growing techniques

b. <u>Animals</u>

- increased resistance, productivity, hardiness and feed efficiency
- better yield of meat, eggs and milk
- improved animal health and diagnostic methods

c. <u>Environment</u>

- 'friendly' herbicides and bio-insecticides
- conservation of soil, water and energy
- bio-processing for forestry products
- better natural waste management
- more efficient processing

d. <u>Society</u>

- increased food security for growing populations

1.3 Controversies / Disadvantages Of Genetically Modified Foods

a. Safety

- potential human health impacts, including allergens
- potential environmental impacts, including unintended transfer of transgenes through cross-pollination and loss of flora and fauna biodiversity

b. Access and Intellectual Property

- domination of the world food production by a few companies
- increasing dependence on industrialized nations by developing countries
- bio-piracy or foreign exploitation of natural resources

c. Ethics

- violation of natural organism's intrinsic value
- tampering with nature by mixing genes among species
- objections to consuming animal genes in plants and vice-versa
- stress to the animal

d. Labelling

- not mandatory in some countries e.g. U.S.A
- mixing GM products with non-GM products confuses labelling attempts

e. Society

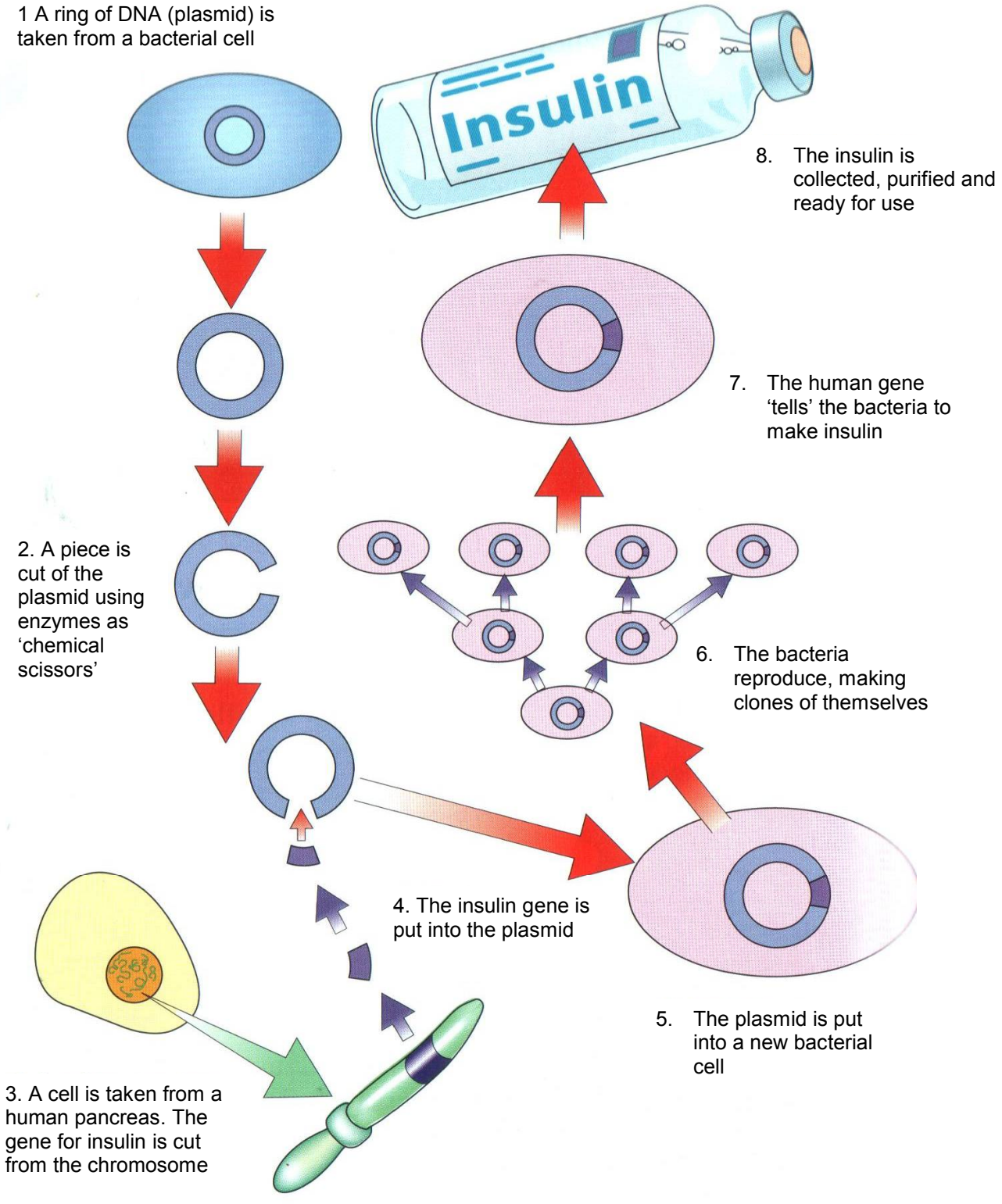
- new advances may be skewed to interests of rich countries

1.4 Management Strategies

1. Institute a body to regulate and provide advice on both safety and other issues concerning GM crops and food
2. Apply for permission before GM crops are planted
3. Stipulate strict labelling requirements for GM foods and foods containing GM ingredients
4. Introduction of legislation and controls by governments

2. Insulin Production

The Process



Steps In The Process

- A ring of DNA (plasmid) is taken from a bacterial cell
- A piece is cut of the plasmid (rings of DNA found in bacteria)
- using enzymes as 'chemical scissors'
- a cell is taken from a human pancreas
- the gene for insulin is cut from the chromosome
- The insulin gene is put into the plasmid
- The plasmid is put into a new bacterial cell
- The bacteria reproduce, making clones of themselves
- Tthe human gene 'tells' the bacteria to make insulin
- The insulin is collected, purified and ready for use

Advantages

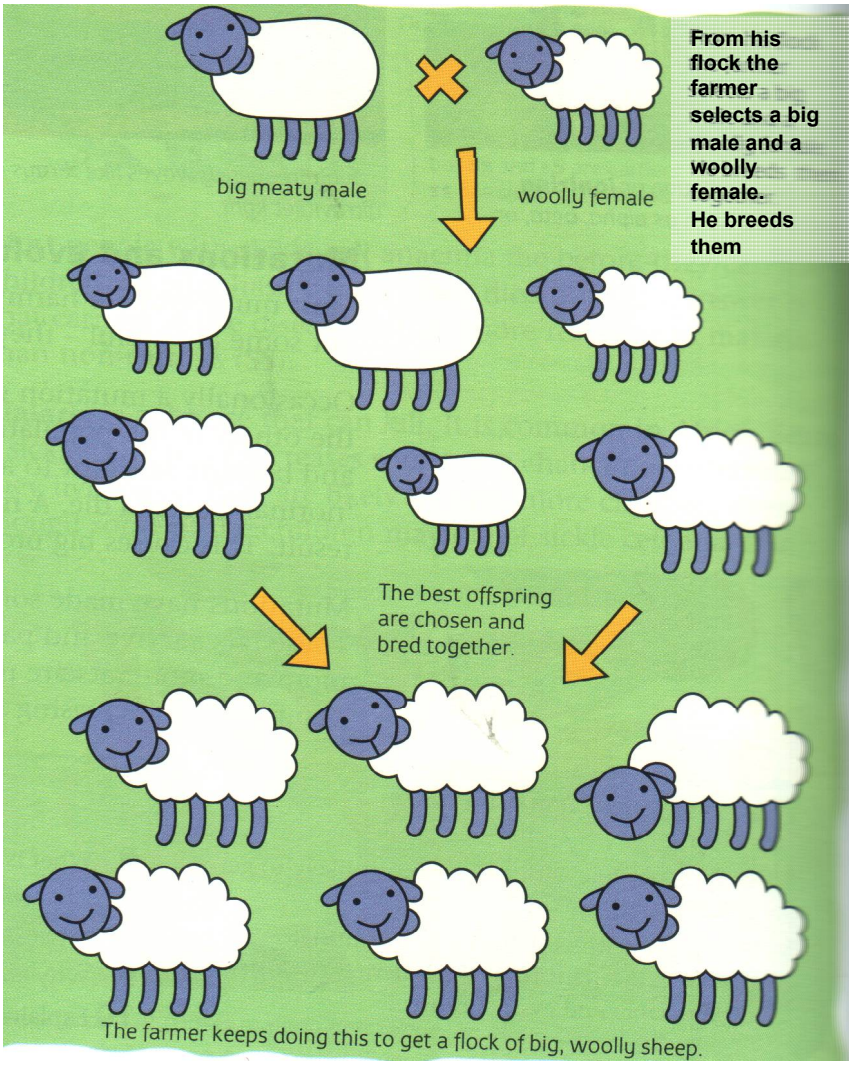
- Fewer side effects compared to previous methods of producing insulin e.g. from pigs
- Faster rate of production (due to rapid reproduction in bacteria)
- Avoidance of religious conflicts e.g. insulin production from pig cells – could offend individuals from the Muslim religion and vegetarians

Disadvantages

- tampering with nature / God's creation

SELECTIVE BREEDING

1. Choose the animal or plants that have the best characteristics
2. Breed them with each other
3. Choose the offspring with the best combination of characteristics
4. Allow them to breed with each other
5. Repeat the procedure many times to improve the characteristics



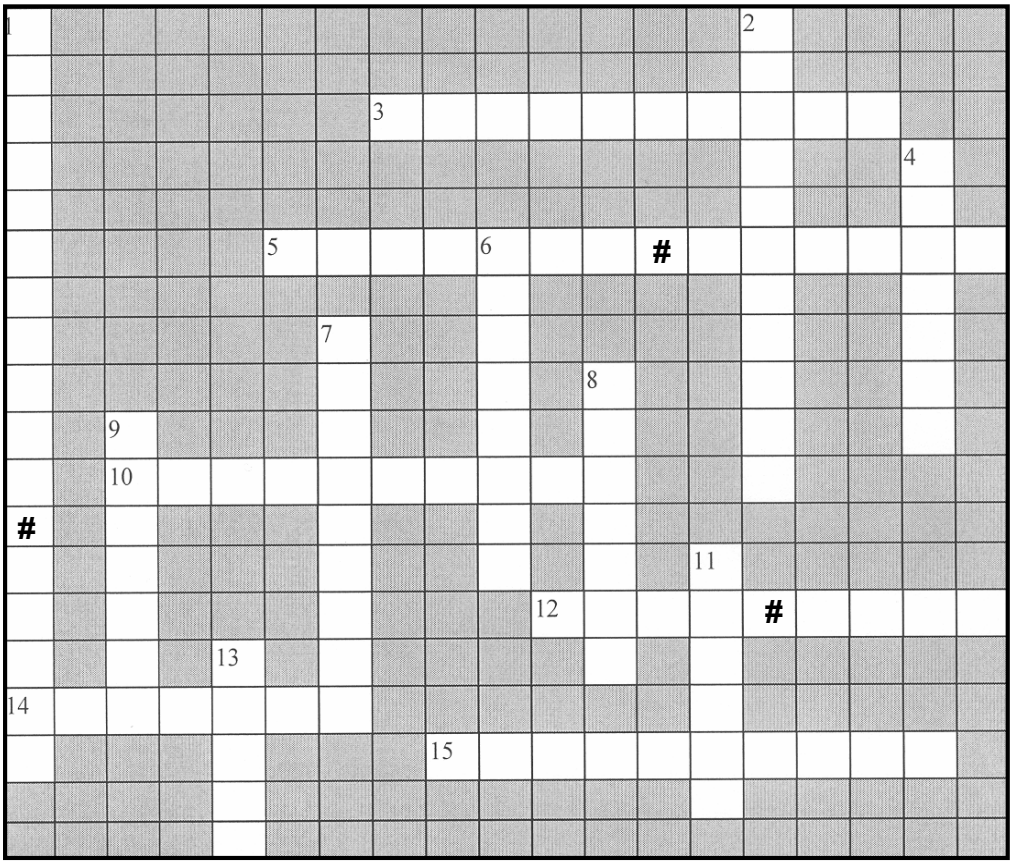
Advantages

- Produced cattle with more meat
- cows that give more milk
- wheat that produces more seeds
- sheep that produce more offspring

Disadvantages

- Usually closely related organisms are bred – leading to inbreeding
- Inbreeding reduces the gene pool of a species
- This could cause the entire species to be wiped out if exposed to a disease against which it has no resistance

EVOLUTION



CrosswordPuzzleGames.com
Eclipse crossword

ACROSS

3. Structures in different organisms which may differ in their function but have a similar anatomy
5. A large opening in the skull through which the spinal cord passes
10. A group of organisms of the same species found in the same locality
12. All the different alleles of genes in a particular population
14. Remains of organisms which are preserved in sedimentary rocks
15. The formation of a new species from an existing species as a result of geographical isolation

DOWN

1. The movement of continents relative to each other across the surface of the Earth
2. Having a pointed face because of projecting jaws and nose
4. Mutations that have no effect on the structure and functioning of the organism that possesses them
6. A sudden change in the structure of a gene
7. Structures that have similar functions and superficial appearance but very different anatomy
8. The group of birds in which Darwin noticed great variation in beak sizes and shapes
9. A group of organisms that can breed with each other to produce fertile offspring
11. Mutations that lead to the death of organisms such that the harmful characteristics are not passed on to the next generation
13. Mutations that are advantageous to an organism and remain for long periods within the gene pool

VARIATION, NATURAL SELECTION AND SPECIATION

Sources of variation

- Mutation
- Meiosis : - independent assortment / crossing – over
- Random mating
- Chance fertilization

Natural selection

- Most species produce a **large number** of offspring
- Offspring of the same species show a great deal of **variation**
- These offspring **compete** with each other for food, shelter etc
- Offspring that have **desirable features** for obtaining these resources will survive
- **Nature has selected** organisms with the desirable features for survival
- A large number of offspring will die and only a **small number** of offspring **survive**
- Those that survive, **reproduce** to form the next generation

Speciation

- As a result of a geographical **barrier**
- a population may **split** into two
- The geographical barrier **prevents reproduction** between the two populations
- Each group undergoes **natural selection**
- as a result of varying **environmental conditions**
- and develops **differently** genotypically and phenotypically
- The two populations become so different that they **cannot inter-breed** again even if they mix
- One or both of the populations becomes a **new species**

DARWIN AND LAMARCK

1.
Outline Darwin's approach using an example e.g. giraffe

Darwin

- As a result of genetic variation in the giraffe population
- some giraffes have longer necks than others
- Environmental change/competition for resources occurred
- causing those with shorter necks to die
- and those with longer necks to survive
- since they could reach the leaves of tall trees
- This is termed natural selection
- The genotype for longer necks
- was passed on to subsequent generations
- In this way each subsequent generation had necks longer than the generation before

Outline Lamarck's approach using the same example e.g. giraffe

Lamarck

- All giraffes had short necks originally
- Giraffes frequently stretched/used their necks to reach for leaves of tall trees
- causing their necks to become longer
- The characteristics of long necks acquired in this way
- was then passed on to the next generation
- forming offspring with longer necks than the generation before

2. Tabulate differences between Darwin and Lamarck

Darwin	Lamarck
There was variation in the necks of the giraffe at the beginning (there were short and long necks)	All the giraffes had short necks initially
Genetics causes variation	Environment causes change
Chance occurrence - Environment selected which genes survived	Deterministic - Organism tried to adapt to environment

3. Why is Lamarck's theory not acceptable?

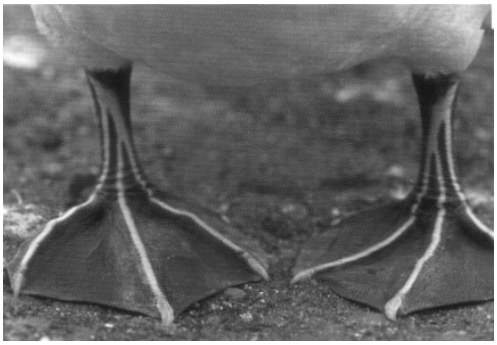
Acquired characteristics cannot be passed from one generation to the next

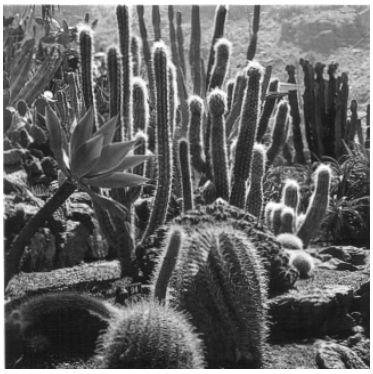
OR

Organisms did not evolve because they wanted to evolve/Lamarck's theory is deterministic

4. Give MANY other examples to illustrate the differerences between Darwin's and Lamarck's theory.

The diagrams below show the webbed feet of a duck and cacti plants.





Explain how Lamarck and Darwin respectively would have explained the …

- webbed feet of the duck
- succulent feature of xerophytic plants.

Webbed Feet

Lamarck

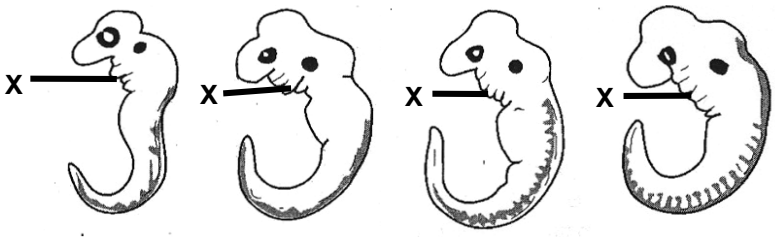
- Lamarck would have stated that ducks initially used their feet only for walking, looking for food on land.
- As food became scare on land the ducks were forced to search for food in the water.
- The ducks tried to stretch their toes apart in an attempt to achieve an efficient swimming stroke
- As a result the skin between their toes became stretched to form the beginnings of the webbed feet.
- This characteristic was then inherited by the future generations.

Darwin

- Darwin would have stated that there was a great deal of variation amongst the phenotypes of the individuals of the duck population
- Some ducks had a little skin attached between their toes.
- As food became scare on land the ducks were forced to search for food in the water.
- Those ducks which had more skin attached between their toes were able to perform a swimming action to secure food from a watery environment.
- Those that were not able to do this died.
- Those that survived reproduced and produced offspring with a large amount of skin between their toes
- Over a period of time the skin became so prominent as found in the webbed feet of ducks today

COMPARATIVE EMBRYOLOGY

- Give learners diagrams showing the embryo stage of various vertebrates
- Highlight the similarity in terms of the presence of a tail and gill slits
- State that scientists use this as evidence of common ancestory
- The common ancestor was most likely an aquatic organism in view of the presence of gill slits and the tail.



A. Fish **B. Chicken** **C. Pig** **D. Human**

X – Represents the internal gill pouches

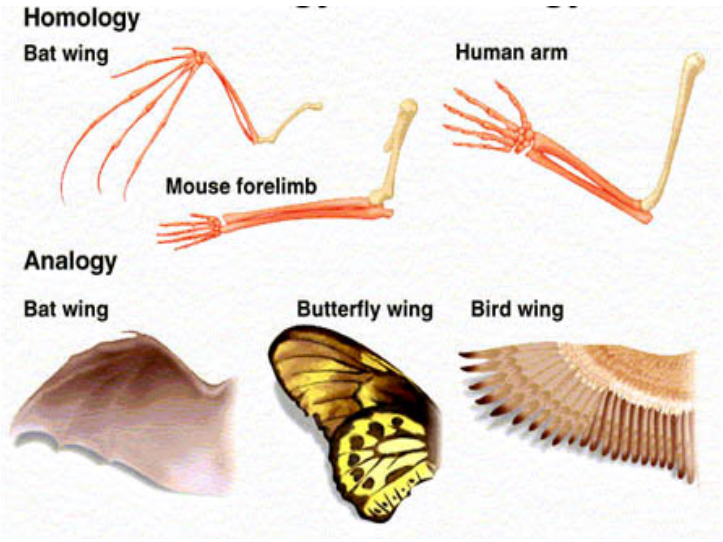
Embryos of different vertebrates

COMPARATIVE ANATOMY

- First teach the terms analogous and homologous.
- To understand the term homologous in this context review the term homologous in terms of chromosomes (referring to identical chromosomes) or in homozygous (referring to identical genes). In the same way refer to analogous as meaning different (digital watches vs analogue watches)

ANALOGOUS	HOMOLOGOUS
Different origin though the function of the body parts may be the same	**Same/Identical** origin though the function of the body parts may be different
wings of bird (endoskeleton) and locust(exoskeleton) are different in plan/origin but it is used for flight by both organisms	eg. Limbs of bird and mole have same basic origin but bird uses it for flight and mole uses it for digging

- Homologous structures in different organisms are indicative of common ancestory - so the bird and mole are more closely related than the bird and the locust
- Diagrams should be used to emphasise the above points
- Different examples of diagrams should be used so that learners can deal with any new diagrammatic representation that may appear in examination papers.

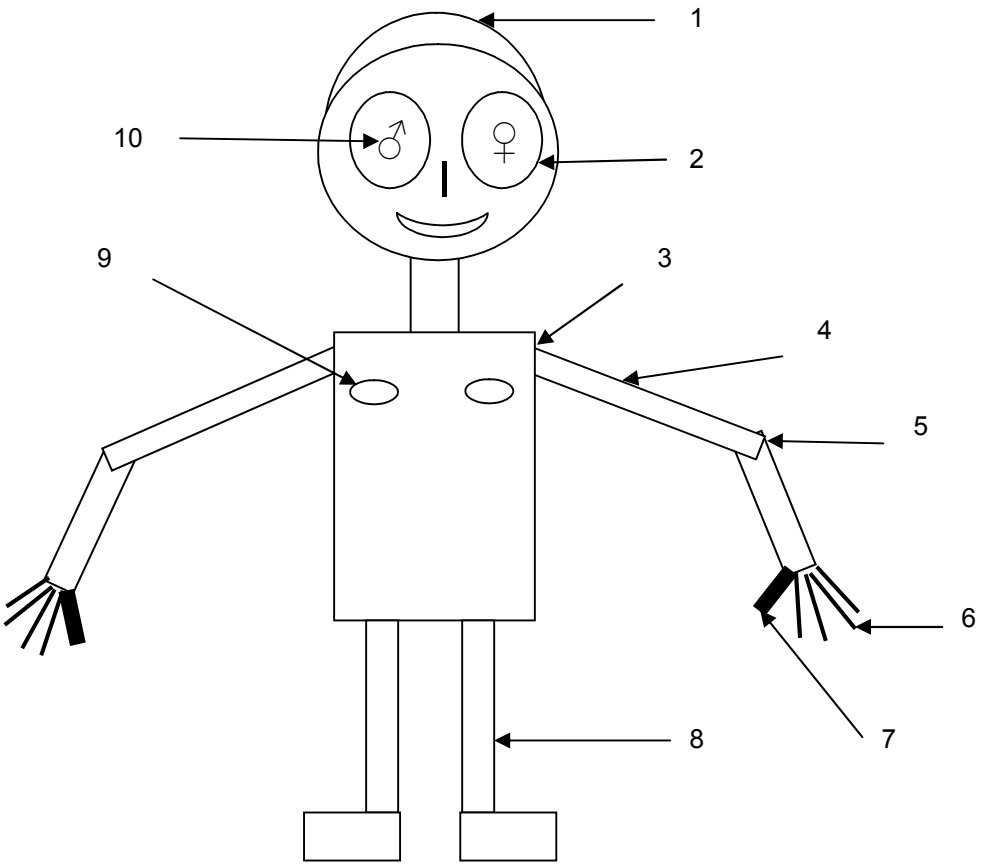


Homology and Analogy

SIMILARITIES BETWEEN *HOMO SAPIENS* AND OTHER PRIMATES

- The following similarities are required by the syllabus

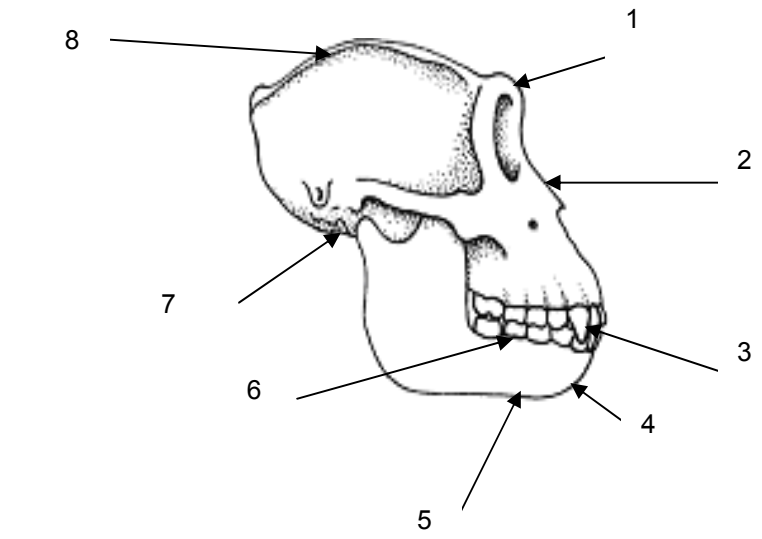
- Upright posture✓
- Long upper arms✓
- Freely rotating arms✓
- Elbow joints allowing rotation of forearm✓
- Rotate hands at least 180º✓
- Flat nails instead of claws✓/bare finger tips
- Opposable thumbs✓ which work in opposite direction to their fingers
- Large brains/skulls compared to their body mass✓
- Eyes in front✓/binocular vision/stereoscopic vision
- Eyes with cones✓/colour vision
- Sexual dimorphism✓/distinct differences between male and female
- Olfactory brain centres reduced✓/reduced sense of smell
- Parts of the brain that process information from the hands and eyes are enlarged✓
- Two mammary glands only✓

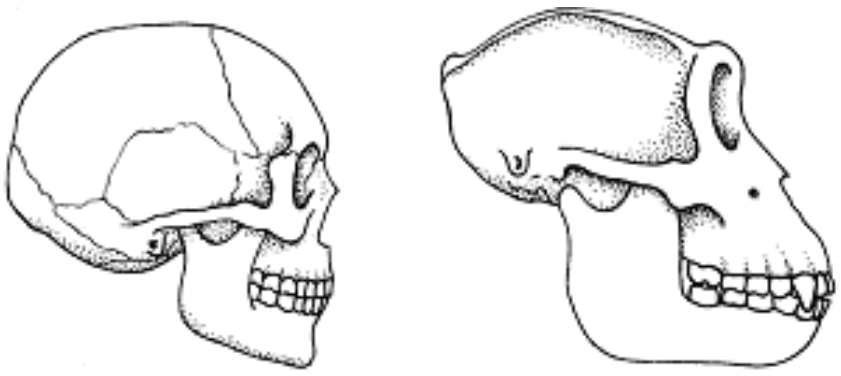


DIFFERENCES BETWEEN HOMO SAPIENS AND OTHER PRIMATES

- The 2nd and 3rd column below contains the differences that are required by the syllabus
- The differences below relate to the head. To this must be included the posture of the organism (bipedal vs quadripedal) and difference in the development of language.

FEATURE	***Homo sapiens***	***Other primates***
Cranium	1. Larger cranium✓/brain	1. Smaller cranium ✓/brain
Face	2. Flat face✓/ Forehead slope less backwards	2. Face sloping✓/ Foreheads slope much backwards
Foramen Magnum	3. Foramen magnum forward✓/bottom of the skull	3. Foramen magnum at the back of the skull✓
Brow Ridges	4. Brow ridges are not as pronounced✓	4. Brow ridges pronounced✓
Canines	5. Smaller canines✓	5. Larger canines✓
Spaces between teeth	6. Smaller spaces between the teeth	6. Larger spaces between the teeth
Arrangement of teeth	7. Jaws with teeth on a gentle/round curve✓	7. Jaws with teeth in a rectangular/U shape✓
Jaws	8. Less protruding jaws✓	8. More protruding jaws✓/ prognathous
Chin	9. Lower jaw has a well developed chin✓	9. Lower jaw has poorly developed chin✓





Environmental Studies

Corrective Management to reduce overexploitation of resources

- Educating the community on the consequences of overexploitation.
- Sustainable harvesting should be practised.
- Research to be done to look at reproductive cycle and cloning
- Legislation to control harvesting to be developed
- There should be penalties to break legislation
- Establish nurseries and seed banks to replace plants harvested
- Establish more nature reserves to conserve indigenous plants.
- Provision of free and cheaper food to reduce dependence on indigenous plants.

Impact of overexploitation on the environment

- Plants can become extinct / leads to loss in biodiversity
- Food chains and food webs can be destroyed
- Leads to shortage of food
- Could lead to degradation of the environment
- Could lead to the erosion of the soil surface

Preventing over-exploitation of perlemoen

- Limit number caught
- Only licensed fishermen catch perlemoen
- Heavy penalties/fines for those who contravene regulations
- Stipulate minimum size of perlemoen that can be caught to minimize the impact on the population
- Patrol all those beaches where perlemoen is found to ensure compliance with regulations

Preventing over-exploitation of fish

- Each country tries to keep within its quota by setting limits to the number
- and size of each fish type that each fisherman can catch.
- To achieve this control, each fisherman is expected to have a valid fishing permit.
- Heavy fines are imposed for fishing without a permit
- or contravening the catch or size limit (even with a permit).

Preventing over-exploitation of Devil's claw/ African potato

- Collecting only the amount that is permitted
- Cultivating the plants at home for your own use
- Collecting fruits of the plant and distributing the seeds widely so as to increase the range of the plant
- Establish nurseries and seed banks to prevent collecting these plants from the wild
- Introduce legislation to control the harvesting of these plants
- Monitor the observance of legislation on harvesting

Managing Pollution

Air Pollution

The best way to reduce the effect of air pollutants on human physiology and health is to reduce the incidence of air pollution. The following are some ways in which this can be done:

- Conserve our plants since they maintain a balance between the gases in the atmosphere
- Control the lighting of fires since the burning (combustion process) releases carbon dioxide into the atmosphere
- Reduce use of wood and coal since the burning of these fuels contributes to pollution.
- Use alternate, renewable energy sources
- Use public transport. This helps to reduce the number of vehicles on the road and therefore the amount harmful pollutants from these vehicles.
- Use unleaded petrol. This decreases the amount of lead that will be released into the atmosphere.
- Monitor emissions from industries.
- Educate people on specific ways in which they can help prevent air pollution.
- Introduce legislation that prevents people from polluting
- Impose heavy fines for polluting

Water Pollution

The best way to reduce the effect of water pollutants on human physiology and health is to reduce the incidence of water pollution. The following are some ways in which this can be done:

- Do not throw rubbish or chemicals into the water.
- Monitor emissions from industries
- Use clean containers to collect water. Sometimes containers used may have pollutants that contaminate the water when the container is placed into the water during collecting.
- Educate people (at school, in factories or in our community) on specific ways in which they can help prevent water pollution.
- Reduce the use of pesticides since they often leach into a water source, thus contaminating the water.
- Introduce legislation that prevents people from polluting
- Impose heavy fines for polluting

Land Pollution

The best way to reduce the effect of land pollutants on human physiology and health is to reduce the incidence of land pollution. The following are some ways in which this can be done:

- Recycle, reuse and reduce our use of non-biodegradable substances
- Monitor dumping from industries
- Reduce the use of pesticides as chemical control of pests
- Educate people on specific ways in which they can help prevent land pollution
- Introduce legislation that prevents people from polluting
- Impose heavy fines for polluting

Waste Management

- **Landfill and burning with energy recovery**✓
- Incorporate private companies✓ to utilise the heat generated ✓from the burning of landfill sites to generate electricity✓ thus saving on the electricity bill✓
- Investigate methods to collect and utilise methane gas as a fuel✓

- **Recovery and recycling**✓
- Encourage citizens of the city to put different types of waste✓ into different waste containers/bins of different colours✓
- Partnership with recycling companies for collection of different wastes✓
- This could generate income✓ and reduce the transport cost ✓
- Educate lower income groups to use organic waste✓ for example to make compost✓ which could fertilise soil, they can plant vegetables that will benefit poor people✓

- **Educate citizens and companies to reuse waste**✓ for example glass containers for milk, cold drinks and alcohol etc✓
- This will reduce the need to produce more from these items✓
- thus saving energy and money✓

- **Reducing waste**✓
- Charge people extra if they generate more waste. ✓
- Fines for people that do not separate the waste into different bins✓
- To encourage citizens to manage waste more efficiently✓

GRAPHICAL INTERPRETATION – steps to follow

1. Title: Read and underline key words in the title of the graph. The title provided information on the 2 variables that have been graphed
2. Determine what the underlining concept/s are that are covered by the graph
3. X-axis; learners must take note of what is being measured as well as the units of measurement (the X-axis contains the independent variable – the variable that is controlled by the investigator)
4. Y-axis; learners do the same as with the X-axis
5. If there are two graphs check if the same scale has been used for both dependent variables
6. Scale: Be aware of the intervals used for the different measurements; To read points on an indicated scale learners could use the halfway mark as a guideline, e.g. halfway between 0 and 7 days will be 3½ days.
7. If a legend/key is given in a separate textbox, study the key and then use it to label the graph
8. Study the patterns of each graph to see where they drop, rise or maintain a straight line. Use a pencil to indicate the various sections on the line:

   If the graph goes up – the measure of the dependent variable (Y-axis) is increasing
   If the graph goes down – the measure of the dependent variable (Y-axis) is decreasing
   If the graph stays flat – the measure of the dependent variable (Y-axis) is remaining constant

9. State that any increase in the measure of the depend variable is as a result of the influence of the independent variable (Y-axis)
10. Read each question and underline the key words in the question.

USING NEWSPAPER ARTICLES

Steps in using articles to develop learning materials assessment tasks

- Read the article
- Which knowledge area does it relate to?
- Which Grade is it relevant for?
- Highlight the essential features of the article as you read it
- Summarise the article
- Acknowledge the source (sometimes… *adapted from*)
- Use the title of the original article or provided an adapted title for the summarised article if desired
- Set questions on the article (direct and indirect)
- State the cognitive ability level applicable to each question
- Provided possible answers for each question