PROVINCE OF KWAZULU-NATAL

DEPARTMENT OF EDUCATION

STEP-AHEAD SUPPORT DOCUMENT

LESSON PLANS

GRADE 12

LIFE SCIENCES

JANUARY 2021

PREFACE

This support documents serves to assist Life Sciences teachers and learners on how to deal with curriculum gaps and learning losses as a result of the impact of COVID 19 in 20202. It also captures the challenging topics in the Grade 12 work. The lesson plans should be used in conjunction with the 2021 Recovery Annual Teaching Plan. Activities should serve as a guide on how to assess topics dealt with in this document. It will cover the following:

TOPIC: DNA - The Code of Life			
TERM	1	**WEEK**	1
DURATION	2 hours	**WEIGHTING**	27 marks (18%)
SUB-TOPICS	• Nucleic Acid, • Location of DNA • Discovery of DNA		
RELATED CONCEPTS/ TERMS/VOCABULARY	Nucleotides, nucleic acid, DNA, double helix, monomer.		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Grade 10: Plant and Animal cells, nucleic acids.

RESOURCES

Textbook, 2019 revision document, MTG, JIT documents.

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Nucleic acids with nucleotides

METHODOLOGY

LESSON 1

Introduction

- Explain types of nucleic acids
- Revise structure of cell emphasizing on nucleus, cytoplasm and ribosome
- Explain DNA location (Nuclear DNA and Mitochondrial DNA)

LESSON 2

- Explain the discovery of DNA (Watson & Crick, Franklin and Wilkins)

ACTIVITIES

- Label and state the function of parts of the cell (JIT TERM 1, 2020, Page 8)
- Interpret a diagram of a nucleic acid (2019 revision doc, page 1)

SUMMARY

- Cell structure (ribosome, nucleus and cytoplasm)
- Types of nucleic acids are:
  - ✓ Deoxyribonucleic acid
  - ✓ Ribonucleic acid
- Brief history of DNA
- Watson and Crick discovered the shape of DNA that it was double helix

TOPIC: DNA- The Code of Life			
TERM	1	**WEEK**	2
DURATION	4 hours	**WEIGHTING**	27 marks (18%)
SUB-TOPICS	• Structure of DNA • Role of DNA • Replication of DNA • DNA Profiling		
RELATED CONCEPTS/ TERMS/VOCABULARY	Double helix, nucleotide, DNA replication, DNA profiling, nitrogenous base, monomer.		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Grade 10 Cells, chromosomes and nucleic acids

RESOURCES
Textbook, 2019 Revision document, previous exam papers, MTG, JIT document.
ERRORS/MISCONCEPTIONS/PROBLEM AREAS
• DNA replication and protein synthesis • DNA nucleotide and RNA nucleotide • DNA replication and transcription
METHODOLOGY
LESSON 3 • Explain components of DNA nucleotide • Stick diagram of DNA molecule • Describe the shape of DNA • Explain functions of DNA
LESSON 4 • Describe the process of DNA replication
LESSON 5 • Define DNA profile • Explain uses of DNA profile
LESSON 6 • Interpret DNA profile
ACTIVITIES
• Label diagrams of DNA • Describe DNA replication and its significance (2019 revision doc, page 3 and 4) • Interprete DNA profiles (2019 revision doc, page 5)
SUMMARY
• DNA structure is made up of nucleotides and is double helix. • DNA replication is a process where DNA makes copies of itself. • DNA profile are barcoded patterns, which are used to: ✓ prove paternity ✓ solve criminal cases as biological evidence ✓ develop cures for inherited disorders ✓ diagnose inherited disorders.

TOPIC: DNA - The Code of Life			
TERM	1	**WEEK**	3
DURATION	4 hours	**WEIGHTING**	27 marks (18%)
SUB-TOPICS	• RNA types, location and structure • Genetic code • Protein synthesis		
RELATED CONCEPTS/ TERMS/VOCABULARY	Gene, nucleotide, transcription, translation, nucleus, ribosome, tRNA, mRNA, amino acids.		
PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE			
Nucleic Acids, cell structure, location of DNA and chromosome.			
RESOURCES			
Textbook, Mind The Gap, previous exam papers, JIT doc			
ERRORS/MISCONCEPTIONS/PROBLEM AREAS			
Learners confuse the following terms/ concepts:			

- DNA replication with protein synthesis
- Transcription with translation
- Codon with anticodon

METHODOLOGY

LESSON 7

- Explain the types, location and structure of RNA

LESSON 8

- Describe the role of RNA in protein synthesis

LESSON 9

- Describe transcription using simple diagrams to illustrate transcription in protein synthesis

LESSON 10

- Describe translation using simple diagram to illustrate translation in protein synthesis

ACTIVITIES

- Tabulate similarities and differences between DNA and RNA
- Interprete diagrams on protein synthesis to identify different events in translation and transcription (2019 revision doc, page 9 and 13)

Summary

- RNA is located in nucleus and cytoplasm
- Types of RNA are mRNA and tRNA
- RNA structure:
  - ✓ is single stranded
  - ✓ consists of Nucleotides and have four nitrogenous bases: Adenine (A), Uracil (U), Guanine (G) and Cytosine (C).
  - ✓ DNA and RNA play a role in protein synthesis

TOPIC: Meiosis			
TERM	1	**WEEK**	4
DURATION	2 Hours	**WEIGHTING**	21 marks (14%)
SUB-TOPICS	• Structure of chromosome • Process of meiosis • Importance of meiosis		
RELATED CONCEPTS/ TERMS/VOCABULARY	Chromosomes, chromatids, centromere, centriole, homologous chromosomes, cytokinesis.		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Chromosomes and mitosis

RESOURCES

Textbook, 2019 revision document, previous exam papers, Mind The Gap.

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Centrosome/ centriole with centromere
- Homologous chromosome with bivalent
- Nuclear membrane with cell membrane
- Chromosome with chromatid
- Random arrangement with random assortment and independent assortment

METHODOLOGY

LESSON 1

- Revise the structure of the cell with emphasis on the parts of the nucleus, centrosome and cytoplasm.
- Stick diagram of a chromosome to illustrate its structure.
- Differentiate between haploid and diploid cells, sex cells and somatic cells and sex chromosomes and autosomes

LESSON 2

- Define meiosis
- Explain where meiosis takes place in plants and in animals
- Describe the events of interphase
- Describe the events of the phases of Meiosis I, using diagrams

LESSON 3

- Describe the events of the phases of Meiosis II, using diagrams

LESSON 4

- Describe the importance of meiosis

ACTIVITIES

- Identify, with reasons, the various phases of meiosis from diagrams (2019 revision doc page 19)
- Explain the significance of meiosis
- Tabulate differences between Meiosis I and Meiosis II

Summary

- Structure of chromosomes:
  - ✓ Chromosomes consist of DNA (which makes up genes) and protein
  - ✓ Chromosomes which are single threads become double (two chromatids joined by a centromere) as a result of DNA replication
- Process of meiosis
  - ✓ Meiosis is a cell division where a diploid cell divides to form four different haploid cells
  - ✓ Meiosis is a continuous process, but the events are divided into different phases of meiosis 1 and meiosis 2
- Importance of meiosis
  - ✓ Production of haploid gametes
  - ✓ The halving effect of meiosis overcomes the doubling effect of fertilisation, thus maintaining a constant chromosome number from one generation to the next
  - ✓ Introduce genetic variation

TOPIC: Meiosis			
TERM	1	**WEEK**	5
DURATION	2 hours	**WEIGHTING**	21marks (14%)
SUB-TOPICS	Abnormal meiosis and consequences Similarities and differences between meiosis and mitosis		
RELATED CONCEPTS/ TERMS/VOCABULARY	Meiosis, cytokinesis, chromosomes, haploid, diploid, karyokinesis chromatids, non-disjunction, down syndrome.		
PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE			
Cell structure, mitosis.			
RESOURCES			
Textbook, 2019 revision document, previous exam papers, MTG			

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Down syndrome and non-disjunction

METHODOLOGY

LESSON 5

- Describe non-disjunction and its consequences

LESSON 6

- Describe the non-disjunction of chromosome pair 21 during Anaphase I in humans to form abnormal gametes with an extra copy of chromosome 21
- Explain the fusion between an abnormal gamete (24 chromosomes) and a normal gamete (23 chromosomes) may lead to Down syndrome

LESSON 7

- Explain the similarities of mitosis and meiosis

LESSON 8

- Explain the differences between mitosis and meiosis

ACTIVITIES

- State the consequence of non-disjunction during meiosis (2019 revision doc page 24 and page 25)
- Tabulate the differences between mitosis and meiosis.
- Practical investigation (Understanding Life Sciences, page 31- 32)

Summary

- Abnormal Meiosis:
  - ✓ chromosomes may fail to separate during Anaphase 1 / 2 due to Non-disjunction.
  - ✓ Fusion between an abnormal gamete with extra copy of chromosome in pair 21and a normal gamete may lead to Down Syndrome
- In both meiosis and mitosis:
  - ✓ DNA replication takes place
  - ✓ The nucleus divides
  - ✓ The cytoplasm divides
  - ✓ New cells are formed
- Differences between mitosis and meiosis:
  - ✓ Meiosis forms 4 haploid different cells.
  - ✓ Mitosis forms 2 diploid identical cells.

TOPIC: Reproduction in vertebrate			
TERM	1	**WEEK**	6
DURATION	4 hours	**WEIGHTING**	8 marks (5%)
Sub-topics	Diversity of reproductive strategies		
RELATED CONCEPTS/ TERMS/VOCABULARY	Internal fertilization, external fertilization, precocial, altricial, amniotic egg, yolk sac, allantois, chorion, ovipary, ovovivipary, vivipary		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Grade 9 Reproductive system and adaptation of organisms to its habitat.
Grade 12 Meiosis

RESOURCES

Textbook, 2019 revision document, previous exam papers, MTG, JIT doc.

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Reproductive strategies
- Ovipary,vivipary and ovovivipary

- Precocial and altricial development.

METHODOLOGY

LESSON 1

- Explain the role of external fertilisation and internal fertilisation in animals in maximising reproductive success in different environments (using relevant examples)

LESSON 2

- Describe the differences between ovipary, ovovivipary and vivipary

LESSON 3

- Identify parts of the amniotic egg and state their functions.

LESSON 4

- Explain how precocial and altricial development and parental care in animals maximise reproductive success

ACTIVITIES

- Identify the reproductive strategies, (JIT doc term1 2020 page 48 and 2019 revision doc page 28)
- Label and give the functions of amniotic egg (JIT doc term 1 2020 page 49)

SUMMARY

- Types of Fertilisation:
  - ✓ Internal fertilisation- takes place inside the female's body
  - ✓ External fertilisation- takes place outside the female's body
- Protection of embryo:
  - ✓ Ovipary- eggs are laid to develop outside the female's body
  - ✓ Ovovivipary– eggs are not laid but retained and hatch within the female's body
  - ✓ Vivipary– embryo develops inside the uterus of the mother
- Amniotic egg
- Precaution and altricial development
- Parental care

TOPIC: Human reproduction			
TERM	1	**WEEK**	7
DURATION	4 hours	**WEIGHTING**	41 marks (27%)
SUB-TOPICS	• Structure of male and female reproductive systems • Puberty • Gametogenesis		
RELATED CONCEPTS/ TERMS/VOCABULARY	Puberty, secondary sexual characteristics, spermatogenesis, oogenesis, gametogenesis, testosterone, oestrogen, spermatozoa, ovum, semen.		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Structure of a cell with emphasis on nucleus, mitosis, meiosis.

RESOURCES

Textbook, 2019 revision document, previous exam papers, MTG, JIT doc.

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Ureter with urethra
- Ovary with ovum
- Gametogenesis with oogenesis
- Adolescent instead of puberty

METHODOLOGY

LESSON 1

- Revise the schematic outline of the human life cycle to show the role of meiosis, mitosis and fertilisation
- Stick diagram of a male reproductive system to illustrate the structure, labels and functions of the testis, epididymis, vas deferens, seminal vesicle, prostate gland, Cowper's gland and the urethra

LESSON 2

- Stick diagram of a female reproductive system to illustrate the structure, labels and functions of the ovary, fallopian tubes, uterus lined by endometrium, cervix, vagina with its external opening and the vulva
- Explain the structure of the ovary, using a diagram, showing the primary follicles, the Graafian follicle and the corpus luteum

LESSON 3

- Define puberty
- Explain main changes that occur in male characteristics during puberty under the influence of testosterone
- Explain main changes that occur in female characteristics during puberty under the influence of oestrogen
- Describe gametogenesis , spermatogenesis and oogenesis

LESSON 4

- Stick diagram of a sperm cell to illustrate the structure, labels and functions of the parts of a sperm cell (acrosome, head with haploid nucleus, middle portion/neck with mitochondria and a tail)
- Stick diagram of a ovum to illustrate the structure, labels and functions of f an ovum (layer of jelly, haploid nucleus, cytoplasm)

ACTIVITIES

- Identify and state functions of parts of the male and female reproductive system (2019 revision doc page 33)
- Draw a labelled diagram of a sperm cell and ovum

Summary

- Structure of Male reproductive system
  - ✓ Functions of testis, epididymis, vas deferens, seminal vesicle, prostate gland, cowper's gland and urethra.
- Structure of Female reproductive system
  - ✓ Functions of ovary, fallopian tubes, uterus lined by endometrium, cervix and vagina.
- Testosterone stimulates development of male secondary sexual characteristics.
- Oestrogen stimulates development of female secondary sexual characteristics.
- Gametogenesis is the formation of gametes.
  - ✓ Spermatozoa parts and functions, acrosome, haploid nucleus, mitochondria, tail.
  - ✓ Ovum parts and functions, layer of jelly, haploid nucleus, cytoplasm.

TOPIC: Human reproduction			
TERM	1	**WEEK**	8
DURATION	4 hours	**WEIGHTING**	41marks (27%)
SUB-TOPICS	Menstrual cycle Fertilisation Development of zygote to blastocyst		
RELATED CONCEPTS/ TERMS/VOCABULARY	Puberty, secondary sexual characteristics, spermatogenesis, oogenesis, gametogenesis, ovum, zygote,morula,blastocysts, acrosome.		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Structure of a cell with emphasis on nucleus, mitosis, meiosis.

RESOURCES

Textbook, 2019 revision document, previous exam papers, MTG

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

Learners confuse the following terms/ concepts:

- Corpus luteum with corpus callosum
- Gestation with pregnancy
- Progesterone with oestrogen
- Menstrual cycle with menstruation

METHODOLOGY

LESSON 5

- Describe menstrual cycle

LESSON 6

- Describe the hormonal control of the menstrual cycle (ovarian and uterine cycles) with reference to the action of FSH, oestrogen, LH and progesterone
- Describe negative feedback mechanism involving FSH and progesterone in controlling the production of ova

LESSON 7

- Define copulation and fertilisation
- Describe the process of fertilisation
- Describe the development of zygote > embryo (morula and blastula/ blastocyst) > foetus

ACTIVITIES

- Interpret graphs showing the menstrual cycle and role of hormones in the menstrual cycle (2019 revision doc page 45 and 48)
- Draw diagrams relating to reproduction (gametes) (2019 revision doc page 57 Q.29.4)
- Describe development of a zygote to embryo (2019 revision doc page 55 and 5)

Summary

- Menstrual cycle involves:
  - ✓ Ovarian cycle- development of follicle, ovulation and formation of corpus luteum
  - ✓ Uterine cycle- changes that takes place in the thickness of the endometrium, menstruation
- Fertilisation is a process whereby the nucleus of the sperm cell fuses with the nucleus of the ovum.
- Functions of Hormones in Menstrual cycle:
  - ✓ FSH stimulate development of the follicles
  - ✓ LH stimulates ovulation and formation of corpus luteum
  - ✓ Oestrogen increase the thickens of the endometrium and influences puberty in females
  - ✓ Progesterone increases and maintains the thickness of endometrium in preparation of implantation just in case fertilisation takes place.

- Negative feedback mechanism involving FSH and progesterone in controlling production of ova.

TOPIC: Human reproduction			
TERM	1	**WEEK**	9
DURATION	4 hours	**WEIGHTING**	41marks (27%)
SUB-TOPICS	• Implantation • Gestation • The role of the placenta		
RELATED CONCEPTS/ TERMS/VOCABULARY	Fertilisation, zygote, morula, blastocyst, pregnancy, chorion, placenta, gestation, umbilical cord, chorionic villi, amniotic fluid, amnion, embryo, foetus.		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Structure of a cell with emphasis on nucleus, mitosis, meiosis.

RESOURCES

Textbook, 2019 revision document, previous exam papers, MTG. JIT doc.

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Corpus luteum and corpus callosum
- Gestation and pregnancy
- Chorion and choroid
- Umbilical artery and umbilical vein

METHODOLOGY

LESSON 9

- Define implantation
- Stick diagram of a developing foetus in the uterus to illustrate the structure and labels, then explain the functions of the following parts: chorion and chorionic villi, and placenta
- Explain the role of oestrogen and progesterone in maintaining pregnancy.

LESSON 10

- Explain the functions of the amnion, amniotic cavity, amniotic fluid, umbilical cord (including umbilical artery and umbilical vein)

ACTIVITIES

- Describe implantation (2019 revision doc page 57)
- Identify and state the functions of the different parts associated with the development of the foetus in the uterus, (2019 revision doc page 59 and 62)

SUMMARY

- Implantation is the attachment of the chorionic villi of the embryo in the endometrium.
- Role of Oestrogen and progesterone in maintaining pregnancy:
  - ✓ Oestrogen increase the thickens of the endometrium and influences puberty in females
  - ✓ Progesterone increase and maintain the thickness of endometrium in preparation of implantation just in case fertilisation takes place.
- Gestation:
  - ✓ The embryo is protected by chorion, amnion with amniotic fluid.
  - ✓ The embryo is nourished through umbilical cord (including umbilical vein and artery) and placenta

TOPIC: Genetics and inheritance			
TERM:	2	**WEEK**	1
DURATION	4 Hours	**WEIGHTING**	48 (32%)
SUB-TOPICS	• Concepts in inheritance • Monohybrid crosses • Types of dominance • Sex determination		
RELATED CONCEPTS/ TERMS/ VOCABULARY	Chromosome, Co- dominance, Variation, Genetics, Gene, Genotype, Incomplete dominance, Inheritance, Dominant allele, Allele, Karyotype, Heterozygous/hybrid, Multiple alleles, Contrasting Characteristics, Homozygous/ true breeding, Sex- linked characteristics, Genome, Monohybrid & dihybrid cross, Cross fertilisation, Pedigree diagram, Phenotype, Recessive allele, Complete dominance		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

- DNA- functions
- Chromosomes
- Meiosis- independent assortment
- Reproduction – fertilisation

RESOURCES

- Term 2 JIT document, ATP, Exam guideline, Revision documents, Textbooks, Mind the gap

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Sex cells with sex chromosomes.
- Genes; alleles, traits; characteristics.
- Homozygous and homologous.
- Genome and karyotype.
- Y-chromosome as a carrier of sex-linked genes.
- Failure to determine an ordinary genetic disorder and a sex-linked one.

METHODOLOGY

LESSON 1

- Chromosomes being made up of DNA.
- Overview of DNA as the molecule of inheritance (having genes on it).
- Independent assortment during meiosis leading to variation in sex cells.
- Teach terminology using the template with terms and definitions, diagrams

LESSON 2

- Brief outline of Mendel's experiments on monohybrid crosses and the Laws
- Use the template for a genetic cross.
- (Teaching tool 1, Pg. 30 MTG) to highlight the important steps in a genetic cross
- Solve a genetic crosses of monohybrid crosses of complete dominance
- Indicate phenotypic and genotypic ratio/ percentage in both F1 and F2 generations.
- Go through homework together with class.

LESSON 3

- Explain the three types of dominance:
  - ✓ Complete dominance
  - ✓ Co-dominance
  - ✓ Incomplete dominance

LESSON 4

- Define the following terms: Karyotype, autosomes, gonosomes.
- Solve genetic problems to show inheritance of sex
- Solve genetic problems on sex linked genetic characteristics

ACTIVITIES/ASSESSMENT

- Solve monohybrid genetic problems

SUMMARY

- Genetics refers to the study of hereditary and variations of the inherited characteristics
- Sir Gregor Mendel is the father of genetics, who from his experiments introduced three laws:
  - ✓ Law of dominance
  - ✓ Law of segregation
  - ✓ Law of independent assortment

TOPIC: Genetics and Inheritance			
TERM	2	**WEEK**	2
DURATION	4 Hours	**WEIGHTING**	48 Marks (32%)
SUB-TOPICS	Blood grouping, Mutations, Sex-linked inheritance, Pedigree Diagrams		
RELATED CONCEPTS/ TERMS/VOCABULARY	Gene, Multiple Allele, Mutation, Codominance, Sex Linked, Pedigree, Haemophilia, Down Syndrome, Colour-Blindness		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

- DNA- functions
- Chromosomes
- Meiosis- independent assortment
- Reproduction – fertilisation

RESOURCES

- JIT 2, Mind The Gap, Exam Guideline, Revision Documents, Learner Assistance Document

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Blood groups genotype and phenotype
- Y-chromosome as a carrier of sex-linked genes
- Sex determination vs sex-linked disorders

METHODOLOGY

LESSON 5

- Define multiple alleles
- Explain that blood groups are controlled by multiple alleles.
  (Alleles for blood types A, B and O)
- Representation of blood group phenotypes and genotypes in the form of a table.
- Emphasize the use of superscripts

LESSON 6

- Define mutation
- List causes and effects of mutations
- Describe genetic disorders e.g. Haemophilia, colour-blindness and Down syndrome
- Solve a genetic cross of sex-linked genetic disorders

LESSON 7

- Define pedigree diagram

- Explain how to interpret the pedigree diagram
- Use pedigree diagrams from previous question papers and revision documents to illustrate your

ACTIVITIES

- Solve genetic problems on blood grouping and sex-linked characteristics
- Interpret pedigree diagrams

SUMMARY

- Blood groups are examples of multiple alleles which are controlled by three alleles which I^A, I^B and *i*
- There are four blood groups (A, AB, B and O)
- Mutation is the sudden change in a structure of a gene or chromosome
- Mutations can be useful or harmless or harmful
- Genetics problems involving the inheritance of blood type, Sex-linked alleles and sex-linked disorders

TOPIC: Genetics and Inheritance			
TERM	02	**WEEK**	3
DURATION	4 hours	**WEIGHTING**	48 (32%)
SUB-TOPICS	Genetic engineering, paternity testing, genetic links: dihybrid cross		
RELATED CONCEPTS/ TERMS/VOCABULARY	Genetic engineering, Biotechnology, Cloning, Stem cells, dihybrid cross		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

- Meiosis
- Grade 10 (Cloning, stem cells)
- Grade 11(Genetic engineering)

RESOURCES

- Mind The Gap, Jit document, Previous Question Papers

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Poor understanding of the following terms
  - ✓ Cloning
  - ✓ Genetic engineering
  - ✓ Biotechnology
- Learners are asked to give an 'explanation' on people's views for and against genetic engineering, they only mention the statement without elaboration
- genotype of the gametes in dihybrid crosses
- working out phenotypic ratios for F2

METHODOLOGY

LESSON 8

- Revise monohybrid cross & Mendel's laws
- Differentiate between mono and dihybrid crosses
- Combine 2 monohybrid crosses
- Use examples already done e.g. shape & colour
- Emphasize notation for characteristics
- Gamete formation & application of Mendel's laws (Independent Assortment, Law of Dominance & Law of Segregation)

LESSON 9

- Do P1 crosses using examples from resource materials
- Use results from F1 to determine F2 genotypes and phenotypes

LESSON 10

- Terminology-differentiate between genetic engineering/ GMO and biotechnology,
- cloning, stem cells
- Describe the process using example of Dolly or Futhi Stem Cell
- Definition, sources & uses of stem cells
- Production of insulin, Benefits of GMO, Discuss plant & animal eggs.
- Views for & against GMO

ACTIVITIES

- Describe cloning, stem cell research and genetic modification as examples of genetic engineering.
- Solve genetics problems on dihybrid crosses

SUMMARY

- Genetic engineering uses biotechnology to satisfy human needs:
  - ✓ Stem cell research – sources and uses of stem cells
  - ✓ Genetically modified organisms – brief outline of process (names of enzymes involved are not required) and benefits of genetic modification
- Cloning is a process whereby we use biotechnology to produce an organism that is genetically identical to another organism
- Paternity testing
- The role of each of the following in paternity testing:
  - ✓ Blood grouping
  - ✓ DNA profiles
- Genetic links
- Mutations in mitochondrial DNA used in tracing female ancestry

TOPIC: Responding to the environment - Humans			
TERM	2	**WEEK**	4
DURATION	4 Hours	**WEIGHTING**	54 (33%)
SUB-TOPICS	Human Nervous System: Neurons, Brain, Spinal cord		
RELATED CONCEPTS/ TERMS/VOCABULARY	Axon, Cerebellum, Co-ordination, Neurilemma, Corpus collosum, Voluntary, Myelin sheath, Medulla oblongata, Involuntary, Axon, Dorsal root, Cerebrum		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Central nervous system:

- Cell structure
- Knowledge of stimuli
- Receptors
- Nervous tissue

RESOURCES

Term 2 JIT 2020 document, Exam guideline, Revision documents, Textbooks and Mind The Gap

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Learners lack basic knowledge of the autonomic nervous system (ANS).
- Learners fail to distinguish between the cerebrum and cerebellum.
- Learners confuse the reflex arc and reflex action
- Learners fail to distinguish between the reflex arc and reflex action.

METHODOLOGY

LESSON 1

- The nervous system (involving nerves) and endocrine system (involving hormones) are two components that help us respond to the environment
- The need for a nervous system in humans:
  - ✓ Reaction to stimuli (stimuli can be external and internal)
  - ✓ Coordination of the various activities of the body
- Emphasise that the brain and spinal cord are protected by meninges.
- Discuss the location and functions of the parts of the **central nervous system**:
  - ✓ Brain: (Cerebrum, Cerebellum, Corpus callosum, Medulla oblongata)
  - ✓ Spinal cord (label parts and functions) / Structure of spinal cord- hands on

LESSON 2

- Autonomic and peripheral nervous system:
  - ✓ Discuss location and functions of the peripheral nervous system (cranial and spinal nerves)
  - ✓ State the location and functions of the autonomic nervous system (sympathetic and parasympathetic sections)
  - ✓ Explain the functions of sensory and motor neurons including the effect of each when damage has been caused.
  - ✓ Discuss the structure and functions of parts of sensory and motor neurons, using diagrams: (nucleus, cell body, cytoplasm, myelin sheath, axon and dendrites)

LESSON 3

- Define the reflex action and reflex arc
- Draw a flow chart of Reflex Arc showing components through which the impulse travels from the stimulus to the effector.
- Describe steps that occur during a reflex action.
- Explain the significance of the reflex action.
- Explain the significance of the synapse.

LESSON 4

- Discuss the causes, symptoms and treatment of following disorders:
  - ✓ Alzheimer's disease.
  - ✓ Multiple sclerosis.

ACTIVITIES/ASSESSMENT

- Label and give functions of parts of the brain and spinal cord.
- Draw and/or label sensory and motor neurons.
- Write the role that each part plays in performing the reflex action using diagrams.
- Explain the effect when parts of the brain are damaged.

SUMMARY

- The nervous system and endocrine system.
- Functions of receptors, neurons and effectors in responding to the environment.

- The body responds to a variety of different stimuli, such as light, sound, touch, temperature, pressure, pain and chemicals (taste and smell). (N.B. No structure and names are necessary except for names of the receptors in the eye and ear.)

TOPIC: Responding to the environment-Humans			
TERM	2	**WEEK**	5
DURATION	4 Hours	**WEIGHTING**	54 (36%)
SUB-TOPICS	Sense organs: The Eye		
RELATED CONCEPTS/ TERMS/VOCABULARY	Accommodation, pupillary mechanism, short-sightedness, long-sightedness, Astigmatism, Cataracts, Receptors		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

- Central nervous system: Knowledge of stimuli, receptors, and nerves.

RESOURCES

Term 2 JIT 2020 document, Revision documents, Textbooks and
Mind The Gap

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Ciliary muscles with ciliary body.
- Blind spot and yellow spot with respect to receptors (rods and cones).
- Choroid with chorion.
- Accommodation and pupillary mechanism.
- Long and short-sightedness.
- Learners do not relate the structures of the eye to their appropriate functions.

METHODOLOGY

LESSON 5

- Define binocular vision and state its significance.
- Identify the type of receptors (photoreceptors) and stimulus(light)
- State that the eye is the organ responsible for vision.
- Use appropriate diagrams (and models if available) in order to describe the structure and the functions of the various parts of the eye.
- Describe the adaptations of different parts of the eye.

LESSON 6

- Explain the pathway of light in the formation of a clear image.
- Use diagrams and tables which include various parts of the human eye to describe the changes that occur in near and distant vision (Accommodation).
- Interpret graphs using data response questions related to the eye.

LESSON 7

- Use diagrams which include various parts of the human eye to describe the changes that occur in dim and bright light (Pupillary mechanism).
- Use a table to differentiate between pupillary mechanism in bright and dim conditions.
- Interpret graphs using data related to pupillary mechanism.

LESSON 8

- Recap accommodation and structure of the lens and relate to short and long - sightedness and its treatment.
- Recap lens functions and characteristics and relate to occurrence of cataracts and its treatment.
- Review the structure and functions of the cornea and relate to Astigmatism and its treatment.
- Consolidation of core concepts on the eye, light pathway, accommodation and pupillary mechanism.

ACTIVITIES/ASSESSMENT

- Label and give functions of the parts of the eye.
- Use diagrams to explain accommodation and pupillary mechanism.
- Draw / interpret graphs using data related to the eye.
- Solve investigative questions that relate to pupillary mechanism and accommodation.

SUMMARY

- Structure and functions of the parts of the human eye, using diagram(s).
- Binocular vision and its importance.
- The changes that occur in the human eye for each of the following, using diagrams:
  - ✓ Pupillary mechanism (Emphasis on the change of radial muscles, circular muscles, and pupil)
  - ✓ Accommodation (Emphasis on the change of ciliary muscles, suspensory ligaments and lens)
- The nature and treatment of the following visual effects using diagrams:
  - ✓ Short- sightedness
  - ✓ Long- sightedness
  - ✓ Astigmatism
  - ✓ Cataracts

TOPIC: Receptors			
TERM	2	**WEEK**	6
DURATION	4 Hours	**WEIGHTING**	54 (36%)
SUB-TOPICS	**Sense organ: The Ear**		
RELATED CONCEPTS/ TERMS/VOCABULARY	Auditory nerve, Maculae, Organ of Corti, Cristae, Eustachian tube, Radial muscles, Cerebrum, Grommet, Receptor, Cerebellum.		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Central nervous system: Knowledge of stimuli, receptors, and nerves

RESOURCES

JIT Term 2 2020 document, Exam guideline, Revision documents, Textbooks and Mind The Gap.

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Semi-circular canals (cristae) and utriculus and sacculus (maculae) when they describe balance
- Learners fail to conceptualise the functions of different parts on ear.
- Learners confuse the receptors for hearing and the balance
- Fail to differentiate between round window and oval window when Identifying in diagram.

METHODOLOGY

LESSON 9

- State the two main functions of the ear: Hearing and Balance.
- Identify and explain functions of all parts of the ear.

- Describe the hearing process (Include the role of Organ of Corti, without details of its structure.

LESSON 10

- Describe balance (include the role of maculae and cristae without details of their structure
- Put emphasis on the role of each receptor involved in both hearing and balance (also identify the position of each receptor in the diagram)

LESSON 11

- Review the structure and functions of the middle ear and relate to middle ear infection and its treatment.
  - ✓ Impact/ effect when part is not functioning/ damaged. (Any part of the ear)
  - ✓ The use of grommet on treating middle ear infection.
- Review the structure and functions of the cochlea and relate to deafness.

ACTIVITIES/ASSESSMENT

- Label and give functions of parts of the ear.
- Describe the process of hearing.
- Describe how balance is maintained.
- Solve investigative questions that relate to the ear in respect of hearing and balance.

SUMMARY

- Structure of the human ear and the functions of the different parts, using a diagram
- Functioning of the human ear in:
  - ✓ Hearing (include the role of the organ of Corti, without details of its structure).
  - ✓ Balance (include the role of maculae and cristae, without details of their structure).
- Causes and treatment of the following hearing defects:
  - ✓ Middle ear infection (the use of grommets)
  - ✓ Deafness (the use of hearing aids and cochlear implants)

TOPIC: ENDOCRINE SYSTEM AND HOMEOSTASIS			
TERM	2	**WEEK**	7
DURATION	4 Hours	**WEIGHTING**	34 (23%)
SUB-TOPICS	Human Endocrine system; Negative Feedback; TSH and Thyroxin; Insulin and Glucagon		
RELATED CONCEPTS/ TERMS/VOCABULARY	ADH, Adrenalin, Negative Feedback, Aldosterone, Oestrogen, Diabetes Mellitus, Endocrine Glands, Pancreas, Glucagon, Progesterone, Growth Hormone, Prolactin, Thyroxin, Hypophysis/ Pituitary Gland, Testosterone, Hypothalamus, Insulin, TSH.		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

- Nervous system
- Excretion
- Human reproduction
- Nutrition
- Gaseous exchange

RESOURCES

JIT 2 - 2020, Mind The Gap, Exam Guideline, Revision Documents, Learner Assistance Document

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Glucagon and glycogen
- Adrenal gland and adrenalin
- Negative feedback mechanism

METHODOLOGY

LESSON 1

- Differentiate between chemical and nervous coordination (endocrine and nervous systems)
- Define endocrine and exocrine glands. (GIVE EXAMPLES)
- Define the term Hormone.
- Use a diagram to show the location of the different endocrine glands in the body.

LESSON 2

- Construct a table showing:
  - ✓ Glands
  - ✓ Hormones
  - ✓ Functions on Endocrine system

LESSON 3

- Define homeostasis
- State what is meant by negative feedback mechanism (Use flow diagrams)
- Explain the principle of negative feedback mechanism.
- Describe the negative feedback mechanism involving:
  - ✓ TSH and thyroxin
  - ✓ Insulin and glucagon (result of an imbalance: diabetes mellitus)

LESSON 4

- Use the principle of negative feedback mechanism to explain the control of the following:
  - ✓ Water (osmoregulation)
  - ✓ Carbon dioxide
  - ✓ Salt (Sodium ions)
  - ✓ Temperature (Thermoregulation)
- Interpret graphs

ACTIVITIES

- Identify from diagrams the location of various endocrine glands & name and state the function/s of the hormones that they secrete
- Using an example, describe how a negative feedback mechanism occurs using a diagram of the skin
- Describe the role of the sweat gland and blood vessels in maintaining a constant body temperature

SUMMARY

- Location of each of the following glands, using a diagram, the hormones they secrete and function(s) of each hormone:
  - ✓ Hypothalamus (ADH)
  - ✓ Pituitary/Hypophysis (GH, TSH, FSH, LH, prolactin)
  - ✓ Thyroid glands (thyroxin)
  - ✓ Islets of Langerhans in the pancreas (insulin, glucagon)
  - ✓ Adrenal glands (adrenalin, aldosterone)
  - ✓ Ovary (oestrogen, progesterone)
  - ✓ Testis (testosterone)
- Homeostasis as the process of maintaining a constant, internal environment within narrow limits, despite changes that take place internally and externally.
- Factors such as carbon dioxide, glucose, salt and water concentration, temperature and pH must be kept constant in the internal environment (tissue fluid)

TOPIC: Plant Hormones			
TERM	2	**WEEK**	8
DURATION	4 HOURS	**WEIGHTING**	13 marks (9%)
SUB-TOPICS	Auxins,Gibbellirins, Absciscic acid, Geotropism, phototropism, chemicals and thorns		
RELATED CONCEPTS/ TERMS/VOCABULARY	Hormone,Tropism, Phototropism, Geotropism, Apical dominance		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

Photosynthesis

RESOURCES

MTG, textbooks, past papers, worksheets, Jit support document (Term 2, 2020)

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

Learners fail to interpret diagrams on geotropism and phototropism
Learners fail to identify variables in a scientific investigation
Learners fail to answer questions on application of phototropism and geotropism

METHODOLOGY

LESSON 1:

- List functions of the following:
  - ✓ Auxins
  - ✓ Gibberellins
  - ✓ Abscisic acid
- The control of weeds using plant hormones

LESSON 2:

Explain the role of auxins in Phototropism

LESSON 3:

Conduct a practical investigation showing effects of light and gravity on growing seeds

LESSON 4:

- Describe the role of auxins in Geotropism
- State how chemicals and thorns are used in plant defence:
  - ✓ Chemicals
  - ✓ Thorns

ACTIVITIES /ASSESSMENT

- Describe the role of auxins in geotropism and phototropism (Jit 2020 Activity 1,2,3,4)
- Interpret data/ draw graphs on geotropism and phototropism
- Interpretation of scientific investigation on phototropism and geotropism

SUMMARY

- Growth and development in plants are controlled by hormones
- Tropism is the growth movement of a plant or part of a plant in response to an environmental stimulus.
- Phototropism is the growth of a plant in the direction of a light source
- Geotropism is the growth of a plant in response to gravity

TOPIC : Evolution			
TERM	3	**WEEK**	1
DURATION	4 hours	**WEIGHTING**	54 marks (36%)
SUB-TOPICS	• Introduction • Sources of variation • Evidence of Evolution • Lamarckism		
RELATED CONCEPTS/ TERMS	Scientific Theory, Hypothesis, Biological Evolution, Homologous, Biogeography, Fossil, Species, Population, Continuous variation, Discontinuous variation, Fossil record		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

- Meiosis
- Genetics
- Fossil

RESOURCES

Textbooks, JIT documents, MTG, videos, Power Point slides, past papers, Revision document 2019

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Hypothesis and theory
- Continuous and discontinuous variation

METHODOLOGY

LESSON 1

Introduction

- Define evolution, biological evolution and evidence of evolution
- Describe different theories of development; i.e. Darwinism, Lamarckism and punctuated equilibrium

LESSON 2

Explain the following sources of variation:

- Meiosis
  - ✓ Crossing over
  - ✓ Random arrangement of chromosomes
- Mutations
- Random fertilisation
- Random mating

LESSON 3

- Differentiate between the following and give examples:
  - ✓ continuous and discontinuous variation
  - ✓ hypothesis and theory
  - ✓ species and population

LESSON 4

- Explain Lamarckism according to:
  - ✓ Law of use and disuse
  - ✓ Law of inheritance of acquired characteristics
- Explain reasons for Lamarck's theory being rejected

ACTIVITIES/ ASSESSMENT

List various sources of variation (JIT TERM 3, 2016)

Describe different lines of evidence for evolution Describe Lamarckism (MTG 2 p67, NSC 2019 P2 Q3.4.4, 2019 Revision Doc p133 Q1-2)
SUMMARY
Hypothesis is a tentative explanation to a phenomenon and a Theory is something that has been observed in nature and can be supported by facts, evolution is a change that takes place over a long period of time, Laws of Lamarckism

TOPIC : EVOLUTION			
TERM	3	**WEEK**	2
DURATION	4 HOURS	**WEIGHTING**	54 marks (36%)
SUB-TOPICS	Theory of Natural selection Examples of Natural selection Evolution in present times		
RELATED CONCEPTS/ TERMS/VOCABULARY	Species, Natural selection, Population, Offspring, Competition		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE
Intraspecific competition
RESOURCES
Textbooks, JIT documents, MTG, videos, Power Point slides, past papers
ERRORS/MISCONCEPTIONS/PROBLEM AREAS
Application of Darwinism
METHODOLOGY
LESSON 5 Describe Darwin's theory of natural selection as per the exam guideline
LESSON 6 Describe Darwin's theory of natural selection using various examples
LESSON 7 Compare Lamarck's and Darwin's theory of natural evolution
LESSON 8 • Describe any ONE example of natural selection and evolution in present times: • Use of insecticides and consequent resistance to insecticides in insects • Development of resistant strains of tuberculosis-causing bacteria (MDR and XDR) to antibiotics, due to mutations (variations) in bacteria and failure to complete antibiotic courses • HIV resistance to antiretroviral medication • Bill (beak) and body size of Galapagos finches
ACTIVITIES /ASSESSMENT
• Natural Selection (*2019 revision doc P139, JIT Term 3 p7-8*) • Comparison of Lamarckism and Darwinism (Revision Doc 2019 p138 Q9-10, JIT Term 3 p7-8)
SUMMARY • Theories of evolution through by Lamarck and Darwin ,Natural selection and evolution in present

TOPIC : EVOLUTION			
TERM	3	**WEEK**	3
DURATION	4 HOURS	**WEIGHTING**	54 marks (36%)
SUB-TOPICS	Punctuated Equilibrium Artificial selection Speciation Reproductive isolation		
RELATED CONCEPTS/ TERMS/VOCABULARY	Biological species, Geographic speciation,Punctuated equilibrium		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

- Genetics
- Sexual reproduction

RESOURCES

- Textbooks, JIT documents, MTG, videos, Power Point slides, past papers, Revision Document 2019

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- Punctuated equilibrium and Darwinism
- Speciation and Natural selection
- Artificial and natural selection

METHODOLOGY

LESSON 9

- Discuss Punctuated equilibrium
- Compare punctuated equilibrium and Darwinism with the use of examples

LESSON 10

- Describe artificial selection using appropriate examples
- Compare artificial and natural selection

LESSON 11

- Describe speciation through geographical isolation

LESSON 12

- Describe the different forms of reproductive isolation mechanisms.

LESSON 13(extra lesson)

- Consolidation and revision of general evolution

LESSON 14 (extra lesson)

- Topic Test on general evolution

ACTIVITIES /ASSESSMENT

- Describe punctuated equilibrium (Revision Doc 2019 page 137)
- State the benefits of artificial selection (MTG 2 page 69)
- Describe how speciation occurs (MTG 2 page 70)
- List reproductive isolating mechanisms that keep species separate
- Describe one example of evolution in current times(NSC 2019 p2 page 11)

SUMMARY

- Punctuated equilibrium explains the speed at which evolution takes place
- Artificial selection satisfies human needs
- Speciation through geographic isolation leading to formation of new species
- Reproductive isolation mechanism that help to keep species separated

TOPIC HUMAN EVOLUTION			
TERM	3	**WEEK**	4
DURATION	4hours	**WEIGHTING**	54 marks (36%)
SUB-TOPICS	• Introduction to human evolution • Interpretation of phylogenetic tree • Evidence of common ancestry • Characteristics of humans and Apes • Similarities between Humans and Apes • Differences between Humans and Apes		
RELATED CONCEPTS/ TERMS/VOCABULARY	Bipedalism, Foramen Magnum, Prognathous, Hominid, Quadrapedalism, Hominid, Dentition, Brow ridges		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

- Fossil formation and methods of dating them.

RESOURCES

- Mind the gap, JIT document, exam guidelines, Text book

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

- They cannot analyse and interpret a phylogenetic tree

METHODOLOGY

Lesson 13

- Interpretation of a phylogenetic tree to show the place of the family Hominidae in the animal kingdom

Lesson 14

- Discuss evidence of common ancestors for living hominids including humans

Lesson 15

- Discuss characteristics that humans share with African apes

Lesson 16

- Discuss anatomical differences between African apes and humans, with the aid of diagrams, as it applies to the following characteristics:
  - ✓ Bipedalism (foramen magnum, spine and pelvic girdle)
  - ✓ Brain size
  - ✓ Teeth (dentition)
  - ✓ Prognathous
  - ✓ Palate shape
  - ✓ Cranial ridges
  - ✓ Brow ridges

ACTIVITIES /ASSESSMENT

- Interpret diagram or phylogenetic trees to show progressive evolution using fossil evidence.
- List similarities and tabulate differences between humans and African apes (MTG 2 p72,73,78-80, 2019p2 Q3)

SUMMARY

- Interpretation of the phylogenetic tree.
- List similarities between humans and apes.
- Tabulate the differences between humans and apes.

TOPIC: Human Evolution			
TERM	3	**WEEK**	5
DURATION	2Hours	**WEIGHTING**	54 marks (36%)
Sub-topics	• Evidence of common ancestor for living hominids including humans • Out of Africa hypotheses		
RELATED CONCEPTS/ TERMS/VOCABULARY	• Hominid, Quadrupedalism		

PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE

- Fossil formation and methods of dating them.

RESOURCES

- Mind the gap, JIT document, exam guidelines, Text book

ERRORS/MISCONCEPTIONS/PROBLEM AREAS

Fossil evidence and genetic evidence

METHODOLOGY

LESSON 17

- Describe lines of evidence that support the idea of common ancestors for living hominids including humans:
  - ✓ Fossil evidence: Evidence from fossils of different ages show that the anatomical characteristics of organisms changed gradually over time.
  - ✓ Emphasis on evolutionary trends provided by the anatomical features of fossils of the following three genera:
    - *Ardipithecus*
    - *Australopithecus*
    - *Homo*
  - ✓ The age of each fossil found/time-line for the existence of the three genera
  - ✓ The fossil sites where they were found: emphasis on the fossil sites that form a part of the Cradle of Humankind
  - ✓ The scientists who discovered them
- Describe genetic evidence with reference to:
  - ✓ mitochondrial DNA
  - ✓ Cultural evidence: tool-making

LESSON 18

- Describe evidence for the Out of Africa hypothesis:
  - ✓ Fossil evidence: information on each of the following fossils that serve as evidence for the Out of Africa hypothesis:
  - ✓ *Ardipithecus* (fossils found in Africa only)
  - ✓ *Australopithecus* (fossils found in Africa only, including Karabo, Littlefoot, Taung Child, Mrs Ples)
  - ✓ *Homo* (fossils of *Homo habilis* found in Africa only; oldest fossils of *Homo erectus* found in Africa, while the younger fossils were found in other parts of the world)
  - ✓ Genetic evidence: mitochondrial DNA
- Interpret/analyse timeline for the existence of different species of the genus *Homo* and the significant features of each type of fossil to illustrate the differences amongst them
- Interpret the phylogenetic trees proposed by different scientists showing possible evolutionary relationships as it applies to hominid evolution

ACTIVITIES /ASSESSMENT
• Describe evidence for the “Out of Africa hypothesis” (JIT term 3 Activity 9 - 2019)
SUMMARY
• Anatomical characteristics of organisms changes gradually over time. • Anatomical features of fossils. • Mitochondrial DNA and cultural evidence. • Evidence for the Out of Africa hypothesis. • Timeline to illustrate the differences among different species of the genus Homo. • Interpretation of the phylogenetic tree.