STRAND: Life processes in plants and animals

Grade 11: Life processes related to homeostasis

Different organisms need support, transport and excretory systems, which differ in relation to size, surface area to volume ratio AND type of habitat (aquatic or terrestrial). There is a relationship between transport and excretion systems of larger organisms and gaseous exchange mechanisms *[done in Grade 10].*

LO1 Investigating phenomena in the Life Sciences	***LO2 Constructing Life Sciences knowledge***	***LO3 Applying Life Sciences in society***
Support and transport in plants		
Interpretation of microscope slides and/or electron micrographs of sections through roots and stems Aging a tree by counting annual rings Demonstrations of • water movement through xylem • transpiration of water through leaves • effect of environment on rate of transpiration	**Anatomy of dicotyledonous plants** Root and stem *[leaf done in Grade 10]* including the distribution of the different tissues – epidermis, xylem, phloem, sclerenchyma, collenchyma, parenchyma. Secondary growth **Uptake of water and mineral salts** into a root and their transport to leaves **Translocation** of manufactured substances from leaves to other parts **Transpiration:** definition of and how water loss is related to leaf structure *[recap of grade 10]* and the effects of variation in temperature, humidity and light intensity on transpiration rate; how wilting occurs	Economic uses of plants related to their anatomy e.g. fibres (xylem and sclerenchyma) used to make paper, fabric, for weaving, baskets, etc and secondary growth – wood for furniture, building and containers
Supporting systems and movement in animals		
Exploring different ways of moving, related to ecological niche preferably from the ecosystem studied in Grade 10, e.g. running, walking, hopping, crawling, swimming, flying Comparing skeletons of (or photographs of) different vertebrates Analysis of x-rays of human bones and joints Observing a longitudinal and	Different kinds of skeletons: hydrostatic skeleton, endoskeleton, exoskeleton. Advantages and disadvantages of each. **Human skeleton** Identify bones comprising the axial skeleton *[bones forming the skull not required]* and the appendicular skeleton. *[It is not necessary to know the parts of the bones.]* Functions related to movement, protection, support, mineral storage and hearing. Structure of a long bone Tissues: Bone, cartilage, tendons and ligaments – structure as	Diseases of the musculo-skeletal system: rickets, osteoporosis, arthritis, muscular dystrophy. Injuries: sprains, strains, cramps, dislocations and fractures Incidence of back injuries Importance of exercise for healthy muscular and skeletal development and avoidance of injuries

transverse section through a long bone. Demonstration to show that a combination of mineral salts and organic fibres produces hard strong resilient bone (HCl and burning) Examining microscope slides or micrographs of skeletal muscle tissue and drawing the muscle tissue observed. Making models of how antagonistic muscles work	related to function only. *[Other details of tissue structure not necessary.]* **Joints** Types of joints: fixed, partly moveable and freely moveable (synovial) joints. Structure of a synovial joint. Role of each of the following in human locomotion- bones, joints, ligaments, tendons and antagonistic muscles **Muscles** How antagonistic muscles work together to raise or lower a limb. Structure of skeletal muscle and changes in myofibril structure when muscles contract	
Transport in animals		
Dissection of a mammalian heart Measuring pulse rates of a number of individuals Effects of exercise on pulse and pulse rate and how they relate to heart rate. Examining micrographs or slides of blood and drawing the blood tissue observed.	Many animal groups have transport systems which include *blood, blood vessels and heart* arranged as circulatory systems Basic design of open circulatory systems, closed circulatory systems **Human circulatory system** Structures indicating *closed, double circulatory system (pulmonary and systemic),* identifying: *heart* and its associated *blood vessels; brain, small intestine, liver, kidneys* and their associated major *blood vessels*, indicating the direction of blood flow and distinction between oxygenated and deoxygenated blood in different parts of the circulatory system-this can be explained in diagrammatic format. ***Heart structure*** – internal and external structure related to functioning-to be articulated diagrammatically. Events of cardiac cycle, relating events to the flow of blood through the heart Mechanisms controlling heartbeat and heart rate ***Blood vessels*** – structure and function of *arteries, veins and capillaries*	Cardiovascular diseases – congenital and those cause by poor diet and lifestyle *[link to grade 10]* e.g. anaemia, high and low blood pressure, heart attacks, strokes. Significance of resting pulse rate in relation to fitness. Blood transfusions and blood types *[link to genetics in grade 12]* Prof Chris Barnard and the first successful heart transplant conducted in SA.

	Blood and lymph as a tissue: Structure and function of constituent parts Relationship between lymphatic system and blood system Functions of lymphatic system	
Excretion		
Dissection of a mammalian kidney Interpretation of data related to composition of fluids in different parts of the nephron and collecting duct.	Define excretion **Excretion in humans** The role of each of the following: lungs, kidney, liver, gut, bladder, skin indicating the substance each excretes and the origin(s) of those substances. **The urinary system** in humans – position of kidneys, ureters, bladder and urethra. Structure and function of the kidney in terms of the removal of urea and excess water and salts and the reabsorption of glucose and some salts Homeostatic control of water and salts in the kidney involving ADH and aldosterone The structure and function of the nephron in filtration, reabsorption and formation of urine	Diseases leading to kidney failure e.g. kidney stones, kidney infections, bilharzia Injuries to kidneys and protective measures Dialysis and how it works with respect to kidney machines Discuss the advantages and disadvantages of kidney transplants, compared with dialysis

STRAND: Life at the molecular, cellular and tissue level

Grade 11: Viruses, bacteria, protists and fungi

In grade 11, we look at four main groups of organisms i.e. viruses, bacteria, protists and fungi. These 4 groups consist of micro-organisms and, in the case of the protists and fungi, macro-organisms. They are either single-celled or form colonies of similar cells or are made of primitive tissues. The viruses, bacteria, protists and fungi play a very important role in the environment. In addition, many micro-organisms have an effect on the health of other living organisms. Humans have used these organisms for thousands of years for a variety of purposes.

LO1 Investigating phenomena in the Life Sciences	***LO2 Constructing Life Sciences knowledge***	***LO3 Applying Life Sciences in society***
Viruses, bacteria, protists and fungi		
Research using other resources eg books, health pamphlets: Investigate a disease caused by ONE of the microorganisms and common in a community e.g. HIV/AIDS, malaria, cholera, TB, influenza. Select data on occurrence, effects on body, resistance to drugs and suitable treatment. **Practical investigation:** Look for evidence of viral, bacterial or fungal diseases on plants e.g. in the school garden, learners' garden, amongst their vegetables or crops. Identify ONE of these diseases and describe the effect on the plant. Find out about at least TWO ways of treating this disease, and conduct a scientific investigation to compare the effectiveness of these treatments, e.g. different chemicals and natural remedies, etc.	**Biodiversity** of these organisms. *[Link with grade 10]* **Basic structures and general characteristics** **Important role** in maintaining balance in the environment / in web of life. *[Links to grade 10 & 12]* **Roles in symbiotic relationships** e.g. nitrogen-fixing bacteria in plants; *E. coli* in human intestines. *[Links to grade 10]* **Effects and management** of at least ONE disease from each of the four groups • viruses – e.g. rabies, HIV/AIDS, influenza • bacteria – e.g. blight, cholera, tuberculosis, anthrax • protists- e.g. malaria • fungi – e.g. rusts, thrush, ringworm **Immunity** • Immune response by plants or animals against infecting micro-organisms • Use of drugs e.g. antibiotics and response of infecting micro-organisms	**Historical developments** • Discovery of viruses and bacteria • Debates about classifying these organisms e.g. classifying viruses as living organisms **IKS and biotechnology** • Traditional technology e.g. beer, mahewu, amasi(link to Grade 10) • Micro-organisms and biotechnology in the food industry e.g. cheese, wine; and in other industries **Economic use** of bacteria, protists and fungi e.g. mushrooms, seaweeds **Medical biotechnology** e.g. immunity, antibiotics **Beliefs, attitudes and values** concerning causes of and cure of at least ONE disease e.g. HIV/AIDS, malaria. TB, cholera.

STRAND: Diversity, change and continuity

Grade 11: Diversity of animals and plants and biogeography

Underlying concepts: Plants and animals can be grouped according to similarities in their basic structure or body plan. Members of each group have modified versions of their basic body plan, depending on their mode of life. Biogeographic variation shows that different but similarly adapted species inhabit different continents and islands.

LO1 Investigating phenomena in the Life Sciences	***LO2 Constructing Life Sciences knowledge***	***LO3 Applying Life Sciences in society***
Plant and animal diversity in South Africa		
Illustrate through diagrams, charts and graphs, the numbers of species of each major group represented in South Africa. Read and interpret distribution maps of species.	Enormous diversity of life in southern Africa, and the number of endemic species.	Threats to biodiversity in South Africa: Consider the impact of agriculture, industry, human population growth, cities and roads on biodiversity. Value of retaining biodiversity: tourism potential, aesthetic value of retaining biodiversity for its own sake.
Plant diversity		
Learners should be able to identify South African examples of each of these groups of plants. • Bryophytes (mosses and liverworts). • Pterophytes (ferns) • Gymnosperms (yellowwoods, cycads) • Angiosperms (flowering plants) Compare the morphology of a local monocotyledonous and a dicotyledonous plant, including the flowers.	Plants can be grouped according to the presence or absence of: • vascular tissue (xylem and phloem) • true leaves and roots • seeds or spores • fruit, as well as the dependence on water for reproduction These groups include the: • Bryophytes: no vascular tissue, no true leaves and roots, spores, depend on water for fertilisation • Pterophytes: vascular tissue, true leaves and roots, spores, depend on water for fertilization. • Gymnosperms and angiosperms: vascular tissue, true leaves and roots, seeds, fertilization independent of water. Gymnosperms produce cones which bear seeds with no protective covering. Angiosperms produce flowers, the seed is enclosed in a fruit.	Ancient and unique plant groups in southern Africa: cycads and *Welwitschia.* Ecotourism and theft of cycads, conservation efforts. Angiosperms include many agriculturally important plants, such as fruit trees, and crops such as maize, wheat, oats and sorghum. Forestry – economic importance and impact on ecosystems *[Link to environmental issues.]*

Animal diversity		
Interpret a phylogenetic tree representing the evolutionary history of animals. Identify Southern African representatives of each of the phyla listed below, through photographs, appropriate books, or during visits to museums or on field trips and by using field guides. • Porifera (sponges) • Cnidaria (jelly fish, blue bottles, corals, sea anemones) • Platyhelminthes (*Planaria*, flukes e.g. bilharzia worm, tapeworm) • Annelida (earthworm, polychaetes, leeches) • Nematoda (roundworms, hookworms, threadworms) • Arthropoda (insects, arachnids, crustaceans, myriapods) • Mollusca (snails, oysters, limpets, octopus and squid) • Echinoderms (sea urchins, starfish) • Chordata (fish, amphibians, reptiles, birds, mammals). Choose ONE phylum or class from the list above and illustrate its biodiversity in South Africa on a poster. (Individuals or small groups each select a different animal group)	Concept of phylum as illustrated by a body plan. The Animal kingdom contains about 30 phyla, but we will focus on only six, i.e. Porifera, Cnidaria, Platyhelminthes, Annelida, Arthropoda, Chordata, with respect to the following body plans. • Symmetry (asymmetry, bilateral symmetry, radial symmetry) • Number of tissue layers developing from the embryo (two or three). • Absence or presence of a coelom (a cavity within the mesoderm). • Presence or absence of a through-gut Relate body plans to mode of life. • Phylum Porifera: asymmetrical, no tissues and no coelom; simple but highly specialized for filter-feeding • Phylum Cnidaria: radially symmetrical, two tissue layers, no coelom, single opening to the gastrointestinal cavity. Simple, but possess highly specialized nematocysts. • Phylum Platyhelminthes: bilaterally symmetrical, three tissue layers, no coelom, and a single opening to the gut. • Phylum Annelida: bilaterally symmetrical, three tissue layers, a coelom, a through-gut. • Phylum Arthropoda: bilaterally symmetrical, three tissue layers, coelom, through-gut, an exoskeleton made of chitin • Phylum Chordata: bilaterally symmetrical, three tissue layers, coelom, through-gut. Internal skeleton made of cartilage and bone. A very brief comparative analysis of the body plans of the different phyla is required. It should be explained in the context of evolution.	Any ONE of the parasitic worms found in South Africa: distribution, prevalence, life cycle, effects on host, treatment, and ways of reducing the spread. (Select a local parasitic worm that is problematic for humans or other animals). Role of arthropods as ectoparasites and vectors of pathogens that cause disease e.g flies and cholera, ticks and tick bite fever, mosquitoes and malaria, tsetse flies and sleeping sickness. Role of invertebrates in agriculture and ecosystems (e.g. pollinators, decomposition, aerating the soil). Sustainable use of animals in South Africa e.g. perlemoen/ fishing / game farming: economic and employment opportunities. Problems with poaching.

Modifications of basic body plans		
Select ONE of the following for investigation *[Link to LO 2]:* Identify the limb bones of vertebrates from diagrams, and make notes of how the bones are modified to suit each function. OR Identify feeding or locomotory appendages of insects. OR Identify modified flowers.	Select ONE of the following for further study: Mammal forelimb: basic plan modified for digging (mole), flying (bat), fast running (horse), swimming (seal) and climbing trees (monkey). OR Modification of feeding or locomotory appendages of insects for eating different foods OR Modification of flowers such as orchids (or any other suitable group) for specific pollinators.	Nature of science: Looking for explanations for modifications of body plans: Charles Darwin proposed that modification of basic body plans indicates common descent from a single ancestor. *[Relate to examples in LO 2]*
Biogeography		
Draw a map of the world and put pictures of ostrich, emu, rhea and moa where they occur.	Diversity exists within continents, but is even more striking on different landmasses and islands. Worldwide distribution of large flightless birds: ostrich in Africa, emu in Australia, rhea in South America, and moa (recently extinct) in New Zealand. These flightless birds resemble each other, and have similar modes of life in each landmass, but they are distinctly different species.	Nature of science: Darwin's explanation for the biogeographic distribution of species.

STRAND: Environmental Studies

Grade 11: Human influences on the environment

Over thousands of years, humans have gradually changed the environments they live in, in order to make their lives and their human endeavours easier, safer, and more profitable. With the human population explosion and modern technology, these changes to the environment have been massive and have had a significant local, national and global impact upsetting the balance in natural ecosystems and threatening the continuation of life on earth. In grade 11, we examine human influences on the environment and consider ways in which we can contribute to a more sustainable future.
[This section could possibly be considered as belonging to LO 3, but we have chosen to place much of the content in LO 2 since scientific concepts are involved.]

LO1 Investigating phenomena in the Life Sciences	***LO2 Constructing Life Sciences knowledge***	***LO3 Applying Life Sciences in society***
Human influences on the environment		
Conduct a practical investigation on ONE example of human influences on the environment in your local area e.g. impact of alien species or overgrazing on biodiversity, river pollution on a river ecosystem, oil refinery waste on a local community, or smoke from burning coal on a local community. • Identify the problem • Collect and analyse data • Make decisions concerning ways to solve the problem. • Present the findings in a suitable way e.g. a poster, newspaper article, flyer, written assignment or illustrated talk. Propose solutions to the environmental problem. • Take action to solve the problem and report on that action.	Air, land and water pollution: causes, impact on the environment and on human health, and possible solutions. Local, national and global issues: • ozone depletion • greenhouse effect and its importance for sustaining life on earth; enhanced greenhouse effect leading to global warming • desertification, deforestation • effects of overgrazing, crops and commercial forests on biodiversity. • Deposits of poisonous substances in rivers and the water table. Use food pyramids and food webs to interpret environmental changes caused by humans e.g. destruction of fauna and flora by pollutants in streams, rivers, or the sea; eutrophication of rivers; impact of acid rain on ecosystems, deforestation on producers and consumers, insecticides and culling on consumers, and overpopulation on producers and consumers. Introduction of invasive alien species into South Africa, impact on biodiversity, and mechanisms of control. Exploitation of local indigenous resources e.g. devils claw, rooibos, fynbos, African potato, Hoodia, pepper-bark tree vs sustainability Sustaining our environment e.g. management and treatment of domestic waste and effluents from industry; reduction of emissions through more sustainable use of resources.	Historical developments: • the ozone story – a success story? • global warming, climate change, the Kyoto protocol, politics and economics - future scenarios • introduction and control of invasive alien species Management, use and abuse of resources e.g. fossil fuel usage Ecotourism Rehabilitation of the environment Pollution and political, legal, economic, ethical, and other influences with regard to environmental issues Environmental lobbying and the importance of evidence. Biefly discuss the case study of St Lucia.