### YEAR 9 LESSON NOTES SCIENCE UNIT 3: VARIATION AND INHERITANCE

### KEYS

Intro:

Biological keys are sets of statements that act as clues leading to the identification of an organism. By following the keys, we can be able to place an organism in its group. The most common key is the dichotomous key.

**Dichotomous keys** consist of a series of questions, each of which has only two mutually exclusive alternative answers, for example (a) twig hairy or (b) twig not hairy. Answers to these questions then lead on to further questions until a definite identification is made.

### ACTIVITY,

Going through key on page 42 and 43

### **Constructing a Dichotomous Key (or simply Keys)**

Steps:

#### **Step 1: List down the characteristics**

List down the characteristics that you can notice.

#### **Step 2: Organize the characteristics in order**

Start with the most general characteristics first, before moving to the more specific ones.

### **Step 3: Divide the specimens**

You can use statements (i.e. has feathers and no feathers) or questions (does it have feathers?) to divide your specimens into two groups. The first differentiation should be made on the most general characteristic.

#### **Step 4: Divide the specimen even further**

Based on the next contrasting characteristic, divide the specimen further. For example, first, you may have grouped your animals as *have feathers* and *have no feathers*, in which case the ones with feathers can be categorized as *birds* while you can further subdivide the ones that have no feathers as *having fur* and *having no fur*. Continue to subdivide your specimen by asking enough questions until you have identified and named all of them.

### Step 5: Draw a dichotomous key diagram

You can either create a text-based dichotomous key or a graphical one where you can even use images of the specimen you are trying to identify. Here you can use a tree diagram or a flowchart. **Step 6: Test it out** 

Once you have completed your dichotomous key, test it out to see if it works. Focus on the specimen you are trying to identify and go through the questions in your dichotomous tree to see if you get it identified at the end. If you think the questions in your dichotomous key needs to be rearranged, make the necessary adjustments.

### Keep this in mind!

- Consider only one characteristic at a time
- Use morphological or observable characteristics as much as you can
- Use major characteristics when dividing the organisms in the beginning and use lesser or less obvious characteristics to divide them into smaller groups
- When writing contrasting statements, rely on similar word formats (i.e. have feathers and don't have feathers)
- Be specific in your statements and avoid repeating the same characteristics
- Use questions that lead to yes or no answers rather than plain statements.

### **Dichotomous Key Examples**

Complete the key on page 43.

Let's look at some examples to make more sense of what is a dichotomous key.

https://abel.masitsa.com

### Dichotomous key for some animals



**Dichotomous key for insects** 



Dichotomous key for some plants



### Dichotomous key for leaves

# DICHOTOMOUS KEY LEAVES



## Variation and Inheritance

Variation- are the differences between individuals in a species.

To show variation within a species, scientists use a binomial system of naming the individuals (i.e. binomial nomenclature) in Latin or Greek since Latin/Greek was the Universal European Language at that time. Examples: Black jack *Bidens pilosa* 

### Grove snail, brown-lipped snail or Lemon snail-Cepaea nemoralis

### Variation is Caused by:

i) **Genes**- are sets of instructions for organisms. A gene is the basic physical and functional unit of heredity.

-Heredity or inheritance is the passing of features from parents to offsprings.

-The genes provide instructions for the building of an organism belonging to a particular species.

-All organisms have genes, be they plants, animals, bacteria or fungi.

-The genes determine many features of an organism for example, height and eye color.

-Genes ensure that organisms in a particular species bring forth offsprings belonging to that same species.

-The Genes are found inside Cell nucleus along Chromosomes.

-Bothe genes and chromosomes are made of **DNA** (**D**eoxyriboNucleic Acid), the **Hereditary** material.

-Chromosomes are thread-like molecules that carry hereditary information for every characteristic of an organism.



also look at images in Course book page 49.

-Chromosomes are made of proteins and a molecule of DNA which contains genetic instructions.

-Chromosomes exist in pairs e.g. in humans, there are 23 pairs totaling to 46 chromosomes.

### The passing on of genes

-In humans for example, during fertilization, the chromosomes of the male parent combine with those from the female parent to form the first cell, the Zygote.

-As the zygote grows into a fetus, the chromosomes divide leading to cell division forming daughter cells.

-Each daughter cell will have equal number of chromosomes as the parent cell hence the same genes.

### ii) The organism's environment

-The environment including climate, lifestyle, food and nutrition among others alter characteristics of organisms.

-Organisms adapt to the prevailing conditions to ensure their survival.

-As an example, the hydrangeas produce blue flowers if growing in acidic soil but pink flowers in alkaline soils.

# The table below shows a summary of some of the features acquired genetically or environmentally.

Genetic only	Environmental only	Genetic and environmental
Eye colour	Tattoos	Height
Blood group	Scars	Weight
Attached ear lobes	Language spoken	Human's hair colour - can lighten in summer or can be dyed
Animal's fur colour	Colour of hydrangea flower - blue in acid soil, pink in alkaline	Size of plant

## **Breeding**

-This the propagation of a organisms sexually or asexually.

**Selective Breeding** -is the propagation of plants or animals with desired characteristics obtained from selected parents. It is artificial/man-made breeding.

-Continued use of selective breeding leads to production of a new variety of the plant or animal. (Look at sample cases in the Course book pgs. 50,51)

-Selective breeding can lead to the extinction of the breed with undesired qualities.

**Natural Selection** -happens when a breed of organisms becomes unable to effectively compete for food and mates and hence die off leaving the fittest to survive, breed and reproduce.

-It is believed that their existed both long necked and short necked giraffes, but due to inadequate vegetation on the ground for feeding, the short-necked giraffes died off leaving the long-necked ones which could feed on tall shrubs to survive and hence reproduce propagating their genes.

Study the table of comparison between selective breeding and natural selection below.

Selective breeding	Natural selection	
To begin with, there is a population of organisms that show variation. The variation is partly caused by their genes.	To begin with, there is a population of organisms that show variation. The variation is partly caused by their genes.	
People choose individuals that have characteristics that they want.	Individuals that have characteristics that provide the best adaptations to their habitat are more likely to survive.	
Only the individuals with the characteristics that people want are allowed to breed.	Only individuals with the best adaptations survive long enough to breed.	
These individuals pass on their genes, and there- fore their characteristics, to their offspring.	These individuals pass on their genes, and therefore their characteristics, to their offspring.	

### Q: What two differences between selective breeding and natural selection can you notice?

The theory of survival for the fittest can be seen in action when bacteria develop drug resistance, dark moths survive predation unlike grey or light one etc. (Read literature on this on pgs. 54-55.)

### Theory of Natural Selection (By Charles Darwin)

The theory states that the individuals that are best adapted to their environment are the ones that are most likely to pass on their features to the next generation.

The main points in his theory were as follows:

- The organisms in a species are not all exactly the same as each other. They show variation.
- Many organisms will not survive until adulthood. They may be killed by predators, die of disease, or not be able to get enough to eat.
- The individuals that have variations that make them best adapted to the habitat are the ones that have the best chance of surviving.
- The best-adapted organisms are therefore the ones that are most likely to breed and have offspring.
- The offspring will inherit some of the features of their parents
- If this continues, generation after generation, then there could be a change in the species over time. Eventually, it could change so much that it would be a different species.

Do end of unit questions.