

Topic 27: Variation and Selection

Competency: The learner understands that variation is as a result of changes in the genetic make-up of an organism.

NEWS BULETIN ON THE STORY OF VARIATION AND SELECTION

EAGLE TV SCIENCE BULLETIN

Anchor: Rita Nakato, *Eagle TV science desk*

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[INTRO MUSIC FADES OUT]

Anchor (Mirembe Bridget):

Good evening, viewers. Tonight, on the *Biology News Hour*, we turn our focus to one of the cornerstones of life science **Variation and Selection**. Why are some people resistant to diseases while others are not? Why do animals of the same species look different? Our science correspondent, *Kurunda Misaki*, brings us the full story.

Reporter (Kirunda Misaki)

Thank you, Bridget. From the busy corridors of Eagle High School's science block to research labs across the world, students and scientists alike are digging deeper into the mystery of variation and selection the biological forces that shape all living organisms.

What is variation?

Variation refers to the differences in characteristics between individuals of the same species. These differences can be **genetic** passed from parents to offspring or **environmental**, influenced by diet, climate, or lifestyle.

“For instance,” says biology teacher Mr. Odongo, “two students may have different heights due to inherited genes, but one may grow taller because of a better diet.”

Types of variation

Type of variation	Examples
Genetic variation	Blood groups, eye colour, finger prints, albinism. In plants leaf shape, number of petals, seed shape
Environmental variation	Tattoos, scars on skin, language accents, knowledge due to education levels. Plants: Stunted growth due to nutrients, wilting due to low watering rate,
Combined variations (Can be due to both genetic or environmental factors)	Height, intelligence, body weight

The role of natural selection

Natural selection, a concept made famous by Charles Darwin, is the process where organisms better adapted to their environment are more likely to survive and reproduce.

One powerful example is the **peppered moth** in industrial England. As pollution darkened tree trunks, darker moths became less visible to predators and survived longer, gradually replacing lighter-coloured ones.

Student perspective

We spoke to *Naome*, a Senior Two student, who shared her thoughts:

“I now understand why some crops survive droughts better. Variation and selection help farmers choose better seeds.”

Relevance of variation

Variation is not just historical it's shaping modern medicine too. With rising antibiotic resistance, bacteria are showing how random **mutations** lead to new traits that can survive our drugs, making treatment harder.

Artificial selection: man takes the lead

Beyond nature, humans apply **artificial selection** in agriculture and animal breeding. Crops are bred for drought resistance, cows for higher milk yield, and dogs for traits like speed or companionship.

Closing remarks

As Uganda prepares to launch its next biology syllabus update, experts agree: understanding variation and selection helps students appreciate not only diversity, but also the importance of adapting to a changing world.

Reporter (KIRUNDA Misaki)

Back to you, Bridget, from the Eagle TV Science Desk where we bring biology to life, one gene at a time.

Anchor (Mirembe Bridget)

Thank you, Kintu. That was informative. For more science stories, join us every Friday right here on *Eagle TV*, your number one classroom companion. Up next: how genes determine your resistance to malaria don't go away!

Activity 27.1:

In the highlands of Nakapiripirit, a young farmer named Sarah discovers a few of her bean plants survived a long drought. The rest of the crop dried out. A visiting researcher collects samples and explains that one plant may have undergone a mutation that helped it survive. He adds that such variation can be caused by internal genetic changes or environmental stress, and sometimes these changes are beneficial.

Tasks and responses

- a) Explain how both internal and external factors may have caused variation among Sarah's bean plants.

Responses

How internal and external factors may have caused variation among Sarah's bean plants

- ❖ Internal (genetic) factors include mutations sudden, random changes in the DNA of a plant's cells such mutations can occur during DNA replication or gamete formation, leading to new traits like drought resistance
- ❖ External (environmental) factors such as drought stress, temperature changes, or soil conditions can affect gene expression and survival rates some plants may have been better adapted or triggered protective responses due to these external factors

b) Justify why the mutation observed in the drought-resistant bean plant is considered beneficial, and explain how it could influence farming practices.

Responses

Why the drought-resistant mutation is beneficial and how it could influence farming:

- ❖ The mutation allowed the bean plant to survive harsh drought conditions, which is a major environmental challenge in Nakapiripirit
- ❖ Such a trait is beneficial because it increases the plant's chances of survival and reproduction in dry areas
- ❖ If this trait can be passed on to offspring, it could lead to more resilient crops over time
- ❖ Farmers could select and replant seeds from the surviving plant to gradually multiply the drought-tolerant varieties
- ❖ This could lead to higher yields, more reliable harvests, and food security even during dry seasons

c) Propose a way scientists could use such a plant to help other farmers in drought-prone areas.

Responses

How scientists could use such a plant to help other farmers:

- ❖ Scientists can collect seeds or tissue from the drought-resistant plant and test its genetic characters
- ❖ They could use selective breeding to cross it with other high-yielding varieties, producing new drought-tolerant varieties
- ❖ Use of genetic engineering to identify and insert the drought-resistance gene into other crops
- ❖ These improved varieties can be distributed to farmers in drought-prone areas to enhance productivity and resilience
- ❖ Extension workers and researchers can also educate farmers on how to conserve and multiply such resilient seeds

Activity 27.2:

At a school in Hoima, a nurse gives a talk on genetic disorders. She highlights three cases: a student with sickle cell anaemia, another born with albinism, and a third with Down's syndrome. Some students express fear and misunderstanding. The nurse explains that these conditions are caused by changes in genes or chromosomes and are not contagious. She emphasizes that people living with these disorders deserve respect and support.

Tasks and responses

- a) For each of the following: sickle cell anaemia, albinism, and Down's syndrome, identify the type of genetic change and how it affects the person.

For each disorder: identify the type of genetic change and how it affects the person

Sickle Cell Anaemia:

Type of change: A gene mutation affecting the gene for haemoglobin on chromosome 11

Effect: Red blood cells become sickle-shaped instead of round, which reduces oxygen transport causes pain, fatigue, and frequent infections

Albinism:

Type of change: A gene mutation affecting melanin production genes

Effect: The person has little or no pigment in the skin, hair, and eyes they may have vision problems and are sensitive to sunlight

Down's Syndrome:

Type of change: A chromosomal abnormality specifically, trisomy 21, where a person has three copies of chromosome 21

Effect: Causes delayed physical and intellectual development, distinct facial features, and may lead to heart and health complications

- b) Explain two ways schools and communities can support students living with genetic disorders.

Two ways schools and communities can support students with genetic disorders

- + Inclusive programs that allow such students to learn at their own pace and provide learning aids if needed (e.g., larger print for students with albinism)
- + Offer guidance and counselling to support emotional well-being and build confidence of the affected learners
- + Organise health talks and campaigns to educate others about the non-contagious nature of genetic disorders
- + Create peer support groups and promote kindness and understanding among students

- c) Discuss how better awareness and understanding of genetic disorders can reduce stigma and promote inclusion in Uganda.

How better awareness and understanding can reduce stigma and promote inclusion in Uganda

- ❖ Awareness encourages students and community members to treat those affected with dignity and compassion
- ❖ Better understanding leads to timely health care, therapy, and support for affected individuals
- ❖ Inclusive policies in schools and workplaces ensure that people with genetic disorders can participate fully in society
- ❖ Awareness campaigns can boost self-esteem and encourage people living with genetic disorders to share their talents and dreams

Activity 27.3

In Masaka, a poultry farmer, Mr. Kato, crossbreeds his local chickens with a fast-growing foreign breed. The new chicks grow faster and lay more eggs. Some neighbours worry the birds are less resistant to local diseases. An agriculture officer explains this is an example of artificial selection, where farmers choose traits they prefer. Meanwhile, a science teacher nearby is teaching how natural selection works in wild animals adapting to their environment.

Tasks

- a) Compare natural selection and artificial selection using Mr. Kato's chickens as an example.
- b) Identify two advantages and two risks of artificial selection in animals or crops.
- c) Imagine a future where only fast-growing chickens are raised. Predict how this could affect the survival of native breeds and suggest a solution.