NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF EDUCATION

COURSE CODE: SED 327

COURSE TITLE: ENVIRONMENT AND POLLUTION

COURSE MATERIAL

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SED327
ENVIRONMENT AND POPULATION.

DEPARTMENT OF SCIENCE EDUCATION
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ZARIA

JANUARY, 2015

SED 325: ENVIRONMENT AND POPULATION

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MODULE I

THE ENVIRONMENT

Introduction

This module discussed the environment and all its components. The natural environment is a complete ecological unit that functions as a natural system without massive civilized human intervention. It includes all vegetations, microorganism, soil, rocks atmosphere, and natural phenomenon that occur within their boundaries.

All the characteristics of temperature, light, aridity, ground structure, radiation, electric charge, and magnetism all of which were not originating from civilized human activity; this module will look at the natural environment and try to explain them.

The module will be discussed under the following units:

Unit I: Concept of the Environment

Unit II: Biotic Environment

Unit III: Community

Unit IV: Succession

Unit V: Biomes

UNIT I: CONCEPT OF THE ENVIRONMENT

Table of Content

1.0 Introduction

The earth is the only planet known to contain life. Even here most organisms live within a thin surface layer where we have streams, river, lakes, and seas, land down to a soil depth of a few meters and the atmosphere up to an altitude of a few kilometers. The part of the earth occupied by living organisms is called the BIOSPHERE. This unit is going to look at the components of the environment and see how they interact with one another.

2.0 OBJECTIVES

By the end of this unit, the student should be able to:

- State the different type of environment
- Define the community
- State the factors of the physical environment
- State factors of the biotic environment

- Explain how the physical and biotic interact

3.0 CONTENT

3.1 Physical Environment

The environment is the complete range of external conditions in which an organism lives. It composes of the living or biotic part.

The community of living things in an environment is the biotic environment. Factors such as predation and disease which result from the activities of living organism are called biotic factors. The non-living or physical part of an ecosystem forms the abiotic environment.

SELF ASSESSMENT EXERCISE 1

What are the Abiotic Factors?

The abiotic factors of an environment are in 3 categories:

- Climatic factors such as light, temperature, water availability and wind (in a microhabitat this form the microclimate)
- Edaphic factors: These are factors associated with the soil, such as texture, ……, temperature and inorganic content of soil derived from rocks by mechanical and chemical weathering.
- Topographic factors such as angle and aspect of a slope.
- Geology – rock types forms the geology. These rock types have been long formed as a result of continental movement called plate tectonics, igneous activity like volcanoes, accumulation of sedimentary and erosion of rocks

3.2 Effect of Abiotic on Biotic Environment

The physical or abiotic environment experienced by an organism depends on several factors – like geology, topography (landscape), world location (latitude light and temperature variations), climate and weather, and catastrophes.

Some of these factors such as geology an topography of an area are relatively stable over a long period much longer that the life of organisms living there.

The inorganic components of soil are derived from rocks by weathering, so it is important which rock is in a place to produce the soil. The type of soil will determine the type of crops that will grow there topography play on important role in distribution of organisms.

The distance below the surface of a sea or lake is important for aquatic organisms as it determines the amount of light that can penetrate and so the distribution of marine organisms.

Climate and weather – The fluctuation in weather and climate may affect organism that live long as it may experience variation in temperature, drought length and wind speeding during its life.

Thus it is clear that the biotic environment can be determined by the abiotic environment.

Diagram p.96 (Ecology book)

4.0 Conclusion

The environment is the external condition of an organism. It is clear that the external condition of an organism particularly ones like geology and topography can determine the types of organism that will be present in a particular place or habitat.

5.0 Summary

This unit has explained what the components of the environment. The earth is the only place where living organism are found, and where these organisms are found, is determined by the condition of the physical environment.

6.0 Tutor-marked Assignment

Discuss in details the composition of the physical environment.

7.0 References/Further Readings

1. Chiras, D.D. (2010) Environmental Science, 8th ed.

Jones and Bartlett Publishers, Sudbury Massachusetts.

2. Taylor, D. J., Green, N.P.O.,& Stout, G. W., (2006) Biological Science 3rd ed Replika Press Pvt Ltd. Kunli 131028.

UNIT II: BIOTIC ENVIRONMENT

Table of Content

1.0 Introduction

The biotic environment is experienced by an individual as an interactions with other organisms, of the same species and of different species. The way in which organism found in a community and react to each other is an important aspect of ecology, and population.

This unit will introduce the students into these various types of interactions.

2.0 Objectives

By the end of this study the student should be able to:

Explain the various types of inter-specific interactions.

Explain the intra-specific interactions.

3.0 Contents

3.1 Intra-specific Relationship

This is the type that occur within organisms of the same species. These include reproduction, care of offspring, social behaviour and competition.

Reproduction – In sexual reproduction the first thing is for the organism to locate her sex mate. This is done in different ways like croaking as in frogs. It may involve competition and the males may fight. In some it may be display of colours as in some birds and the females will choose her mate without fight.

SELF- ASSESSMENT EXERCISE 1

In what ways do organisms care for their young ones?

Organisms care for their young ones by parents hunting for food for their young ones e.g. deer. In some organisms like termites, the siblings care for the young ones.

Social behaviors – Mostly centres around guarding of territories, and depending such.

Competition – this occurs between individuals within a species, for environmental resources like food, space, light, water and mineral nutrients. e.g. between sperm or poll tube for the chance to fertilize an egg.

3.2 Inter-specific Relationship (Between Species)

This is shown in area of reproduction, seed disposal, parasitism and disease, predation, protection, competition and defence.

Reproduction – this is shown in plants during the process of pollination where insects move pollen grains from one flower to another of same to species in cross-pollination. The pollinator benefits by receiving nectar.

Dispersal - Many plants use animals to dispense their seeds. E.g. birds which eat flashy fruits.

Parasitism and Disease

Parasitism occurs when individual of one species live or reproduce using the food and other resources of an individual of another species, resulting in a deleterious effect on the host. E.g. endo-parasites like tape worm, liver flukes gut of humans. Ecto-parasite like ticks on dogs skin.

Predation – Apart from autotrophs all other organism have to feed on other organisms. Herbivores eat grass, carnivores eat herbivores. There is therefore pressure on predators to locate their prey and prey to avoid being eaten. Each is trying to survive.

Protection – Many organisms trying to avoid predation use other organisms to protect themselves e.g. an insect hiding at the bark of a tree to avoid being eaten.

Competition – Competition between individuals of different species is extremely important in determining the abundance health reproductive capacity and distribution of species within the community.

Competition may occur for all the limited resources like food, light, space, pollinators, water and minerals. Competition may occur between quite different species that require some resources or within some species. Evolution of species however has helped to minimize competition.

Defense - Organisms respond to predation, parasitism and competition by using defense mechanisms.

4.0 CONCLUSION

This unit has dealt with the type of relationships organism have in an environment. This can be between species of same type or of different types. All these are in a bid for survival. No species like to go into oblivion so the struggle put up by any living organism is in order for it to be alive. Hence the need for all this various reactions.

5.0 SUMMARY

In this we have seen that in any one environment every move is for the sake of survival and comfort. Thus organisms go through all kinds of interactions within same species and between different species. These interactions involve certain aspects of competition, predation, herbivory, reproduction and dispersal.

6.0 TUTOR-MARKED ASSIGNMENT

What factors are likely to affect the diversity and number of species found in an area? Give reasons for your answer.

7.0 FURTHER STUDIES

1. Chapman J. L. & Reiss, M. J. (1995) Ecology Principles and Applications

2. Chiras, D.D. (2010) Environmental Science, 8th ed.

Jones and Bartlett Publishers, Sudbury Massachusetts.

3. Taylor, D. J., Green, N.P.O.,& Stout, G. W., (2006) Biological Science 3rd ed Replika Press Pvt Ltd. Kunli 131028.

UNIT III: COMMUNITY

Content

1.0 Introduction

This unit introduces us to the community. The community represents the living part (biotic) of an ecosystem and could be seen as a dynamic unit, with a web of energy flew and an exchange or cycling of materials.

2.0 Objectives

By the end of this unit, the students should be able to:

- Define or explain what a community is.
- Recognize different communities in his or her environment
- Understand the complex mesh of interactions within a community.

3.0 CONTENT

3.1 Definitions and Recognition of Community

Simply put, the community consists of population of different species which live in the same place at the same time and interact with one another.

The term used to be applied only to plants but communities are not made up only of plants. Some communities are mainly animals like associations of fish and invertebrates which make up coral reef communities.

SELF-ASSESSMENT EXERCISE 1

What are most community you know composed of?

Most communities are composed of a mixture of plants, animals, fungi, prokaryotes and proctocists.

SELF-ASSESSMENT EXERCISE 2

How can you identify communities?

There are different ways of identifying communities.

Some take their names from physical features like rock pools, lakes or, sand dunes. Others are recognized by dominant species in the association. These are usually the largest or most abundant plant species present, hence deciduous oak wood, community, rubber tree community, date-palm community. It depends on the dominant plant species.

SELF-ASSESSMENT EXERCISE 3

Is there a fixed sixe for a community?

There is no fixed size. They can range from the very small and constrained like association of microorganism in a mammalian gut to the huge and variable expanses of grassland on forest.

3.2 Structure of a Community

Within any community is a whole series of complex interactions between individuals of different species. The whole collection of population fit together into a working unit.

SELF-ASSESSMENT EXERCISE 4

How can one understand this complex mesh of interactions?

An ecologist has to unravel this.

First by noting the abiotic features of the area e.g. the water situation, whether the physical environment is marine, freshwater, marsh, drained soil or desert. The mineral nutrient, geology and topography.

Secondly, the overall form of the community can be described. In terrestrial community this is usually determined by the vegetation. Plants can have various growth forms like trees which create forest or woodland communities.

Bushes which are shrubs

Herbs and grasses are major types in savannah or practice and

Wet mass which build up bags.

In aquatic habitats, the physical structure is not so obvious.

The next question after this is what species are present? How many species live in the community? Is it diverse or species poor? Further investigation will show which species are dominant.

SELF-ASSESSMENT EXERCISE 5

In what ways can species be said to be the dominant one in a community?

It may be dominant because of the size of its individual such as tree or because of its number. Dominant species have strong biotic effect on the environment of the other species.

Once you done this description, one can now begin to investigate things like tropic food webs in the community, assess the importance of primary producers, herbivores, predators and decomposers. This will provide data for energy and nutrient cycle.

The overall structure of the community will be determined by combination of several features such as physical environment, community size and longevity of species present. The community may be stable or unstable with high or low primary productivity, or may change seasonally or daily.

4.0 Conclusion

This unit has described the community as a small unit of the biosphere and it is a microcosm in itself, where all interactions in an ecosystem occur.

5.0 Summary

- Communities are integrated groups of species which occur together in a common environment or habitat
- The organism within a community usually includes primary producers, herbivores, predators and decomposers.
- Community structure is determined by features of the physical environment and characteristic of the organism present.

6.0 Tutor- Marked Assignments

Distinguish between a community and a population which one is more complicated and why? Suggest why plants in the arctic region tend to be short.

7.0 References/ Further Readings

1. Kent, M. (2000) Advanced Biology. Oxford University Press

2. Taylor, D. J., Green, N.P.O.,& Stout, G. W., (2006) Biological Science 3rd ed Replika Press Pvt Ltd. Kunli 131028.

UNIT IV: SUCCESSION

CONTENT

7.0 References/Further Reading

1.ChapmanJ.L.,& Reiss, M.J. (1995) Ecology, Principles and Applications

2. Taylor, D. J., Green, N.P.O.,& Stout, G. W., (2006) Biological Science 3rd ed Replika Press Pvt Ltd. Kunli 131028.

1. Introduction

The biotic environment is always changing. They change in response to external factors such as changing factors caused by they themselves. The time scales for change are highly variable. So long as the abiotic factors remain relatively constant, the biotic community will develop through time from an initial bare rock to a 'climax community'.

2.0 Objectives

By the end of this unit, the students should be able to:

- Describe succession
- Identify primary and secondary succession.
- Understand reasons for change in a community

3.0 CONTENT

3.1 Succession

Succession is a natural change in the structure and species composition of a community

Does change in succession include the animals also?

Succession is often taken to mean changes in vegetation alone. Other organisms associated with the vegetation types also change, but it is plants which dominate and most influence the community structure.

In succession, the climax community is considered to be the most complex, diverse and productive community in a given complex. It is essential stable, except if a catastrophic event occurs, like a volcanic eruption or human induced fire or deforestation.

The change from bare rock or open water is rapid, especially in the initial stages, and it follows a series of recognizable but predictable stages. This process is called **succession**. Individual succession are called **seres** and the developed mental phases are called **seral stages**

SELF-ASSESSMENT EXERCISE 2

When do you have primary succession?

When the sequence of succession starts on bare uncolonised ground, which never had any vegetation growing on it before or in newly formed lakes, it is known as **Primary Succession.**

It is unknown to find the early stages of primary succession today. Bare areas are rare, but they may occur on sand dune, law flows of volcanoes, new volcanic islands.

SELF-ASSESSMENT EXERCISE 3

Why do we not have lands today?

Today most of the bare areas have been exposed because existing vegetation have been destroyed by fire or covered with silt from flood or vulcanic ash. The vegetation growing in such an area will be exposed to conditions not available in primary successions. Such as soil remnant, organic matter, seeds, and even some plants which have survived the changes.

The sequence of vegetation which will develop on this type previously vegetated and disturbed areas are called secondary succession.

The series of changes which occur in organic communities like a lake is referred to as hydrosere, if on dry land it is xerosere and on rock it is lithosere.

3.2 CAUSE OF CHANGE

SELF-ASSESSMENT EXERCISE 4

Why do these changes occur?

Successional change is an indication that environmental conditions have altered. There are different types of change – Autogenic change can be caused by the plants themselves or from external by the environmental influences that is allogenic succession.

Autogenic changes can be caused by changes in the soil which are caused by organisms growing there. This include accumulation of organic matter in the litter or humic layers, alteration of soil nutrient status or change in $_{p}$H. The structure of the plants themselves can alter the community e.g. a large matured tree can cast shade on developing wood land floor Allogenic changed caused by environmental influences, such as changes due to erosion, leaching or deposition of silt. Animals can bring about increased fertility. Climatic factors may be important but on a much longer time-scale. Changes in temperature and rainfall patterns will promote changes in the community.

4.0 Conclusion

This unit has dealt with the issue of succession as series of changes observed mainly in plants and which eventually can lead to a climax community.

5.0 Summary

Succession occurs when the structure and species of a community change due to natural causes.

Primary succession is vegetation change on bare ground (xerosere) on rock (lithosere) and in new lakes (hydrosere).

Secondary succession is colonization and change on areas disturbed by fire, flood or cultivation where some seeds, vegetation, animals or soil structure remain.

Vegetation changes caused by effect of plants themselves is autogenic succession, if an external influence produces change then it is allogenic.

6.0 Tutor-marked Assignment

What do you understand by the term succession? How many types exist? Which one is faster than the other and why?

7.0 **References/Further Readings.**

1. Kent, M. (2000) Advanced Biology. Oxford University Press

2. Taylor, D. J., Green, N.P.O.,& Stout, G. W., (2006) Biological Science 3rd ed Replika Press Pvt Ltd. Kunli 131028.

3. ChapmanJ.L.,& Reiss, M.J. (1995) Ecology, Principles and Applications

UNIT V: BIOMES

Content

1.0 Introduction

The earth came to existence about 4.5 billion years ago. At first, the planet was a barren mass of rock and ice, several billion of years have evolved and today the earth surface is covered with diverse array of life forms existing in a complex web of life.

The biosphere varies from one region to another and as such, it ecologists have divided it into distinct climatic regions called biomes. This difference has lead to variations in the types of species.

2.0 Objectives

By the end of this unit, the students should be able to:

- Explain the factors that determine the weather pattern of region.
- Enumerate the major biomes of the world.
- Mention some characteristics of each biome

3.0 CONTENT

3.1 Determinant of Biomes – Weather and Climate

Self-Assessment Exercise 1

What is the difference between weather and Climate?

Weather refers to daily conditions in our surroundings, including temperature and rainfall. Weather changes constantly either week to week, day to day and even hour to our. Climate is the average weather over a long period approximately 30 years. Climate determines what plants can live in what area.

Self-Assessment Exercise 2

What factors determine the weather and climate patterns of a region?

The earth is tilted and so making the amount of heat and light that incident on in to be unequal. The weather and climate are determined by the amount of heat and light that heat the different sides.

Based on this the earth can be divided into 3 major climatic regions or zones. The tropics the side that receives the most sun, the temperate zone receives less heat and light from the sun, and the polar zone which receives the least amount.

The tropical regions which receives the most heat is the hottest part and the polar the coldest and darkest.

Self-Assessment Exercise 3

What other environmental factors affect the weather?

The weather within the 3 major climate zones is altered by wind flow pattern which are greatly influenced by the spin of the earth. It is also affected by topography, especially mountain ranges.

Climate is also influenced by ocean currents. Warm water from the equator flows toward the poles warming land masses near which it passes. As it flows northward, it cools. Cool water eventually sinks and flows back toward the equator creating a huge global circulation current.

3.2 The Biomes

The earth's surface can be divided into biologically distinct zones called biomes, each with a distinct climate and unique assemblage of plants and animals. However, as weather also changes, we also have regional variations within each biome.

There are about seven main biomes in the world, we shall briefly name them and give their characteristics briefly.

The Tundra-Stretches across the northern most portions of North America, Europe, and Asia is the Arctic tundra. It covers about 10% of land mass of the Earth. It lies between a region of perpetual ice and snow to the north and a band of coniferous forests to the south. It is devoid of trees characterized by grasses, shrubs and mat-like vegetation – mosses and lichens adapted to harsh climate. Precipitation less than 25cm per year, makes it easily damaged by human action, and Tundra is a fragile environment, easily damaged by human action, with little time to recover.

Taiga – this is a band of coniferous trees spreading across the northern continents just south of the tundra. Its climate is milder, and its life forms are more diverse than those of the tundra.

The taiga supports many large populations of wild animals, but the forests here are under great pressure to meet rising demands for wood and wood products.

Temperature Deciduous Forest

The temperature deciduous forest biome is located in the east United States, Europe and northeast China. This biome is home to half of human population in the United States. It is characterized by abundant rain and long growing season (5 – 6 months). It supports a wide range of plants-and animals.

The dominant plants – the broad-leaved trees that shed their leaves each year in the fall. The sail is very rich as a result of minerals and organic nutrients. Human settlement has altered the soil.

Grassland – occurs in regions of intermediate precipitation, enough to support grasses but not enough to support trees. They exist in temperature and tropical regions. On most continents the rich soil has been heavenly exploited by humans for agriculture.

Desert biome – exist throughout the world, some cover vast regions like Sahara which stretches across northern Africa about the size of United States. It is characterized by hot, dry conditions, but they have plants and animals that have adopted to heat and lack of moisture. Unfortunately world deserts are expanding as a result of human activity such as overgrazing, livestock and production of green house gases.

The tropical rain forest biome south of the equator we find one of the most endangered biomes of the world – tropical rain forest. It exist south and Central America and Asia. It is by far the most diverse of all Earth biomes.

There is abundant rainfall and climate is warm.

4.0 Conclusion

This unit has treated the issue of weather and climate as it affect the environment. This helped to determine the type of organisms to be expected in a given area.

5.0 Summary

The incident light on the tilted earth help to divided the earth into three climatic zones namely; polar, temperature and tropical.

The natural assemblage of organisms in the world can be divided into **biomes.**

Terrestrial biomes are traditionally divided in terms of their vegetation.

6.0 Tutor-marked Assignment

7.0 Further Reading

1 Charis, D. D. (2010) 8th Edition; Environmental Science Jorves & Bartlet Publishers Sudbury Massachusetts.

2 .Chapman, J. L. and Reiss, M. J. (1995). Ecology Principles and Applications

MODULE II

INTERACTION OF LIVING AND NON-LIVING THINGS

Introduction

This module exposes you to the concept in biology called ecology which actually explains the interaction going on between living and non-living things on the earth particularly in the area of showing the feeding relationship, flow of energy in and materials. It is presented under the following five units:

Unit I: Ecology

Unit II: Ecosystems

Unit III: Energy flow and Circulation of Materials

Unit IV: Producers and Consumers

Unit V: Man's Dependence on Plant and Animals

UNIT I: ECOLOGY

Table of Content

Content

1.0 Introduction

Before one can understand the environment it is good to have a good understanding of ecology. This is because its study makes one to see the whole earth as operating as a larger ecosystem, inside of which we have smaller ecosystems like the oceans, forests, grasslands etc. it also helps smaller ecosystems are linked by energy flow and exchange of materials to form the overall planetary ecosystem.

1.1 Objectives

After reading this unit, you should be able to understand what ecology is.

State the components parts of ecology

List the various approaches to ecology

1.2 What is Ecology?

Ecology is the study of the relationships of living organisms with each other, and their non-living or physical surrounding. Studies in ecology, helps us to understand the scientific foundations for our understanding of agriculture, forestry and fisheries. It also gives us the basis for predicting, preventing and remedying pollution. It helps us to understand the effect of intervention of man in certain environmental situation. Like construction of dam, diversion of rivers and makes us to understand the reasons for conservation of the natural environment.

Exercise 1.1

What are the main components of ecology and their compositions?

1.3 Component Parts of Ecology

In studying component parts of ecology, there are two parts:

1. The biotic parts which includes individual organisms, populations and communities (of both plants and animals). These are the living parts of a system called the ecosystem.

2. It also includes the non-living parts known as the abiotic part. The different ecosystems together form the biosphere or ecosphere, which include all living organisms and the physical environments with

which they interact. Thus the oceans, land surface and lower parts of the earth form part of the biosphere.

1.4 List of Approaches to Ecology

Ecology has several ways or approaches to its study. These include;

i. Ecosystem approach – which focuses on the exchange of energy and matter between living and non-living components of the system.
ii. Community approach – Concerned mainly with the living components of the system.
iii. Population approach – This approach is concerned with the characteristics, mathematical forms of the growth, maintenance and decline of species population.
iv. Habitat approach – This approach describes the typical environment of a particular organism, population, community or ecosystem.
v. Evolutionary or historical approach – This system studies how ecosystems, communities populations and habitats have changed over time.

Exercise 1.2

What do you understand by the term community approach to studying ecology? See (ii)

Exercise 1.3

i. State one important aspect of community studies.
ii. One important aspect of community studies is the concept of succession and climax communities.

1.5 Conclusion

This unit discusses the term ecology as a concept in biology, its components and various approaches of its study.

1.6 Summary

In this unit you learnt that: the

- Environment consists of living and non-living components
- Organisms can be studied at different levels of organizations, i.e. genes, cells, tissues and organs. Ecology can be studies under – Organisms,

population and communities which ecologist regard as the living part (biotic components) of the ecosystem. It also includes the non-living part of i.e. (abiotic components) which contains energy and matter.

- There are several approaches to the study of ecology.

1.7 Tutor Marked Assignment

i. Briefly explain the advantages of using the evolutionary approach to the use of evolutionary to the study of ecology.
ii. In what way are historical and palancology approaches used in the study of ecology.
iii. Which of them best explain more of man's impact on the environment?

1.8 References

Taylor, D. J., Green, N.P.O. & Stout, G. W. (2006) Biological Science, 3rd Edition Cambridge University Press.

Wikipedia, the free Encyclopedia, en.wikipedia.org/natural environment.

UNIT II: ECOSYSTEMS

Content

1.0 Introduction

This unit discusses the ecosystems. It explains the interactions between the biotic and abiotic environment in an ecological system. It also talks about how food chains and food webs are derived.

2.0 Objectives

After reading this unit, you should be able to:

i. State the key points of the ecosystems
ii. Describe and draw the structure of the ecosystems
iii. Know the different types of the ecosystem
iv. Know the components of the biotic and abiotic environment
v. Draw a simple food chain
vi. Derive a food web

3.0 Key Points about the Ecosystem

Ecosystem is defined as a natural unit consisting of all plants, animals and microorganisms (biotic factors) in an area; functioning together with all of the non-living physical (abiotic) factors of the environment. (another name for ecosystem is the environment).

One important thing about the ecosystem is that there is a close association between living (biotic) and non-living (abiotic) components because both affect each other and are equally important for the ecosystem.

Ecosystem can be studied at any level of organization. For instance, ecosystem principles may be applied to:

A puddle ⟶ pond ⟶ lake ⟶ sea ⟶ ocean ⟶ planet.

For the ecosystem to be stable or balanced, it is necessary for all the organisms and all features of the physical environment to be present.

The tendency for a system to maintain a stable state is known as homeostasis (self-regulation).

What can move the system away from equilibrium?

Changes in both biotic and abiotic environment can move the system away from equilibrium.

Small changes can be restored by feedback processes within the system. Large changes may alter the state of the system away from equilibrium points.

This may happen when the feedback mechanisms cannot respond rapidly enough to maintain the original equilibrium. A new equilibrium will be reached but the original ecosystem may be radically changed.

For example: the development of scrubland or forest from initial bare land. Another example is changes brought about by human manipulation in the environment, which has led to expected side effect, such as problem with insect pest in simple agricultural system.

Exercise 2.1

It is true that changes in the ecological system can bring about good or bad results? Give reasons for your answer.

Self – Assessment Exercise 2

What are the components of the ecosystem?

The components of the ecosystem are the bio factors which are all the plants and animals and microorganisms in that area, and the abiotic factors which are the non-living components such as the soil, water and climate.

Self – Assessment Exercise 3

What are the different types of ecosystems?

The different types of ecosystems include land or terrestrial, aquatic which include oceans, (marine), freshwater which include lakes, rivers, ponds, puddles, march etc. and aerial which is the air.

4.0 Conclusion

This unit has discussed the ecosystem. It looked at the different types of ecosystems and the definition and the key concepts.

5.0 Summary

- Ecosystem consists of biotic and abiotic factors.
- Biotic and abiotics factors interact with each other in a way to strike a balance or stability – a phenomenon known as homeostasis.

- It is possible to disturb the homeostatic balance in an ecosystem by human manipulations.
- Biotic component of the ecosystem include – plants, animals and microorganisms.

6.0 Tutor-marked Assignment

Make a simple schematic comparison of terrestrial and aquatic ecosystems.

7.0 Further Reading

1. Odum, E.P. (1975) Ecology, 2nd Edition. Holt, Rinehart & Wilson.

2.Taylor, D. J., Green, N.P.O. & Stout, G. W. (2006) Biological Science, 3rd Edition Cambridge University Press.

UNIT III: ENERGY FLOW AND CIRCULATION OF MATERIALS

Content

1.0 Introduction

Generally speaking living things are highly organized, and in order for them to maintain this internal order organizations need good supply of the relevant nutrients and a supply of energy. This unit will look at how organizations obtain their energy and how they pass energy up a food chain or food web.

2.0 Objectives

By the end of this unit the student should be able to:

- Define energy explain how living things obtain their energy.
- Define producer and consumer.
- Explain the biogeochemical cycle
- Define the ecosystem.
- Explain how energy and materials flow in the ecosystem.

3.0 Main Content

3.1 Flow of Energy

Energy can be defined as the ability to do work. Living things may be likened to machines in that they require energy to keep working and stay alive. The sun is the primary/main source of energy on earth it is referred to as solar energy.

Self Assessment *Exercise 1*

How does this energy get to living organisms.

Solar Energy

Is captured by photo autotrophs in photosynthesis. Autotrophs turn this into food or chemical energy which is supplied to the ecosystem.

Self Assessment *Exercise 2*

What is the source of the chemicals founds in food?

The chemical found in food are derived originally from the abiotic components of environment, such as the soil, water and air. The materials founds in food include carbon which gets to the autotrophs in form of carbon dioxide from the air, water (H_20) from the soil. The autotrophs are the green plants which absorb the solar energy and use it to cause a reaction between water and carbon dioxide to form sugar which is food for other organisms.

Self Assessment *Exercise 3*

How does the earth maintain constant flow of these chemicals?

There is a constant supply of carbon dioxide and water in the air because when these chemicals are removed from the air and soil to make food by the photo autotrophs i.e green plants the eventually return into the environment by way of decomposition of the waste products or by dead bodies of the organisms bacterial and fungi are responsible for decomposition, as they obtain energy from the waste products and dead organisms in the process.

Thus the chemical materials needed by the living organisms are being cycled within the ecosystem.

Self Assessment *Exercise 4*

What is the biogeochemical cycle. Thus is the chemicals in the ecosystem are being recycled. Since the both living and non living parts of the ecosystem are involved in these chemical cycles they are called BIOGEOCHEMICAL CYCLES. Thus in an ecosystem, energy flow from the sun, to the plant, from the plant to other organisms in form of chemical energy. This food is broken down, energy for work is released, and the chemicals sent back to the atmosphere.

3.2 Ecosystem and Material Flow

Ecosystem is a chemical physical and biological system. It consists of the community of organisms (biological system) and the associated of physical environment.

Life on land and water is possible mainly because of the existence of a group of organism called the producers such as algae and green plants. These organism absorb sunlight and use its energy to synthesize organic foodstuffs from atmospheric carbon dioxide and water by the process of photosynthesis.

Self Assessment *Exercise 5*

How does the manufactured food get transferred to the users.

The organic food manufactured are also used by the producers themselves, but in addition, they provide nourishment for all the other organisms. Producers, therefore form the foundation of the living world.

Self Assessment *Exercise 6*

Apart from producers what other group of organisms benefit from this manufactured food?

Another large group of organisms is the consumers depending on what they feed on. The ones that feed directly on plants are the herbivores e.g deer, cattle.

Others such as wolves, leopards lions, feed on herbivores and are known as carnivores some like humans and other animals survive on mixed diet of plants and animals and are known as omnivores. Another group feeds on animals waste or the remains of plants and animals and are called detrivores or decomposers. This group include many bacteria, fungi and insects.

4.0 Conclusion

This unit exposes you to how energy and materials flow in an ecosystem. It also gives you an idea of how materials are recycled such that they are never exhausted in the system.

5.0 Summary

In this unit you learnt that materials are highly organized, and in order to maintain this organization, nutrients and energy supply must be adequate. Thus we have learnt that the ultimate sources of energy is the solar energy and it is always there fore the photo autotrophs to trap, the chemicals need come from the air and soil, these are with the aid of the sun's energy incorporated to form chemical foodstuff, which when form the nutrient in the body. The sun's energy built into the chemical is used up, and the chemicals are again free to go back into the atmosphere.

6.0 Tutor Marked Assignment:

The earth is a closed system. What does this mean, and what are the implications of this fact?

7.0 References/ Further Readings

Chireis, D.D., (2010) 8th ed. Environmental science. Jones & Bartle Publishers sudbury massachesetts.

Taylor, D.J., Green N.P.O. and stoot, G.W. (2006) 3rd ed. Cambridge University Press.

Unit IV: FOOD CHAIN AND FOOD WEBS

Contents

Introduction

This unit discusses the feeding ecosystem. Relationships in an ecosystem and how they can be represented in a food chain and food web, and also discusses trophic levels in living organism and how energy transferred from one level to the other is reducing and as it does so an energy pyramid is built.

Objectives

By the end of this unit the student should be able to;

- Differentiate between food chain and food webs.
- Describe the way energy is transferred and how it is reducing.
- Define trophic levels.

3.0 Main Content

3.1 Food Chain and Trophic Levels.

Food chain are series of organisms each one feeding on the organism proceeding it. There are two types of food chains recognized by biologists they are grazer and decomposers.

Self Assignment Exercise 1

What is the beginning of grazer food chain and that of the decomposers?

Grazer food chain begins with plants and algae. These are eaten by herbivores in turn may be eaten by carnivores.

Decomposers food chain begins with dead organisms, animals wastes (feaces) or remains of plants and animals. These are consumed by insects, worms and a host of other micro organisms like bacteria. These decomposing are the organisms responsible for the decomposition of waste and the return of its nutrients to the environment for recycling.

Self Assessment Exercise 2

What do you understand by trophic levels, in feeding relationship of organism each stage of the food chain is known as a trophic level. The first trophic level is occupied by the autotrophic organisms called the producers. The organisms in the second trophic level are usually called primary consumers, while those in the third level are the secondary cosumers.

Self Assessment Exercise 3

Give a reason why the number of trophic level or length chain is limited.

There are usually four or five trophic level and seldom more than six. This is partly because at every feeding stage some energy is wasted from the chains of animals feeding on each other. Also the availability of sufficient food of choice, and tenitonal space may also restrict the numbers of end-of-chain organisms and thus the length of food chains.

Fig 1

Flow of energy and cycling of materials through a typical food chain. Note: a 2 way exchange is possible between carnivores and detritus feeders/decomposers. The latter feed on dead carnivores, carnivores may eat living detritus feeder decomposers.

3.2 Food-webs and Energy Flow:

In an ecosystem, the food chain show each organism to be feeding on one thing however the feeding relationship within an ecosystem are usually more complex than this most organisms feed on more than one other organism some feed in both grazing and detritus food chains. This is particularly true of carnivores many of which have varied diet and feed at secondary tertiary, quaternary and higher trophic levels. Some including humans feed on all trophic levels and consume plants, animals and fungi, these organisms are called omnivores.

Self Assessment Exercise 4

How do you call the network of feeding relationship you have in an ecosystem?

The network of feeding interactions existing in the ecosystem is referred to as the foodweb. This really is what obtains in an ecosystem, and the food chains are just a part of a much more complex network of feeding interactions called the foodweb. It is a mesh of interlining food chains.

Self Assessment Exercise 5

How does energy and nutrient flow through the food-webs.

Energy and nutrients flow through food webs but in very different ways from food chains looking at energy flow, the sun is the ultimate sources of energy. This energy is captured by plants and then used to produce organic food molecules. Energy from the sun is then stored in these molecules. Organics molecules pass from plants to animals. Molecules are broken down in both plants ad animals in order to release energy. This energy is used to power the numerous activities that take place in life. A large part of the energy released is lost as heat. The heat is radiated into over space see fig 1. This heat cannot be recaptured and reused by plants or animals. Since solar energy is converted to heat, energy is served to flow in one direction through food chains and food webs. This means energy cannot be recycled.

Self Assessment Exercise 6

Is there any different in the way energy flows in the webs?

In contrast nutrient flow cyclically, that is to say that they are recycled. Nutrient in sol, air and water are first incorporated into plants and algae and are then passed from plants to animals through various food chains. Nutrient in the food again eventually reenter the environment through waste or decomposition of dead remains of organisms.

3.3 Ecological Pyramids

Food webs are useful description of the feeding relationships of organism in a community, but it is not quantitative.

At the base of the grazer food chain are the producers.

Self Assessment Exercise 6

How are ecological pyramids built up?

Feeding relationship and the efficiency of energy transfer through the biotic component (plants & animals) of an ecosystem have been summarized in pyramid diagrams.

Three types of pyramids have been used they are:

- Pyramids of numbers based on counting the numbers of organisms at each trophic levels.
- Pyramid of biomass which note the weight (usually the dry weight) of organization at each trophic levels.

And lastly pyramids of energy which monitor the energy content of the organism at each trophic level.

Elton 1972 was the first person to talk about feeding relationships in terms of pyramids must often a true pyramids shape may not be obtained because producers very greatly in size, a gram cannot be equated to a tree, thus producers are often omitted in the pyramid.

Assessment Exercise 7

Why do we have pyramids of biomass?

Some pyramids of numbers are sometime inverted due to the very large size of some producers or small size of parasites, ecologist started to determine the pyramid of biomass, this is calculated by the determining for a given area the biomass of the producers, of herbivores, 1st level carnivores etc.

Very few pyramid of this nature have been determined because they are more time consuming.

Self Assessment Exercise 8

What is the most ideal way of representing relationships between organisms in different trophic levels?

The must ideal way is of representing feeding relationships is by pyramid of energy.

This is because it takes into account the rate of production, as against pyramid of number which depict the standing states of organisms at a particular moment in time.

4.0 Conclusion

This unit has dealt with feeding relationships in any ecosystem. It shows how organisms depend on one another and how living things actually rely on non-living things (biotic & abiotic) for existence. It also shows that feeding relationship can be represented as chains, webs and pyramids.

5.0 Summary

In this unit you have learnt that photosynthetic organisms such as plants and algae produce food within the ecosystem and their well-being is essential to the survival and well-being of all other species. Food and energy flow through food chains which are a part of a much longer food web. Food chans are biological avenues for the flow of energy and the cycling of nutrients in the environment. Energy flow in one direction through food chains, but nutrient are recycled. The position of an organism in a food chain is called its trophic level. Producers are on the first trophic level, herbivores are on the second level. Carnivores are on the third. The length of a food chain are limited by the less of energy from one trophic level to

another. The largest number f organism is generally supported by the base of the food chain the producers.

6.0 Tutor Marked Assignment

The earth is a closed system. What does this mean and what are the implications of this fact?

8.0 Further Reading

1. Charis,D.D., (2010), Environmental Science 8th ed.

Jones & Bartlett Publishers.

2. Chapman, J.L & Reiss, M.J (1995).Ecology Principles and Application Cambridge University Press.

3.Taylor, D.J Green N.P.O. & stout G.W (2010). Biological Science. Cambridge University Press

Unit V: MAN'S DEPENDENCE ON PLANT AND ANIMALS

1.0 Introduction

The brilliant physicist Albert Einstein once said if the bee disappears from the surface of the earth. Man would have no more than four years to live. This is to say if there are no more bees, there will be no more pollution, no more plants, no more animals and no more man. This statement emphasize that if there is no pollination soon plant will all die as seeds will not be produced if there are no plants there will be no food for animals and even man, and if no food, no life. Thus it is a truism that animals depends on plants and vice veneer.

2.0 Objective

By the end of the this unit, the student will be able to:

(i) Identify the role of plants in human life.

(ii) Identify the role of animals in life of man and plants.

(iii) Explain the importance of bees in the life of pants and man.

Contents

3.0 Content

3.1 Autotrophic and Heterotrophic Life

Importance of Plants to Man

Plants are useful to use in many ways. It is at the beginning of any food chain. This is because they are the only group of organisms that can make use of sample inorganic matter in the environment (CO_2 and H_2O) and energy from the sun and turn it into useful organic form called food, on which every other forms of life depends. The group of organisms that behave like plants are referred to as the autotrophs while other forms of life-like animals and human being are referred to as heterotrophs.

The sun is the ultimate sources of energy for all living things but only the green plants can use it build organic food from inorganic materials.

Self-Assessment Exercise 1

Who uses the food produced?

The food produced by plants are used by man and other animals and even the plants themselves use the manufactured food to sustain their own lives, also. Thus it is clear that humans are completely dependent on plants.

3.2 Humans and Animals are Completely Depend on Plants.

Self-Assessment Exercise 2

State the different ways in which humans and animals are completely depended on plants.

Humans are completely dependent on plants in the following ways:

- Plants are useful to use in many ways.
- The most important necessities of humans are food clothing and shelter. Plant provide us with this to a great extent, because plants are the main sources of food in the form of cereals, pulses, vegetables, fruits and oil.
- In area of clothing material, cotton and flex are fibre yielding plants. The cotton fibres from cotton plant are used for weaving clothing. Hemp and jute obtained from the stem are not only used for making bags, ropes and carpets but are nowadays used to make dress materials as well. Flax fibre also obtained from the stem and used as fine fabric fibre e.g linen, cloth, thread canvas, carpet etc.
- A life depends on plants. If there were no plants all life on earth would come to and end, because plants produce food if there is no food to eat man and animals will starve to death.

Self-Assessment Exercise 3 apart from food what other things do we get from plants?

- Plants also give oxygen out. If no oxygen, no living things would survive without respiration.
- Plants need proper amount of sunlight air, water and temperature to grow well.

- Plants are used as medicines, herbal medicines are repaired from plants only, these do not caused side effects compared to synthetic ones.
- Plants with soft green and perishable stems are called herbs e.g coriander, mint, spinach oregane fennel, and even banaban plants are greent herbs. They live only for a few months and they add flavor to the food.
- Petals of some flowers contain sweet smelling oil used for making perfumes or scents. E.g rose. Jasmine, kiore and lavender. Clove is also a flower bud used for seasoning food.

3.3 Plants also depend on humans and animals

- It has already been stated earlier that the primary requirement of plants and animals is food, without food they will die. Plants make their food through the process of photosynthesis. Is the process where plan to make their food from carbon dioxide and water in the presence of sunlight and chlorophyll. They are therefore food producers. Must of this food is stored in them as sugar and starch. Some animals eat this plant, while some eat other plant eating animals. Therefore they are food consumers.
- Food chain begin with green plants which are the producers, linked to them are the plant eating animals or herbivores, and they eat the food stored in the plants. They are also called the primary consumers e.g horse, goat and deer.

Next in the chain are the flesh eating animals or carnivores who eat the herbivores they are called secondary consumers e.g tiger, cheetah and fex. The next link in the chain are the flesh eating carnivores which eat other carnivores e.g snakes eat frogs, which in turn feed on plant eating insects the snake is a tertiary consumer. The final link are the decomposers or creatures who feed on dead plants and animals e.g fungi.

Self-Assessment **Exercise 4:**

What do you thing will happen if any member of the chain is missing for instance the detritivores.?

It upsets the balance of nature if any member of the chain is missing. You can imagine if the detritivores/decomposers were missing the whole of the environment will be full of dead bodies of man, animals and plants and soon the inorganic materials required to manufactured food will be exhausted and everything will come to a stand still.

***Self-Assessment* Exercise 5:**

How does plant give shelter to animals

The forests are the home to animals birds and insects. Birds make nests in trees. Snakes, squirrels, ants etc. live in holes made in tree trunks, cutting trees and destroying forests affect the natural habitat of many animals indirectly man obtain shelter from the forest by cutting trees to build houses.

Self Assessment

***Self-Assessment* Exercise 6:**

In what way would you say that plant need animals including man?

Plant need animals and man to keep going. When animals breathe out, they send out carbon dioxide gas. This gas is used by the plants to make food by the process of photosynthesis. In turn, the plant will give out oxygen, needed by animals to breathe. Without green plants man will not have enough oxygen to breathe and they will all die.

Apart from carbon dioxide, plants also get other nourishment from animals which help them to grow, such as cow-during and other waste matter.

4.0 Conclusion

From this unit, we have seen that man and other animals owe their continual survival on planet earth to the existence of green plants since they all need food to live, and also oxygen to respire. However plants also rely on the continual existence of man and other animals for its continual survival as they need carbon dioxide which comes from the animal also to manufacture food. They also get nourishment from the animals waste. Thus it is not a anidirechonal relationship as such, it is an interdependence types.

5.0 Summary

In this unit we have discussed some of the ways in which man depend on plants for their ****** existence, we have also discussed ways in which man and other animals also help plants to continue to exist. We have also revisited the food chain emphasing the need for the chain not to have any organism.

6.0 Tutor-marked Assignment

How true is the saying of Albert Eintein who said that "if bees should disappear from the face of the earth, the earth would have just four years to live"?

Discuss this vis-à-vis the interdepence of plants and animals especially humans.

7.0 References/ Further Readings

Chiras, D.D., (2010) 8th ed. Environmental science. Jones & Bartle Publishers sudbury massachesetts.

http://www.preservearticles.com/2010 why do we say that man, animals and plants depend on each other?

MODULE III
REPRODUCTION, GROWTH AND DEVELOPMENT IN PLANTS AND ANIMALS

Introduction

In this module you will learn the meaning of reproduction, the different types that we have in general and the types found in higher plants and animals. You will also learn about how man has intervened in reproduction of both plant and animals to bring about improved varieties of organisms and also that of man in order to control population.

Unit I Meaning and types of reproduction

Unit II Sexual reproduction in flowering plants

Unit III Human reproductive system

Unite IV Reproductive in man

Unit V Human intervention in reproduction

UNIT I: MEANING AND TYPES OF REPRODUCTION

Contents

1.0 Introduction

In this unit you will be introduced to the meaning of reproduction and also the different types the advantages and disadvantages of the different types of reproduction.

Objectives

After studying this unit, you should be able to;

- Differentiate between sexual and asexual reproduction.
- Name organisms that show each type
- Environment the advantages and disadvantages of each types.

3.0 Content

3.1 What is reproduction?

Reproduction is the production of a new generation of individuals of the same species. This is one of the basic characteristics of living organisms. It involves the transmission of genetic maternal. From one generation to another in order that a species survive s over long penods of time, even though individual members of the species die.

3.2 Types of Reproduction

Self assessment exercise I

What are the types of reproduction?

There are two main types of reproduction they are asexual and sexual types. As sexual reproduction is that which occurs by a single organisms without production f gametes. It usually result in production of identical off spring. Variation occurs among the off springs only of there is genetic mutation on one of the off springs. Identical off springs from a single parent are called “clone”.

Self- Assessment Exercise 2

What are the different types of asexual reproduction?

There are sexual types of asexual reproduction.

Unicellular organisms such as bacteria and protocists reproduce asexually by a process called fission, i.e. the parent cell divide into two or more daughter cells identical to the parents cell.

Protocists like amoeba and paramecium reproduce by a process called binary fission. Under suitable conditions it result into rapid population growth. Another types is the multiple fission here repeated divisions of the parent nucleus here repeated division of parent nucleus results into many daughter cells. This occur in a group of protoctists like the malaria parasite plasmodium.

Self-Assessment Exercise 3

there other types of sexual reproduction?

Yes, there are other types like in fungi kingdom we have the types called spore formation. These are usually produced at the tip of hypha and are enclosed in a special structure called sporangium e.g mucor. Some produce spores directly on the tip of hyphae. E.g penicillium.

Budding is a form of asexual reproduction in which a new individual is produced as an outgrowth (bud) of the parent and in later released as an independent, identical copy of the parent e.g the fungi and yeast and in the enidarians notably the hydra.

In the plant kingdom, the most common form of asexual reproduction is called **Vegetative Propagation**.

Self- Assessment Exercise 4

How does vegetative propagation take place?

In this type a bud from the stem grows and develops into a new plants. At some stage the new plant becomes detached from the parent plant and starts to lead an independent existence.

Self- Assessment *Exercise 5*

What are the different organs specialized for vegetative propagation in plants.

Certain specialized structure develop for vegetative propagation, but they must all have buds so they contain part of the stem. These strcutrues are called perennating organs and they include bulbs, corns, rhizomes stolens, and tubers.

Take Home Assignment

Make a well labeled drawing of each of the perennating organ named. Why are they so called?

Some of these organs store food as a means of survival during adverse condition, like cold, or drought periods.

Self assessment exercise 6

Explain asexual reproduction in animals

Asexual reproduction occurs only in few unspecialized animals. Such animals in the phylum enidaria, can underge budding. That is the type in which a new individual is produced as an outgrowth of the parent. E.g hydro. Another form is fragmentation. This is breaking of an organism into two or more parts, each will now grow to form a new individual. For this types strong power of regeneration is necessary for the organism. Examples are ribbon worms, can break into small pieces each of which can regenerate a new individual starfish and even earth worms can regenerate if accident occurs.

Exercise 6

What other type of reproduction do we have?

The other type of reproduction is sexual reproduction. This is the production of off springs by the fission of gametes to form a diploid zygote, which develop into a matured off spring.

The act of fusion is called fertilization. Gametes that fuse are usually of two types – male and female, but in some promotive organisms they are one type only. If the gametes are of two types, they may be produced by separate male and female parents, or by a single parent bearing both male and female reproductive organs species that have separate male and female individuals are described as unisexual, such as humans and most other animals.

Some species can produce both male and female gametes within the same organisms, they are described as hermaphrodite or bisexual. Many protozooms like paramacum, cnidana like obewa, platihelminthes such as taenia, oligocheates such as lumbricus (earth worm) crustaceer such as Balanus (bamacle), molluse such as helix (garden snail) some fish, lizard, and birds and must flowering plants are her maphrodite.

4.0 Conclusion

This unit has given us a vital description of what reproduction is and the different types has be described. It is a means of ensuring continuity in life. Each organism with a phylum show its own peculiar way of reproduction.

5.0 Summary

This unit has defined reproduction. It has also described the two types of reproduction and the different ways in which they manifest in the different organisms.

6.0 Tutor-marked assignment

a) In a tabular form compare asexual and sexual reproduction in living organism.

b) Briefly state the advantages and disadvantages of natural asexual reproduction.

c) What do you understand by the term ‘cloning’ where does it occur and how is it done.

7.0 Further Reading/ References

1. Charis,D.D., (2010), Environmental Science 8th ed.

Jones & Bartlett Publishers.

2. Chapman, J.L & Reiss, M.J (1995).Ecology Principles and Application Cambridge University Press.

3.Taylor, D.J Green N.P.O. & stout G.W (2010). Biological Science. Cambridge University Press

UNIT II: SEXUAL REPRODUCTION IN FLOWERING PLANTS

Content

3.1 Parts of a flower

3.2 Pollination and fertilization

3.3 Development of seed and fruit

4.0 Conclusion
5.0 Summary
6.0 Tutor-marked assignment
7.0 Further Readings/References

Introduction

Flowering plants owe much of their success to the ways in which their sexual reproduction has been adopted to dry land, by the production of seeds and fruits, to nourish and protect the embryo plants and help in its dispersal. Also male gametes are carried to the female by an agent instead of allowing it to swum, in a process of pollination. This followed by development of a pollen tube which carried the male nuclei to the female gamete for fertilization and lastly the reduction of the gametophyte generation.

2.0 Objectives

The objectives of this unit will therefore be to;

- Study the parts of flower
- Draw and label the flower
- Understand what pollution is
- Describe what you understand by fertilization
- Explain how seed and fruit develop.

3.0 Main Content

3.1 Parts of a flower

Flower are the reproductive structures of a flowering plant or angiosperm (seed producing plants). The flower is made up of the following parts.

Inflorencescence is a collection of flowers borne on the same stalk. A collection of flowers on a stalk is more attractive to pollinating insects the a small solitary

exercise flower. What are the parts of each flower. Each flower consists of the following parts. The receptacle is the tep of the flower stalk or pedicel, from which the flower part arise. The perianth consists of two whorls of structures called penath segment they are the sepals and petals. In moncptyledons both sepals and petab are similar in dicotyledons they are usually different the outer worls are the sepal all together called calyx and an inner whorl petals which all together we call corolla the calyx is the collection of sepals. They batter are usually green and leaf like structures. Their function is to enclose and protect all the other parts of the flower in a bud. Occasionally they are brightly coloured, and petal-like serving to attract insects for pollination.

The corolla is the collection of petals in insect pollinated flowers petals are usually large brightly coloured to attract insect. They are usually reduced in size and green or may be entirely absent.

The stamen is the male reproductive organ. Collection of them is called androecum each stamen consists of an anther and of filament. The anther contains pollen sacs in which pollen is made the filament contains a vascular bundle what carries food and water to the anther.

The female structure is the gynoecium and is a collection of carpel forming the female reproductive organs of the flower. A carped consists of stigma style and ovary. The stigma receives the pollen grains during pollination and the style bears the stigma in a suitable position in the flower to receive the pollen. The ovary is the swollen hollow base of the carpel and it contains one or more ovules. Ovules are the structures in which embryo sacs develop and which becomes seed after fertilization. Each ovule is attached to the ovary wall by a stalk called funicle and the point of attachment is called the placement.

Take home assignment

What do you understand by the following term: hypogynous, epigynous and perigynous. Superior and inferior ovary, and nectaries.

Self -Assessment Exercise 3

What do you understand by the following terms used to describe a flower?

- Hermaphrodite (bisexual) plants. That is male and female sex organs borne on the same plant.

- Dioecious (unisexual) plants- here male and female sex organs borne on separate plants i.e plants are either male or femae e.g pawpaw.
- Monocision plants separate male and female flower borne on the same plant e.g maize, orange. Such pantsn are hermaphrodite.

Drawing of part of a flower

3.2.1 Pollination

What is pollination?

This is the transfer of pollen grains from the anther to stigma. Pollination always proceed fertilization. There are two types of pollination self pollination this is the type that occurs when pollen grain is transferred from an anther to a stigma of the same flower. While transfer of pollen from the anther of one plant to the stigma of another plant is called CROSS- POLLINATION. Exercise what are the merits of cross and self pollination.

- Cross pollination lads to cross fertilization and has the advantages of creasing the amount of genetic variation. The disadvantage of wasting pollen. E.g mango, pawpaw.
- Self-pollination leads to self-fertilization it is more reliable, especially where members of the species are not common and are separated by long distances. This is because it is not dependent on an external factor such as winder insect to deliver pollen. It is also useful in harsh climates where insects are less common, such as high mountain. One disadvantage is self- fertilizer results in inbreeding and can result on less vigorous off spring. E.g grains sorghum, maize, they produce no nectar or scent.

3.2.How Does Fertilization Take Place?

Once a pollen grain has landed on the stigma of a compatible species, it begins to germinate. The epidermal cells of the stigma secretes a sucrose solution. This stimulate germination f the grain and possible supplies food.

A pollen tube emerges from one of the pores (pits) in the wall of the pollen grain and grows rapidly down the style to the ovary.

During growth of the pollen tube, the generative nucleus of the pollen grain divides by mitosis to produce two male nuclei that represents male gametes. They cannot swim unlike the sperms of lower plants and depend on the pollen tube to reach the female gamete which is located in the emrbryo sac of the ovule. The pollen tube enters the ovule through the micropyle, the tube nucleus degenerates and the tube bursts releasing the male gametes near the embryo sac, which they enter. One of the two nuclei fuses with the female gate forming a diploid zygote, and the other fuses with the diploid nucleus form a triploid nucleus known as the primary endosperm nucleus. This double fertilization is unique to flowering plants. It leads eventually to the two structures found in seeds namely the embryo and the endosperm.

3.3 Development of seed and fruits

Immediately after fertilization the ovule becomes known as seed and the ovary fruit. These changes occur in the following ways.

1. The zygote undergoes several mitotic divisions to become a multi cellular embryo which consists of a first shoot called the plumule a first root called the radicle and either one or two seed-leaves called cotyledons. (one in monocotyledon and two in dicotyledons). The cotyledons act as food storage reserved pea for the embryo pumule radical during seed germination broad bean the plumule consists of a stem, the first pair of two foliage leaves and a terminal build.
2. The tripled primary endosperm nucleus undergoes repeated mitotic divisions to from the endosperm, which is a mass of triploid nuclei which are separated from one another by thin cell walls. In some seeds, this remain as the food store as in cereals.

3. If cotyledons act as the food store, they grow at the expense of the endosperm. Which may disappear altogether, e.g bean seed. Some seed store food in both endosperm and cotyledon. E.g pride of babardos.

- Testa develops from the integument is a thin but tough protective layer.
- The mycropyle is a small pore in the testa through which oxygen and water will enter when the seed germinates.
- Lastly stage of seed development involves a reduction in the water content of the seed from the normal levels for plant tissues of about 90% by man to 10-15%. This reduction of water is an essential step in ensuring seed dormancy.
- While seed develops changes take place in ovary which turns it to mature fruit the wall is known as PERICARP. The main function is protection flower parts with due.

4.0 Conclusion:

In this unit we have seen the flower as the productive structure on flowering plants. It is an adaptation for survival on land. The flower first undergo pollination after which fertilization follows to produce seeds that can keep up to the next generation.

5.0 Summary:

This unit discusses the parts of a flower, which is the reproductive structure of the flowering plant. It looks at hpe sexual reproduction takes place in this structure. It take about different types of pollination after which fertilization take place. After fertilization seed and fruit development.

6.0 Tutor- marked assignment

1. Discuss the mechanism that favour CROSS pollination. What are the main agents of pollination.

   State the advantages and disadvantages of seed and fruit format.

2. Dioecious plants are rare, despite the advantages of cross-pollination. Suggest two possible reasons for this.

   Dioecism is more common in animals than in plants. Suggest why this phenomenon is more successful on animals than plants.

7.0 References/Further studies:

1. Charis,D.D., (2010), Environmental Science 8th ed.

   Jones & Bartlett Publishers.

2. Chapman, J.L & Reiss, M.J (1995).Ecology Principles and Application Cambridge University Press.

3.Taylor, D.J Green N.P.O. & stout G.W (2010). Biological Science. Cambridge University Press

UNIT III: HUMAN REPRODUCTIVE SYSTEM

Content

1.0 Introduction

Human beings can be said to be discuss. That is to say the male and female sexes are separate. Thus their reproductive organs are different and perform different functions. The functions are so collaborate that in this unit we shal study the structure separately for clearly.

2.0 Objectives:

By the end of this unit the student should be able to;

* Name of the main structures of the male reproductive organ and state their functions.
* Name the main structure of the female reproductive organ and state their functions.
* Explain the process of gamete genesis in male and female.

3.0 Content

Male reproductive organ

Although structurally and functionally different the male reproductive system and the female one have something in common.

Both sexes have:

1. A pair of gamete-producing organs, called gonads in the female they are called ovaries and in the males the testes.
2. Both have a system of ducts which connect the gonads to other parts of the body and the outside world.
3. Structures of COPULATION (the act of mating, when sperms from the male are transferred to the female.

The male reproductive system this system is made up of the following:

Testes: there are two spherical structures which are the male gonad i.e site where the male gametes or sperm are made. They also produce the male sex hormone testosterone.

Scrotal sac: the testes (singular testis) are situated outside the abdominal cavity in a sac of skin called the scrotal sac. This makes it possible for the sperms to development at a temperature 2-3^{0}C lower than the main barely temperature. This the optimum temperature for sperm in greatly reduced if the temperature is higher somniferous tubules-inside each testis are about 1000 somniferous tubules, each tubule is about 50cm long and 200mm in diameter. The walls of the tubules produce the sperm. Also known as spermatozoa, in a process called spermatozoa genesis. Vasa differentia (sing vasa efferens) 10 to 20 vase, efferentia collect sperm from inside the testis and transfer them to epididymis. Epididemis a called tube of about 6m long proceed against the testis. Sperm are concentrated here to about 5000million per cm^3 by reabsorption of fluid secreted originally by the somniferous tubules. Sperms are stored here for a while before they pass to vas deferens.

Vas deferens (plural vasa deferentia): This is a straight tube about 40cm long which carries sperm to urethra.

Urethra- this is tube carries urine fro the bladder as well as sperm from the vasa deferentia, through the penis.

Penis: this contains erectile tissue. When the male is sexually excited, the tissues fills with blood causing penis to become erect. The erect penis is inserted into the female vagina before ejaculation of semen.

Seminal vesicles: This secretes mucus and a watery alkaline fluid that contains nutrient including sugar fructose which is an energy sources for sperms. Each seminal vesicle empties its contents into the ejaculatory duct during ejaculation of sperm, adding to the volume of the semen. Further chemicals in the fluid may help sperm to penetrate the cervical mucus and may cause peristaltic movement of the

lenerg of the uterus and fallopian tube, which help to carry the sperm to the ovaries.

Prostrate Gland: This also secrete mucus and a slightly alkaline fluid whih is released during ejaculation and helps to neutralize the acidity of the vagina, making the sperm more achieve.

Cowper's glands: secrete mucus and on alkaline fluid into the urethra. The alkaline fluid neutralizes the acidity of the remaining urine.

Assignment 1:

List the sequence of 3.2 structures through which a sperm passes through from its site of production to the site of fertilization of an ovum.

3.2 Female Reproductive Organ

Self-Assessment Exercise 1

How do egg cell move from the ovary to the uterus?

In the female there are separate external openings to the excretory and reproductive system.

Ovaries: these are structures about 2.5cm long containing some sac like structures called follicles, they are the female gonads. The gametes are called eggs or ova. The ovaries are almond-shaped, measure about 3-5cm long and 2-3cm wide. They secrete the female sex hormones oestrogen and progesterone. Usually one egg is produced every month. Out 200,000 – 4000,000 eggs a women can produce 200-4000 which can complete their development. The shedding of eggs usually start of puberty. This egg shedding is called ovulation.

Where is the destiny of egg that leaves the ovary?

Ovary: there are two ovaries in the female reproductive organ. They are he gonads, the site where the female gamete are mode. The gametes are known as egg or ova. They also produce the hormone oestrogen and progesterone.

Oviduct or fallopian tubes: the tubes about 12cm long carry eggs from the ovaries to the uterus. The ends of the tubes nearest the ovaries have feathery processes called fumbriae. Cilia lining the fumbriae beat and cause a current which draws in the ovum or egg after it is released from the ovary. Fertilization occurs at the oviduct uterus (womb) bout 7.5cm long and 5cm wide about the shape of an

inverted pear. It lie behind the bladder. If fertilization takes place the embryo in plants in the wall of the uterus and grows there until birth. The inner layer is the endometrium which contains glands and many blood vessels.

Cervix: Narrow entrance to the uterus from the vagina. It is normally blocked by a plug of mucus and a ring of muscle can closed vagina – muscular tube 8-10cm long whose walls contain elastic tissue. The lining is folded, it structures during child birth to allow passage of the baby, and during sexual intercourse when the penis is paced in it. The clitoris is a small structure which is equipment to the male penis and like the penis can be erect.

Assignment:

What is the function of the prostrate gland?

List the sequence of structures through which a sperm passes from its site of production to the sight of fertilization of an ovum.

3.3 Gametagenesis

Exercise what do you understand by gametogenesis.

Gametogenesis is the production of gametes there actual 3 stages to reproduction in humans. They are gametogenesis, fertilization and the development of the embryo.

Two types of gametes are produced for sexual reproduction.

They are spermatogenesis which is the production of sperms and oegenesis which is production of egg.

Self assessment exercise: Where and by what process does spermatogenesis occur?

Spermatogenesis takes place in the testis both spermatogenesis and oogenesis involve meiosis. The cells which undergo meiosis are called mother cells. Sperm mother cells are known as spermatocytes, and egg mother cells are the oocytes.

Both processes start with cells in outer gonad, known as the germinal epithelium. In both male and females the process involves three stages which is a multiplication stage.

What happens at multiplication stage?

This stage involves repeated mitotic division producing spermatogonia and oogonia. Each undergoes a period of growth in preparation for the first meiotic division and cell division. This marks the beginning of maturation stage during which the first and second meiotic divisions occur followed by the formation of matured haploid gametes.

The gametes produced by a given individual will show variation as a result of independent assortment of chromosomes and crossing over during mieosis.

4.0 Conclusion

In this unit we have looked at the reproductive system in male and female human beings. We have explain.

5.0 Summary

In this unit we look at the male and female reproduction structures and their functions. The process of gametogenesis was also discussed and it is clear that since meiosis try.

6.0 Tutor - marked assignment

Describe the similarities and differences between male and female gametes. Explain the way in which fertilization occur in animals.

7.0 References

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UNIT IV: SEXUAL REPRODUCTIVE HUMANS

Content

3.2 Fertilization and implantation

4.0 Conclusion
5.0 Summary
6.0 Teacher-marked assignment
7.0 References

1.0 Introduction

This unit introduce us to the actual reproductive process in humans we already knew that humans have separate sexes and the reproductive structures are different as they perform separate functions. Human like other terrestrial organism have adopted to this types of life by showing internal fertilization. This helps to ensure survival of the species and hence increase in man's population on earth. This unit will discuss the reproductive cycle and development of the embryo.

2.0 Objectives

By the end of this unit the student should be able to.

- Describe the stages of the reproductive cycle in humans.
- Describe the stages of reproduction.
- Describe what happens after fertilization.

Content

3.1 Human reproductive cycles

Exercise 1 describe the human menstrual cycle.

Human are sexually receptive throughout the year. They mate and menstruate anytime. Human reproductive cycles is called menstrual cycle, because menstruation is prominent. The cycles takes about 28days.

Self-Assessment Exercise 2:

Explain the stages

The events are divided into three stages follicular phase, the ovulatory phase, and luteal phase.

Follicular phase: starts with menstrual phase which lasts from 1-5days. The uterine lining breaks down and is discharged with some blood. A day before menstruation the hypothalamus releases the hormone a Gonadotrophine which riggers the secretion of the follicle stimulating hormone (FSH) from the anterior pituitary gland. (FSH) triggers the development of 1 or 2 follicles in the ovary. As a follicle grows in size, it stimulates the release o oestrogens which stimulates the repair and growth of uterine lining, and growth of milk-producing tissues in the mammary gland. This inhabits the production of more FSH to prevent more than one follicle from being produced. Oestrogens also cause secretion of Luteini sing hormone (LH). Some (LH) is released into the blood and stimulates the mature ovarian follicle to produce another hormone progesterone.

Self-Assessment Exercise 3

What happens after this?

After this the organ enter the ovulatory phase, in which there is a surge of LH and FSH, which result in production of secondary oocyte from an ovarian follicle. Immediately after ovulation the woman is fertile an can conceive a baby if she has sexual intercourse, or if sperms are present already in the oviduct.

Lastly the third phase is the luteal phase. After ovulation the remains of the ovarian follicle form the corpus liteum. This is a yellow glandular tissue which secretes larges amounts of progesterone and small oestrogens. This hormone stimulates further development of the mammary glands and uterus in anticipation of pregnancy if the oocyte is not fertilization within 36hours of being sheel into the oviduct it dies.

Self assessment exercise 4.

What happens when the egg/oocyte dies?

When the oocyte dies, the corpus liteum gets smaller and secretion of progesterone and oestrogen reduces. At day 28, about 14 days after ovulation lack of progesterone brings about another menstruation and the cycle starts again.

Self assessment exercise 5

How long does a women continues to menstruate?

Menstruation in a female occurs from puberty until menopause, after which there are no more fertile follicles so follicular development and ovulation cease.

If the oocyte is fertilized, it forms a zygote which is propelled towards the uterus. During its journey it forms an embryo which becomes unplanted in the uterine lining.

3.2 Fertilization and implantation

Fertilization is the fusion of the sperm nucleus with the egg nucleus to form a diploid cell known as the zygote. In human this process occurs after the sperm has spent at least seven hours in the female. This is because the sperm has to under go a process called capacitation which involve a number of changes.

Self-Assessment Exercise 6

After fertilization what happens?

If fertilization occurs a zygote is formed, and this develops into a ball of cells called blastocyst which bury itself into the wall of the uterus with eight days of ovulation. The outer cells of the blastocyst, the triphoblastic cells. Then begin to secrete a hormone called human chorionic gonadotrophin (HCG) whose function is similar to that of LH. This functions include prevention of the breakdown of the corpus luteum the corpus luteum therefore continues to secrete progesterones an oestrogen which result in increased growth of the endometrium of the uterus. Since there is no breakdown of endometrium there is no menstruation and this is the earliest sign of pregnant.

That placenta gradually takes over from the corpus luteum from about 10weeks of pregnancy when it begins to secrete most of the progesterone and oestrogen essential for a normal pregnancy. Failure of the corpus luteum before the placenta is fully established is a common cause of miscarriage.

During pregnancy HCG is detected in urine, and this form the basis for pregnancy testing.

Self assessment exercise7

How does the process of implantation take place.

After fertilization the zygote passes down the oviduct and begins to divide by a successive cell division by mitosis into a small ball of cells by a process called cleavage- cell division without growth in size. The cells formed are called

blastomeres, and they form a hollow ball of cells whose cavity is called blastocoels. This fills with liquid from the oviduct.

The outer layer of blastomere is called the trophoblast. This thicken at a point to form a mass of cell called the inner mass cell. This stage s called blastocyst, this takes 4-5days after fertilization to form. The blastocyst cells moves to the uterus, making the trophoblast make contact with the endometrium. The trophoblast cells multiply in the presence of nutrients and between the sixth and ninth days after fertilization, the blastocyst becomes embedded within the endometrium. This process is called implantation.

4.0 Conclusion

This unit has discussed the process of sexual reproduction on humans it has shown the menstrual cycle to be of paramount importance in thus processes, if there will be continuity several hormones are involved and all must be working very well. If conception will take place.

5.0 Summary

In this unit the menstrual cycle was treated as the breakdown of the wall of the uterus if conception does not occur in the human being. It occurs every 28days. Human being unlike some other mammals that have seasons for reproduction can give birth any time of the year.

6.0 **Tutor- marked Assignment**

Explain the process of fertilization in man . Describe the human Menstrual cycle of what importance is to man?

7.0 **References/ Further Readings**

1. Charis,D.D., (2010), Environmental Science 8th ed.

Jones & Bartlett Publishers.

2. Chapman, J.L & Reiss, M.J (1995).Ecology Principles and Application Cambridge University Press.

3.Taylor, D.J Green N.P.O. & stout G.W (2010). Biological Science. Cambridge University Press

UNIT V: HUMAN INTERVENTION IN REPRODUCTION

1.0 Introduction

This unit introduces us to the various ways in which man has intervened in reproduction, as a way of controlling the astronomieal increase in the world population. This they are doing by means of birth control. We shall see the various method of intervention in this unit.

2.0 Objectives

By the end of this unit the student should be able to:

- State the various methods of contraception
- Identify both natural and artificial methods
- Enumerate some advantages and disadvantages of each method.
- Find out reasons for infertility.
- Know how man has been able to put in check.

3.0 Content

3.1 Contraception and birth control.

Contraception is the prevention of conception, that is preventing the fusion of the male gamete with the female and artificial methods of contraception.

Birth control it is any measure taken after fertilization designed to prevent birth, and this include contraception, it also include method that prevent implantation, such as intra-uterine device (IUD or Coil), the morning after pill and abortion.

Self-Assessment Exercise 1

What are the different methods of contraception?

They include but natural and artificial methods. The artificial methods include condom, a thin strong rubber sheath, which prevents sperm entering the vagina. Femidom females equivalent of the condom, diaphragm/cap. A flexible rubber which fits over the cervix and prevents entry of sperm to the uterus, it is used with a spermicidal cream or jelly, a spermacide chemical that kills sperm, sponge-poly ethane spong poly urethane sponge impregnated with with spemicide, fits over cervix it is disposable. Others include the hormonal methods which include use of 'pill' this contains oestrogen and progenetrone, it prevents development of eggs and ovulation by inhabiting secretion of FSH.

Minipill: contains progesterone only. Obulation may occur, but cervical mucus is thickened preventing entry of sperm.

IUD (intra-uterine device) or coil: is a small device made up of copper, plastic or stainless steel inserted into the uterus, prevents implantation. This is not contraception, but a birth control method.

Other methods of birth control is sterilization like vasectomy male cutting of each as deferens, and also tying of oviducts in female cut both oviduct.

Also we have termination method like morning after pill, taken within 3days after sexual intercourse, and lastly abortion, which is a most controversial method, as it contravenes ethics.

Self assessment exercise 2

What are the natural methods of contraception?

The natural methods include abstinence this is avoidance of sexual intercourse.

Rhythm method – avoidance of sexual intercourse around ovulation time for about 7 days.

Temperature method: nothing rise in temperature at ovulation time and avoidance of sexual intercourse at that time.

Coitius interruption: penis withdrawal before ejaculation.

Self-Assessment Exercise 3

Are all these method acceptable for use all over the world. Are there side effects from their uses?

Not all individuals have accepted the use of these various methods. Some on religious basis do not want to use contraception. Some of the methods have terrible side effects, some may even fail.

The next rejected one is abortion one reason for this being that some countries have not legalized it. Some have legalized it under certain conditions, like if the child to be born is going to be handicapped or if it will be risking the life of the woman.

What are medical problems are associated with abortion.

- Damage to the cervix may occur which may make it difficult for the woman to carry another baby.
- Risk of ectopic pregnancy in increased.
- Damage to the uterus may occur.

3.2 Infertility

This is a great social problem, it involves inability of a couple bear children.

There are many reasons why a couple may not be able to have children. Some of the reasons in the female include failure to ovulate. This may not be unconnected with inability to produce oestrogen. This can be cured by using synthetic various of the natural hormones.

The most commonly used drugs is clomiphene, a synthetic oestrogen-like drug which stimulates ovulation by bringing about the release of FSH. Tamoxifen is an alternative similar drug. This drugs are taken as pills usually for about5 days as soon as the menstrual cycle starts.

(ii) Damage to oviducts: about 1/3 of female infertility is due to tubal disease that is damage to oviducts. The tubes may be completely blocked. Infection may cause scarring and hence partial or complete blockage or narrowing of the tubes or damage to the delicate lining of the oviducts.

Self -Assessment Exercise 4.

How are problems of oviduct treated?

The most common treat is surgery. This is carried out with the aid of a microscope (microsurgery) because the tubes are extremely fine. Lasers are being used with some success. Sometimes the blocked portion of the tube is but out and then rejoined.

Others include uterus damage, cervix damage and production of antibodies against sperms. Drugs that suppren imunune system can be used to treat the latter, while surgery is used to treat uterine and cervix damage.

Self-Assessment Exercise 5

What are the main causes of male infertility?

Male infertility may be due to absence of sperm in the semen- this is called azoospermia. This may be due to sperm not being produced at all, it is being produced but it is not seen in the semen due to blockage of the seminal vesicles. This blockage may be due to infection like Gonorrhoa and TB, or it may be congentilal. It may be a result of physical injury to the testes, or occasionally a result of infection by mumps virus after puberty, or it could be hormonal, which is very difficult to treat. There is hardly any treatment for them.

Treatment for Infertility

A number of other treatment are available for infertility such as in vitro fertilization, donor insemination and artificial insemination. All these treatment are applied with very little measure of success. Where they even succeed it may not be well taken on ethical grounds.

4.0 Conclusion

This unit has addressed the issue of how man has intervened in the area of reporudtcion. First in the area of controlling the world's population, and the number of children contraception and birth control measures are taken in the area of infertility medical science has gone a long way to treat several causes of infertility of that every couple wanting children can have. However more success has been achieved in the area of controlling birth that in the area of having children.

5.0 Summary

This unit started with differentiating between contraception and birth control, and as a ways in which main intervened in reproduction. It looked at various artificial and natural ways of contraception, some of the ways they operate and some side effects that may result from their use. It also looked at the infertility and various types an causes of infertility. While some can be treated with hormones and surgery especially in females, for the male.

It is more difficult. However man has tried to solve the problem of infertility by other means such as inviro fertilization, Gamete intra-fallopian transfer (GIFT), zygote intra-fallopian transfer (ZIFT), artificial insemination (AID), egg donation sunogacy etc.

6.0 Tutor-marked Assignment

a. What are the various ethical considerations concerning intervention of man in birth control and infertility.

b. What are the various grounds for abortion in some countries, do you think this act should go on? Give reasons for your answers.

1. Charis,D.D., (2010), Environmental Science 8th ed.

Jones & Bartlett Publishers.

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MODULE IV

GROWTH AND DEVELOPMENT

Unit I Deference between Growth and Development

Unit II Measuring of Growth

Unit III Growth and development in flowering plants

Unit IV Role of hormones on growth and development in humans

Introduction

In this module, you will be exposed to the concept of growth and development in living organisms. We shall learn about the growth patterns and how flowing plants and human being develop. You will also find out about the distinction between plant and animals growth and also between growth and development. You will learn the venous methods etc.

Measuring growth

The module will be studied under the following headings:
See above please.

UNIT I: WHAT IS GROWTH

Contents:

1.0 Introduction
2.0 Objectives
3.0 Main content
3.1 Definition of growth as distinct from development.
3.2 Phases of growth.

1.0 Introduction

This unit looks at the meaning of growth as it pertains to living organism it is a fundamental characteristic of all living organisms. This unit will therefore define it distinguish it from development and understand what is anabolism.

2.0 Objective

Based on the above the objectives of this unit therefore is as follows by the end of this unit the student should be able to;

- Define growth properly
- Distinguish growth from development
- Explain the phases of growth
- Explain positive and negative growth..

3.0 Content

3.1 Growth Definition

Growth is a fundamental characteristic of all living things. It is defined as an irreversible increase in dry mass of living materials. By saying dry mass we can ignore the short term fluctuations in water content that characterize plants. By specifying living materials we can ignore non-living materials such as inorganic lime stone.

3.2 Phases of growth

Growth of multicellular organism can be divided into three phases thus:

- Cell division – an increase in cell number as a result of mitosis and cell division.
- Cell enlargement: an irreversible increase in cell size as a result of the uptake of water or the synthesis of living maternal.
- Cell differentiation – the specialization of cells, in its broad sense, growth also includes this phase of cell development.

While growth is increase in size, development is increase in complexity, thus the phase of cell specialization may be regarded as developmental phase.

***Self-Assessment* Exercise 1**

What is the difference between the cell division in multi cellular plant and that of bacteria?

The difference is that where as the division in plant leads to growth, that of the bacteria results in reproduction and growth in population.

***Self-Assessment* Exercise 2**

What changes take place during growth in the organisms?

All stages of growth involve biochemical activity. During growth the DNA message is translated and as a result specific proteins are made including enzymes. Enzymes control cell activities. They bring about the changes which eventually result in change in overall form (development) and structure both of individual organs and of the organism as a whole. This process is known as morphogenesis, and is influences by the environment and the genes.

3.3 Positive or Negative Growth

Positive growth occurs when the synthesis of materials (ANABOLISM) negative growth occurs when catabolism exceeds anabolism.

***Self-Assessment* Exercise 3**

Give an insight when you can demonstrate negative and positive growth.

It can be demonstrated with germinating seed. During germination of seed to produce seedling, there is an increase in the number of cells, cell size, fresh mass, length, volume and complexity. Which dry man may decrease because the resourced food are being used up.

Germination therefore includes a period of negative growth which only becomes positive when the seedlings starts to photosynthesis and make it own food.

4.0 Conclusion

This unit has defined growth and has shown that in multi-cellular organisms done is where growth means increase in size un-unicellular organisms it is reproduction and growth.

5.0 Summary

- Growth is an irreversible changes living organisms.
- There are three phases in plant growth.
- In multi-cellular organisms cell division leads to growth but in unicellular organism cell division leads to reproduction and population increase.
- Anabolism and catabolism can be demonstrated in germinating seed.

6.0 Tutor-marked assignment

UNIT II: MEASURING OF GROWTH

Content

5.0 Summary

6.0 Tutor-marked Assignment

7.0 Further Reading

Content

1.0 Introduction

This unit introduces you to how growth is measured i.e. how you know that an organism is growing. You need to measure certain parameters and use this to plot graphs against time.

2.0 Objectives

By the end of this unit, the students should be able to:

- Measure length, weight, area volume of organisms
- Count the number of organism in an area.
- Plot different types of growth curves
- Interpret the curves Correctly

3.0 Content

3.1 Measuring Growth

There are various levels by which growth is measured. At the level of biological organization – we can measure growth of cell, organism or population.

For population growth one can count the number of organisms in a population at different times, and then plot it against time.

At the level of organism the parameters we use include – length against time, area, volume and mass against time. In plants growth curves for roots, stems intermodes and leaves are often required, and length and area are the parameters commonly chosen. In the case of animals and entire plants, length and mass are two commonly measured parameters.

Self-Assessment Exercise 1

In human what are the parameters used?

In men changes in standing height and body mass are frequently used indicators of growth.

If in using mass, there are two types that can be used – fresh mass and dry mass. The fresh mass in easier because it does not require much preparation of the sample and how the advantage of not causing any damage to the organism so that repeated measurement of the organism may be take over a period of time.

The problem of using fresh mass is that it may give inconsistent reading because of the fluctuations in water content. True growth is reflected in the amount of constituents solution substances other than water, and the only way to obtain this is by using the dry mass.

Self-Assessment Exercise 2

How do you obtain the dry mass?

It is done by killing the organism and placing it in the oven at $110^{o}C$ to drive off all the water. The specimen is cooled in a dissector and weighed. This procedure is repeated until a constant mass is obtained.

The Growth Curve

By using different parameters such as length, height, mass, surface area, volume against time different types of growth curves can be obtained. The shape of the curve is described as sigmoid meaning S-shaped and is typical of growth curves.

A sigmoid curve can be divided into four parts as shown in fig 22.2.

- The first phase is the lag phase during which little growth occurs.
- This leads into the second phase, the logarithmic or log phase, during which growth proceeds exponentially. Rate of growth accelerates and at any point is proportional to the amount of material or number of cells already present. In all cases …… growth the exponential increase eventually declines and the rate of growth begins to decrease.
- The point at which this occurs is called the inflexion point. This is the rate of growth at its maximum point.
- The third phase is the decelerating phase during which growth becomes limited due to some internal or external factors, or the interaction of both.

- The final phase is the plateau phase or stationary phase. This marks the period when overall growth has ceased and the parameters under consideration remains constant. At this phase the nature of the curve varies depending on what is being measured.

In some cases the organism may continue to rise slightly until the organism dies as in monocotyledonous leaves, many non-vertebrates, fish and certain reptiles. This shows growth to be continuing in them and such is positive growth. In the case of certain cnidarians, the curve flatters out showing zero growth, while others tail off, indicating a period of negative growth. This is characteristic of many mammalians including humans is a sign of sequence.

Graph

4.0 Conclusion

In this unit we have learnt that the parameters for measuring growth are length, height, volume, area, width. While growth is irreversible increase in dry man development is increase in complexity and both occur in all living things.

5.0 Summary

Growth is increase in size and it occurs in three phases. For bacteria and other unicellular organisms, cell division means reproduction and growth of the population.

When growth is measured it is represented in a graph known as the sigmoid curve (S-shaped).

1. Charis,D.D., (2010), Environmental Science 8th ed.

Jones & Bartlett Publishers.

2. Chapman, J.L & Reiss, M.J (1995).Ecology Principles and Application Cambridge University Press.

3.Taylor, D.J Green N.P.O. & stout G.W (2010). Biological Science. Cambridge University Press

UNIT III: GROWTH AND DEVELOPMENT IN FLOWERING PLANTS

Content

Content

1.0 Introduction

Flowering plants are seed producing plants with the seed protected by the ovary wall called fruit. The seed is the means by which it is propagated. Seeds in many cases have been found to be incapable of germinating immediately until after a while. Even when all environmental conditions of water availability, oxygen, and suitable temperature are there, still there will be no germination. This unit will look at ways of removing the barriers and the process of germination of seed itself.

2.0 Objective

By the end of this the student should be able to:

- Explain the meaning of seed dominancy
- Discuss the various methods of removing dominancy

- State the environmental condition needed for germination
- Explain the types of germination and growth of primary plant body.

3.0 Content

3.1 Barriers to Growth

In many instances some seed will not germinate, even when the factors of water, oxygen and warmth are settled, such seeds are described as **Dormant**. Before such seeds will germinate they must undergo certain internal changes, described as "after-ripening" before they will germinate.

Self-Assessment Exercise 1

What can be the effect if "after-ripening" did not occur?

If this process did not occur premature germination may occur, as in popcorn and the plant will not grow to maturity, as it will not survive the harmattan, that will follow the rainy season.

This means that mechanisms exist which ensure that germination is synchronized with the onset of a season favorable for growth. These can be termed mechanisms for preserving the seeds until the right time for it to germinate and grow to maturity.

Self-Assessment Exercise 2

What are the mechanisms that synchronizes germination with the onset of favourable growth season?

They include – Barrier methods. This mechanism include those one that make the outer layers of seed impervious to oxygen or physically strong enough to prevent growth of embryo as in many legumes e.g. soya beans, flamboyant. The barrier can be removed by different methods, but the most usual ways include the following:

Some plants contain **growth inhibitors** like abscises acid which can be removed by thorough soaking of the seeds or you can introduce it into growth promoter like gibberellins. Tomato seed contains lots of abscisic acid which prevent it from germinating inside the fruit.

Dormancy of some seeds is broken by light after water uptake, a phyto-chrome controlled response.

Temperature – some seeds require a cold period (prechilling) before germination will take place e.g. plum, cherry and apple.

3.2 Germination of Seed and Growth of Plant

Germination is the onset of growth of the embryo usually after a period of dormancy.

Self-Assessment *Exercise 3*

What are the environmental conditions necessary for germination?

There are three things that must be present for germination to occur; water, minimum/optimum temperature and oxygen.

Water – absorbed through the micropyle and testa by the process called **inhibition** is a physical process called by adsorption of food – carbohydrate, protein, fat present in the seed.

Water activates the bio-chemical reactions associated with germination, because these take place in aqueous solution. Water is an important reagent here as it is used in hydrolysis (digestion) of food stores.

Optimum temperature usually this is concerned with that of the environment and is between $5 – 40^{o}C$, outside the seed may not germinate.

Temperature influences enzymes controlled reaction and oxygen is needed for aerobic respiration.

During germination, there are to centres of activity – these are – the **storage centre** (food reserved) and **growth centre** (embryo). Both obtain energy from their activities from respiration.

Self-Assessment *Exercise 4*

What are the first visible Sign of growth?

Within the embryo, growth occurs by cell division, enlargement and differentiation. The first sign of growth is – the emergence of the radicle i.e. the (embryo root). This is positively geotropic so it grows downward and anchor the

seed. Subsequently, the embryo shoot the plumule emerges and being negatively geotropic and positively phototropic grows upwards.

Self-Assessment Exercise 5

Are there different types of germination?

There are two types of germination;

Epigeal – This type occurs in dicotyledons – where the cotyledons are carried above the ground and hypogeal – occurs in monocotyledons, where the internode just above the cotyledons elongates, then the cotyledon remain below the ground.

In the grasses (monocotyledon), the plumule is protected by a sheath called the coleoptiles through which the first leaf grow and unrolls in response to light.

In dicotyledon, the epicotyls (internode just above the cotyledon) is hooked, protecting the plumule tip as it comes up the hooked structure straightens as it is exposed to light and it change from etiolation to normal growth.

Once exposed to light, the shoot also shows phototropic responses.

Self-Assessment Exercise 6

How does plant growth differ from that of animals.

Unlike in animals that growth occurs all over, growth in plants is confined to certain regions called meristems.

A meristem is a group of cells which retain the ability to divide by mitosis producing daughter cells which grow and form the rest of the plant body. The daughter cells forms the permanent tissue.

There are three types of Meristems, Apical, lateral (combium) and interclary meristems.

Find out the locations and functions of each types of meristem.

Self-Assessment Exercise 7

How many types of growth do we have in plants?

Two types of growth occur in plants.

Primary growth – this is the first form of growth to occur. Formed many from apical and intercalary meristem. It is the only type of growth found in monocotyledons and herbaceous plants.

Secondary growth – This is growth that comes from lateral meristems or cambium, found mainly in dicotyledoneous plants which are perennials like shrubs and trees.

Plants which lack extensive secondary growth are called herbaceous plants or herbs. A few herbaceous plants how restricted amount of secondary thickening that is additional vascular bundles e.g. helianthus (sunflower).

4.0 Conclusion

This unit has explained reasons which some seeds will not germinate immediately they are formed. It is because they need to undergo the after ripening process which ensures that they on germination they grow until they produce seeds. In growing plant usually have special growing regions unlike animals where every organ grows.

5.0 Summary

In this unit the students have been made to see that certain internal changes must occur in the seed before germination will occur this process is known as after-ripening

If there is no after ripening , premature germination will occur and the plant will not grow to maturity.

Certain mechanisms exist which synchronizes germination with the onset of favourable growth.

Three things must be present if germination is to occur in a matured seed-water,warmth

1. Charis,D.D., (2010), Environmental Science 8th ed.

Jones & Bartlett Publishers.

2. Chapman, J.L & Reiss, M.J (1995).Ecology Principles and Application Cambridge University Press.

3.Taylor, D.J Green N.P.O. & stout G.W (2010). Biological Science. Cambridge University Press

UNIT IV: ROLE OF HORMONES IN GROWTH AND DEVELOPMENT IN HUMANS

Content

Content

1.0 Introduction

Generally speaking human growth and development is controlled centrally by hypothalamus and pituitary gland. Hypothalamus is the part of the brain immediately above the pituitary gland.

The former receives information from the brain as well as from the chemicals circulating in the blood.

The hypothalamus controls the pituitary gland by secreting specific realizing and inhibitory factors which control the release of the hormones from the pituitary gland. These then control the growth hormones like thyroid gland, liver, adrenal cortex and gonads.

In this unit we shall study the growth and development hormones and their effects on organisms if they are not there.

3.1 The Main Control Centre

The main control centre for the grow hormones is the hypothalamus, as it controls the pituitary gland.

The pituitary gland secrete the growth hormone known as the **somatotrophin.** This is the most the most important hormone that controls growth and development in animals it is a protein.

Secretion of human growth hormones (hGH) is controlled by the combined effects of two other hormones produced by the hypothalamus exercise what are the hGH that are released?

The human Growth Harmonies released by hypothalamus are growth hormones releasing hormones (GHRH) also known as somatocrinin and growth hormone has direct effect on all parts of the body but particularly on growth of skeleton and skeletal muscles.

Indirectly, the protein hormones called somatomedins from liver which is also known as insulin-like growth factors or IGFs regulate some of the effect of growth hormones.

3.2 Effect of Abnormal Production

What effect can deficiency of growth hormone have on man?

Abnormal production of growth hormone may occur in some humans. For instance a deficiency of growth hormones result in dwarfism to distinguish it from other causes. Brain development and IQ are unaffected.

If problem is due to growth hormone alone, the affected individual will mature sexually. The pygmies of Africa have been found to be deficient in somatto medins, which shows that these growth factor is very important.

Another deficiency called organism is as a result of over-production of growth hormones, during childhood when the bones can still grow the person becomes a 'giant'.

This is caused by a humor in the pituitary gland. The condition can be prevented if detected in time by early removal or irradiation of part of the pituitary gland.

What happens when the person is already an adult?

If it happens at adulthood, the person bone can no longer grow. But it can be grow in thickens together with an increased growth in soft tissues. This condition is known as **acromelagy.** This is observed in the enlargement of the hand, feet, skull, nose and jawbone.

What other glands secrete growth hormones in the body?

The thyroid glands – these secrete two hormones which affect growth and development. They are thyroxine (T4) and triodothyronine (T3). They stimulate protein synthesis and they are particularly important in stimulating growth of skeleton.

Another one is the gonad growth hormone. The gonads are the generate producing hormones.

At puberty they secrete sex hormones in response to signal from the pituitary gland and hypothalamus.

The sex hormones are responsible for fundamental change in growth and development and stimulate the development of secondary characteristics.

Lastly, the adrenal cortex is the outer region of each adrenal glands. They produce steroid hormones, which include small amounts of both males and female sex hormones estrogen and androgens.

The androgen from the males contributes to adolescent growth spurt an development of pubic hair and under am hair in both boys and girls.

Androgen may contribute to sexual behaviour including sex drive.

4.0 Conclusion

This unit, we have seen that with the proper working of the various glands to produce the hormones at the appropriate times there will not be proper

coordination of the body and this may lead to some abnormality in the body of man.

5.0 Summary

The hypothalamus is the link between the brain and the growth hormones. The chief producer of the human growth hormones is the pituitary gland.

The human growth hormones has both direct and indirect effect on all parts of the body.

Under production of growth hormones lead to dwarfism while over production lead to gigantism.

6.0 Tutor-marked Assignment

Describe the relationship of the brain to the growth hormones illustrating with diagram.

7.0 Further Studies

1. Charis,D.D., (2010), Environmental Science 8th ed.

Jones & Bartlett Publishers.

2. Chapman, J.L & Reiss, M.J (1995).Ecology Principles and Application Cambridge University Press.

3.Taylor, D.J Green N.P.O. & stout G.W (2010). Biological Science. Cambridge University Press

MODULE V

HUMAN POPULATION

Unit I - Population growth

Unit II - Growth of Human Population

Introduction

Populations are dynamic, constantly changing component of the ecosystems. It is defined as a group of organisms of one species occupying a particular place and usually isolated to some extent from other similar groups by geography or topography. In studying population the characteristics of the group are examined. The interactions of the populations such as competition predation and parasitism regulate the growth as well as the structure of the communities.

In this module we shall examine how populations grow, how population are maintained and how and why population decline. It will also study some peculiarities of the human population.

Content

UNIT I – POPULATION GROWTH

Content

1.0 Introduction

Population growth is one of the phenomenon in the world today that is giving msn concern. Many forests are turning into desert because they are being cleared to sustain life. Improvement in technology has made it possible for all organisms to be able to survive. This unit will investigate the growth of population under ideal conditions and what factors of the environment limit population growth.

2.0 Objectives

By the end of this unit the student should be able to:

- Define population
- Give characteristics of a growth population.
- Differentiate between factors that cause population to grow and those that will not.

Content

3.1 Population growth under ideal condition

Population is a group of organisms of one species occupying a particular place and usually separated from other similar groups by geography or topes graphy. e.g the roe deer of a particular woodland, frogs of a particular valley, are all examples of population.

Self – Assessment Exercise 1

How do we describe population?

Population is described using the leans.

- Population density – number of individual.
- Population growth – a change in number of individual. It may be positive if it is increasing or negative it is reducing.

Self – Assessment Exercise 2

What is ideal condition for population growth?

A population of colonizing a new habitat in which all conditions like food, supply competition, predators, or disease, orphaned temperature they are all right can be represented by the sigmoid curve

of number of organism against time the curve can be explained in fear phases.

- Log phases growth is slow, and the growth curves rises gently. Few reproducing individual. Those reproducing sexually may not be able to find a mate.
- Log phase – exponential growth phase population grows at its maximum rate.
- Decelerating phase – here population shows down rising by various factors of the environment such as competition for resources, lack of food, built up of toxic materials by organisms.
- Growth stops and curve levels up: factors that limit population are called environmental resistance.

3.2 Environmental factors that limit population size.

In a natural situation – some environmental factors tend to increase the population while others decrease it such factors are shown in the table below: in table I

Factors that increase population size	Factors the decrease population size
Plenty of suitable space available	Suitable space unavailable or limited
Good food supply	Inadequate food supply
Good water supply	Inadequate water supply
Ability to resist disease	In ability to resist disease
Small number of predators of ability to avoid predators	In ability to avoid predators
High reproductive rate	Low reproductive rate
Favourable light	Too much or too little light
Stable abiotic conditions	Unstable abiotic conditions

4.0 Conclusion

This unit has look at population generally for all living things and concluded that any population whose number, length, volume etc is plotted against time will give the sigmoid curve, which is referred to as normal curve, an it can be explained in four phases.

5.0 Summary

This unit has given us the idea of what a population is and described a sigmoid populations, population is limited by such factors as food, diseases, fluctuation in temperature.

6.0 Tutor-marked Assignment

a. Explain what is meant by population?

b. The size of a population may be limited by density-dependent factors or density independent factors.

Explain how these two types of factors operate to limit population size.

7.0 Further Studies

1.Kent, M. (2000) Advanced biology Oxford University Press.

Taylor, D.J, Green, N.P.O & stoot, G.W (2006) Biological Science.

2. Replica Press Put, Ltd, Kudli 131,028

UNIT III: GROWTH OF THE HUMAN POPULATION

Content

5.0 Summary
6.0 Tutor-marked Assignment

7.0 Further – Reading

Introduction

One of the things most feared in the world today is population explosion. It is stimulated that between the 1950s and today the world population has double. Today we have more than 6billion people inhabiting the earth. This has been attributed to development in agriculture, social and economic changes including increase in mechanization and advances in technology brought about increase in birth rate, and advances in medicine and hygiene reduced death rate. In this unit we are going to study the carrying capacity and demographic transition on ground.

By the end of this unit

Objectives

- Describe the major in world's population.
- Describe the demographic pattern that has occurred in Britain since the industrial revolution.
- Describe how the major factors which affect population changes.

3.0 Content

3.1 Carry Capacity and Environmental Factors.

The carry capacity in an environment is the maximum population size that can be sustained over a relatively long period of time, by that environment.

In some situation, the population can increase so much that the environment over shoots it capacity, this can lead to population crash. Population that show this type is referred to as 'boom and bust'. Population.

Over population can damage the environment and this may lead to a lower carrying capacity. After the crash the population fluctuates around the new carry capacity.

How do environmental factors determine the size of a population?

Environmental factors determine the size of a population by affecting.

- The birth rate.
- The death rate (number of deaths/adults in the population).
- The amount of movement into the population (immigration).
- The amount of movement out of the population (immigration).

In favourable conditions, the population will grow if:

Number of births + number of immigrants is greater than number of deaths + number of immigrant.

Infavourable conditions

Number of births + number of immigrant is less than number of death + number of emigrants.

Carrying capacity: The effect of human population growth will depend on the carrying capacity of the Earth. i.e the number of people that the earth can sustain over a longtime.

We cannot really say what the Earth's carrying capacity is, since we cannot use that of animals study to determine that of man.

***Self-Assessment* Exercise 3**

What factor can change the carrying capacity?

New discoveries and inventions can change the carrying capacity of the land dramatically, like it happened in the time of industrial revolution.

Today world food production is growing at a faster rate than the world's population, and development in genetic engineering are likely to increase food productivity even more.

***Self-Assessment* Exercise 5**

Is there any hope that in future that the world will not exceed its carrying capacity?

There are two views to this.

In the pessimistic view, they believe the world's population will exceed its carrying capacity if it continues unabated. The result will be war, famine and disease on a global scale.

The optimism however believes that our population curve will eventually change from its J shape to a sigmoid S (normal curve). The population growth rate will slow down and the world population will stabilize at about 12billion in 120years' time. There are already signs that population is slowing down.

3.2 Demographic Transition

This is a change in population. Much of the population growth in recent years has taken place in developing countries. Some people believe that the population growth rate in these developing countries will be similar to that of European industrially developed countries.

For instance before the industrial revolution population in Britain was relatively low and stable, with high mortality and high birth rates.

Industrial revolution brought improved agriculture, better nutrition, and better medical knowledge, so that birth rate become high, death rate low. This allowed population to grow very rapidly. As economy improved, having a large family become less important, so birth rate, fell. (This is happening in Nigeria today, among the elites).

The change in human population from having high birth rates and high death rates to having low birth rates and low death rates is called demographic transition. This changes may not necessary happen in all countries.

4.0 Conclusion

The world has not yet reached its carrying capacity, yet. Reaching this stage may be a mirage reason being that in today's world war and disease is still ravaging nations, and people are dying in their numbers. However, it is good to be optimistic and one day the world will came to that period of stability.

5.0 Summary

When the carrying capacity of an ecosystem is exceeded the population density falls. The world population of humans seems to be going through exponential phase. However some nations have developed economically and are going through a change in population.

6.0 Tutor-marked Assignment

What do you understand the term population and population dynamics.

The diagram represents four ways in which changes take place in the number of organisms in a population.

Use the letters B, I, and E to write a formula to show

i. A stable population which is in equilibrium
ii. A population which is increasing in size.

7.0 Further Reading

Kent, M. (2000); Advanced Biology Oxford University Press

Taylor, D. J., Green, N.P.O and Stout, C. W, 2006, Biological Science. Cambridge University Press.