# Chapter 1:
# Introduction to the Chemistry of Life

| *Learning Objectives* |
| --- |
| At the end of this section, the students will be able to:<br>a. Describe matter and elements<br>b. Describe the interrelationship between protons, neutrons, and electrons, and the ways in which electrons can be donated or shared between atoms |

وَفِى ٱلْأَرْضِ قِطَعٌ مُّتَجَـٰوِرَٰتٌ وَجَنَّـٰتٌ مِّنْ أَعْنَـٰبٍ وَزَرْعٌ وَنَخِيلٌ صِنْوَانٌ وَغَيْرُ صِنْوَانٍ يُسْقَىٰ بِمَآءٍ وَٰحِدٍ وَنُفَضِّلُ بَعْضَهَا عَلَىٰ بَعْضٍ فِى ٱلْأُكُلِ ۚ إِنَّ فِى ذَٰلِكَ لَءَايَـٰتٍ لِّقَوْمٍ يَعْقِلُونَ ﴿٤﴾

*Wafii l-ardhi qitha'un mutajaawiraatun wajannaatun min a'naabin wazar'un wanakhiilun shinwaanun waghayru shinwaanin yusqaa bimaa-in waahidin wanufadhdhilu ba'dhahaa 'alaa ba'dhin fii lukuli inna fii dzaalika laaayaatin liqawmin ya'qiluun (Qs. Ar Ra'd :4)*

[13:4] Dan di bumi ini terdapat bagian-bagian yang berdampingan, dan kebun-kebun anggur, tanaman-tanaman dan pohon korma yang bercabang dan yang tidak bercabang, disirami dengan air yang sama. Kami melebihkan sebagian tanam-tanaman itu atas sebagian yang lain tentang rasanya. Sesungguhnya

pada yang demikian itu terdapat tanda-tanda (kebesaran Allah) bagi kaum yang berfikir.

[13:4] And in the earth there are tracts side by side and gardens of grapes and corn and palm trees having one root and (others) having distinct roots -- they are watered with one water, and We make some of them excel others in fruit; most surely there are signs in this for a people who understand.

## A. Reading Text

*Figure 1.1 Foods such as bread, fruit, and cheese are rich sources of biological macromolecules. (credit: modification of work by Bengt Nyman)*

The elements carbon, hydrogen, nitrogen, oxygen, sulfur, and phosphorus are the key building blocks of the chemicals found in living things. They form the carbohydrates, nucleic acids, proteins, and that are the fundamental molecular components of all organisms. These interactions determine what atoms combine and the ultimate shape of the molecules and macromolecules, that shape will determine their function.

Food provides an organism with nutrients—the matter it needs to survive. Many of these critical nutrients come in the form of biological macromolecules, or large molecules necessary for life. These macromolecules are built from different combinations of smaller organic molecules.

At its most fundamental level, life is made up of matter. Matter occupies space and has mass. All matter is composed of elements, substances that cannot be broken down or transformed chemically in to other substances. Each element is made of atoms, each with a constant number of protons and unique properties. A total of 118 elements have been defined; however, only 92 occur naturally, and fewer than 30 are found in living cells. The remaining 26 elements are unstable and, therefore, do not exist for very long or are theoretical and have yet to be detected. Each element is designated by its chemical symbol (such as H, N, O, C, and Na), and possesses unique properties. These unique properties allow elements to combine and to bond with each other in specific ways.

Atoms is the smallest component of an element that retains all of the chemical properties of that element. For example, one hydrogen atom has all of the properties of the element hydrogen, such as it exists as

a gas at room temperature, and it bonds with oxygen to create water molecule. Hydrogen atoms can not be broken down in to any thing smaller while still retaining the properties of hydrogen. If a hydrogen atom were broken down in to sub atomic particles, it would no longer have the properties of hydrogen. At the most basic level, all organisms are made of a combination of elements. They contain atoms that combine together to form molecules. In multicellular organisms, such as animals, molecules can interact to form cells that combine to form tissues, which make up organs. These combinations continue until entire multicellular organisms are formed. All atoms contain protons, electrons, and neutrons. The only exception is hydrogen (H),which is made of one proton and one electron. A proton is appositively charged particle that

resides in the nucleus (the core of the atom) of an atom and has amass of 1 and a charge of+1. An electron is a negatively charged particle that travels in the space around the nucleus. In other words, it resides outside of the nucleus. It has a negligible mass and has a charge of –1. Neutrons, like protons, reside in the nucleus of an atom. They have amass of 1 and no charge. The positive (protons) and negative (electrons) charges balance each other in a neutral atom, which has a net zero charge.

Because protons and neutrons each have amass of 1, the mass of an atom is equal to the number of protons and neutrons of that atom. The number of electrons does not factor into the overall mass, because their mass is so small. As stated earlier, each element has it sown unique properties. Each contains a different number of protons and neutrons,

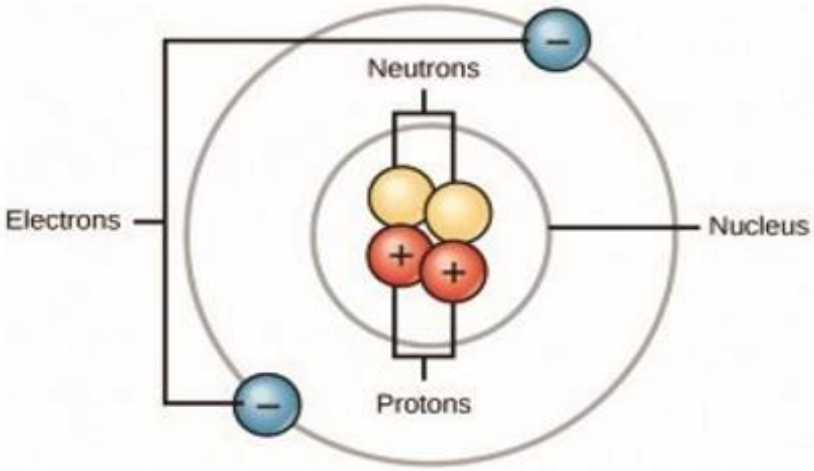



Figure 2.2 Atoms are made up of protons and neutrons located within the nucleus, and electrons surrounding the nucleus.

Giving it its own atomic number and mass number. The atomic number of an element is equal to the number of protons that element contains. The mass number, or atomic mass, is the number of protons plus the number of neutrons of that element. Therefore, it is

possible to determine the number of neutrons by subtracting the atomic number from the mass number. These numbers provide information about the elements and how they will react when combined. Different elements have different melting and boiling points, and are in different states (liquid, solid, or gas) at room temperature. They also combine in different ways. Some form specific types of bonds, whereas others do

not. How they combine is based on the number of electrons present. Because of these characteristics, the elements are arranged into the periodic table of elements, a chart of the elements that includes the atomic number and relative atomic mass of each element. The periodic table also provides key information about the properties of elements—of ten indicated by color-coding. The arrangement of the table also shows how the electrons in each element are organized and provides important details about how atoms will react with each other to form molecules. Isotopes are different forms of the same element that have the same number of protons, but a different number of neutrons. Some elements, such as carbon, potassium, and uranium, have naturally occurring isotopes. Carbon-12,the most common isotope of carbon, contains six protons and six neutrons. Therefore, it has amass number of 12 (six

protons and six neutrons) and an atomic number of 6 (which makes it carbon). Carbon-14 contains six protons and eight neutrons. Therefore, it has a mass number of 14 (six protons and eight neutrons) and an atomic number of 6, meaning it is still the element carbon. These two alternate forms of carbon are isotopes. Some isotopes are unstable and will lose protons, other subatomic particles, or energy to form more stable elements. These are called radioactive isotopes or radioisotopes.

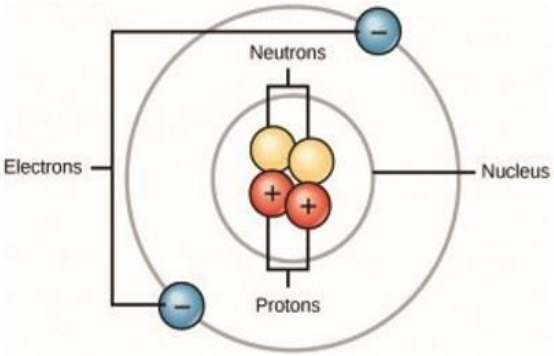
*Source: Concepts of Biology-1st Canadian Edition by Charles Molnar and Jane, 2013 Rice University*

## B. Reading Comprehension

Exercises

A. Read the following text and while reading answer the following questions

1. What does the first paragraph tell you about ?
2. What kind of information told by the second paragraph ?
3. What is the main idea of the third paragraph ?
4. What is the fourth paragraph describe ?
5. What is the fifth paragraph describe ?
6. What is the element ? Please explain!
7. What is atom ? Please explain !




8. Please explain more about picture above
9. What kind of tense is frequently use in the text ?
10. What are the difficult vocabularies do you find in the text ?

## C. Check your Vocabulary

1. The elements carbon, hydrogen, nitrogen, oxygen, sulfur, and phosphorus are the *key* building blocks of the chemicals found in living things. What is meant by *key* ?
2. Each element is *designated* by its chemical symbol (such as H, N, O, C, and Na), and possesses unique properties. What is meant by *designated* ?
3. Some isotopes are *unstable* and will lose protons, other subatomic particles, or energy to form more stable elements. What is meant by *unstable ?*
4. The atomic number of an element is *equal* to the

number of protons that element contains. What is meant by *equal* ?

5. These numbers provide information about the elements and how *they* will react when combined. The word *they* refers to ?

## D. Grammar Focus VERBS

Jika kita mempelajari bahasa inggris maka kita tidak akan terlepas dari Verb. Apa itu Verb? Secara sederhana verb dapat diartikan sebagai kata yang digunakan untuk menyatakan aktifitas atau keadaan. Berikut ini adalah contoh Verb atau kata yang menyatakan aktifitas dan keadaan :

Aktifitas : Sleep, eat, study.....
Keadaan : Forget, love, hate.....

Kemudian verb juga dapat dibedakan menjadi beberapa bagian yaitu:

A. Berdasarkan bentuk

1. Infinitive Form or Present Form
   Bentuk infinitive biasanya digunakan dalam bentuk present juga. Yang merupakan bentuk infinitive adalah:

a. To infinitive ( To + V1) Contohnya To study, to sleep.....
b. Bare infinitive (V1) Contohnya study, sleep.....
c. Additional infinitive ( Vs/es) contohnya studies....

2. Past form (V2)

Dalam bentuk past ini biasanya menggunakan verb 2. Past form tebagi menjadi dua bentuk yaitu:

a. Regular

Kata kerja bentuk regular atau biasa kita kenal dengan regular verb adalah sebuah kata kerja yang mengalami perubahan bentuk yang beraturan. Yang dimaksud dengan perubahan bentuk disini adalah perubahan bentuk dari verb 1 ke verb 2 dari verb 2 ke verb 3 dan biasanya hanya di tambahkan *ed* di akhir kata, biasanya dirumuskan dengan V1 + ed. Seperti contoh dibawah ini:

V1 : Study, berubah ke V2 menjadi Studi**ed**

V1 : Walk, berubah ke V2 Menjadi Walk**ed**

b. Irregular

Seperti halnya regular verb dalam irregular verb juga mengalami perubahan bentuk namun dalam irregular verb ini perubahan bentuknya tidak beraturan, seperti contoh di bawah ini :

V1 : go berubah ke V2 menjadi went berubah lagi ke V3 menjadi gone ( go – went – gone)

3. Participle form

Participle form biasanya kita kenal dengan V3 contohnya gone, eaten, done.....

Berikut ini adalah contoh perubahan bentuk kata kerja yang tidak beraturan :

## A list of irregular verbs

| | | |
|---|---|---|
| Awake | Awoke | awoken |
| Be | was, were | Been |
| Bear | Bore | Born |
| Beat | Beat | Beat |
| Become | Became | Become |
| Begin | Began | Begun |
| Bend | Bent | Bent |
| Beset | Beset | Beset |
| Bet | Bet | Bet |

| | | |
|---|---|---|
| Bid | bid / bade | bid / bidden |
| Bind | Bound | Bound |
| Bite | Bit | Bitten |
| Bid | bid / bade | bid / bidden |
| Bleed | Bled | Bled |
| Blow | Blew | Blown |
| Break | Broke | Broken |
| Breed | Bred | Bred |
| Bring | Brought | Brought |
| Broadcast | Broadcast | Broadcast |
| Build | Built | Built |
| Burn | burned / burnt | burned / burnt |
| Burst | Burst | Burst |
| Buy | Bought | Bought |
| Cast | Cast | Cast |
| Catch | Caught | Caught |
| Choose | Chose | Chosen |
| Cling | Clung | Clung |
| Come | Came | Come |
| Cost | Cost | Cost |
| Creep | Crept | Crept |
| Cut | Cut | Cut |
| Deal | Dealt | Dealt |

Berdasarkan posisi atau kedudukanya

Kata kerja berdasarkan posisi atau kedudukanya dibedakan menjadi ordinary verb dan auxiliary verb.

4. Ordinary Verb

   Ordinary verb adalah sebuah kata kerja utama yang harus ada dalam kalimat dan sebuah kalimat hanya membutuhkan satu kata kerja utama. Contoh

ordinary verb adalah eat, bring, buy, walk....

Ordinary verb terbagi menjadi dua yaitu transitive verb dan intransitive verb. Transitive verb adalah verb yang membutuhkan object, ada dua jenis transitive verb yaitu monotransitive dan distransitive verb.

Monotransitive verb adalah verb yang membutuhkan satu object,

contohnya Azam drinks baygon

S Vt O

Sedangkan distransitive adalah verb yang boleh mempunyai 2 object.

Rumus :

S + V + Io + Do

S + V + Do + to/for + Io

Prep

Note:

S : Subject

V : Verb

Io : Indirect Object (Objek tidak langsung)

Do: Direct Object ( Object yang langsung berhubungan dengan subject)

Contoh distransitive:

Agung membelikan Neli seekor kucing
S Vdit Io Do

Agung buys Neli a cat
S Vdit Io Do
Agung buys a cat for Neli
S Vdit Do Io

Selanjutnya adalah Intransitive verb yang merupakan sebuah kata kerja yang tidak membutuhkan object. Ada dua jenis intransitive verb, complete predication dan incomplete predication. Complete predication adalah sebuah kata kerja yang sudah lengkap rumusnya adalah :

S + V + Adv

Contoh :

Zamrud sleeps every night
S V adv

Sedangkan incomplete predication adalah kata kerja yang belum lengkap sehingga membutuhkan pelengkap.

Rumus :

S + Vord + Complement

Contoh :

I feel confused
S V Complement

5. Auxiliary Verb

   Auxiliary verb merupakan kata kerja bantu. Ada tiga jenis auxiliary verb.

   a. Primary auxiliary

      Primary auxiliary merupakan kata kerja bantu yang tidak mempunyai makna kamus (dalam kalimat) apabila sendirian maka dapat menjadi Verb ordinary seperti Be: am, is, are, was, were, been, being, be, have, has, had.

   Contohnya - I am handsome
   - I am eating bread

   b. Modal auxiliary

      Modal auxiliary merupakan kata kerja bantu yang

mempunyai makna kamus ( dalam kalimat) dan selamanya auxiliary diantaranya can, will, must, may, should....

Contoh :

Vito can help Retno

c. Emphasize auxiliary

Emphazise auxiliary merupakan kata kerja bantu yang memberikan penekanan dan bermakna sungguh –sungguh atau benar – benar. Yang merupakan emphazise auxiliary adalah do, does, did.

Contoh :

I do love you : saya benar benar mencintaimu

# Chapter 2:
# Introduction to Cell Structure and Function

| *Learning Objectives* |
| --- |
| At the end of this section, the students will be able to:<br>a. Describe the roles of cells in organisms<br>b. Compare and contrast light microscopy and electron microscopy<br>c. Summarize the cell theory |

خَلَقَ ٱلسَّمَٰوَٰتِ وَٱلۡأَرۡضَ بِٱلۡحَقِّ وَصَوَّرَكُمۡ فَأَحۡسَنَ صُوَرَكُمۡۖ وَإِلَيۡهِ ٱلۡمَصِيرُ ٣

*Khalaqa ssamaawaati wal-ardha bilhaqqi washawwarakum fa-ahsana shuwarakum wa-ilayhi lmashiir (Qs At Taghaabun : 3)*

[64:3] Dia menciptakan langit dan bumi dengan haq. Dia membentuk rupamu dan dibaguskanNya rupamu itu dan hanya kepada Allah-lah kembali(mu)

[64:3] He created the heavens and the earth with truth, and He formed you, then made goodly your forms, and to Him is the ultimate resort.

## A. Reading text

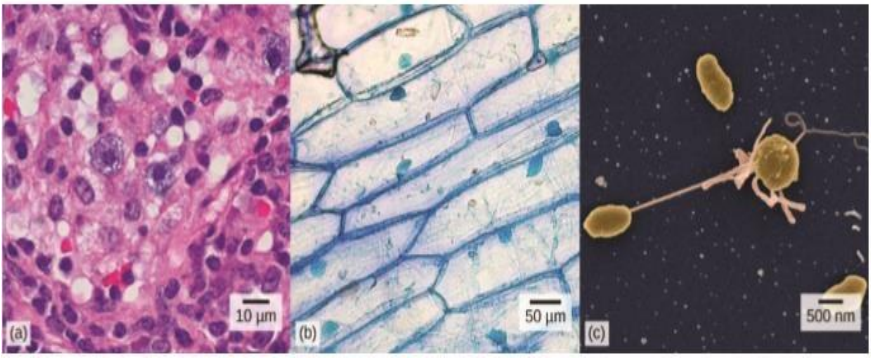



*Figure 2.1 (a) Nasal sinus cells (viewed with a light microscope), (b) onion cells (viewed with a light microscope), and (c) Vibrio tasmaniensis bacterial cells (viewed using a scanning electron microscope) are from very different organisms, yet all share certain characteristics of basic cell structure. (credit a: modification of work by Ed Uthman, MD; credit b: modification of work by Umberto Salvagnin; credit c: modification of work by Anthony D'Onofrio; scale-bar data from Matt Russell)*

Close your eyes and picture a brick wall. What is the basic building block of that wall ? It is a single brick, of course. Like a brick wall, your body is composed of basic building blocks, and the building blocks of your body are cells. An average human is thought to have 37.2 trillion cells. Your body has many kinds of cells, each specialized for a specific purpose. Just as a home is made from a variety of building materials, the human body is constructed from many cell types. For example, epithelial cells protect the surface of the body and cover the organs and body cavities within. Bone cells help to support and protect the body.

Cells of the immune system fight invading bacteria. Additionally, red blood cells carry oxygen throughout the body. Each of these cell types plays a vital role during the growth, development, and day-to- day maintenance of the body. In spite of their enormous variety, however, all cells share certain fundamental characteristics.

A cell is the smallest unit of a living thing. A living thing, like you is called an organism. Thus, cells are the basic building blocks of all organisms. In multicellular organisms, several cells of one particular kind interconnect with each other and perform shared functions to form tissues (for example, muscle tissue, connective tissue, and nervous tissue), several tissues combine to form an organ (for example, stomach, heart, or brain), and several organs make

up an organ system (such as the digestive system, circulatory system, or nervous system). Several systems functioning together form an organism (such as an elephant, for example). There are many types of cells, and all are grouped into one of two broad categories: prokaryotic and eukaryotic. Animal cells, plant cells, fungal cells, and protest cells are classified as eukaryotic, whereas bacteria and archaea cells are classified as prokaryotic.

Cells vary in size. With few exceptions, individual cells are too small to be seen with the naked eye, so scientists use microscopes to study them. A microscope is an instrument that

magnifies an object. Most images of cells are taken with a microscope and are called micrographs.

To give you a sense of the size of a cell, a typical human red blood cell is about eight millionths of a meter or eight micrometers (abbreviated as μm) in diameter; the head of a pin is about two thousandths of a meter (millimeters, or mm) in diameter. That means that approximately 250 red blood cells could fit on the head of a pin.

The optics of the lenses of a light microscope changes the orientation of the image. A specimen that is right-side up and facing right on the microscope slide will appear upside-down and facing left when viewed through a microscope, and vice versa. Similarly, if the slide is moved left while looking through the microscope, it will appear to move right, and if moved down, it will seem to move up. This occurs because microscopes use two sets of lenses to magnify the image. Due to the manner in which light travels through the lenses, this system of lenses produces an inverted image (binoculars and a dissecting microscope work in a similar manner, but include an additional magnification system that makes the final image appear to be upright).

Most student microscopes are classified as light microscopes .Visible light both passes through and is bent by the lens system to enable the user to see the specimen. Light microscopes are advantageous for viewing living organisms, but

since individual cells are generally transparent, their components are not distinguishable unless they are colored with special stains. Staining, however, usually kills the cells.

Light microscopes commonly used in the undergraduate college laboratory magnify up to approximately 400 times. Two parameters that are important in microscopy are magnification and resolving power. Magnification is the degree of enlargement of an object. Resolving power is the ability of a microscope to allow the eye to distinguish two adjacent structures as separate; the higher there solution, the closer those two objects can be, and the better the clarity and detail of the image. When oil immersion lenses are used, magnification is usually increased to 1,000 times for the study of smaller cells, like most prokaryotic cells. Because light entering a specimen from below is focused on to the eye of an observer, the specimen can be viewed using light microscopy. Forth is reason, for light to pass through a specimen, the sample must be thin or translucent.

*Source: Concepts of Biology-1st Canadian Edition by Charles Molnar and Jane, 2013 Rice University*

## B. Reading Comprehension

Answer the following questions !

1. What does the first paragraph tell you about ?
2. What does the second paragraph describe ?
3. What does the third paragraph describe ?

4. What does the fourth paragraph talking about ?
5. What does the fifth paragraph describe ?
6. What does the sixth paragraph tell you about ?
7. What does the last paragraph describe ?
8. What do you know about cells ?
9. When you read the material about —cell structure and function‖, what appears in your mind ?
10. What the conclusion of the text above ?

## C. Check your vocabulary.

1. The human body is constructed from many cell types. What is meant by Constructed ?
2. There are many types of cells, and all are grouped into one of two broad categories: prokaryotic and eukaryotic, what is of Eukaryotic cell ?
3. There are many types of cells, and all are grouped into one of two broad categories: prokaryotic and eukaryotic, what is Prokaryotic cell
4. Cells vary in size. With few exceptions, individual cells are too small to be seen with the naked eye, so scientists use microscopes to study them. What is Microscope ?
5. In multicellular organisms, several cells of one particular kind interconnect with each other and perform shared functions to form tissues (for

example, muscle tissue, connective tissue, and nervous tissue), what is meant by Particular ?

6. Light microscopes are advantageous for viewing living organism, what is meant by *advantageous*?
7. Light microscopes commonly used in the undergraduate college laboratory magnify up to approximately 400 times, what is meant by *approximately* ?

## D. Grammar focus

Simple Sentence

Simple sentence adalah kalimat yang terdiri dari satu independen clause. Satu independent clause terdiri dari subject dan predicate. Kalimat ini merupakan bentuk kalimat yang paling sederhana. Unsur terpenting dalam kalimat simple adalah: a subject, a verb, and a completed thought.

Seperti contoh di bawah ini:

Your body has many kinds of cells

The formula of the sentence is :

Subject + Verb + Object

| | | |
|---|---|---|
| Your Body | Has | Many kinds of cells |

| Subject | Verb | Object |
|---|---|---|

Simpel sentence bisa berupa kalimat pendek dan bisa juga dalam bentuk kalimat panjang. Simpel sentence yang berupa kalimat panjang terdiri dari one subject-verb combination. Seperti contoh di bawah ini.

a. I ate.
b. I ate dinner.
c. I ate dinner with my brother and sister.
d. Last night, I ate dinner at a restaurant with my brother and sister.

Types of Simple Sentences

a. Simple Sentence with ONLY a Subject and a Verb

Sebagaimana telah di jelaskan di atas bahwa simpel sentence ada yang berupa kalimat pendek dan kalimat panjang namun tetap terdiri dari satu subject dan satu predicate

a. I see.
b. He ran.

c. We looked.
d. They cooked.
e. The dog ate.
f. The baby cried.

b. Simple Sentence with other Objects or Modifiers

Simpel sentence yang berupa kalimat panjang tetap mengandung satu subject dan predicate dan bisa di tambah dengan object atau modifier. Seperti contoh di bawah ini.

a. I see you **behind the** cotton candy machine!
b. He ran to the fair **as fast as possible**.
c. We ate buttery corn **at the famous** farmer's market.
d. They prepared cotton candy **in an old-fashioned** machine.

Latihan :

1. Find in the text other sentences, if any, with the same formula.
2. Make five sentences with the same formula.
3. Make a summarize about the cell theory.

# Chapter 3:
# Introduction to How Cells Obtain Energy

| *Learning Objectives* |
| --- |
| At the end of this section, the students will be able to:<br>a. Explain what metabolic pathways are<br>b. Show cause and effect sentences |

أَلَمْ تَرَوْا۟ كَيْفَ خَلَقَ ٱللَّهُ سَبْعَ سَمَٰوَٰتٍ طِبَاقًا ﴿١٥﴾

*Alam taraw kayfa khalaqallaahu sab'a samaawaatin thibaaqaa (Qs. Nuh : 15)*

[71:15] Tidakkah kamu perhatikan bagaimana Allah telah menciptakan tujuh langit bertingkat-tingkat?

[71:15] Do you not see how Allah has created the seven heavens ,~ one above another,

وَجَعَلَ ٱلْقَمَرَ فِيهِنَّ نُورًا وَجَعَلَ ٱلشَّمْسَ سِرَاجًا ﴿١٦﴾

*Waja'ala lqamara fiihinna nuuran waja'ala sysyamsa siraajaa (Qs. Nuh :16)*

[71:16] Dan Allah menciptakan padanya bulan sebagai cahaya dan menjadikan matahari sebagai pelita?

[71:16] And made the moon therein a light, and made the sun a lamp?

**A.** Reading Text

*Figure 4.1 A hummingbird needs energy to maintain prolonged flight. The bird obtains its energy from taking in food and transforming the energy contained in food molecules into forms of energy to power its flight through a series of biochemical reactions. (credit: modification of work by Cory Zanker)*

Virtually every task performed by living organisms requires energy. Energy is needed to perform heavy labor and exercise, but humans also use energy while thinking, and even during sleep. In fact, the living cells of every organism constantly use energy. Nutrients and other molecules are imported into the cell, metabolized (broken down) and possibly synthesized into new molecules, modified if needed, transported around the cell, and possibly distributed to the entire organism. For example, the large proteins that make up muscles are built from smaller molecules imported from dietary amino acids. Complex carbohydrates are broken down into simple sugars that the cell uses for energy. Just as energy is required to both build and demolish a building, energy is required for the synthesis and break down of molecules as well as the transport of molecules in to and out of cells. In addition, processe such as in gesting and breaking down pathogenic bacteria and viruses, exporting wastes and toxins,

and movement of the cell require energy.

Scientists use the term bioenergetics to describe the concept of energy flow through living systems, such as cells. Cellular processes such as the building and breaking down of complex molecules occur through stepwise chemical reactions. Some of these chemical reactions are spontaneous and release energy, whereas others require energy to proceed. Just as living things must continually consume food to replenish their energy supplies, cells must continually produce more energy to replenish that used by the many energy-requiring chemical reactions that constantly take place. Together, all of the chemical reactions that take place inside cells, including those that consume or generate energy, are referred to as the cell's metabolism.

Consider the metabolism of sugar. This is a classic example of one of the many cellular processes that use and produce energy. Living things consume sugars as a major energy source, because sugar molecules have a great deal of energy stored within their bonds. For the most part, photosynthesizing organisms like plants produce these sugars. During photosynthesis, plants use energy (originally from sunlight) to convert carbon dioxide gas ($CO_2$) into sugar molecules (like glucose: $C_6H_{12}O_6$). They consume carbon dioxide and produce oxygen as a waste product. This reaction is summarized as:
$6CO_2 + 6H_2O$ + energy ——-> $C_6H_{12}O_6 + 6O_2$

Because this process involves synthesizing an energy-storing molecule, it requires energy input to proceed. During the light reactions of photosynthesis, energy is provided by a molecule called adenosine triphosphate (ATP), which is the primary energy currency of all cells. Just as the dollar is used as currency to buy goods, cells use molecules of ATP as energy currency to perform immediate work.

In contrast, energy-storage molecules such as glucose are consumed only to be broken down to use their energy. The reaction that harvests the energy of a sugar molecule in cells requiring oxygen to survive can be summarized by the reverse reaction to photosynthesis. In this reaction, oxygen is consumed and carbon dioxide is released as a waste product. The reaction is summarized as:

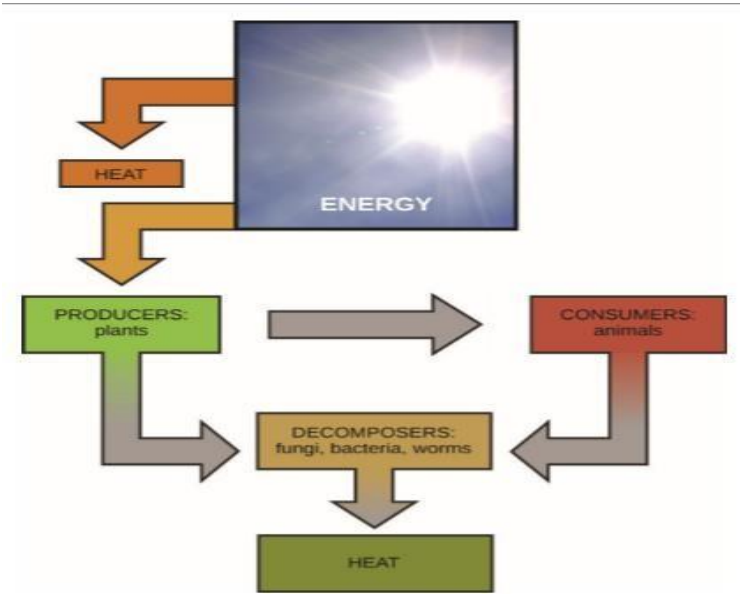



*Figure 4.2 Ultimately, most life forms get their energy from the sun. Plants use photosynthesis to capture sunlight, and herbivores eat the plants to obtain energy. Carnivores eat the herbivores, and eventual decomposition of plant and animal material contributes to the nutrient pool.*

$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$ + energy Both of these reactions involve many steps. The processes of making and breaking down sugar molecules illustrate two examples of metabolic pathways. A metabolic pathway is a series of chemical reactions that takes a starting molecule and modifies it, step-by-step, through a series of metabolic intermediates, eventually yielding a final product. In the example of sugar metabolism, the first metabolic pathway synthesized

sugar from smaller molecules, and the other pathway broke sugar down into smaller molecules. These two opposite processes—the first requiring energy and the second producing energy—are referred to as anabolic pathways (building polymers) and catabolic pathways (breaking down polymers into their monomers), respectively. Consequently, metabolism is composed of synthesis (anabolism) and degradation (catabolism) It is important to know that the chemical reactions of metabolic pathways do not take place on their own. Each reaction step is facilitated, or catalyzed, by a protein called an enzyme. Enzymes are important for catalyzing all types of biological reactions—those that require energy as well as those that release energy.

*Source: Concepts of Biology-1st Canadian Edition by Charles Molnar and Jane, 2013 Rice University*

## B. Reading Comprehension

a. Answer the following questions

1. What the first paragraph talking about ?
2. What is the main idea of the second paragraph ?
3. What the third paragraph describe ?
4. What the fourth paragraph talking about ?
5. What kind of tenses frequently used in the text ?
6. What is energy ?
7. What the function of energy for human life ?
8. What do you know about metabolic pathway ?
9. Why Enzymes are important for catalyzing all types of biological reactions ?

10. What the function of sugar for metabolism ?

## C. Check your vocabulary

1. Energy is needed to perform heavy labor and exercise, what is meant by *needed ?*
2. Complex carbohydrates are broken down into simple sugars that the cell uses for energy. What is meant by *broken down* ?
3. In fact, the living cells of every organism constantly use energy. What is meant by *constantly ?*
4. Nutrients and other molecules are imported into the cell, metabolized (broken down) and possibly synthesized into new molecules, modified if needed, transported around the cell, and possibly distributed to the entire organism. What is meant by *imported* ?
5. Energy is required for the synthesis and break down of molecules as well as the transport of molecules in to and out of cells. What is meant by *Transport ?*

## D. Grammar Focus.

### 1. Cause and effect

Kalimat *cause and effect* biasa juga disebut dengan kalimat sebab-akibat atau kalimat kausalitas adalah kalimat yang dibangun dengan melibatkan tindakan yang membuat sesuatu terjadi dan hasil dari tindakan tersebut. Paling gampang ditandai dengan kata hubung yang menandakan sebab akibat,

misalnya: *because, for, since, when*, dan *as, owing to, due to.*

*For example :*

1. *Global warming is caused by pollution.*
2. *The human need energy for thinking and even during sleep*

Things to remember about cause and effect.

a. Due to, because of, owing to, and tanks to are followed by Noun

*Example : Thanks to energy the synthesis and break down of molecules as well as the transport of molecules in to and out of cells.*

b. Because, since , as , for are followed by Subject + Verb.

*Example : Because the bird obtains its energy from taking in food, they can flight through a series of biochemical reactions.*

## E. Jenis- Jenis Cause and Effect

1. Single Event : Saat hanya ada satu *cause* dan *effect* dalam suatu kalimat.

Contoh :

*His eyes was myopic because he often played online games*



a. Saat Anda bertanya apa yang terjadi, maka jawabannya

adalah, -*His eyes was myopic*‖ (Matanya rabun). Inilah yang disebut dengan *effect/* akibat.

b. Saat Anda bertanya mengapa hal itu bisa terjadi, maka jawabannya adalah, -*He often played online games*.‖ (Dia sering bermain games online). Inilah yang merupakan *cause/* penyebab matanya rabun.

1. *Chain Reaction: Reaksi berantai. Hal ini terjadi saat suatu* cause *menyebabkan suatu efek dan efek tersebut berubah menjadi* cause *dan menyebabkan* effect *lain, atau singkatnya satu hal berimbas pada hal lainnya.*

   Contoh:

   *Mario forgot to bring an umbrella . When he walked home from school, the day was rain. So Mario waiting in the front of people`s house until the rain stopped .*

   a. Penyebab atau *cause* utama dalam bacaan ini adalah, —Mario forgot to bring an umbrella.// (Mario lupa membawa payung).

   b. *Cause* tersebut menyebabkan *effect* berupa, -*he walked home from school the day was rain*// (Dia berjalan pulang dari sekolah, hujan pun turun ).

   c. *Effect* tersebut berubah menjadi *cause* baru dan menyebabkan *effect* baru, yakni, -*Mario waiting in the front of people`s house until the rain stopped*.‖ (Mario menunggu/berteduh didepan rumah orang sampai hujan turun).

2. *Branching Tree yakni saat beberapa penyebab/*causes *yang terjadi pada waktu bersamaan atau di lain waktu yang dapat menyebabkan atau berkontribusi pada satu* effect*.*

Contoh:

*Dani went home very late last night after taking her mother to the emergency room for vertigo. He woke up very late this morning but however he decided to attend the class . Not far from his house, his motorcycle broke, so he must to service it. When he's back on the road, the traffic was jammed and he's trapped. That's why he was 30 minutes late to the class this morning.*

Dari bacaan di atas, kesimpulannya ada pada akhir paragraf, yakni, -*Mario was 30 minutes late to the class this morning.*‖ (Mario terlambat 30 menit ke kelas pagi ini.)

Hal itu merupakan efek dari beberapa hal yang telah disebutkan di dalam paragraf, antara lain:

a. *Dani went home very late, therefore he went to bed very late, and woke up very late the next morning* (Dani pulang amat larut, sehingga ia

terlambat tidur, dan terlambat bangun keesokan paginya).

b. *His motorcycle broke, so he must to service it* (Motornya rusak, jadi dia harus memperbaikinya).

c. *The traffic was jammed* (Jalanan macet).

**2. Exercise**

a. Identifying cause and effect on the text above

b. Please make ten sentences with cause and effect formula

# Chapter 4:
# Introduction to Photosynthesis

| *Learning Objectives* |
| --- |
| At the end of this section, the students will be able to:<br>a. Summarize the process of photosynthesis<br>b. Explain the relevance of photosynthesis to other living things<br>c. Make conditional sentences |

وَهُوَ ٱلَّذِىٓ أَنزَلَ مِنَ ٱلسَّمَآءِ مَآءً فَأَخْرَجْنَا بِهِۦ نَبَاتَ كُلِّ شَىْءٍ فَأَخْرَجْنَا
مِنْهُ خَضِرًا نُّخْرِجُ مِنْهُ حَبًّا مُّتَرَاكِبًا وَمِنَ ٱلنَّخْلِ مِن طَلْعِهَا قِنْوَانٌ دَانِيَةٌ
وَجَنَّٰتٍ مِّنْ أَعْنَابٍ وَٱلزَّيْتُونَ وَٱلرُّمَّانَ مُشْتَبِهًا وَغَيْرَ مُتَشَٰبِهٍ ۗ ٱنظُرُوٓا۟
إِلَىٰ ثَمَرِهِۦٓ إِذَآ أَثْمَرَ وَيَنْعِهِۦٓ ۚ إِنَّ فِى ذَٰلِكُمْ لَـَٔايَٰتٍ لِّقَوْمٍ يُؤْمِنُونَ ﴿٩٩﴾

*Wahuwalladzii anzala mina ssamaa-i maa-an fa-akhrajnaa bihi nabaata kulli syay-in fa-akhrajnaa minhu khadhiran nukhriju minhu habban mutaraakiban wamina nnakhli min thal'ihaa qinwaanun daaniyatun wajannaatin min a'naabin wazzaytuuna warrummaana musytabihan waghayra mutasyaabihin unzhuruu ilaa tsamarihi idzaa atsmara wayan'ihi inna fii dzaalikum laaayaatin liqawmin yu/minuun (Qs. Al An'aam : 99)*

[6:99] Dan Dialah yang menurunkan air hujan dari langit, lalu Kami tumbuhkan dengan air itu segala macam tumbuh-tumbuhan maka Kami keluarkan dari tumbuh-tumbuhan itu tanaman yang menghijau. Kami keluarkan dari tanaman yang menghijau itu butir yang banyak; dan dari mayang korma mengurai tangkai-tangkai yang menjulai, dan kebun-kebun anggur, dan (Kami keluarkan pula) zaitun dan delima yang serupa dan yang tidak serupa. Perhatikanlah buahnya di waktu pohonnya berbuah dan (perhatikan pulalah) kematangannya. Sesungguhnya pada yang demikian itu ada tanda-tanda (kekuasaan Allah) bagi orang-orang yang beriman.

[6:99] And He it is Who sends down water from the cloud, then We bring forth with it buds of all (plants), then We bring forth from it green (foliage) from which We produce grain piled up (in the ear); and of the palm-tree, of the sheaths of it, come forth clusters (of dates) within reach, and gardens of grapes and olives and pomegranates, alike and unlike; behold the fruit of it when it yields the fruit and the ripening of it; most surely there are signs in this for a people who believe

## A. Reading Text

Figure 4.1 This sage thrasher's diet, like that of almost all organisms, depends on photosynthesis. (credit: modification of work by Dave Menke, U.S. Fish and Wildlife Service)

All living organisms on earth consist of one or more cells. Each cell runs on the chemical energy found mainly in carbohydrate molecules (food), and the majority of these molecules are produced by one process: photosynthesis. Through photosynthesis, certain organisms convert solar energy (sunlight) into chemical energy, which is then used to build carbohydrate molecules. The energy used to hold these molecules together is released when an organism breaks down food. Cells then use this energy to perform work, such as cellular respiration. The energy that is harnessed from photosynthesis enters the ecosystems of our planet continuously and is transferred from one organism to another. Therefore, directly or indirectly, the process of photosynthesis provides most of the energy required by living things on earth. Photosynthesis also results in the release of oxygen into the atmosphere. In short, to eat and breathe, humans depend almost entirely on the organisms that carry out photosynthesis.

Some organisms can carry out photosynthesis, whereas others cannot. An autotroph is an organism that can produce its own food. The Greek roots of the word autotroph mean ―self‖ (auto) ―feeder‖ (troph). Plants are the best-known autotrophs, but other sexist, including certain types of bacteria and algae. Oceanic algae contribute enormous quantities of food and oxygen to global food chains. Plants are also photoautotrophs, a type of autotroph that uses sunlight and carbon from carbon dioxide to synthesize

chemical energy in the form of carbohydrates. All organisms carrying out photosynthesis require sunlight.

Heterotrophs are organisms incapable of photosynthesis that must therefore obtain energy and carbon from food by consuming other organisms. The Greek roots of the word heterotroph mean —other‖ (hetero) —feeder‖ (troph), meaning that their food comes from other organisms. Even if the food organism is another animal, this food traces its origins back

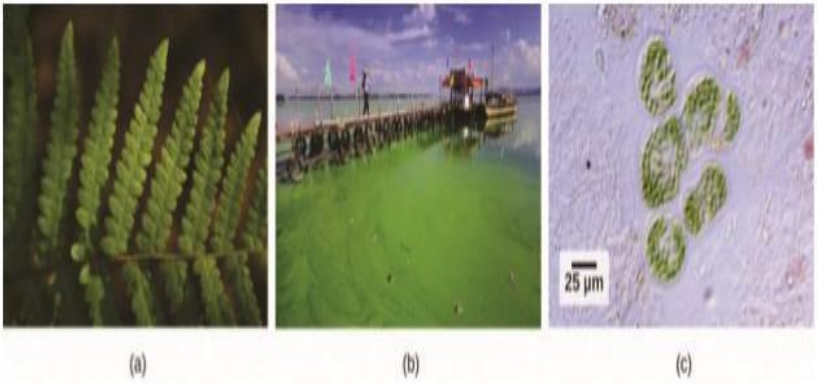



Figure 5.2 (a) Plants, (b) algae, and (c) certain bacteria, called cyanobacteria, are photoautotrophs that can carry out photosynthesis. Algae can grow over enormous areas in water, at times completely covering the surface. (credit a: Steve Hillebrand, U.S. Fish and Wildlife Service; credit b: -eutrophication&hypoxia‖/Flickr; credit c: NASA; scale-bar data from Matt Russell)

to autotrophs and the process of photosynthesis. Humans are heterotrophs, as are all animals. Heterotrophs depend on autotrophs, either directly or indirectly. Deer and wolves are heterotrophs. A deer obtains energy bye a ting plants. A wolf eating a deer obtains energy that originally came from the

plants eaten by that deer. The energy in the plant came from photosynthesis, and therefore it is the only autotroph in this example (Figure 5.3).Using this reasoning, all food eaten by humans also links back to autotrophs that carry out photosynthesis.

Figure 5.3 The energy stored in carbohydrate molecules from photosynthesis passes through the food chain. The predator that eats these deer is getting energy that originated in the photosynthetic vegetation that the deer consumed. (credit: Steve VanRiper, U.S. Fish and Wildlife Service)

*Source: Concepts of Biology-1st Canadian Edition by Charles Molnar and Jane, 2013 Rice University*

## B. Reading Comprehension

Answer the following questions

1. What does the first paragraph explain you about ?
2. What is the main idea of the second paragraph?
3. What the third paragraph describe ?
4. What is photosynthesis ?

5. From where does a heterotroph directly obtain its energy?
6. What is the conclusion of the paragraph above ?
7. What is the paragraph that tell about the organism cannot do photosynthesis process ?
8. Why are carnivores, such as lions, dependent on photosynthesis to survive?
9. What is the overall purpose of the light reactions in photosynthesis?
10. What two products result from photosynthesis?

## C. Check your vocabulary

1. Through photosynthesis, certain organisms convert solar energy (sunlight) into chemical energy, which is then used to build carbohydrate molecules. What is meant by *build* ?
2. Cells then use this energy to perform work, such as cellular respiration. What is meant by *to perform* ?
3. The energy that is harnessed from photosynthesis enters the ecosystems of our planet continuously and is transferred from one organism to another. What is meant by *enters* ?
4. Heterotrophs are organisms incapable of photosynthesis that must therefore obtain energy and carbon from food by consuming other organisms. What is meant by *incapable* ?

5. A wolf eating a deer obtains energy that originally came from the plants eaten by that deer. What is meant by *originally* ?

## D. Grammar focus

CONDITIONAL SENTENCES

Conditional sentence adalah bentuk kalimat yang menyatakan pengandaian penyesalan dari suatu peristiwa. Ada tiga jenis kalimat conditional, setiap kalimat terdiri dari berbagai pasangan tensesnya.

1. Conditional Sentences type 1.

   Conditional tipe 1 ini merupakan sebuah harapan yang kemungkinan besar terjadi

   Formula :

   **If + Present + Future**

   **If I study hard, I will get good grades**

2. Conditional Sentences type 2.

   Conditional tipe 2 ini merupakan sebuah pengandaian yang bertentangan dengan fakta

sekarang atau yang akan datangdan kemungkinan terjadinya kecil bahkan hampir tidak terjadi.

Formula:

**If + Past + Would + V**

**If I studied hard, I would get good grades**

Dalam conditional tipe 2 ini jika menggunakan —be‖ harus diganti dengan —were‖, misalnya: If I were you, I would not do the duty

3. Conditional Sentences type 3.

Conditionsl tipe ke 3 ini merupakan bentuk penyesalan yang bertentangan dengan fakta lampau yang tidak mungkin terjadi.

**If + Past Perfect + Would + have+ Past Participle**

**If I had studied hard, I would have gotten good grades**

**1. Exercise :**

a. Ubahlah kalimat di bawah ini ke dalam bahasa inggris dengan menggunakan pola kalimat conditional .

1. Jika kemarin saya disini, saya akan pergi ke rumah Liza

2. Jika kamu mengajakku, aku akan ikut
3. Jika Agus jadi kumbang, irwan akan jadi bunganya
4. Jika saya punya banyak uang, saya akan membeli sebuah becak
5. Jika kamu datang kemarin, saya akan memberimu sebuah cincin

b. Tanggapilah statement di bawah ini dengan menggunakan conditional sentence

1. Imagine that the bird cannot found the food for several days
   If the bird.....
2. Imagine that the majority of these molecules are not produced by one process
   If.....
3. Imagine that the proses of photosynthesis is good
   If.....
4. Imaging that All living organisms on earth don't have cells
   If .....

# Chapter 5:
# Introduction to Reproduction at the Cellular Level

| *Learning Objectives* |
| --- |
| At the end of this section, the students will be able to:<br>a. Describe the prokaryotic and eukaryotic genome<br>b. Distinguish between chromosomes, genes, and traits<br>c. Make sentences by using Question tag form |

إِنَّا خَلَقْنَا ٱلْإِنسَـٰنَ مِن نُّطْفَةٍ أَمْشَاجٍ نَّبْتَلِيهِ فَجَعَلْنَـٰهُ سَمِيعًۢا بَصِيرًا

۲

*Innaa khalaqnaa l-insaana min nuthfatin amsyaajin nabtaliihi faja'alnaahu samii'an bashiiraa (Qs. Al Insan : 2)*

[76:2] Sesungguhnya Kami telah menciptakan manusia dari setetes mani yang bercampur yang Kami hendak mengujinya (dengan perintah dan larangan), karena itu Kami jadikan dia mendengar dan melihat.

[76:2] Surely We have created man from a small life-germ uniting (itself): We mean to try him, so We ave made him hearing, seeing

# A. Reading Text

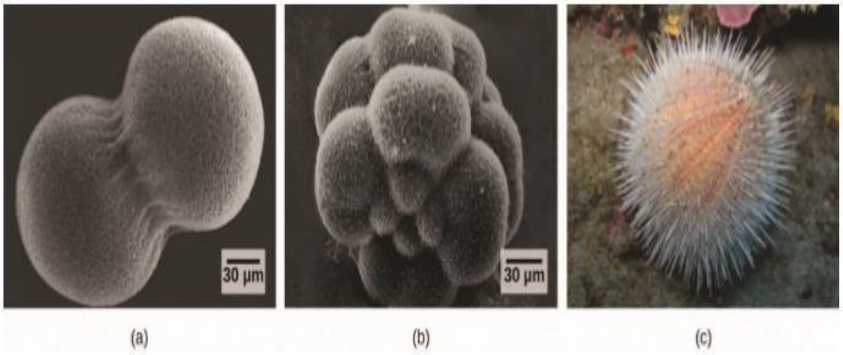



Figure 5.1 A sea urchin begins life as a single cell that (a) divides to form two cells, visible by scanning electron microscopy. After four rounds of cell division, (b) there are 16 cells, as seen in this SEM image. After many rounds of cell division, the individual develops into a complex, multicellular organism, as seen in this (c) mature sea urchin. (credit a: modification of work by Evelyn Spiegel, Louisa Howard; credit b: modification of work by Evelyn Spiegel, Louisa Howard; credit c: modification of work by Marco Busdraghi; scale-bar data from Matt Russell)

The individual sexually reproducing organism—including humans—begins life as a fertilized egg, or zygote. Trillions of cell divisions subsequently occur in a controlled manner to produce a complex, multicellular human. In other words, that original single cell was the ancestor of every other cell in the body. Once a human individual is fully grown, cell reproduction is still necessary to repair or regenerate tissues. For example, new blood and skin cells are constantly being produced. All multicellular organisms use cell division for growth, and in most cases, the maintenance and repair of cells and tissues. Single-celled organisms use cell division as their

method of reproduction.

A cell's complete complement of DNA is called its genome. In prokaryotes, the genome is composed of a single, double-stranded DNA molecule in the form of a loop or circle. The region in the cell containing this genetic material is called a nucleoid. Some prokaryotes also have smaller loops of DNA called plasmids that are not essential for normal growth. In eukaryotes, the genome comprises several double-stranded, linear DNA molecules bound with proteins to form complexes called chromosomes. Each species of eukaryote has a characteristic number of chromosomes in the nuclei of its cells. Human body cells (somatic cells) have 46 chromosomes. A somatic cell contains two matched sets of chromosomes, a configuration known as diploid. The letter n is used to represent a single set of chromosomes; therefore a diploid organism is designated $2_n$.Human cells that contain one set of 23 chromosomes are called gametes, or sex cells; these eggs and sperm are designated n, or haploid.

The matched pairs of chromosomes in a diploid organism are called homologous chromosomes. Homologous chromosomes are the same length and have specific nucleotide segments called genes in exactly the same location, or locus. Genes, the functional units of chromosomes, determine specific characteristics by coding for specific proteins. Traits

are the different forms of a characteristic. For example, the shape of earlobes is a characteristic with traits of free or attached.

Each copy of the homologous pair of chromosomes originates from a different parent; therefore, the copies of each of the genes themselves may not be identical. The variation of individuals within a species is caused by the specific combination of the genes inherited from both parents. For example, there are three possible gene sequences on the human chromosome that codes for blood type: sequence A, sequence B, and sequence O. Because all diploid human cells have two copies of the chromosome that determines blood type, the blood type (the trait) is determined by which two versions

of the marker gene are inherited. It is possible to have two copies of the same gene sequence, one on each homologous chromosome (for example, AA, BB, or OO), or two different sequences, such as AB.

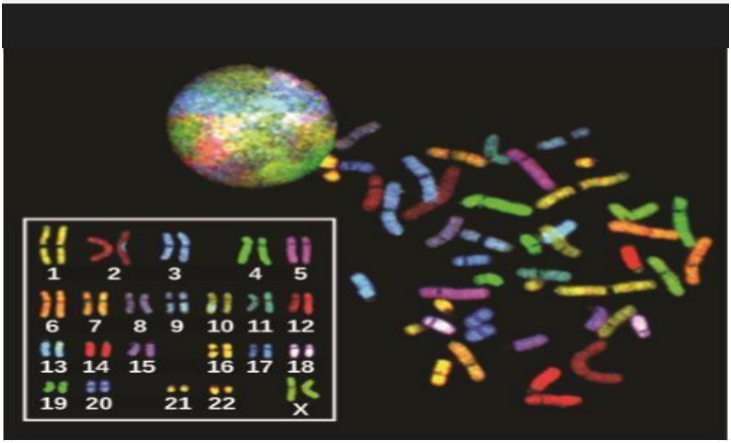



Figure 6.2 There are 23 pairs of homologous chromosomes in a female human somatic cell. These chromosomes are viewed within the nucleus (top), removed from a cell in mitosis (right), and arranged according to length (left) in an arrangement called a karyotype. In this image, the chromosomes were exposed to fluorescent stains to distinguish them. (credit: —718 Bot||/Wikimedia Commons, National Human Genome Research)

Minor variations in traits such as those for blood type, eye color, and height contribute to the natural variation found within a species. The sex chromosomes, X and Y, are the single exception to the rule of homologous chromosomes; other than a small amount of homology that is necessary to reliably produce gametes, the genes found on the X and Y chromosomes are not the same.

*Source: Concepts of Biology-1st Canadian Edition by Charles Molnar and Jane, 2013 Rice University*

## B. Reading Comprehension

Answer these questions below

a. What does the first paragraph tell you about ?
b. What kind of information told by the second paragraph ?
c. What is the main idea of the third paragraph ?
d. What do you know about reproductions ?
e. What is the fourth paragraph describe ?
f. What do you know about DNA ?
g. A diploid cell has_____the number of chromosomes as a haploid cell.
h. An organism's traits are determined by the specific combination of inherited_____.
i. Compare and contrast a human somatic cell to a human gamete.
j. What is the difference between diploid and haploid ?

## C. Check your vocabulary

a. Trillions of cell divisions subsequently occur in a controlled manner to produce a complex, multicellular human. What is meant by *occur* ?
b. For example, new blood and skin cells are constantly being produced. What is meant by *constantly* ?
c. The region in the cell containing this genetic material is called a nucleoid. What is meant by *containing* ?
d. Some prokaryotes also have smaller loops of DNA called plasmids that are not essential for normal growth. What is meant by *essential* ?

e. For example, there are three possible gene sequences on the human chromosome that codes for blood type: sequence A, sequence B, and sequence O. What is meant by *sequence* ?

## D. Grammar focus
## QUESTION TAGS

Question tags adalah pertanyaan singkat yang terletak di akhir kalimat yang berfungsi untuk meminta persetujuan atau penegasan pada lawan bicara. Misalnya :

a. The original single cell was the ancestor of every other cell in the body, was not it ?
b. New blood and skin cells are not constantly being produced, are it ?
c. The weather is lovely today, isn't it?
d. The weather is lovely today, isn't it?‖ -Yes,itis.‖

Dari contoh di atas, dapat kita analisa bahwa ada perbedaan pola antara kalimat pertama dan kedua. Pada kalimat pertama pernyataanya berupa kalimat positive -The original single cell was the ancestor of every other cell in the body‖ maka question tagsnya harus negative -was not it?‖. berbeda dengan kalimat yang kedua, pernyataan berupa kalimat negative -New blood

and skin cells are not constantly being produced‖, maka question tagsnya harus positive -are it?‖. Untuk membuat question tags, disesuaikan dengan verb dan subject kalimatnya, pada kalimat -The original single cell was the ancestor of every other cell in the body‖ verb nya adalah –was dan subjectnya adalah -The original single cell‖, maka question tagsnya adalah -wasn't it‖. -it‖ disini merupakan kata ganti dari -The original single cell‖. Untuk memisahkan antara pernyataan dan question tags biasanya menggunakan tanda koma (,) seperti contoh di atas.

Jadi, dari contoh dan penjelasan di atas dapat disimpulkan bahwa ada beberapa aturan penulisan question tags, yaitu:

1. Tags question diawali tanda koma { —,‖)
2. Subjectnya berupa pronoun (kata ganti)
3. Apabila pernyataanya negative maka question tagsnya positive
4. Apabila pernyataanya positive maka question tagsnya negative

Contoh :

1. Jika ada aux verb digunakan dalam sebuah pernyataan, maka verb yang sama di gunakan dalam question tag nya.

a) You can stay, can't you?
b) You didn't want it, did you?
c) She is married, isn't she?
d) He might come, mightn't he?

2. Jika tidak ada aux verb dalam sebuah pernyataan (kalimat affirmative dalam present) maka question tagnya menggunakan do/did.
   a) He comes every Friday, **doesn't** he?
   b) You went to the supermarket, **didn't** you?
3. Subject biasanya berupa kata ganti orang (pronoun)
   a) Mary is your friend, isn't **she**?
   b) Mary is your friend, isn't **Mary**?

**Berikut ini adalah contoh perubahan subject:**

| **Subject** | **Subject dalam question tag** | **Contoh** |
|---|---|---|
| anybody/anyone | They | Anyone could have done it, couldn't they? |
| somebody/someone | They | Somebody has come, haven't they? |

| | | |
|---|---|---|
| everybody/everyone | They | Everybody has understood, haven't they? |
| That | it/he/she | ➢ That is a strange book, isn't it?<br>➢ That woman is very intelligent, isn't she?<br>➢ That man is so handsome, isn't he? |
| This | it/he/she | This is the best film we've ever seen, isn't it? |
| These | They | These are apples, aren't they? |
| Those | They | Those books aren't boring, are they? |

**4. Positive dan negative tags**

POSITIVE STATEMENT, NEGATIVE TAG? Ex: It is hot, isn't it?

NEGATIVE STATEMENT, POSITIVE TAG? Ex: It isn't warm, is it?

Tidak semua pernyataan negative menggunakan not, ada beberapa kata yang bermakna negative walaupun tidak mengunakan not, seperti : never, nothing, none, neither, nobody and no one

**Ex:** Nobody is coming tomorrow, are they?
He never says that, does he?

**Excersice:**

**A.** Complete the sentences below:

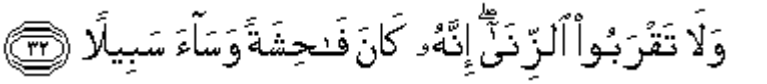
1. Peter doesn't smoke, ..... ?
2. The region in the cell containing this genetic material is called a nucleoid,... .....?
3. Ana ..... studying music, is she ?
4. Human body cells (somatic cells) have 46 chromosomes, .....?
5. Some prokaryotes also have smaller loops of DNA,.....?

6. Are..... written before you phoned, hadn't he.?
7. Arif helped you,. .....?
8. Plasmids that… .....essential for normal growth, are it ?
9. Amin lives here, .....?
10. Soimah..... got colour tv, has she ?

**B.** Please make five sentences by using question tag form.

# Chapter 6:
# Introduction to the Cellular Basis of Inheritance

| *Learning Objectives* |
| --- |
| At the end of this section, the students will be able to:<br>a. Explain that variation among off spring is a potential evolutionary advantage resulting from sexual reproduction<br>b. Describe the three different life-cycle strategies among sexual multicellular organisms and their commonalities |



*Walaa taqrabuu zzinaa innahu kaana faahisyatan wasaa-a sabiilaa (Qs. Al Isro' :32)*

[17:32] Dan janganlah kamu mendekati zina; sesungguhnya zina itu adalah suatu perbuatan yang keji. Dan suatu jalan yang buruk.

[17:32] And go not nigh to fornication; surely it is an indecency and an evil way

## A. Reading Text

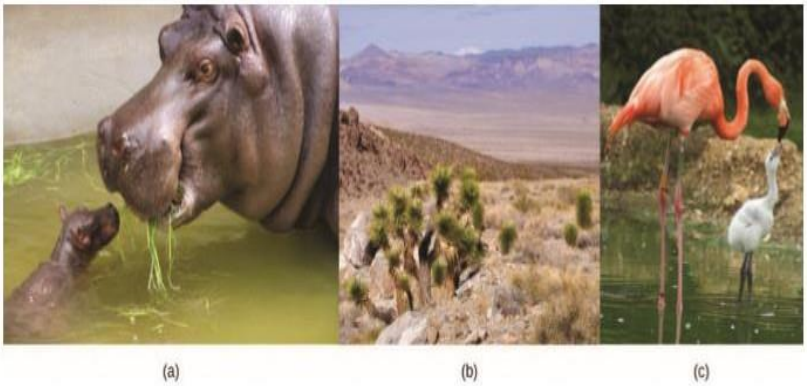



*Figure 7.1 Each of us, like these other large multicellular organisms, begins life as a fertilized egg. After trillions of cell divisions, each of us develops into a complex, multicellular organism. (credit a: modification of work by Frank Wouters; credit b: modification of work by Ken Cole, USGS; credit c: modification of work by Martin Pettitt)*

The ability to reproduce in kind is a basic characteristic of all living things. In kind means that the off spring of any organism closely resembles its parent or parents. Hippopotamuses give birth to hippopotamus calves; Monterey pine trees produce seeds from which Monterey pine seedlings emerge; and adult flamingos lay eggs that hatch into flamingo chicks. In kind does not generally mea exactly the same. While many single-celled organisms and a few multicellular organisms can produce genetically identical clones of themselves through mitotic cell division, many

single-celled organisms and most multicellular organisms reproduce regularly using another method. Sexual reproduction is the production by parents of haploid cells and the fusion of a haploid cell from each parent to form a single, unique diploid cell. In multicellular organisms, the new diploid cell will the n undergo mitotic cell divisions to develop in to an adult organism. A type of cell division called meiosis leads to the haploid cells that are part of the sexual reproductive cycle. Sexual reproduction, specifically meiosis and fertilization, introduces variation into off spring that may account for the evolutionary success of sexual reproduction. The vast majority of eukaryotic organisms can or must employ some form of meiosis and fertilization to reproduce.

Sexual reproduction was an early evolutionary innovation after the appearance of eukaryotic cells. The fact that most eukaryotes reproduce sexually is evidence of its evolutionary success. In many animals, it is the only mode of reproduction. And yet, scientists recognize some real disadvantages to sexual reproduction. On the surface, offspring that are genetically identical to the parent may appear to be more advantageous.

If the parent organism is successfully occupying a habitat, off spring with the same traits would be similarly successful. There is also the obvious benefit to an organism that can produce offspring by asexual budding, fragmentation, or asexual eggs. These methods of reproduction do not require another organism of the opposite sex. There is no need to expend energy finding or attracting a mate. That energy can be spent on producing more off spring. Indeed, some organisms that lead a solitary lifestyle have retained the ability to reproduce asexually. In addition, asexual populations only have female individuals, so every individual is capable of reproduction. In contrast, the males in sexual populations (half the population) are not producing offspring themselves. Because of this, an asexual population can grow twice as fast as a sexual population in theory. This means that in competition, the asexual population would have the advantage. All of these advantages to asexual reproduction, which are also disadvantages to sexual reproduction, should mean that the number of species with asexual reproduction should be more common.

However, multicellular organisms that exclusively depend on asexual reproduction are exceedingly rare. Why is sexual reproduction so common? This is one of the important questions in biology and has been the focus of much research from the latter half of the twentieth century until now. A likely explanation is that the variation that sexual reproduction creates among offspring is very important to the survival and reproduction of those offspring. The only source of variation in asexual organisms is mutation. This is the ultimate source of variation in sexual organisms. In addition, those different mutations are continually reshuffled from one generation to the next when different parents combine their unique genomes, and the genes are mixed into different combinations by the process of meiosis. Meiosis is the division of the contents of the nucleus that divides the chromosomes among gametes. Variation is introduced during meiosis, as well as when the gametes combine in fertilization.

*Source: Concepts of Biology-1st Canadian Edition by Charles Molnar and Jane, 2013 Rice University*

## B. Reading Comprehension

Answer these question below

1. There are three paragraphs in the text. Identify the main idea in each paragraph.
   b. Paragraph 1…….
   c. Paragraph 2…….
   d. Paragraph 3…….
2. What is sexual reproduction ?
3. What is multicellular organisms ?
4. What is conclusion of the paragraph ?
5. Which event leads to a diploid cell in a life cycle?
6. Describe the two events that are common to all sexually reproducing organisms and how they fit into the different life cycles of those organisms
7. What is a likely evolutionary advantage of sexual reproduction over asexual reproduction?

## C. Check your vocabulary

1. The vast majority of eukaryotic organisms can or must employ some form of meiosis and fertilization to reproduce. What is meant by *employ* ?
2. Sexual reproduction was an early evolutionary innovation after the appearance of eukaryotic cells. What is meant by *appearance* ?

3. The fact that most eukaryotes reproduce sexually is evidence of its evolutionary success. What is meant by *evidence* ?
4. Indeed, some organisms that lead a solitary lifestyle have retained the ability to reproduce asexually. What is meant by *asexually* ?
5. This means that in competition, the asexual population would have the advantage. All of these advantages to asexual reproduction, which are also disadvantages to sexual reproduction, should mean that the number of species with asexual reproduction should be more common. What is meant by *common ?*

## D. Grammar focus

### COMPARISON DEGREE

### a. Positive Degree ( Se )

Positive degree adalah bentuk tingkat perbandingan yang mempunyai arti sepadan atau tidak sepadan misalnya —sebanyak, secantik, sekaya, sepintar, seputih dll‖.

Ada dua bentuk kalimat positive degree yaitu bentuk positive degree untuk kalimat positive dan negative.

Formula untuk kalimat positiv.

**As + adj/adv + as**

Example:

Mr. Faiz is **as handsome as** Mr. Amin. ( Tuan Fais -Se‖ ganteng tuan Amin)

As +adjective +as

Kalimat di atas merupakan gabungan dari 2 kalimat yaitu Mr. Faiz is handsome dan Mr. Amin is handsome.

Formula untuk kalimat negativ:

**So + adj/adv + as**

Example :

My book is not **so expensive as** your book

So + Adjective + as

**b. Comparative Degree**

Bentuk perbandingan ini adalah bentuk kalimat yang membandingkan 2 hal yang bermakna lebih dari, misalnya – ida lebih pintar dari pada siska‖.

Formula :

1. Adj + er + than ( satu suku kata atau syllable)

   She works clever**er** than her brother ( dia bekerja lebih rajin dari pada kakaknya)

   Adj + er + than

Untuk kata yang terdiri dari satu syllable atau satu suku kata cukup ditambahkan —er‖ di belakang kata sifat. Contoh kata yang mempunyai satu suku kata diantaranya -hard, clever, smart dll‖. Namun ada pengecualian untuk kata -good‖, jika dalam kalimat comparative degree ada kata -good‖ maka akan berubah menjadi —better‖ yang artinya —lebih baik atau lebih bagus‖. Contoh kalimatnya he is better than my brother ( dia lebih baik dari pada kakaku)

2. More + Adj + than (dua suku kata atau lebih)

He is more dilligent than his sister (dia lebih rajin dari pada kakaknya)

More + Adj + than

Untuk kata yang terdiri dari dua suku kata atau lebih maka ditambahkan —more‖ di depan adjective seperti contoh di atas.

**c. Superlative Degree**

Superlative degree adalah bentuk kalimat yang digunakan untuk membandingkan satu diantara banyak yang bermakna —Paling.

Misalnya Rossa adalah murid yang paling malas di kelas.

Formula:

1. Adj + est (satu suku kata)

   He is the smart**est** student in the class ( dia murid yang paling cerdas di kelasnya)

   He is the smartest student of all his class ( dia murid yang paling cerdas diantara teman-temanya)

   Dalam superlative degree untuk satu suku kata cukup ditambahkan —est‖ setelah kata sifat.

2. Most + adj

   She is the most beautiful girl in city ( dia gadis yang paling cantik di kotanya)

   She is Jhon's best Friends ( dia teman terbaiknya jhon.) dalam superlative degree kata —good‖ berubah menjadi —Best‖ yang artinya -terbaik‖.

**d. Special Pattern ( pola khusus)**

Ada pola khusus dalam kalimat perbandingan, yaitu membandingkan 2 hal tetapi bermakna superlative (paling).

Formula:

**Of the two + Noun Plural S + V + the + Comparative**

Example :

Diantara 2 murid andi yang paling pintar

Of the two student**s** Andi is the cleverer

Of the two + Noun Plural + S + V + the + comparative

**e. Double Comparison**

1. Gradual Comparison

   Formula :

   S + V + O + Comparative and Comparative

   Example :

   Metro gets hotter and hotter ( metro semakin lama semakin panas)

2. Paralell Comparison

   Formula :

   The Comparison + S + V + O, the comparative + S + V + O

   Example :

   The more vocabularies she memorizes, the more easily she forgets it.

(semakin banyak kosa kata yang dia hafal, semakin mudah melupakannya).

## Perubahan Bentuk pada Comparative Degree (Adjective)

### Regular Form

*Adjective* mengalami perubahan bentuk ketika digunakan sebagai perbandingan. Pada *regular form,* perubahan bentuk kata sifat ini mengikuti pola tertentu. Berikut penjelasan dan contoh kalimat *comparative degree* pada *regular adjective*.

| Aturan dan Contoh | Contoh Kalimat Comparative Degree |
|---|---|
| **One syllable (satu suku kata)** | |
| *Adjective* yang terdiri dari satu suku kata ditambahkan suffix (akhiran) – *er.* Biasanya terjadi *double* huruf *consonant* diujung | I am **easier** to forget a problem than she is. (Saya lebih mudah |
| kata pada kata yang berpola huruf diujung: consonant-vocal- | melupakan suatu masalah daripada dia.) |

| | |
|---|---|
| consonant. *Contoh:*<br>a. big-bigger<br>b. fat-fatter<br>c. hard-harder<br>d. hot-hotter<br>e. smart-smarter<br>f. quick-quicker | |
| | The student<br>is **quicker** to learn English than her friend.<br>(Siswa tersebut lebih cepat belajar bahasa Inggris daripada temannya.) |
| Namun jika *adjective* berasal dari *past participle*, lebih sering digunakan kata *more* (lebih banyak) atau *less* (lebih sedikit) didepan *adjective* tersebut.<br>*Contoh:*<br>a. bored-more bored,<br>b. tired-more tired | The worker seemed **more tired** than the other.<br>(Pekerja tersebut tampak lebih lelah dari yang lain.) |

| **More than one syllable (lebih dari satu suku kata)** | |
|---|---|
| *Adjective* yang lebih dari satu suku | This park |
| kata, ditambahkan kata *more* atau didepannya.<br>*Contoh:*<br>a. beautiful-more beautiful<br>b. delicious-more delicious<br>c. dilligent-more dilligent<br>d. playful-more playful | looks **more beautiful** than the other park. (Taman ini tampak<br>lebih cantik daripada taman yang lain.) |
| | He's **more interested** in gardening than I am.<br>(Dia lebih tertarik berkebun daripada saya.) |
| | The topic is **more interesting** than the last one.<br>(Topik tersebut lebih menarik dari topik sebelumnya.) |
| Pada two syllables yang ber-*ending* -y, huruf -y‖ tersebut direduksi kemudian | Today<br>is **cloudier** than |

| | |
|---|---|
| kata, ditambahkan kata *more* atau didepannya.<br>*Contoh:*<br>e. beautiful-more beautiful<br>f. delicious-more delicious<br>g. dilligent-more dilligent<br>h. playful-more playful | looks **more beautiful** than the other park. (Taman ini tampak<br>lebih cantik daripada taman yang lain.) |
| | He's **more interested**<br>in gardening than I am.<br>(Dia lebih tertarik<br>berkebun daripada saya.) |
| Pada two syllables yang ber-*ending* -y, huruf -y‖ tersebut direduksi kemudian | Today<br>is **cloudier** than |
| ditambahkan *suffix –ier*. | yesterday |
| *Contoh:* | (Hari ini lebih |
| a. cloudy-cloudier | mendung dari |
| b. easy-easier | kemarin.) |
| c. happy-happier | |
| d. lucky-luckier | This dress |
| e. pretty-prettier | is **prettier** than that |
| f. tidy-tidier | one. |
| | (Gaun ini lebih |

| | |
|---|---|
| | cantik dari yang itu.) |
| Beberapa *adjective* dapat dibentuk | Your design |
| dengan menambakan *suffix* -*er*. | is **simpler** than his |
| *Contoh:* | design. |
| a. clever-cleverer | (Desainmu lebih |
| b. narrow-narrower | sederhana dari |
| c. simple-simpler | desainnya.) |

**Irregular Form**

Beberapa *adjective* yang memiliki bentuk *irregular.* Berikut contoh *comparative degree* pada *irregular adjective*.

| Positive | Comparative | Superlative |
|---|---|---|
| Bad | **Worse** | Worst |
| Far | **Further** | Furthest |
| Good | **Better** | best |
| Little | **Less** | least |
| many, much, some | **More** | most |

**Exercise:**

Ubahlah kalimat di bawah ini ke dalam bahasa Inggris sesuai dengan bentuk kalimatnya.

1. Farhat Abbas tidak sekaya Nia Daniati
2. Kulitnya selembut kapas

3. Avanza lebih cepat dari pada ayla
4. Ular itu sangat berbahaya diantara binatang lainya
5. Dia bernyanyi sangat jelek sekali diantara teman-temanya.
6. Diantara dua pegawai, Ani yang paling malas
7. Sinta semakin lama semakin cantik
8. Semakin lama mereka bersama, semakin besar cinta mereka.

An English adjective has three forms – positive, comparative and superlative.

Complete the following sentences using the appropriate form of the adjective.

1. She is .....than her sister.
    a) pretty
    b) prettier
    c) prettiest
2. Martha is a..... girl.
    a) nice
    b) nicer
    c) nicest
3. Supriya is the.....girl in the class.
    a) intelligent
    b) more intelligent
    c) most intelligent
4. Martin speaks English .....

a) well

b) better

c) best

5. Russia is the .....country in the world.

a) big

b) bigger

c) biggest

6. China is a..... country.

a) big

b) bigger

c) biggest

7. China is .....than India.

a) big

b) bigger

c) biggest

8. This is the..... book I have ever read.

a) interesting

b) more interesting

c) most interesting

9. I am ..... than you.

a) smart

b) smarter

c) smartest

10. Take the ..... of the two routes.

a) short

b). shorter
C). shortest

Complete the following sentences.

1. No other boy is as ..... as James. (tall / taller / tallest)
2. Milk is .....than any other food. (nourishing / more nourishing / most nourishing)
3. Radium is one of the ..... metals. (valuable / more valuable / most valuable)
4. Few English poets were as ..... as Wordsworth. (great / greater / greatest)
5. Shimla is .....than most other hill stations in India. (famous / more famous / most famous)
6. Gold is one of the ..... metals. (precious / more precious / most precious)
7. Solomon was .....than any other king. (wise / wiser / wisest)
8. Few historians write as ..... as Macaulay. (well / better /best)
9. Very few books are as .....as David Copperfield. (popular / more popular / most popular)
10. A train is ..... than a car. (fast / faster / fastest)

## Glossary

**Anion** : a negative ion formed by gaining electrons

**atomic number** :the number of protons in an atom

**cation** : a positive ion formed by losing electrons

**chemical bond** : an interaction between two or more of the same or different elements that results in the formation of molecules

**covalent bond** : a type of strong bond between two or more of the same or different elements; forms when electrons are shared between elements

**electron** :a negatively charged particle that resides outside of the nucleus in the electron or bital;lacksfunctional mass and has a charge of –1

**electron transfer** :the movement of electrons from one element to another

**element** : one of 118 unique substances that cannot be broken down into smaller substances and retain the characteristic of that substance; each element has a specified number of protons and unique properties

**hydrogen bond :** a weak bond between partially positively charged hydrogen atoms and partially negatively charged elements or molecules

**ion** **:**an atom or compound that does not contain equal numbers of protons and electrons,and therefore has a net charge

**ionic bond** :a chemical bond that forms between ions of opposite charges

**isotope** :one or more forms of an element that have different numbers of neutrons

**mass number** :the number of protons plus neutrons in an atom

**matter** :anything that has mass and occupies space

**neutron** :a particle with no charge that resides in the nucleus of an atom; has a mass of 1

**nonpolar covalent bond**: a type of covalent bond that forms between atoms when electrons are shared equally between atoms, resulting in no regions with partial charges as in polar covalent bonds

**nucleus** :(chemistry) the dense center of an atom made up of protons and (except in the case of a hydrogen atom) neutrons

**octet rule** : states that the outermost shell of an element with a low atomic number can hold eight electrons

**periodic table of elements**: an organizational chart of elements, indicating the atomic number and mass number of each element; also provides key information about the properties of elements

**polar covalent bond**:a type of covalent bond in which electrons are pulled toward one atom and away from another, resulting in slightly positive and slightly negative charged regions of the molecule

**proton** :a positively charged particle that resides in the nucleus of an atom; has a mass of 1 and a charge of +1

**radioactive isotope**:an isotope that spontaneously emits particles or energy to form a more stable element

**van der Waals interaction:** a weak attraction or interaction between molecules caused by slightly positively charged or slightly negatively charged atoms

**microscope** : the instrument that magnifies an object

**unified cell theory** : the biological concept that states that all organisms are composed of one or more cells, the cell is the basic unit of life, and new cells arise from existing cells

**autotroph** : an organism capable of producing its own food.

**Chlorophyll** :the green pigment that captures the light energy that drives the reactions of photosynthesis

**Chloroplast** **:** the organelle where photosynthesis takes place

**Granum** : a stack of thylakoids located inside a chloroplast

**Heterotroph** : an organism that consumes other organisms for food light-dependentreaction:thefirststageofphotosynthesiswherevisiblelightisabsorbedtoformtwoenergycarrying molecules (ATP and NADPH)

**Mesophyll** **:** the middle layer of cells in a leaf

**Photoautotroph** : an organism capable of synthesizing it sown food molecules (storing energy),using the energy of light

**Pigment** : a molecule that is capable of absorbing light energy

**Stoma** : the opening that regulates gas exchange and water regulation between leaves and the environment; plural: stomata

**Stroma** : the fluid-filled space surrounding the grana inside a chloroplast where the Calvin cycle reactions of photosynthesis take place

**Thylakoid** : a disc-shaped membranous structure inside a chloroplast where the light-dependent reactions of photosynthesis take place using chlorophyll embedded in the membranes

**activation energy**:the amount of initial energy necessary for reactions to occur active site:a specific region on the enzyme where the substrate binds allosteric

**inhibition**: the mechanism for inhibiting enzyme action in which a regulatory molecule binds to a second site (not the active site) and initiates a conformation change in the active site, preventing binding with the substrate

**anabolic** : describes the pathway that requires a net energy input to synthesize complex molecules from simpler ones

**bioenergetics**: the concept of energy flow through living systems

**catabolic :** describes the path way in which complex molecules are broken down into simpler ones, yielding energy as an additional product of the reaction

**competitive inhibition**: a general mechanism of enzyme activity regulation in which a molecule other than the enzyme's substrate is able to bind the active site and prevent the substrate itself from binding, thus inhibiting the overall rate of reaction for the enzyme

**endergonic** : describes a chemical reaction that results in products that store more chemical potential energy than the reactants

**enzyme** : a molecule that catalyzes a biochemical reaction

**exergonic** : describes a chemical reaction that results in products with less chemical potential energy than the reactants, plus the release of free energy

**feedback inhibition**: a mechanism of enzyme activity regulation in which the product of a reaction or the final product of a series of sequential reactions inhibits an enzyme for an earlier step in the reaction series

**heat energy** : the energy transferred from one system to another that is not work

**kinetic energy**: the type of energy associated with objects in motion

**metabolism :** all the chemical reactions that take place inside cells, including those that use energy and those that release energy

**noncompetitive inhibition:** a general mechanism of enzyme activity regulation in which a regulatory molecule binds to a site other than the active site and prevents the active site from binding the substrate; thus, the inhibitor molecule does not compete with the substrate for the active site; allosteric inhibition is a form of noncompetitive inhibition

**potential energy** : the type of energy that refers to the potential to do work

**substrate** :a molecule on which the enzyme acts

**thermodynamics** : the science of the relationships between heat, energy, and work

**diploid** : describes a cell, nucleus, or organism containing two sets of chromosomes (2n)

**gamete** : a haploid reproductive cell or sex cell (sperm or egg) gene: the physical and functional **unit of heredity**; a sequence of DNA that codes for a specific peptide or RNA molecule

**genome** : the entire genetic complement (DNA) of an organism

**haploid** : describes a cell, nucleus, or organism containing one set of chromosomes (n)

**homologous chromosomes**: chromosomes of the same length with genes in the same **location;** diploid organisms have pairs of homologous chromosomes, and the members of each pair come from different parents

**locus** : the position of a gene on a chromosome

**alternation of generations** : a life-cycle type in which the diploid and haploid stages alternate

**diploid-dominant** : a life-cycle type in which the multicellular diploid stage is prevalent

**haploid-dominant** : a life-cycle type in which the multicellular haploid stage is prevalent

**gametophyte** : a multicellular haploid life-cycle stage that produces gametes

**germ cell :** a specialized cell that produces gametes, such as eggs or sperm

**life cycle** : the sequence of events in the development of an organism and the production of cells that produce offspring

**meiosis :** a nuclear division process that results in four haploid cells

**sporophyte** : a multicellular diploid life-cycle stage that produces spores

## DAFTAR PUSTAKA


Celce-Mucia, M. & Larsen-Freeman, D. *The Grammar Book: An ESL/EFL Teacher's Course (2nd Ed.),* United State of America:Heinle & Heinle,1999.

Charles Molnar and Jane. *Concepts of Biology-1st Canadian Edition*. Rice University. 2013

Frank, Marcella. *Modern English (Jilid I),* Jakarta: Penerbit Erlangga, 1990.

Hanafi, Tommy. *Pasti Cepat Bisa 16 Tenses*. Yogyakarta: Javalitera. 2011

Hidayatullah Agus dkk, Aljamil: AlQur'an dan Terjemah, Cipta Bagus Sagara. 2013

Kersti Börjars and Kate Burridge. *Introduction English Grammar*. London: Great Britain. 2010

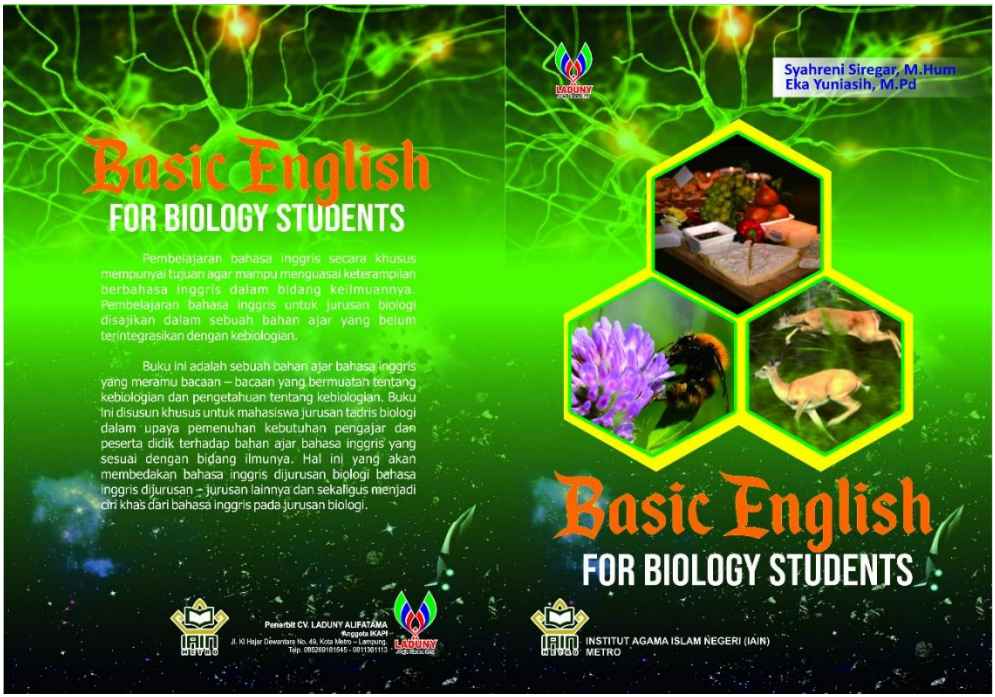
Mugijatna, Bathoro dkk. *Reading 1 Module*, Surakarta. 2006

_____. *Reading 2 Module*, Surakarta 2007

Murphy, Raymond. *Essential Grammar in Use (2nd Ed.),* Cambridge: Cambridge University Press, 1990.

Purnama, Puji. *Melahap 16 English Tenses Semudah Makan Fastfood*. Yogyakarta: New Diglossia. 2012

Thomson, A.J. & Martinent, A.V. *A Practical English Grammar (4th Ed.),* Oxford: Oxford University Press, 1986.


Basic English
FOR BIOLOGY STUDENTS
Pembelajaran bahasa inggris secara khusus mempunyai tujuan agar mampu menguasai keterampilan berbahasa inggris dalam bidang keilmuannya. Pembelajaran bahasa inggris untuk jurusan biologi disajikan dalam sebuah bahan ajar yang belum terintegrasikan dengan kebiologian.
Buku ini adalah sebuah bahan ajar bahasa inggris yang meramu bacaan – bacaan yang bermuatan tentang kebiologian dan pengetahuan tentang kebiologian. Buku ini disusun khusus untuk mahasiswa jurusan tadris biologi dalam upaya pemenuhan kebutuhan pengajar dan peserta didik terhadap bahan ajar bahasa inggris yang sesuai dengan bidang ilmunya. Hal ini yang akan membedakan bahasa inggris dijurusan biologi bahasa inggris dijurusan – jurusan lainnya dan sekaligus menjadi ciri khas dari bahasa inggris pada jurusan biologi.
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