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ABSTRACT

This self-study program for high-school level contains lessons on: Life Functions and Cells; Cell Structure; Tissues, Organs, Systems; Growth and Nutrition; and Metabolism. Each of the lessons concludes with a Mastery Test to be completed by the student. (DB)

PM 431 - 52

ADVANCED GENERAL EDUCATION PROGRAM

A HIGH SCHOOL SELF-STUDY PROGRAM

LIFE FUNCTIONS AND CELLS
LEVEL: II
UNIT: 7
LESSON: 1

U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION, JOB CORPS
NOVEMBER 1969

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You are now beginning the study of biology, the science of living things. Biologists study all living things in order to understand the various functions or activities of life. Biologists want to know how living things are created, how they grow and survive under changing conditions, how they create new living things, and how they react with other living and non-living things in the world.

You may ask yourself, "Why should I study biology?" or "Why is biology important to me?" There are many answers to these questions -- but there is one basic answer: By studying biology you will gain new knowledge about the structure and functions of your own body. You will learn about the various activities of your body which help you survive, grow, fight off disease, and live comfortably under changing environmental conditions. Biology is a science which helps to satisfy man's natural curiosity about the processes of life in his own body and in other living things. It is the science which is the foundation of all the medical sciences which are concerned with health.

Biology is the science of living things. How can we tell the difference between living things and non-living things? That may seem like an unnecessary question to you -- maybe even a silly one. After all, we all rely on our common sense to help us distinguish between living and non-living things. We all know that things such as people, cats, frogs and birds are alive; things such as tables, rocks, cars and ping-pong balls are not alive. With these things it is easy to tell which are living and which are not. But sometimes it is not so easy. For example, you have probably seen stale bread which has fuzzy greenish-blue patches on it. That greenish stuff is called a mold. Is it living or non-living? Is it something alive growing on the bread, or is it just chemical compounds coming out of the bread? In this case it is not so easy to tell the difference between living and non-living; you must have more information about what the mold looks like, and even more important, about what it does, before reaching any decision.

How do scientists distinguish between living and non-living things? Over the years biologists have discovered that living things perform certain functions which non-living things cannot perform. These functions, or activities, are found in all animals and plants, in things as large as a whale or as small as one-cell animals like germs which are so tiny that they can only be seen with the help of a microscope.

What kinds of activities are represented in these life functions which are found only in living things? To begin with, all living things take food into their bodies and break the food down into simpler chemical compounds. Some of these chemical compounds are absorbed into the body and are combined with parts of the body. This allows the body to grow new tissue or repair worn-out tissue. Other compounds from the digested foodstuffs are combined with oxygen which is taken into the body and react chemically to provide energy for all of the body's activities. All living things get rid of harmful waste products resulting from chemical reactions in the body. To regulate all their activities, all organisms produce fluids which influence and control the many chemical reactions in their bodies. All living things produce other living things like themselves. Every living thing shows all of these life functions. No non-living thing shows all of them.

The activities just described are some of a larger set of life functions which you will learn about in your study of biology. In the following sections you will learn about each of the life functions and the interaction between them, in detail. You will gain useful and interesting information about the world of all living things.

Time completed _____

1. PREVIEW FRAME You are now beginning your first lesson in biology, the science of all living things. In this lesson you will learn about what living things do. You will learn about functions that are performed by all living things. NO RESPONSE REQUIRED	GO ON TO THE NEXT FRAME
2. You already know one important fact about biology: it is the science of <u>all</u> living things. Which of the following are living things? ☐ animals ☐ plants ☐ rocks	animals plants
3. The science of biology includes the study of all plants and animals. All plants and animals: ☐ are living things ☐ are not living things Biology is the science of ☐ living things ☐ non-living things Are there any living things other than plants and animals? ☐ no ☐ yes	are living things living things no

4. Any living thing is an <u>organism</u>. Which of the following are organisms? ☐ animals and plants ☐ animals only ☐ plants only	animals and plants
5. All living things are: ☐ either animals or plants ☐ either animals, plants, or other things All living things: ☐ are called organisms ☐ are not called organisms All organisms: ☐ are living things ☐ are not living things	either animals or plants are called organisms are living things

6. CHECK the phrase(s) which correctly complete(s) the following sentence. Biology is the science of: ☐ animals only ☐ living things ☐ non-living things ☐ plants and animals ☐ plants only CHECK the correct statement(s). ☐ All living things are organisms. ☐ All plants and animals are organisms. ☐ Only animals are organisms. ☐ Only plants are organisms.	living things plants and animals All living things. . . All plants and . . .
7. PREVIEW FRAME Biology is the science of all living things. An important part of this science is the study of the acitivities, or functions, which are performed by all living things. In the following section you will learn about the important life functions which biologists have discovered in all organisms. We will begin by considering those functions of organisms which involve getting and using food for nourishment. NO RESPONSE REQUIRED	GO ON TO THE NEXT FRAME

8. All organisms take in food. An oak tree takes in food through its roots. A human being eats. He takes in food: ☐ through his mouth ☐ through his skin Different organisms have: ☐ different ways of taking in food ☐ the same ways of taking in food The activity of taking in food is a function performed by: ☐ all living things ☐ only some living things	through his mouth different ways of . . . all living things
9. All living things perform the function of taking in food. This function is called <u>ingestion</u>. Do animals take in food? ☐ no ☐ yes Do plants ingest food? ☐ no ☐ yes The function of ingestion is performed by: ☐ animals and plants ☐ animals only ☐ plants only	yes yes animals and plants

10. Is ingestion the function of taking in food? ☐ no ☐ yes Ingestion is a function performed by: ☐ all organisms ☐ only some organisms	 yes all organisms
11. When an organism ingests food, the food is composed mostly of chemical compounds made up of many large molecules. Many of these molecules are too large to pass into all parts of the organism and therefore, cannot be used by the organism in their original form. Before it can be used by all parts of the organism, the food. ☐ must be changed into more complex compounds with larger molecules ☐ must be changed into simpler compounds with smaller molecules	 . . .changed into simpler. . .
12. Each organism performs the function of changing ingested food to simpler chemical compounds which can be used by all parts of that organism. The function of changing ingested food to simpler compounds is performed by: ☐ animals only ☐ all living things ☐ plants and animals ☐ plants only	 all living things plants and animals

13. Digestion is the scientific term for the process of changing ingested food into simpler compounds which can be used by all parts of an organism. Food that has been ingested: ☐ can be used before it has been digested ☐ cannot be used until after it has been digested	cannot be used. . .
14. Do all organisms perform the function of digestion? ☐ no ☐ yes	yes
Digestion refers to: ☐ changing ingested food into simpler compounds	changing. . . simpler. . .
☐ changing ingested food into more complex compounds	
☐ taking in food	
Food which has not been digested cannot be used by an organism because it: ☐ can pass into all parts of the organism ☐ cannot pass into all parts of the organism	cannot pass . . .
Which occurs first? ☐ digestion ☐ ingestion	ingestion

15. In order for food to be used by an organism it must first be ingested, then digested, and then carried to all parts of the organism. Digestion changes food into simpler chemical compounds which are dissolved in fluids. The chemical compounds which result from the process of digestion are usually in the form of: ☐ liquids ☐ solids	liquids
16. Digested foods are always in liquid form. In order for an organism to make use of the liquid digested foods, the liquids: ☐ must be expelled from the organisms ☐ must pass into all parts of the organisms	must pass into . . .

17. In order to make use of digested foods in liquid form, the liquids must pass into all parts of an organism. In most organisms the function of digestion occurs in one part of the organism. The digested foods in liquid form are first concentrated in that part. Then the liquids are soaked up by other parts, the way water is soaked up by a dry sponge. The process of soaking up digested foods in liquid form: ☐ helps to concentrate food in one part of an organism ☐ helps to distribute digested foods to all parts of an organism	helps to distribute . . .
18. In all organisms liquid foods are soaked up in ways: ☐ different from the way water is soaked up by a sponge ☐ similar to the way water is soaked up by a sponge The process of soaking up liquids is called <u>absorption</u>. The function of <u>absorption</u> helps to distribute digested foods through all parts of an organism. The function of absorption is performed by: ☐ all living things ☐ only some living things	similar to the way . . . all living things

19. MATCH the following to indicate the correct description for each term. A. absorption B. digestion C. ingestion 1. _____ conversion of food into simpler compounds 2. _____ soaking up digested foods in liquid form 3. _____ taking in food	1. B 2. A 3. C
20. Some of the digested food that is absorbed by an organism is changed chemically and becomes part of the organism itself. You could guess that this function of converting absorbed food into part of the organism itself: ☐ is the basis of growth in all organisms ☐ is not the basis of growth in all organisms	is the basis . . .
21. The function of converting absorbed food into parts of the organism is the basis of growth in all organisms. The scientific term for this function is <u>assimilation</u>. The function of assimilation involves the conversion of: ☐ digested food into parts of an organism ☐ digested and undigested food into parts of an organism	digested food. . .

22. The function of <u>assimilation</u> is performed by all organisms. The function of assimilation is best described as: ☐ the conversion of absorbed food into part of the organism itself ☐ the conversion of undigested food into simpler chemical compounds ☐ the taking in of raw food by the organism	. . .of absorbed food. . .
23. absorption assimilation digestion ingestion COMPLETE the sentences below. CHOOSE the correct word from the list above. A word may be used more than once. All organisms perform a function which involves taking in food. The name of that function is _____. Digested food is converted into parts of the organism itself by the process of _____. Food which has been digested is soaked up by all parts of an organism. This function is called _____. The function of converting food into simpler chemical compounds is called _____. The function which is the basis of growth in all living things is _____.	ingestion assimilation absorption digestion assimilation

24.

In the preceding frames you learned that some of the digested food which an organism absorbs is <u>assimilated</u>.

That means the food:

- ☐ becomes part of the organism
- ☐ is broken down into simpler compounds
- ☐ is digested

becomes part . . .

Another part of the food is used up in chemical reactions in the organism. These chemical reactions produce heat and energy. Organisms use energy when they move and when they perform all the life functions.

The chemical reactions which produce energy for an organism involve:

- ☐ digested food
- ☐ undigested food

digested food

25.

In all organisms part of the digested food is absorbed and used in chemical reactions which produce energy.

In nearly all living things oxygen is also used in the chemical reactions which produce energy. The organism gets the oxygen from the oxygen which is part of the air or from the oxygen which is dissolved in water.

In nearly all living things the production of energy depends on chemical reactions which use:

- ☐ absorbed food and oxygen
- ☐ absorbed food only
- ☐ oxygen only

absorbed food and oxygen

Plants get oxygen from the air (through their leaves) and from the water (through their roots).

Human beings get the oxygen they need:

- ☐ from the air
- ☑ from the water

from the air

Fish get the oxygen they need:

- ☐ from the air
- ☐ from the water

from the water

26.

FOOTNOTE FRAME

There are some simple animal and plant organisms, like certain disease germs, which only use absorbed food in reactions which produce energy. These organisms do not use oxygen. They are called anaerobic organisms.

The very great majority of organisms do need oxygen for reactions which produce energy. In this course we shall not learn about anaerobic organisms.

NO RESPONSE REQUIRED

GO ON TO THE NEXT FRAME

27.

Respiration is the function of taking in oxygen and combining it with absorbed food in reactions which produce energy.

Organisms which use oxygen get it:

- ☐ by producing it from other elements
- ☐ from the air or from the water

from the air. . .

28.

MATCH the following.

A. absorption

B. assimilation

C. digestion

D. ingestion

E. respiration

1. _____ conversion of food into parts of the organism

2. _____ conversion of raw food into simpler compounds

3. _____ soaking up of digested food in liquid form

4. _____ use of digested food and oxygen in chemical reactions which produce energy

1. B

2. C

3. A

4. E

29.

Organisms often cannot use all the food which they take in. Usually part of the food is indigestible; the organism cannot change it into simpler chemical compounds which can be absorbed.

Indigestible food and certain chemicals which result from chemical reactions in an organism are waste products.

If wastes are allowed to accumulate they can become poisonous and dangerous to the organism. All organisms have ways of getting rid of wastes.

Indigestible food and many products of reactions in the organism are wastes that:

- ☐ are absorbed by the organism
- ☐ are eliminated from the organism
- ☐ remain in the organism

are eliminated. . .

30.

All organisms perform the function of <u>excretion</u>, which is the function of eliminating wastes.

Excretion is the function of eliminating:

- ☐ digested food and chemical products which can be used by the organism
- ☐ indigestible food and chemicals that cannot be used by the organism

indigestible food and . . .

31.

absorption
assimilation
digestion
excretion
respiration

CHOOSE the correct words from the list above to COMPLETE the sentences below.

The function of converting absorbed food into part of the organism is called _____. assimilation

Oxygen is taken in and reacts with absorbed food to produce energy. This describes the function of _____. respiration

The function which involves the elimination of wastes from the organism is called _____. excretion

32.

All of the life functions which you have studied are complicated activities which occur in any organism.

Each function depends on other functions. For example, digestion cannot begin until the organism has performed the function of ingestion.

The function of respiration must go on all the time unlike the functions of ingestion and digestion. However, the function of respiration cannot occur if the organism runs out of the compounds which are used in the chemical reactions which produce energy.

You can guess then, that the functions of ingestion, digestion, and absorption:

- ☐ are essential for the function of respiration
- ☐ are not essential for the function of respiration

are essential . . .

33.

In order to make sure that the various life functions work together to maintain the organism, each organism makes special chemicals which control the activities of each of the life functions.

For example, each organism produces chemicals which "turn on" and "turn off" the function of digestion. Those chemicals also control the speed of digestive processes.

Here is another example: the function of respiration occurs at all times. But at certain times an organism needs more energy than at other times. A man needs more energy when he runs to catch a bus than when he walks to catch a bus. When a man runs to catch a bus certain chemicals are released in his body. These chemicals speed up the production of energy in the man's body.

The function of producing special chemicals to control all the life functions is called <u>secretion</u>.

The special chemicals resulting from the function of secretion:

- ☐ do not help to regulate the function of respiration
- ☐ do help to regulate the function of respiration

do help to regulate . . .

34.

The function of secretion is performed by all living things.

<u>Secretion</u> is the function of producing:

- ☐ chemicals which control all life functions
- ☐ chemicals which control only the digestive processes
- ☐ wastes

. . .control all life functions

35.

respiration
absorption
assimilation
excretion
ingestion
secretion

MATCH each description of a life function given below with the correct name from the list above and WRITE the name in the blank next to the description.

_____ taking in oxygen and using it to produce energy	respiration
_____ producing chemicals to control all the life functions	secretion
_____ eliminating waste products from the body	excretion

36.

PREVIEW FRAME

The functions which we have studied serve to provide each organism with material and energy with which to maintain itself and grow.

There are other functions which help each organism to survive. These functions allow each organism to get information about things going on around it. These functions also provide each organism with the ability to react to its environment.

NO RESPONSE REQUIRED

GO ON TO THE NEXT FRAME

37.

All organisms, no matter how small or simple they are, have some ways of sensing changes in the environment around them.

Human beings, and other animals, like cats, dogs and horses, can see light, hear sounds, and smell odors. All these activities

- ☐ are ways of sensing changes in the environment
- ☐ are not ways of sensing changes in the environment

are ways of sensing. . .

Can plants see?

- ☐ no
- ☐ yes

no

Can plants hear?

- ☐ no
- ☐ yes

no

Can plants smell?

- ☐ no
- ☐ yes

no

The flowers of many plants open in the light and close in the dark.

This example shows that plants:

- ☐ do have ways of sensing changes in the environment
- ☐ do not have ways of sensing changes in the environment

do have ways . . .

38.

Different organisms have different ways of sensing what is going on around them.

The ability to sense changes in the environment is called <u>irritability</u>.

Which of the following statements gives an example of irritability in an organism?

- ☐ A baby sees a bright red rattle and reaches out for it. — A baby sees a bright. . .
- ☐ A cow digests and absorbs food. Part of the absorbed food is converted to milk.
- ☐ A human breathes in air and uses oxygen to produce energy.
- ☐ A hunting dog smells the scent of a deer and chases after it. — A hunting dog smells . . .
- ☐ The leaves of a plant slowly turn to face the sun, as the sun changes its position in the sky. — The leaves of a . . .

39.

<u>Irritability</u> is the ability:

- ☐ of all organisms to get information about what is going on around them — of all organisms. . .information.
- ☐ of all organisms to change what is going on around them
- ☐ of only some organisms to sense changes in their environment

40.

In the previous frames you learned that all organisms have the ability to sense changes in the world around them. This sensing function of all organisms is called irritability.

In all organisms there are certain parts that are best suited to sense changes in the environment.

For example, what part of the human organism is best suited for sensing light?

- ☐ the brain
- ☐ the ear
- ☐ the eye
- ☐ the nose

the eye

What part of a bird is best suited for sensing sound?

- ☐ the brain
- ☐ the ear
- ☐ the eye
- ☐ the nose

the ear

41.

When an organism gets information by sensing with one of its special parts, that information is transferred to other parts of the organism.

For example, you see a hot apple pie and your mouth begins to water. You see the apple pie:

- ☐ with your mouth
- ☐ with your eyes

with your eyes

When your mouth waters, it shows that information about the apple pie:

- ☐ was not transferred from your eyes to your mouth
- ☐ was transferred from your eyes to your mouth

was transferred. . .

42. Think of another example: A baby touches a hot stove with his finger tips. He quickly pulls his arm away. The baby sensed the heat from the stove: ☐ with his finger tips ☐ with the muscles of his arm The baby used the muscles in his arm to pull his arm and hand away from the heat. Did the muscles in the baby's arm sense the heat? ☐ no ☐ yes Was information about the heat transferred from the baby's finger tips to the muscles in his arms? ☐ no ☐ yes	with his finger tips no yes
43. All organisms perform a function by which information is transferred from one part of an organism to other parts. This function is called <u>conduction</u>. <u>Conduction</u> is a function of: ☐ all living things ☐ only some living things ☐ plants and animals ☐ plants only	all living things plants and animals

44. The function of conduction is found in all living things. Conduction is the function of: ☐ sensing changes in the environment ☐ transferring information from one part of an organism to other parts	transferring information. . .
45. You have learned that all organisms can sense changes in the environment. In addition, all organisms have ways of reacting to their environments. A baby touches a hot stove, and pulls his hand away quickly. A flower that is closed at night opens its petals when the sun strikes it. A man sees a coiled rattlesnake. The man freezes in his tracks. His heart beats rapidly. Movement is involved in the reactions of: ☐ the baby and the man ☐ the baby only ☐ the baby, the man and the flower	the baby, the man. . .
46. All living things move. All living things can make some of their parts shorter or longer. These processes of making parts shorter or longer allow all organisms to move. A baby moves his arm and hand away from a hot stove. Which parts of the baby got shorter or longer? ☐ the bones in the baby's arm ☐ the muscles in the baby's arm	the muscles in . . .

47. The function which allows all organisms to move by making some of their parts shorter or longer is called <u>contraction</u>. A man talks. Are parts of the man moving? ☐ no ☐ yes Is the function of contraction involved? ☐ no ☐ yes The petals of a flower close at night. Are parts of the flower moving? ☐ no ☐ yes Is the function of contraction involved? ☐ no ☐ yes	yes yes yes yes
48. The function of contraction: ☐ is not the basis for movement in all organisms ☐ is the basis for movement in all organisms The function of contraction involves: ☐ change in the size of parts of an organism ☐ no change in the size of parts of an organism	is the basis for . . . change in the size . . .

49.

All the functions that you have studied have been important because they help individual organisms to survive.

There is one other activity of all living things that is not absolutely necessary for the survival of the individual organism. This is the activity of all living things by which they produce other living things like themselves.

Which of the following sentences are examples of living things producing other living things like themselves?

- ☐ A dog gives birth to puppies.
- ☐ A cow produces milk.
- ☐ A fish lays eggs which grow into little fish.
- ☐ A rock is split into two rocks by a tree growing through it.
- ☐ A seed from an apple is planted and grows into an apple tree.

A dog gives. . . .

A fish lays eggs. . . .

A seed from an . . . .

50.

The function of all living things by which they produce other living things is called <u>reproduction</u>.

The ways in which organisms reproduce:

- ☐ are different for different organisms
- ☐ are the same for all organisms

are different . . .

51.

conduction
contraction
irritability
reproduction

MATCH each description of a life function given below with the correct name from the list above.

WRITE the name in the blank next to the description.

The ability to sense changes in the environment _____ . irritability

The processes by which living things produce other living things like themselves _____. reproduction

The processes by which organisms shorten or lengthen some of their parts, thus providing movement _____. contraction

The function of transferring information from one part of an organism to other parts _____. conduction

52.

CHECK the names of the life functions in the list of words below.

- ☐ absorption
- ☐ assimilation
- ☐ conduction
- ☐ contraction
- ☐ digestion
- ☐ excretion
- ☐ ingestion
- ☐ irritability
- ☐ reproduction
- ☐ respiration
- ☐ secretion

absorption
assimilation
conduction
contraction
digestion
excretion
ingestion
irritability
reproduction
respiration
secretion

COUNT the life functions. How many are there?

11

All of the life functions are found:

- ☐ in all organisms
- ☐ only in animals
- ☐ only in plants

in all organisms

Each living thing performs:

- ☐ all of the life functions
- ☐ only some of the life functions

all of the life functions

53.

PREVIEW FRAME

In the previous section you learned about the life functions that are performed by all organisms.

In this section you will learn that all living things are composed of certain parts which perform the same functions in all organisms.

NO RESPONSE REQUIRED

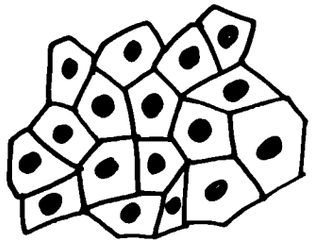
GO ON TO THE NEXT FRAME

54. A brick building is made up of many parts, like the foundation, and the walls. The basic part of the brick building is: ☐ the brick ☐ the wall In a brick building, are there longer parts than the basic part? ☐ no ☐ yes Can you break the basic part into smaller pieces? ☐ no ☐ yes	the brick yes yes
55. The brick is the basic part of the brick building. The brick can be broken down into smaller pieces, but those pieces cannot serve the same purpose that a whole brick can as a basic part of the building. All organisms are composed of very small parts. These parts are usually so small that we can only see them by using a microscope. The very small parts of which all organisms are composed are like bricks in a building. They are the basic parts of all living things. You would guess, then, that if these basic parts of organisms were broken down into smaller pieces, the smaller pieces: ☐ would be able to perform all the functions performed by the basic part ☐ would not be able to perform all the functions performed by the basic part	would not be able. . .

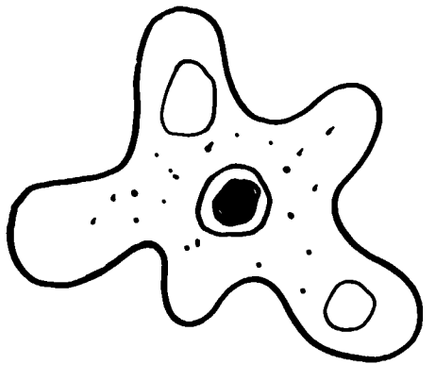
56. The small parts of which all organisms are composed are called <u>cells.</u> The cell is the basic part of all organisms, the way the brick is the basic part of a brick building. Do organisms have parts which are larger than cells? ☐ no ☐ yes Cells are composed of many different molecules. Which is larger? ☐ a cell ☐ molecules in a cell Cells: ☐ can be broken down into smaller parts ☐ cannot be broken down into smaller parts	yes a cell can be broken . . .
57. The cell is like a brick in a brick building. When the brick is broken down into smaller parts, those parts cannot serve the same purpose as the brick. A cell can be broken down into smaller parts. The parts of a cell: ☐ can serve the same purpose as the whole cell ☐ cannot serve the same purpose as the whole cell The cell is: ☐ the basic part of all organisms ☐ the smallest part of all organisms	cannot serve the same . . . the basic part . . .

PANEL I

A.



B.



58.

REFER TO PANEL 1.

If we look at the small pieces of most organisms under a microscope, we find that the organism is composed of collections of cells. These organisms are called multicellular organisms.

Some small organisms, both plants and animals, are composed of only one cell. These organisms are called unicellular organisms.

Which drawing in Panel 1 shows a unicellular organism?

- ☐ A
- ☐ B

B

Do multicellular organisms have parts which are smaller than the cell?

- ☐ no
- ☐ yes

yes

Do unicellular organisms have parts which are smaller than the cell?

- ☐ no
- ☐ yes

yes

The cell:

- ☐ is not the basic part of all organisms
- ☐ is the basic part of all organisms

is the basic part . . .

59.

A unicellular organism is made up of:

- ☐ less than one cell
- ☐ more than one cell
- ☐ one cell only

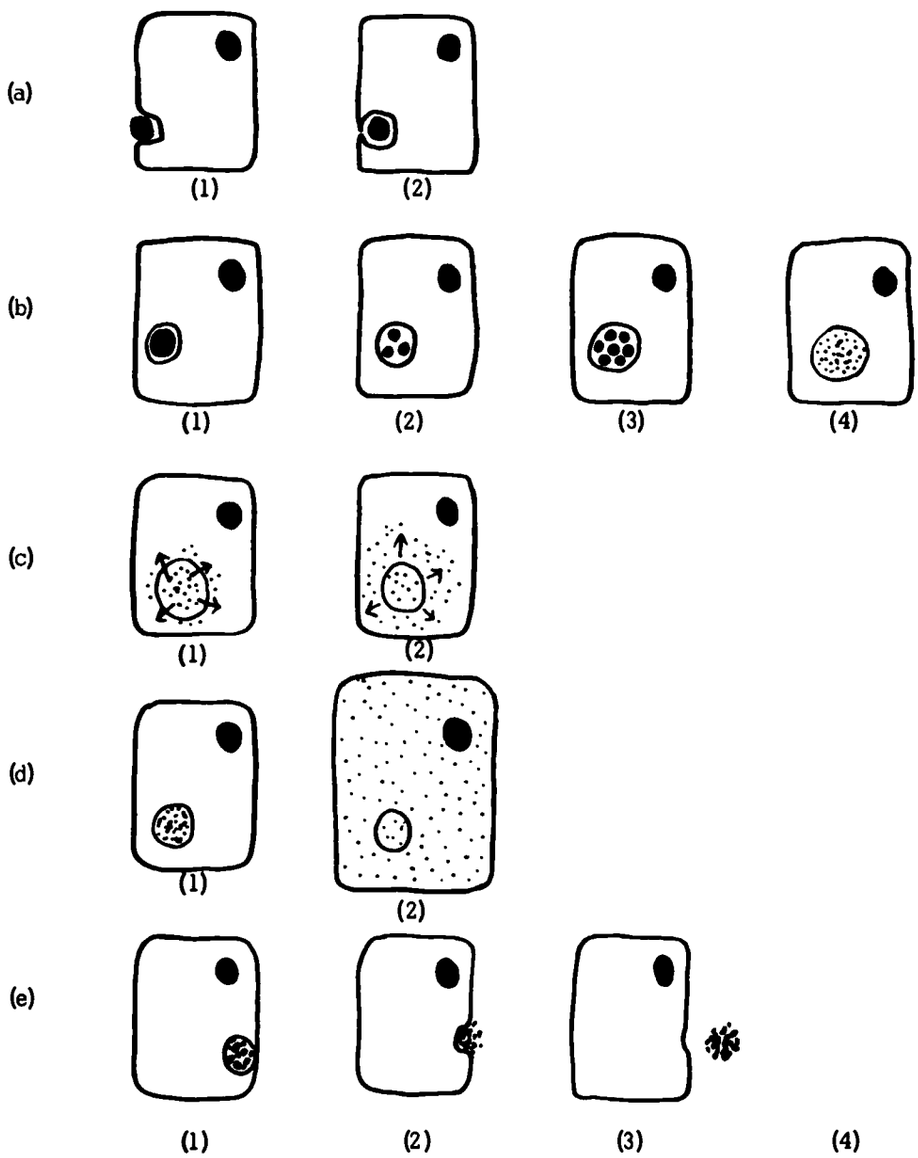
one cell only

A multicellular organism is made up of:

- ☐ less than one cell
- ☐ more than one cell
- ☐ one cell only

more than one cell

PANEL 2



60. PREVIEW FRAME You have learned that there are certain functions, called the life functions, which are performed by all living things. Now you will learn about the functions performed by the cells of all organisms. NO RESPONSE REQUIRED	GO ON TO THE NEXT FRAME
61. REFER TO PANEL 2. The drawings in Panel 2 illustrate the functions found in the cells of <u>all</u> organisms. In (a) the cell is: ☐ eliminating ☐ taking in food In (a) the cell is performing the function of: ☐ digestion ☐ excretion ☐ ingestion In (b) we see a cell breaking food down into simpler compounds. This function is called: ☐ digestion ☐ excretion ☐ ingestion The drawing in (c) shows a cell soaking up liquid foods to be used in the cell. This is an example of: ☐ absorption ☐ digestion ☐ ingestion	taking in food ingestion digestion absorption

62.

REFER TO PANEL 2.

In (d) we see a cell before, (1), and after, (2), it has absorbed digested food and converted it into part of the cell itself.

The cell in (2) is:

- ☐ larger than the cell in (1)
- ☐ smaller than the cell in (1)

larger than the . . .

This is an example of growth by:

- ☐ assimilation
- ☐ digestion
- ☐ excretion

assimilation

The cell in (e) is:

- ☐ eliminating waste materials
- ☐ taking in waste

eliminating waste materials

This is the process of:

- ☐ absorption
- ☐ excretion
- ☐ ingestion

excretion

The functions seen in (d) and (e) are performed by cells of:

- ☐ all living things
- ☐ only some living things

all living things.

63.

In illustrations (a) through (e) of Panel 2 we see how a cell ingests food, digests it, absorbs it, assimilates the absorbed food, and excretes wastes.

Cells need energy to function. Like most organisms, most cells get their energy from the chemical reactions involving:

- ☐ absorbed foodstuffs alone
- ☐ absorbed foodstuffs and oxygen
- ☐ oxygen alone
- ☐ undigested foodstuffs and oxygen

absorbed foodstuffs and . . .

The function of getting energy from these reactions is called:

- ☐ absorption
- ☐ assimilation
- ☐ respiration

respiration

All cells produce special chemicals to control the activities of the various cell functions. This function is called:

- ☐ assimilation
- ☐ excretion
- ☐ secretion

secretion

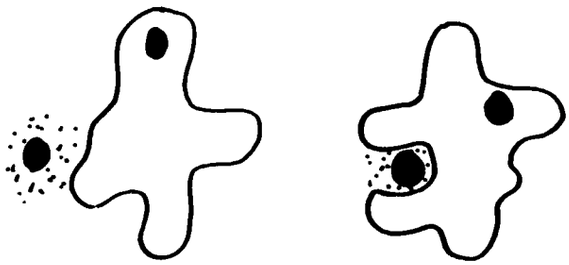
The functions of getting energy and producing special controlling chemicals are performed by cells of:

- ☐ animals and plants
- ☐ plants only

animals and plants

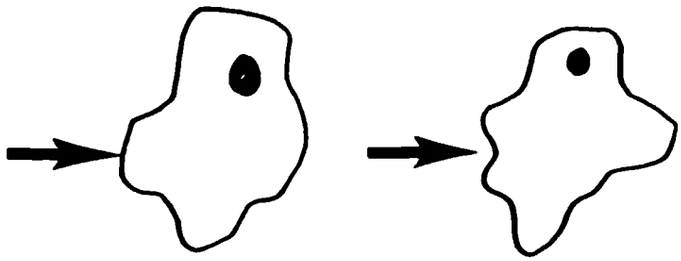
PANEL 3

(a)



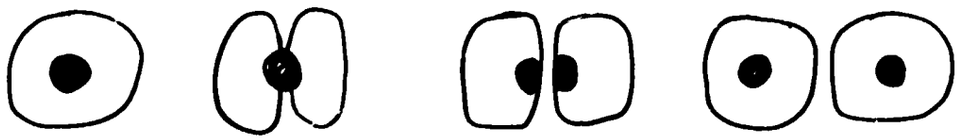
(1) (2)

(b)



(1) (2)

(c)



(1) (2) (3) (4)

64.

REFER TO PANEL 3.

In part (1) of illustration (a) we see a cell near a food particle.

In part (2) the cell has moved to the food and is beginning to ingest it.

We can guess that the cell:

- ☐ was able to sense the food
- ☐ was not able to sense the food

was able to sense . . .

This shows that cells:

- ☐ do have the characteristic of irritability
- ☐ do not have the characteristic of irritability

do have the . . .

In part (1) of (b) we see a sharp object touching a cell. In part (2) the cell has shortened and moved away from the object. The cell's movement is due to the function of:

- ☐ contraction
- ☐ reproduction
- ☐ respiration

contraction

In (b) the sharp object touched the cell at one point. The cell began to move by extending itself at another point.

Information about the object:

- ☐ was transferred from one part of the cell to other parts
- ☐ was not transferred from one part of the cell to other parts

was transferred from . . .

This is an example of:

- ☐ conduction
- ☐ contraction

conduction

65.

REFER TO PANEL 3.

Illustration (c) shows a cell splitting to produce two new cells:

- ☐ which are like the original cell
- ☐ which are not like the original cell

which are like the . . .

This is an example of the life function of:

- ☐ assimilation
- ☐ reproduction
- ☐ respiration

reproduction

Irritability, conduction, contraction, and the function of producing new living things are found in:

- ☐ all cells
- ☐ only some cells

all cells

66.

Below is a list of the life functions which are found in all organisms.

CHECK those functions which are found in the cells of all organisms.

- ☐ absorption
- ☐ assimilation
- ☐ conduction
- ☐ contraction
- ☐ digestion
- ☐ excretion
- ☐ ingestion
- ☐ irritability
- ☐ reproduction
- ☐ respiration
- ☐ secretion

absorption
assimilation
conduction
contraction
digestion
excretion
ingestion
irritability
reproduction
respiration
secretion

How many life functions are there?

11

How many life functions are found in the cells of all organisms?

11

Plant cells perform:

- ☐ all the life functions
- ☐ only some life functions

all the life functions

Animal cells perform:

- ☐ all the life functions
- ☐ only some life functions

all the life functions

40

67. Can all organisms perform all the life functions? ☐ no ☐ yes	 yes
Can all cells perform all the life functions? ☐ no ☐ yes	 yes
If a cell is broken down into smaller parts, those parts cannot perform <u>all</u> the life functions. Can parts of a cell perform some of the life functions? ☐ no ☐ yes	 yes
68. The cell is called the smallest living unit of all organisms because it is the smallest part of any organism that can perform all the life functions. If cells are broken down into smaller parts, those parts: ☐ can perform all the life functions ☐ can perform only some of the life functions	 . . . only some of the . . .
The cell is: ☐ the basic part of all organisms ☐ the smallest part of all organisms	 the basic part of . . .

69.

The cell is called the smallest living unit of all living things because:

- ☐ cells are the smallest parts of all living things which can perform all the life functions
- ☐ cells are the smallest parts of all organisms
- ☐ cells are not the smallest parts which can perform all the life functions

. . smallest . . . can perform all life functions

Time completed _____

YOU HAVE NOW FINISHED THE FIRST PART OF THIS LESSON. WRITE DOWN THE TIME. THEN, AFTER YOU HAVE REVIEWED THE MAIN IDEAS IN THE FOLLOWING SUMMARY, TAKE THE MASTERY TEST AT THE END OF THE BOOKLET.

BIOLOGY	the science of all living things (plants and animals).
ORGANISMS	all living things (all plants and animals).
INGESTION	a function of all living things involving taking in food.
DIGESTION	the function which plants and animals perform when they change ingested food into simpler chemical compounds that can be used by all parts of the organism.
ABSORPTION	the function performed when digested food substances (usually liquids) are absorbed so that they can be distributed to all parts of the body.
ASSIMILATION	organisms grow when absorbed food is converted into parts of the organism itself. The function performed when digested food is converted into parts of the organism is called assimilation.
ANAEROBIC ORGANISMS	living things which do not need oxygen in order to grow. Many germs are anaerobic organisms.
RESPIRATION	the function whereby most plants and animals take in oxygen which reacts with digested food to produce energy. Respiration depends on ingestion, digestion and absorption.
EXCRETION	the function of eliminating waste material (food that cannot be digested and unusable chemicals) from the organism.
SECRETION	the function performed by living organisms when they produce chemicals which control the other life functions.
IRRITABILITY	the ability of organisms to get information about their environment by sensing changes in their immediate surroundings.
CONDUCTION	a function performed by all living organisms when they transfer information from one part to another.
CONTRACTION	a function which involves making some part of the organism shorter or longer. Contraction is the basis of all movement.

REPRODUCTION	the function by which all organisms produce other living things like themselves.
CELL	the building block or basic structural unit of all living organisms. Each cell performs all the basic life functions.
MUTICELLULAR ORGANISM	an organism made up of a collection of cells.
UNICELLULAR ORGANISM	an organism made of <u>one</u> cell.

MASTERY TEST

Time started _____

1. The cells of different organisms:

   a. ☐ are of the same size and shape in all organisms

   b. ☐ are of the same shape but vary in size from one organism to another

   c. ☐ are of the same size but vary in shape from one organism to another

   d. ☐ vary in both size and shape from one organism to another

2. IDENTIFY the labeled parts of the diagram below. WRITE the appropriate letter in each blank.

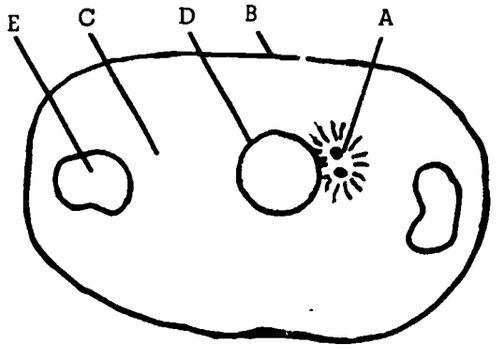
   1. _____ cell membrane

   2. _____ centriole

   3. _____ cytoplasm

   4. _____ nucleus

   5. _____ vacuole



3. Chlorophyll is a substance found in the cells of:

   a. ☐ animal and plant organisms

   b. ☐ only some animal organisms

   c. ☐ only some plant organisms

In the organisms in which it is found, chlorophyll serves the function of:

   a. ☐ enclosing each cell with a membrane

   b. ☐ controlling the activities of the cell

   c. ☐ producing food for the organism

4. WRITE a P in each blank if the term refers to a structure in a plant cell, WRITE an A if the term refers to an animal cell, WRITE A and P if the term refers to both animal and plant cells.

1. _____ cell membrane
2. _____ cell wall
3. _____ centrioles
4. _____ chlorophyll
5. _____ chloroplasts
6. _____ cytoplasm
7. _____ nucleus
8. _____ vacuole

5. MATCH the following to indicate the definition of each term given below:

A. chromatin
B. nuclear membrane
C. nucleolus

1. _____ consists of many fine coiled threads
2. _____ separates the nucleus from the rest of the cell
3. _____ small round body which regulates certain activities of the cell

Time completed _____

WHEN YOU HAVE FINISHED THIS TEST, WRITE DOWN THE TIME. THEN TAKE THE LESSON TO YOUR INSTRUCTOR OR HIS ASSISTANT FOR CHECKING. WAIT UNTIL THE LESSON IS APPROVED BEFORE GOING ON TO THE NEXT LESSON.

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PM 431 - 53

ADVANCED GENERAL EDUCATION PROGRAM

A HIGH SCHOOL SELF-STUDY PROGRAM

CELL STRUCTURE
LEVEL: II
UNIT: 7
LESSON: 2

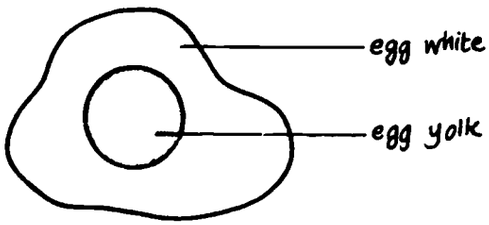
U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION, JOB CORPS
NOVEMBER 1969

50

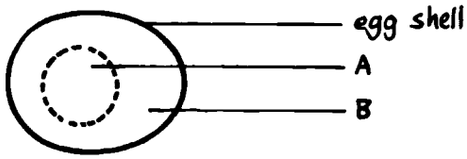
U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION, JOB CORPS
NOVEMBER 1969

1. CELL STRUCTURE AND FUNCTION PREVIEW You have learned that cells are the smallest parts of living things which have all the properties of living things. Cells can be thought of as the basic building blocks of living things. In the next lesson you will learn what goes on inside these tiny units of living matter. NO RESPONSE REQUIRED	GO ON TO THE NEXT FRAME
2. Most cells are very small. They can only be seen with a microscope. You can say, therefore, that most cells are (CHECK one): ☐ invisible to the naked eye ☐ visible to the naked eye A blood cell is a typical example of a cell. Can you see it with your naked eye? ☐ yes ☐ no	invisible to the naked eye no

3.



The picture above shows a fried egg. It is a chicken egg. The picture below shows the same egg before the shell was broken and the egg was fried.



In the picture immediately above, the egg <u>yolk</u> is labeled by (CHECK one):

- ☐ the letter A
- ☐ the letter B

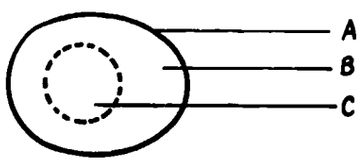
the letter A

4.

The yolk of a bird's egg is a single cell. This type of cell is:

- ☐ invisible to the naked eye
- ☐ visible to the naked eye

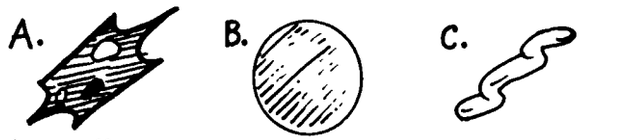
visible to the naked eye



In the bird's egg shown above, which letter represents a single cell?

- ☐ A
- ☐ B
- ☐ C

C

5. Most cells are (CHECK or): ☐ invisible to the naked eye ☐ visible to the naked eye	invisible to the naked eye
The smallest known single cell is called a bacterium. A bacterium is (CHECK one): ☐ invisible to the naked eye ☐ visible to the naked eye	invisible to the naked eye
A bacterium is a single cell. It is (CHECK one or more): ☐ an average size cell ☐ bigger than the yolk of a bird's egg ☐ the biggest single cell anyone has found ☐ smaller than the yolk of a bird's egg ☐ the tiniest single cell anyone has found	 smaller than the yolk . . . the tiniest single cell . . .
6.  plant cell bird's egg yolk bacterium Are all of the above examples of a <u>single cell</u>? ☐ yes ☐ no	 yes
The largest example above is (GIVE letter): _____	B
The smallest example above is (GIVE letter): _____	C
From the examples you can conclude that (CHECK one): ☐ all cells have the same shape ☐ cells may have various shapes	 cells may have various shapes

7.

Most cells are (CHECK one):

- ☐ invisible to the naked eye
- ☐ visible to the naked eye

invisible to the naked eye

An example of a single cell we can see unaided is (CHECK one):

- ☐ a bacterium
- ☐ a blood cell
- ☐ the yolk of a bird's egg

the yolk of a bird's egg

The smallest known cell is (CHECK one):

- ☐ a bacterium
- ☐ a blood cell
- ☐ the yolk of a bird's egg

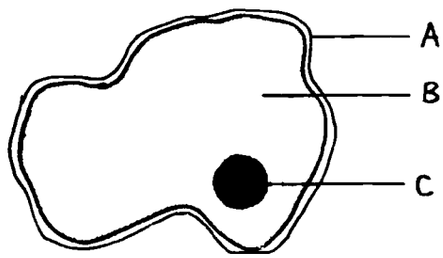
a bacterium

CHECK the statement below which is true:

- ☐ All cells have the same shape.
- ☐ Cells may have various shapes.

Cells may have various shapes.

8.



Above is shown a cell, as if it had been cut in two like an apple. The picture is much enlarged.

The cell is wrapped up in a sort of skin.

This "skin" is referred to by the letter _____. A

Within the cell is a special small body which controls and regulates the cells' activities.

This body is indicated by the letter _____. C

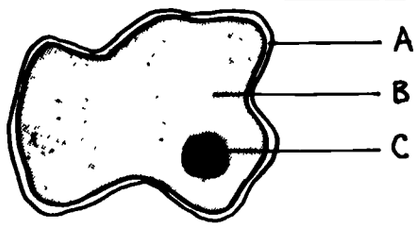
Most of the volume of the cell is filled up by the substance indicated by the letter _____. B

9.

The body within the cell which regulates and controls its activities is called the nucleus.

The part of the cell which surrounds it like a skin is called the cell memorane.

The substance which fills up most of the cell (except for the nucleus) is called the cytoplasm.



MATCH the letters in the above cell diagram to the terms below by writing one letter in each blank:

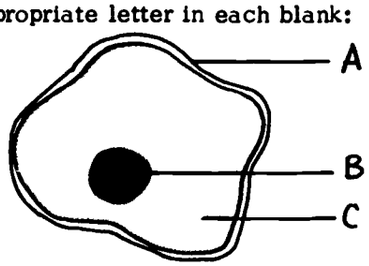
1. _____ cell membrane
2. _____ cytoplasm
3. _____ nucleus

1. A
2. B
3. C

Substances can pass into and out of the cell. To do so, they must pass through the (CHECK one):

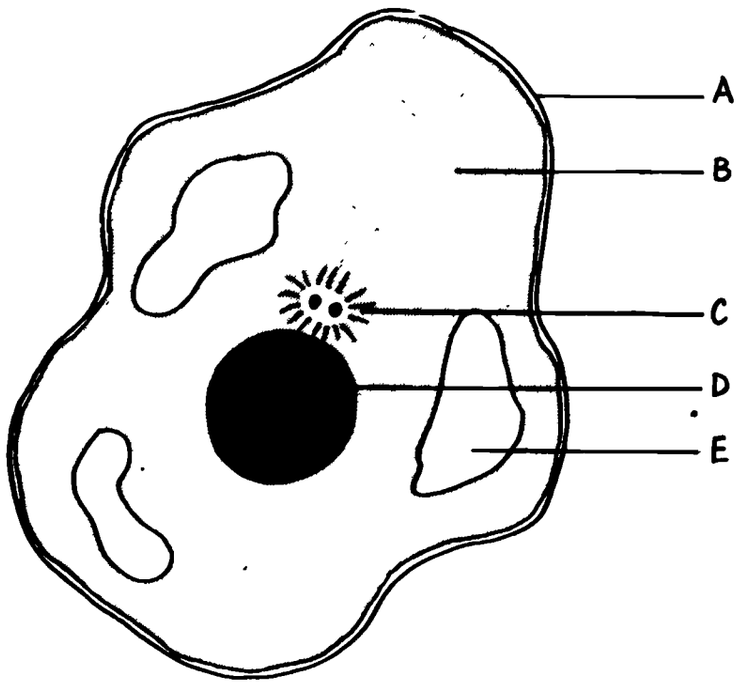
- ☐ cell membrane
- ☐ cytoplasm
- ☐ nucleus

cell membrane

10. MATCH the terms below with the definitions by writing one letter in each blank: A. nucleus B. cytoplasm C. cell membrane 1. _____ allows substances to enter and leave the cell 2. _____ controls and regulates the cell 3. _____ encloses the cell 4. _____ substance that fills most of the cell outside the nucleus	1. C 2. A 3. C 4. B
11. IDENTIFY the labelled parts of the diagram below by writing the appropriate letter in each blank:  1. _____ cell membrane 2. _____ controls and regulates the cell 3. _____ cytoplasm 4. _____ encloses the cell, but lets substances pass in and out 5. _____ living substance that fills the cell outside the nucleus 6. _____ nucleus	1. A 2. B 3. C 4. A 5. C 6. B

PANEL 1

STRUCTURE OF A CELL



12. REFER TO PANEL 1 The panel shows a diagram of a cell with two new structures. Lying near the nucleus of the cell are two small round bodies. They are indicated by the letter _____. Within the cytoplasm of the cell are shown some spaces of irregular shape. An example of these is labelled with the letter _____.	C E
13. REFER TO PANEL 1 The small round body lying near the nucleus is called a centriole. Centrioles are often found in pairs. The irregularly shaped space within the cytoplasm is called a vacuole. MATCH the structures in the panel to the terms below by writing one letter in each blank: 1. _____ cell membrane 2. _____ centriole 3. _____ cytoplasm 4. _____ nucleus 5. _____ vacuole	1. A 2. C 3. B 4. D 5. E

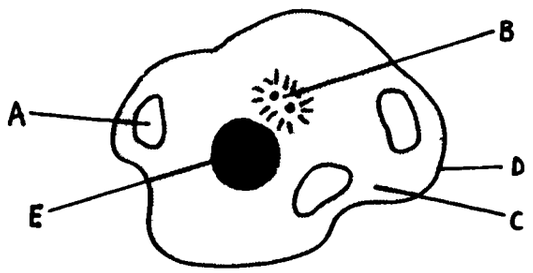
14. REFER TO PANEL 1 The cytoplasm is made up of a substance which is able to grow and to repair itself, requires food, and gives off wastes. The vacuoles hold the food for the cytoplasm. They also contain the wastes it gives off. You can, therefore, say that the material filling the vacuoles and the material of the cytoplasm are: ☐ different ☐ identical	different
15. REFER TO PANEL 1 MATCH the terms below with the definitions by writing one letter in each blank: A. cell membrane B. centriole C. vacuole 1. _____ a small round body, lying near the nucleus, often found in pairs 2. _____ a space within the cytoplasm 3. _____ contains different material than the cytoplasm 4. _____ encloses the cell 5. _____ lets substances pass in and out of the cell	1. B 2. C 3. C 4. A 5. A

16.

TERMINAL FRAME

DO NOT REFER TO THE PANEL

IDENTIFY the labelled parts of the diagram below by writing the appropriate letter in each blank:



1. ____	cell membrane	1. D
2. ____	centriole	2. B
3. ____	controls and regulates the cell	3. E
4. ____	cytoplasm	4. C
5. ____	encloses the cell, but lets substances pass in and out	5. D
6. ____	nucleus	6. E
7. ____	small round bodies lying near the nucleus, often found in pairs	7. B
8. ____	space in the cytoplasm filled with different material	8. A
9. ____	substance that fills the cell outside the nucleus	9. C
10. ____	vacuole	10. A

17.

Many plant cells contain a substance not found in animal cells. It is called chlorophyll and is used by the plant cell when it is making its food. Chlorophyll is contained in small bodies inside the plant cell, called chloroplasts. Chlorophyll is responsible for the color of the leaves of trees and of blades of grass.

Chlorophyll is (CHECK one or more):

- ☐ found in animal cells
- ☐ found in some plant cells
- ☐ green in color
- ☐ red in color
- ☐ used by the cell in making food
- ☐ used by the cell in movement

found in some plant cells
green in color

used by the cell in making food

Chloroplasts are (CHECK one or more):

- ☐ bodies contained in the chlorophyll
- ☐ bodies that contain chlorophyll
- ☐ found in animal cells
- ☐ found in some plant cells

bodies that contain chlorophyll

found in some plant cells

18.

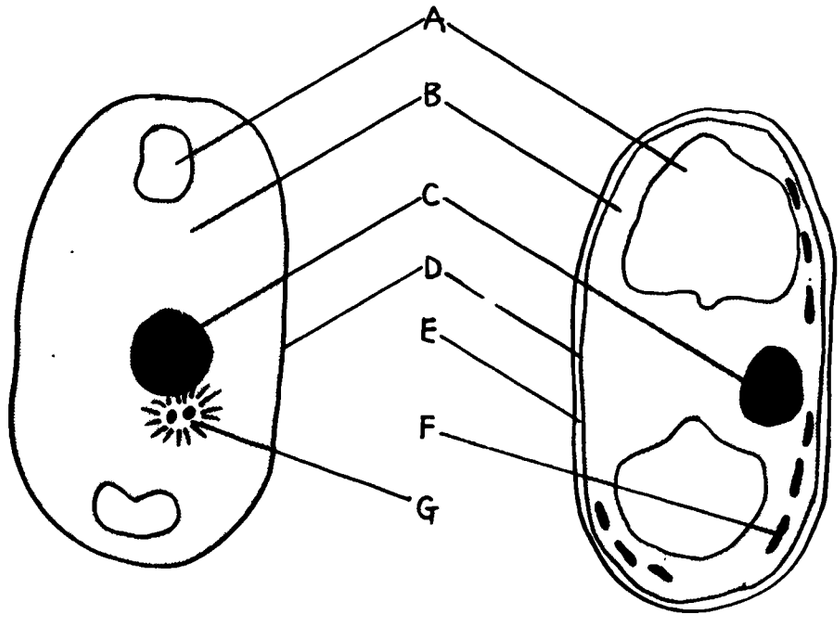
TERMINAL FRAME

COMPLETE the following table by checking the appropriate boxes:

	CHLORO-PHYLL	CHLORO-PLAST	CHLORO-PHYLL	CHLORO-PLAST
a green substance used by the cell to make its food	☐	☐	☒	☐
found in animal cells	☐	☐	☐	☐
found in some plant cells	☐	☐	☒	☒
structure within the cell which contains the green substance	☐	☐	☐	☒

PANEL 2

COMPARISON OF PLANT CELL AND ANIMAL CELL



19.

REFER TO PANEL 2

We will now briefly compare plant and animal cells.

LOCATE the objects corresponding to the terms below and WRITE the appropriate letter in each blank:

1. _____ cell membrane — 1. D
2. _____ cytoplasm — 2. B
3. _____ nucleus — 3. C
4. _____ vacuole — 4. A

Which of the above four structures are found in both plant cells and animal cells?
GIVE letter(s): _____ — A, B, C, D

In the panel, REFER TO the structures labelled E and F.

These structures are found (CHECK one):

- ☐ in both plant and animal cells
- ☐ only in animal cells
- ☐ only in plant cells — only in plant cells

Structure E surrounds the entire cell. In this respect, it is <u>like</u> the (CHECK one):

- ☐ cell membrane — cell membrane
- ☐ cytoplasm
- ☐ nucleus

REFER to structures D and E in the plant cell. Which statement is true? (CHECK one)

- ☐ Structure D surrounds structure E on the outside.
- ☐ Structure E surrounds structure D on the outside. — Structure E surrounds . . .

20.

REFER TO PANEL 2

Structure E is called the cell wall. Do animal cells have a cell wall?

- ☐ yes
- ☐ no

no

Now REFER TO structure F. This structure is already familiar to you. It is called a chloroplast.

Structure F contains a substance known as (CHECK one):

- ☐ centriole
- ☐ chlorophyll
- ☐ cytoplasm

chlorophyll

Structure G is also familiar to you. It is a small round body. It is often found as one of a pair lying near the nucleus. It is called a (CHECK one):

- ☐ centriole
- ☐ chloroplast
- ☐ cytoplasm

centriole

COMPLETE the following table by checking the appropriate boxes:

	FOUND IN PLANT CELLS	FOUND IN ANIMAL CELLS	FOUND IN PLANT CELLS	FOUND IN ANIMAL CELLS
cell membrane	☐	☐	☒	☒
cell wall	☐	☐	☒	☐
centriole	☐	☐	☐	☒
chlorophyll	☐	☐	☒	☐
chloroplast	☐	☐	☒	☐
cytoplasm	☐	☐	☒	☒
nucleus	☐	☐	☒	☒
vacuole	☐	☐	☒	☒

21.

REFER TO PANEL 2 (Page 14)

The vacuoles are indicated by the letter _____.

A

The vacuoles in the plant cell are (CHECK one):

- ☐ larger than the vacuoles in the animal cell
- ☐ smaller than the vacuoles in the animal cell
- ☐ the same size as the vacuoles in the animal cell

larger than the vacuoles . . .

Vacuoles store the food and wastes of the cytoplasm. Which has the most storage space for food and waste? (CHECK one)

- ☐ an animal cell
- ☐ a plant cell

a plant cell

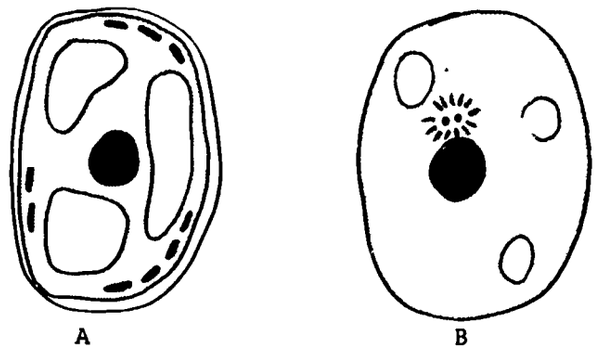
22.

TERMINAL FRAME

DO NOT REFER TO THE PANEL

LOOK AT the figure below.

IDENTIFY the plant cell and the animal cell by writing the appropriate letter in each blank below:



A B

1. _____ animal cell — 1. B
2. _____ plant cell — 2. A

MATCH the terms with the items below by writing one or both letters in each blank:

1. _____ cell walls — 1. A
2. _____ centrioles — 2. B
3. _____ chlorophyll — 3. A
4. _____ large vacuoles — 4. A

23.

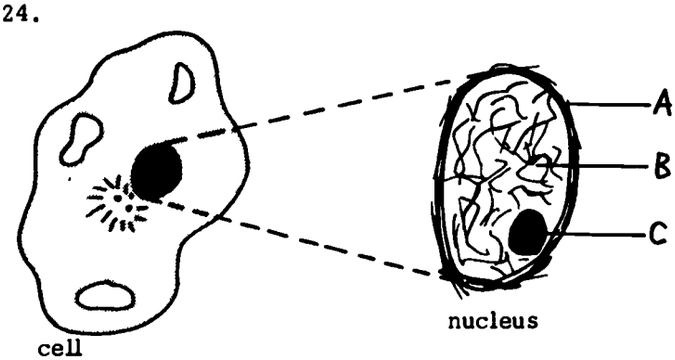
PREVIEW FRAME

You have learned to identify some of the important structures within the living cell. Next you will examine more carefully the cell's nucleus, and learn that it, too, has several components.

NO RESPONSE REQUIRED

GO ON TO THE NEXT FRAME

24.



In the above diagram, the cell's nucleus is shown very much enlarged. The picture shows it as if it had been cut through the middle, like an apple.

Like the cell itself, the nucleus is surrounded by a sort of skin. In the diagram this "skin" is referred to by the letter _____.

A

Within the nucleus is a small round body believed important in regulating some cell activities. In addition to this body there is a mass of fine, coiled threads.

The structure which apparently regulates certain cell activities is labelled in the diagram as (GIVE letter):

_____

C

The fine, coiled threads are labelled as (GIVE letter):

_____

B

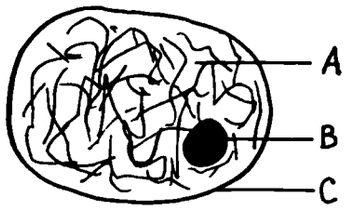
25.

The "skin" of the nucleus is called the nuclear membrane.

The small round body believed important in regulating certain cell activities is called the nucleolus.

The mass of fine, coiled threads is called chromatin.

cell nucleus:



MATCH the letters in the above diagram to the terms below by writing one letter in each blank:

1. _____ chromatin
2. _____ nuclear membrane
3. _____ nucleolus

1. A
2. C
3. B

The substance which seems to fill the greater part of the nucleus is called _____.

chromatin

The structure apparently involved in controlling the cell in some ways is the _____.

nucleolus

The structure which might resemble a tuft of short, curly hairs is called _____.

chromatin

26.

MATCH the terms below with the definitions by writing one letter in each blank:

A. chromatin

B. nuclear membrane

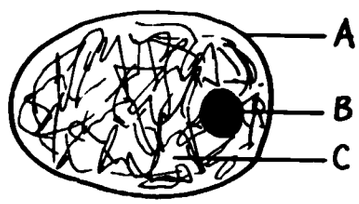
C. nucleolus

1. _____ consists of many fine, curly threads
2. _____ separates the nucleus from the rest of the cell
3. _____ small round body believed important in regulating certain cell activities

1. A
2. B
3. C

27.

IDENTIFY the parts of the nucleus on the figure below by writing the appropriate letter in each blank:



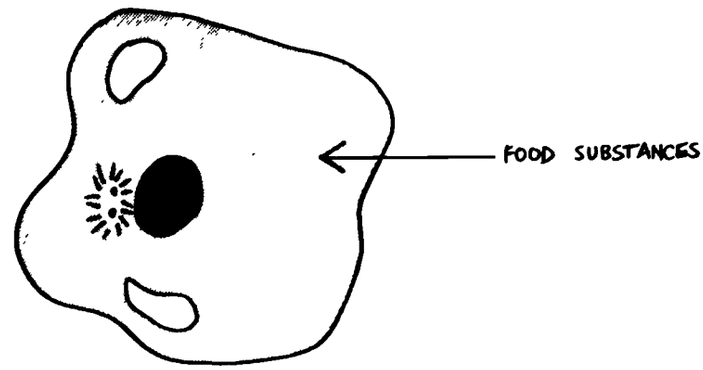
1. _____ chromatin
2. _____ consists of many fine, coiled threads
3. _____ encloses the nucleus
4. _____ nuclear membrane
5. _____ nucleolus
6. _____ small round body believed important in regulating certain cell activities

1. C
2. C
3. A
4. A
5. B
6. B

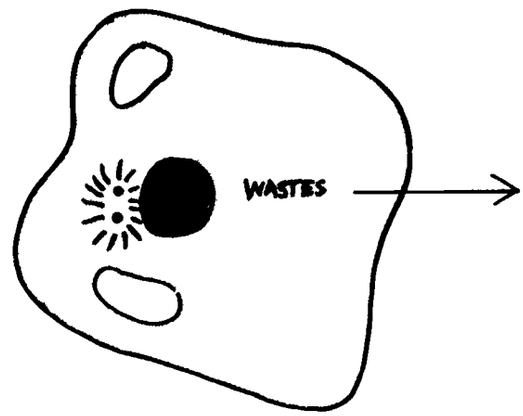
PANEL 3

TWO CELL PROCESSES

PROCESS A:



PROCESS B:



28. PREVIEW FRAME All cells need food. Plant cells, with the help of their chlorophyll, can make their own food. Animal cells, however, must obtain their food from outside. In the next section you will learn how animal cells nourish themselves. You will also see how they get rid of their waste materials. NO RESPONSE REQUIRED	GO ON TO THE NEXT FRAME
29. REFER TO PANEL 3 The cells shown are (CHECK one): ☐ animal cells ☐ plant cells	animal cells
In process A, food substances enter the cell by going through (CHECK one): ☐ the cell membrane ☐ the chromatin ☐ the nuclear membrane ☐ the nucleus	the cell membrane
Something leaves the cell during (CHECK one): ☐ process A ☐ process B	process B
The cell gains new material as a result of (CHECK one): ☐ process A ☐ process B	process A
Process B involves material passing through (CHECK one): ☐ the cell membrane ☐ the nuclear membrane ☐ the nucleus	the cell membrane

30.

REFER TO PANEL 3

Process A is called <u>ingestion</u>.

Process B is called <u>elimination</u>.

Ingestion is concerned with the movement of (CHECK one):

- ☐ food substances
- ☐ the cell
- ☐ wastes

food substances

Elimination is concerned with the movement of (CHECK one):

- ☐ food substances
- ☐ the cell
- ☐ wastes

wastes

Something <u>enters</u> the cell during the process of (CHECK one):

- ☐ elimination
- ☐ ingestion

ingestion

Something <u>leaves</u> the cell during the process of (CHECK one):

- ☐ elimination
- ☐ ingestion

elimination

CHECK the true statement(s) below:

- ☐ Elimination occurs through the cell membrane.

Elimination occurs through . . .

- ☐ Ingestion occurs through the cell membrane.

Ingestion occurs through . . .

- ☐ Neither process occurs through the cell membrane.

31.

DO NOT REFER TO THE PANEL

COMPLETE the following table by checking the appropriate boxes:

	PROCESS OF ELIMINATION	PROCESS OF INGESTION	PROCESS OF ELIMINATION	PROCESS OF INGESTION
causes food substances to enter the cell	☐	☐	☐	☒
causes wastes to leave the cell	☐	☐	☒	☐
takes place through the cell membrane	☐	☐	☒	☒

Time completed _____

YOU HAVE NOW FINISHED THE FIRST PART OF THIS LESSON. WRITE DOWN THE TIME. THEN, AFTER YOU HAVE REVIEWED THE MAIN IDEAS IN THE FOLLOWING SUMMARY, TAKE THE MASTERY TEST AT THE END OF THE BOOKLET.

NUCLEUS	the body within the cell which regulates and controls the cell's activities.
CELL MEMBRANE	the "skin" which surrounds the cell.
CENTRIOLE	a small round body lying near the nucleus, often found in pairs.
CYTOPLASM	the substance that fills most of the cell outside the nucleus.
VACUOLE	irregularly shaped space within the cytoplasm.
CHLOROPHYLL	a green substance found within plant cells which is used by the plant cell for making food.
CHLOROPLASTS	bodies inside the plant cell that contain chlorophyll.
NUCLEAR MEMBRANE	the "skin" which encloses the nucleus.
NUCLEOLUS	the small round body within the nucleus that controls certain cell activities.
CHROMATIN	structures within the nucleus which resemble a mass of fine, coiled threads.
INGESTION	the process by which food substances enter the cell through the cell membrane.
ELIMINATION	the process by which wastes leave the cell through the cell membrane.
	See the diagram of the comparison of the plant cell and the animal cell.

MASTERY TEST

Time started _____

1. All of the life functions are found:

   a. ☐ in all organisms

   b. ☐ only in animals

   c. ☐ only in human beings

   d. ☐ only in plants

2. MATCH the following to indicate the correct description for each term.

A. absorption	1. _____ conversion of food into part of the organism
B. assimilation	2. _____ conversion of raw foods into simpler compounds
C. digestion	3. _____ elimination of wastes from the organism
D. excretion	4. _____ soaking up of digested foods in liquid form
E. ingestion	5. _____ taking food into the organism
F. respiration	6. _____ use of digested food and oxygen to produce energy

3.

conduction
contraction
irritability
reproduction
secretion

CHOOSE the correct words from the list above to COMPLETE the sentences below.

1. The ability to sense changes in the environment is called _____.

2. The function of all living things by which they produce other living things is called _____.

3. The function of producing special chemicals which control all life functions is called _____.

4. The function of transferring information from one part of an organism to other parts is called _____.

5. The function which is the basis for movement in all organisms is _____.

4. The cell is the basic part of:

a. ☐ all animal and plant organisms

b. ☐ only animal organisms

c. ☐ only multicellular organisms

d. ☐ unicellular organisms only

5. A unicellular organism is made up of:

a. ☐ less than one cell

b. ☐ more than one cell

c. ☐ one cell only

6. The cell is called the smallest living unit of all living things because:

a. ☐ cells are the smallest parts which perform all the life functions

b. ☐ cells are the smallest parts of all organisms

c. ☐ cells are not the smallest parts which perform all the life functions

Time completed _____

WHEN YOU HAVE FINISHED THIS TEST, WRITE DOWN THE TIME. THEN TAKE THE LESSON TO YOUR INSTRUCTOR OR HIS ASSISTANT FOR CHECKING. WAIT UNTIL THE LESSON IS APPROVED BEFORE GOING ON TO THE NEXT LESSON.

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ADVANCED GENERAL EDUCATION PROGRAM

A HIGH SCHOOL SELF-STUDY PROGRAM

TISSUES, ORGANS, SYSTEMS
LEVEL: II
UNIT: 7
LESSON: 3

U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION, JOB CORPS
NOVEMBER 1969

U.S. DEPARTMENT OF LABOR
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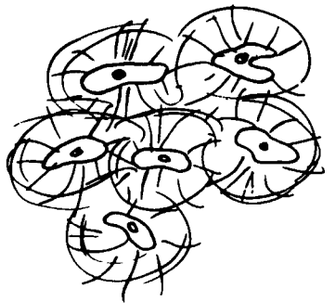
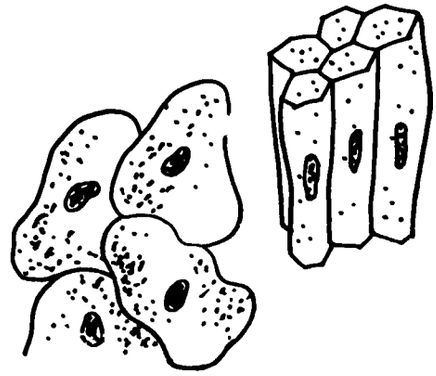
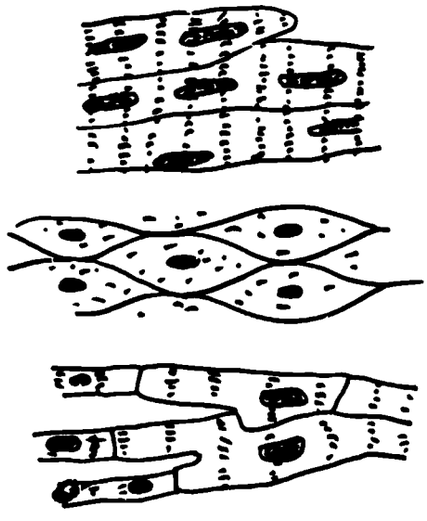
PANEL 1



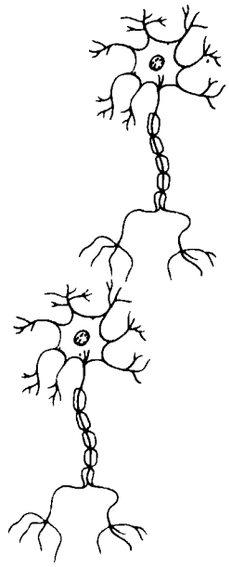
A. Connective Cells



B. Epithelial Cells



C. Muscle Cells



D. Nerve Cells

1. PREVIEW FRAME The following section will build on what you already know about the life functions and cells. The facts that you will now learn are presented in terms of the human body -- the most highly developed of all organisms. However, the facts you will learn are true of many other organisms besides man. NO RESPONSE REQUIRED	GO ON TO THE NEXT FRAME
2. You already know that the cell is the basic building block of any organism. However, organisms that are made up of more than one cell generally contain more than one type of cell. In very highly developed organisms like the human being, there are several different types of cells. An organism with several different types of cells would have to be: ☐ multicellular ☐ unicellular	multicellular
3. REFER TO PANEL 1 Panel 1 shows the different types of cells found in higher organisms like the human body. The name of the type of cell is written under each diagram. How many different types of cells does the panel show? _____	4 (four)

4. REFER TO PANEL 1 There are four main types of cells that are found in the human body. One of these types is the <u>muscle cell</u>. How many varieties of muscle cell are shown in the panel? _____ Another of he cell types is epithelial. There are many varieties of epithelial cell; however, the main varieties are shown on the panel. How many varieties are shown? _____ <u>Connective cells</u> are another type of cell. Again, there are many varieties of connective cells. However, how many varieties are shown? _____ Nerve cells are another one of the types of cells found in the human body. How many varieties of nerve cells are shown? _____	3 (three) 2 (two) 1 (one) 1 (one)

5.

REFER TO PANEL 1

The following paragraphs will give you a description of each of the types of cells. FIND the type of cell that is described and WRITE its name in the space provided.

One variety of this type of cell is irregular in shape. Another variety looks like a column. All varieties of this type of cell are very tightly packed together. The membrane of one cell is right up against the membrane of another.

Which cell type fits this description? _____ epithelial cells

Another variety of cell is <u>not</u> tightly packed together. In fact, there is a great deal of space between the cells filled with what is called intercellular material.

Which type of cell fits this description? _____ connective cells

Another of the types of cell has a long tube-like part with what look like brushes at the end. It has similar brush-like structures at the other end.

Which type of cell fits this description?_____ nerve cells

Another type of cell is generally elongated. The cells appear to be tightly packed together from end to end in strips or bands. Some varieties look as if they are striped.

Which cell type fits this description? _____ muscle cells

6.

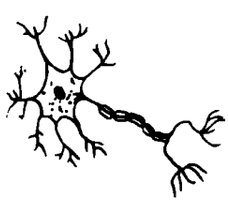
connective cells
epithelial cells
muscle cells
nerve cells

WRITE the cell name from the above list that fits each description and diagram below:

1. generally elongated, sometimes striped in appearance _____ muscle (cells)

2. a great deal of space between the cells filled with intercellular material _____ connective (cells)

3. generally irregular or like a column in shape and very tightly packed together _____ epithelial (cells)



4. long tube-like part with brush-like structures at the end; similar brush-like structures at the other end _____ nerve (cells)

5

7.

DO NOT REFER TO PANEL 1

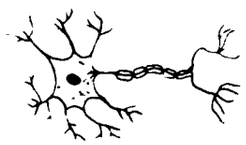
MATCH the name of the cell type with its diagram:

A. connective cells

B. epithelial cells

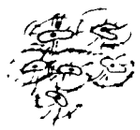
C. muscle cells

D. nerve cells

1. _____ 

2. _____ 

3. _____ 

4. _____ 

5. _____ 

1. D (nerve cells)

2. B (epithelial cells)

3. C (muscle cells)

4. A (connective cells)

5. B (epithelial cells)

6

8.

You know that all cells can perform all of the life functions. However, each of the cell types in higher organisms like the human body have developed in such a way that they are able to perform one or more of the functions particularly well. This is called specialization.

Nerve cells, which are found throughout the body, specialize in conducting sensory impulses from the surface of the body and in conducting motor impulses to moving parts.

For example, when a person touches something that is hot, the nerve cells in the fingers send a message (sensory impulse) that tells him that he is about to burn himself. The nerve cells also send a message for him to move his hand (motor impulse).

In other words, nerve cells specialize in the life functions of:

- ☐ absorption
- ☐ conduction
- ☐ irritability
- ☐ respiration

conduction
irritability

9.

Muscle cells specialize in contracting and moving body parts.

For example, when you bend your arm at the elbow, muscle cells are contracting, and so moving your arm.

However, it is nerve cells that send the message (motor impulse) that causes the muscle cells to contract.

MATCH the following types of cells with the functions that they specialize in:

A. moving body parts by contracting

B. conducting motor impulses to moving parts

C. conducting sensory impulses from different parts of the body

1. _____ muscle cells

2. _____ nerve cells

1. A

2. B, C

10.

Epithelial cells specialize in absorbing substances from the environment, protecting body parts from the environment and secreting vital substances.

Epithelial cells protect body parts from the environment. Which of the following would you expect to be made up of epithelial cells?

- ☐ internal body parts
- ☐ muscles
- ☐ skin

skin

In addition to protection, what other life functions are specialized in by epithelial cells?

- ☐ absorption
- ☐ digestion
- ☐ irritability
- ☐ respiration
- ☐ secretion

absorption

secretion

11. Connective cells, as their name implies, connect body parts. They also support and protect them. For example, connective cells are found in bones and structures like bones that support and protect internal body parts. You would expect to find connective cells performing the functions of connection, support, and protection of body parts in: ☐ all parts of the body ☐ only some parts of the body	all parts of the body
12. CHECK the life functions of the human body that are listed below: ☐ absorption of substances from the environment ☐ conduction of sensory impulses from different parts of the body ☐ conduction of motor impulses to moving parts ☐ connection of one body part to another ☐ contraction and movement of body parts ☐ protection of body parts from the environment ☐ secretion of vital substances ☐ support of body parts	absorption of substances . . . conduction of sensory . . . conduction of motor . . . connection of one body . . contraction and movement . . . protection of body parts from . . . secretion of vital substances support of body parts

13.

MATCH the columns below to indicate the function of each type of cell listed on the right:

A. absorbs substances from the environment, protects body parts from the environment, and secretes vital substances	1. _____ connective cell	1. C
	2. _____ epithelial cell	2. A
B. conducts sensory impulses from different parts of the body and conducts motor impulses to moving parts	3. _____ muscle cell	3. D
	4. _____ nerve cell	4. B
C. connects, supports, and protects body parts		
D. moves body parts by contracting		

14.

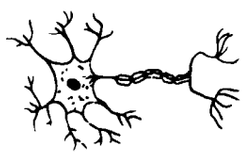
A group of cells that are similar in appearance generally specialize in one or more similar functions. You have seen that muscle cells perform the function of contracting and moving body parts. You also know what functions epithelial cells perform, what functions connective cells perform and what functions nerve cells perform.

Pictured below in Columns A and B are each of the four different cell types.

MATCH the cells in Column A to the cells in Column B that you would expect to specialize in the same function by drawing a line from one cell to the other:

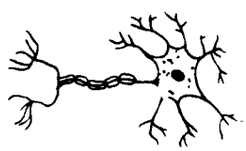
Column A Column B

1.



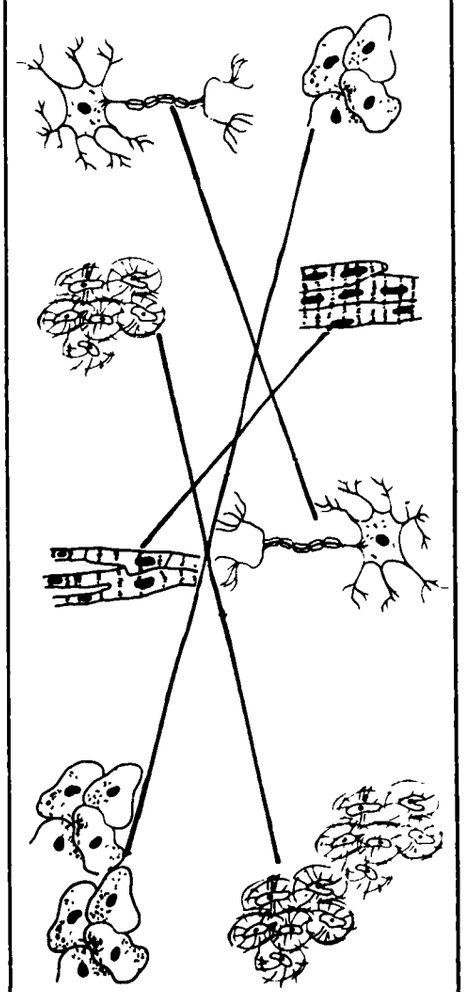
2.

3.



4.

Column A Column B



15. The term specialization refers to the fact that cells of the same type perform: ☐ all functions equally well ☐ one or more functions particularly well	one or more functions . . .
16. Cells that perform the same function are usually: ☐ different in appearance ☐ similar in appearance Cells that perform different functions are usually: ☐ different in appearance ☐ similar in appearance	similar in appearance different in appearance

17.

Groups of cells that have

1. similar appearance

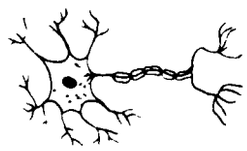
and

2. similar functions

are called tissues.

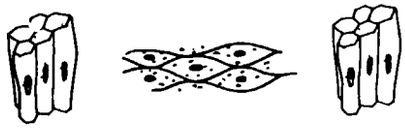
In other words, tissues are composed of cells that look alike and that specialize in the same function.

Which of the following are possible diagrams of tissues?

☐ 

☐  ☒

☐  ☒

☐ 

☐  ☒

18.

A tissue is a structure that is:

- ☐ composed of cells that have similar appearances
- ☐ composed of cells that have different appearances
- ☐ composed of cells that perform similar functions
- ☐ composed of cells that perform different functions
- ☐ not composed of cells

. . . have similar appearances

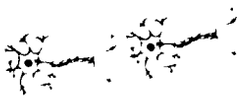
. . . perform similar functions

19.

epithelial tissue
connective tissue
muscle tissue
nerve tissue

As you can see from the above list, the names of the tissues found in the human body are the same as the names of the four different types of cells.

Using the above list, WRITE the name of the tissue shown in each of the diagrams below:



_____ nerve tissue

_____ connective tissue

_____ muscle tissue

_____ epithelial tissue

20. CHECK the type(s) of tissue found in the human body: ☐ connective tissue ☐ epithelial tissue ☐ muscle tissue ☐ nerve tissue ☐ none of the above	connective tissue epithelial tissue muscle tissue nerve tissue
21. You have learned the life functions that organisms must perform in order to stay alive. You have also learned that different types of cells grouped together as tissues are able to specialize in particular functions. In higher organisms -- like the human being -- several related life functions are performed by ONE structure that is made up of <u>two or more different types of tissues</u>. Which of the following describes single structures able to perform several related functions? ☐ a structure made up of connective, epithelial and muscle tissues ☐ a structure made up of muscle tissue alone ☐ a structure made up of nerve, muscle, and connective tissues ☐ a structure such as a nerve cell	. . . and muscle tissues . . . and connective tissues

22.

When several related functions are performed by a single structure that is composed of two or more different types of tissues, that structure is said to perform an activity.

For example, irritability and conduction are two of the life functions that are involved in control of thought, feeling and motor impulses. Control of thought, feeling and motor impulses is an activity performed by a structure composed of three different types of tissues.

Filtration of wastes out of the blood and their subsequent elimination from the body involves absorption and excretion.

Filtration of wastes and their elimination is:

- ☐ a life function
- ☐ an activity

an activity

Absorption is:

- ☐ a life function
- ☐ an activity

a life function

Excretion is:

- ☐ a life function
- ☐ an activity

a life function

23.

Three of the many activities that go on in the human body are:

*1. control of thought, feeling and motor impulses

*2. filtration of wastes out of the blood and elimination of fluid

*3. pumping of blood throughout the body

Which of the following structures would be capable of performing the above activities:

- ☐ a cell
- ☐ a tissue
- ☐ two or more different types of tissues

two or more different types . . .

24. Production of thought, feeling and motor impulses is an activity that is performed by a structure composed of epithelial, connective and nerve tissue. Which of the three types of tissue making up this structure would you expect to find in the largest proportion since the activity primarily involves irritability and conduction? _____ Filtering wastes out of the blood and elim nating fluid is an activity that is performed by a structure composed of epithelial, connective, nerve and muscle tissue. This activity primarily involves absorption and excretion. Therefore, which of the four types of tissues would you expect to find in the largest proportion? _____ Pumping of blood throughout the body is an activity that is performed by a structure composed of epithelial, nerve, muscle and connective tissue. This activity primarily involves contraction. Therefore, which of the four types of tissues would you expect to find in the largest proportion? _____	nerve tissue epithelial tissue muscle tissue
25. Below is a list of three activities that go on in the human body. After each, there is a description of the structure that performs the activity. UNDERLINE the key tissue -- the one you would expect to find in the largest proportion in each of the structures: control of thought, feeling and motor impulses, performed by a structure composed of nerve, epithelial and connective tissue filtering wastes out of the blood and eliminating fluid, performed by a structure composed of connective, epithelial, nerve and muscle tissue pumping blood throughout the body, performed by a structure composed of connective, epithelial, nerve and muscle tissue	<u>nerve</u> <u>epithelial</u> <u>muscle</u>

26. The structures that perform the three activities you have examined are composed largely of one kind of tissue and: ☐ lesser numbers of one other kind of cell ☐ lesser numbers of one or more other types of tissue	. . . other types of tissue
27. MATCH the columns below to indicate the activity performed by each structure described on the right: A. produces thought, feeling and motor impulses B. filters wastes out of the blood and eliminates fluid C. pumps blood throughout the body 1. _____ structure composed largely of epithelial tissue, with some connective, nerve and muscle tissue 2. _____ structure composed largely of muscle tissue, with some epithelial, nerve and connective tissue 3. _____ structure composed largely of nerve tissue, with some epithelial and connective tissue	1. B 2. C 3. A

28. A structure that is composed of two or more tissues and that is capable of performing a particular activity is called an organ. Which of the following describe an organ? ☐ connective tissue, which specializes in connecting, supporting and protecting body parts ☐ a nerve cell ☐ a structure composed largely of muscle tissue with some nerve epithelial and connective tissue capable of pumping blood throughout the body	a structure composed largely . . .
29. An organ is a structure that: ☐ is composed of one tissue only ☐ is composed of two or more tissues ☐ performs many different activities ☐ performs one particular activity	is composed of two or more . . . performs one particular activity
30. Three examples of the many organs found in the human body are: *1. the brain *2. the heart *3. the kidney You would expect that the brain, the heart, and the kidney are composed of: ☐ one cell ☐ one tissue ☐ two or more tissues	two or more tissues

31. The brain controls thought, feeling and motor impulses. The brain is composed of three different types of tissues. However, since the brain controls thought, feeling and motor impulses, you would expect it to be composed largely of: ☐ connective tissue ☐ epithelial tissue ☐ muscle tissue ☐ nerve tissue	nerve tissue
32. The kidney filters wastes out of the blood and eliminates fluid. The kidney is composed of four different types of tissues. However, since the kidney filters wastes out of the blood and eliminates wastes, you would expect it to be composed largely of: ☐ connective tissue ☐ epithelial tissue ☐ muscle tissue ☐ nerve tissue	epithelial tissue
33. The heart pumps blood throughout the body. The heart is an organ. It is composed of four different types of tissue. However, since the heart must contract in order to pump blood throughout the body, you would expect it to be composed largely of: ☐ connective tissue ☐ epithelial tissue ☐ muscle tissue ☐ nerve tissue NOTE: **Turn to back cover for frame 34.**	muscle tissue

34.

MATCH the columns below to indicate the description of each organ listed on the right:

A. composed largely of epithelial tissue, with some connective, muscle and nerve tissue

B. composed largely of muscle tissue, with some epithelial, nerve and connective tissue

C. composed largely of nerve tissue, with some epithelial and connective tissue

1. _____ brain
2. _____ heart
3. _____ kidney

1. C
2. B
3. A

35.

CHECK the human organs listed below:

- ☐ brain
- ☐ epithelial cell
- ☐ heart
- ☐ kidney
- ☐ muscle tissue
- ☐ nerve tissue
- ☐ nerve cell

brain

heart
kidney

36.

There are approximately 100 different organs in the human body.

We have discussed three of them, the brain, the heart, and the kidney, in terms of the activity they perform and the types of tissues that they are composed of.

Which of the following would also be true of the other 97 organs?

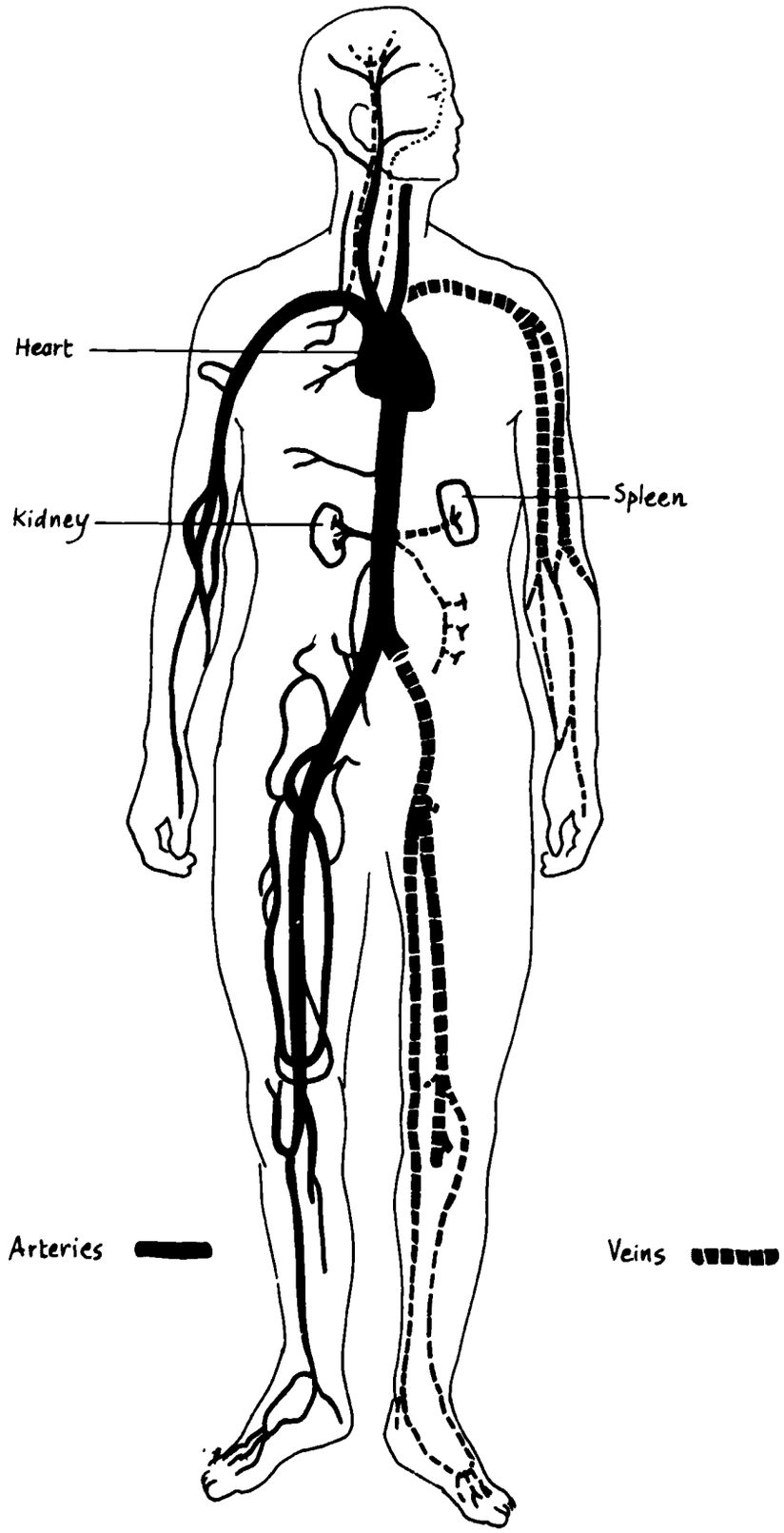
- ☐ capable of performing a particular activity
- ☐ composed of one tissue
- ☐ composed of two or more tissues

capable of performing a . . .

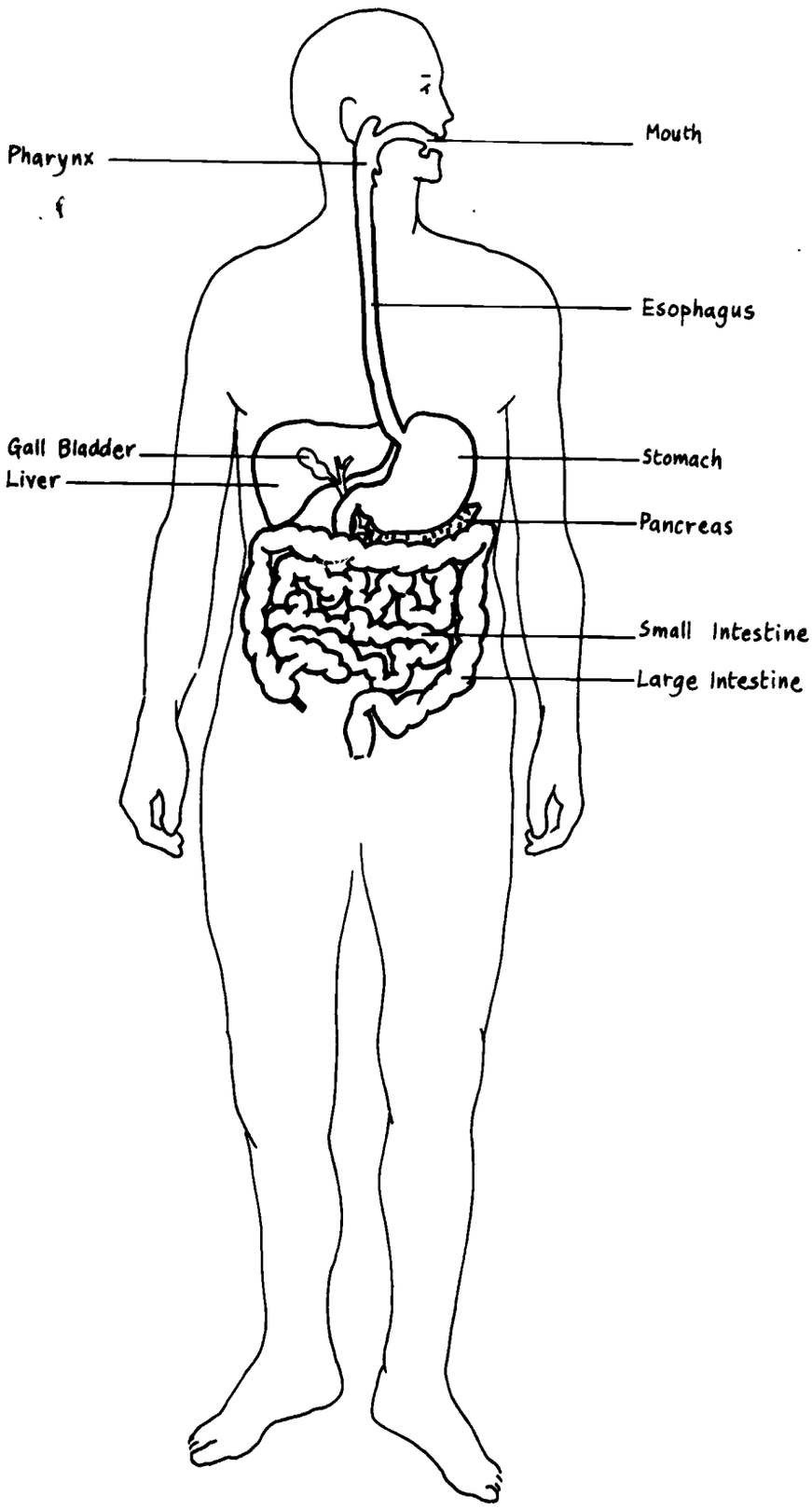
composed of two or more tissues

NOTE: Skip six(6) pages to find page 36 and Frame 37.

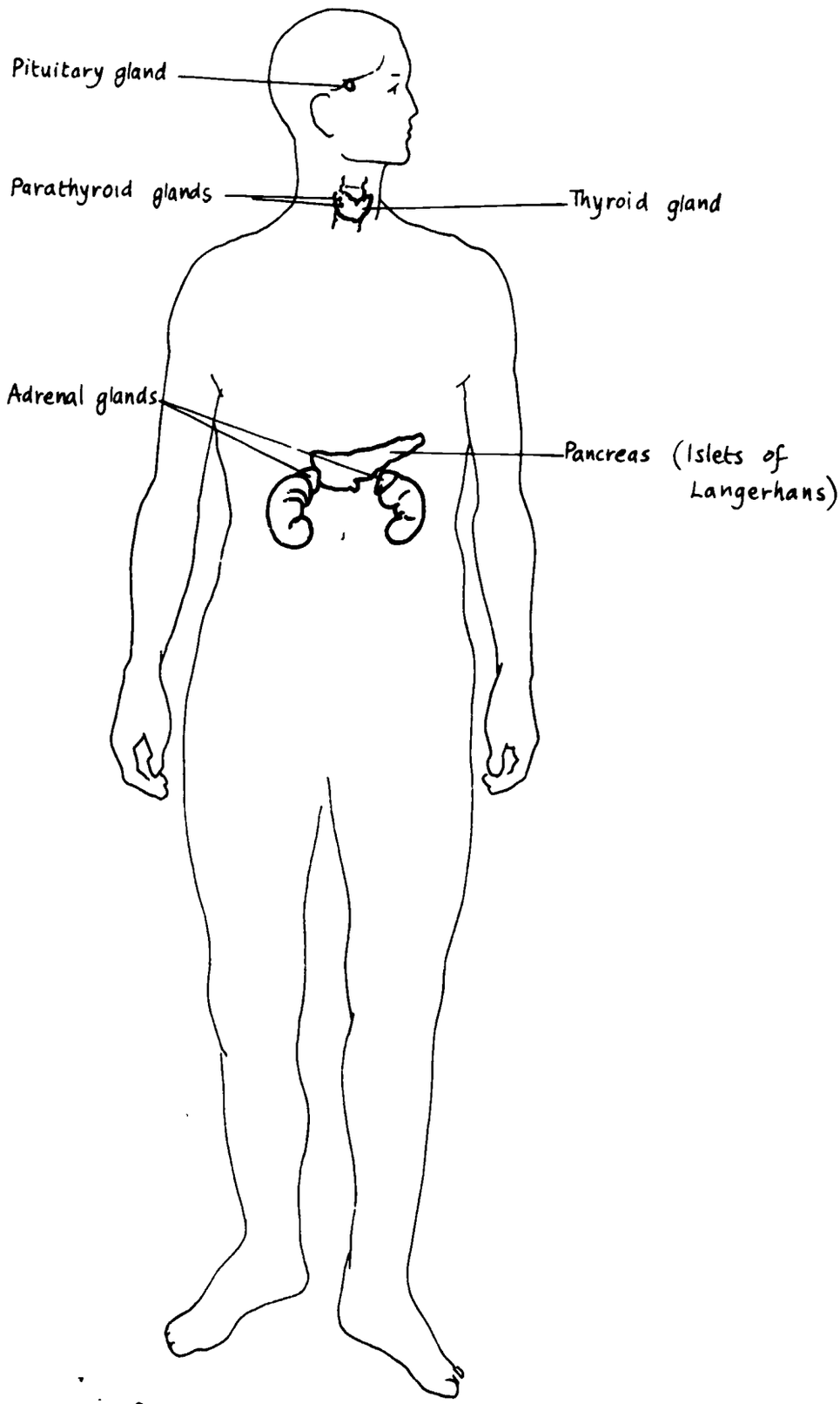
PANEL 2



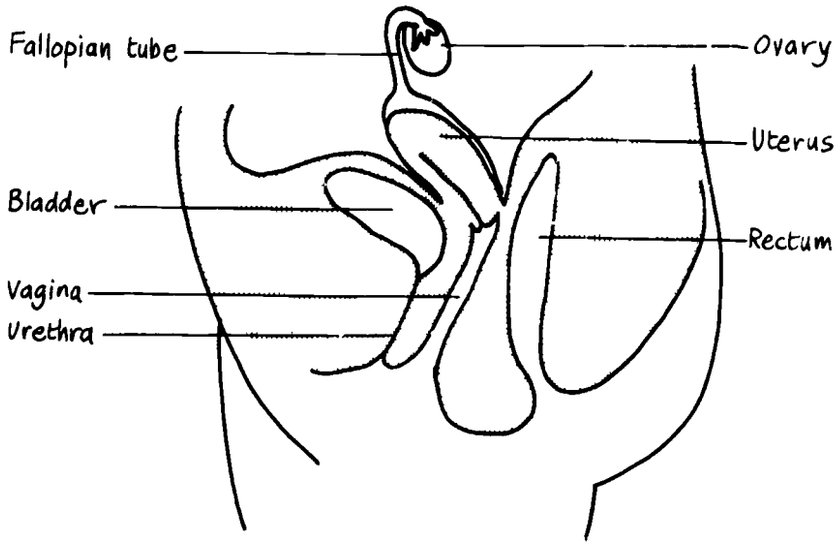
PANEL 3

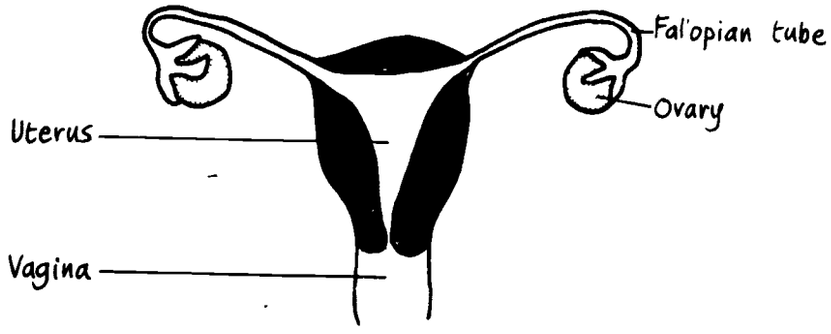

Pharynx
Mouth
Esophagus
Gall Bladder
Liver
Stomach
Pancreas
Small Intestine
Large Intestine

PANEL 4

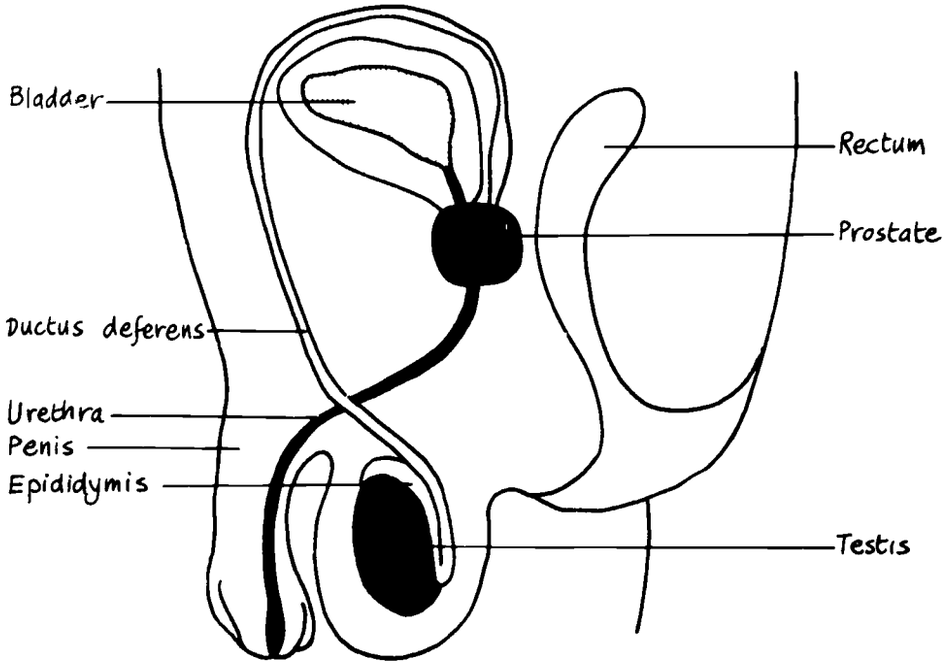

Pituitary gland
Parathyroid glands
Thyroid gland
Adrenal glands
Pancreas (Islets of Langerhans)

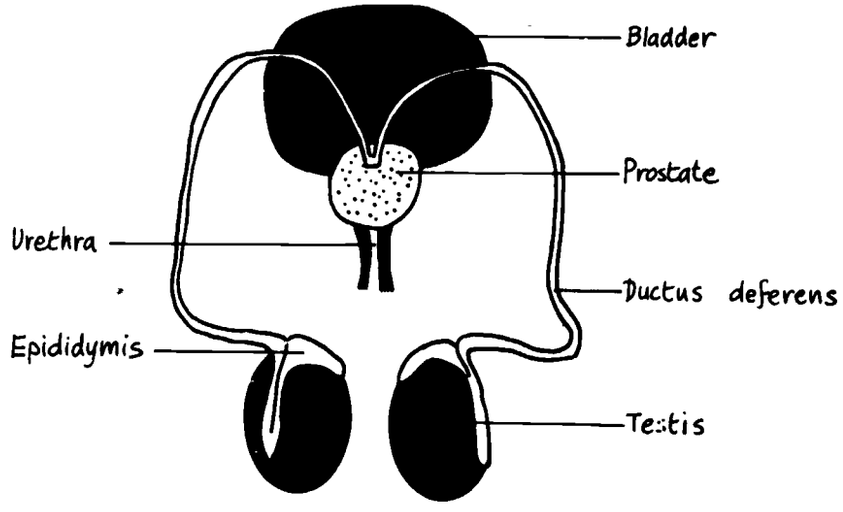
PANEL 5


Fallopian tube
Ovary
Uterus
Bladder
Rectum
Vagina
Urethra

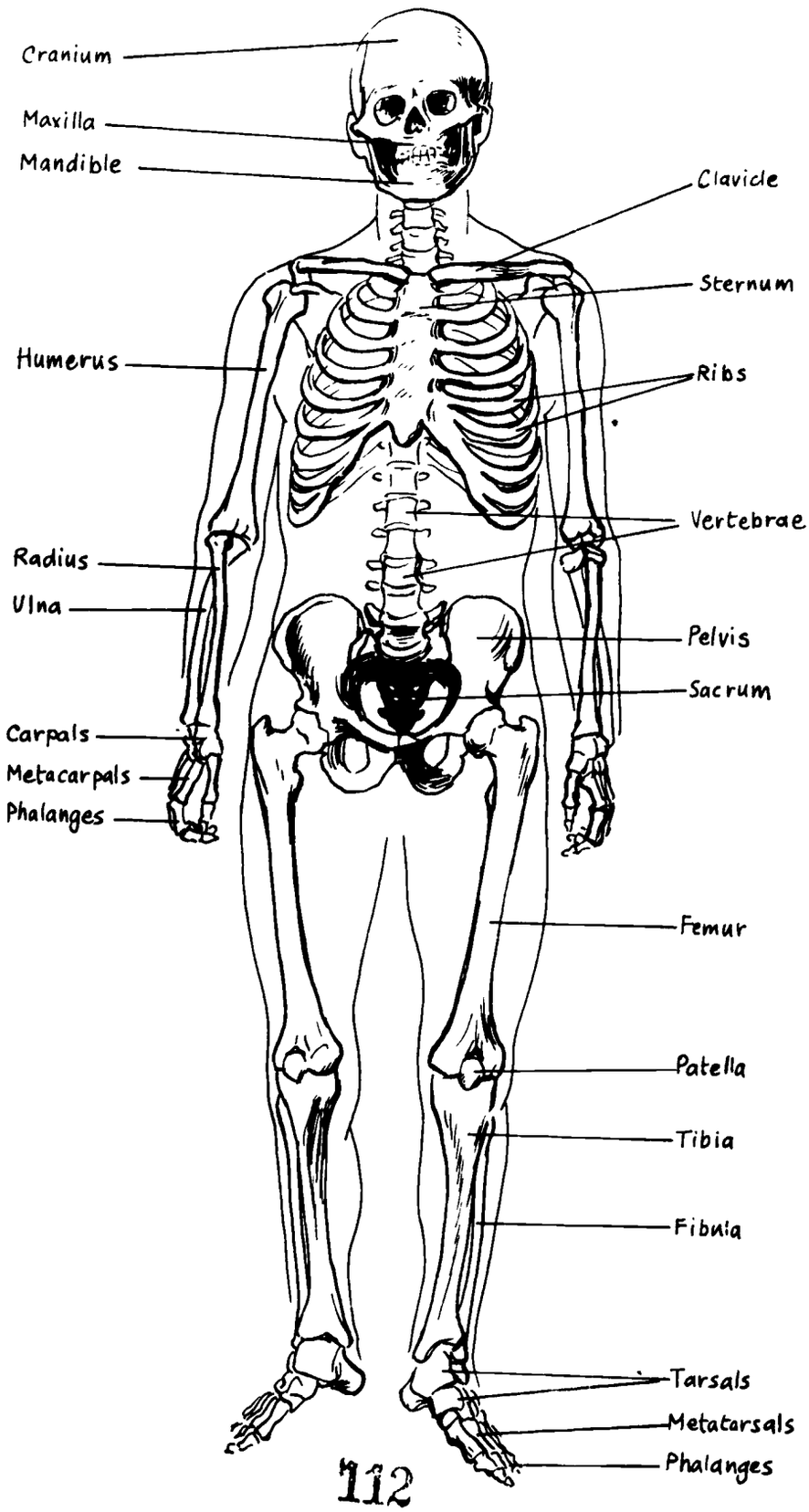

Fal'opian tube
Ovary
Uterus
Vagina

PANEL 6


Bladder
Rectum
Prostate
Ductus deferens
Urethra
Penis
Epididymis
Testis

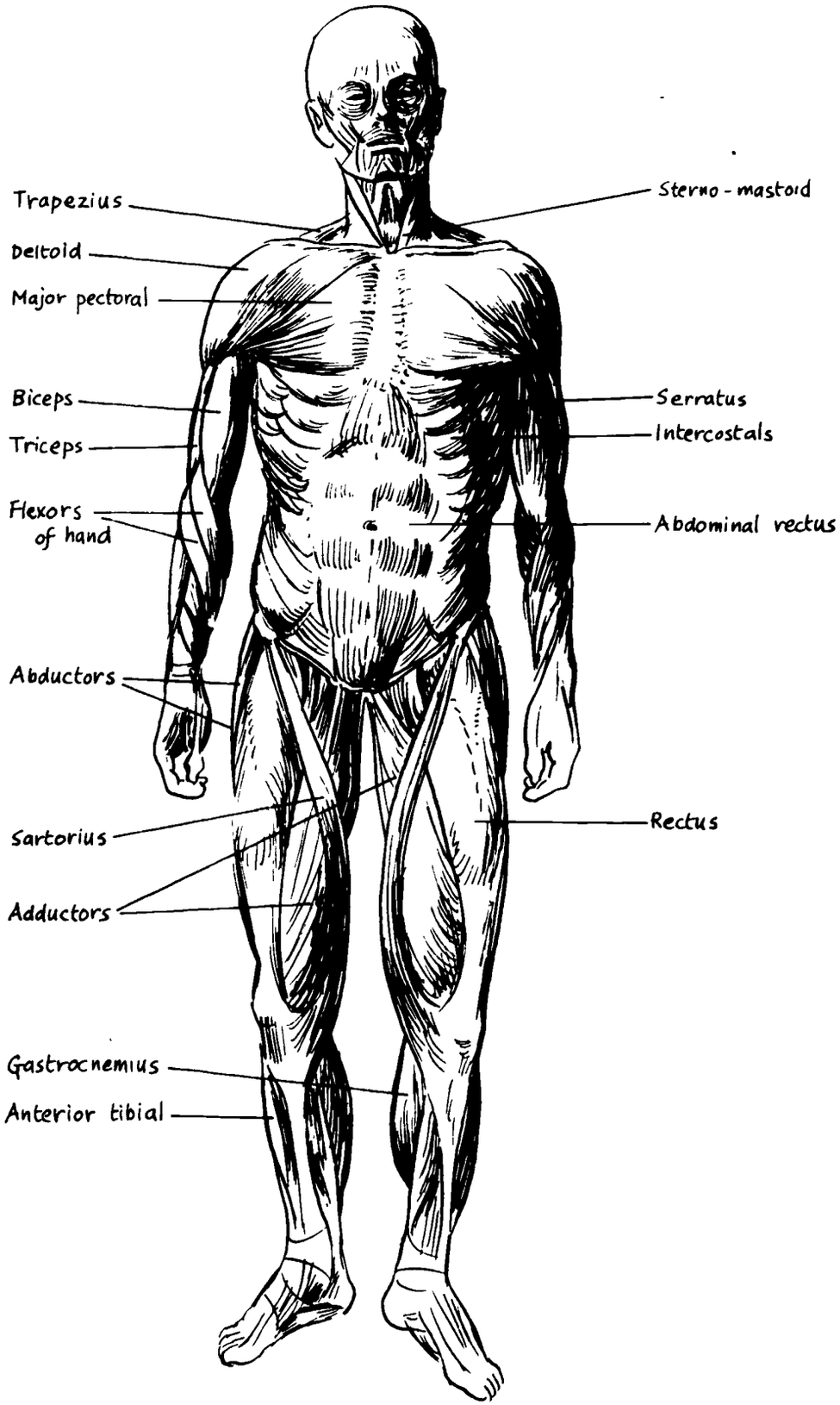

Bladder
Prostate
Urethra
Ductus deferens
Epididymis
Testis

PANEL 7

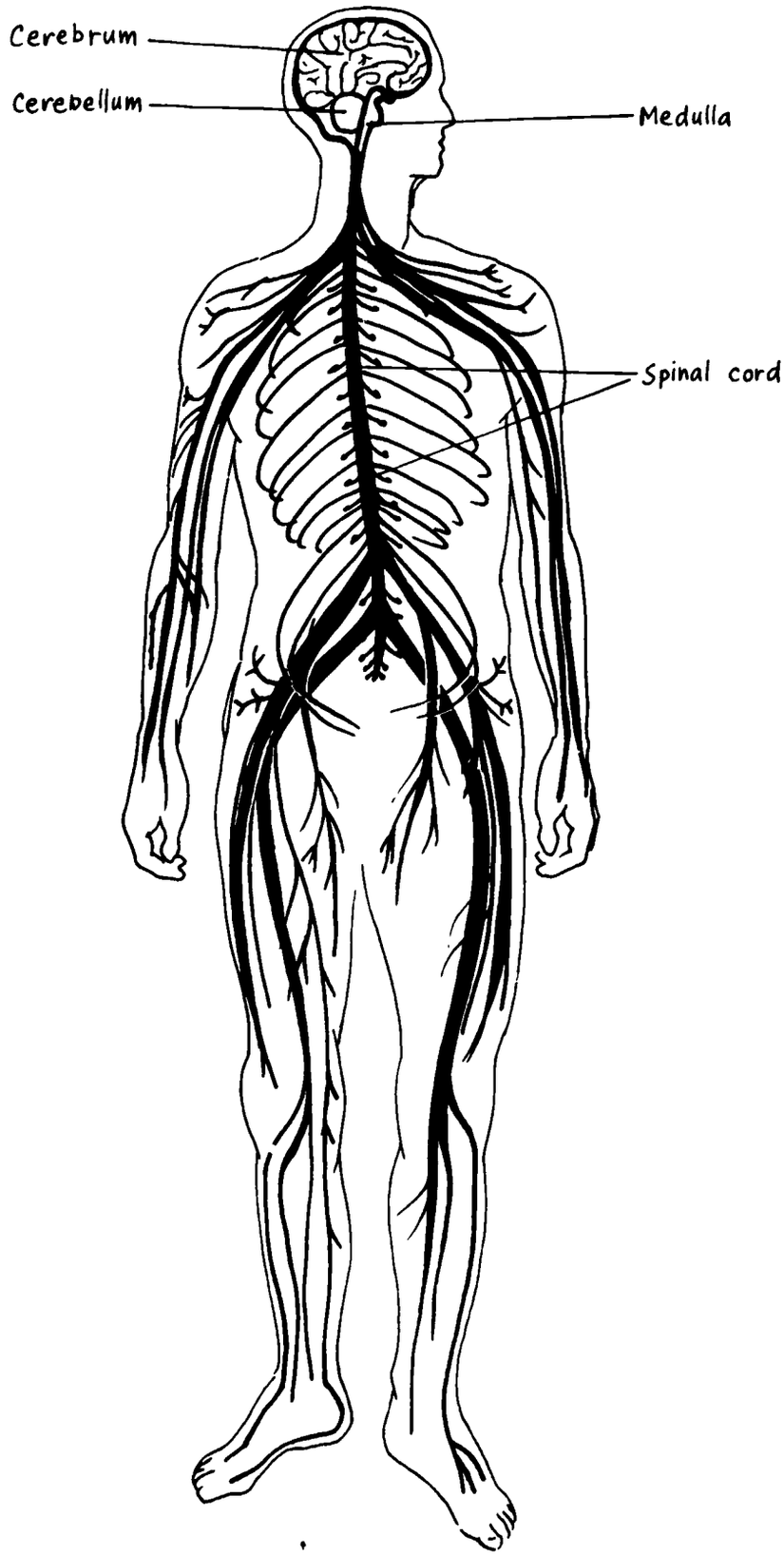

Cranium
Maxilla
Mandible
Clavicle
Sternum
Humerus
Ribs
Vertebrae
Radius
Ulna
Pelvis
Sacrum
Carpals
Metacarpals
Phalanges
Femur
Patella
Tibia
Fibula
Tarsals
Metatarsals
Phalanges

112

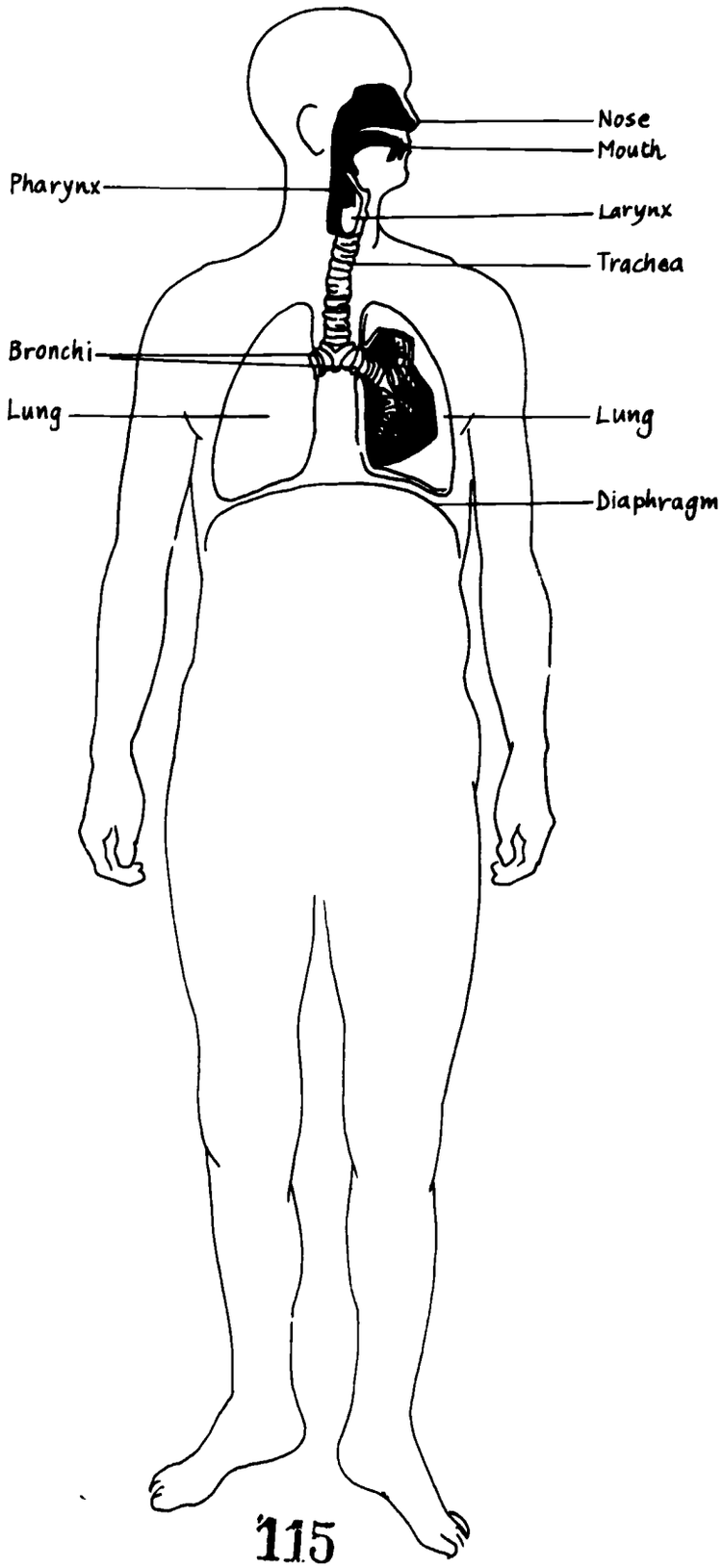
PANEL 7 (cont'd.)



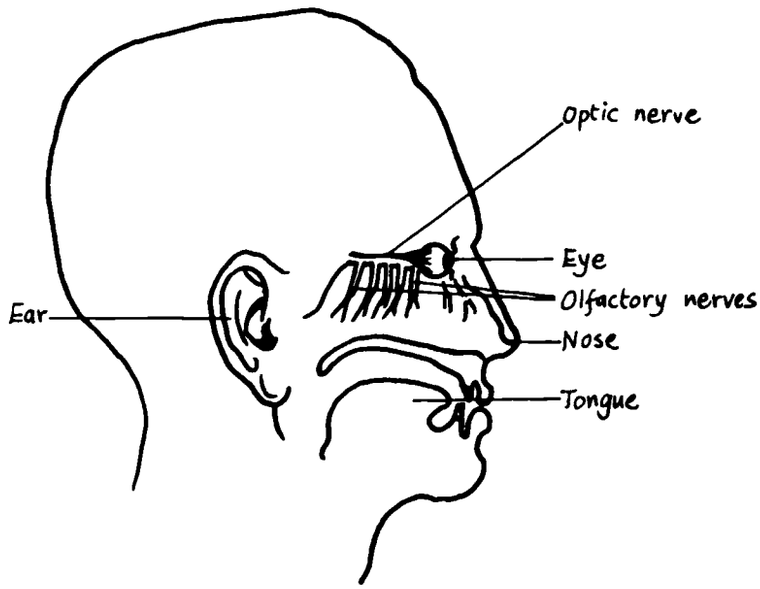
PANEL 8



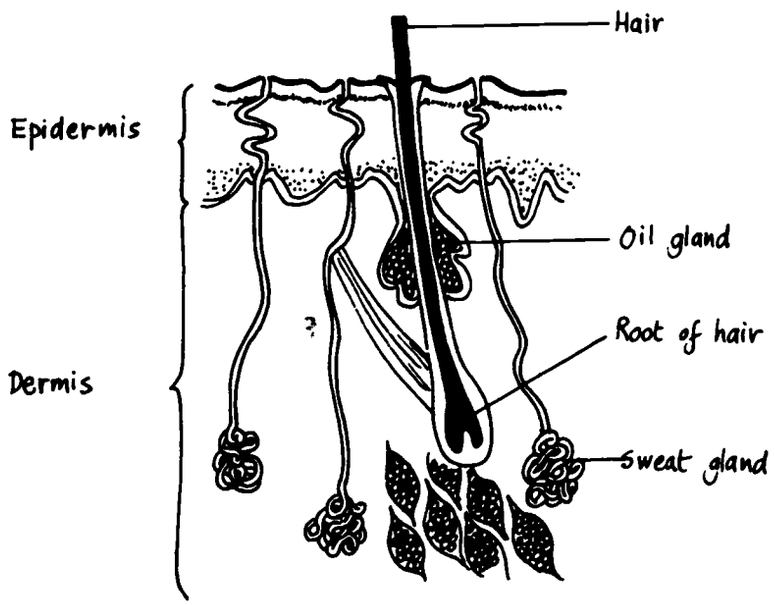
PANEL 9


Nose
Mouth
Pharynx
Larynx
Trachea
Bronchi
Lung
Lung
Diaphragm

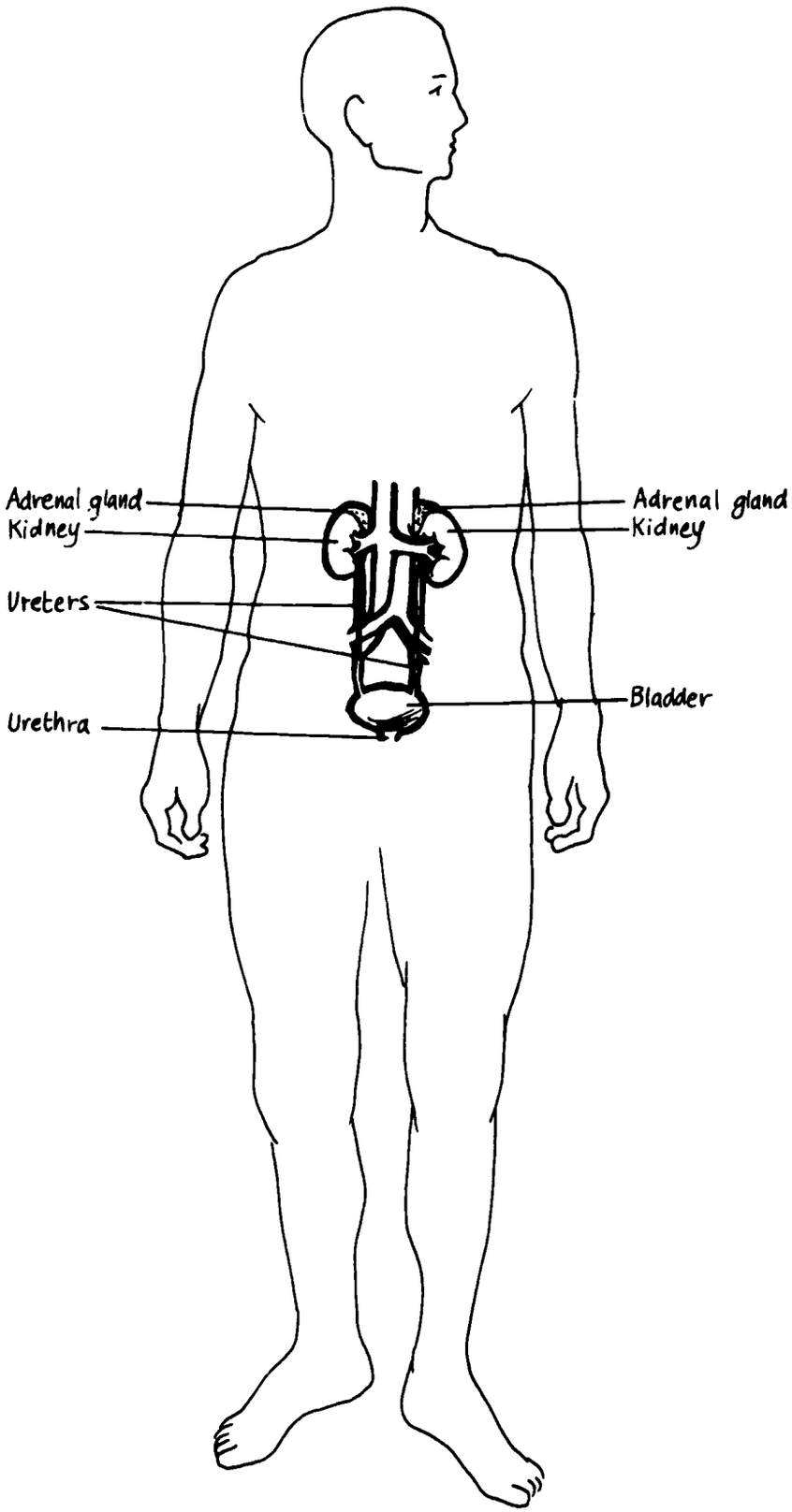
PANEL 10



PANEL 11



PANEL 12


Adrenal gland
Kidney
Ureters
Urethra
Adrenal gland
Kidney
Bladder

37. About how many organs are there in the human body? ☐ about 10 ☐ about 100 ☐ about 1000 ☐ about 10,000	about 100
38. REFER TO PANELS 2 through 12 **(Pages 24 to 35).** Panels 2 through 10 show the major organs found in the human body. Each different panel contains groups of organs that work together to perform one or more related activities which we will call a process. You would expect that the total number of organs shown on Panels 2 through 10 is: ☐ approximately 100 ☐ more than 100 WRITE the number of the panel that contains a picture of the heart as well as other organs that carry blood throughout the body: _____ WRITE the number of the panel that contains a picture of the kidney as well as other organs that filter wastes out of the blood and eliminate fluid from the body: _____ WRITE the number of the panel that contains the brain (cerebellum, medulla, and cerebrum) as well as other organs that conduct motor and sensory impulses: _____	**approximately 100** 2 12 8

39. REFER TO PANELS 2 through 12 Breakdown and absorption of food and elimination of solid wastes are processes carried out by the mouth, pharynx, esophagus, stomach, small intestine, large intestine, pancreas, and liver. Which panel shows these organs carrying out these processes? _____	3
Exchange of carbon dioxide for oxygen is a process carried out by the nose, mouth, pharynx, larynx, trachea, bronchi, lungs, and diaphragm. Which panel shows these organs carrying out this process? _____	9
Protection of the body surface, and regulation of body temperature is a process that involves the epidermis, dermis, sweat glands, hairs, oil glands and nails. Which panel shows these organs carrying out this process? _____	11
Production of eggs, fertilization and pregnancy is a process that involves the ovaries, fallopian tubes, uterus, and vagina. Which panel shows the organs that are capable of carrying out this process? _____	5
The kidneys, ureters, bladder and urethra are the organs that carry on the processes of filtration of wastes out of the blood and elimination of fluid from the body. Which panel shows these organs carrying on this process? _____	12
The muscles and bones give the body movement, protection, and support. Which panel illustrates this? _____	7

40. The eyes, ears, nose (olfactory organ), tongue (taste-buds), pressure receptors (in the skin) and temperature receptors (in the skin) carry on the process of sensing events in the environment. Which panel shows these organs? _____	10
The pituitary, thyroid, parathyroids, adrenals and Islets of Langerhans are organs that produce chemicals (hormones) that control and coordinate the activities of the other organs in the human body. Which panel shows the organs that control and coordinate the activities of other organs in the body? _____	4
Conduction of motor and sensory impulses and therefore, the ability to act, think, speak, etc. is carried out by the cerebellum, medulla, and cerebrum (the brain) and peripheral nerves, and spinal chord. Which panel shows these organs? _____	8
The heart pumps blood throughout the body. The blood, carrying food, oxygen, etc. to the cells is carried by arteries, veins, and capillaries. Which panel shows these organs carrying on this process? _____	2
Production of sperm and delivery of sperm is carried on in the testes, epididymis, ductus deferens, seminal vesicles, prostate gland and penis. Which panel shows these organs? _____	6

41.

Referring to PANELS 2-12, WRITE the number of the Panel that shows the group of organs that carries out each process described below:

breakdown and absorption of food and elimination of solid waste	_____	3
conduction of motor and sensory impulses, regulation of thought, speech and feeling, and control of activity of internal organs	_____	8
delivery of food, oxygen, water and other vital substances to every cell in the body, and removal of cellular waste products	_____	2
elimination of fluid waste	_____	12
exchange of carbon dioxide in blood for oxygen	_____	9
movement and support of body parts and protection of internal organs	_____	7
production of egg for fertilization and place for fertilized egg to grow and develop	_____	5
production of sperm to fertilize egg and means for delivery of sperm to egg	_____	6
protection of body surface and regulation of body temperature	_____	11
production of substances called hormones to control rate of body growth, rate of cell activity, rate of sexual development and level of other substances in body tissues	_____	4
sensing of events in the environment and inside the body	_____	10

42.

REFER TO PANELS 2 through 12

Each group of organs -- even though they are widely spaced throughout the human body -- perform a particular process.

When a group of organs work together in this way, they are said to compose a system.

In other words, each panel shows a different system.

How many systems have we identified in the human body?

_____

11 (There are 11 panels and each shows a different system)

Using the panels, CHECK the groups of organs below that work together in the same system:

☐ epidermis, kidneys, bones	
☐ heart, arteries, veins, capillaries	heart, arteries, veins, capillaries
☐ ovaries, oviducts, uterus, vagina, breasts	ovaries, oviducts, uterus, . . .
☐ pituitary, prostate gland, nose and mouth	
☐ nose, mouth, pharynx, larynx, trachea bronchi, lungs, diaphragm	nose, mouth, pharynx, larynx, . . .

43.

REFER TO PANELS 2 through 12

The heart, arteries, veins and capillaries that carry blood and therefore deliver food, etc. to cells compose the circulatory system.

Which panel shows the circulatory system? _____ 2

The kidneys, ureters, bladder and urethra filter wastes out of the blood and eliminate fluid. These organs compose the urinary system.

Which panel shows the urinary system? _____ 12

The pituitary, thyroid, parathyroids, adrenals and Islets of Langerhans secrete chemicals (hormones) that coordinate and control the activities of other organs. They make up the endocrine system.

Which panel shows the endocrine system? _____ 4

The eyes, ears, nose (olfactory organ), tongue (taste buds), pressure receptors (in the skin), and temperature receptors (in the skin) sense events in the environment. They make up the sensory system.

Which panel shows the sensory system? _____ 10

44.

REFER TO PANELS 2 through 12

The mouth, pharynx, esophagus, stomach, small intestine large intestine, pancreas, liver and gall bladder perform the processes of breakdown and absorption of food and elimination of solid wastes. These organs form the digestive system.

Which panel shows the digestive system? _____ 3

The ovaries, oviducts, uterus, vagina and breasts are involved in production of eggs, fertilization and pregnancy. These organs make up the female reproductive system.

Which panel shows the female reproductive system? _____ 5

The testes, epididymis, ductus deferens, seminal vesicles, prostate gland and penis produce and deliver sperm. These organs make up the male reproductive system.

Which panel shows the male reproductive system? _____ 6

The epidermis, dermis, sweat glands, hairs, oil glands, and nails are involved in protection of the body surface and regulation of body temperature. These organs make up the skin system.

Which panel shows the skin system? _____ 11

45.

REFER TO PANELS 2 through 12

The nose, mouth, pharynx, larynx, trachea, bronchi lungs and diaphragm are involved in exchange of carbon dioxide for oxygen. These organs make up the respiratory system.

Which panel shows the respiratory system? _____ 9

The muscles and bones which move, protect and support the body make up the musculoskeletal system.

Which panel shows the musculoskeletal system? _____ 7

The peripheral nerves, spinal cord, cerebellum, medulla, and cerebrum conduct motor and sensory impulses and therefore control thought, speech, action, etc. These organs compose the nervous system.

Which panel shows the nervous system? _____ 8

46.

A system:

- ☐ consists of one organ only
- ☐ consists of many closely spaced organs
- ☐ consists of many widely spaced organs
- ☐ performs any process
- ☐ performs a particular process

. . . widely spaced organs

performs a particular process

47.

Referring to PANELS 2-12, WRITE the number of the Panel that shows each system named below?

skin system	_____	11
nervous system	_____	8
urinary system	_____	12
sensory system	_____	10
endocrine system	_____	4
male reproductive system	_____	6
digestive system	_____	3
respiratory system	_____	9
circulatory system	_____	2
musculoskeletal system	_____	7
female reproductive system	_____	5

48.

CHECK the systems listed below that are found in the human body:

- ☐ circulatory system
- ☐ digestive system
- ☐ endocrine system
- ☐ female reproductive system
- ☐ male reproductive system
- ☐ musculoskeletal system
- ☐ nervous system
- ☐ respiratory system
- ☐ sensory system
- ☐ skin system
- ☐ urinary system

circulatory system
digestive system
endocrine system
female reproductive system
male reproductive system
musculoskeletal system
nervous system
respiratory system
sensory system
skin system
urinary system

128

49.

CHECK the processes listed below that are processes of the human body:

- ☐ breakdown and absorption of food and elimination of solid waste
- ☐ conduction of motor and sensory impulses, regulation of thought, speech and feeling, and control of activity of internal organs
- ☐ delivery of food, oxygen, water and other vital substances to every cell in the body, and removal of cellular waste products
- ☐ elimination of fluid waste
- ☐ exchange of carbon dioxide in blood for oxygen
- ☐ movement and support of body parts and protection of internal organs
- ☐ production of egg for fertilization and place for fertilized egg to grow and develop
- ☐ production of sperm to fertilize egg and means for delivery of sperm to egg
- ☐ protection of body surface and regulation of body temperature
- ☐ production of substances called hormones to coordinate and control other body organs
- ☐ sensing of events in the environment and the body

breakdown and absorption . . .

conduction of motor and . . .

delivery of food, oxygen . . .

elimination of fluid waste

exchange of carbon dioxide . . .

movement and support of . . .

production of egg for . . .

production of sperm to . . .

protection of body surface . . .

production of substances . . .

sensing of events in the . . .

50.

MATCH the columns below to indicate whether each body part listed on the right is a system, an organ or a tissue:

A. organ
B. system
C. tissue

1. _____	brain	1. A
2. _____	brain, spinal cord and peripheral nerves, as a group	2. B
3. _____	connective cells as a group	3. C
4. _____	epithelial cells as a group	4. C
5. _____	heart	5. A
6. _____	heart, arteries, veins and capillaries as a group	6. B
7. _____	kidney	7. A
8. _____	kidney, ureters, bladder and urethra, as a group	8. B
9. _____	muscl cells as a group	9. C
10. _____	nerve cells as a group	10. C

Time completed _____

YOU HAVE NOW FINISHED THE FIRST PART OF THIS LESSON. WRITE DOWN THE TIME. THEN, AFTER YOU HAVE REVIEWED THE MAIN IDEAS IN THE FOLLOWING SUMMARY, TAKE THE MASTERY TEST AT THE END OF THE BOOKLET.

The human body is a multicellular organism made up of four main types of cells:	
MUSCLE CELLS	Structure: cells which appear to be tightly packed together from end to end in strips or bands; are generally elongated; some looked striped. Function: move body parts by contracting.
CONNECTIVE CELLS	Structure: cells which are spaced far apart and have intercellular material between them. Function: connect, support and protect all parts of the body; bones are composed of connective cells.
EPITHELIAL CELLS	Structure: generally irregularly shaped or shaped like a column; very tightly packed together.
NERVE CELLS	Structure: have a tube-like part in the middle and brush-like structures at either end. Function: specialize in conducting sensory impulses from different parts of the body and conducting motor impulses to moving parts. Specialize in the life functions of conduction and irritability.
SPECIALIZATION	the process by which cells develop the ability to perform one or more function particularly well; that is, a particular type of cell specializes in performing certain jobs and does not perform other jobs.
TISSUE	a structure composed of cells that have similar appearances and perform similar functions. Examples: epithelial tissue connective tissue, muscle tissue, nerve tissue.
ACTIVITY	that which is performed by a single structure, composed of two or more different types of tissues. Examples: pumping of blood throughout the body is performed by muscle tissue, also by epithelial, nerve and connective tissues.

ORGAN	a structure composed of two or more tissues and performs one particular activity. Examples: brain, heart, kidney
SYSTEM	a group of organs working together to perform one or more related functions. See diagrams of the systems attached.

MASTERY TEST

Time started _____

1. INDICATE whether each body part listed below is a system, an organ or a tissue by writing S after the systems, O after the organs, and T after the tissues:

   a. nerve cells as a group _____

   b. muscle cells as a group _____

   c. kidney, ureters, bladder and urethra, as a group _____

   d. kidney _____

   e. heart, arteries, veins and capillaries as a group _____

   f. heart _____

   g. epithelial cells as a group _____

   h. connective cells as a group _____

   i. brain, spinal cord and peripheral nerves as a group _____

   j. brain _____

2. MATCH the columns below to indicate the process of each system listed on the right:

A. breakdown and absorption of food and elimination of solid wastes	1. _____ circulatory system
B. conduction of motor and sensory impulses, therefore control of action, thought, speech, etc.	2. _____ digestive system
C. carrying of blood throughout the body, therefore, delivery of food, oxygen, etc. to cells	3. _____ endocrine system
D. exchange of carbon dioxide for oxygen	4. _____ female reproductive system
E. filtration of wastes out of blood, elimination of fluid	5. _____ male reproductive system
F. movement, protection and support	6. _____ musculoskeletal system
G. production of eggs, fertilization and pregnancy	7. _____ respiratory system
H. production of sperm, delivery of sperm	8. _____ nervous system
I. protection of body surface, regulation	9. _____ sensory system
J. secretion of chemicals (hormones) that coordinate and control the activities of other organs	10. _____ skin system
K. sensing of events in the environment	11. _____ urinary system

Time completed _____

WHEN YOU HAVE FINISHED THIS TEST, WRITE DOWN THE TIME. THEN TAKE THE LESSON TO YOUR INSTRUCTOR OR HIS ASSISTANT FOR CHECKING. WAIT UNTIL THE LESSON IS APPROVED BEFORE GOING ON TO THE NEXT LESSON.

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PM 431 - 55

ADVANCED GENERAL EDUCATION PROGRAM

A HIGH SCHOOL SELF-STUDY PROGRAM

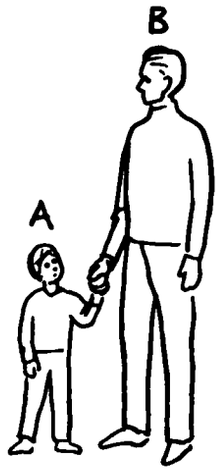
GROWTH AND NUTRITION
LEVEL: II
UNIT: 7
LESSON: 4

U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION, JOB CORPS
NOVEMBER 1969

U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION, JOB CORPS
NOVEMBER 1969

1. PREVIEW FRAME Like an automobile, the human body requires fuel. It's fuel consists of the food and air it takes in. In Lesson 4 we will examine the foods a human body requires. How the body uses air will be examined later, in Lesson 5. The next section looks more closely at the comparison of a human organism with an automobile. NO RESPONSE REQUIRED	GO ON TO THE NEXT FRAME
2. Imagine an automobile in which small parts of the hood and the doors and the tires continually crumbled and had to be replaced. Suppose that this automobile was able to repair the crumbled pieces all by itself, even as it drove around the streets. This unusual automobile would be performing two activities <u>at the same time</u>. CHECK the two activities below: ☐ filling up with gasoline ☐ moving from one place to another ☐ repairing its own body ☐ parking in a lot	moving from one place to another repairing its own body
3. No one has ever made an automobile which repairs itself as it moves around. However, the human body does this. In its ability to replace dying tissue, the human organism: ☐ is different from an automobile ☐ resembles an automobile	is different from an automobile

4.



Above are shown a child and a man. Which organism has more tissue?

- ☐ A
- ☐ B

B

A child grows into a man. As he grows, his amount of tissue:

- ☐ decreases
- ☐ increases

increases

Increasing the amount of tissue in the body could be considered:

- ☐ adding cells
- ☐ taking away cells

adding cells

Growing involves:

- ☐ leaving tissue as it is
- ☐ putting more cells into tissue
- ☐ taking cells from tissue

putting more cells into tissue

5. Replacing dying tissue and adding cells to the tissue are related activities. Thus, replacing dying tissue is associated with which process below (CHECK one): ☐ growing ☐ irritability ☐ muscular contraction ☐ nervous conduction ☐ seeing In its ability to grow, the human body: ☐ is different from an automobile ☐ resembles an automobile	growing is different from an automobile

6.

COMPLETE the following table by CHECKING the appropriate boxes:

	human body	auto-mobile	human body	auto-mobile
can move from place to place	☐	☐	☒	☒
can replace dying portions of itself	☐	☐	☒	☐
can grow	☐	☐	☒	☐

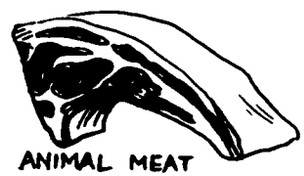
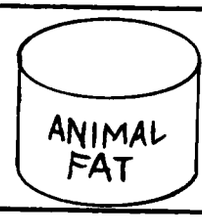
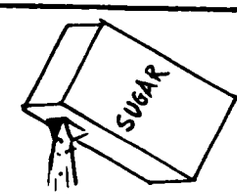
7. No activity of the human body is possible without food. Similarly, an automobile cannot run without gasoline. However, food allows the body to do certain things which gasoline cannot help a car to do. WRITE an F beside each activity below which food makes possible. WRITE a G beside each activity below which gasoline makes possible. _____ motion from one place to another _____ growth _____ replacement of dying portions	1. F, G 2. F 3. F
8. Every activity of the human body requires food. Food makes it possible for the body to maintain the life functions discussed in Lesson 1. In this respect, growth and tissue replacement: ☐ differ from the other life functions ☐ resemble the other life functions	resemble the other life functions
9. TERMINAL FRAME CHECK below the activities of the human body which require food: ☐ growth ☐ irritability ☐ muscular contraction ☐ nervous conduction ☐ replacement of tissue	growth irritability muscular contraction nervous conduction replacement of tissue

10. PREVIEW FRAME Humans need food in order to perform their activities. Although the human organism consumes a great variety of foods, it breaks them down into three types of substances which it then stores and uses in different parts of the organism. In the next section you will learn about these three substances which our bodies derive from its food. Later, you will find out how the substances are employed by the organism. NO RESPONSE REQUIRED	GO ON TO THE NEXT FRAME

PANEL 1

THE THREE CLASSES OF FOOD SUBSTANCES

FOR THE HUMAN ORGANISM

	SUBSTANCE A	SUBSTANCE B	SUBSTANCE C
FOOD SUBSTANCE IS THE CHIEF CONSTITUENT OF:			
BODY CHANGES IT INTO:	AMINO ACIDS	GLYCERINE FATTY ACIDS	GLUCOSE
CHEMICAL ELEMENTS PRESENT IN FOOD SUBSTANCE IN LARGE QUANTITY:	carbon hydrogen oxygen nitrogen	carbon hydrogen oxygen	carbon hydrogen oxygen

143

11.

REFER TO PANEL 1

The chief constituent of animal meat is called protein. The chief constituents of animal fat are called lipids. The chief constituent of table sugar, in fact, its only constituent, is carbohydrate.

Which of the following substances is broken down by the body into glucose?

- ☐ carbohydrate
- ☐ lipid
- ☐ protein

carbohydrate

The chief constituent of animal meat is:

- ☐ carbohydrate
- ☐ lipid
- ☐ protein

protein

The body changes lipids into:

- ☐ amino acids
- ☐ fatty acids
- ☐ glucose
- ☐ glycerine

fatty acids

glycerine

The body changes protein into:

- ☐ amino acids
- ☐ fatty acids
- ☐ glucose
- ☐ glycerine

amino acids

12.

REFER TO PANEL 1

The body makes glucose from:

- ☐ carbohydrate
- ☐ lipid
- ☐ protein

carbohydrate

The body makes amino acids from:

- ☐ carbohydrate
- ☐ lipid
- ☐ protein

protein

The chief constituent of animal meat is:

- ☐ carbohydrate
- ☐ lipid
- ☐ protein

protein

The body obtains glycerine and fatty acids from:

- ☐ carbohydrate
- ☐ lipid
- ☐ protein

lipid

13. REFER TO PANEL 1 The chief constituent of sugar is: ☐ carbohydrate ☐ lipid ☐ protein	carbohydrate
Protein is the chief constituent of: ☐ animal meat ☐ animal fat ☐ sugar	animal meat
The chief constituent of animal fat is: ☐ carbohydrate ☐ lipid ☐ protein	lipid
The body changes lipids into: ☐ amino acids ☐ glucose ☐ glycerine and fatty acids	glycerine and fatty acids
14. REFER TO PANEL 1 Amino acids are obtained from: ☐ carbohydrate ☐ lipid ☐ protein	protein
Glycerine and fatty acids are obtained from: ☐ carbohydrate ☐ lipid ☐ protein	lipid
Glucose is obtained from: ☐ carbohydrate ☐ lipid ☐ protein	carbohydrate

15.

DO NOT REFER TO THE PANEL

The body changes protein into amino acids. It changes carbohydrates into glucose. It changes lipids into glycerine and fatty acids.

Amino acids come from:

- ☐ animal fat
- ☐ animal meat
- ☐ sugar

animal meat

Glycerine comes from:

- ☐ animal fat
- ☐ animal meat
- ☐ sugar

animal fat

Glucose comes from:

- ☐ animal fat
- ☐ animal meat
- ☐ sugar

sugar

Fatty acids come from:

- ☐ animal fat
- ☐ animal meat
- ☐ sugar

animal fat

16.

DO NOT REFER TO THE PANEL

MATCH the substances below with the foods from which they come, by WRITING one letter in each blank.

A. protein
B. carbohydrate
C. lipid

1. _____ animal fat	1. C
2. _____ animal meat	2. A
3. _____ sugar	3. B

Now MATCH the same substances with the substances into which the body changes them.

1. _____ amino acids	1. A
2. _____ fatty acids	2. C
3. _____ glucose	3. B
4. _____ glycerine	4. C

17.

DO NOT REFER TO PANEL 1

COMPLETE the following table by CHECKING the appropriate boxes:

	proteins	carbo-hydrates	lipids	proteins	carbo-hydrates	lipids
comes from animal fat	☐	☐	☐	☐	☐	☒
comes from animal meat	☐	☐	☐	☒	☐	☐
comes from sugar	☐	☐	☐	☐	☒	☐
changed by body into amino acids	☐	☐	☐	☒	☐	☐
changed by body into fatty acids	☐	☐	☐	☐	☐	☒
changed by body into glucose	☐	☐	☐	☐	☒	☐
changed by body into glycerine	☐	☐	☐	☐	☐	☒

18.

REFER AGAIN TO PANEL 1

The chemical elements present in lipids in large quantity are (CHECK one or more):

- ☐ carbon — carbon
- ☐ hydrogen — hydrogen
- ☐ neon
- ☐ nitrogen
- ☐ oxygen — oxygen
- ☐ uranium

The chemical elements present in protein in large quantity are (CHECK one or more):

- ☐ carbon — carbon
- ☐ hydrogen — hydrogen
- ☐ neon
- ☐ nitrogen — nitrogen
- ☐ oxygen — oxygen
- ☐ uranium

The chemical elements present in carbohydrates in large quantity are (CHECK one or more):

- ☐ carbon — carbon
- ☐ hydrogen — hydrogen
- ☐ neon
- ☐ nitrogen
- ☐ oxygen — oxygen
- ☐ uranium

19.

DO NOT REFER TO THE PANEL

You would expect to find nitrogen in:

- ☐ amino acids
- ☐ fatt, acids
- ☐ glucose
- ☐ glycerine

amino acids

You would expect to find oxygen in large quantity in:

- ☐ amino acids
- ☐ fatty acids
- ☐ glucose
- ☐ glycerine

amino acids
fatty acids
glucose
glycerine

Carbon, hydrogen, and oxygen are <u>all</u> found in large quantity in:

- ☐ animal fat
- ☐ animal meat
- ☐ sugar

animal fat
animal meat
sugar

Nitrogen is found in large quantity <u>only</u> in:

- ☐ carbohydrate
- ☐ lipid
- ☐ protein

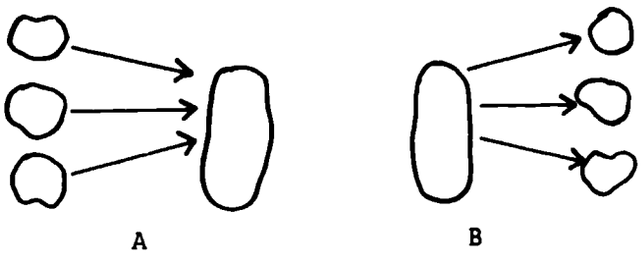
protein

20.

DO NOT REFER TO PANEL 1

COMPLETE the following table by CHECKING the appropriate boxes:

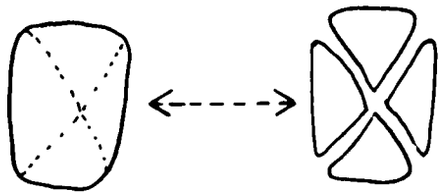
	protein	carbo-hydrates	lipids	protein	carbo-hydrates	lipids
contains carbon in large quantity	☐	☐	☐	☒	☒	☒
contains hydrogen in large quantity	☐	☐	☐	☒	☒	☒
contains nitrogen in large quantity	☐	☐	☐	☒	☐	☐
contains oxygen in large quantity	☐	☐	☐	☒	☒	☒
comes from animal fat	☐	☐	☐	☐	☐	☒
comes from animal meat	☐	☐	☐	☒	☐	☐
comes from sugar	☐	☐	☐	☐	☒	☐
changed by body into amino acids	☐	☐	☐	☒	☐	☐
changed by body into fatty acids	☐	☐	☐	☐	☐	☒
changed by body into glucose	☐	☐	☐	☐	☒	☐
changed by body into glycerine	☐	☐	☐	☐	☐	☒

21. PREVIEW FRAME You have learned the three types of substances the human body obtains from its food. When the body obtains substances from its food it builds them up into new substances it needs, or breaks them down into other substances it needs. These processes will be briefly described in the next section. Lesson 5 will illustrate them in greater detail. NO RESPONSE REQUIRED	GO ON TO THE NEXT FRAME
22.  A B Inside the body, substances are constantly being built up into larger substances, while others are being broken down into smaller substances. Which of the above processes occur in the human organism? ☐ A ☐ B The building-up process is illustrated by Process: ☐ A ☐ B Process B is an example of: ☐ breaking down ☐ building up	A B A breaking down

23.

The building up of substances in the body from simpler ones is called anabolism. The breaking down of substances is called catabolism.

EXAMPLE:



The above example, if the arrow points to the right, the process would be:

- ☐ anabolism
- ☐ catabolism

catabolism

If the arrow points to the left, the process would be:

- ☐ anabolism
- ☐ catabolism

anabolism

24.

If you give a cat a piece of tissue to chew on, the cat will:

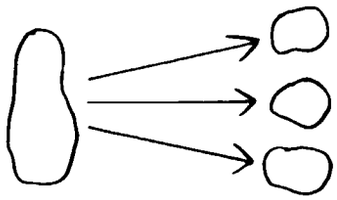
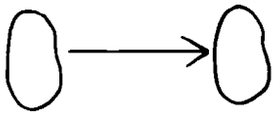
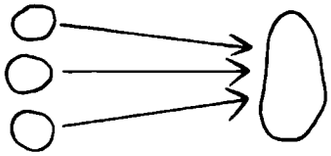
- ☐ break the tissue down
- ☐ build the tissue up

break the tissue down

This will help you remember that the destruction of a substance is called:

- ☐ anabolism
- ☐ catabolism

catabolism

25. The totality of all building-up processes and breaking-down processes in the body is called <u>metabolism</u>. Metabolism includes: ☐ anabolism ☐ catabolism	anabolism catabolism
26. Any process of building-up or of breaking-down within the organism is included under the term metabolism. CHECK the metabolic processes below: ☐ A  ☐ B  ☐ C 	A C

27.

Catabolism is an example of a:

- ☐ breaking-down process
- ☐ building-up process
- ☐ metabolic process
- ☐ reproductive process

breaking-down process

metabolic process

28.

MATCH the terms below to their descriptions by WRITING the appropriate letter in each blank:

A. anabolism
B. catabolism
C. metabolism

1. _____ the totality of all building-up and breaking-down processes in the organism

2. _____ building-up process

3. _____ breaking-down process

1. C

2. A

3. B

Time completed _____

YOU HAVE NOW FINISHED THE FIRST PART OF THIS LESSON. WRITE DOWN THE TIME. THEN, AFTER YOU HAVE REVIEWED THE MAIN IDEAS IN THE FOLLOWING SUMMARY, TAKE THE MASTERY TEST AT THE END OF THE BOOKLET.

GROWTH	the process of manufacturing more tissue; growth depends upon food.
NUTRIENTS	substances derived from the goods we eat that are used to provide energy for the life functions.
PROTEIN	COMES FROM: animal meat CONTAINS: carbon, hydrogen, nitrogen, oxygen CHANGED BY BODY INTO: amino acids
CARBOHYDRATES	COMES FROM: sugar CONTAINS: carbon, hydrogen, oxygen CHANGED BY BODY INTO: glucose
LIPIDS (FATS)	COMES FROM: animal fat CONTAINS: carbon, hydrogen, oxygen CHANGED BY BODY INTO: glycerine , fatty acids
ANABOLISM	the building up of substances in the body from simpler ones.
CATABOLISM	the breaking down of substances.
METABOLISM	all the building-up and breaking-down processes in the body; the processes of anabolism and catabolism together .

MASTERY TEST

Time started _____

1. MATCH the following:

A. carbohydrates	1. _____ animal fat
B. lipid	2. _____ animal meat
C. protein	3. _____ sugar

2.

amino acids
fatty acids
glucose
glycerine

CHOOSE one or more terms from the list above to COMPLETE the sentences below.

1. Animal fat is digested and converted into _____.
2. A piece of roast beef with no fat on it would be converted by the body into _____.
3. Before it can be used by the body, the sugar in a piece of candy must be changed into _____.

3. a. Which of the following substances are found in large quantity in all three types of food substances (carbohydrates, lipids and proteins)?

   a. ☐ carbon
   b. ☐ hydrogen
   c. ☐ nitrogen
   d. ☐ oxygen

   b. Which of the following is/are found in large quantity only in proteins?

   a. ☐ carbon
   b. ☐ hydrogen
   c. ☐ nitrogen
   d. ☐ oxygen

4. MATCH the terms below with their descriptions:

A. anabolism

B. catabolism

C. metabolism

1. _____ all building-up processes and breaking-down processes

2. _____ breaking-down processes

3. _____ building-up processes

Time completed _____

WHEN YOU HAVE FINISHED THIS TEST, WRITE DOWN THE TIME. THEN TAKE THE LESSON TO YOUR INSTRUCTOR OR HIS ASSISTANT FOR CHECKING. WAIT UNTIL THE LESSON IS APPROVED BEFORE GOING ON TO THE NEXT LESSON.

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ADVANCED GENERAL EDUCATION PROGRAM

A HIGH SCHOOL SELF-STUDY PROGRAM

METABOLISM
LEVEL: II
UNIT: 7
LESSON: 5

U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION, JOB CORPS
NOVEMBER 1969

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MANPOWER ADMINISTRATION, JOB CORPS
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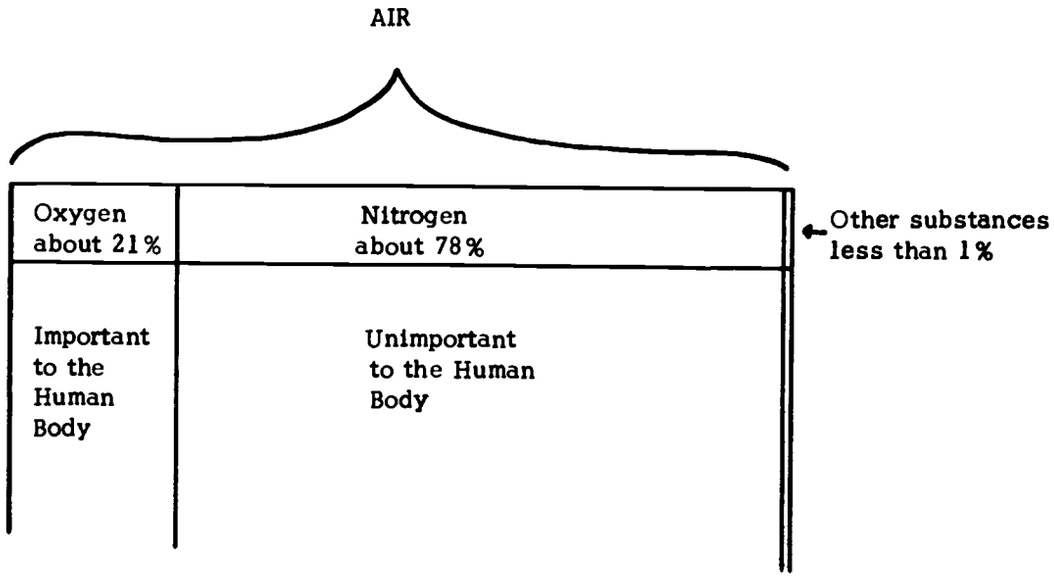
1. PREVIEW FRAME In lesson 4 you learned why the human body needs food. You learned the three basic substances the body derives from its food, and the elements of which these substances consist. In the next lesson you will learn how the body utilizes these substances in order to sustain all its activities. NO RESPONSE REQUIRED	GO ON TO THE NEXT FRAME
2. The body requires two sources of energy: an immediate, moment-to-moment source, and a source that can be stored for later use. The layers of fat beneath the skin of the belly, buttocks, and other regions provide the main storage place for long-term energy. On the other hand, moment-to-moment energy is obtained mainly from sugar and similar substances. From the above, you would expect lipids to be used chiefly for: ☐ long-term energy ☐ moment-to-moment energy Carbohydrates would be used mainly for: ☐ long-term energy ☐ moment-to-moment energy	long-term energy ► moment-to-moment . . .

3. Moment-to-moment energy is obtained mainly from (CHECK one): ☐ carbohydrates ☐ lipids ☐ proteins Long-term energy is obtained chiefly by storing: ☐ carbohydrates ☐ lipids ☐ proteins	carbohydrates lipids
4. PREVIEW FRAME You have noted the two kinds of energy sources needed by the human body: short-term sources and storable long-term sources. In the next section you will learn the two processes by which energy is released from substances. NO RESPONSE REQUIRED	GO ON TO THE NEXT FRAME

PANEL 1

COMPOSITION OF THE AIR WE BREATHE



5. REFER TO PANEL 1 You must first learn a few facts about the air you are breathing right now. It consists mainly of two substances. LIST them below: _____ _____ The greater part of the air is made up of a substance called _____. Is this component of the air used by the human body? ☐ no ☐ yes According to the Panel, the component of air which is used by the body is called _____.	 nitrogen oxygen nitrogen no oxygen
6. DO NOT REFER TO THE PANEL When the body breathes in air, it uses that component of the air called (CHECK one): ☐ carbohydrates ☐ hydrogen ☐ nitrogen ☐ oxygen	 oxygen

7.

The human body eats food and breathes in air. These two activities supply the raw materials for an energy-producing process that occurs within the body.

From this it is clear that oxygen:

- ☐ enters into the process at the start
- ☐ is an end result of the process

enters into the process at the start

It is also clear that carbohydrates may:

- ☐ be an end result of the process
- ☐ enter into the process at the start

enter into the process at the start

8.

The object of the energy-producing process is to release energy for the body's use. Another outcome of this process is certain waste products, which are useless to the body.

MATCH the following by writing one letter in each blank.

A. present at start of process

B. present at end of process

1. _____ energy — 1. B
2. _____ oxygen — 2. A
3. _____ substances obtained from food — 3. A
4. _____ waste products — 4. B

9. Oxidation is the name of an energy-releasing process that requires oxygen. The process we have been discussing: ☐ can be named oxidation ☐ cannot be named oxidation Which of the following are used for the production of energy: ☐ nitrogen ☐ substances derived from food ☐ waste products	can be named . . . substances derived from food
10. An energy-releasing process that requires oxygen is called: ☐ anabolism ☐ oxidation ☐ respiration The unwanted results of this process is: ☐ energy ☐ oxygen ☐ substances derived from food ☐ waste product	oxidation waste product
11. A process that liberates energy in the human body is called (CHECK one): ☐ carbohydrate ☐ digestion ☐ oxidation ☐ oxygen ☐ waste products	oxidation

12.

MATCH the following by writing one letter in each blank:

A. material entering into the oxidation process

B. result of the oxidation process

1. _____ energy
2. _____ oxygen
3. _____ substances obtained from food
4. _____ waste products

1. B
2. A
3. A
4. B

13.

CHECK the appropriate item(s) below.

The process of oxidation:

- ☐ does not involve energy
- ☐ does not involve oxygen
- ☐ involves oxygen
- ☐ releases energy
- ☐ uses up energy

involves oxygen
releases energy

14.

PREVIEW FRAME

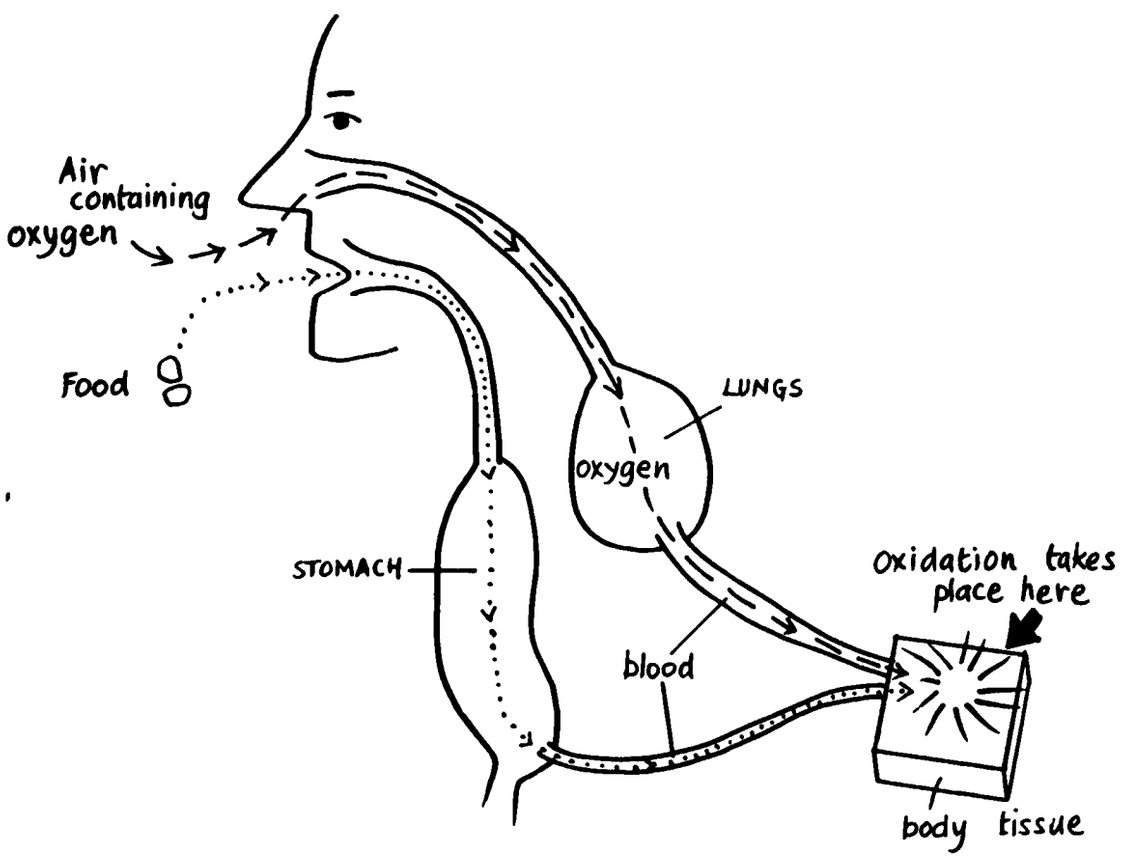
We will now look more closely at the process of oxidation. In the next section you will see how this process is carried out in the human body.

NO RESPONSE REQUIRED

GO ON TO THE NEXT FRAME

PANEL 2

HOW THE MATERIALS FOR OXIDATION ARE CARRIED
TO THE PLACE WHERE THE PROCESS OCCURS



16. REFER TO PANEL 2 One of the two raw materials for oxidation is a gas. The gas reaches the point where oxidation occurs by passing through the: ☐ lungs ☐ stomach This gas: ☐ enters the body through the mouth ☐ enters the body through the nose The blood carries to the point of oxidation: ☐ both the materials that enter into the process ☐ only one of the materials that enter into the process	lungs . . . through the mouth . . . through the nose both the materials . . .
17. REFER TO PANEL 2 NUMBER the following events from 1 to 5 in the blanks, in the order in which they occur: _____ oxygen enters blood _____ oxygen enters body tissue _____ oxygen enters lungs _____ oxygen enters nose _____ oxidation occurs	3 4 2 1 5

15.

REFER TO PANEL 2

Two components are required in order for oxidation to occur: oxygen from inhaled air and substances derived from food.

COMPLETE the following table by checking the appropriate boxes:

	substance derived from food	oxygen from inhaled air	substance derived from food	oxygen from inhaled air
enters the body by the nose	☐	☐	☐	☒
enters the body by the mouth	☐	☐	☒	☒
passes through the stomach	☐	☐	☒	☐
passes through the lungs	☐	☐	☐	☒
travels through the blood	☐	☐	☒	☒
arrives at the body tissue	☐	☐	☒	☒

18. REFER TO PANEL 2 NUMBER the following events from 1 to 5 in the blanks, in the order in which they occur: _____ oxidation occurs _____ substance enters blood _____ substance enters body tissue _____ substance enters mouth _____ substance enters stomach	 5 3 4 1 2

19.

DO NOT REFER TO THE PANEL

	Materials Entering into Oxidation			
	substance derived from food	oxygen	substance derived from food	oxygen
carried to body tissue by blood	☐	☐	☒	☒
passes through lungs	☐	☐	☐	☒
passes through stomach	☐	☐	☒	☐

20. DO NOT REFER TO THE PANEL You recall from the previous lesson that the chief substances composing the foods we eat are proteins, carbohydrates, and lipids. The element carbon is present in: ☐ carbohydrates ☐ lipids ☐ proteins A morsel of food is therefore: ☐ almost certain to contain carbon ☐ unlikely to contain carbon	carbohydrates lipids proteins almost certain . . .
21. In oxidation, oxygen combines with carbon to form a gas. This gas is called <u>carbon dioxide</u>. Carbon dioxide, therefore, is: ☐ an end result of the oxidation process ☐ a material going into the oxidation process	an end result . . .
22. At the same time that carbon dioxide is formed, water is also formed. Water is consequently: ☐ a material present at the beginning of oxidation ☐ a material present at the end of oxidation	. . . at the end of oxidation

23.

Except for the energy released, all the results of the oxidation process are waste products.

You would expect that the human body would want to:

- ☐ eliminate the carbon dioxide produced
- ☐ eliminate the water produced
- ☐ retain the carbon dioxide produced
- ☐ retain the water produced

eliminate the carbon . . .
eliminate the water . . .

24.

DO NOT REFER TO THE PANEL

MATCH the terms below to the numbered descriptions by writing one or more letters in each blank.

A. carbon dioxide
B. energy
C. hydrogen
D. oxygen
E. water
F. substances obtained from food

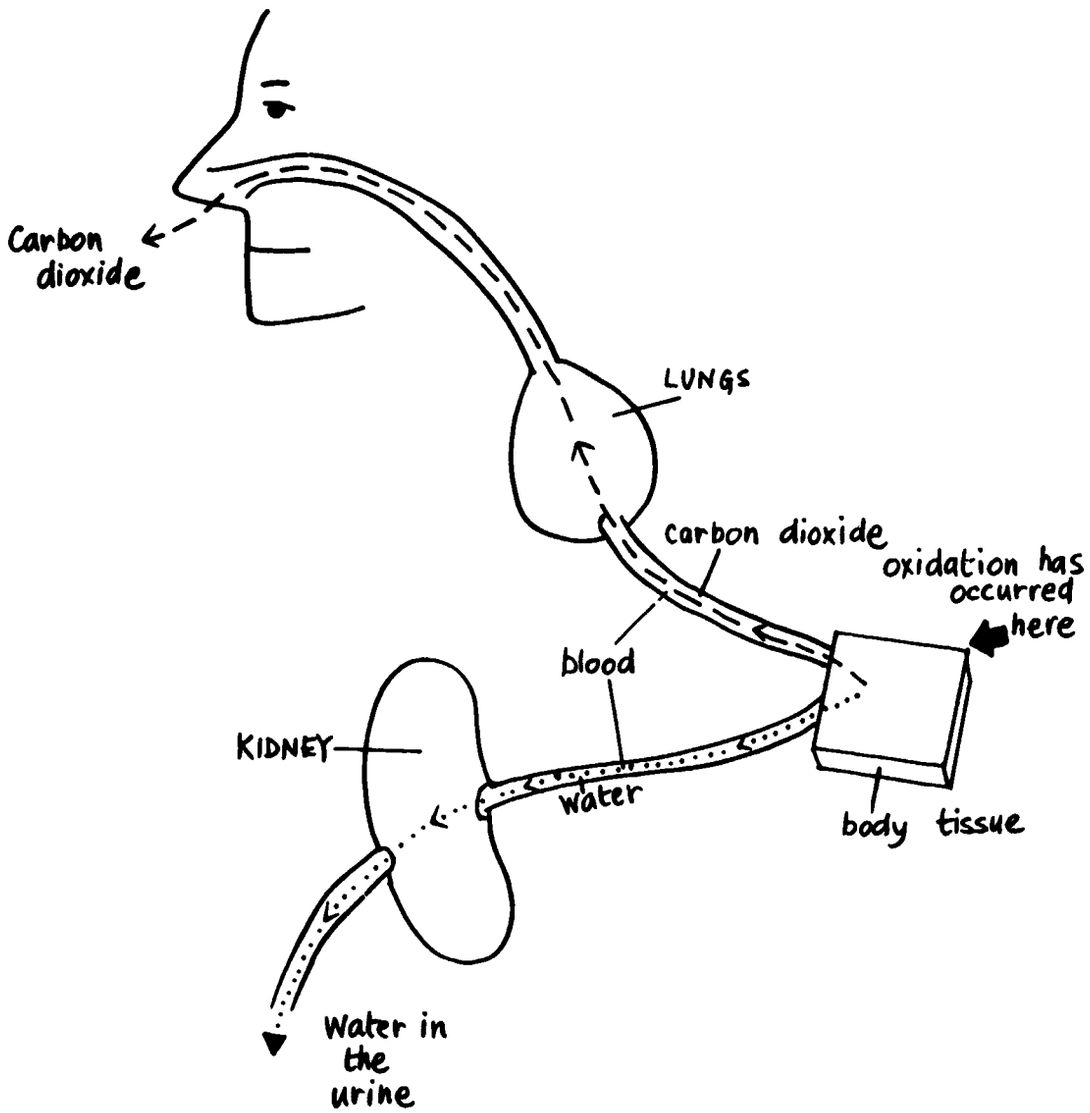
1. _____ material(s) entering into oxidation
2. _____ result(s) or product(s) of oxidation
3. _____ result(s) useful to the body
4. _____ result(s) useless to the body

1. D, F
2. A, B, E
3. B
4. A, E

25. PREVIEW FRAME You have learned that besides releasing energy, oxidation also leaves certain useless waste products. In the next section you will learn how the body gets rid of these wastes. NO RESPONSE REQUIRED	GO ON TO THE NEXT FRAME
26. In a previous lesson you learned about the life function called excretion. When a cell excretes a substance it is (CHECK one): ☐ getting rid of the substance ☐ taking the substance in Just as a cell can be said to excrete substances, the human body can also be said to excrete substances. CHECK below the component(s) of oxidation which the human body would excrete (CHECK one or more): ☐ carbon dioxide ☐ energy ☐ oxygen ☐ substance derived from food ☐ water	getting rid of . . . carbon dioxide water

PANEL 3

HOW THE WASTE FROM OXIDATION
IS EXCRETED FROM THE BODY



27.

REFER TO PANEL 3

This panel shows how the waste products of oxidation leave the body.

COMPLETE the following table by checking the appropriate boxes:

	carbon dioxide	water	carbon dioxide	water
enters the kidneys	☐	☐	☐	☒
enters the lungs	☐	☐	☒	☐
is carried away from the tissue by the blood	☐	☐	☒	☒
is exhaled from the lungs into the air	☐	☐	☒	☐
leaves the body tissue	☐	☐	☒	☒
leaves the body in the urine	☐	☐	☐	☒

28.

FOOTNOTE FRAME

Some of the water produced in oxidation is exhaled from the lungs along with the carbon dioxide. Also, a small amount of water is lost through the skin by sweating.

However, the chief way in which water leaves the body is in the urine.

NO RESPONSE REQUIRED

GO ON TO THE NEXT FRAME

29.

REFER TO PANEL 3

Carbon dioxide is a gas. Water is a liquid. The blood:

- ☐ is able to transport a gas
- ☐ is able to transport a liquid

. . . transport a gas
. . . transport a liquid

30.

REFER TO PANEL 3

One of the waste products of oxidation is a gas; the other is a liquid. The gas leaves the body:

- ☐ by passing through the kidneys
- ☐ by passing through the lungs

. . . through the lungs

The liquid leaves the body:

- ☐ by passing through the kidneys
- ☐ by passing through the lungs

. . . through the kidneys

31.

DO NOT REFER TO THE PANEL

The blood carries away from the body tissue:

- ☐ both of the waste products of oxidation
- ☐ only one of the waste products of oxidation

both of the waste . . .

Carbon dioxide leaves the body:

- ☐ by being exhaled by the lungs
- ☐ in the urine

by being exhaled . . .

32.

DO NOT REFER TO THE PANEL

COMPLETE the table below by checking the appropriate boxes.

	Waste Products of Oxidation			
	carbon dioxide	water	carbon dioxide	water
carried away from the tissue by the blood	☐	☐	☒	☒
exhaled by the lungs	☐	☐	☒	☐
leaves the body in the urine	☐	☐	☐	☒

33.

REFER TO PANELS 2 AND 3 (Pages 8 and 15).

The two panels follow the paths of the four substances involved in the oxidation process.

How many of these substances are carried by the blood?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

4

How many of these substances pass through the lungs?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

2

34.

DO NOT REFER TO THE PANELS

MATCH the materials in the list with the statements below by writing one or more letters in each blank.

A. carbon dioxide

B. oxygen

C. substance derived from food

D. water

1. _____ carried from the body tissue by the blood

2. _____ carried to the body tissue by the blood

3. _____ pass(es) through the lungs

4. _____ pass(es) through the stomach

5. _____ leave(s) the body in the urine

6. _____ waste products of oxidation

7. _____ substance(s) entering into oxidation

1. A, D

2. B, C

3. A, B

4. C

5. D

6. A, D

7. B, C

Time completed _____

YOU HAVE NOW FINISHED THE FIRST PART OF THIS LESSON. WRITE DOWN THE TIME. THEN, AFTER YOU HAVE REVIEWED THE MAIN IDEAS IN THE FOLLOWING SUMMARY, TAKE THE MASTERY TEST AT THE END OF THE BOOKLET.

METABOLISM	the total of all the building-up and breaking-down processes in the body .
LONG-TERM ENERGY	energy that can be stored for later use in layers of fat beneath the skin of the belly, buttocks, and other fatty regions; lipids are used chiefly for long-term energy.
MOMENT-TO-MOMENT ENERGY	energy that can be obtained immediately; carbohydrates are used mainly for moment-to-moment energy .
ENERGY PRODUCING (or RELEASING) PROCESS	a process which releases energy for the body's use and produces waste products at the end of the process .
OXIDATION	a process that releases energy in the human body; process; oxygen from the air enters the nose and mouth, goes through the lungs, enters the blood, and is carried to the body tissue where oxidation takes place; oxygen also enters the body via substances derived from food, passes through the stomach, travels through the blood, and arrives at the body tissue where oxidation takes place.
END REACTION:	oxidation releases energy and leaves certain useless waste products: carbon dioxide and water.
EXCRETION	one of the life functions involved in getting rid of waste products.
CARBON DIOXIDE	leaves the body tissue, is carried away from the tissue by the blood, enters the lungs, and is exhaled from the lungs into the air .
WATER	leaves the body tissue, is carried away from the body tissue by the blood, enters the kidney, and leaves the body in the urine. (Some water is exhaled from the lungs and is lost through the skin by sweating.)

MASTERY TEST

Time started _____

NOTE NOTE NOTE NOTE

Skip one(1) page to find page 22.

1. Which of the following nutrients is used as the chief source of moment-to-moment energy in the body?

   a. ☐ carbohydrates

   b. ☐ lipids

   c. ☐ proteins

2. The function of respiration, which involves the process of oxidation, includes the release of energy in reactions between oxygen and:

   a. ☐ food substances absorbed by the organism

   b. ☐ hydrogen absorbed by the organism

   c. ☐ nitrogen absorbed by the organism

   d. ☐ water in the organism

3. Which of the following are the waste products which result from the process of oxidation?

   a. ☐ carbon dioxide

   b. ☐ hydrogen

   c. ☐ oxygen

   d. ☐ water

NOTE: Continue with question 4 on the next page.

4. MATCH the terms on the left with the statements on the right. WRITE one or more letters in each blank:

A. carbon dioxide	1. _____ carried from the body tissue by the blood
B. food substances	2. _____ carried to the body tissue by the blood
C. hydrogen	3. _____ leave(s) the body in the urine
D. oxygen	4. _____ pass(es) through the lungs
E. water	

Time completed _____

WHEN YOU HAVE FINISHED THIS TEST, WRITE DOWN THE TIME. THEN TAKE THE LESSON TO YOUR INSTRUCTOR OR HIS ASSISTANT FOR CHECKING. WAIT UNTIL THE LESSON IS APPROVED BEFORE GOING ON TO THE NEXT LESSON.

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