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The Teaching of Biology and Difference to a Special Education Seventh Grade Class

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As a Special Education teacher in the Middle School, I am responsible for teaching the three R's as well as science and social studies. The problem which exists is that science tends to be neglected in order to teach the essentials, (reading, writing, arithmetic), so that our students will be able to survive and get a job.

Special Education students need to be exposed to the sciences as well to promote an understanding of their development and the processes which occur within the cell to bring on their physical characteristics. They also will gain benefit from using the scientific method and materials such as microscopes, in that they will learn by doing.

Traditional teaching methods fail with a ‘special’ learner because of their specific disabilities, thus the teaching of this unit will require the use of materials which are interesting and motivating to the students. The materials and short lessons in this unit provide the student with the initial stimulus needed to seek out the answers to the questions posed throughout.

This project will be taught during the school year to a class of approximately twelve students who have learning disabilities and some who are diagnosed as emotionally disturbed. Some would question the use of microscopes and slides within this class due to maturity. A study was done which investigated eleven to fourteen year olds and their observations through microscopes. The study observed 250 school age children whose IQ ranged from 76 to 140, making their own mounts, and using specimens. The study found that all but ten of those surveyed were able to see and record information without assistance from the teacher.

It is felt by this writer that this would also be the case within the ‘special’ class. Many of these students have never used a microscope, thus the newness of this instrument plus the amazing things that will be discovered once they look through the objective will promote a respect towards using this tool.

Throughout this unit, the lessons are set up in a way that the student will feel that he is responsible for finding out answers to meet his curiosity. For example, the first lesson which will be about the cell, will start out with the question:

“How big do you think a single cell is?”

The students will then be given time to answer and ponder the question. The answers will vary but through the ideas that are given, the teacher will then begin to clarify through actual learning-by-doing observations. The students will have the opportunity to look at real cells through the microscope and draw what they observe. A model of the cell will be utilized at this point to show the parts of the cell. At the end of these learning periods, the teacher will then go over pertinent information that the student needs to know about the topic. For example: the cell is the building block of life. The lessons will be short enough so that the students do not get laden with too many facts to learn. At the end of the lesson, worksheets will be utilized so that the students can apply what they learned. For example: Label this diagram of the cell that you observed. At times, the students will be given worksheets to be done at home which will involve their household.

The worksheets/questions given at the end of each lesson will also give the teacher an indication of whether the students understood the lesson and whether more time should be spent on that same topic the next day.

Throughout this unit, the student will feel that he is competent to find out answers on his own, and he will learn about the resources needed to find out particular answers. As a Special Education student, these children have been told what to do and what to learn, without really getting the chance to pursue their curiosities. Throughout this unit, the student is able to, in the beginning, give an answer to a question and not immediately be told, “No, that is wrong.” He is told, “That could be,” then he is led to find out the answer on his own. In this manner, the child will instill in himself the ability to say, “I can do it,” or “I did it on my own.”

Learning will be taking place in other areas besides science. Students will be using their reading skills during experiments, reading on topics of special interest from newspapers or other resources. Spelling skills will also be utilized in that the scientific terminology will act as spelling words for the week. Writing skills will be used in writing out mini-reports based on experiments, observations and in answering questions and short essays at the end of each lesson.

Due to the nature of a ‘Special ‘ class, some students may need more motivation than others. To combat this and provide more incentive to be attentive and participate, a point system can be incorporated into the worksheet/questions at the end of the lesson. Each question will be worth certain points if answered correctly. When corrected, the paper will be handed back with a grade and total points earned for that assignment. At the end of the week, the student with the most points will be given a reward such as free time, cookies, or a treat from the lunchroom. This has worked well with students in the past.

Thus this unit will be taught and structured in a manner that the students will be motivated to learn, develop a sense of self-worth, and enjoy the learning part.

STRUCTURE OF THE UNIT TOPICS

The unit will be broken into five main topics:

1) The Cell and its Function
2) Heredity—Inheriting Traits
3) Animals—Fertilization and Development
4) Human Development—The Development of the Zygote Into a Fetus

5) Heredity and Environment—Development of Individuality

Each of these main topics will begin with a list of objectives to be achieved by the student. After the objectives, the concepts to be taught will be discussed with descriptions of the materials to be used at the time as well as any drawings which may be utilized by the teacher or the students.

The Teaching of Biology and Difference to A Seventh Grade Special Education Class

1) The Cell

Objectives The student will:

Đunderstand that cells are the building blocks of all living things
Đunderstand the basic parts and function of the cell
Đunderstand cells carry out the basic life functions
Đunderstand difference between animal and plant cell
Đunderstand chromosomes are found within the nucleus
ĐDNA is found within the chromosomes
Đunderstand cell division
Đname three one-celled animals

To introduce this unit, a discussion of the scientific method and the microscope will occur so that the student will have an understanding of the processes a scientist goes through in his investigations and a guideline that they will be able to follow as they start to investigate on their own.

In order to find answers to a problem, a scientist uses a method called the scientific method. The five steps to the scientific method are as follows:

1. Statement—tells about the problem to be investigated
2. Research-information and observations are made to try to answer the problem
3. Hypothesis—a possible answer to the question

4. Experimentation—to test the theory
5. Theory—the statement which is made to explain the answer which stands up to testing and observation. The microscope is a basic research tool which scientists use to look at objects which are very small, which man cannot see with the naked eye. Anton Leeuwenhoek is credited with making the first microscope from lenses which he ground and polished. He observed living organisms in a drop of pond water.

At this time, the students will be asked to pretend they were Anton looking through the microscope for the first time. How do you think he felt when he observed tiny moving objects in the sample of pond water? After directing them to answer and a discussion of how the microscope should be handled, they will look at their own samples of pond water, make observations and drawings, and describe what they see, and how they felt.

What is a cell? How small is it? Cells were first discovered by Robert Hooke when he looked at cork under the microscope. Scientists continued to study cells of different organisms, plants, and animals and formulated a cell theory. The Cell Theory states that all living things are made up of cells. Cells carry on life functions. Cells produce new cells. The cell is made up of many parts which include the nucleus, cytoplasm, cell membrane. The nucleus controls the life functions of the cell and it controls the reproduction of the cell. The cytoplasm is all the material which is found between the cell membrane and the nucleus. In the cytoplasm are storage spaces called vacuoles. The cell membrane surrounds the cell. Food, oxygen, and wastes pass through the cell membrane. There are different shapes and types of cells. Different cells have different jobs.

An activity for this section involves the student making a cell ‘model’ out of gelatin at home. Before the gelatin hardens, insert a grape or raisin into the center to act as the nucleus. The animal cell model could be used at this time for the students to hold and observe where the parts are located.

Within the nucleus of the cell are chromosomes which are threadlike structures in which DNA is located. DNA controls the development of hereditary traits called genes.

What is the difference between a plant cell and an animal cell? A plant cell contains those parts mentioned earlier as well as chloroplasts and a cell wall. A cell wall surrounds the cell membrane. It protects the cell and helps it to hold it’s shape. The cell wall is made up of hard, non-living material called cellulose. Chloroplasts contain chlorophyll which gives a plant its green color. Vacuoles in a plant cell are larger than those in an animal cell.

Have the students make a chart comparing the differences between plant and animal cells. In the classroom there will also be charts for the students to observe and note differences.

A Plant Cell Has:	An Animal Cell Has:
nucleus	nucleus
cytoplasm	cytoplasm
cell membrane	cell membrane

cell wall	no cell wall
large vacuoles	small vacuoles
chloroplasts	no chloroplasts

A cell reaches a point at which it cannot grow any further. At this point, cell division takes place during which the cell produces a new cell which contains the same information from the original.This process is called mitosis. The nucleus of the cell controls this process. Chromosomes within the nucleus make a copy of themselves then they become short and thick. At this time, the cell membrane disappears. The chromosomes line up in the center of the nucleus. The chromosomes split apart and move towards the opposite ends of the cell.

Part I—The Cell

(figure available)
(figure available)
(figure available)
(figure available)
(figure available)
(figure available)

At this time, a new membrane begins to form around the chromosomes. The chromosomes then stretch back to their threadlike state, and the two cells separate. What exists now, are two daughter cells which contain the same number of chromosomes is each cell. The two cells are exactly alike. The daughter cells are about half the size of the original parent. How that this has occurred, the cell begins to take in food through their membrane and begin to grow. When the cell reaches a point where it cannot grow any further it will split and divide again in the same manner.

2) Heredity

Objectives The student will understand:

Ðthe female reproductive cell is the egg
Ðthe male reproductive cell is the sperm
Ðgenes are the controllers of hereditary traits
Ðthe part of the cell which contains genes is the chromosomes
Ðevery human cell,(except reproductive cell), contains two pairs of twenty-three chromosomes
Ða reproductive cell contains twenty-three chromosomes
Ðeach person inherits two genes for a particular trait, one from father, one from mother
Ðdominant and recessive genes
Ðevery cell in our bodies contain an identical set of chromosomes from that of the original cell before it began to divide
Ðour environment influences our inherited traits
ÐDNA in genes determines what a plant or animal looks like

To interest the students in this new topic of heredity, a question is posed.

“Who do you most look like in your family?”

The teacher can further engage the students in explaining why they answered as they did. The characteristics that the students have mentioned, eye color, hair color, height, etc., are called traits. Traits are those characteristics which are passed from parents to offspring. Heredity is the transmission of traits from generation to generation. Genetics is the science of heredity.

Gregor Mendel was the first scientist to study how traits were inherited, and he founded the science of genetics. His experimentation, and observation of pea plants over generations helped us to understand how traits were inherited.

He crossed pure tall plants with pure short plants. Pure means that the tall plant has two like genes for ‘tallness’, and the short plant has two like genes for ‘shortness’. TT stands for pure tall, and tt stands for pure short. Draw a tall plant and a short plant on the board and label them as mentioned above.Mendel found that when these plants were crossed, the offspring had all tall plants. Each of these plants had one gene for tallness ‘T’, and one gene for shortness,’t’. So each plant had Tt genes. These plants were called hybrids because they had a pair of unlike genes.

At this time use a Punnett Square to diagram how this occurred. At the top put TT, and on the side put tt. Show how when combined we get for sets of Tt.

(figure available)
Mendel continued to cross the pea plants and he discovered that in a hybrid, having two unlike genes, one gene always showed itself, and the other gene stays hidden. The gene that always shows itself is called dominant. The gene that stays hidden is called recessive.

Referring back to the diagram of the plants that the students drew, ask them, “Which trait of the pea plant was dominant, tallness or shortness?”

Tallness in pea plants is the dominant trait. Whenever pure tall plants are crossed with pure short plants the resulting plants will always be tall.

At this time, it might be helpful to the students to give them some problems about combining traits and telling them which trait is dominant. Dittos using the Punnett square would also be helpful. For example:

One parent is pure for brown hair and the other is pure for blond hair. Brown hair is dominant. What color hair will the offspring have?

(Have the students designate a capital B for brown hair and a small b for blond hair. Complete a Punnetts square. Figure out the ratio of brown hair to blond hair.)

It may take a couple of days for the students to grasp this information. Continue to review that organisms contain two genes for each trait that they have. One gene came from their father and one from their mother. Use diagrams to illustrate this for various traits that the students would like to discuss. Continue to point out that a capital letter stands for dominant, and a small letter stands for recessive.

How do you develop into a girl or boy? Sex chromosomes determine whether a fertilized egg develops into a

girl or boy. In males, the sex chromosomes are XY.

In females, the sex chromosomes are XX. When egg cells are produced, each egg receives only one of these sex chromosomes. So female egg cells contain X chromosomes. A male sperm can contain either an X or Y chromosome.

It would be helpful to diagram the possible chromosomes that would be found in a female and male egg cell to show that females can have only X chromosomes in their egg cell, and males can have either an X or Y chromosome in their sperm cells.

If the egg cell is fertilized by a sperm carrying an X, a girl will develop. If the egg is fertilized by sperm carrying a Y chromosome, a boy will develop. At this time it would be helpful to show students the possible combinations using diagrams, or they can try to figure out the combinations using the Punnett Square. Ask the students whether the mother or father determines the sex of the child. All children inherit their sex from their fathers.

Why do we grow to be humans and not a kangaroo, bear or snake? Each fertilized egg contains a set of instructions which tells how the cell should grow. So a human fertilized egg will grow into a human and a chicken egg will grow into a chicken.

Genes, which are found in the chromosomes, are what carries the hereditary information from generation to generation. Genes control how tall we are, the color of our hair, eyes, and skin, and they control the activity that goes on within each cell as it grows. Genes are the reason that people look different from each other. Have the children fill out a chart on hair color, eye color, height, and weight, for all the members of their immediate family. As these characteristics are compared, explain that genes determine the differences that we see among individuals. Remind them that every person inherits two genes for each particular trait. In most cases, the dominant trait will show in the offspring. Sometimes traits combine to produce a mixture of both traits. For example, when blue eyes and brown eyes combine, hazel eye color may result. When two traits combine to form a mixed trait, this is called blending.

Part II—Heredity

(figure available)
(figure available)
The color of our skin is the result of blending. Have the children look around the room and note how many different colors of skin there are. Because of blending, the amount of melanin that an individual has in his skin is different. More melanin produces darker skin, less melanin produces lighter skin.

Genes are the instructions that are carried from generation to generation that determine heredity and cell activity. These instructions are in a coded form which is determined by DNA. DNA stands for deoxyribonucleic acid.

Each trait that we inherit is made up of a code which is different for every characteristic, job and part of the body which the cell makes up. Refer the class to the model kit of DNA. As the model is demonstrated, discuss the make-up of the structure which looks like a twisted ladder. DNA’s rungs are made up of four nucleotides called adenine, guanine, cytosine, and thymine. Continue the discussion if the students interest remains high on the make-up and coding sequences of DNA.

3) Animals and Development

Objectives The student will understand:

Đanimals spend their life struggling to survive
Đreproduction is a process which allows survival of the species
Đthere are two types of reproduction; asexual and sexual
Đfission, budding, and regeneration are types of asexual reproduction
Đfertilization can occur internally or externally
Đexamples of animals which reproduce asexually
Đexamples of animals which have internal/external fertilization
Đlife cycles of certain animals

The purpose of this section is to promote an understanding that all animals reproduce differently. Not all animals reproduce through sexual means and have their young born alive or laid in eggs. Most of the students taught at the seventh grade level will have the knowledge that all living things come from other living things of the same kind.

A question to ask to promote interest at the beginning of this section could be “Do all animals reproduce in the same way as others?” Have the students list means of reproducing on the board.

Mention the amoeba to the students and ask how it reproduces. From this point, the discussion can lead to asexual reproduction . During fission, the single cell splits into two cells which look exactly alike. In budding the cell wall pushes out to form a small bud, then the nucleus of the cell moves towards the bud, divides, then the bud breaks away to form a separate cell. When a starfish’s leg is severed, regeneration occurs during which the lost leg grows back. Starfish can also be reproduced into a new starfish from part of its body. This is also called regeneration.

An activity for this section could involve labeling diagrams of different types of asexual reproduction. Observe a yeast cell under a microscope to note budding.

At this point in regular curriculums, the topic turns to sexual reproduction in plants. Plants have been excluded altogether from this unit as the terminology, modes of reproduction can become too complicated for discussion or comparison. The students may begin to transfer or mix up parts, and it can become too confusing. Thus it is recommended that plants and plant reproduction be treated as an entirely separate unit.

What are the reproductive organs in animals who reproduce sexually? A discussion of the reproductive organs

and fertilization will occur. Once a zygote is formed, cell division takes place and forms the beginning of the embryo. This rapid cell division is called cleavage, and it continues until a hollow ball of cells is formed. As the embryo develops, one side of the ball begins to grow inward. The hollow ball then becomes two layers, then a third layer develops between the first two layers. The tissues and organs of the organism are formed from these three layers of cells.

Part III—Animals and Development

(figure available)
(figure available)
Have the students label drawings of these stages. Look at microslides of animal mitosis and the development of a chick from an egg, to further reinforce these concepts.

In most fish and amphibians, fertilization takes place outside of the body and the embryo develops in the water. In most reptiles and birds, fertilization takes place inside the body, and the embryo develops in the egg.

The yolk provides the food for growth. In most mammals, dolphins and whales included, fertilization takes place inside the body, and the embryo develops inside the uterus.

The placenta provides the food for development.

How do insects reproduce and develop? Most insects go through a metamorphosis, or change in form. Have the students name some stages that they have seen for a fly, butterfly, and mosquito. Then put the stages into the appropriate order, using diagrams.

Animals reproduce and develop differently. In order for the young to survive, the parents must care for their young until they are able to function on their own. What would happen if all the parents of one specie of sparrow left their young once they had hatched? Would they survive? Why do some animal babies die when they are born? These questions will promote discussions on what it takes to survive and how different animals have different ways of protecting their species.If an animal dies before reproducing the strong ‘genes’ that allow that particular animal to survive may be lost through many generations.

4) Human Development

Objectives The student will understand:

Ðparts and functioning of the male and female reproduction system
The student will understand:
Ðwhere fertilization occurs
Ðthe human egg cell is very small because it does not contain any stored food
Ðcell division continues to occur after fertilization during which the cells differentiate into various tissues and functions

The purpose of this section is to touch on human reproduction. The content of this section will be mainly films, diagrams, and models of the human reproductive organs, and the development of the fetus through the nine months. This will promote a better understanding of what occurs in the mothers womb while she is carrying the fetus. At this time the birth process will not be shown on film, but if the students pose questions about the topic, it will be discussed, or the students will be referred to the resource material.

5) Heredity and Environment—The Development of the Individual

Objectives The student will understand:

Ðgenes are the means by which offspring have the same characteristics as their parents
Ðgenes also cause differences among the same members of a species or family
Ðenvironmental factors produce differences among members of the same family
Ðtraits that are not brought on by genes, but that develop during the organism's lifetime are called acquired characteristics
Ðmutations affect the genes of the sex cells, and cause change

Who are you? What makes you different from your brother or sister, or friend? We learned earlier that we are products of an egg and sperm coming together with genetic information from our mother and from our father. That genetic information combined to give us some traits from our mother and some from our father. Some traits that we have are influenced by both heredity and the environment in which we live. For example, a person could have inherited the gene for tall bone growth, but if that person lives in an environment in which there is a poor diet, which results in a lack of vitamins necessary for bone growth, the bones will not grow appropriately. Some of our behavior is inherited such as our neonatal sucking and rooting reflexes. Other behavior is influenced by both heredity and environment.

Acquired characteristics are those traits that we develop during our lifetime which are not brought on by genes. Foe example, an opera singer's voice is the result of many years of lessons and practice. Unless the opera singer's sex cells contain the gene for an operatic voice, the offspring will not inherit it.

When the environment is not right for a trait to develop, the trait will be weak or it will not develop at all. Changes in the environment will not effect the genes but they will determine whether the trait will develop as it should or not.

Sometimes the environment will change. For example, the weather may get colder and remain that way. In order for the species to survive this colder environment, they need to develop new traits. What trait could help you survive if the weather became colder? These traits that are developed to live in the environment are called adaptions.

Mutations are changes which take place in an organism's gene or chromosome. If it occurs in a sex cell, it will be passed on to the next generation and a new trait may develop. Mutations can help an organism or they can

produce a negative effect, such as in mental retardation.

Thus many factors contribute to a person's individuality. Have the students imagine they were in a different environment, for example, colder or hotter climate. Or have them picture themselves growing up with different parents or in a different town. Have them write about how they would be different from who they are now. Discuss different cultures and their effects on individuality. How would you be different if you were brought up in a tribal village, or Iceland? What effects would the climate, people and their customs have on how you act or what you believe?

Suggested Materials For Classroom Use—by section

The Cell and its Function

Charts:
Generalized Cell

Meiotic Cell Division

Mitosis

Filmstrips:
The Living Cell

Microslides:.
Pond Life

Cell Structure

Ultra-Structure of Animal Cells

Animal Mitosis

Cells of Your Body

Meiosis

Models:.
Cell Model

Heredity-Inheriting Traits

Charts:
Basic Genetics

DNA

Filmstrips:

Genetics and Heredity

Books:
Cartoon Guide To Genetics

Microslides:
Chromosomes and Genes

Models and Kits:
Heredity—Made Easy

DNA Made Easy

DNA Model kit

Animals-Fertilization and Development

Books:
Biology Coloring Book

Adventures With a Microscope

Microslides:
Ultra-Structure of Animal Cells

Animal Mitosis

How a One-Celled Animal Divides

From Egg to Chick

Models:
Animal Cell

Human Development

Books:
Cartoon Guide to Genetics

Biology Coloring Book

Microslides:
Reproduction-Human

Charts:
Male and Female Reproductive Organs

Heredity and Environment—The Development of the Individual

See section on *Heredity-Inheriting Traits*

Note:
The majority of these materials come from the FREY Scientific Catalog under Biology.

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