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Where Did That Curly Hair Come From?

Curriculum Unit 96.05.10
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In today's society our children are inundated with cartoons, video games, movies, MTV, HBO, Playboy Channel, cable, videos, 1-900 numbers, rap, sex, drugs, guns, violence, and a multitude of other disheartening images that plaque our environment. After eighteen hours a day of being immersed in such a sad reflection of our community, how are we supposed to grab the attention of our students with such mundane topics as reading, writing, and science? Gone are the days when studying meant sitting down and learning your times tables. Today we have to put our material to a tune and rap it out in order to get a second glance. There are so many topics that should be addressed in our school curriculums. However, with time constraints and high priority subjects that have already spelled out our day for the next ten months, and little to no room for deviating when each subject text has to be completed by a certain time, it has become virtually impossible to explore any of the interesting areas of our society that our children are never exposed to while viewing The Ricki Lake Show.

In writing this unit, it is my intention to take one topic and integrate it so that students will be able to practice what they are learning. If a topic or unit can be related to real life and real life experiences, then I believe that it will increase comprehension and ultimately the mastery of the material. Integration allows the teacher to pull from different resources being as accurate as he/she chooses. It can encourage our children to do their best while giving them the opportunity to exercise their rights. Cooperative groups and hands-on lessons usually facilitate a conducive learning environment. Libraries, field trips, speakers, videos, computers, community involvement, are all examples of an active learning tools that can create a connection between your students and the subject. We, as teachers, know that almost all the material we teach will in some way will be utilized at some point during the lives of our students. It is our students who do not see the correlation. We have to show and involve them. Nobody likes to be a bystander, we all want a part of the action. Our students should be exposed to all the subjects focusing on the same topic. By this I mean, (and I will use Genetics because it is my topic) we should educate our students on the topic of Genetics through subjects such as math, reading, writing, science, social studies or history, literature, art, and any other areas that can be applied. We all have our strengths and weaknesses and it is my belief that if a student can succeed in an area then his abilities, expectations, and self-esteem will flourish. Likewise, when forcing a person to learn when he/she cannot grasp the material in a certain context, the expectation is for failure and more often than not, the student fulfills that expectation. If one subject area can increase the student's mastery of a given topic then there is a possibility of applying that success to a different, less popular, subject area. If a student cannot or does not choose to focus his concentrations on a particular subject, then that student can redirect his abilities to a more comfortable area while still being immersed in the content.

My unit of study is on the topic of Genetics. Being a third grade teacher, I have written this “curriculum” and directed it towards elementary aged students and their teachers. However, it is my feeling that children are capable of comprehending complex and detailed subject matter as long as it is presented in an interesting and exciting manner. Therefore, I have not substituted any scientific words with elementary type terms. The genetic terminology is accurate, though not exceedingly difficult. The curriculum material has been developed allowing the teacher the ability to tailor the unit to his/her students either individually or as a whole class. This unit should be viewed as a guide to assist the instructor in the study of heredity.

Genetics is a topic that has numerous as well as various areas to study and investigate. Throughout this unit I found that there were many times when a teacher could stop and expand on a new concept. Each new area to be explored has the potential to become a unit within itself depending on how much time and how in depth the teacher wishes to focus on that particular “subtopic.” Additionally, these other areas of related study can also be integrated within the regular curriculum and then combined with the unit on heredity to produce a spectacular exhibit of the student’s work . The time spent researching and teaching this unit is entirely up to the teacher. As I mentioned earlier, this curriculum has many avenues to take, which ones chosen depend on the availability of resources, academic levels of the students, time constraints, etc.

Objectives

1. Students will be able to pronounce (as best as they can) the scientific term used in explaining heredity.
2. Students will understand the meaning and/or significance of these genetic terms .
3. Students will be able to use these words in sentences relating to the information taught in the unit.
4. Students will see a connection between heredity and the importance of it not only in science but, in other academic areas as well.
5. Students will be able to make predictions regarding possible genotype results of the F2 generations for situations in which the P generations have homozygous and heterozygous charecteristics through the use of Punnett Squares.
6. Students will grasp the material through different and interesting lessons that will incorporate all subject areas. These lessons will include games and puzzles. All resources that can be of any assistance in the comprehension and application of the unit, will be employed.
7. Students will construct their own models of a genetic concept learned and present it finding information through various resources available to them.
8. The Hybrid Cross will be applied to all individuals and they will construct family trees on either themselves or a fictitious character.
9. Students will understand and become more compassionate towards individuals who may have inherited diseases, birth defects or problems.

In introducing this lesson I will construct a bulletin board finding and posting pictures of people with their families from sources such as magazines or collecting pictures of my students and their families. (Including also pet photographs to illustrate the same idea with animals as with humans.) These pictures would serve to show the similarities and differences between families as well as between unrelated people. (At this time I will also examine traits and what they are. It might be fun to get a poster of a person and circle all the traits we could see. The students can also draw pictures of themselves and/or families and list all of their traits as well.) It is important, I believe, to get across the concept that people are made the way they are. Noone has had the chance to ask for blonde or brown hair, be tall or short, have blue or brown eyes. We can change some of these things through contact lenses, dying our hair, or other artificial substances. I would also like to stress that even though everyone may look different on the outside, we all possess the same basic physiological construction and it is our genetic material which gives us our individuality. It would be during this time that a separate lesson(s) would be introduced on different types of people around the world. Students can become familiar with all kinds of ethnicity's from Hispanic to Jamaican. Different cultures and traditions can be fun and interesting to learn about while concentrating on our uniqueness. No one's looks or beliefs are bad or wrong (provided it doesn't harm others) but simply different, and that's what makes up our world. I might also want to deviate slightly and examine the USA and how this country is made up of so many different and unique people, beliefs, cultures, etc. The library would most likely be able to provide many resources on this topic. Books, videos, listening tapes, may be helpful for the students to view or listen to while exploring different countries or parts of the U.S. This lesson can incorporate many subjects. There are plenty of trade books that the kids can read to learn about different societies and cultures. Mapping countries and/or regions where certain people are located while using a key and a scale can reinforce geography and math. Writing can surely be integrated either with reports or creative pieces. Art will add a great segment to any "project." Maps or models of people can be made using paper mache. Paintings of other places should be displayed. Collages of foreign environments or simply pictures accompanying a piece of writing add color and dimension to everyone's work.

The next objective of my lesson would be to get across the difficult concept of how our traits and characteristics came from our parents and made us up . There are many words that can be put into vocabulary lists. Spelling, cursive, grammar, sentence structure, etc., can all be attacked using the genetic terms used to describe heredity. Genetic dictionaries with illustrations created by the students can reinforce all of these objectives in one. Cell and cell structure is another topic that can be examined much more closely. Again, there are many areas and types of resources that can assist in the teaching of this subject. All academic areas can be integrated. The concept of DNA RNA, ribosome's, double helixes, bases, codons, nucleotides etc., are also areas where further examination can become separate units of study. Each one presents new and added information that is directly related to heredity. Again, every subject can be integrated. There are tons of books to read, many experiments that can be used to promote the scientific method. Using microscopes to look at students own cells or slides of different types of cells will allow the students to see what is being learned. Laboratories may allow trips for classrooms to view their work and explain what they are doing , how, and why. Writing can be accomplished through simply recording observations and creating hypothesis or in creative pieces that can attack the CMT standards simultaneously. The history of genetics is fascinating and can encourage the study of other parts of the world where famous scientists came or come from. Theories of heredity and the time frame from when they were thought to be true is interesting. Recreating some of the earlier science experiments to see how results were derived can be fun (Gregor Mendel for example). Making a cell from material or paper mache and slicing it open to show the different components can help with understanding . T-shirts using fabric crayons can have genetic designs permanently ironed on. The students have a super piece to show and talk about. Aprons with removable

genetic parts can be made, puzzles, games, and of course, illustrations are only a few ideas to encourage active learning.

Finally, explaining how each individual has traits passed down to him/ her and the consequences associated with recessive and dominant genes can be investigated in numerous ways, all of course, involving integration. Patterns and pairing can be reinforced in math while reinforcing codons(always in three) bases (always in two) chromosomes(all different numbers of pairs depending on the animal) genes (in two, especially when looking at traits on the hybrid cross). Experiments using animals to determine traits and characteristics can be done or read about. Discussions about ethic may lead to reports, presentations, creative writing, letters (concerning ethics in other areas such as testing on animals). A unit or lesson(s) can be taught on the subject of mutations and the biolological and sociological effects of those on people. The history of this problem and how it was and is dealt with yesterday and today. Places in the world that may have more or less frequency in genetic mutations and why (drugs, nuclear disasters, scientific mutations). Social behaviors and how we as a society should be prepared to serve any genetic "problems."

There are so many more ideas that can be used to create a learning environment that will allow the students to work on their own as well as in groups, access all the academic areas for every level student, utilize resources, permit art to teach our students. It is imperative that educators understand that this unit has the potential to become anything a teacher wants. If the vocabulary is too tough, the contents too difficult, ideas too abstract, then the unit can be modified to fit you and your students needs. Objectives, methods and activities will be included for each section within the genetics unit.

I. Introduction to Heredity: Exploring similarities and differences between various cultures.

Objectives

1. Students will master the difference between non-living and living objectives with regard to physical makeup.
2. Students will understand that all members of the same species will have similar characteristics that help to identify them.
3. Students will become aware of the differences between various members of the same species.
4. Students will become aware that genetic makeup is the same within all human being regardless of our ethnic background.

Has anyone ever told you that you look like your mom or dad, brothers or sisters, grandma, grandpa, aunts, uncles, or cousins? Has anyone ever commented on how different you look from the rest of your family? Maybe your blond hair sticks out while everyone else has dark hair. Or, do you have blue eyes and your entire family has brown eyes. Well, if you answered yes to any of these questions, and you probably did, don't worry because everyone who's anyone has asked the same question. And there's an answer too! Probably a much longer and complicated one than you thought but, once you hear this explanation you'll understand everything. Now, some words and ideas in here are tricky but if you listen and ask questions, eventually things will become clear. But hey, you've got it easy! It's taken hundreds of years, thousands of guesses, dozens of

scientists, and lots and lots of experiments just figure out what you're going to learn in the next few pages.

When someone tells you that you have your mother's eyes, your father's hair, someone's chin, are you ever confused? I mean did your mom have to take out her eyes and give them to you? Did your father cut off his hair and stick it to your head? No, of course not. That would be awfully messy and you come in a nice, neat package. So, if your parents didn't actually give you their eyes, hair, chin, whatever. How did you get it? Well, the answer is in a special chemical that every person has. It's called DNA. Actually, not only do we have it (humans, of course) but your dog has it, the trees have it, tomatoes and potatoes have it, in fact all living things have DNA. Do cars and planes and silly putty have DNA? Absolutely not! They can't. DNA is only found in living organisms. (An organism is something that has lots of smaller parts.)

By now you must be asking, "What is this DNA stuff?" Good question. DNA is the chemical that gives the instructions that tell what a living organism is supposed to look like. It's kind of like a recipe. In a certain order DNA prepares the recipe that will give you curly or straight hair, blue or brown eyes, make you tall or short. DNA is short for a very long word called deoxyribonucleic acid. It's pronounced dee-ahk-see-ry-boh-noo-klee-ik acid. DNA holds the traits that pass from parents to their young. We call this heredity. Heredity works in two ways. First, it makes each living thing look the same, in many ways, as others of its kind. Secondly, at the same time it makes things look the same, it also makes each organism unique. Let's look at this a little more closely. Because of heredity all living things look like others of their own kind in some way. For instance, all cats have the same types of features. Fur, pointed ears, whiskers, long tails, are all characteristic of a cat. Likewise, all dogs are easy to identify because they have dog traits. This happens because every living thing gives birth to its own kind. Cats have kittens, dogs have puppies, bears have cubs, humans have babies, and so on. No cat has ever given birth to a puppy and you will never see a human give birth to a goldfish. Humans also share the same features.

Almost all people are born with two arms, two legs, and one head. But (and this is a big one) even though animals and people look like their own species, each animal , like every human being is also unique in it's own special way. For example, how many of you have or had a cat or dog? Okay, now if you took all the cats or dogs, including your own, from your neighborhood and rounded them up into one big room, would you be able to pick out your cat or dog? Of course! Because even though cats and dogs (and every other animal) resemble each other, each individual animal has its own special qualities that make it different from any other cat or dog. And if you were asked to draw a picture of your cat or dog it would be the same as your friends cat or dog. You say no. Well, don't both cats or dogs have ears? Don't they both have eyes, tails, fur, and legs? Yep. But not everything's the same, right? What would be different? Let's take a minute and list all the things that help you pick out your cat or dog and not your neighbors. Now, if we couldn't do this what do you think would happen? Sure! Every cat and dog would be identical. The same thing applies to humans. There are lots and lots of people in the world and almost all have the same characteristics as you. A few of these people might include humans with different skin color. African-American, Indian, Hispanic, Asian, Caucasian, are just a few. These people also have the same basic features as you but are they exactly the same? Nope. How are they different? Do black people and white people both have mouths and noses? I hope so. Look closely. When you compare noses and mouths are they the same? What do you see that makes them different from each other? As you can see we are all the same with some features that make us different. But this isn't where it ends. In fact it's just the beginning. We realize now that event though we share characteristics, we're all very different from each other. That's why you look like you and I look like me.

Methods

1. Students will construct two lists. One list will identify living organisms. The second list will identify non-living organisms.
2. Students will draw a full body self portrait. A class list will be constructed which depicts similar and different characteristics exhibited through the drawings.
3. A mini unit exploring different ethnicities will be conducted during the course of four to six weeks. This unit will include information pertaining to prominent cultures within our school. This will include people of African-American, Hispanic, Asian-American and Caucasian backround
4. Students will be exposed to various cultures while examining and making comparisons of the physical manifestations of their genetic material.
5. Mapping skills will be utilized to identify the geographic origin of the ethnicities be examined.
6. Students will utilize various resources to compile information relating to a certain topic being studied. Computers, libraries, videos will be of assistance. Class members will submit reports, as well as, creative writing pieces focusing on a chosen prompt.

II. DNA (Deoxyribonucleic Acid)

Objectives:
1. Class members will grasp the understanding of “traits” and how they are passed on from parents to their young.
2. Students will master the proper genetic terminology for the four DNA bases.
3. Students will comprehend the minute size of the DNA strands which are encompassed in each cell.
4. Students must gain some understanding of cells, amino acids, proteins and codons.
5. Class members will master the concept of free nucleotides and the “unzipping” of DNA strands in the transfer of genetic codes.

What about your relatives? If they have the same color or hair or nose how come they don’t look the same as everyone else with the same features? And how come you share the same overall features with your brother or sister or mom and dad and you look different from them? Well, besides sharing the same features, everyone else has their own special look at the same time. Otherwise, we’d all be very confused because we wouldn’t know who was who! But, if you look at your mom or dad or both you’ll probably see that you look like them too. Sometimes a kid might look just like his mom or just like his dad. Lots of times it’s both. This is

because your parents pass down what we call “traits” to you. A “trait” is a feature. Everyone has traits. Being short or tall, having straight hair or curly hair, green eyes or brown eyes, are all traits. Your traits come right from your parents. This is how come you look like them and not Michael Jackson or Whitney Houston. In order for you to look like Michael Jackson or Whitney Houston, they would have to be your mom or dad. (Unless you have Michael’s plastic surgeon, in which case you can look like anything you want) The tricky part is how two separate people, your mom and your dad, can get together, each with their own set of traits, and produce you with only one set of traits. If you added it up you should really have two of everything. Your moms nose and your dads nose. Your moms hair and your dads hair. But you know that this just cannot be. You’d be a mess. Besides, what if your mom was tall and your dad was short? How can you be tall and short at the same time? And if this were true how could your brother have blue eyes when the rest of the family has brown? There is an answer and it’s not that your brother was adopted! The answer to all these questions is in DNA. Remember DNA? Anyone remember what those letters stand for? (Illicit responses, or refer to board where word should be written phonetically) Awesome! DNA has the instructions for everyone’s traits. You get your DNA from mom and dad and you’ll pass down your DNA to your kids and they’ll pass down their DNA to their kids and so on. The tough part is understand how you got this DNA stuff anyway. It’s not in a shot and you can’t drink it, so where does it come from and how did you end up with it? And who gets to decide what’s going to be in this DNA that made you look the way you do? To understand this, we have to start from the beginning, and you thought we were way past that!

All living things are made up of cells. Every living creature from fleas to mice to birds all began life just like you—- as a single, tiny cell. Cells are so small that you have to use a very powerful microscope to see them. Using a microscope would let you see hundreds of cells. To see just one cell you would have to use the MOST powerful microscope. Cells are the building blocks of life. Your body has about one trillion cells (100,000,000,000,000). That’s a lot of cells. Each cell is smaller than a grain of sand. You probably can’t believe that something so small was once you, but it was! Inside every cell is a very complicated and super-neat plan all designed to create you. This plan lies inside the cell in a part call the nucleus (noo-klee-us). The nucleus is like the cell’s brain. So, where do you come in, you want to know. The ingredients to make you up were and are coiled up in DNA in a tangle of forty-six long thread -like things we call chromosomes (KROH-muh-sohmz). Chromosomes are found in the nucleus of EVERY cell. DNA is truly amazing. Here are some super facts that your parents won’t even know! The DNA threads or chromosomes are a thousand times thinner than a strand of hair. You could fit about five million through the eye of a needle. And as hard as that is to believe, if you were to unwind the DNA from one cell, it would stretch for about six feet. The DNA from one itty bitty cell has more information in it than a whole set of encyclopedias. You were pretty smart for being just one cell. Every species has chromosomes in each cell. The number of chromosomes is different for each species. For example; a tomato has twenty-four, a pea plant has fourteen, a gorilla has forty-eight, a mosquito has six, a dog has forty-eight, a cat has thirty-four, a goldfish has ninety-four, a cabbage has eighteen, and of course we have ____? If you look at the chromosome number you will see that they all have something in common. Did you get it? If you said the numbers are even, then you’re right. The chromosome numbers are always even because they are always in pairs.

I’m sure you already know that in order to have a pair there must be two. We have two sets of twenty-three, making a total of forty-six. See if you can figure out how many pairs the species that were mentioned before have. Remember, pairs are sets of two. Chromosomes are full of DNA. If you had X-ray vision like Superman and could see very tiny things up close and personal, you would see that a thread of DNA has a very cool secret. There isn’t just one strand of DNA, but two strands that wind around each other. It looks like a ladder that is twisting and turning. We call this strange shape a “double helix.” We’ll get back to this later. Now, in order for you to grow, that one cell that you began with would have to change into two cells and then change

again into four cells and again into eight cells and so on. To do this a cell must divide. You all know what dividing is, right? I hope so, but just to be on the safe side when something divides it simply splits up. You've done this a zillion times. When you are playing a game in gym and the teacher says, "Divide yourselves up into two teams." Or when you have to share your most favorite candy bar with your bratty little sister and your mom says, "Divide it up." The trick with dividing things up is that each side is supposed to be exactly the same as the other. Sometimes this happens and sometimes, like when that candy bar is supposed to be equal, it doesn't. When cell divides itself it splits up perfectly. But before a cell can divide the DNA inside the cell must copy itself so the new cell will have its own set of DNA. Do you remember when we talked about every cell having its own set of DNA inside it? Great.

Now, when I say "copy" you might think that there's a tiny little copier inside each cell, kind of like the one your teacher uses to run off dittos. But that's not the case. Your DNA is so smart that it copies itself with out any help from machines. Hard to imagine but true. However, it's not that simple. In order for DNA to copy itself, it must go through a very complicated and precise process. Kind of like baking a cake. The right ingredients must be there and you have to follow the instructions carefully or else you end up with something very different from cake. Let's take an even closer look at DNA so you'll have a better understanding of what I'm talking about. As you already know DNA or a chromosome is shaped like a twisted ladder. The steps of the DNA ladder are made up of things we call bases. There are four different bases. Adenine, Thymine, Cytosine, and Guanine. We'll call them by their first initial to make things easier. So now we simply have A, T, C, and G. There, that's much better. Each step on the DNA ladder is made up of a pair of bases. Got that? Good. The next trick is to remember that a pair of bases ALWAYS goes together in a special combination. Confused? I thought so. Let's zoom in and clear this up. You see A base and T base are friends, and they hang out together. And, you guessed it, C base and G base are friends and those two hang out on the chromosome together. You will never see A base hanging with C base or G base. And you will never see T base hanging out with C base or G base. The same holds true for C and G base, they will absolutely not, under any circumstances hang out with anyone but themselves.

We don't know why it's like this, but it's very important when DNA copies itself that these are in the right combination. The secret message in the DNA gives instructions on how to make you. We talked about that before. You know that your body is made up of cells but did you know that your cells are made up of water, sugars, fats, proteins, and of course, DNA. DNA is the code for making the proteins in your cells. Proteins are very important because they help a cell make the other chemicals that it needs to do its job the right way. Proteins also make your cells a certain color and shape. The DNA in your cells has the recipe to make about fifty thousand different types of proteins. How is a protein made? I knew you'd ask that question. It's a good question with a good answer. Remember the bases we just talked about? They're called A, T, C, and G. Okay, well those chemicals or bases are arranged in a special order along the DNA thread. This special order makes a protein. But, what is a protein? Proteins are the basic building block molecules that make up all living things. Your body must have proteins to grow and stay strong. There are lots of different proteins in your body. All the proteins are made up of twenty different small chemicals called "amino acids." Let's get back to A, T, C, and G. Those guys get together and they spell out the instructions for making all the different proteins. A, T, C, and G can get together in many different ways. Every time the bases decide to make a protein they spell it out using three of the letters or bases. When the base letters make up a code for a protein we call it a "codon." That's pretty easy to remember because it sounds like the word "code" and that's exactly what the bases are doing. Making up a code. But, we're getting off track here. We'll come back to that in a little while. What you need to know is that DNA makes proteins, proteins make cells, and cells make you! You know that your body is made of calls but, do you know what kinds of cells your body has and needs? Take a minute and think and see if you can come up with some of the cells in your body. Okay, I bet you were able to name a bunch of

cells. How many of you came up with blood cells? How about muscle or skin cells? There's also hair cells, mucus cells, teeth cells, and many, many more.

We still haven't answered the question of how one cell, the cell that started you, became a trillion cells, that you are now. Do you remember when we talked about DNA and how it's really a double helix? (A quick review may be necessary so students are not confused) And how each step on the "ladder" is a combination of bases A and T or C and G ? Anyone remember the name for those bases? Well, in order for a cell to split, the DNA in the double helix must first copy itself. To do this the double helix has to unwind. So now the "ladder" that was once twisting and turning, straightens out. Then the neatest thing happens! The double helix or "ladder" begins to UNZIP itself breaking apart the bases. Now if bases A and T make up one step they're forced apart. Think of it as base A holding hands with base T. They are right next to each other when the double helix begins to unzip and WHAM! They are split up. Now, once the DNA is unzipped there are two separate threads, right? Think of the zipper on your coat or jacket or pants or whatever. When you zip up your coat, the two sides are connected and make one. When you unzip your coat, they come apart and then you have two separate sides. All right, once the double helix has been unzipped and the two separate threads are exposed, these cool things called "free nucleotides" (new-klee-o-tydz) come in and join up with the free bases. Let's clear this up a little bit more. A free nucleotide is like a single base floating around without a partner. So there would be A's, T's, C's, and G's with noone to hold hands with. Can you tell me which bases always stay together? Super! A's and T's and C's and G's. So if the DNA has unzipped and there are bases hanging out by itself, what do you think those free nucleotides might do? I hope you said that a free nucleotide would come in and attach itself to the correct base. Let's see if you've been paying attention. Ready? If there's an A base on one side of the separated DNA thread with no partner, which free nucleotide would come in and attach itself to that A base? Did you say a T based free nucleotide? YEAH!!! How about another one? Let's say there's a C base with no partner. Which nucleotide will pair up with it? Most definitely a G nucleotide. If you got that give yourself a pat on the back. This happens for every base without a partner.

Now, let's say that this is exactly what has happened. The double helix unzipped breaking apart the bases and separating them into two DNA threads. Each thread has bases attached but without their partner. The free nucleotides come in and pair up with the right unattached base. How many "ladders" or double helixes would we have now? The answer is two. If you didn't get that don't worry, it takes lots of people a lot of time to get it straight. Since the bases of the DNA strands can only have a certain partner, once the free nucleotides have attached themselves to the unpaired base, DNA has made an exact copy of itself. Just to make sure you understand this let's take one example. Say the DNA ladder has steps that look like this: AT, CG, TA, and CG. Now, the strands unzip leaving only one base on each side. One side has bases A, C, T, G. The other side has its partners T, G, A, C. Once these bases are left hanging the free nucleotide come in and connect with the right base. If this happened what would be connected to the DNA strand with the bases A, C, T, G ? The base A would have the free nucleotide T pair up with it. And C would get G nucleotide, T would get A, G would be paired with C nucleotide. Do the other strand yourself and see if you match up the right nucleotide to the right base. The answer for T, G, A, and G is A, C, T, and C. Once the DNA has finished copying itself and there are two identical double helixes, the cell can now divide and give the new copy to the new cell. This whole process has a name, it's called "mitosis." (my-tow-sis)

Remember proteins? Remember talking about how DNA acts as a code for making the proteins? It's almost the same as copying itself except for one little detail. Let's take a look. When a protein needs to be copied a small part of the DNA ladder unzips and the recipe for a certain must be copied from one strand of the DNA to another strand. This other strand is called a "copy strand."

Methods

1. Visuals will be used to get across the concept of how tiny a chromosome is. A needle will be used to demonstrate.
2. This will be an opportune time to reinforce multiplication, division, or patterns. Research will include finding the number of chromosomes for various animals and presenting how many pairs each animal has. Games, puzzles, etc., will be utilized to extend math skills as well as facilitate continued chromosomal study
3. Students will benefit from having a visual displayed reminding them of this information. A coloring page with this message colored in and hung up around the classroom will heighten comprehension.
4. Students will work in cooperative groups and construct a list or deviate for a period of time and investigate cells. Types of cells, cell structure, differences among cells, are all topics that can be researched and discussed. Diagrams, illustrations, models, slides, speakers, etc., will be of assistance in this unit.
5. Separate zippers will be purchased at any fabrics or sewing store and used to show the students the zipping and unzipping of the double helix. Using a visual aid is helpful and will assist with the concept of free nucleotides pairing up. Doing examples on the board will help the student "see" how the bases and nucleotides attach and form two new double helixes.
6. Kids will come up to the board to match them up or work in cooperative groups doing the pairing on paper, or the students can construct a portion of a double helix with removable parts. Velcro is useful in making removable parts.

III: RNA (Ribonucleic Acid)

Objectives

1. Students will understand the difference between DNA and mRNA.
2. Students will comprehend the four bases of RNA and be able to correctly pair up the bases using the base Uracil instead of Thymine.
3. Students will grasp the understanding of mRNA's job within the cell.
4. Students will know what a protein is and why it is necessary for cell integrity and function.
5. Students will learn the relationship between a ribosome and proteins.

The copy strand has its own name. We call it “messenger RNA.” RNA is short for ribonucleic acid (ry-bow-new-klay-ik) RNA doesn’t need to be nearly as long as DNA because the mRNA isn’t a copy of all the proteins that make up the body. It’s just a copy of only one set of instructions for one protein. A protein that a certain cell may need to do its job. We talked about all the different cells your body has and how each cell has its own job to do. Different proteins help different cells get the job done. So, when it’s time for a protein to be copied mRNA is the man on the job. We know the bases on the DNA strand. The bases on mRNA are the same EXCEPT for one. While DNA has A, T, C, and G, mRNA has A, C, and G. The difference is the T. DNA has T base and RNA instead of T has U base. U stands for the chemical uracil (yur-uh-sil). This U base acts just like a T base. For instance, if the DNA has a T base, mRNA will copy with its partner the A base. If DNA has a C base then mRNA will copy with a G base. It the DNA has a G base the mRna will copy with a C base. BUT, if the DNA base is A then mRNA will copy with a U base, not a T base. Nobody knows why this happens. Think of it as simply a substitute and don’t worry because if you’ve gotten this far, then this will be no sweat. Try to copy this protein from the DNA strand. Think of yourself as the copy strand for proteins mRNA. Here’s the code: C, T, A, G, C, T, A, G, T. Now, mRNA copy that! Here’s the answer: G, A, U, C, G, A, U, C, A. Once the mRNA or copy strand has the code for the protein, it travels to another part of the cell to find something called a ribosome (ry-bow-sohm). The ribosome is the cell’s protein factory where mRNA’s instructions are read and the proteins are put together. All proteins come from chemicals called amino acids. This was brought up before. Do you remember how many amino acids we have? Twenty. Now, the ribosome has the instructions that take the different amino acids and turn them into a protein. As the ribosome reads the instructions from the copy strand (mRNA), it joins the amino acids together like beads on a necklace. When the ribosome has finished reading and attaching a protein has been put together. What do proteins do again? Proteins help cells and you are made up of cells! There are more than two hundred different kinds of cells in your body. You may wonder why cells are different if they all have the same DNA instructions to make proteins. That’s because in any one cell only a small part of the DNA threads are unzipped and making proteins. DNA threads are so long and complex that some cells are making proteins from one section of the DNA thread while another cell is copying protein from another part of that same thread.

Methods

1. Students will again use the board or work together to figure out the corresponding bases. If models have been made mRNA can be included and removable bases added. Several practice codes can be done to ensure mastery of mRNA.
2. Lessons or mini units will be inserted here to examine more thoroughly the job of proteins and why it is essential that we have them. Books, videos, posters or visuals, speakers such as doctors or scientists, computers, diagrams, et., can be used to facilitate learning on this topic.

IV. Boy or Girl

Objectives

1. Students will have mastered the number of chromosomes within each cell in the human being.
2. Students will be able to identify X and Y chromosomes and the significance of each in determining the sex of an organism.

3. Students will be learn the difference between Mitosis and Meiosis.

DNA is responsible for almost everything about you. That's a lot of responsibility! It's also the reason that you are a girl or a boy. How is that, you ask? Read on. Both men and women have forty-six chromosomes in every cell (we already knew that). The chromosomes are always in pairs. So half of forty-six gives us how many pairs in each cell? Terrific! Twenty-three pairs is right. The ONLY difference between men and women or boys and girls is the twenty-third pair. All the chromosomes look like little X's. But, the twenty third pair of chromosomes in a man has one chromosome that looks like an X and instead of the other looking like an X too, the other looks like a Y. The twenty-third pair of chromosomes in a women's cell are both X's. Now, pay attention here! In order to make you two cells had to come together. One from the father and one from the mother. The father always gives the sperm cell and the mother always gives the egg cell. These cells, the sperm cell and the egg cell, are called gametes. Gametes are special because while all your other cells have forty-six chromosomes, gametes only have half. That is to say that sperm cells and egg cells only carry twenty-three chromosomes in each cell. A cell with a single set of chromosomes is called "haploid." A cell with two sets of chromosomes are called "diploid." So, we call gametes haploid cells while the rest of the cells in our body are diploid. Can you figure out why these cells would only have twenty-three and not forty-six? Well, if dad was to give you forty-six chromosomes and mom was to give you forty-six chromosomes, you would have ninety-two chromosomes in one cell! That's a little too close for comfort. So, to get you started dad gave you half of his chromosomes and mom gave you half of hers. Now, since each gamete gave you twenty-three chromosomes, one from each parent, you have a total of forty-six. Much more like it! But, why are you a girl and not a boy? Or a boy and not a girl? Well, like we said before, the twenty-third in mom's chromosome in mom's is XX. And the twenty-third chromosome in dad is XY, right. Since the gametes only carry half the number of chromosomes some of the sperm cells carry dad's X and some of the sperm cells carry dad's Y chromosome. Since mom has both XX's then all of the egg cells have an X. Here's the trick, if the sperm cell that is carrying the X chromosome gets together with mom's egg cell then there are two XX's. One from mom and one from dad. Two XX's and you are a girl. But, if the sperm cell with the Y chromosome hooks up with mom's egg cell, then you have an X and a Y chromosome. If you have an X and a Y then you are a boy. Imagine that, one tiny chromosome out of forty-six and you're either a boy or a girl. This whole process of determining whether something is male or female is called "meiosis."

Methods

1. Undoubtedly, the teacher may get questions relating to sex. This is an appropriate time to examine the topic and explain it in a scientific sense rather than a sexual matter. There is an abundance of materials and people who can provide assistance. In addition there are many coloring books, diagrams, and question and answer guides to allow the student to participate in many different ways. The topic of identical and fraternal twins will be addressed at this time and later on when discussing looks you can refer back to this as to why some people look exactly alike and other do not. Illustrations and diagrams will be utilized to further comprehension.
2. The scientific method will be implemented here. Students will draw or look at what has been learned up to this point and observe carefully. They will be able to make an educated guess or hypothesis concering why gametes only have half the regular chromosomes. Once they have

come up with a hypothesis they can try to predict the next step and give an explanation.

V. Where did that curly hair come from?

Objectives

1. Students will be able to differentiate between dominant and recessive alleles within genetic makeup.
2. Students will know the definition of a gene.
3. Students will create a Punnett Square to determine the outcome of a hypothetical hybrid cross.
4. Students will gain an awareness of mutations and the effects on genes and the person who possesses the genes.

So, now that you know why you're a boy or a girl, the question still remains why do you look the way you do? What decides whether you will have your mother's nose or your father's nose? We know that proteins are building blocks. We know that amino acids make up proteins. A gene is a part of DNA and a part of a chromosome. A gene controls the way you look. We learned how DNA makes its proteins. Amino acids join together like beads on a necklace. The DNA decides which beads go where and then tells the mRNA. The mRNA brings it to the ribosome and the ribosome reads the message. But, how does mRNA decide whose gene to carry or copy. The mother's gene or the father's gene that makes the protein that gives you a specific trait. The answer is simple. Some genes we call dominant or pushy. Other genes we call recessive or shy. Everyone has a little of both in their chromosomes. When both a recessive gene and a dominant gene are there (one gene from mom and one gene from dad) one of them has to win out. Can you figure out which gene would win if there was a dominant and a recessive gene? Sure, the pushy one would get the mRNA to copy its gene. (Just a note: this is not always true. Both genes are copied BUT, the effect of one protein is stronger than the other. For example: melanin is dark. Or one gene may make a defective protein or no protein at all because of a mutation. You'll learn about mutations later.) And, depending who has that pushy gene, mom or dad, you get that trait. For example, let's say that mom gives you her gene for blue eyes. We'll call it "b." Dad, on the other hand gives you his gene for brown eyes. We'll call his "B." So you end up with a pair that looks like "Bb." Since brown is dominant over blue, you end up with brown eyes and not blue. But, check this out! If Mom gives you a gene for blue eyes "b" and dad gives you a gene for blue eyes "b." What's your pair now? "bb" If there are two of the same kind of gene either both dominant or both recessive, what happens? Right, there's no competition. There's no need to, they're both the same and you get blue eyes. Let's do another example. Say mom has blond hair and dad has brown hair. You have brown hair. Which gene won out? Obviously, it must be dad's because we know that brown is dominant over blue. But does this mean that you have two "BB" genes? Nope. You could have that "B" gene from dad and a "b" from mom. But, how is it that you have brown hair and your sister or brother has blonde hair. Well, we know that mom must have two blonde genes for hair color. She can't have a blonde gene and a brown gene or here hair would be brown. But, dad could have a blonde hair gene. We don't know because he has brown hair. He could have a "B" gene

and a “b” gene. If those genes get split up in the sperm cells and the gene for blonde hair pairs up with your mom’s gene for blonde hair, then you brother or sister has a “bb” gene and there’s no dominant gene for the mRNA to pick. It’s just blond hair for that kid. We all have genes. Sometimes you can figure out what genes you have or might have by looking around at your family and how they look. Scientists came up with this way to figure out who has what genes for which thing. They use what is called a “Hybrid Cross.”

Sometimes there can be a mistake when a gene is being made. Most of the time that mistake isn’t ever even noticed and everything turns out fine. But other times that mistake can cause problems. When a mistake is made we call it a mutation (mew-tay-shon). A mutation in a gene is just a change in the DNA’s sequence of the nucleotides. In other words, when the nucleotides pair up they don’t do it the right way. And remember we said that each base has its own specific partner? The bases form a code for the ribosome to change into protein. Well, if the nucleotide copied the message the wrong way then the protein isn’t made right. Different things can happen if there’s a mistake. Sometimes people may be blind or deaf. Other times they may be very, very short. Some people may be born with a disease that may make them sick. There are lots of different problems that can happen when there’s a mutation but, on the brighter side, there are lots and lots of doctors who are figuring out how to solve these problems. These doctors are called “geneticists,” and their job is to study our genes and find out how they work and how to fix them when there’s a problem. This work is very hard and takes a long time.

So, hopefully you understand the basics of why you look the way you do and how important the whole process is. Without mitosis or meiosis you wouldn’t be here. Don’t become discouraged if you don’t understand everything. Like we talked about before, it’s a very hard concept and if you go slowly and work out the parts you don’t get, eventually it will come to you. This is one VERY small part of genetics. There is soooo much more to learn. If you’re interested there are lots of books and people who will help you learn all about it. Have fun and good luck!

Methods

1. The Teacher will demonstrate the Hybrid Cross on the board andonce the students can figure out how to combine the genes, they will do practice sets and eventually do a family tree and determine where their traits came from. They may also do some hypothetical practice and try to determine what their children would look like depending on their mate’s genes. The kids will either make them up or a game can be made out of it. The teacher and students will brainstorm a list of types of genes we have and the variations of each. The teacher can make a list of all the genes and gene variations, copy it two or three times and then have the students pick out genes and try to figure out what the end result might be.
2. The class will discuss the effects that having a disease or birth defects. There will be some focus directed toward feelings and behaviors. Medical professionals may be beneficial with explanations and expectations.
3. The class can begin exploring other areas of genetics. Again, there are volumes of information to look through at the library. There may be a geneticist who can speak to your class. Videos, books, texts, other people can help to expand your knowledge on all the different facets connected to genetics.

Lesson Plan I: Exploring Similarities and Differences Between Cultures

Objectives

1. Students will understand that all members of the human species will have similar characteristics that help to identify them.
2. Students will become aware of the differences between various members of the same species.
3. Students will become aware that physiological makeup is the same within all human beings regardless of ethnic background.

Materials

1. Accompanying worksheet
2. Paper, pencils, crayons, markers, or paints.
3. Pictures, diagrams, or books available to students for referral when drawing the internal organisms of the human body.
4. Books, videos, and related materials on stereotyping, discrimination, and violence relating to racism and its effects.

Method

1. Have students measure out paper that will accommodate their entire body (feet to head). Students should draw and color in the whole body exterior self-portrait of themselves making certain to be as accurate as possible. Teachers may wish for each student to be equipped with a picture of him/herself for easier and better accuracy when drawing the self-portraits.
2. Students should either measure out a second sheet of paper equal to the first or use the blank side of the self-portrait to draw the insides of a human being. The class should have some knowledge what to include. The teacher may want to create a web, KWL chart, or list to assist the students. All class members should include basic organs, blood, bones, and heart.
3. All portraits should be displayed around the room. Students should work independently on the first part of the worksheet. After this has been completed the class should make one combined list of all the characteristics that are the same between different people. The same should be done to determine characteristics that help us identify one another. A final list should be constructed to determine that all species of the same kind contain the same basic internal make-up.
4. The teacher should instruct students to complete the second section of the worksheet. A

discussion focusing on similarities and differences between different ethnicities or races can be initiated. This topic can include racism, stereotyping, discrimination, hate crimes, etc. Books, videos, personal experiences may be shared to help student gain a full awareness of the severity of the problems that society is facing today. Students should, at appropriate times, take notes.
5. The instructor will have students utilize the information that has been presented to write a paragraph. Students can use the worksheet and notes to aid the with the writing section. The class will write on the similarities and differences, on the exterior as well as the interior, between the human species. A personal opinion component can be added to get feedback on the problems and possible solutions discussed earlier.
6. This lesson should be followed by a social studies unit that explores different cultures and the connection to each of us on a community, state, national, and worldwide level. Students should have developed the knowledge to "see" past an individual's race and focus on how each culture brings something wonderful to our lives.

Lesson 1: Exploring similarities and Differences Between Cultures

1. *What color is your:*
    hair:_____
    eyes: _____
    skin:_____
2. *What shape are your:*
    eyes:_____
    mouth:_____
    nose:_____
    face:_____
3. How tall are you?_____
4.How much do you weigh?_____
5. Other:_____
    _____
    _____
    _____
    _____

Look around the room at everyone ‘s portrait. Look at yourself too. List ten things that everyone has on the outside on the outside of your body. For example hair:

1._____ 6._____
2._____ 7._____
3._____ 8._____
4._____ 9._____
5._____ 10._____

Look around at everyone’s portraits and pick out ten things that are different between you and them. For example: hair color

1._____ 6._____
2._____ 7._____
3._____ 8._____
4._____ 9._____
5._____ 10._____

Looking at the portraits of everyone’s insides write down ten things that we all have. For example: blood

1._____ 6._____
2._____ 7._____
3._____ 8._____
4._____ 9._____
5._____ 10._____

Notes

What are some of the reasons that people might make fun of someone else just by looking at that person:

_____

_____

_____

_____

How do you think this would make the other person feel?_____.

Why?_____
What are some different types of races or cultures?_____
_____

_____

Write down some of the things that you learned about each culture and what they have brought to everyone:

1._____
_____
2._____
_____
3._____
_____
4._____
_____
5._____
_____

Lesson II: ***Adenine, Thymine, Cytosine, Guanine, and Uracil***

Objectives

1. Students will reinforce their knowledge of the DNA and RNA bases.
2. Students will practice pairing up the correct bases with one another.
3. Students will work cooperatively with each other to assist in the mastery of the bases and their correct pairs.
4. Students will gain a better understanding of how free nucleotides pair up with the bases on the double helix.

Materials

1. Game board
2. DNA and RNA bases

3. Dice with the four bases on each side

Method

1. The teacher must first construct the game board. One side of the doublehelix strand with the four bases attached should be enlarged and color-coordinated For example: all adenine bases should be colored red. All thymine bases should be colored green, etc. Each student should have his/her own game board. The game boards can be copied on the copier and then colored in. Laminating the board will extend the life of the game board.
2. The dice can be made out of one large square piece of Styrofoam. On one side the base adinine should be printed boldly. Gaunine should be printed on another side and cytosine on the third side. Both thymine and uracil should be printed on the forth side of the dice.
3. Each game board should have an envelop attached that contains free nucleotide bases. Each base should have the corresponding color to the base on the game board.
4. The game can be played with one player or many players. The student(s) roll the dice, one turn per student. Depending on the base shown when the dice is rolled the student will choose the correct nucleotide and "attach" it to the base on the game board. The nucleotides can be attached using small circles of self- adhesive velcro. One circle should be placed on the game board where the nucleotide is to be placed and the other circle should be adhered to the nucleotides.
5. The teacher can have the students play the game using the thymine base for DNA or the uracil base for RNA.
6. Students should work cooperatively to check one another making certain that the bases are correctly paired. If a student pairs a wrong base to the single strand of the double helix, he/she loses his/her turn and the next player rolls. The player that successfully completes the of either DNA bases or RNA bases wins the game.
7. The teacher may wish to use this as a lesson the first time and then set up the game in a center. Having this game in a center will allow the students to continue learning this material during their free time while enjoying the "game."

Lesson III: ***Where Did That Curly Hair Come From?***

Objectives

1. Students will strengthen their knowledge of dominant and recessive alleles within a genetic makeup.
2. Students will create a Punnet Square to determine the outcome of a hypothetical hybrid cross.

Materials

1. Pencils, crayons or markers.
2. Worksheet

Method

1. The teacher should have an enlarged example of a Punnet Square either on the board or an overhead to show the class before they are expected to work independently.
2. The students may have their own copy of a Punnet square to do along with the teacher as the example(s) are demonstrated. Worksheets can be copied as many times as necessary for mastery of the objective.
3. The teacher may choose from various traits that are easily shown using dominant and recessive alleles. Hair texture, hair color, eye color, height are only a few of the possibilities. Together, with the teacher, students should take the hypothetical information for eye color. The teacher should reiterate how the parents give the genes for eye color and the possibilities of the child having a certain eye color. The teacher may begin with an easy set of alleles. For example: brown and brown that would be shown using B and B. This union would produce a hundred percent chance of a child with brown eyes.
4. The next example would use two alleles for blue eyes. This would result in a child that has blue eyes. The children will observe how the lower case b is used to identify the blue eyed allele. The next example will increase in difficulty using a brown and a blue allele. The students will set up the Punnet Square with a capital B above the top left corner square and a lower case b above the top right corner square. They will continue by making a capital B next to the top left corner square and making a lower case b underneath that next to the lower left square.
5. The students will then pair up the alleles from the top and sides and write down what they find. The top right square will have a BB. The top left square will have Bb. The bottom right square will have Bb and the bottom right square will have bb. Using this information the class will predict what the percentage is of having a child with brown eyes or blue eyes would be.
6. The students should use the worksheet to color in the appropriate trait for each child corresponding to the results of the Punnet Square. For example: three children would have brown eyes colored in and one child would have blue eyes colored in.
7. The students should have an understanding of how to tell which trait will be dominant by looking at the letters used to describe the alleles. Capitals should be used to show a dominant allele while lower case letters indicate a recessive allele. Any pair that has a capital letter will most likely express that trait that the capital letter stands for. Two recessive alleles paired will

express that trait that the lower case letter represents.
8. Once students have learned how to predict using a Punnet Square to determine the outcome of a hybrid cross, they can begin to work independently with information that the teacher presents or the class decides on as a whole.

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