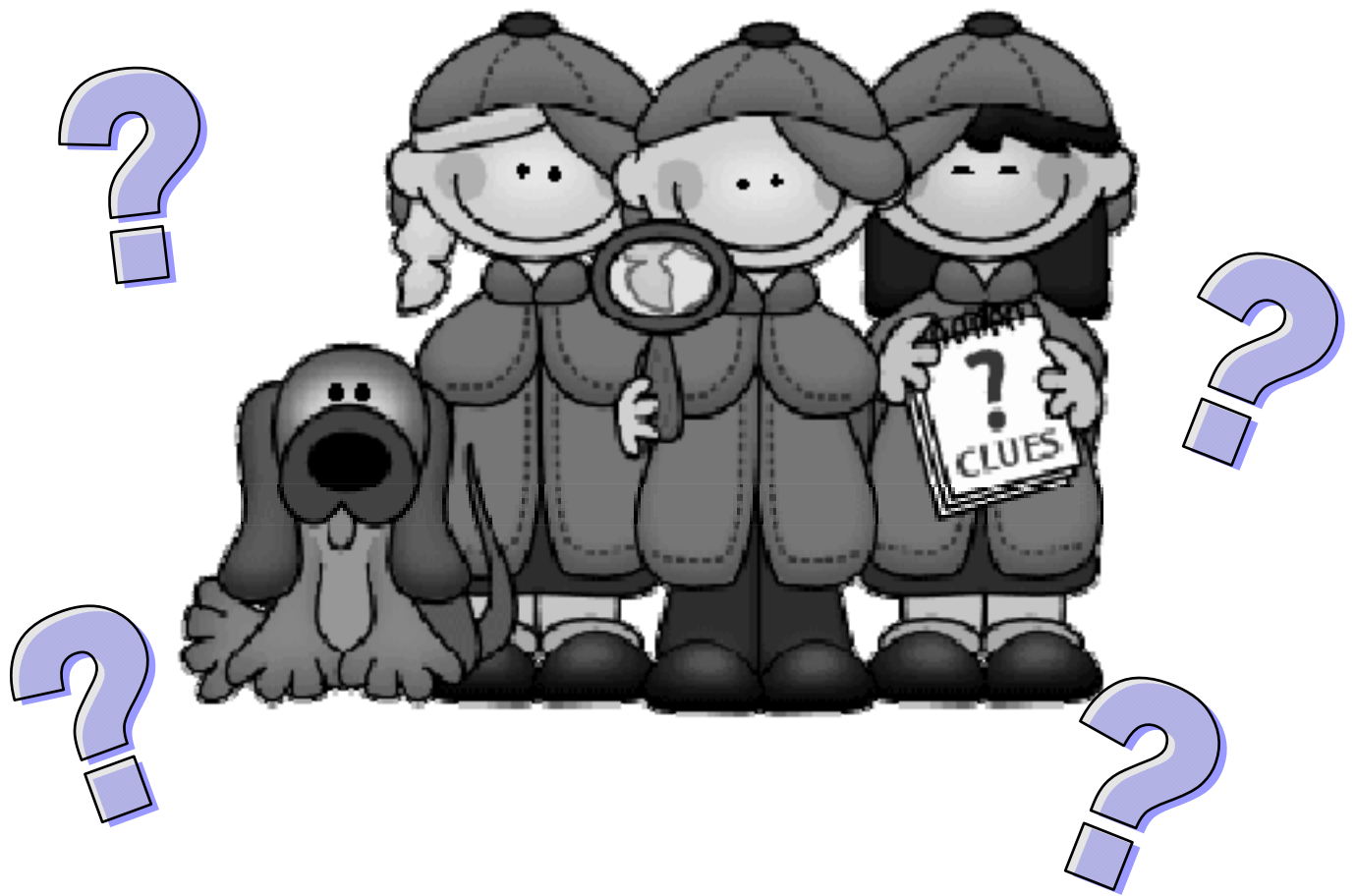


CSI



Name _____ Station# _____

Homeroom Teacher _____

Discovery Lab
Science Notebook

What is Forensic Science?

The word *forensic* comes from the Latin word *forensis*, meaning "connected with forum." The forum was the Roman square where the Court of Law and public discussions were held. In some countries, such as Canada and the United States, forensic science is also known as criminalistics.

Who?

Forensic science is any science that is used to solve crimes, and its results are used in courts of law. It is based on the belief that whenever a contact is made, there is always some exchange of material. This principle was first suggested by the famous French criminologist Edmond Locard who, in 1910, said that a criminal always leaves something at the scene of a crime, or takes something away. In other words, when a person comes in contact with an object or another person, there is always some material transferred from one to the other. This has been referred to as **Locard's Exchange Principle**. These pieces of evidence are for the police to find for the forensic scientist to analyze.

What?

Things left at a crime scene can include fingerprints, small fibers from clothes, body hair, saliva left on a sealed envelope, footprints, tool marks from a forced entry, ink, paint flakes, oil or prints from the getaway car. In fact, anything, no matter how small, that has been altered by the crime can be called a **contact trace**.

When?

Before the 20th century, criminals had it very easy. As long as there were no witnesses, criminals were hardly ever caught. With modern technology today, however, it is almost impossible to commit the perfect crime. Today, eyewitness accounts are still very helpful in bringing a criminal to justice. A car registration number recorded by an eyewitness can lead to a possible suspect and save the police many hours of work. A good description of a criminal by an eyewitness can lead to the speedy capture of a suspect and eliminate other innocent people from police inquiries. To be a good eyewitness, a person should be alert and observant. In this way, he or she can notice and remember as many details as possible.



Twenty words every CSI should know:

1. **Forensic Scientist**– a person who uses several fields of science to help answer questions of interest to the legal system
2. **Investigation**– an examination or inquiry into something, especially a detailed one that is undertaken officially
3. **Laboratory**– a place where research and testing is carried out
4. **Detective**– somebody who investigates and gathers evidence about possible crimes or wrongdoing
5. **Eyewitness**– a person who has firsthand knowledge of an event **Why?**
6. **Criminal**– somebody who has committed a crime
7. **Observant**– paying such careful attention that little or nothing is unnoticed
8. **Evidence**– anything that provides proof
9. **Contamination**– the act or process of damaging something so it can no longer be used
10. **Examine**– to inspect or study somebody or something in detail
11. **CSI**– Crime Scene Investigators
12. **Victim**– somebody who or something that is adversely affected by an action or circumstance
13. **Suspect**– somebody who is suspected of a wrongdoing **Where?**
14. **Microscope**– a device that uses a lens or system of lenses to produce a greatly magnified image of an object.
15. **Magnifying Lens**– used to increase the apparent size of something
16. **Clue**– evidence that helps solve a problem
17. **Code**– a system of signals or symbols used for communication
18. **Morse Code**– a code made up of various dots and dashes that is used to communicate
19. **Scale drawing**– a representation in which objects and distances are drawn to scale
20. **Crime Scene**– the place where an illegal act occurs and the source of evidence needed to help solve the crime





The Scientific Method

State the Question

Collect Information

Form a hypothesis

Test the hypothesis

Observe

Record and Study Data

Conclusion



CSI always ask good questions!

Closed Question
A question that has a yes or no answer

Direct Question
A question that requires an answer

Leading Question
One that suggests a right answer or leads a person toward a particular answer

Open Question
One that begins with how, or why, or when

Probing Question
A question that follows a certain line of thought to get at a fine point



? Using your laptops we are going to explore the world of Forensic Science. ?

PART ONE: ?

First we will begin by looking at the overhead projector and a website called CSI We Adventures to learn more about the men and women who work as Crime Scene Investigators.

Forensic Biology: ? ?

1. What type of cells were looked at under the microscope? ?

2. What are the four basic steps of processing DNA? _____, _____, _____ and _____.

3. What does CODIS stand for? ?

4. What part of a cell contains most of the DNA? _____

PART TWO:

It is your turn to have a little fun and explore a website with me. Click on the first website listed under websites titled: Taking Legible Fingerprints. This site is going to give us some information on the importance of getting a good fingerprint.

Now, let's test your investigation skills by solving a crime. Click on the title Who Touched Jimmy's holographic NOVA lollipop?

After completely the three parts record the *culprit's* (someone who is responsible for or guilty of an offense or misdeed) name. _____

PART THREE: ?

The last crime that we are going to investigate is titled: A Strange Flashlight. Here we will learn how the FBI investigates.

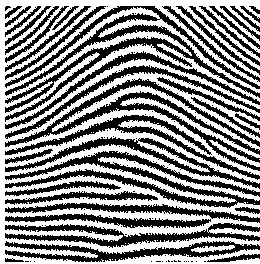


Arch, Loop, or Whorl

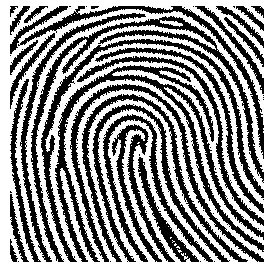
Fingerprint Identification Activity

Take a close look at your thumb. See all of those tiny ridges on the skin? Those are **friction ridges**, and they help you hold onto things. A **fingerprint** is an impression, or print, of those ridges. Fingerprints are left behind when someone touches an object with their fingers. Every person has his or her own unique pattern of ridges and furrows. They are found on the outer layer of skin of fingers, thumbs, toes, lips, palms and soles of the feet. There is even a record of a lip print used to identify a car in a hit-and-run accident in the United States. No two people have the same pattern of ridges, not even identical twins. These patterns are completely formed by the third or fourth month of pregnancy and will never change in shape throughout the person's lifetime. After most injuries and burns, the same patterns will return as the skin heals. Once formed, fingerprints only grow in size as the body grows.

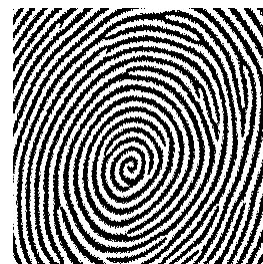
There are three main patterns of fingerprints: arches, loops, and whorls.



Arch



Loop



Whorl

To help identify a fingerprint as one of these three patterns, a triangular shape, formed where two patterns meet, was recognized and called a **delta**.

An **arch** is a pattern that runs from one side of the finger to the other without making a backward turn. Hence, an arch has no delta. A tented arch has an upward ridge that gives the pattern a spine.

When the ridge makes a backwards turn, a **loop** is formed. A loop has one delta. A loop where the ridges slope downwards toward the thumb is called a radial loop, and a loop where the ridges slope toward the little finger of the hand is called an ulnar loop.

A **whorl** is a pattern with two deltas where the ridges form a complete turn. A central pocket loop has two deltas. It has a core like a whorl, but the rest of the pattern is like a loop. A double loop has two clear intertwined loops with two deltas and two cores.

FACTS: Early in the 20th century, it was found that in Western European populations, the loop was the most common type of fingerprint, accounting for 60% of all prints. Arches were quite rare, being found in only about 5% of all prints, with whorls and composites making up the last 35% of fingerprints. Composite fingerprints are a mixture of patterns and may have three or more deltas.

Arch, Loop, or Whorl

Fingerprint Identification Activity

Taking fingerprints: In this activity you make a record of your own fingerprints in much the same way the police take those of criminals, suspects, and witnesses. It is a good idea to practice a few times on scrap paper first until you are confident you can get a print that shows the pattern of ridges clearly.

Whole Group Directions:

1. Print your name on the fingerprint card: last name, first name and middle name. You only get one card so please be careful not to make a mistake.
2. You may fill in your date of birth if you would like. These cards are for you to keep. :-)

Partner Directions:

1. Place the newspaper on your table with the inkpad, fingerprint card and scratch paper on top of it.
2. Working with a partner place your hand near the edge of your table, roll the end joint of your first finger on the inkpad so that the whole joint is inked.
3. Being careful not to use too much ink, which will give a blurred print, roll your finger once from side to side on your record sheet. **DO NOT GO BACK AND FORTH, ONE ROLL.**
4. Wipe your finger on the wet paper towel and repeat.
5. Working with a partner will keep you from making a careless mistake. Also, police are the ones who roll the fingers on the cards, not the person being fingerprinted. This helps prevent errors.
6. After you and your partner have finished make sure that you wipe each finger clean. The ink we are using will stain your clothes.
7. Using a magnifying glass examine your fingerprints. Record your findings in the chart below.

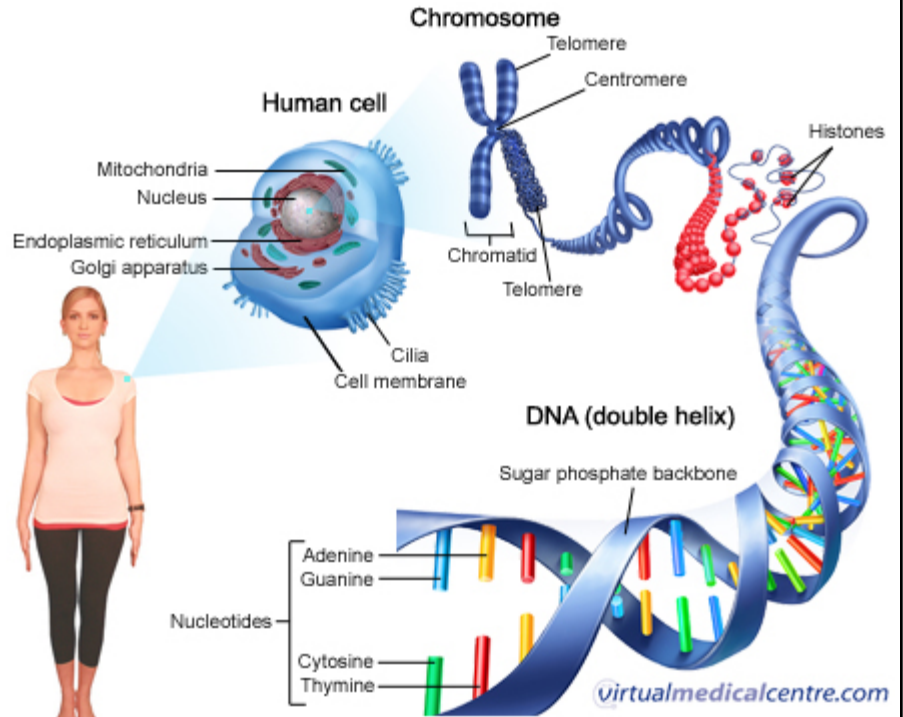
My Fingerprints

Arches	Loops	Whorls	Composite

Making a Model of DNA

Background Information:

DNA is short for **deoxyribonucleic acid**. DNA is a gigantic molecule found in the nucleus of every cell and in every living organism. It looks something like a ladder with about 3 billion rungs, and is the chemical of which chromosomes are made. **Chromosomes** are large entwined strands of DNA. They can be divided into smaller sections called **alleles**, which encode instructions for



cell operation. These instructions are genes, and they are passed down from parent to child through alleles in DNA. The DNA from related people is always more similar than DNA from unrelated people. In the same way, the DNA of closely related animals and plants is also more alike than the DNA of organisms that are only distantly related. It has been found that human DNA has about 90% of its alleles in common with the DNA of other primates.

The only people who share exactly the same DNA are identical twins, because they started out as a single fertilized egg. In its early stages, the egg split apart and then grew into two separate babies who are genetically identical.

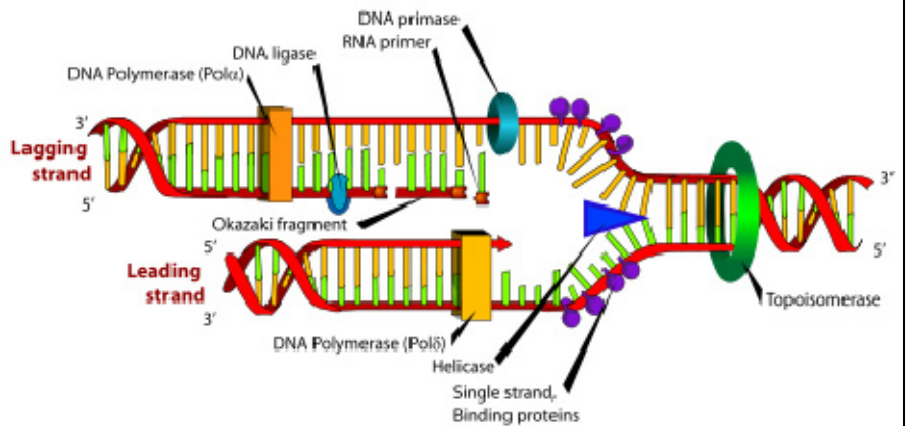
The legs of the "ladder" consist of alternating molecules called **deoxyribose** (sugars) and **phosphates**. The ladder twists itself into a "double helix" to save room as it fits into the nucleus. The rungs of the DNA ladder are made up of pairs of molecules called **bases**. There are only four different bases, and they always pair up in exactly the same way. **Adenine (A)** always pairs with **thymine (T)**, and **cytosine (C)** always attaches to **guanine (G)**.

Making a Model of DNA

The DNA ladder has also been compared to a Zipper with four bases forming the teeth. The difference is that in order to join the two strands of DNA, A must pair with T, and G must pair with C. The order in which these bases appear is the **genetic code** that determines all inherited characteristics.

This DNA, or genetic code, is unique to every person and is a combination of which 50% is inherited from the father and 50% from the mother. When a cell divides in two, it opens like

a zipper, and the DNA copies this order of bases, exactly, so the DNA in the new cell is identical to the DNA in the original cell.



Directions for Making your Model:

1. Color the individual structures on the worksheet as follows:

adenine = red

thymine = green

guanine = blue

cytosine = yellow

phosphate = brown

deoxyribose = purple

2. Cut out each structure.

3. Using the small symbols (*squares, circles and stars*) on the structures as guides, line up the bases, phosphates and sugars.

4. Glue the appropriate pairs together to form nucleotides.

5. Construct the right side of your DNA molecule by putting together in sequence a cytosine, thymine, guanine and adenine nucleotide.

6. Complete the left side of the DNA ladder by adding complementary nucleotides or nucleotides that fit. Your finished model should resemble a ladder.

7. To show replication of your model, separate the left side from the right side on your table, leaving a space of about 15 to 20 cm.

8. Using the remaining nucleotides, add to the left side of the model to build a new DNA molecule. Do the same with the separated right side.

9. Glue the nucleotides together to form two complete identical DNA ladders or molecules.

Every Contact Leaves a Trace

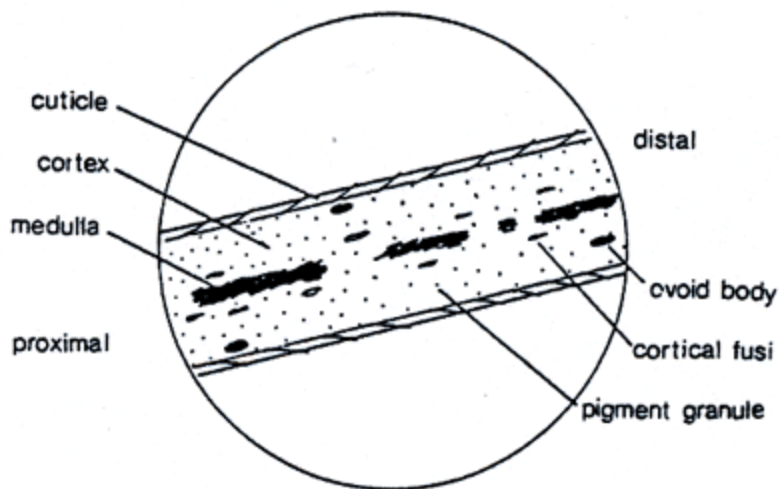
Hair:

Although hair cannot usually identify a single individual as fingerprints can, hair found at a crime scene can be very useful. Besides giving some indication of age, race, male/female, hairs found at a crime scene can strengthen the links between a suspect and that scene.

Hair is composed mainly of the protein keratin, which is very difficult to destroy except by fire and certain chemicals. Microscopic inspection of hair can also indicate whether hair was pulled out, cut off, or just fell out naturally.

A strand of hair consists of three layers:

1. the central core, called the **medulla**
2. the colored layer, called the **cortex**, surrounding the medulla
3. the outer layer of overlapping scales, called the **cuticle**



Fibers:

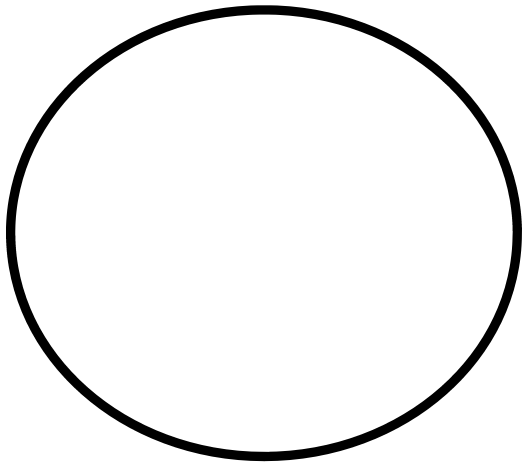
If loose fibers found at the crime scene have not come from the victim, they may have come from a large number of sources— from the **perpetrator's** clothes, from carpet or curtains where the crime occurred, or even from a rug or blanket. Also, fibers from the victim may have been deposited on the perpetrator, and these will be looked for on all suspects. Any such fibers found could connect the suspect with the crime scene.

Fibers can either be **synthetic** (manmade), such as nylon, rayon, polyester, terylene; or they can be natural, being made from either plants (cotton and linen) or from animals (wool, silk, and mohair). Generally under the microscope, natural fibers have a rougher surface, taper from root to tip, and appear somewhat irregular. Cotton fibers are actually collapsed tubes, while wool fibers, like hair, have scales. On the other hand, synthetic fibers are smooth and even. They also tend to have a much longer length.

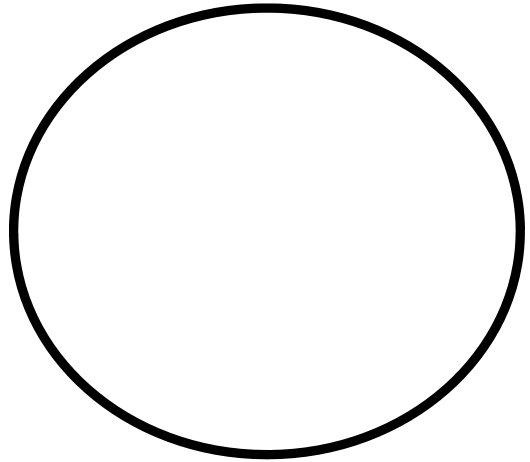
Some CSIs are fortunate enough to find a piece of fabric instead of only a few fibers. The distinctive shape of a piece of fabric found at a crime scene may be compared with the suspect's clothes.

Every Contact Leaves a Trace

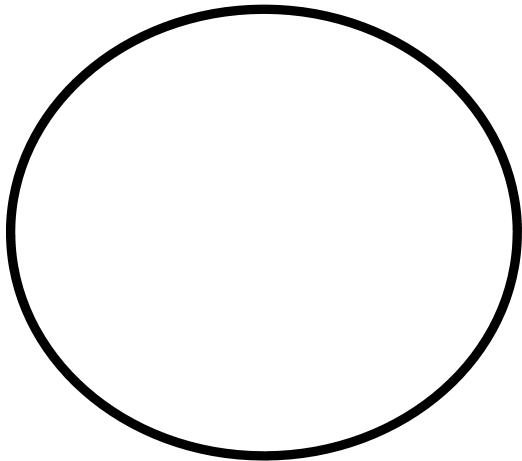
Use the circles provided below to draw and label what you preview in each slide. You may use colored pencils after all slides have been drawn to add details.



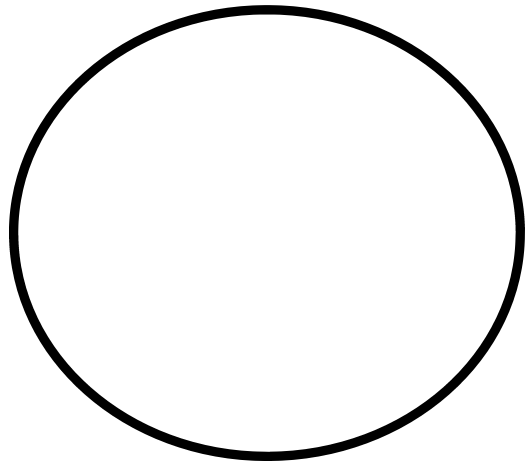
SLIDE 1 _____



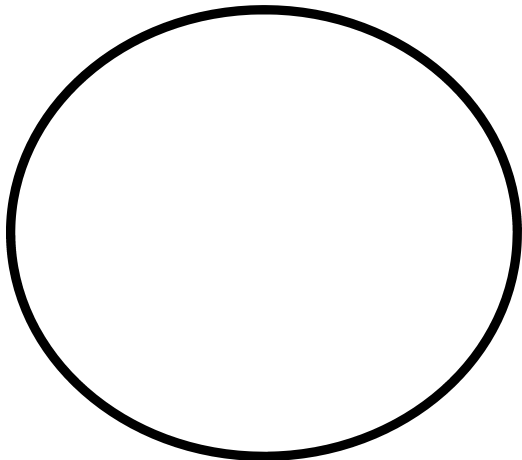
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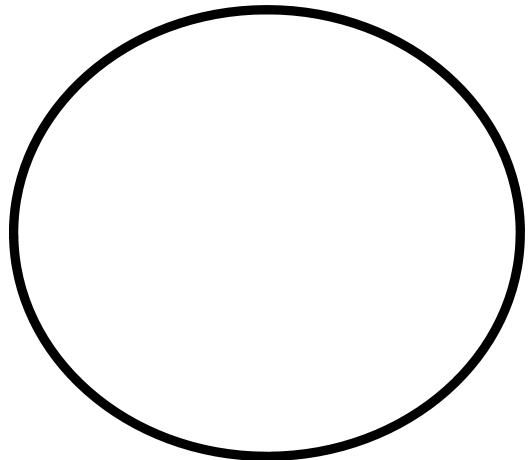
SLIDE 3 _____



SLIDE 4 _____



SLIDE 5 _____



SLIDE 6 _____