fingerprints

The Science And Art Of Observing

by
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The Louis Armstrong
Middle School

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OVERVIEW

Observation skills are an important tool to the scientist. The ability to detect the differences between odors, tastes, feel, and appearance of things enables the scientist to tell a lot about his/her world. Looking at something is not enough. If asked to make a list of every item depicted on a dollar bill, one would find this task rather difficult. A dollar, an item used every day, and one that we see thousands of times each year, we do not know everything about. This is because one looks at a dollar bill, but never really observes it. One became use to the large recognizable items on the bill, but fail to notice the small finer details of the bill. So it is with other everyday things in our world, we never really take the time to observe and notice the details in the world around us. In this unit, students will practice the art of observation through fingerprint identification. At first, students will look at and identify the major types of fingerprints. Students will then move on to sort and classify prints

according to these major groupings. Identification of specific prints and the lifting of latent prints are all part of this unit. Students will also learn to make prints and will fingerprint each other. The observation skills learned through the identification process will become a valuable tool to the student scientist.

FINGERPRINT UNIT

SPELLING/VOCABULARY WORD LIST

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Spelling/Vocabulary Words For Fingerprint Unit

1- valley
2- ridges
3- furrow
4- whorl
5- arch
6- loop
7- powder
8- latent
9- cross section
10-moisture

11-sweat
12-roll
13-core
14-delta
15-spikes
16-rods

ABOUT FINGERPRINTS

The skin on the edges of each of your fingertips , or bulbs, have ridges on them. These ridges can be see with the eye, and can be shown very clearly with the use of a magnifying glass. These ridges that stick up higher than other parts on the finger tips form patterns. These patterns remain unchanged throughout a persons lifetime. No two people have the same pattern on their finger tips. Even identical twins have different patterns. This, therefore,allows for a practical means by which to identify people. Around 1858 a British government official, in Bengal India, began using fingerprints as a means to prevent impersonations.Although the Chinese were using thumb prints as a form of signature even before the birth of Christ, this British government official, Sir Francis Galton, was credited with the founding of the present system of fingerprint identification. Over the years that followed, police departments started files of all the criminals they caught. If fingerprints were left behind (latent prints) they could be matched to the prints on file for identification. We associate fingerprints with criminal events because of its wide spread use by law enforcement agencies. Fingerprints are, however, useful in many other ways. Hospitals fingerprint or footprint newborn babies to prevent possible mixups. Along with hospitals other institutions use fingerprints for identification purposes. Fingerprints are useful in the identification of missing persons, and in unidentified deaths. The armed services use

fingerprints to identify soldiers, as do many government agencies.

We can classify fingerprints according to the types of patterns, and the number of ridges appearing between certain designated points within this pattern.All fingerprints can be separated into three main groups: the arch, the loop and the whorl.Since there are a few different types of arches, loops, and whorls, we can expand to eight Subclassifications of fingerprints as indicated in the experiments. In the arch patterns, the ridges extend all the way across the fingertip or bulb, and rise slightly in the center to form a tented rise. In loop patterns, one or more of the ridges curve into a hairpin turn.Both ends of a loop ridge stop on the same side of the bulb. In the whorl patterns, the ridges follow a spiral or circular direction.

To make a permanent record of fingerprints, all one has to do is to ink the bulbs or tips of the fingers so that the ink adheres to the hills or ridges on the skins surface. By the pressing or rolling those inked fingers onto white paper the ink will transfer from the ridges to the paper thus leaving a perfect copy of the ridge pattern on those fingers. Skin oils act like inks on the ridges on the fingertips. When you touch something the oils on the ridges transfer to the object you have touched. Since oil is clear, however, you cannot see the print as you can on the inked versions. You can darken the oil prints with powders that will stick to the oils. We call these type of prints latent

prints. Latent fingerprints are used in solving crimes where criminals have touched objects at the scene.

Points To Look For In Fingerprint Identification
CORE

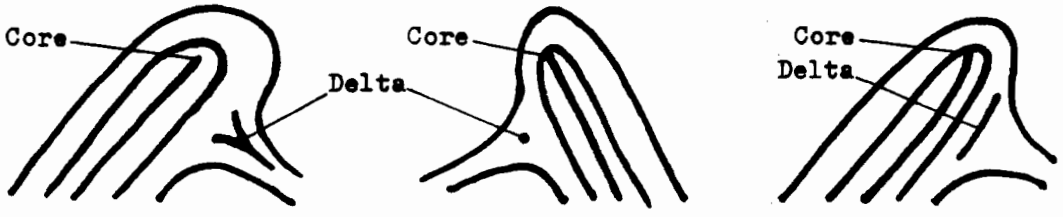
CORE: The core as the name implies, is the approximate center of the pattern.

In order to locate the core you must first locate the innermost sufficient recurve.

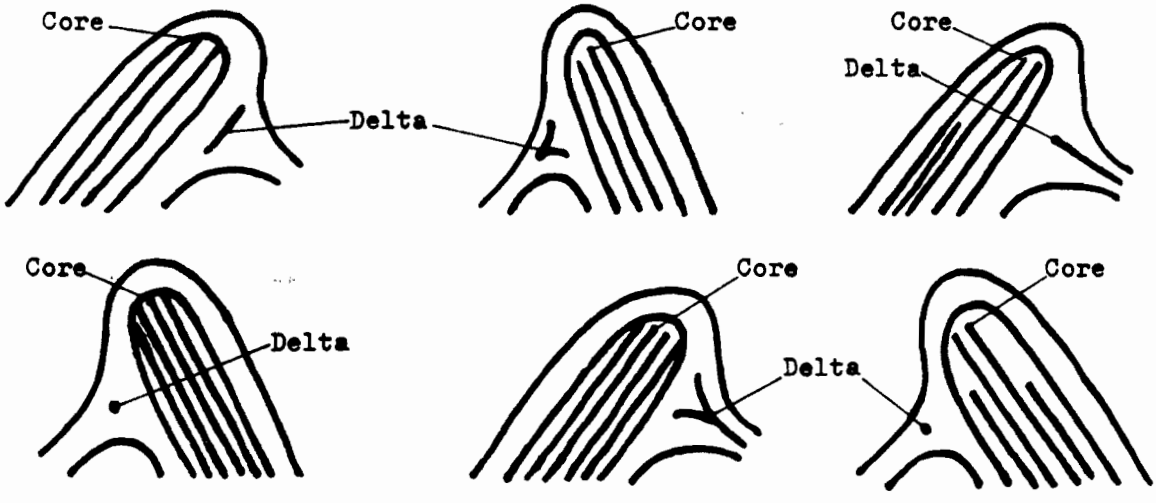
The core will always be located on or within the innermost sufficient recurve.

1. The core is located on the shoulder of the innermost loop farthest from the delta.

2. The core is located on the spike or rod in the center of the innermost recurve, provided the spike or rod rises as high as the shoulders.



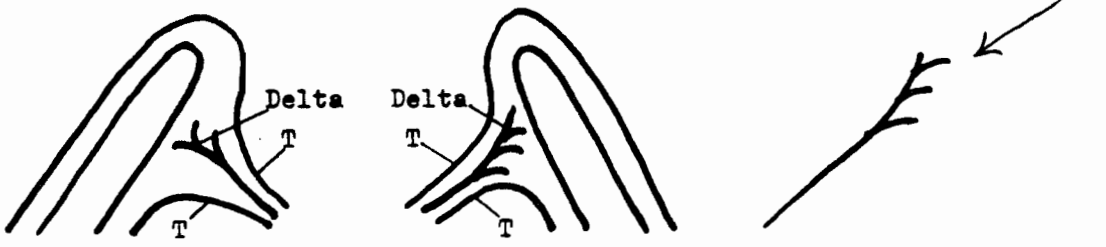
3. If there are an even number of spikes or rods as high as the shoulders, the core is located on the farthest of the innermost spikes from the delta, whether or not the spike or rod touches the inside of the recurve.



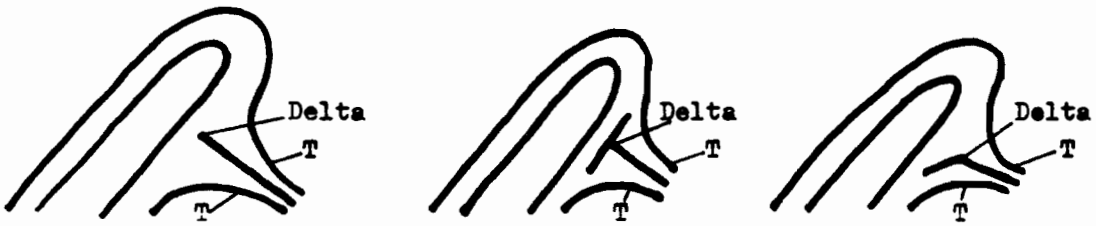
Points To Look For In Fingerprint Identification
DELTA

DELTA RULES:

1. When there are two or more possible bifurcation deltas which conform to the definition, the one nearest the core should be chosen.(refers to a series of bifurcations)



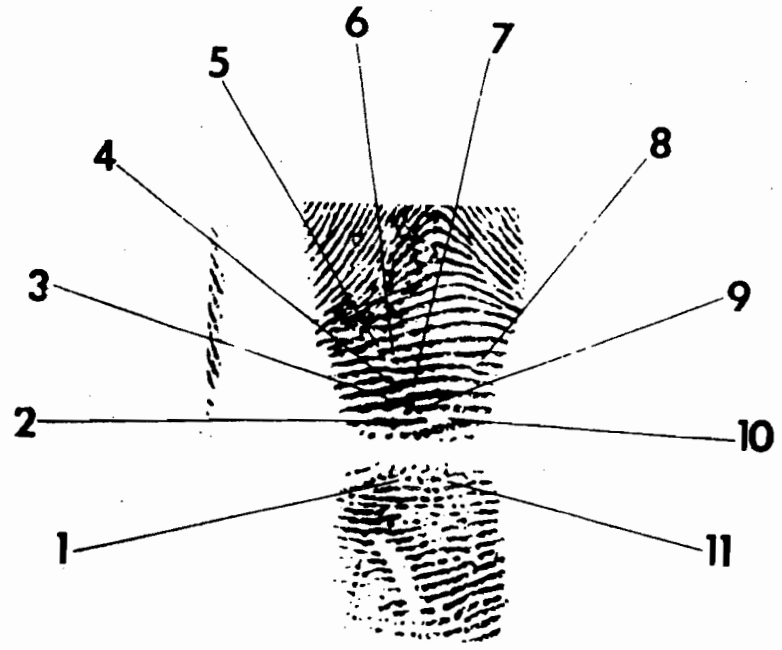
2. The delta may not be located in the middle of a ridge running between the typelines toward the core, but at the end nearest to the core.



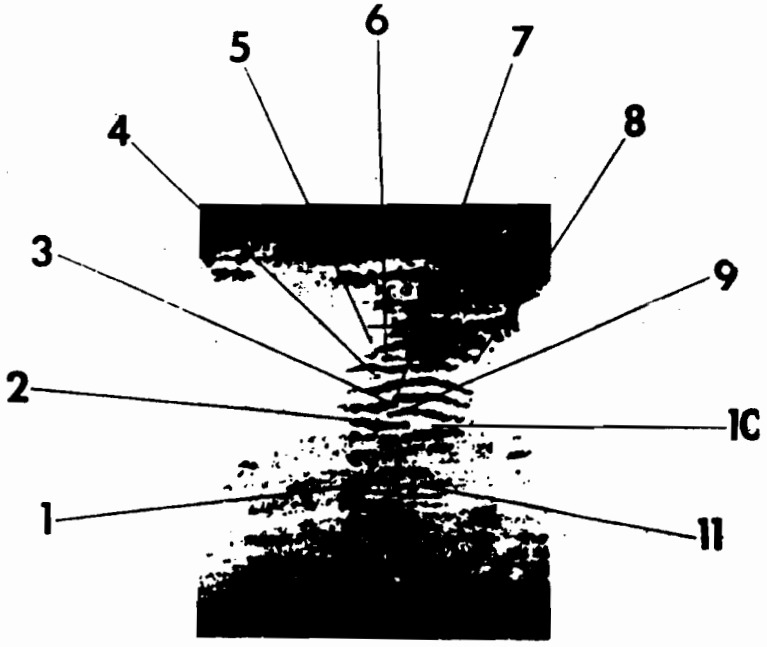
3. The delta may not be located at a bifurcation which does not open toward the core.

4. Where there <u>is a choice</u> between a bifurcation and another type of delta, the bifurcation is selected.

Points To Look For In Matching Latent Prints To Inked Prints



INKED



LATENT

HANDS-ON EXPERIMENTS

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Lesson No. 1

Aim: What are fingerprints and why are they important?

MOTIVATION

Talk about a penny.
Ask- How would a blind person tell the difference between a penny and a dime?

Elicit- That a dime has ridges on its edges and a penny is smooth. Also, a dime is a smaller coin.

DEVELOPMENT

Allow students time to work on experiment number 1. Explain the cross section drawing of the finger tip and how it makes a finger print.

Each fingerprint is unique and distinct even in the case of identical twins.

SUMMARY

Have students talk about the things that make a print form. Ridges and valleys are the items that cause the print and the spaces between the lines on the print.

Homework

1) What do hills and valleys have to do with a fingerprint?

2) What are ridges, and what part do they play in the fingerprint process.

1 Fingerprints

What are fingerprints and why are they important?

name _____ class _____

1 Try to picture this item in your mind.

There is a 1975 penny that is dull on the side without the year. There is a 1/4 inch scratch on Lincoln's face. Just to the left of Lincons beard is a red mark.

Note: There are millions of pennies around but only one will fit this picture

2 All items fingers included are different from each other. No two things are identical. There are small differences in even those things you think are identical

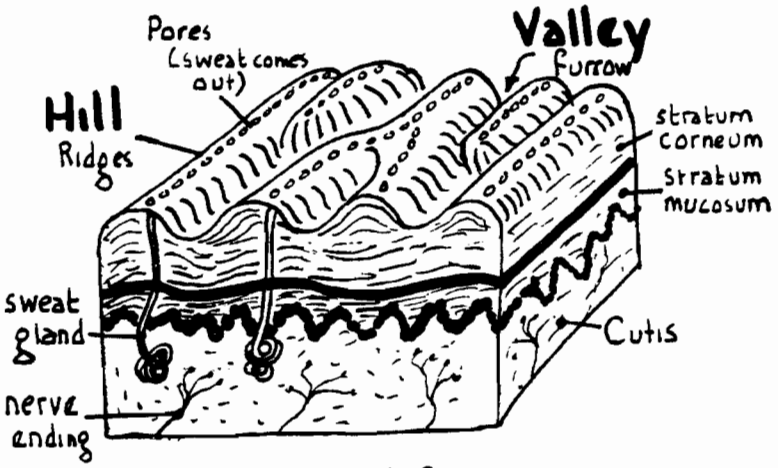
Place a **Penny** on a ink pad. Press down on the penny.

Remove the penny and put it here

Why do only certain parts come out?

Press on it. Now remove it.

3 Fingers have hills and valleys on the surface



cross section of finger tip

If you put **ink** on this finger why would only the hills or **ridges** get ink on them?

4 The pattern caused by the hills pressing on objects is called a **finger print**. Each print has a different pattern

Define-

Pattern-

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Lesson No. 2

Aim: How can we make a fingerprint?

MOTIVATION

Allow children to make potato prints as an art or science project. Ask why only certain parts of the potato print, and why others do not. Children will say that some parts stick up higher and get ink on them. These are the only parts that show up in a print.

DEVELOPMENT

These potato prints will help the children understand the fingerprint process. It enlarges the hills and valleys and makes the concept more concrete to the children.

Allow the children time to work on experiment 2. Have soap and paper towels ready for cleanup.

Practice with the children the process of rolling the finger so as to print the sides of the finger.You may wish to do this on an overhead projector so the whole class can follow along at the same time.

SUMMARY

Talk about ridges and valleys and their influence on fingerprints. Talk about why there is a need to roll the finger in making a good print. Talk about why there is a need to take fingerprints at a crime scene.

<u>Homework</u>

1) In what way is a pressed finger print different from a rolled finger print?

2) Why do your finger tips leave these prints?

3) Why do you have to be careful about how much ink you use?

2 Fingerprints

How can we make a fingerprint?

name _____ class _____

1 How can you make a print of your finger so that it looks like this one?

2

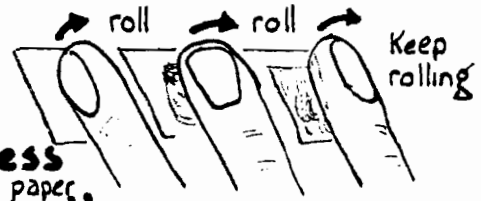
Press your finger on the Ink pad.

Now look at your finger

3 Press your Inked finger here

4 Why do you see lines in the print of your finger?

5 Press your finger on the Ink Pad

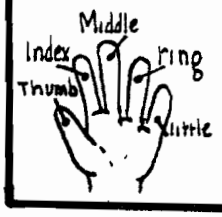


Press on paper and **roll** finger to the right

6 Lets Try Some

A	B
right thumb	right thumb

names



Which print came out better A or B?

How can you make a better print?

Lets Try Some More

right thumb	right index	right middle	right ring

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Lesson No. 3

Aim: What are the different types of fingerprints ?

MOTIVATION

Show slides or enlarged pictures of the eight main types of fingerprints. Explain why each type of print is different.

DEVELOPMENT

Allow the children time to look at the fingerprints and to see the differences. Ask how the prints are different, and how someone might tell them apart. If all peoples prints differ, and they fall into one of the eight types of prints, then we can use fingerprints to classify and tell people apart.

In this experiment students will cut out finger prints, from the sheet provided, to match the style of the prints on the experiment sheet and to glue that match onto the experiment. Allow time for students to do this experiment sheet.

SUMMARY

Talk about the major types of fingerprints and discuss the differences between them

Homework

1) Make a list the eight different types of fingerprint styles.

2) Pick Two Types - In what way are these types of prints different? In what ways are they similar?

3) Why might you need a magnifying glass to do this experiment?

fingerprints

What are the different types of fingerprints?

name _____ class _____

fingerprint classification

In this experiment you will find out about print types and you will classify some prints.

This is a pictorial listing (picture list) of the different types of patterns that show up in fingerprints. **Look** through the fingerprint sheet

match prints to the pictures on this page

cut out prints glue to this page next to print

Plain Arch

Loop

Tented Arch

central pocket loop

Loop

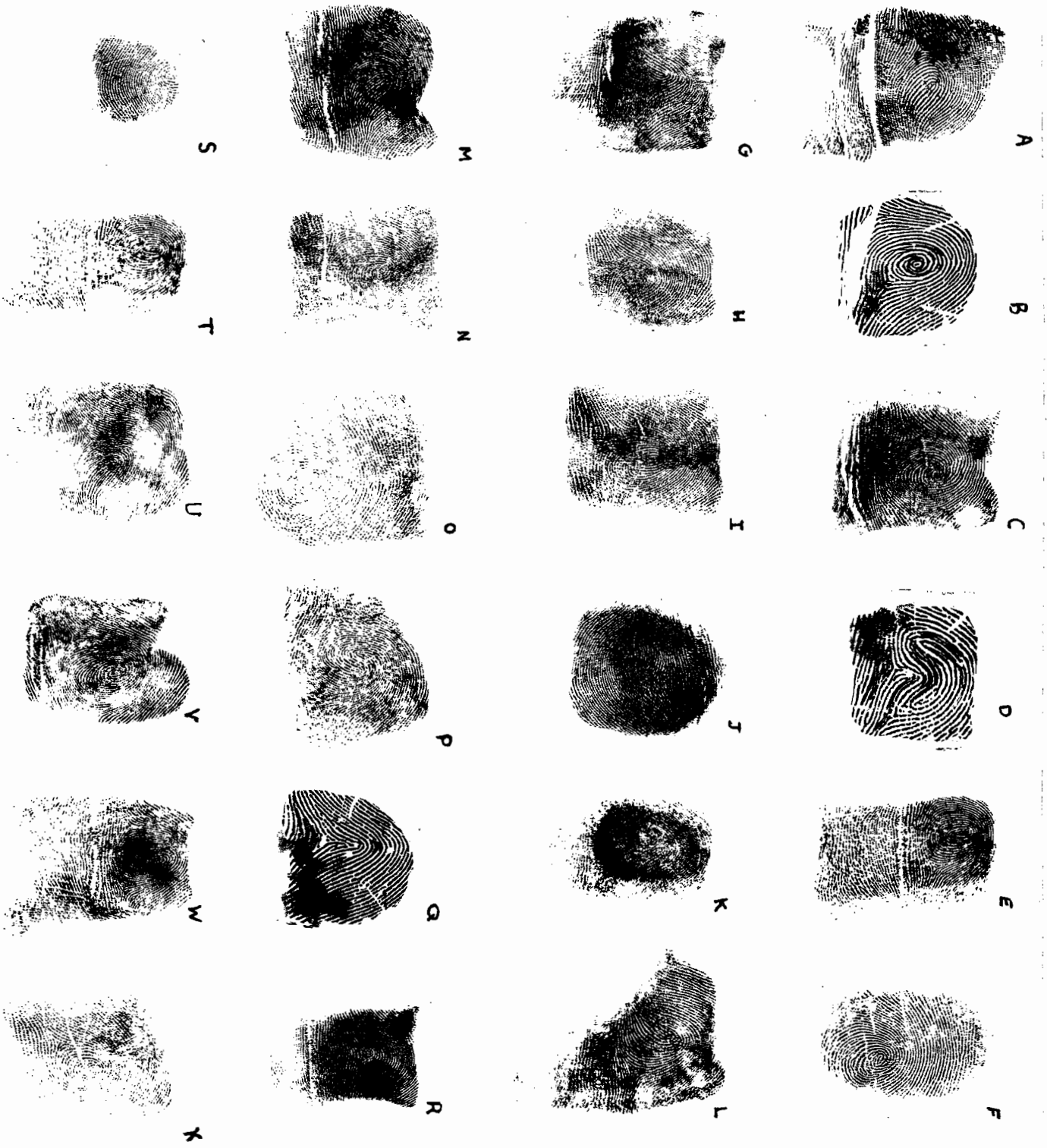
double loop

Plain Whorl

accidental

Fingerprints

fingerprint sheet



Match These Prints To The Types Of Patterns On Experiment 3

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Lesson No. 4

Aim: How can we match fingerprints?

MOTIVATION

A crime has been committed. Someone leaves behind a set of prints on a cashregister drawer. How can you identify the person by these prints.

Hold up an FBI most wanted picture. Why are fingerprints put on these charts in the postoffice?

DEVELOPMENT

In this experiment children are to make perfect fingerprint matches. Using their concepts of observation they are to match the print cards to the prints on the sheet. Prints on the card are given in different sizes and conditions to help the children with their identifications.

Give students time to do this experiment. Question students about their choices. Students are to give reasons for their chioces on the experiment sheet.

SUMMARY

Have the students list the observation strategies they used to match the fingerprints.

Homework

1) How can you use fingerprints to identify a person?

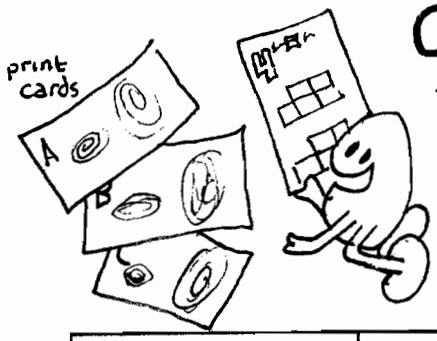
2) What part does observation skills play in this identification?

4

fingerprints

How can we match prints?

name _____ class _____



Compare print cards to this sheet

Try to **match** the cards to this sheet

Put the letter of your choice next to the print on this sheet. Give reasons for choices picked

card choice		reason for choice
		
		
		
		
		

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Lesson No. 5

Aim: How can you lift latent prints?

MOTIVATION

Someone has been hit on the head with a bottle. The lab people think that fingerprints were left behind on the bottle. The police think there is a way to catch the criminal if the prints could be lifted off the bottle.Ask how the children think this could be done.

DEVELOPMENT

During the summer students will probably notice that their skin gets oily. This happens at all times of the year. The body exudes oil to keep the skin moist and soft. This oil comes from within the body through pores. Oil, like ink, will sit on the ridges of a finger print and will leave a print of those ridges if a person touches something. The only thing is that the print will be clear because the oil is clear. If we can make the oil darker, then seeing the print would be easier. Powders can be put on the oils. the powder will stick to the oil making it easier to see.

Allow children time to do experiment 5.

If the childrens fingers are not oily enough, oil their finger tips with salad oil.Use a make-up brush for the powder. Copier toner works well as a finger print powder. Transparent tape is great to lift the prints for placement on cards.

SUMMARY

Have the students make a list for the procedure used to find and lift a latent fingerprint.

Homework

1) You always wash your hands. How is it still possible to leave latent prints?

2) Why do you have to put the powders on carefully?

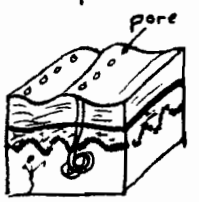
Fingerprints

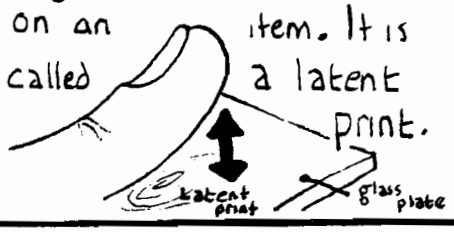
How can you lift latent prints?

name _____ class _____

1

When you press down on something, moisture, sweat and oils, from the pores in your skin, are left behind on that item making a pattern of the hills or ridges on your finger. This is left behind on an item. It is called a latent print.





2

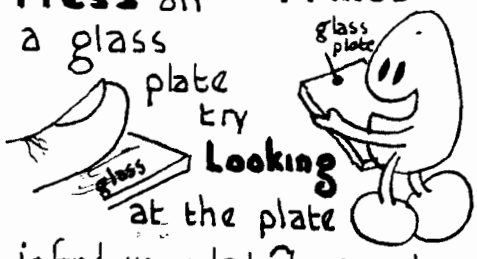
Since **Sweat** and **Oil** are clear, It is hard to see prints made from sweat and oil.

How did the **powder** help you see the print?

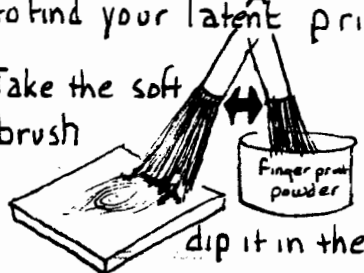
3

Dusting For Prints

Press on a glass plate try **Looking** at the plate to find your latent print.



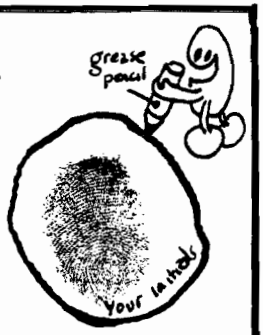
Take the soft brush and dip it in the colored powder. Brush it lightly over the print.



Why does the print appear suddenly?

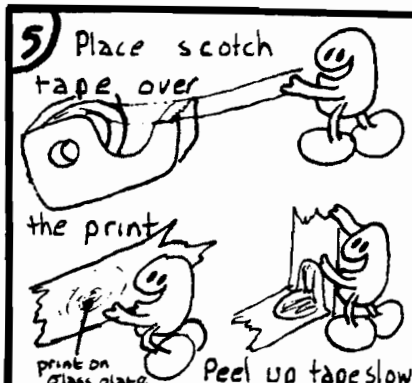
4

Circle the print on your glass plate with a grease pencil. Label the print with your initials.



5

Place scotch tape over the print.



Peel up tape slowly

Place tape here

6

Why did the tape just pick up the print?

This is how police pick up prints

SUPPORT MATERIALS

Fingerprint Card For Student Use And Practice

Name

photo

remarks (scars, marks, etc)

1. NYSIIS No. | 2. Name (Last, First, Middle) | Classification*

3. Street Address | 4. City/State Address

6. Nickname | 7. Alias and/or Maiden Name | 8. Sex | 9. Race | 10. Skin Tone | Key | Maj. | Prim. | Sec. | Sub.-Sec. | Final

11. Height Ft. In. | 12. Date of Birth (M/D/Y) | 12A. Age | 13. Place of Birth (City & State)

"B" Number | 17. FBI No. | 18. Social Security No. | 19. Date | Ref./Crossing*

M Number*

34. Signature of Person Fingerprinted

X

1. Right Thumb	2. Right Index	3. Right Middle	4. Right Ring	5. Right Little

6. Left Thumb	7. Left Index	8. Left Middle	9. Left Ring	10. Left Little

C/C* | Left Four Fingers Taken Simultaneously | Left Thumb | Right Thumb | Right Four Fingers Taken Simultaneously | Sum of Ridges*

*FOR USE BY IDENTIFICATION SECTION ONLY

F.B.I. Most Wanted Poster Including Fingerprints
(for use with experiment 4)

IDENTIFICATION ORDER No. 2154 June 22, 1933

UNITED STATES BUREAU OF INVESTIGATION
DEPARTMENT OF JUSTICE
WASHINGTON, D. C.

Issued by JOHN EDGAR HOOVER, Director

Fingerprint Classification
23 L 1 U 000 12
L 1 U 000

WANTED

CHARLES ARTHUR FLOYD, alias
FRANK MITCHELL, "PRETTY BOY" SMITH

DESCRIPTION

Age, 26 years
Height, 5 feet, 8½ inches
Weight, 155 pounds
Hair, dark
Eyes, gray
Complexion, sodium
Nationality, American
Scars and marks, 1 Vac. etc.
1 tattoo (Anchor in Rose)

Chas A. Floyd

CRIMINAL RECORD

As Charles Arthur Floyd, No. 22718, arrested police department, St. Louis, Missouri, September 16, 1925; charge, highway robbery.
As Charles Floyd, No. 29078, received S.P., Jefferson City, Missouri, December 18, 1925, from St. Louis; crime, robbery, first degree; sentence, 5 years.
As Charles A. Floyd, No. 16946, arrested police department, Kansas City, Missouri, March 9, 1929; charge, investigation.
As Charles Floyd, No. 9984, arrested police department, Kansas City, Kansas, May 6, 1929; charge, vagrancy and suspicion - highway robbery; released May 7, 1929.
As Charles Floyd, No. 687, arrested police department, Pueblo, Colorado, May 9, 1929; charge, vagrancy, fined $50 and sentenced to serve 60 days in jail.
As Frank Mitchell, No. 19949, arrested police department, Akron, Ohio, March 8, 1930; charge, investigation.
As Charles Arthur Floyd, No. 21458, arrested police department, Toledo, Ohio, May 20, 1930; charge, suspicion.
As Charles Arthur Floyd, sentenced November 24, 1930, to serve from 10 to 25 years in Ohio State Penitentiary (bank robbery, Sylvania, Ohio), escaped enroute to penitentiary.

Kansas City, Missouri, March 9, 1929, charge, investigation.

Charles Arthur Floyd is wanted in connection with the murder of Fitz Reed, Chief of Police of McAlester, Oklahoma, William J. Grooms and Frank E. Hermanson, police officers of Kansas City, Missouri, Raymond J. Caffrey, Special Agent of the United States Bureau of Investigation, and their prisoner, Frank Nash, at Kansas City, Missouri, on June 17, 1933.

Any information or criminal record to nearest office, United States Bureau of Investigation.

Any additional information

Law enforcement agencies kindly transmit

If apprehended, please notify Special Agent in Charge, United States Bureau of Investigation, 905 Federal Reserve Bank Building, Kansas City, Missouri, and the Director, United States Bureau of Investigation, Department of Justice, Washington, D. C.

Used courtesy Federal Bureau of Investigation

Fingerprints

match cards for experiment 4

Fingerprints

match cards for experiment 4

Fingerprint Match Cards For Use With Experiment 4

Fingerprints

match cards for experiment 4

Fingerprints

match cards for experiment 4

Fingerprints

match cards for experiment 4

9

Fingerprints

match cards for experiment 4

10

Fingerprint Match Cards For Use With Experiment 4

Fingerprints

match cards for experiment 4

15

Fingerprints

match cards for experiment 4

16

Fingerprints

match cards for experiment 4

Fingerprints

match cards for experiment 4

Fingerprints

match cards for experiment 4

1

Fingerprints

match cards for experiment 4

3

Fingerprint Match Cards For Use With Experiment 4

Fingerprints

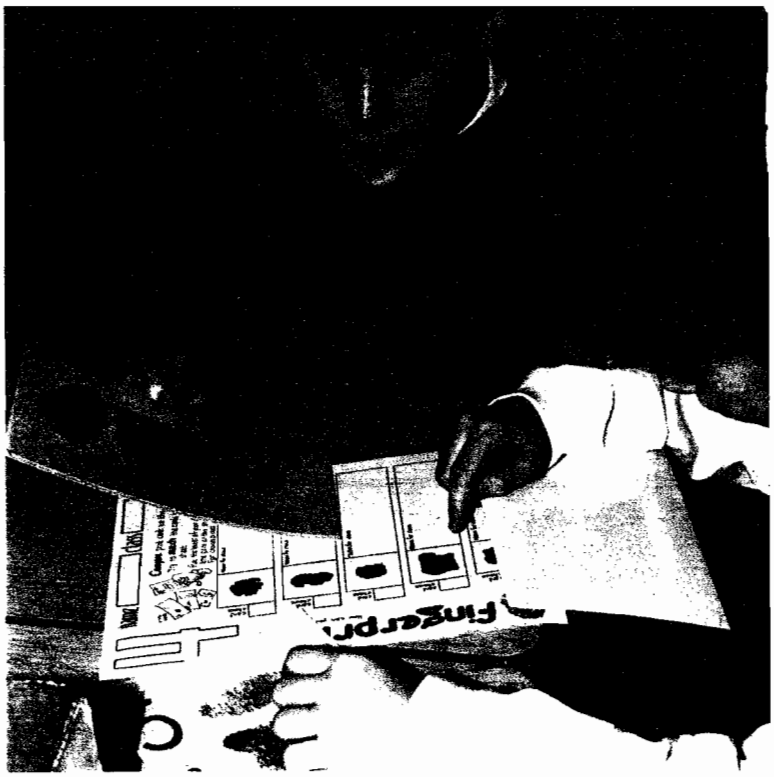
match cards for experiment 4

Fingerprints

match cards for experiment 4

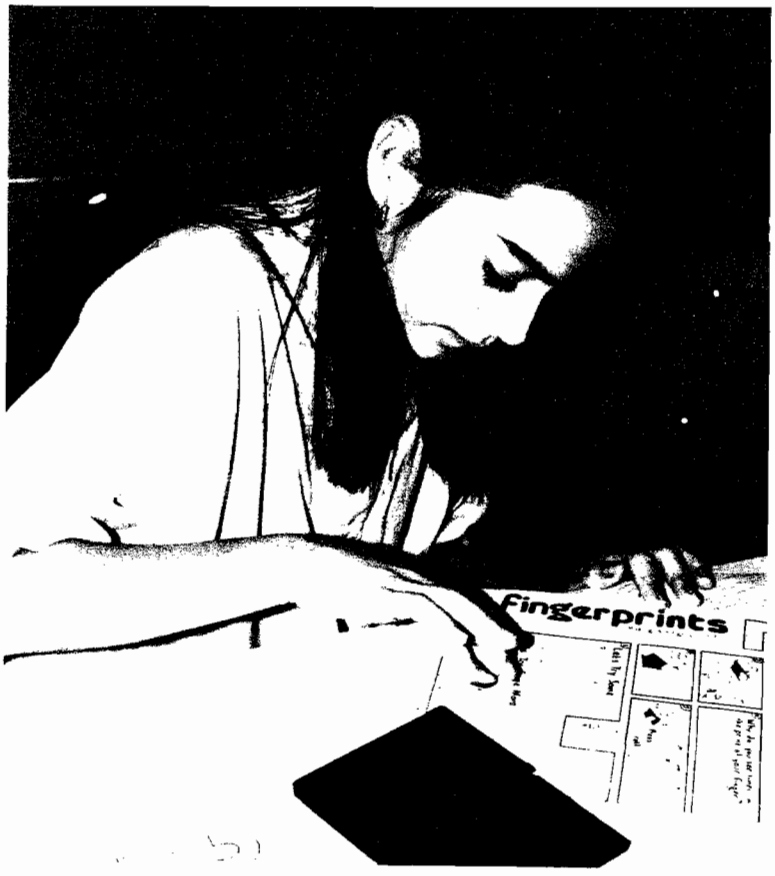
PHOTOGRAPHS

Examining fingerprints and matching them to the print cards

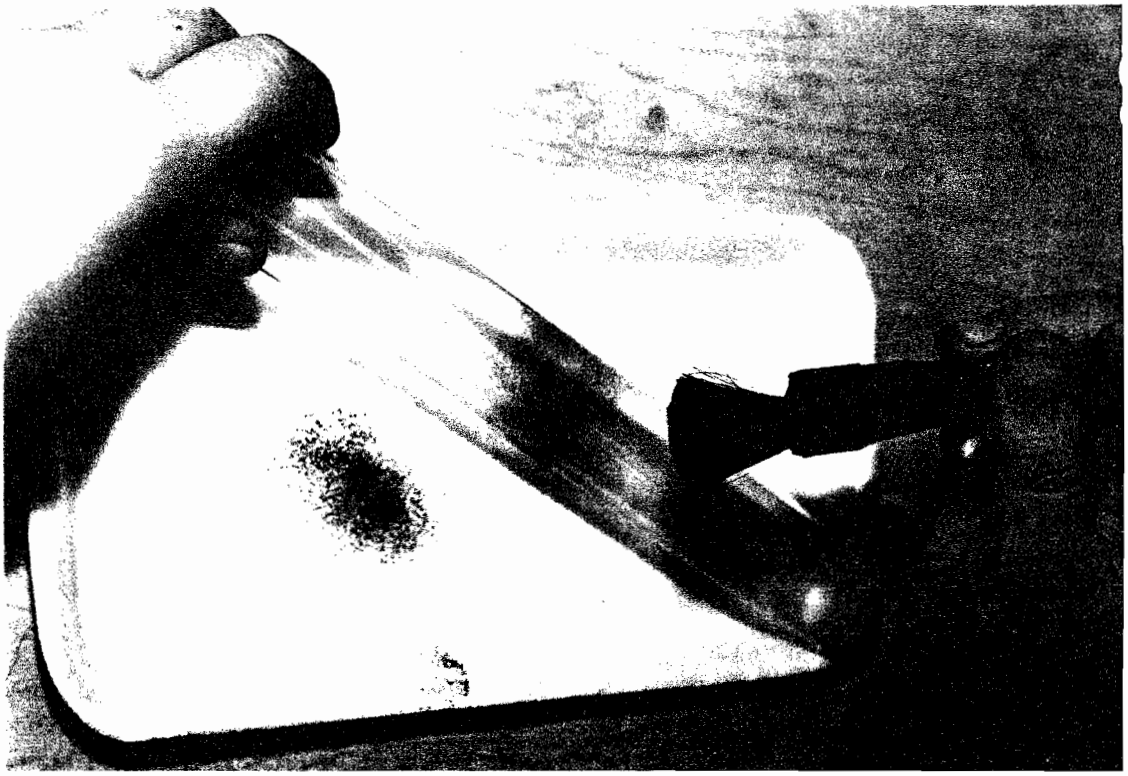


Matching the prints to the cards on experiment 4

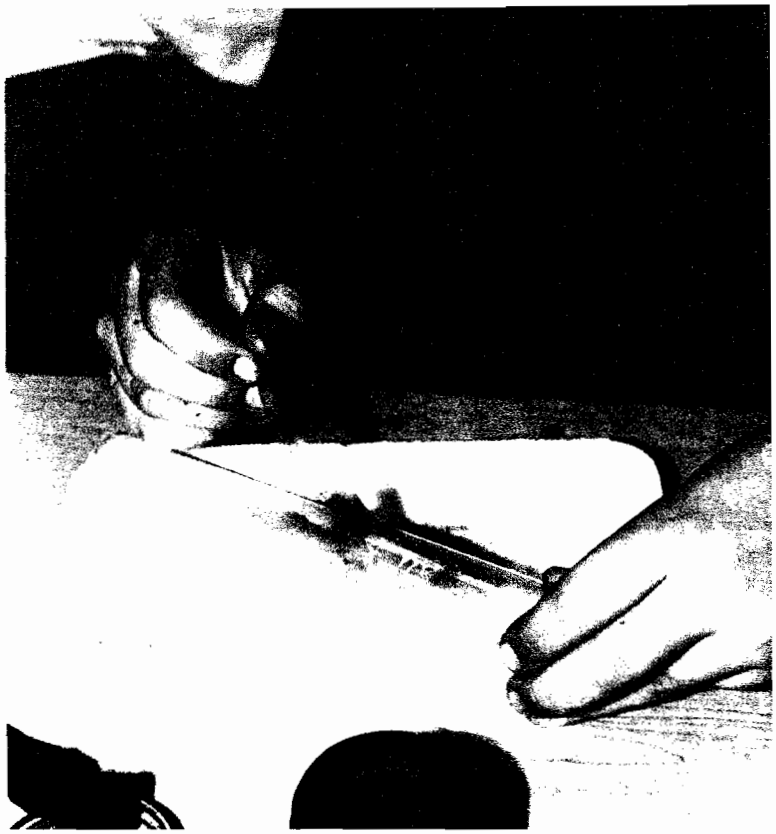
Rolling the finger to make prints on experiment 2



Making inked fingerprints

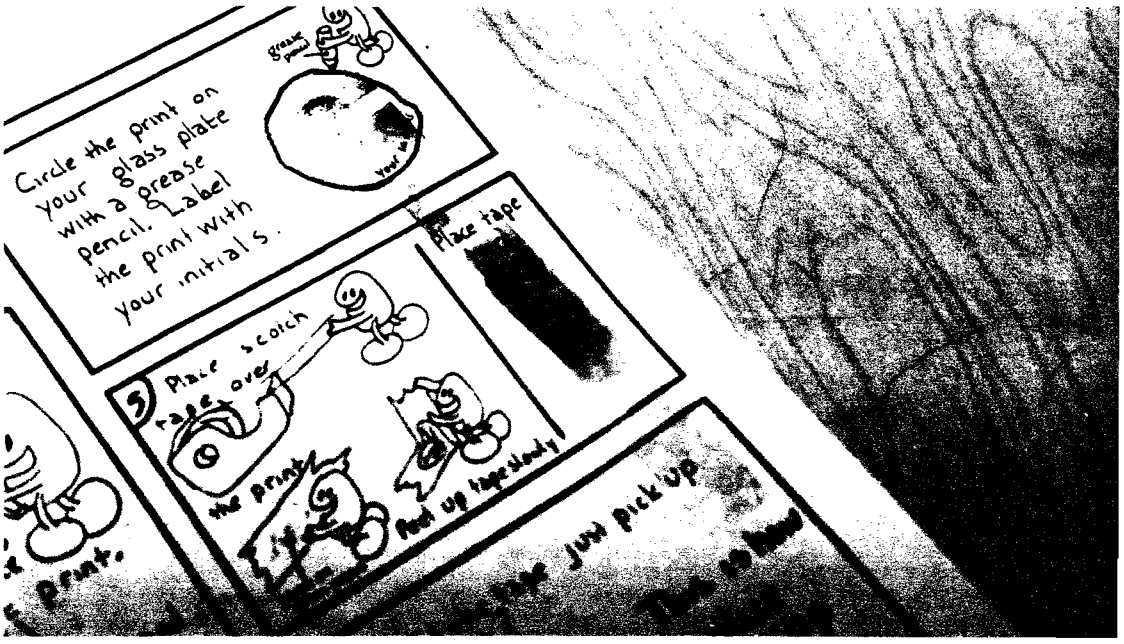


Dusting with black powder to find latent prints

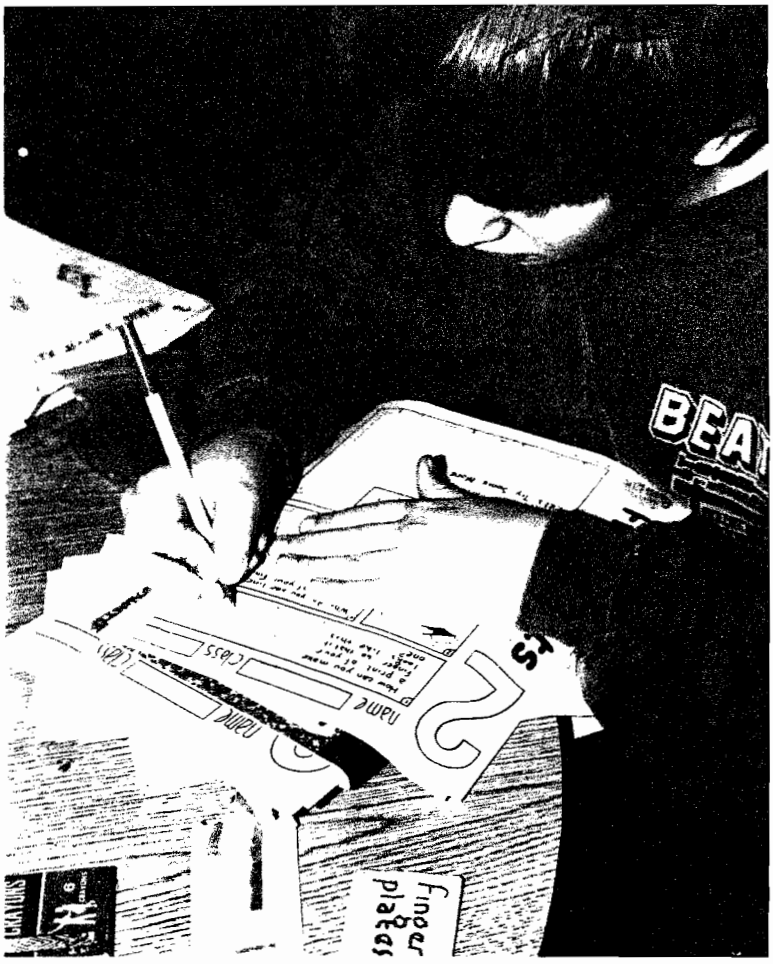


Lifting the latent print with clear tape

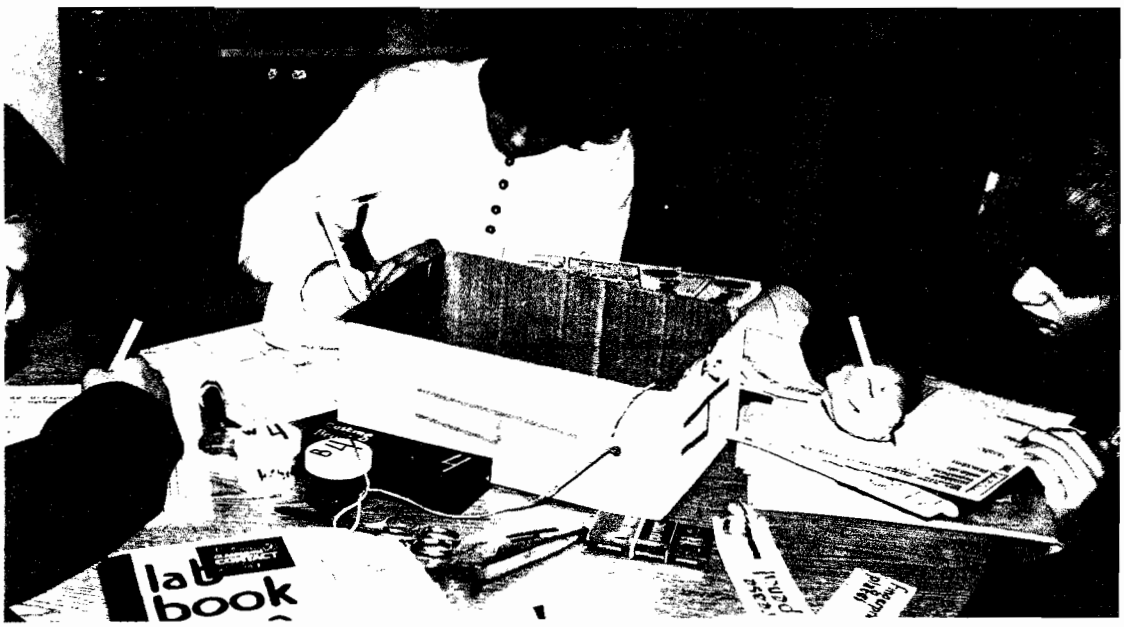
Lifting the latent print



The print taped onto experiment 5



Filling in the answers to the questions



Answering questions on the experiment worksheets

STUDENT COMMENTS ON FINGERPRINT UNIT

David Pirozzi

Finger Prints 

What I liked most about Fingerprints was experiment 5. In experiment 5 we made latent prints. We put our finger on glass. Then we put black powder on the print. We took tape and put it on the powders. That is a latent print.

Experiment 4 was the hardest. We had to match prints with cards. Then we had to give reasons for our choices.

The easiest experiment was experiment 1. The answers were practically on the page. We found out only ridges and hills are what come out on the ink.

In experiment 2 we made our own fingerprints, the way the police do.

Ryan Mallon

Finger prints

The most fun about the fingerprints was matching them. We learned about the textures or how to tell fingerprints apart.

This is my left thumb fingerprint. My fingerprint is kind of like the loop or whirl on fingerprints sheet #3.

The fingerprint experiments fun because it was kind of challenging. It was kind of like a matching game. ing experiment 3 you got a cut out sheet that you had to match with the ones on the experiment sheet, and on experiment 4 there were 16 cards that you had to match with five others on the experiment sheets.

On the back of every experiment we had to attatch a paper that asked you what the problem was, what your hypothesis was, and so on. If you could, there was a space to make a graph.

I had fun doing these experiments and hope that we do other things like this.

Justin Fuchs

Finger Prints

On the first experiment we learned about hills, ridges, and valleys on your finger. You can only see the hills and ridges, like this. →

On the second experiment we put our fingerprints on paper and examined them.

On experiment 3 we cut out an exact duplecate of the original. We had fun cuting and gluing prints.

On experiment 4 we matched prints on the paper with a card.

The fifth experiment was the most fun. We put prints on slides and then on paper.

I wish there were more experiments.