No Two The Same

Topic

Identification of individual fingerprints

Introduction

Patterns made by the ridgelines forming fingerprints are very complex. In addition to the simple patterns – loop, arch, whorl – used in the classifications in Experiments 3.02 and 3.03, other features known as Galton characteristics can be identified in fingerprints. These features are formed by the branching, appearance, and disappearance of ridgelines; they have been given names describing their appearance as shown in Table 1 below. There is also a characteristic called the core – the center of a loop, whorl, or arch.

Table 1. *Different Galton characteristics*

Characteristic	Illustration	Characteristic	Illustration
Bridge		Ending ridge	
Delta		Fork	
Dot		Short ridge	
Double bifurcation		Spur or branch	
Enclosure		Trifurcation	

Identification of a certain number of these characteristics on a single fingerprint found at a crime scene allows the investigator to pronounce that print unique. If a copy of that print is on file, the police can identify the person who made the print. If a suspect is fingerprinted, his guilt can be confirmed if the characteristics of one of his fingerprints match those of a fingerprint found at the crime scene. In the first part of this experiment, you will make a print of your right index finger and identify characteristics in the patterns of the ridgelines on the fingerprint. In the second part of the experiment, you will identify your fingerprint in a collection of prints made by your fellow students.

Time required

Part A: 40 minutes
Part B: 1 hour

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Materials

No. 2 pencil
pencil sharpener
clear tape 25 mm wide
scissors
30 cm ruler
magnifying glass
sheet of white unlined ($8\frac{1}{2} \times 11$) paper
index card
table

Safety note

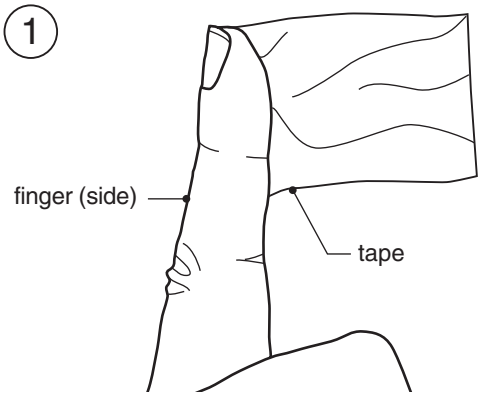
Please read the general safety precautions.

Procedure

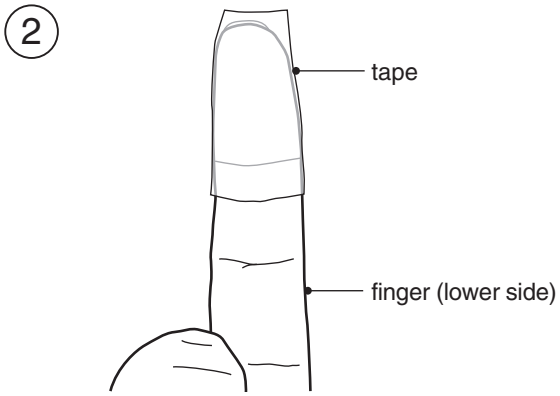
This experiment is a whole class activity.

Part A: Analyzing your own fingerprint

1. Cut a piece of clear tape 35 mm long.
2. Draw a square (4×4 cm) on the index card. Rub the pencil all over the square so that it is colored black and shiny all over.
3. Rub the skin between the top joint and the tip of your right index finger (the side opposite the nail) on the black square until the surface of your finger is covered with graphite from the pencil.
4. Place the piece of tape sticky side up on a table and then put one edge of your right index finger on the tape (see diagram 1 below).
5. Carefully press down your finger onto the tape. Starting from one side of your finger, roll it around on the tape until the tape covers the area of your finger covered with graphite (see diagram 2 below).
6. Carefully remove the tape from your finger and stick the tape in the data table on the next page.
7. Use the magnifying glass to look at the pattern of ridgelines in your fingerprint. Identify as many characteristics of the ridgelines as you can. Label them clearly in the area around the print in the data table, using lines to link the characteristic identified to the label.



Placing your index finger on the tape



Tape covering the area of the finger with graphite

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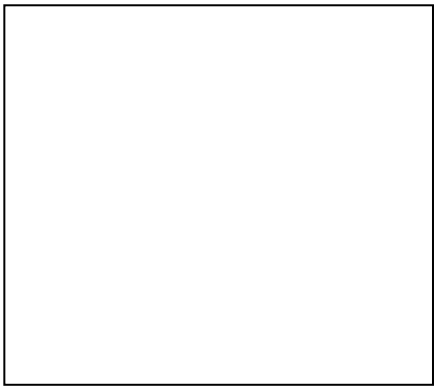
DATA TABLE



Part B: Identifying your own fingerprint

1. Make a copy of the print from your right index finger by following steps 1 to 6 above. Stick this copy to the index card. Label the back of the card with your name.
2. Collect the index cards from the other members of the class.
3. Using the characteristics of the print of your right index finger you recorded in the data table, use a magnifying glass to identify your index card from the class collection. *Do not look at the names on the backs of the cards.*

Analysis

Part A: Analyzing your own fingerprint

1. How many characteristics did you identify?

Part B: Identifying your own fingerprint

1. How easy was it to identify your own fingerprint from the collection of index cards?

Want to know more?

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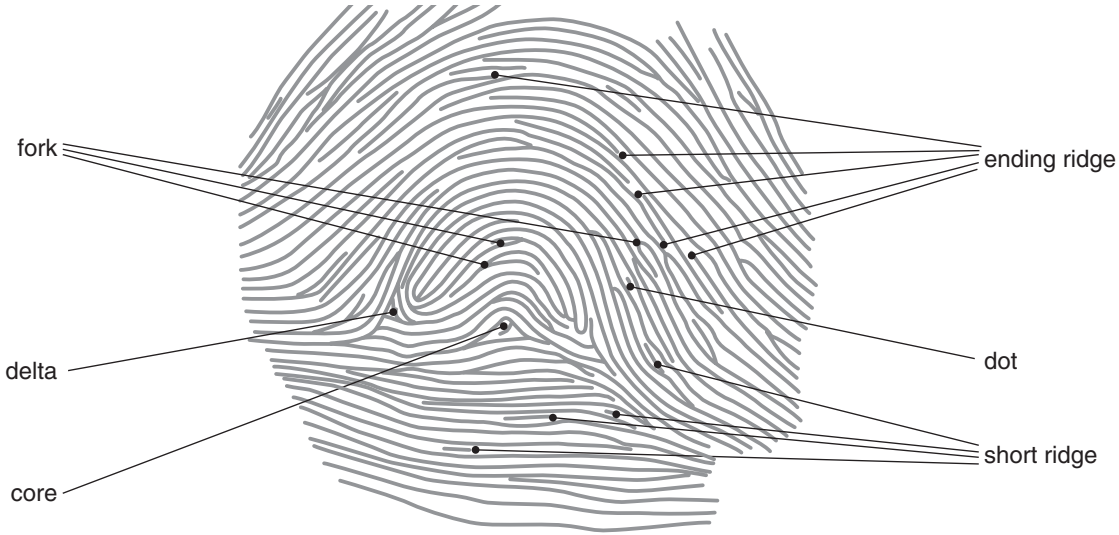
Part A: Analyzing your own fingerprint



Our fingerprint

1. Our fingerprint looked like the one shown in the diagram above. Criminalogists need between 8 and 10 identified characteristics to make an identification. If you have made less than this, try to identify some more.

Part B: Identifying your own fingerprint

1. Matching the characteristics of a group of fingerprints can be time-consuming and awkward.

Computer technology has led to a vast improvement in the storage and retrieval of fingerprints. Fingerprints are taken on a small electronic pad and stored electronically, allowing rapid comparison using a system called Automatic Fingerprint Identification System (AFIS).

Special Safety Note To Experimenters

Each experiment includes any special safety precautions that are relevant to that particular project. These do not include all of the basic safety precautions that are necessary whenever you are working on a scientific experiment. For this reason, it is absolutely essential that you read, copy, and remain mindful of the General Safety Precautions that follow this note. Experimental science can be dangerous, and good laboratory procedure always includes carefully following basic safety rules. Things can happen very quickly while you are performing an experiment. Things can spill, break, even catch fire. There will be no time after the fact to protect yourself. Be prepared for unexpected dangers by following basic safety guidelines the entire time you are performing the experiment, whether or not something seems dangerous to you at a given moment.

We have been quite sparing in prescribing safety precautions for the individual experiments. We made this choice for one reason: We want you to take very seriously every safety precaution that is printed in this book. If you see it written here, you can be sure that it is here because it is absolutely critical to your safety.

One further note: The book assumes that you will read the safety precautions that follow, as well as those in the box within each experiment you are preparing to perform, and that you will remember them. Except in rare instances, the general precautions listed below will not be repeated in the procedure itself. It is up to you to use your good judgment and pay attention when performing potentially dangerous parts of the procedure. Just because the book does not say **BE CAREFUL WITH HOT LIQUIDS or DON'T CUT YOURSELF WITH THE KNIFE** does not mean that you should be careless when boiling water or cutting a section of a stem for microscope work. It does mean that when you see a special note to be careful, it is extremely important that you pay attention to it. If you ever have a question about whether a procedure or material is dangerous, wait to perform it until you find out from a qualified adult that it is safe.

GENERAL SAFETY PRECAUTIONS

Accidents caused by carelessness, haste, insufficient knowledge, or taking unnecessary risks can be avoided by practicing safety procedures and being alert while conducting experiments. Be sure to check the individual experiments in this book for additional safety regulations and adult supervision requirements. If you will be working in a lab, do not work alone.

PREPARING:

—Clear all surfaces before beginning experiments
—Read the instructions before you start
—Know the hazards of the experiments and anticipate dangers

PROTECTING YOURSELF:

—Follow the directions step-by-step; only do one experiment at a time
—Locate exits, fire blanket and extinguisher, gas and electricity shut-offs, eyewash, and first-aid kit
—Make sure there is adequate ventilation
—Act sensibly at all times
—Wear an apron and safety glasses
—Do not wear open shoes, loose clothing, or loose hair
—Keep floor and workspace neat, clean, and dry
—Clean up spills immediately, being careful to follow the recommended procedure for dealing with the spilt substance
—Never eat, drink, or smoke in the laboratory or workspace
—Do not eat or drink any substances tested unless expressly permitted to do so by a knowledgeable adult

USING EQUIPMENT WITH CARE:

—Set up apparatus far from the edge of the desk
—Use knives and other sharp or pointed instruments with caution
—Pull plugs, not cords, when removing electrical plugs

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—Don't use your mouth to pipette liquids; use a suction bulb
—Check glassware is clean and dry before use
—Check glassware for scratches, cracks, and sharp edges
—Report broken glassware immediately so that it can be cleaned up by a responsible person
—Do not use reflected sunlight to illuminate your microscope
—Use only low voltage and current materials such as lantern batteries
—Be careful when using stepstools, chairs, and ladders

USING CHEMICALS AND BIOLOGICAL MATERIALS:
—Never taste or inhale chemicals
—Label all bottles and apparatus containing chemicals
—Read labels carefully
—Avoid chemical contact with skin and eyes (wear safety glasses, lab apron, and gloves)
—Do not touch chemical solutions
—Wash hands before and after using solutions
—Wipe up spills thoroughly
—Use sterile procedures when handling even common and harmless microorganisms
—Avoid contact with human blood
—Treat all living organisms with appropriate respect

HEATING SUBSTANCES:
—Wear safety glasses, apron, and gloves when boiling water
—Keep your face away from test tubes and beakers
—Use test tubes, beakers, and other glassware made of Pyrex™ or borosilicate glass
—Use alcohol-filled thermometers (do not used mercury-filled thermometers)
—Never leave apparatus unattended
—Use safety tongs and heat-resistant mittens
—If your laboratory does not have heat-proof workbenches, put your Bunsen burner on a heat-proof mat before lighting it
—Take care when lighting your Bunsen burner; use a Bunsen burner lighter in preference to wooden matches
—Turn off hot plates, Bunsen burners, and gas when you are done
—Keep flammable substances away from heat
—Keep sheets of paper and other flammable objects away from your Bunsen burner
—Have a fire extinguisher on hand

FIELDWORK:
—Be aware of environmental dangers (e.g., do not carry out fieldwork near dangerous roads, cliffs, or water)
—Remember that strong sunlight can be dangerous – pack sunscreen and a good supply of drinking water if you will be outside all day
—Never carry out fieldwork in areas where you cannot find your way to safety easily and quickly and never wander off on your own in search of new areas to study

FINISHING UP:
—Clean your work area and glassware (follow any instructions given by a supervising adult)
—Be careful not to return chemicals or contaminated reagents to the wrong containers
—Don't dispose of materials in the sink unless instructed to do so
—Wash your hands
—Clean up all residues and put in proper containers for disposal
—Dispose of all chemicals according to all local, state, and federal laws
—Dispose of all microbiological cultures by treatment with an appropriate disinfectant

BE SAFETY CONSCIOUS AT ALL TIMES

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