“Every gun that is made, every warship launched, every rocket fired signifies, in the final sense, a theft from those who hunger and are not fed, those who are cold and are not clothed.”

—Dwight D. Eisenhower (1890–1969), U.S. general and 34th president
Firearms, Toolmarks, and Impressions

Objectives

You will learn:

How class and individual evidence can answer different questions.

How impression analysis is used in forensic science.

The impact of firearms in the United States.

The importance of microscopic examination in forensic science.
Objectives, *continued*

*You will be able to:*

Distinguish types of firearms.

Measure individual features of bullets and cartridge cases.

Describe how a handgun works.

Use color tests to find gunshot residue.

Describe the procedure for estimating the distance between muzzle blast and target.

Make casts of different types of impressions.
Activities

Characterization of Bullets and Cartridge Casings

The Greiss Test

The Sodium Rhodizonate Test for Lead Residue

The Corpse in the Closet

Matching Toolmarks

Casting Shoeprints

Relating Shoe Size to Height

Comparing Bite Marks

The Case of the Bitten Bonbon
Firearms

Forensic analysis is vital to solve a crime that uses a gun.

The vast majority of U.S. homicides involve guns. And they are more powerful than ever.

_Lansing State Journal, July 2007_

In 2004, there were 12,000 homicides in the United States.
Types of Firearms

Handguns (pistols)
- Revolver
- Semiautomatic

Rifles

Shotguns

Air or BB guns
Ammunition

Components:

- Cartridge case
- Primer
- Propellant
- Projectile
Bullets

Made of lead, sometimes jacketed with brass, copper, or steel

Bullet size—diameter (caliber or gauge)

Shapes
Rifling

The grooved spirals inside the barrel of a gun that produce lands and grooves on a bullet.

Lands and grooves are class characteristics.
Striae

Scratches on a fired bullet, like a barcode, that can serve as individual evidence, matching bullets or bullet to a firearm.
Cartridge Case

Usually brass or nickel-clad brass

Head stamps

Rimfire and centerfire cartridges

Class evidence
Cartridge Case, continued

Individual characteristics

- Firing pin marks
- Extractor marks
- Breech marks
Features of a Semiautomatic Handgun
Firearms Evidence

**Individual:**
- Striae
- Firing pin marks
- Breech marks
- Extractor marks
- Ejector marks
- Chamber marks

**Class:**
- Bullet type
- Bullet caliber
- Bullet weight
- Lands and grooves
- Rifling
- Cartridge case
- Head stamp
Gunshot Residue (GSR)

When a weapon is fired:

Primer and propellant particles blow back toward the shooter. Combustion products (mostly NO$_2^-$), unburned propellant, and particles of lead follow the bullet, spreading out with distance.
Distance to Target

The Greiss test converts nitrites to an orange-red color. Sodium rhodizonate reacts with traces of lead to make purple spots.
Toolmarks

Tools often used in burglaries may leave a mark.

Class characteristics: type, size, shape

Individual characteristics: features from wear and damage
Lab Activity: Matching Toolmarks

Photography and casting are important to match tool with mark.
Impressions

Shoeprints

Class characteristics—
manufacturer, type, model, size

Individual characteristics—
wear patterns, nicks, marks,
occlusions (like pebbles or sticks)
Impressions, *continued*

**Shoeprints**

Captured by oblique-angle photography or chemical enhancement; also by casting in soil, or lifting.
Impressions, *continued*

Treated much the same as shoeprints

Tire Treads

Class characteristics involve design, size, type, and model.

Wear and damage cause defects that can lead to individualization.
Impressions, continued

Tire Treads

TreadMate is a database containing data on more than 5,000 vehicle tires and tread patterns.
Impressions, continued

Bite Marks
Result from assault or sexual attack, common in domestic violence

Individual evidence, if enough impressions

Bite marks were the prime evidence in the conviction of serial killer Ted Bundy.
Impressions, *continued*

Serial Numbers

Restoration of serial numbers

Items of value may have ID numbers stamped into them. Grinding is usually used to obliterate identification numbers. To restore ID numbers on metal, an acid etching solution is employed.

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\text{HCl–CuCl}_2
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Forensics: Debate

Both Sides of the Issue; Gun Control Laws

Should gun sales and ownership be subject to federal regulation?

Introduction

Pro/con sides

Assertion

Evidence

Personal opinion