

Dissecting a Camera



JEFF MCADAMS, PHOTOGRAPHER, COURTESY OF CAROLINA BIOLOGICAL SUPPLY COMPANY

How is a photograph made and what role does the camera play in the process?

INTRODUCTION

Do you own a camera? What type of camera is it? Do you know how it works? What is inside this optical device? Regardless of type or manufacturer, all cameras have certain features in common. In this lesson, you will investigate how a camera works by dissecting a disposable camera.

OBJECTIVES FOR THIS LESSON

Identify the components of a camera.

Identify the function of each camera component.

Discuss the process of taking a photograph.

Getting Started

- 1.** One member of your group should collect the plastic box of materials. Divide the materials in the plastic box between the pairs in your group.
- 2.** Work with your partner to examine the outside of the camera. Draw a sketch in your science notebook of the camera and label all the components you can identify.
- 3.** Discuss with your partner what you think each component does.
- 4.** Your teacher will lead a class discussion about these camera components and their possible functions.

MATERIALS FOR LESSON 23

For you

- 1 pair of safety goggles

For you and your lab partner

- 1 small screwdriver
- 1 nonflash disposable camera
- 1 white screen
- 1 sheet of white paper

SAFETY TIPS

Make sure the camera does not have a flash. If it does, return it immediately to your teacher. There is a danger of electric shock from dismantling cameras with flashes, unless the battery is removed and the flash is discharged.

Put on your safety goggles before you dissect the camera—plastic parts may fly out and damage your eyes.

Use caution when handling the screwdriver. When using the screwdriver to exert pressure, rotate the screwdriver rather than pushing it.

Always point the screwdriver away from your body and away from other people.

Inquiry 23.1

Dissecting a Disposable Camera

PROCEDURE

- 1.** Use the questions below to help you make observations. Discuss the questions and your observations with other students. As you make observations, record them in your science notebook.
- 2.** The exact construction of your camera will depend on its make and model. However, most disposable cameras have the same basic construction. Open the small door on the end of the camera. Inside is a chamber that sits below the film winder. This film compartment used to contain the exposed film, but the film has been removed from the camera.

Which way did the winder need to be turned to advance the film?

- 3.** Examine the access to the film compartment.

Why is the camera constructed so that light is excluded from the film compartment?

- 4.** Try to avoid breaking the parts of the camera as you take it apart—you will be asked to try to reassemble the camera after you have taken it apart. Place parts you remove on the sheet of white paper (see Figure 23.1). Be careful not to lose any of them—you'll need them later. Carefully remove the front of the camera and then the back of the camera. Try not to crack the casing or damage the interior of the camera. Watch out for parts that may fall out of the camera.



questions as a guide to help you make observations as you do so.) Place the parts you remove onto the white paper. Make notes in your notebook as you go.

What color is the inside of the camera? Why?

5. Try to trace the path the film takes as it runs through the camera.

What is the function of the various compartments, gears, and wheels?

6. The film that was in the camera had sprocket holes along its edge. (See the illustration in the reader “Recording a Picture.”)

Would advancing the film move any other components within the camera? If so, what is the purpose of this mechanism?

7. Locate the shutter. Find out how to prime

the shutter. After priming the shutter, shade the back of the camera with your hand and depress the shutter release.

What do you need to do to make the shutter work?

What did you observe when you pressed the shutter release?

What did you notice about the speed at which the shutter opens and closes? Why is such a speed necessary?

Can you vary the speed of the shutter on this camera? Why would you want to?

Figure 23.1 Carefully take the camera apart. (Use the

- 8.** Examine and then remove the viewfinder.

What effect does the viewfinder have on light?

Does the viewfinder contain any lenses? If so, how many and what types?

Why are these types of lenses used in the viewfinder?

- 9.** Remove the winding mechanism. Try to reassemble it and determine the function of each of its components. Try to get it to work again.

- 10.** Use the winding mechanism to open and close the shutter.

What makes the shutter close so quickly?

Can you get the shutter to stay open? If you can, try looking from the inside of the camera out through the lens.

Can you focus on the objects at which the camera is pointing?

- 11.** Carefully pull off the lens. Try not to damage it. What type of lens is it? Look through the lens first at the print on this page and then at distant objects. Try to get the lens to form an image on the white screen.

Can you determine the lens's approximate focal length?

Does this camera have adjustable focusing?

- 12.** Reexamine the shutter mechanism and look at the hole behind the lens. This is called the aperture. Think back to the pinhole camera you constructed.

Why do you think such a small aperture was chosen for this camera?

- 13.** Here is the ultimate challenge! Reassemble the camera. Can you get it working again?

REFLECTING ON WHAT YOU'VE DONE

- 1.** Your teacher will lead a discussion on the results of your dissection. Be prepared to contribute your observations and ideas.
- 2.** In your notebook, draw a cross-section (cut through the center) of the camera from front to back. Label each component and write a short description of its function directly under its label.

Recording a Picture

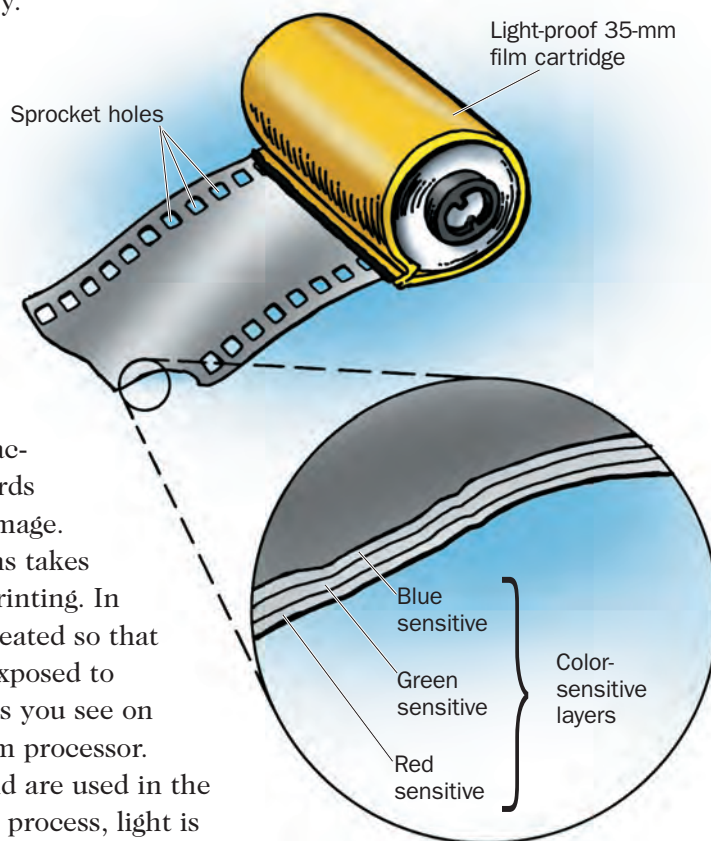
There are two main ways to record pictures—using film or capturing images electronically.

How Film Works

Photographic film can be black and white or color. Black-and-white film records different levels of light intensity. Color film records the intensity of different colors of light. Color film is the most widely used type of film. A color film is made of three layers.

One layer is sensitive to blue light, another to green light, and a third layer to red light. When the film is exposed for a fraction of second, each layer detects and records the amount of each of these colors in the image.

Processing color film to make photographs takes place in two main stages: developing and printing. In the first stage, the film is developed. It is treated so that dyes attach to the film where it has been exposed to light. These dyes produce the strange colors you see on the pieces of film you get back from the film processor. These pieces of film are called negatives and are used in the printing process. In the second stage of the process, light is shone through these negatives and the image recorded on them



Color film has three layers, each of which is sensitive to a different color of light.



Color film processing is a complex process that occurs in this machine.

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PHIL DEGINGER/COLORPIC, INC.

To make color prints, a negative image (left) is made in film. The negative image is used to make a positive image (right) on photographic paper. How do you think slide or movie film differs from the film used to make color prints?

is projected onto special light-sensitive paper. The image on the paper is usually larger than the negative and is therefore referred to as an enlargement. Like film, the light-sensitive paper has three color layers and is developed in similar dyes. The negative colors are turned back into positive ones on the paper—the same as the original image that was photographed.

Digital Photography

Today, many people use digital cameras to capture images. Digital cameras do not contain film. In place of the film, most digital cameras contain a device called a charge-coupled device (CCD). The CCDs in cameras are arrays, usually of millions of tiny light-sensitive diodes. When light strikes these diodes, electrical energy is produced. The amount of light striking each diode determines the amount of electrical energy produced. (The more light that strikes the diodes, the more energy is produced.) A microscopic red, green, or blue filter over different diodes spread throughout the array determines which color the diode is sensitive to. When a picture is taken, the electrical signals from the CCD are converted into digital signals. These are sent to a microprocessor that uses software to convert the signals into a picture. The picture can be shown on a screen, stored in digital form on a memory chip or disk, or printed onto paper. □



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Digital cameras are becoming increasingly popular. Will they completely replace cameras that use film?

MAKING PICTURES WITH LIGHT

A Timeline for Some Important Events in the Development of Photography

Photography started about 200 years ago. It developed very rapidly. Most of the major advances in the development of photographic techniques took place in the first 100 years. Use this timeline to discover when different developments took place. Think about the impact these have had on your life and the lives of your ancestors.



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William Fox Talbot develops the first system using photographic negatives.

1816 Joseph Niepces uses a photosensitive chemical to record an image on light-sensitive paper.

1835 The first photographic negative is made by William Fox Talbot.

1839 The first photographic camera is marketed. It is bulky and takes daguerreotypes.

1851 The first electric flash is used in photography.

1879 George Eastman invents a mass-production process for photographic plates on glass.

1888 The first camera preloaded with film is marketed. The camera is shipped backed to its manufacturer, Kodak, for film processing.

1894 The Lumier brothers, working in France, invent the Cinematographique—a combination movie camera and projector.

1800

1822 One of the earliest surviving photographs (taken by Niepces) is made.

1837 Louis Jacques M. J. M. Daguerre makes a photograph on a copper plate treated with light-sensitive silver. This process becomes the first practical method of photography. These photographs are called daguerreotypes.



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An early photograph by Niepces

1850

1848 Glass plates, covered in photosensitive jelly, are used to make negatives.

1861 The first hand-held miniature camera is sold.

1882 The first photographic film is invented.

1892 The first method of color photography is invented.



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A daguerreotype of Abraham Lincoln

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The Brownie was the first popular camera made in large numbers.



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This Tarzan movie was one the earliest "talkies." It came out in 1929. Is the gorilla real?

1900 The first mass-marketed camera, the Kodak Brownie, is sold. Its price is \$1.00.

1908 Color photography becomes available but is very expensive.

1926 Movies with sound are developed and start to become popular.

1939 The first color movie—a short cartoon by filmmaker Walt Disney—is shown.

1963 Polaroid introduces instant color film.

1978 The first point-and-shoot auto focus camera is introduced.

2000 Digital still cameras become more popular. Digital cameras become cheaper and produce better pictures. Some record short movies and sound.

1900

1895 The first public screening of a motion picture takes place. The movie, and those that follow, have no sound (silent movies).

1905 Silent cinema becomes increasingly popular.

1914 The first 35-mm camera—still a standard for photographers—is developed. (35 mm refers to the size of the film.)

1935 The first commercially available color-slide film, developed for Kodak by Leopold Gadowsky and Leopold Manners, is marketed.

1950

1942 Modern color print film becomes available.

1970 IMAX® movies are introduced.

1987 The first digital still camera goes on the market.

2000

George Eastman, the founder of what became the Eastman Kodak Company, is considered the founding father of popular photography.

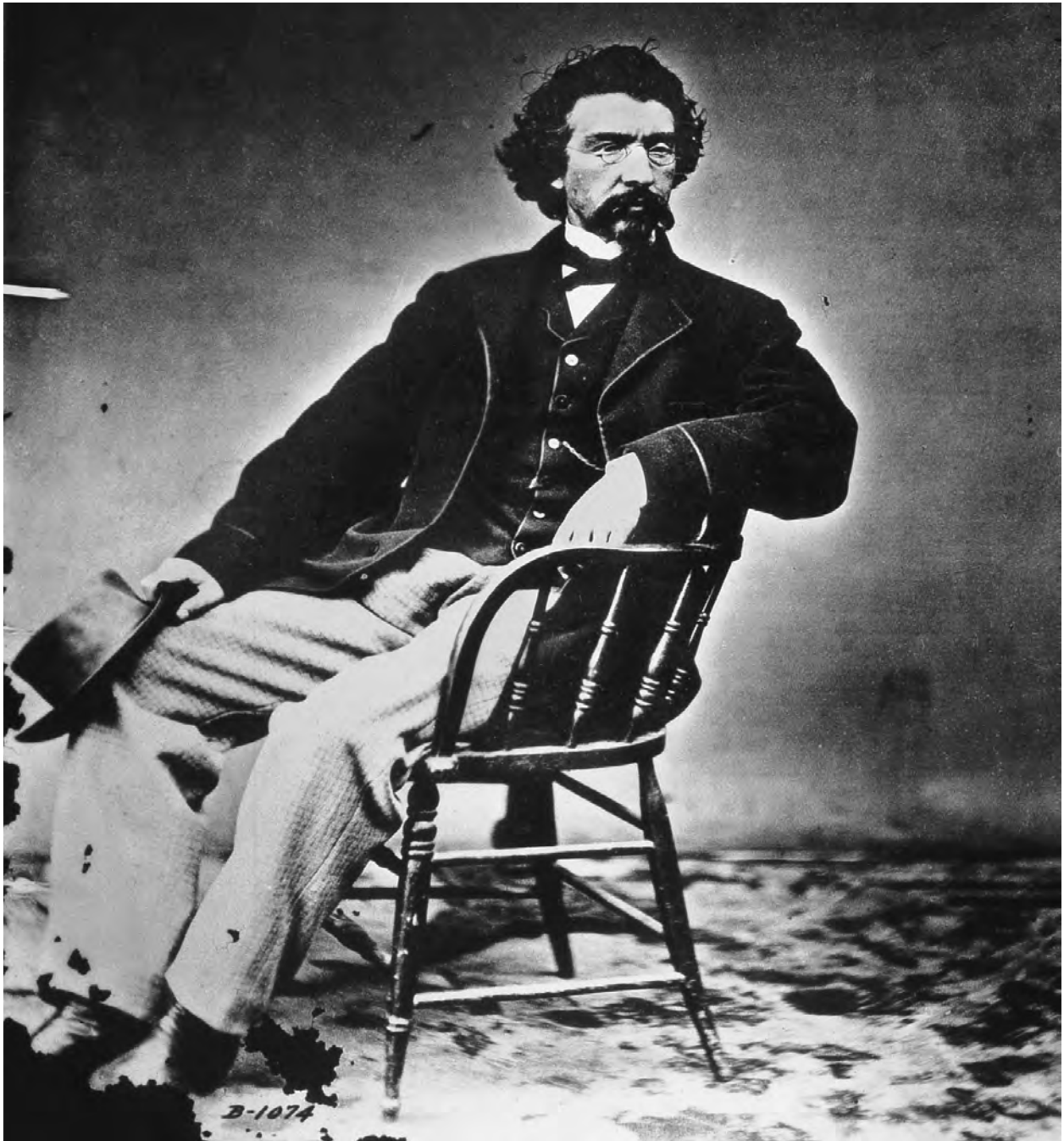


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MATHEW BRADY

RECORDER OF HISTORY

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Mathew Brady was one of America's greatest photographers. He pioneered new approaches to the art and science of photography.

Even as a teenager, Mathew Brady had many talents. A hard worker and good craftsman, he arrived in New York City in 1839 at the age of 16. Soon he started his own business making jewelry boxes for wealthy New Yorkers. Also interested in art, Mathew took lessons in painting; but his real passion was his hobby, daguerreotypy.

Daguerreotypy—then a new art form—was a process that used light to record images on metal plates. It was the forerunner of photography. Working with a friend who had learned the process in Europe, Mathew was soon an expert. In 1844, at the age of 21, he opened his own studio and gallery. His hobby had become his job. He began winning prizes for the high

quality of his work. Within a year he was exhibiting his pictures around the world. On his travels, he learned about even newer processes for making pictures. He quickly mastered and became an expert in these modern photographic methods. Using his talents as a photographer, Mathew Brady set out on a quest that occupied much of the rest of his life.

A Photographic Chronicle

“From the first, I regarded myself as under obligation to my country to preserve the faces of its historic men and mothers,” said Mathew Brady, when asked about his passion for recording important historical figures. Mathew Brady started his career specializing in portraits. To



These two portraits were taken by Brady. The picture of General Sam Houston (left)—President and later Governor of Texas—is a daguerreotype. The picture of Ulysses S. Grant (right), Civil War General and later President of the United States, was taken using a later process involving light-sensitive glass plates.

pursue this passion, he opened a studio in Washington, D.C., and began taking portraits of the famous people of the day. Over the course of his career, he photographed hundreds of dignitaries, including 20 Presidents of the United States and countless other famous people including diplomats and members of the royalty.

By the 1860s, Brady was recognized as America's greatest portrait photographer. So people were shocked when in 1861, at the peak of his profession, he decided to take his career in a new direction. Mathew Brady decided to chronicle in photographs one of the pivotal events in our history—the Civil War.

Nobody had tried such a thing before. How would one make a photographic record of a war in the field? Brady knew it would be a big job. He put all his resources into the project, organizing a corps of photographers. Brady and his photographers went with soldiers into the field, often dodging bullets to get the photographs they wanted. Their photos, like the ones taken of battlefield corpses after the war's most bloody battles at Antietam and Gettysburg, brought the horrors of modern war home to the public.

Over the course of the war Brady built up a huge collection of photographs. He financed the whole enterprise with his own money. After the



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Photographing a war took a lot of equipment, and in those days none of it was small. Brady's photographers used wagons to transport their bulky materials.

war, he published these photographs in book form. But by that time people were war weary. Many were sick of the horror shown in Brady's photographs.

Brady's books of war photos did not sell well and his money had run out. Brady declared bankruptcy and lost all his property. Of his photographs he said, "No one will ever know what they cost me; some of them almost cost me my life."

Mathew Brady, America's first great photographer and photojournalist, died in 1896. He was so poor that his friends in the art world had to pay for part of his funeral. Like so many great artists, Mathew Brady's photographs are appreciated more now than they were during his lifetime. □

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Brady's corps of photographers recorded the horrors rather than the glories of war. This 1863 photograph shows the battlefield after Gettysburg.