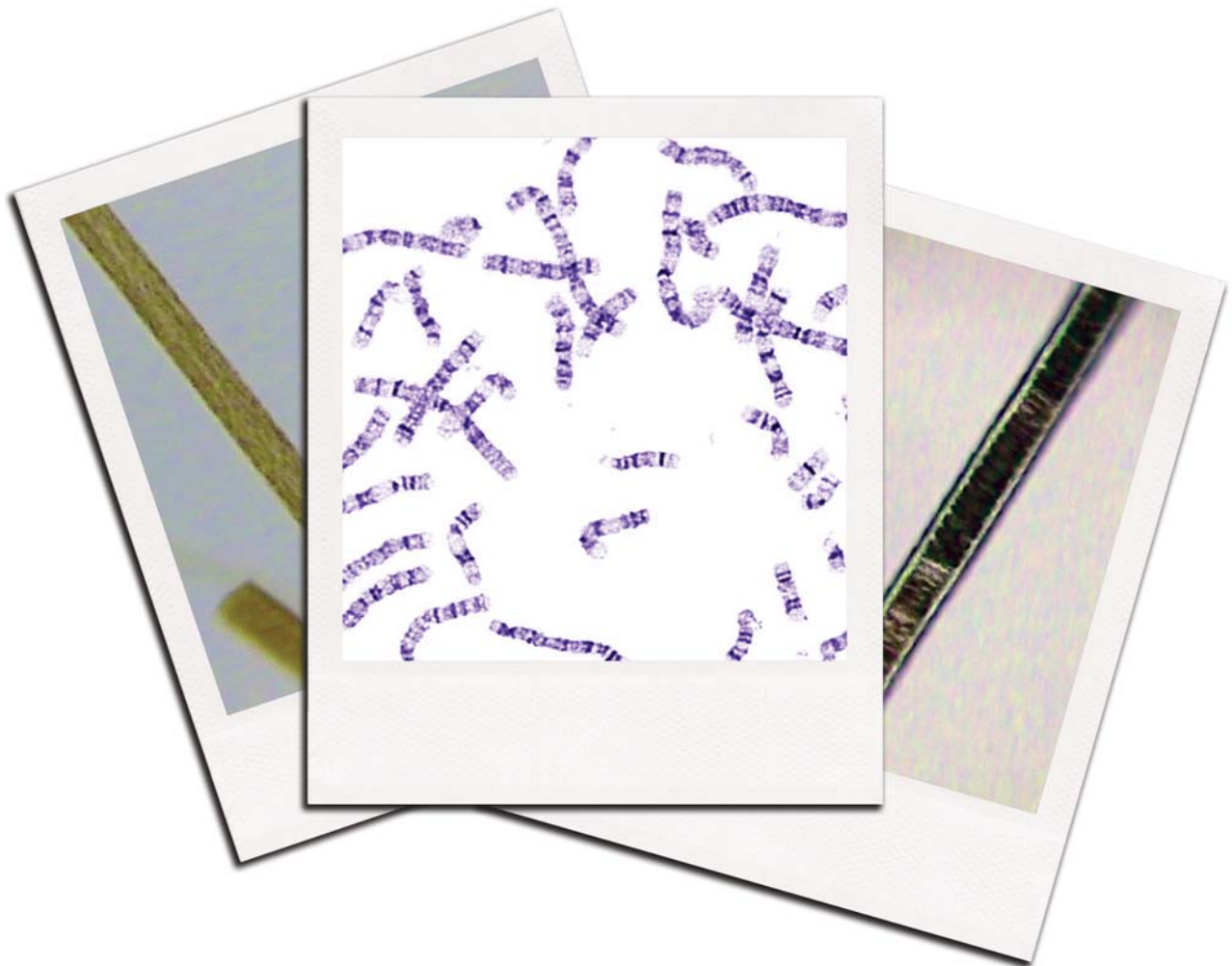


Carolina Beyond the Tape™
Golden River Heist
Biology Kit

TEACHER'S MANUAL
AND STUDENT GUIDE



Carolina Beyond the Tape™
Golden River Heist Biology Kit

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Carolina Beyond the Tape™

Golden River Heist Biology Kit

Overview

Students assume the role of forensic scientists to solve a fictional crime by integrating concepts in physics, chemistry, and biology. This kit is designed for 30 students working in 10 groups of three and rotating through five biology activity stations (one for karyotyping and four for forensic microscopy). Each activity requires 15 minutes, for a total of 75 minutes. Upon completion of the activities, students compile their lab data and recommend how to proceed with the case. The activity titles and descriptions for each topic are as follows:

Forensic Microscopy: Students prepare a slide of hair found at the crime scene, and compare its characteristics to reference samples to determine the species of origin.

Karyotyping: Students perform a karyotype of cells obtained from blood evidence found at the crime scene to determine the gender of the source of the sample.

Objectives

Students will

- determine the species of origin of a hair sample.
- determine the gender of an individual based on a karyotype.
- maintain a chain of custody for evidence.

Content Standards

To view the national and local standards met by this kit, visit www.carolina.com/correlations.

Time Requirements

Teacher Preparation15 minutes

Introduction10 minutes

Activities75 minutes (15 minutes at 5 different stations)

The times given are approximations. Depending on the skill level of your students, you may wish to allow students more time at each station. Note that students will require additional time to read the background information and instructions and to share data after the exercises have been completed.

Assessment questions are intended to be completed as homework. If necessary, the station activities can be conducted over two or more days.

NOTES

Materials

Included in the kit:

- 2 forceps
- hair evidence
- 10 crime evidence envelopes
- microscope slides
- microscope coverslips
- 2 reference slide sets
- 2 Magnetic Karyotyping sets (boards and magnetic chromosomes)
- 2 plastic containers with lids
- Teacher's Manual and reproducible Student Guide

Needed, but not supplied:

- 8 microscopes (100–400×)

Optional:

- sheet protectors for preserving the Activity Instructions and Crime Scene Reports

Safety

Use this kit only in accordance with established laboratory safety practices, including appropriate personal protective equipment (PPE). Ensure that students understand and adhere to these practices. Know and follow all school district guidelines for the disposal of laboratory wastes.

Background

The activities in this kit are centered on a fictional gold theft from a bank vault. The first section of the Student Guide is titled “The Case.” This material is designed to engage students, prepare them for the activities they will perform in class, and supply them with information they will need in order to conduct their investigations—the forensic scenario, the primary suspects, and the available evidence. Students should read this material before they begin the classroom activities. “The Crime” is presented as a conversation between the sheriff, crime lab director, and crime scene investigators; it informs students of the circumstances surrounding the crime and the current status of the investigation. “The Suspects” introduces students to the four main suspects and three bank employees who are suspected accomplices. “The Evidence” lists the materials and data that investigators have found thus far; these are the materials that students will test at different stations during the activities and the data they will incorporate into their forensic analysis.

You may wish to assign The Case as a homework reading assignment before you begin the classroom activities. Alternatively, engage the class by asking student volunteers to assume the roles of the characters, reading the dialog aloud to their

classmates. If you choose this option, devise another way to convey the suspect- and evidence-related information to the class.

The activities in this kit focus on applying the principles of biology to the field of forensics. Students draw conclusions about the case by incorporating their own data with additional crime lab data provided by the teacher—ostensibly collected and analyzed by colleagues using techniques grounded in other branches of science. The activities are designed to be conducted concurrently by students working in 10 groups of three. Each of the five activities is set up at two stations (10 stations total), with two groups working concurrently on each activity. One way of dividing duties so that every student participates is to assign duties for each group member for each subject. One student can serve as the Lab Manager, another as the Data Recorder, and the third as Runner, collecting and organizing materials as needed.

In a crime lab, forensic scientists are not aware of the circumstances surrounding the collection of a piece of evidence. In this activity, some information is similarly withheld from students as they analyze the evidence in this case. Students are not made aware of certain facts until they are given the Compiled Lab Data sheet and the River Map. The “Summary and Recommendations” section of the Compiled Lab Data sheet may be assigned for homework upon completion of the lab activities, if desired.

The Magnetic Karyotyping sets included in this kit can also be used to teach students about chromosomal disorders. Each set of 48 metaphase chromosome magnets include one pair of each autosome (chromosomes 1–22), 1 pair of X chromosomes (one X is marked with the symbol *), one Y chromosome (marked with the symbol #) and one extra Chromosome 21 (marked with the symbol •). The symbols allow each set to be adjusted to represent the following chromosome complements: normal male, normal female, Down syndrome (trisomy 21) male, Down syndrome (trisomy 21) female, Klinefelter’s syndrome male, or Turner’s syndrome female. See the Karyotype Setup Table below for how to produce each karyotype.

Karyotype Setup Table

| Chromosome Complement | Genetic Makeup | Magnets Removed |
|-----------------------------------|----------------|-----------------|
| normal female | 46, XX | # • |
| normal male | 46, XY | * • |
| Down syndrome (trisomy 21) female | 47, XX, +21 | # |
| Down syndrome (trisomy 21) male | 47, XY, +21 | * |
| Klinefelter’s syndrome male | 47, XXY | • |
| Turner’s syndrome female | 45, X | * # • |

Note: * = one of two X chromosomes, # = Y chromosome, • = extra Chromosome 21

The following sections of this manual give detailed instructions for setting up and conducting the activities. Sample answers and expected results also are provided.

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Preparation

1. Make copies of the following reproducible masters in the quantities noted.
 - Forensic Microscopy: Evidence Slide Activity Instructions2
 - Forensic Microscopy: Reference Slides Activity Instructions6
 - Karyotyping Activity Instructions2 sets
 - Chromosome Key2
 - The Case1 per student (or 4 total if read aloud)
 - Biology Crime Lab Data Sheet/Questions1 per student or group
 - Physics Crime Lab Data Report*1 per student or group
 - Chemistry Crime Lab Data Report*1 per student or group
 - Compiled Lab Data*1 per student or group
 - River Map*1 per student or group

***Note:** Distribute the Compiled Lab Data sheet, Crime Lab Reports and River Map only **after** all the groups have completed all five exercises.

2. a. Obtain all the items listed as needed but not supplied in the Materials section.
 - b. Allocate space for each of the 10 lab stations.
3. Prepare the 10 crime evidence envelopes for the Forensic Microscopy: Evidence Slide stations:
 - a. Fill out the 10 envelopes, one for each group, as follows.

| | |
|-----------------------------------|---|
| Article Description | hair, unknown type |
| Exhibit No. | 87-488-963-1 |
| Date Found, Located, or Developed | <i>the date you plan to conduct the lab</i> |
| Where This Article Was Found | hinge of the CB&S vault |
| Investigating Officer | Ann T. Body |

- b. Place several strands of hair in each envelope, and then seal the envelopes.
4. Designate a place where students should put used slides after they complete the activity. Also, set up the two Forensic Microscopy: Evidence Slide lab stations, each with the following materials.
 - 5 crime evidence envelopes containing hair
 - 5 glass microscope slides
 - 5 coverslips
 - forceps
 - microscope
 - Forensic Microscopy: Evidence Slide Activity Instructions