Chapter 8
Blood and Blood Spatter

Scenario: Blood Paints a Picture

I. Introduction
   A. Blood can be used in two ways as evidence during an investigation: to extract DNA for analysis or as physical evidence when blood spatter is studied.

II. Blood History
   A. Blood has been studied for thousands of years.

III. Composition of Blood
   A. Blood is a tissue that circulates around through the body.
   B. There are 3 kinds of cells which make up blood: red blood cells, white blood cells, and platelets. These cells are suspended in plasma.
      1. Blood Cells
         a. Red blood cells (erythrocytes) carry oxygen and carbon dioxide. Red blood cells have hemoglobin, but no nucleus and no nuclear DNA.
         b. White blood cells (leukocytes) are immune system cells. They fight disease and produce antibodies. They are the only blood cells that contain DNA.
         c. Platelets (thrombocytes) assist in clotting when a blood vessel is damaged. They also repair damaged blood vessels.
      2. History of DNA Profiling
         a. Dr. Alec Jeffreys used white blood cells for the first DNA profile.
         b. The Innocence Project helps free inmates falsely convicted of crimes by using DNA evidence.
      3. Blood Typing
         a. This is a less expensive way to analyze blood evidence than DNA analysis.
         b. Blood typing is a form of class evidence because it can only identify a group of individuals.
      4. Discovery of Blood Types
         a. In 1900 Karl Landsteiner discovered that there was more than one type of blood.
         b. Blood types are determined by proteins embedded within the cell membrane of red blood cells.
      5. A and B Proteins
         a. Two proteins, embedded in the cell membranes of red blood cells, are called A and B.
         b. A person may have A proteins, B proteins, both A and B proteins, or neither A nor B proteins on their red blood cells.
      6. Rh Factor
         a. Another blood protein is called Rh factor.
         b. It is estimated that 85% of the human population has the Rh factor protein.
      7. Naming of Blood Types
         a. The name of the blood type depends upon the blood proteins present on the red blood cells. Examples of blood types are: A Rh+, AB Rh-.
      8. Antibodies
         a. B lymphocytes (a specialized kind of white blood cells) secrete antibodies.
b. Each antibody has a shape which is specific to one kind of antigen (foreign molecule, cell, or virus).

9. Antigen-Antibody Response
   a. There are two kinds of response by the immune system to foreign bodies.
   b. In one response, phagocytes (a kind of blood cell) engulf invaders.
   c. In the other response, B leukocytes produce specific antibodies against the invaders.

10. Agglutination
   a. There are 300 known blood group proteins.
   b. There are 1,000,000 known kinds of protein binding sites in each red blood cell.
   c. Antibodies can attach to more than one cell because they are Y-shaped.
   d. If there is an immune response to a blood transfusion, then agglutination will occur because of the double binding action of antibodies.
   e. When agglutination occurs, blood ceases to flow and death can result.

11. Blood Typing Tests
   a. There are three separate tests for blood typing: one for the A protein, one for the B protein, and one for Rh factor.

12. Additional Blood Proteins and Probability
   a. Two other common blood proteins are M and N proteins.

13. Probability and Blood Types
   a. You can calculate the probability (chance) of one person having a particular blood type.

IV. Blood Spatter
   A. Blood spatter is a group of blood stains found in a crime scene.
   B. The pattern of blood spatter can be used to reconstruct a crime.
   1. History of Blood Spatter Analysis
      a. Blood spatter has been used in investigative cases since 1894.
   2. Blood Spatter Analysis
      a. You can tell four things from blood spatter: the direction in which the blood was traveling, the angle of impact between the blood and the wall or surface, the point of origin of the blood, and the blood’s velocity at the time of impact with the wall or surface.
      b. There are six different kinds of blood spatter.
   3. Examination of Directionality of Blood
      a. The shape of an individual drop of blood can provide important clues in an investigation.
      b. Different forces act on the blood as it falls: gravity, cohesion, adhesion, and surface tension.
   4. Lines of Convergence
      a. The location from which the blood originated can be determined if there are at least two blood spatters.

V. Crime Scene Investigation of Blood
   A. Even after washing a room of visible blood, some blood evidence remains.
   B. A compound called Luminol will cause hemoglobin to fluoresce under black light.
   C. There are four steps in investigating blood left at a crime scene: confirm that the stain is blood, confirm that the blood is human blood, determine the blood type, and perform a DNA analysis if necessary and if DNA can be isolated from the sample.