

Figure 10.7 Research Method

Preparing a Human Karyotype

PURPOSE: A karyotype is a display of chromosomes of an organism arranged in pairs. A normal karyotype has a characteristic appearance for each species. Examination of the karyotype of the chromosomes from a particular individual indicates whether the individual has a normal set of chromosomes or whether there are abnormalities in number or appearance of individual chromosomes, and also indicates the species.

PROTOCOL:

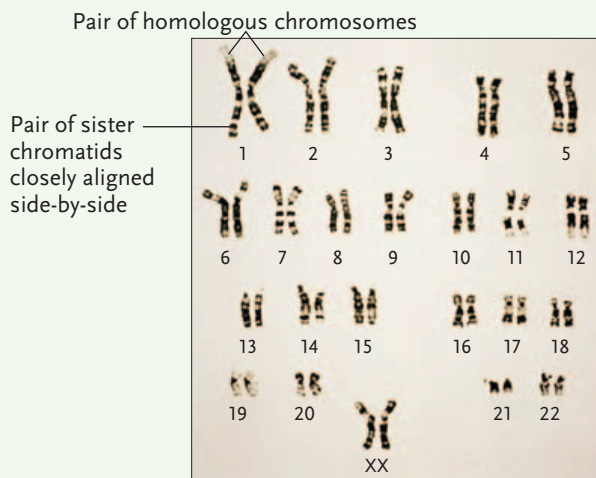
1. Add sample (for example, blood) to culture medium that has stimulator for growth and division of white blood cells. Incubate at 37°C. Add colchicine, which causes spindle to disassemble, to arrest mitosis at metaphase.



2. Stain the cells so that the chromosomes are distinguished. Some stains produce chromosome-specific banding patterns, as shown in the photograph below.



3. View the stained cells under a microscope equipped with a digital imaging system and take a digital photograph. A computer processes the photograph to arrange the chromosomes in pairs and number them according to size and shape.



INTERPRETING THE RESULTS: The karyotype is evaluated with respect to the scientific question being asked. For example, it may identify a particular species, or it may indicate whether or not the chromosome set of a human (fetus, child, or adult) is normal or aberrant.

cases, the plane of cytoplasmic division is determined by the layer of microtubules that persist at the former spindle midpoint.

Furrowing. In furrowing, the layer of microtubules that remains at the former spindle midpoint expands laterally until it stretches entirely across the dividing cell (Figure 10.8). As the layer develops, a band of microfilaments forms just inside the plasma membrane, forming a belt that follows the inside boundary of the cell in the plane of the microtubule layer (microfilaments are discussed in Section 5.3). Powered by motor proteins, the microfilaments slide together, tightening the band and constricting the cell. The constriction forms a groove—the furrow—in the plasma membrane. The furrow gradually deepens, much like the tightening of a drawstring, until the daughter cells are completely separated. The cy-

toplasmic division separates the daughter nuclei into the two cells and, at the same time, distributes the organelles and other structures (which also have doubled) approximately equally between the cells.

Cell Plate Formation. In cell plate formation, the layer of microtubules that persists at the former spindle midpoint serves as an organizing site for vesicles produced by the endoplasmic reticulum (ER) and Golgi complex (Figure 10.9). As the vesicles collect, the layer expands until it spreads entirely across the dividing cell. During this expansion, the vesicles fuse together and their contents assemble into a new cell wall, the cell plate, that stretches completely across the former spindle midpoint. The junction separates the cytoplasm and its organelles into two parts and isolates the daughter nuclei in separate cells. The plasma membranes that line the two sur-