

## Cloning

One meaning of the word **cloning** is *the process of making an exact copy of an organism*. One example of a natural occurrence of cloning, the formation of identical twins, is the result of a chance splitting of the embryonic cells very early in the growth of a zygote. Artificial cloning, using stem cells from animals or meristem cells from plants, can produce identical replicas of the parent cells or, under specialized conditions, a complete organism that is identical to the original organism. The orchid shown in **Figure 26** is a clone of its parent plant. Cloning of plants may hold promise for increasing the yields of crops. Recently, scientists at Pennsylvania State University cloned cocoa plants from cocoa flowers. When cocoa trees are planted from seed, as many as 50% do not mature with the desired characteristics. By planting young trees that are clones of plants with desirable characteristics, farmers may be able to increase their cocoa production.

The first animal to be cloned, a sheep named Dolly, was born in 1996 in Scotland. Dolly was euthanized in 2003 because of lung disease. She had also been diagnosed with arthritis. Both diseases are normally found in sheep older than Dolly was.



**FIGURE 26** Growers can produce many orchids by artificial cloning of the meristem tissue of a single orchid plant.

## Recombinant DNA Technology

Recombinant DNA technology has been used to insert DNA from one organism into another. One technique involves splicing a gene from one organism's DNA into a molecule of DNA from another organism. *Escherichia coli*, a bacterium found in animal intestinal tracts, are often used by biologists as cellular factories for the production or manufacture of DNA fragments cloned from other organisms. In some instances, *E. coli* can even be used to produce protein from DNA cloned from other organisms.

One of the first applications of genetic engineering was the synthesis of human insulin. Previously, most diabetics had to use either pig or cow insulin. But insulin from animals is not exactly the same as human insulin. Today, most insulin used is produced in bacteria and harvested. Human growth hormone is also commercially produced by using recombinant DNA technology.

## SECTION REVIEW

1. What sugar is present in DNA? What sugar is present in RNA?
2. Explain why the two strands of the DNA double helix are said to be complementary instead of identical.
3. Describe how DNA uses the genetic code to control the synthesis of proteins.

4. Why is a very small trace of blood enough for DNA fingerprinting?

### Critical Thinking

5. **INTERPRET AND APPLY** Is it possible to specify 20 amino acids by using only two base pairs instead of three for coding?
6. **DRAWING CONCLUSIONS** Why is the arrangement of base pairs that is found in DNA ideal for holding the double helix of DNA together?