

TRANSGENIC ANIMALS

Although recombinant DNA technology was pioneered in bacteria, it is now being applied to animals. When an animal cell receives a foreign gene, and then an individual develops from the engineered cell, the resulting organism is termed **transgenic** (L. *trans.* through + genes). The altered cell can be from an oocyte or fertilized egg of a sexually reproducing animal.

Because transgenic animals can produce large quantities of valuable drugs, they may revolutionize the pharmaceutical industry. For example, in Edinburgh, Scotland, a flock of sheep now exists that is a direct descendant of one ewe (a female sheep) named Ethel. When Ethel was a fertilized egg, she received a human gene for factor VIII. Factor VIII is a blood protein that animals and humans need for blood to clot. If it is absent, hemophilia results. As a result of the inserted human gene for factor VIII, Ethel and her progeny now produce large amounts of factor VIII in their milk. This valuable protein need only

be separated from the sheep's milk to supply enough clotting factor for all of the hemophiliacs in the world.

Transgenic goats have been similarly engineered to secrete tissue-plasminogen activator (t-PA) in their milk (figure 1). Tissue-plasminogen activator dissolves blood clots in the treatment of heart attacks and arterial blockages. Transgenic mice that contain the gene for breast cancer have been engineered, enabling scientists to study this human disease in an animal model. Other transgenic mice lack an immune system (have severe combined immune deficiency [SCID]) and are now models for studying such human diseases as acquired immunodeficiency syndrome (AIDS), muscular dystrophy, and diabetes. Pig embryos injected with human hemoglobin genes develop into transgenic pigs that synthesize human hemoglobin. Current plans are to purify human hemoglobin and use it as a blood substitute.

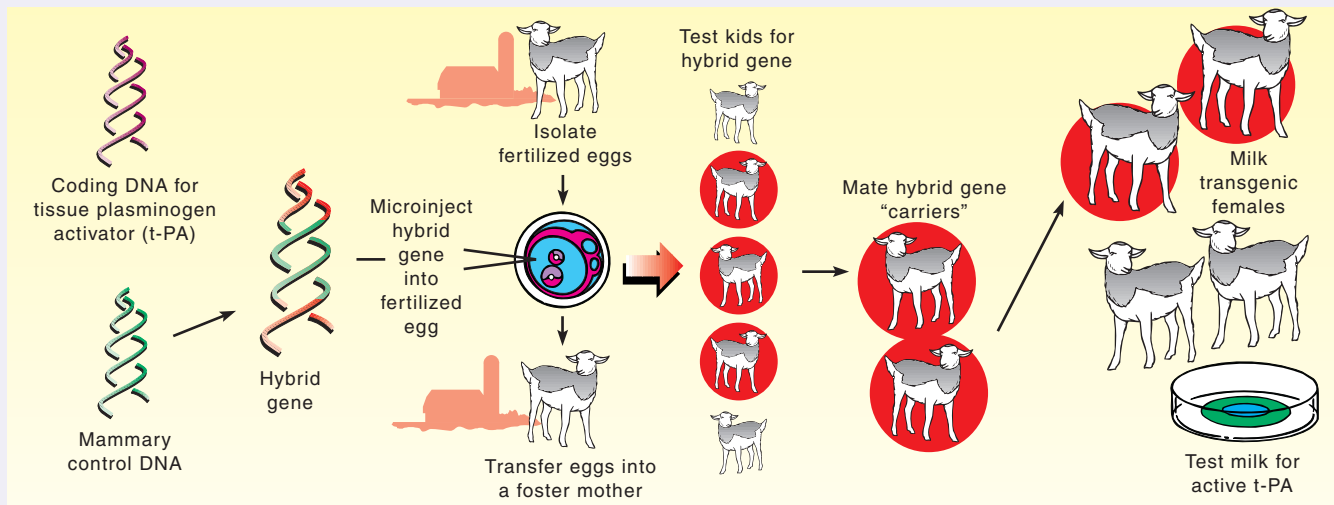


FIGURE 1 How to Put t-PA into Goat's Milk. Circled goats symbolize those goats found to carry the t-PA gene. (Miller/Harley: *Zoology*, 5th ed. © The McGraw-Hill Companies.)