Biotech diagnostics have a wide range of uses. There are over 320 biotech diagnostic companies worldwide competing for this growing market, with $15 billion dollars in worldwide sales in 1995. Over 650 immunodiagnostic and DNA diagnostic products have been approved for clinical use, and an even greater number sold for research purposes (Ernst and Young, 1995).

AGRICULTURAL. Agricultural biotechnology represents a broad collection of technologies and industries.which share a common goal of productively producing safe and healthy food. Veterinary pharmaceutical and biologics companies are utilizing biotechnology to develop new drugs and vaccines. Seed companies are using the technology to insert insect resistance and herbicide resistance genes from microorganisms into traditional crops, such as corn, soybeans, potatoes, sugar beets and canola. Agriculture bioprocessing companies are using "engineered enzymes" to improve the production of specialty chemicals, such as sugars, alcohols, organic acids and amino acids, from grains. Food and feed companies are using biotech diagnostics to monitor product safety and quality.

Biotechnology allows agricultural researchers to identify the molecular basis of "performance", thereby opening the door to developing new treatments and technologies. Virtually every plant and animal grown commercially for food or other application is a product of breeding. Traditional breeding is time consuming and inefficient and subject to limitations. Biotechnology allows animal and plant breeders to identify performance genes that are critical to overall health and productivity. Using rapid genetic identity technologies, these breeders can select the parent stocks which contain the complete set of performance genes, thus eliminating years from development. The following sections briefly review the research and market sectors of agricultural biotechnology.

Animals. Animal research falls into two broad categories - health and performance. Animal health care research addresses the development of medicines, either pharmaceuticals or biologics, for animal diseases caused by infectious agents (bacteria, viruses, parasites, etc.) or stress. According to the United States Department of Agriculture, biologicals are modified live and killed virus vaccines, toxoids and antitoxins; and pharmaceuticals are analgesics, antibiotics, anesthetics, disinfectants, anthelmintics and vitamin supplements. Biotechnology strategies for diagnosing and treating animal diseases follows those incorporated by medical biotechnology firms (see previous section). Most veterinary pharmaceutical and biologics companies have biotechnology R&D programs or employ biotechnology products in their manufacturing quality control procedures.

Obviously, animal performance is greatly enhanced by veterinary medicines. Animal performance can also be improved over generations by selective breeding. Animal breeding has traditionally been a laborious, time-consuming operation that has a "hit-or-miss" aspect. However, today, animal breeders are improving their odds through biotechnology; more specifically, by mapping the genomes of food animals, such as cattle, sheep, swine, poultry, and some fish. These researchers, primarily university and government scientists, use the same rapid and precise mapping techniques being used in the human genome project. They are gaining a fundamental understanding of the genetic basis of many quantitative traits (i.e., controlled by many genes), such as growth rate, liter size, and milk yield. They are developing tools to identify breeding lines with the most favorable set of genes, thus reducing the time for developing superior varieties. Additionally, they open the opportunity for cloning disease resistance genes from nonadaptive populations, and then transferring these genes to superior breeding stock.