Immunity is the result of antibody production and the effects of certain cells directly or indirectly on disease agents. Immunity occurs after a natural infection with a disease but because of the time lag between natural infection and immunity, some morbidity or mortality may occur before immunity is sufficient to stop disease. Planned exposure to a disease agent at the correct time with the correct agent is a method of producing immunity. The process is known as vaccination. The agent used is called a vaccine.

25-A. HOW VACCINES WORK

In most instances vaccines are used to produce a mild infection, with few or no signs of the disease, by using a specific disease agent. Normally, the production of immunity by the use of a vaccine will duplicate that from a natural outbreak. Usually, for effective vaccination protection from a disease, the vaccination must be given well in advance of any natural exposure or infection. There are a few exceptions. These are usually in very slow spreading diseases or ones in which immunity develops very quickly.

The virulence of the vaccine and the number of vaccine or virus particles per individual dose will determine the effectiveness of a vaccination. The immune competence of the chicken and host factors such as stress, genetic background, and other concurrent diseases also play an important role in the outcome of a particular vaccination.
25-B. TYPES OF VACCINES

Vaccines may be classified as:

- live vaccines
- attenuated live vaccines
- inactivated (killed) vaccines
- genetically engineered vaccines

All vaccines are produced from live agents specific for the disease in question. Each vaccine is the result of harvesting bacteria or viruses produced from specific disease agents and grown in the laboratory. They may be treated in a manner to eliminate or reduce the severity of disease (or reaction) produced by the agent, they may be killed by chemical or other means, or portions of the agent may be genetically placed in another agent.

1. **Live vaccine.** The organisms in the vaccine are alive and completely capable of producing the disease in birds not infected or previously vaccinated. Because the vaccine contains a live agent, the vaccine is also capable of transmitting the disease to any susceptible bird that comes in contact with it. Live vaccines (including attenuated live vaccines) replicate after application giving high numbers of the vaccine agent over a fairly long period of time. This helps produce a strong immunologic response.

2. **Attenuated vaccine.** The active organisms used to prepare a vaccine may be weakened (attenuated) by various methods so that when administered to a bird, a mild form of the disease will be produced. In many cases there is no evidence of the disease. Vaccines of this type are tested carefully in the laboratory for their ability to revert to a virulent form of the disease. Only those that have little or no ability to revert to virulence are used as vaccines.

3. **Inactivated (killed) vaccine.** The organisms used to produce these vaccines have been grown in culture in the laboratory and then inactivated by chemical or physical means. Inactivated vaccines are not capable of spreading the agent to other birds. They do, however, have the capacity to produce immunity when used through vaccination. In some instances, however, their ability to do this is impaired, and immunity will not reach as high a level as with live or attenuated vaccines. In such cases, immune stimulators called adjuvants are added to killed vaccines to help overcome the limited amount of the infectious