events. Receiving reports of real or suspected adverse events is the only way manufacturers can economically obtain the data necessary to evaluate the safety and efficacy of their products in clinical settings. Suspected or real adverse events should be reported to the manufacturer of the product and the United States Pharmacopeia (USP; Appendices 3 and 4) If more than one manufacturers' product was used concurrently, all manufacturers should be contacted. Even though the USP forwards all adverse event reports it receives to the manufacturer, a veterinarian may be able to obtain technical assistance by directly contacting the company. Veterinarians may also choose to report adverse events associated with vaccines to the United States Department of Agriculture Center for Veterinary Biologics (USDA-CVB), adverse events associated with pesticides to the Environmental Protection Agency (EPA), and adverse events associated with pharmaceuticals to the Food and Drug Administration (FDA). Reports sent to the USP are automatically forwarded to the appropriate governmental agency and to the American Veterinary Medical Association.

Calculating the rate of adverse events associated with a vaccine requires knowing both the number of such events and the number of vaccines administered during the same period. Because many adverse events go unreported, the calculated rate should be considered a minimum value; the actual rate is probably higher. And, because the total number of doses administered is not known, caution must be exercised when evaluating the number of adverse events associated with a particular product. If the numbers of adverse events reported for 2 products are the same, but 1 vaccine has half the sales of the other, the rate of adverse events for the less popular product is actually double that for the more popular one.

Variation Among Vaccines

Unlike the FDA's licensing process for human vaccines, the USDA does not stipulate the strain or isolate of organism used to develop an animal vaccine, or the cell line used for vaccine licensure and production. Veterinary biologics manufacturers are free to develop vaccines by any means, so long as they are able to demonstrate a consistent manufacturing process that results in consistent purity, potency, efficacy, and safety. Although perhaps differing fundamentally in composition, vaccines for a particular antigen produced by various manufacturers are usually a great deal more similar than they are different.

Veterinary biologics manufacturers do not evaluate the ability of their vaccines to boost immunity conferred by a competitor's products, nor do they attempt to determine whether their vaccines interfere with a competitor's product. Not surprisingly, there is an absence of data demonstrating efficacy when vaccines from one manufacturer are used interchangeably with those of another. However, temporal patterns of immunologic responses in kittens and adult cats suggest that a satisfactory immune response is achieved when a similar vaccine antigen from one manufacturer is used interchangeably with that of another (eg, an FCV vaccine from one manufacturer may be used as a booster vaccine for a cat originally immunized with an FCV vaccine from a different manufacturer).

Use Of Serologic Testing To Monitor Immunity And Assess The Need For Vaccination

Specific immunity to infectious agents comprises both cell-mediated and humoral responses. In general, both are important in resistance to infection or disease, but whether cell-mediated or humoral responses are most important for mediation of protection varies with the pathogen and the vaccination status of the animal. Antibodies are generally most effective against pathogens that are extracellular; cell-mediated immune responses are generally most effective against pathogens that are intracellular, because antibodies do not readily enter infected cells. For some pathogens, antibodies produced as a result of vaccination may be effective in preventing infection; for example, cats vaccinated with an FPV vaccine generally are completely protected from infection as a result of antibodies induced by vaccination. For other pathogens, even when antibodies do not prevent infection, they can limit or prevent disease by reducing the amount of infectious agent. Vaccination is designed to stimulate immunologic memory; that is, to expand populations of antigen-specific T- and B-lymphocytes that can respond if the animal is exposed to the organism at a later date.

In many respiratory or gastrointestinal tract infections, mucosal immune responses, particularly IgA antibody, are most effective. Measurement of specific immune responses to an infectious agent could potentially be used to predict whether vaccination is required in an individual cat, provided the appropriate immune response can be accurately measured.[69] Unfortunately, cell-mediated and mucosal immune responses can not be directly determined in a clinical setting.

Determination of serum antibody responses is technically easy and can be used clinically in some situations to predict resistance to infection or disease.[69] Detection of serum antibodies against an infectious agent can also be used as an indirect measure of cell-mediated immune responses, because T-lymphocyte functions are required for maintenance of B-lymphocyte functions.[70] The presence of serum antibodies to an infectious agent—even if detected months or years after vaccination—indicates that the animal has the memory cells required for a rapid anamnestic cell-mediated and antibody response if the animal is exposed to the same infectious agent at a later time. Serum antibody titers can be correlated with sterile immunity (protection from infection) for a few pathogens (eg, FPV); however, in general, antibody titer is not directly correlated with protection, and the presence of antibody should be considered, rather, an indicator of immunologic memory.[71]

Information correlating vaccine-induced serum antibody responses with resistance to infection has been collected primarily for FPV, FHV-1, and FCV. For FPV, serum