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RESEARCH ON VACCINES: KEY TOPICS AND NEW APPLICATIONS

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Vaccines and vaccination have become essential tools for control and eradication of many transboundary diseases.

To be effective, vaccine must be administered to a large portion of susceptible population and be antigenically matched to viruses in the field. Avian influenza (AI) will be used as a case study for this topic. High potency and properly administered AI vaccines for poultry increase resistance to infection, prevent illness and death, reduce virus replication and shed from respiratory and alimentary tracts, and reduce virus transmission to birds and mammals, including humans. Such protection in birds is primarily mediated by homosubtypic humoral immunity against the hemagglutinin (HA) protein, but cell mediated and innate immunity contribute to protection in some bird species. The immune response to the neuraminidase protein can contribute to protection, but immunity to the viral internal proteins is generally not protective. Some preliminary studies with M2e protein in chickens suggests partial protection may be achievable. Historically, the H5 subtype AI vaccines have demonstrated broad homosubtypic protection, primarily against H5 high pathogenicity (HP) AI viruses isolated in the early stages of outbreaks. However, as H5 viruses have become endemic and outbreaks prolonged, some drift variants with resistance to earlier H5 AI vaccines have emerged in Central America, China, Egypt and Indonesia. How widespread such drift variants are will remain unknown until more detailed genetic and antigenic analyses are conducted on field isolates.

Future vaccines will use the biotechnology of reverse genetics to produce new AI vaccine seed strains using HA genes more closely matching circulating field viruses. In addition, newer recombinant technologies for AI vaccines will improve vaccine coverage by using mass application technologies, for example by drinking water, by spray or via injection *in ovo* or at the hatchery such as with recombinant Newcastle disease virus or adenoviruses with influenza HA gene inserts.

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