# Developments in in ovo vaccinations

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Approximately 90% of all broiler chickens grown in the USA are vaccinated in ovo for Marek's disease (MD). This occurs 48-72 hours prior to hatch at the time when eggs are transferred from the incubator to the hatcher.

In ovo vaccination, first commercialised by Embrex Inc (now PPHD) in 1992 with the development of the automated in ovo injection device (the Embrex Inovoject System), has proven to be an efficient method to mass immunise chickens against several infectious diseases.

It has been successfully used for years in many of the top poultry producing countries, including Argentina, Australia, Brazil, France, Japan, Korea, Mexico, Peru, Spain, Thailand, United States, and most recently in Colombia.

## Successful delivery

Day-of-hatch vaccination has served the industry well for many years. Similar to day-of-hatch vaccination, vaccines are successfully delivered in ovo even though E18 (embryonation day 18) embryos do not have a fully mature immune system.

In fact, modified live vaccines (MLV) for MD, avian metapneumovirus (aMPV), experimental infectious bronchitis (IB) and avian influenza (AI) vaccines produced either earlier onset of immunity or better protective immunity.

Earlier immune responses are one advantage of vaccinating in ovo. We will go into further detail on this topic later in the article.

With the Embrex Inovoject System (EIS) and the Embrex Inovoject Systems Vaccine Saver vaccines are administered via a needle within a needle. Using a punch needle, the shell is penetrated on the blunt air cell end of the egg. The smaller diameter vaccine dispense needle penetrates the air cell and chorioallantoic membrane to deposit vaccine in the amnion.

This allows for vaccination of up to 70,000 chicken eggs per hour in a more uniform and precise manner than most post-hatch mass vaccination methods. In addition, simultaneous in ovo delivery of MD, infectious bursal disease (IBD) and fowl pox (FP) vaccines routinely take place without interference among themselves or with day-of-hatch vaccines for Newcastle disease (ND) and IB.

## Vaccines for use in ovo

In ovo vaccination started with vaccines for MD and mild IBD, followed somewhat later with vaccines for FP. Bursaplex, an antigen antibody complex for IBD, developed and marketed by Embrex Inc, was licensed for in ovo delivery in 1997 and is now available in more than 25 countries.

Recently, Inovocox, an in ovo licensed live oocyst vaccine for coccidiosis, was developed by PPHD and has been licensed for commercial use in the USA.

Vaccines for aMPV (rhinotracheitis) have also been shown to work well when administered in ovo. However, efforts to develop commercial in ovo vaccines for ND and IB have been difficult although it is not for lack of effort by vaccine researchers.

Use of recombinant techniques to manipulate vaccine viruses is becoming an important avenue for increasing the number and types of vaccines compatible with the in ovo route.

Recombinant vaccines, such as MD vaccines using a herpesvirus of turkeys (HVT) vector and FP vectors, have been shown to be safe and effective when given in ovo.

Today, commercially available recombinant vaccines using either FP or HVT vectoring technology are available in a number of countries for protective antigens from Mycoplasma gallisepticum, infectious laryngotracheitis virus (ILT), AI virus, ND virus, or IBD virus.

A number of experimental vaccines that may be compatible with the in ovo route of administration are currently under development, and include non-replicating human adenovirus vectored AI vaccine, alphavirus-vectored AI vaccine and NDV-vectored AI vaccine.

A stand alone recombinant IB vaccine developed for in ovo administration also shows promise.

It is likely that the number of major poultry diseases controlled by in ovo vaccination will grow substantially during the next five years.

Understanding the fundamental differences of the in ovo route compared to post-hatch routes, allows for determining some of the advantages in ovo has over post-hatch immunisation.

During late stage incubation (E17-E19), the embryo ingests the amniotic fluid in which it is surrounded. Upon ingesting the amniotic fluid, vaccines locate rapidly to the upper and lower respiratory tract and the gastrointestinal (GI) tract.

The respiratory system and the intestine function as major immune organs and include the majority of the chicken's local and mucosal immune systems.

The GI tract also contains the all important primary immune organ – the bursa of Fabricius.

Therefore, vaccines delivered in ovo are not only able to stimulate systemic immunity; they will also stimulate local and mucosal immunity due to the ability to locate to mucosal sites in the respiratory and GI tracts.

## Stimulate immunity

Another potential advantage of in ovo vaccination is the ability to deliver vaccines to the developing chick while maternal immunity is relatively low as compared to at hatch.

Research has shown that maternal antibody levels to NDV and IBDV are much lower on E17-E19 than from E20 through the first days post-hatch.

In ovo vaccination offers the opportunity to vaccinate when maternal antibody is comparatively low, potentially allowing traditional and recombinant modified live vaccines to stimulate immunity prior to the steep rise in circulating antibody.

While there are other methods available for vaccination, the advantages to vaccinating in ovo using the Embrex Inovoject System include fast and effective mass immunisation of poultry. ■