

What *in ovo* vaccination and egg identification accuracy could mean for your hatchery

Joshua Deines, PhD
Technical Service Device Lead, Zoetis

Commercial broiler hatcheries in the United States depend on *in ovo* vaccination to efficiently and consistently deliver vaccines before chicks hatch. But not all biodevice technologies are the same.

Accurately identifying viable eggs to be vaccinated and clear eggs to be removed, and delivering vaccine to the optimal location within each viable embryo are the distinctions of biodevice technology that succeeds in helping to protect more chicks, reduce waste and deliver superior value in the hatchery.

Two performance measures are especially important when evaluating *in ovo* vaccination systems:

1. **Site-of-injection (SOI) accuracy** measures whether the vaccine reaches the amnion or embryo.
2. **Egg identification accuracy** measures whether the system correctly distinguishes viable embryos from infertile or early dead eggs.

Comparison trial results from 2025 demonstrate measurable differences among *in ovo* technologies in both SOI and egg identification accuracy.¹ For hatcheries processing millions of eggs, small percentages can represent large numbers of embryos that are not vaccinated appropriately, live eggs that are incorrectly removed or vaccine doses that are used on nonviable eggs.

Why SOI accuracy matters

Optimal SOI delivers vaccine in either the amnion or embryo compartments of developing chicks (Fig. 1).² These *in ovo* vaccine delivery locations support the immune response to help protect chicks as they grow and develop. Vaccine deposited in other areas, including the air cell, allantois, yolk or intraperitoneal cavity, may not provide the same level of immune response (Table 1).³

In a commercial hatchery, the impact of vaccination errors increases with scale. A small percentage of inaccurate injections can affect thousands of chicks per flock per week.

Table 1. A comparison of Marek’s disease protection index among different vaccine delivery locations. The embryonic compartment where vaccine is delivered during *in ovo* vaccination significantly impacts vaccine efficacy.³

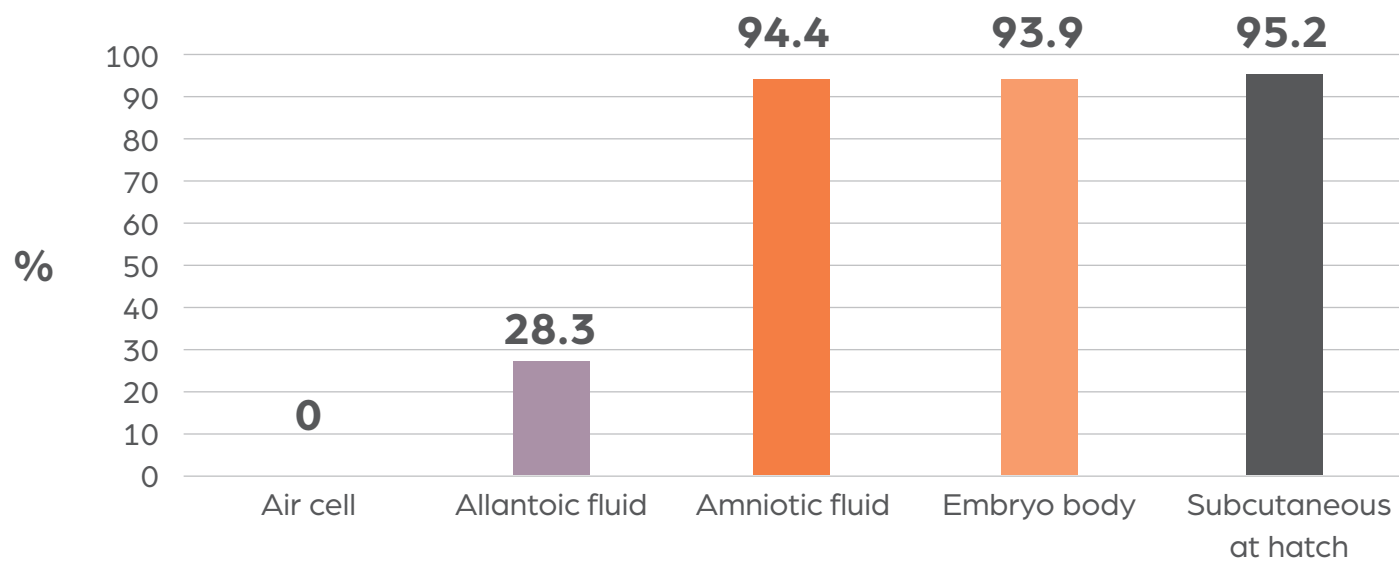
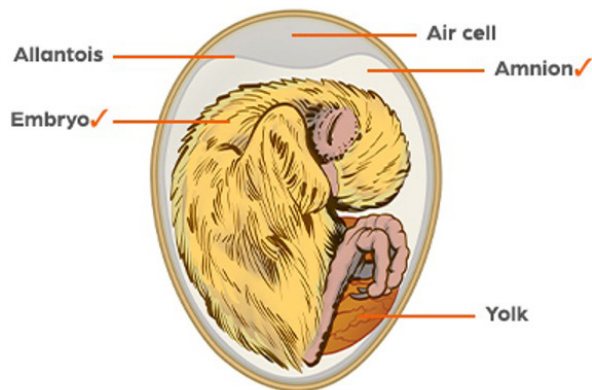


Figure 1. Anatomy of a chick embryo at 18 days of incubation. The amnion and embryo are optimal locations for vaccine delivery during *in ovo* vaccination.²



Trial data reveals differences among *in ovo* vaccination systems

Trials evaluating *in ovo* vaccination technologies have identified significant differences in SOI accuracy.¹

In an SOI trial, Embrex® technology has demonstrated up to **100% SOI accuracy**, with vaccine delivered to either the amnion or embryo of viable embryos (Table 2).²

Table 2. SOI accuracy for Embrex® *in ovo* technology with egg transfer at 18 days, 12 hours of incubation.²

Injection location	Embrex® <i>in ovo</i> technology ²
Amnion	77.9%
Embryo (intramuscular or subcutaneous)	21.7%
% total accurate injections	99.6%

A separate comparative trial conducted in 2025 assessed two other *in ovo* vaccination systems — Device Brand A and Device Brand B. Device Brand A averaged **86% SOI accuracy**, while Device Brand B averaged **77.4% accuracy** (Table 3).¹ All equipment included in the comparative studies had been recently maintained by the designated service provider and were operating according to manufacturer specification (Note: The comparative trial did not compare Brand A and Brand B to Embrex).

The results show that:

- **14% of embryos processed by Device Brand A** did not receive vaccine in the amnion or embryo.¹
- **22.6% of embryos processed by Device Brand B** did not receive vaccine in the amnion or embryo.¹

These values indicate that a significant number of those hatching chicks may lack an optimal immune response from *in ovo* vaccination.

Table 3. SOI accuracy for two other *in ovo* technology brands.^{1,2}

Injection location	Device Brand A ¹	Device Brand B ¹
Amnion	42.5%	74.1%
Embryo (intramuscular or subcutaneous)	43.5%	3.3%
% total accurate injections	86%	77.4%

These findings show why SOI accuracy is an important consideration when comparing systems.

Accurate egg identification supports vaccination efficiency

An *in ovo* vaccination system should also identify which eggs contain viable embryos.

Inline egg identification technology should remove infertile and early dead eggs while allowing viable embryos to remain in the tray for vaccination and hatch. Accurate egg identification can help hatcheries reduce vaccine waste.

In an egg identification trial, Embrex technology demonstrated:

- 100% of live embryos were left in the trays.⁴
- 100% of infertile eggs were removed.⁴
- 99.3% of early dead eggs were removed.⁴

These results indicate that no live embryos were removed during the study and that vaccine was directed to viable embryos rather than infertile eggs.

Misidentification can create loss

The comparative trial of Device Brands A and B identified three potential consequences of inaccurate egg identification (Table 4):

- 1. **Viable embryos may not receive vaccine** — viable embryos may be left vulnerable to disease challenge.
- 2. **Nonviable eggs may receive vaccine** — vaccinating eggs that cannot produce viable chicks represents wasted vaccine.
- 3. **Live eggs may be removed** — removing a viable embryo reduces hatch and the volume of chicks entering growout. In commercial-scale hatcheries, even a fraction of a percentage can represent a substantial number of chicks.

Table 4. An evaluation of egg identification accuracy for *in ovo* technology.^{1,4}

Egg identification outcome	Device Brand A ¹	Device Brand B ¹
Viable embryos with no vaccine delivered	3.5%	3.7%
Nonviable embryos with vaccine delivered	7.3%	1.3%
Live embryos removed	0.61%	High rate

Scaling trial data to commercial hatchery operations

The operational importance of accuracy becomes clearer when percentages are applied across large egg volumes, risking thousands of chicks.

In a hypothetical group of 1 million viable embryos, an SOI accuracy rate of 86% would correspond to approximately 140,000 embryos receiving vaccine outside the amnion or embryo. At 77.4% accuracy, approximately 226,000 embryos would receive an off-target injection.

These figures are mathematical illustrations based on the reported trial percentages. Actual hatchery outcomes will vary according to embryo development, equipment condition, operating practices and other production factors.

The same principle applies to egg identification. A live-egg removal rate of 0.61%, when applied hypothetically to 1 million live eggs, would represent approximately 6,100 viable embryos removed from production.

At commercial scale, differences that appear modest in percentage terms may affect a meaningful number of eggs, vaccine doses and chicks.

Evaluating total system performance

Hatcheries assessing *in ovo* technology should consider both SOI and egg identification accuracy. Along with service provider capability and technical support, a comprehensive evaluation should examine:

- ✓ Percentage of viable embryos injected in the amnion or embryo
- ✓ Percentage of viable eggs receiving no vaccine
- ✓ Percentage of nonviable eggs receiving vaccine
- ✓ Percentage of live eggs incorrectly removed

In ovo vaccination represents an investment in flock health. The value of that investment depends on the accuracy of *in ovo* processes.

Contact your Zoetis representative for more information on accurate and reliable Embrex® *in ovo* vaccination technology.

Joshua Deines, PhD, Technical Service Device Lead, Zoetis

Based in Arkansas, Joshua Deines, PhD, specializes in hatchery and breeder flock management, reproductive physiology and poultry nutrition. He works with poultry operations across the United States to help optimize hatchery performance and provide technical support for Embrex® BioDevices and *in ovo* vaccination. He holds a doctorate from the University of Arkansas.

¹ Data on file, February 2025, Zoetis Inc.

² Avakian AP, Wakenell PS, Bryan T, Schaeffer JL, Williams CJ, Whitfill C. *In ovo* administration of Marek's disease vaccine: Importance of vaccine deposition site in the fertile egg, in *Proceedings*. 51st Western Poultry Disease Conference 2002;119-121.

³ Wakenell PS, Bryan T, Schaeffer J, Avakian A, Williams C, Whitfill C. Effect of *in ovo* vaccine delivery route on herpesvirus of turkeys/SB-1 efficacy and viremia. *Avian Dis*. 2002;46(2):274-280.

⁴ Data on file, Study Report No. 1-20-70R7D, Zoetis Inc.

All trademarks are the property of Zoetis Services LLC or a related company or a licensor unless otherwise noted.

© 2026 Zoetis Services LLC. All rights reserved. DEV-00374

