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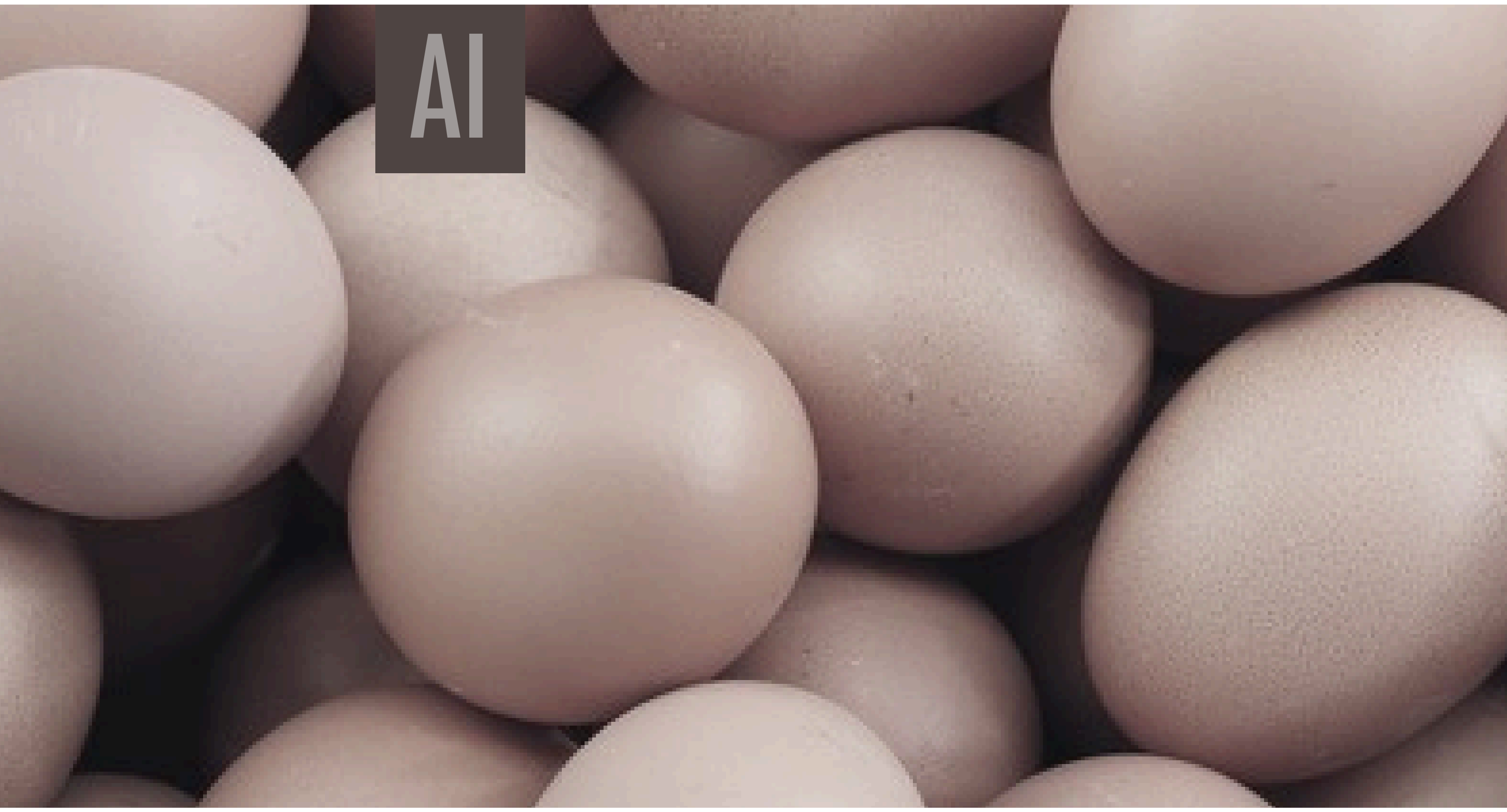
HIGH PATHOGENICITY AVIAN INFLUENZA IN LAYERS:

CONSIDERATIONS AND ESSENTIAL COMPONENTS FOR VACCINATION AND SURVEILLANCE

December 2025

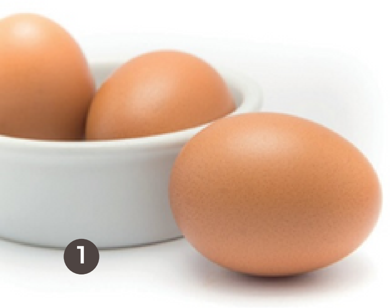
Developed by the World Egg Organisation Avian Influenza Global Expert Group



PURPOSE OF AVIAN INFLUENZA VACCINATION

CONSIDERATIONS AND ESSENTIAL COMPONENTS

Considering the continuous and expanding threat from high pathogenicity avian influenza (HPAI) to the global egg industry and wider food supply chain, this WEO paper explains very clearly the advantages of vaccination against this disease as well as ways to overcome barriers to vaccination. Practical experience demonstrates that without incorporating vaccination as a tool for managing and controlling HPAI, its spread and persistence worldwide will continue. This paper has been developed by the WEO Avian Influenza Global Expert Group.



How can vaccines assist in prevention and control of high pathogenicity avian influenza in layers?

Vaccination against the current H5 panzootic outbreak of HPAI works by increasing the resistance of birds to infection and disease. Well-vaccinated chickens that are exposed to a field strain of HPAI virus will either not get infected or, if so, will likely shed virus in quantities insufficient for sustained horizontal transmission of virus between vaccinated birds. In the few birds that do get infected, the quantities of virus shed are reduced to the extent that it prevents transmission of virus between vaccinated birds. This applies when an appropriate vaccine sufficiently well matched to the circulating virus is delivered to birds at the appropriate times and dose.

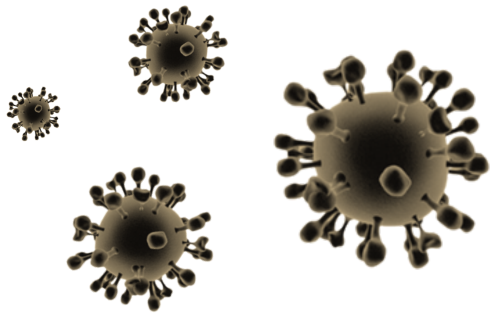
Infection can occur in vaccinated flocks with a poor immune response to vaccines or if the vaccine was not appropriately matched to field strains of virus. In the event of a field strain breaking through vaccine immunity, testing is available to detect infection in these flocks (see surveillance section).

Why has vaccination against HPAI not been used widely in the past and what has changed?

In the past, HPAI was a sporadic disease in many regions readily managed using traditional methods of prevention and control, based on biosecurity, "stamping out", tracing, and movement management. HPAI resulted from the spill over from wild birds of a low pathogenicity avian influenza (LPAI) virus that converted to a HPAI virus in poultry. Up to 1996, virtually all outbreaks of HPAI had been contained and the HPAI viruses causing the outbreaks were eliminated.

This was not the case with the HPAI viruses that were first detected in geese in Guangdong, China in 1996. These so-called goose/Guangdong-related H5Nx HPAI viruses have circulated continuously as HPAI viruses in poultry since they emerged and, soon after, in wild migratory birds. The presence of infection in migratory birds resulted in multiple intercontinental outbreaks of disease from 2005 onwards.

The extent and severity of these outbreaks has increased over the past few years with the



current strains of virus becoming the first HPAI to affect almost all continents of the globe (Africa, Antarctica, Asia, Europe, and North and South America), apart from Oceania, and to persist as year-round outbreaks. The current viruses are now established in migratory and non-migratory wild bird populations and the range of wild bird species capable of transmitting the virus has increased.

This change increases the probability of virus gaining access to poultry farms. Between January 2021 and October 2025, strains of this HPAI virus have caused the loss of more than 490 million head of poultry. Standard and even enhanced biosecurity measures that, in the past, would have prevented HPAI are no longer stopping all incursions of virus, especially in longer-lived poultry. Vaccination can provide an additional layer of protection for these birds.

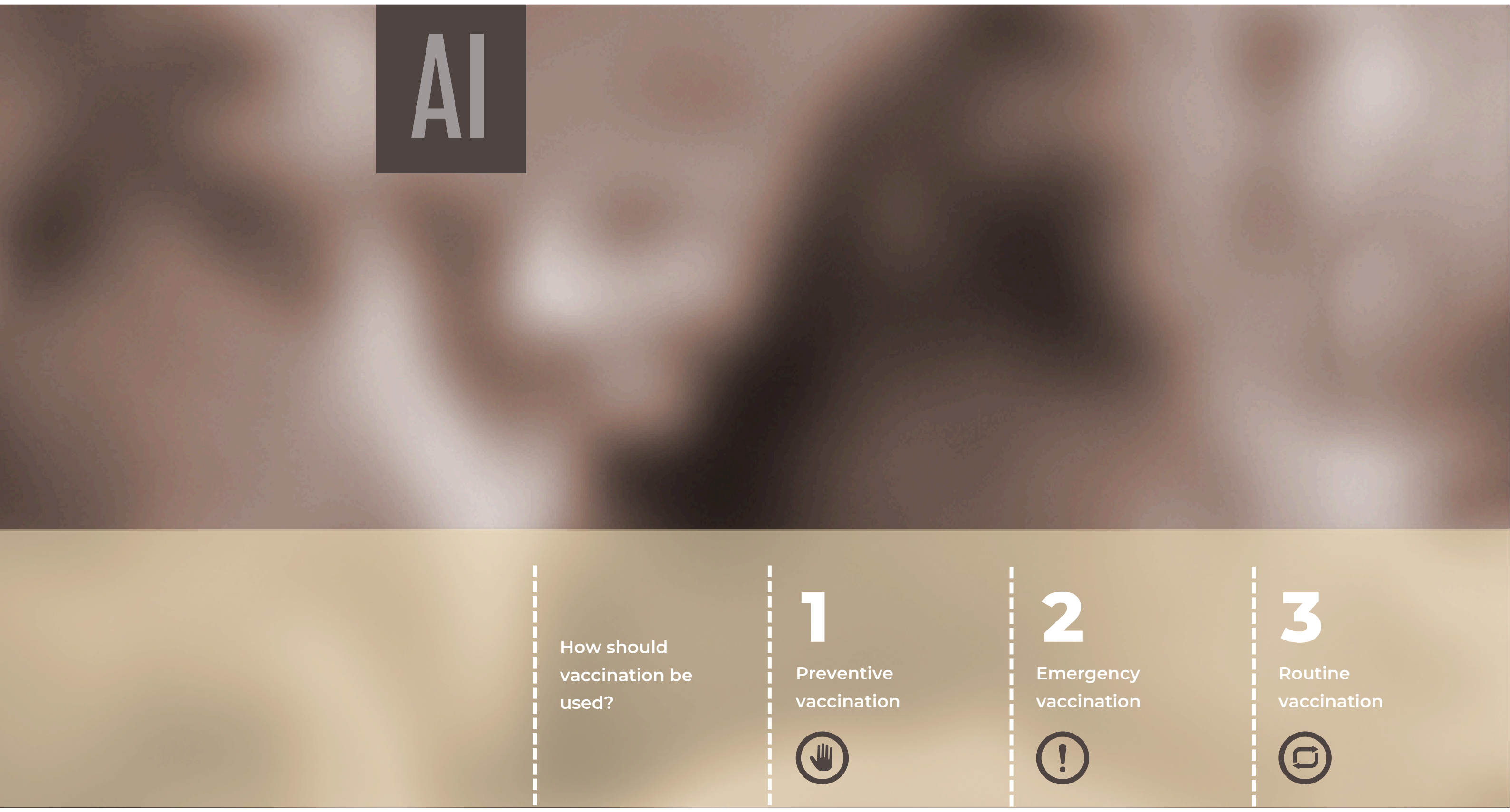
Where has vaccination against HPAI been used?

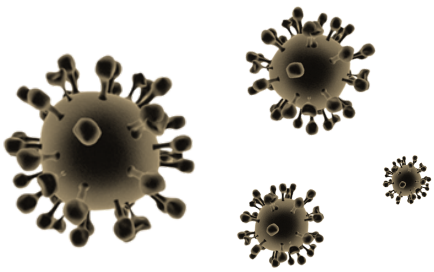
Vaccination against HPAI has been used since the early 2000s in countries where the virus could not be eliminated using standard control methods. In these "endemic" countries, vaccination was used primarily because of the nature of the poultry sector and disease control infrastructure and was aimed at suppressing infection and disease, largely to protect food security and livelihoods. It also helped to reduce exposure of humans to these viruses, thereby assisting in preventing spill over of virus from birds to humans. Although vaccination has not resulted in the elimination of virus from these regions (and these vaccine programmes were not designed to do so), many lessons from these vaccination programmes have been learned about vaccine efficiency[1] and other factors affecting vaccination effectiveness[2].

Vaccination has been used for over 20 years in Hong Kong SAR, which has a zero-tolerance for HPAI. The decision to start was made when it was evident existing biosecurity measures were insufficient to prevent all infections in farms and markets. The experiences there demonstrate that vaccination can be used successfully in a place at high risk of viral incursion. Furthermore, appropriate multi-layered surveillance systems can be implemented to detect infections, and demonstrate with a high degree of confidence that transmission of virus is not occurring in vaccinated flocks.

What other reasons are given for not using vaccination in the past?

As discussed above, vaccines against HPAI have not been used in the USA, Europe and other high income countries, largely because the disease could be managed using traditional measures. Nevertheless, using events in the USA in 2015 and 2022-25, as an example, these measures came at a high cost, with over 230 million head of poultry destroyed in each outbreak, with severe impacts on business continuity and availability of eggs and egg products.





Several other factors have influenced decisions to not use vaccines. The main concerns relate to trade, given some importing countries would not allow live poultry or raw poultry products to be imported from any country where vaccines are being used. Current World Organisation for Animal Health (WOAH) guidance in the Terrestrial Animal Health Code does not place restrictions on trade for vaccinated birds or products, provided an appropriate surveillance system is in place to demonstrate infection is not occurring (see surveillance section). There is no scientific reason why vaccinated poultry or products from vaccinated poultry cannot be traded safely, but some existing bilateral trade agreements may require renegotiation before vaccination can be deployed.

Other barriers to vaccination were discussed in meetings organised by the International Alliance for Biological Standardization (IABS) in Paris at WOAH headquarters in October 2022 and October 2024. Some of these, including the likelihood of silent infection in well-vaccinated flocks, are unlikely to occur. If silent infection were to occur, appropriate, cost-effective, targeted surveillance systems put in place to provide trading partners with evidence that vaccinated flocks are free from infection will allow virus to be detected.

All viruses have the ability to mutate. Updates to vaccines are required when there is evidence from the field or laboratory studies that currently used vaccines may no longer prevent infection and stop transmission of the virus in vaccinated flocks.

One of the main conclusions from the IABS meetings was that all the barriers to usage of vaccination against HPAI can be overcome.

Are suitable vaccines available?

As of October 2025, vaccine availability is a short-term concern that can be resolved once demand for vaccines increases and market signals to manufacturers demonstrate a demand for appropriate products. Note that most vaccines currently available require injection of individual birds and, for inactivated vaccines, require at least two doses, and likely additional booster for long-lived poultry. Live virus-vectored vaccines suitable for administration in the hatchery are available and can provide extended immunity against a wide range of viruses. Some novel vaccines based on mRNA technology have been developed and successfully used in France to protect domestic ducks.

How should vaccination be used?

Vaccination can be used (in partnership with other measures):

- As a preventive measure, in high-risk places before infection occurs in poultry, such as in response to an increase in the threat level (emergency vaccination, WOAH Terrestrial Animal Health Code Article 4.18.3.) or as an on-going programme (systematic vaccination, WOAH Code);
- As an aid to control outbreaks when they occur (emergency vaccination, WOAH Code); or
- As a routine measure, to reduce the likelihood of infection and prevent disease in poultry and humans in "endemic" countries (systematic vaccination, WOAH Code).

The populations to be vaccinated should be supported by risk assessment that considers the likelihood of exposure to field virus. It might be that it is appropriate to apply vaccination to specific sectors at increased risk which might also vary according to region. There is not a one-size-fits-all approach for any country/region/system.

It is important to bear in mind that the success of a vaccination programme not only depends on technically sound and effective elements, but consistently proper execution. This implies that all persons involved should act according to the plan in a consistent way.

The essential components of an effective HPAI vaccination programme for prevention and emergency management are:

1. Vaccination is an additional layer of protection to existing/enhanced biosecurity measures, not a replacement.

2. A national or regional emergency vaccine bank, or adequate commercial supplies of registered or authorised vaccines that are an appropriate match to field viruses must be available to support vaccination.

3. Register and use only high quality (high potency) vaccines to produce a robust immune response to circulating strains of virus; the vaccine must be capable of preventing or significantly reducing infection, preventing or significantly reducing shedding upon infection, and sufficiently reducing transmission between vaccinated birds (R<1)[3]. Vaccines that are no longer affording appropriate protection against circulating strains of virus should be de-registered and removed from use.

4. Vaccine(s) used should have been (laboratory) tested in birds vaccinated under field conditions, and either assessed using established *in vitro* serological methods or *in vivo* challenge experiments against circulating HPAI field stains.

5. If inactivated vaccines are used, antigenically relevant vaccine seed strains that closely match the field virus (based on antigenic cartography and other methods) should be used; this should be kept under continuous review against the circulating field viruses; novel vaccines based on viral nucleic acid should be kept up to date by modifying the genetic code of the nucleic acid in the vaccine.

6. Updating of vaccine antigens should not require a full re-registration of vaccines. A cassette system should be used that allows vaccines to be updated.

7. Vaccines should be administered in accordance with manufacturer's instructions and used in a manner that does not result in inadvertent spread of virus because of poor hygiene and biosecurity breaches by vaccinators. Labour considerations for timely and accurate vaccine application (sourcing workers, training, and compliance assessments) must be addressed.

8. Individual birds should be given the appropriate number of doses of vaccine over their lifetime, usually a minimum of two doses if using inactivated vaccines and possibly more if immunity wanes over the life of a flock.

9. Vaccinated flocks should be monitored regularly for immune response to vaccination where this is possible. Revaccination should be considered if appropriate levels of coverage are not obtained, or levels of immunity fall below acceptable levels[4].

10. Continually review the programme for its effectiveness, having set clear objectives at the onset including a rationale for the discontinuation of vaccination. The programme should be modified based on these reviews including changes of scope and target species as required.

Surveillance for infection in vaccinated flocks:

1 There are no technical barriers to designing and implementing surveillance systems that demonstrate, with a high degree of confidence, that vaccinated flocks (individually and collectively) are not infected, or for early detection of transmission of virus in vaccinated flocks.

2 Various methods can be used alone or in combination, including detection of virus in healthy or dead birds, environmental samples and serological tests that can demonstrate protection, or differentiating infected from vaccinated animals (DIVA) serological tests. Each has strengths and weaknesses, but by using a multi-pronged approach the immune status and infection status of vaccinated flocks can be assessed throughout the life of vaccinated birds.

3 Methods that detect virus provide information about the status of the flock at the time samples are collected, whereas serological (DIVA) testing provides evidence of events in the flock in the past but may be difficult to interpret if other avian influenza viruses are also circulating. Nevertheless, continuous negative DIVA serological test results enhance confidence that a farm has a stable HPAI virus-free status.

4 DIVA serological test results alone should not be used as the basis for declaring a flock to be infected with an HPAI virus. Positive DIVA serological results are a signal for additional investigations to detect active infection, using tests to detect virus.

5 Any surveillance system implemented must be sufficiently sensitive to detect transmission of virus in a flock, but must also be cost-effective, time-sensitive, and logistically feasible. This may require assistance of producers, private veterinarians and private laboratories when implementing surveillance systems for vaccinated flocks.

6 Targeted surveillance based on dead bird testing offers immediate information on infection status of a flock. It increases the sensitivity of the surveillance system when compared to random testing of healthy birds (which has a much lower sensitivity) and is less costly to perform if swabs are collected from birds at source by producers/company veterinarians and kept refrigerated in appropriate transport media, rather than submitting carcasses or tissues to laboratories. Appropriate pooling of samples can further reduce the cost of testing without reducing the sensitivity for detecting infections. It is recommended to develop a sensitive protocol for surveillance based on environmental samples collected in the poultry houses.

7 Discussions between exporting and importing countries, with the engagement of the World Organisation for Animal Health (WOAH) and the World Trade Organization (WTO), are needed to ensure that surveillance systems proposed by exporting countries will be acceptable to all parties. The design of an appropriate surveillance system is best based on a (quantitative) risk assessment comparing the risk of trade in the vaccinated situation with that of the unvaccinated situation in the same region/country. The protection of well-vaccinated flocks against virus transmission needs to be considered in the risk assessment.

8 If a vaccinated flock is found to have evidence of HPAI virus transmission through detection of virus, it will be treated in the same manner as an unvaccinated infected flock with timely reporting of the case to WOAH and action on the farm to prevent onward transmission.

9 WEO recommends that all trade decisions should be based on sound science and that there is no scientific justification for bans on trade of poultry or poultry products if appropriate surveillance systems are in place, as stipulated by WOAH in the Terrestrial Animal Health Code.

ENDNOTES

[1] Vaccine Efficacy. Low antigenic mass in H5 AI vaccines is a less common problem today than it was 10 years ago. The marketplace has demanded high potency vaccines and most manufacturers have provided such to stay in business. However, in some regions, antigenic drift of the field viruses has occurred such that older classic H5 vaccine seed strains have lost efficacy and continual evaluation and match of vaccine seed strains against field viruses is needed to maintain relevant protective vaccine seed strains.

[2] Lack of adequate protection in the poultry population has been associated with a variety of application and related issues including: unrealistic plans not matched by capacity to implement resulting in many targeted flocks remaining unvaccinated; improper vaccination techniques; trying to get field protection from a single vaccination; maternal and active immunity interference; immunosuppressed populations; improper storage & handling of vaccines; administration of reduced vaccine dose; high environmental exposure to virus; farmer resistance to vaccination; high population turnover rate in poultry; logistical problems with administration, and vaccination "burn-out."

[3] R = reproduction number such that in a vaccinated population where R<1, an infected bird will infect on average fewer than 1 other bird, resulting in rapid fade out of the infection in the flock.

[4] The following can be used as guidance for appropriate responses to inactivated (killed antigen) vaccines. At least 80% of the poultry flock should have evidence of a response to vaccination (i.e. vaccine coverage based on hemagglutination inhibition [HI] titres using the vaccine antigen) and 80% of vaccinated birds are protected (i.e. protective HI antibody titre using the field strain). This should be checked regularly and booster inactivated vaccination should be given if less than 80% of the chickens meet the minimum titre. For HVT vectored vaccines it is recommended that vaccinated flocks be tested for evidence of the vector virus in feather pulp (80%+) 4 weeks after vaccination. If not, consider revaccination with another type of vaccine.

WEO AVIAN INFLUENZA GLOBAL EXPERT GROUP

The Avian Influenza Global Expert Group was established in September 2015 and brings together top scientists and experts from around the world to propose practical solutions to combat avian influenza in the short, medium and long term.

The group brings together world class scientists, industry experts, and senior representatives from the World Health Organization (WHO) and the World Organisation for Animal Health (WOAH).

Visit our website to learn more about this group and its members:
www.worldeggorganisation.com/our-work/avian-health/avian-influenza-global-expert-group/

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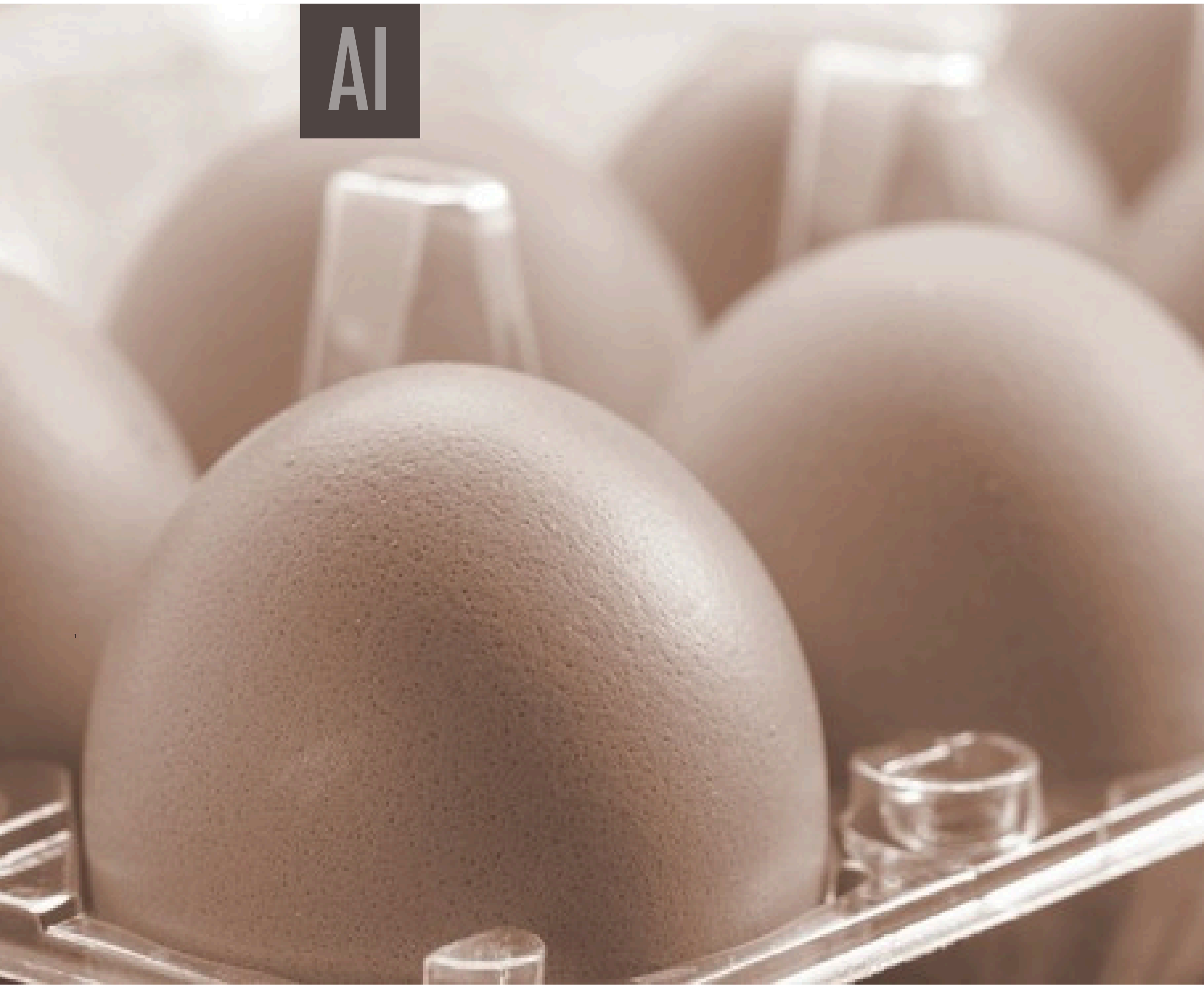

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