Lohmann & *Salmonella* Prevention

A pioneering story leading to a Global Expertise
Outline

- *Salmonella* awareness
- Spotlight on the Poultry industry
- Lohmann portfolio through the years
- Statements for “Global Expertise”
Starting point for *Salmonella* awareness

1988

- **The protagonist**: Ms. Edwina Currie, Junior Health Minister UK
- **The sentence** (19 words): “We do warn people, that most of the egg production in this country, sadly, is now infected with *Salmonella*”
- **The media impact → BBC**: December 3rd, 1988: Health minister Edwina Currie has provoked outrage by saying most of Britain’s egg production is infected with the *Salmonella* bacteria.
- **The consequences**:
  1. Currie had to resign in December 1988
  2. Accumulated losses of income until August 1990: nearly 1.330 million £ (70 million £ / word)
Starting point for *Salmonella* awareness

1990

Reinforcement of National Awareness Campaign (UK)

Rising of skepticism across Europe

Initially launched by the industry in 1986
Starting point for *Salmonella* awareness

2001

**The Telegraph**

Currie 'was right' on salmonella

By David Millward
12:01AM GMT 26 Dec 2001
History of human *Salmonella* infections (EU level)

Emergence of human cases of *Salmonella* Enteritidis (Awareness)

After Mandatory Measures

According to a manuscript describing data from 49 countries, it was reported that *Salmonella Enteritidis* was the most common serotype worldwide, followed by *Salmonella Typhimurium*.
Distribution of food vehicles in strong evidence food-borne outbreaks caused by Salmonella in the EU, 2007

Distribution of food vehicles in strong evidence food-borne outbreaks caused by Salmonella in the EU, 2010

**Salmonella control is a dual issue:** two main concerns

<table>
<thead>
<tr>
<th><strong>Non-Typhoid Salmonella</strong></th>
<th><strong>Typhoid Salmonella</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Serovars Involved</strong></td>
<td></td>
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<tr>
<td>Relevant serovars:</td>
<td>Relevant host-specific serovars:</td>
</tr>
<tr>
<td>Enteritidis and Typhimurium</td>
<td>Gallinarum (adult birds) cause Fowl Typhoid</td>
</tr>
<tr>
<td>Other serovars:</td>
<td>Pullorum (young birds) Pullorum Disease</td>
</tr>
<tr>
<td>EU: Infantis, Hadar, Virchow</td>
<td>Chickens (Avian Disease)</td>
</tr>
<tr>
<td>US: Kentucky, Newport, Senftenberg</td>
<td></td>
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<tr>
<td>ASIA: Weltevreden, Anatum, Stanley</td>
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<tr>
<td>Latin America: Typhi, Montevideo, Paratyphi B</td>
<td></td>
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<tr>
<td>Human being (Foodborne Zoonoses)</td>
<td></td>
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<tr>
<td><strong>Target Species</strong></td>
<td></td>
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<tr>
<td>Human being</td>
<td>Chickens (Avian Disease)</td>
</tr>
<tr>
<td><strong>Economic Impact</strong></td>
<td></td>
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<tr>
<td>Food safety issue:</td>
<td>Animal health issue:</td>
</tr>
<tr>
<td>Compromises reputation and constant demand from the market.</td>
<td>Compromises productivity (morbidity and mortality).</td>
</tr>
<tr>
<td>In severe cases death of infected humans can occur</td>
<td>Great economic losses in different parts of the world.</td>
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<tr>
<td><strong>Regional Impact</strong></td>
<td></td>
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<tr>
<td>Relevant for selected markets</td>
<td>Relevant for developing markets</td>
</tr>
<tr>
<td>(EU, US, Japan and exporting countries)</td>
<td>(Asia, Latin America, CIS, Middle East and Africa).</td>
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<tr>
<td><strong>Preventive Approach</strong></td>
<td></td>
</tr>
<tr>
<td>Pre-harvest → Vaccination</td>
<td>Pre-harvest → Vaccination:</td>
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<tr>
<td>▪ Prevent organ colonization as early and as effectively as possible</td>
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<tr>
<td>▪ Reduce shedding and spreading.</td>
<td>▪ Reduce shedding and spreading.</td>
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<tr>
<td>Post-harvest:</td>
<td>Pre-harvest → bacteriophages?</td>
</tr>
<tr>
<td>▪ Reduce Salmonella “load” at any step of food processing</td>
<td></td>
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<tr>
<td>▪ Consolidate “Salmonella-free” steps in food processing</td>
<td></td>
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<tr>
<td>▪ Cooling chain</td>
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<tr>
<td>▪ Proper handling of food (kitchen hygiene)</td>
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Spotlight on the Poultry industry
Spotlight on the **Poultry industry**

<table>
<thead>
<tr>
<th><strong>Veterinarians</strong> (either independent or integrated)</th>
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<tbody>
<tr>
<td><strong>Expectations</strong></td>
</tr>
<tr>
<td>- Timely supplies</td>
</tr>
<tr>
<td>- Comprehensive service packages</td>
</tr>
<tr>
<td>- Recognition / status / reputation</td>
</tr>
<tr>
<td>- Reasonable prices</td>
</tr>
<tr>
<td>- Product quality / safety / traceability</td>
</tr>
<tr>
<td>- Integrity / responsibility.</td>
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<tr>
<th><strong>Challenges</strong></th>
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<tr>
<td>- Scientific update.</td>
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<td>- Sustainability.</td>
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<tr>
<td>- Animal welfare.</td>
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<tr>
<td>- Field results &amp; practical diagnosis</td>
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<tr>
<td>- Regulatory compliance</td>
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<tr>
<td>- Animal Health</td>
</tr>
<tr>
<td>- Livestock management.</td>
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<tr>
<td>- Foodborne Zoonoses.</td>
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</table>
Dynamics of the Poultry industry

- World population is projected to grow from 7 billion in 2011 to 8 billion by 2050.

- Climate change may affect human and animal health by leading to new emerging serovars (e.g. monophasic *Salmonella* Typhimurium 4,5,12:i:−)

- In the past three decades, nearly 75% of all emerging human infectious diseases worldwide were originated in animals.

- The industry needs to adapt to the market fluctuations:
  - Higher production cost (feed) / Low selling price / Lower margins
  - New and more flexible competitors
  - Longer laying periods (kept up to 90 weeks).
  - Tendency to allow molting period (in some countries >50% of layers are molted).

- The industry needs to foreseen the future (production/consumption):
  - Non-poultry meat (beef, veal, pork) would have an inter-annual decrease of -0.2%
  - Poultry meat (broiler, turkey) would have an inter-annual growth of +5%
  - Current global egg production (58.9 million tones) is estimated to growth by 16.9% in 2015; in order to meet the global demand (70.9 million tones).
Self-analysis questions for the Poultry industry

- Who is requiring *Salmonella* control?
  
  the Wholesaler? 
  
  the Producer? 
  
  the Consumer?
Self-analysis questions for the Poultry industry

- How does the product reach the market?
Self-analysis questions for the Poultry industry

- Does the product carry a brandname?
Self-analysis questions for the Poultry industry

- Is the market recognising the product?
Self-analysis questions for the Poultry industry

- Does the brand have a reputation?

**Quality Seals**

**Official Certificates**

**Producers’ Associations**

**& Brands**
Self-analysis questions for the Poultry industry

- How can the product stand out?

Organic / Free Range
Omega 3 / Corn gold
Self-analysis questions for the Poultry industry

Is the end-user needing any Awareness?

- To promote the nutritional value of eggs (communicational campaign and gastronomic events).
- Expansive broadcast in the Americas, Asia, Africa and EU.
- International Egg Nutrition Consortium, created in 2012 by the US Egg Nutrition Center, with the aim of forming a global communications network (Nutritional Research & Education).
“EU is taking the lead in terms of animal welfare and producing wholesome food; nevertheless the EU is expected to become a net importer of poultry meat in 2015, therefore we empathize the added value of a holistic preventive approach to remain competitive on the global market place”

Association of Poultry Processors and Poultry Trade in the EU countries
December 2011

“Global growth of population and income rise in developing countries would increase the consumption of animal proteins by 73% on current levels in 2050. Therefore it is crucial that meat and eggs are produced as efficiently and sustainably as possible”.

Association of Poultry Processors and Poultry Trade in the EU countries
August 2012
Lohmann portfolio through the years
1994
Historical review of Lohmann *Salmonella* Vaccines

1989
- No vaccination against *Salmonella*.
- VLA (Veterinary Laboratories Agency in UK) develops a phage type 4 oil adjuvanted experimental vaccine. Changes in the adjuvant to Al(OH)3.

1990
- MDM Patent development by Prof. Dr. Klaus Linde.
- Development of Megan® Vac 1 and Megan® Egg.

1994
- Launch of **TAD Salmonella vac® T**. The first live Salmonella vaccine adapted for chicken.
- German Decree for Chicken *Salmonella* (Hühner-Salmonellen-Verordnung) establishing vaccination as mandatory.
Historical review of Lohmann *Salmonella* Vaccines

1997
- EU zoonosis controls are brought in, vaccination does not form part yet of the compulsory instruments.
- Acquisition of MBL (Maine Biological Laboratories).

1998
- Launch of Megan® Vac 1 (USDA Code 19C1.01 approved Nov 25 1998) and Megan® Egg (USDA Code 19C1.02 approved Nov 4 1998). Megan Health supplied the genetically altered isolate to Maine Biological Laboratories for development, registration and manufacturing. Maine Biological Laboratories developed and manufactured the vaccine under a commercial agreement with Megan Health, Inc.
Historical review of Lohmann *Salmonella* Vaccines

**1999**
- Launch of TAD *Salmonella vac*® E in Germany.

**2001**
- Marketing Authorization for TAD *Salmonella vac*® E in UK (first live vaccine in this country).
- USDA officially changed USDA Establishment License number 196 from Maine Biological Laboratories, Inc. to Lohmann Animal Health International, Gainesville, Georgia.
Historical review of Lohmann *Salmonella* Vaccines

2005
- Introduction of a new BEIC rule stating that breeders should be vaccinated against *Salmonella Enteritidis* and *Salmonella Typhimurium*.

2006
- R&D of AviPro® Salmonella Duo, the first bivalent live vaccine against *Salmonella Enteritidis* and *Salmonella Typhimurium*.

2007
- Maine Biological Laboratories, Inc. changed its name to Lohmann Animal Health International (LAHI). USDA Establishment License 196 address was changed to 375 China Road, Winslow Maine 04901.
Historical review of Lohmann *Salmonella* Vaccines

2009
- Lohmann Animal Health International (LAHI), purchased the vaccine licenses/patents/trademarks for Megan® Vac 1 and Megan® Egg from Cellidex, making LAHI the owners, manufacturers and marketers of the two vaccines worldwide.

2012
- Launch of AviPro® Salmonella Duo, the first bivalent live vaccine against *Salmonella* Enteritidis and *Salmonella* Typhimurium for chickens and ducks.
Leading the way in *Salmonella* prevention

- **Creation of LAG (Lohmann & Co. Aktiengesellschaft)**
  - 1970: German Decree for Chicken Salmonella (Hühner-Salmonellen-Verordnung) is established
  - 1988: 92/117: Monitoring levels of zoonotic infection in food production animals
  - 1990: Development of plans to combat zoonoses
  - 1992: Specific measures (inc. slaughter) for S. Typhimurium and S. Enteritidis
  - 1994: Measures for feed quality
  - 1999: Pertinent to breeding and laying flocks
- **MDM Patent development by Prof. Dr. Klaus Linde**
- **Launch of TAD Salmonella vac® T**
  - The first live Salmonella vaccine developed for birds
- **Launch of TAD Salmonella vac® E**
- **2004/665**
  - To study prevalence in layers
- **2005/636**
  - To study prevalence in broilers
- **1003/2005**
  - Defining targets for breeding flocks
- **2003/99**
  - Monitoring of antibiotic resistance in zoonotic pathogens and other bacteria (reservoirs)
  - Mention of need for information on vaccination and other control programmes
- **1168/2006**
  - No antimicrobials shall be used to control *Salmonella*. Vaccination is obligatory in MS when S. Enteritidis flock contamination > 10%
- **2007/99**
  - Introduction of a new BEIC rule stating that birds should be vaccinated against SE and ST
- **646/2007**
  - Defining targets for broiler flocks
- **1168/2006**
  - Defining targets for laying hen flocks

**Starting point for Salmonella awareness**
(Ms. Edwina Currie, Junior Health Minister UK)

**Launch of AviPro® Salmonella Duo**, the first bivalent live vaccine against SE and ST.

**Launch of TAD Salmonella vac® E**

**Marketing Authorization for TAD Salmonella vac® E in UK**

**Introduction of a new BEIC rule stating that birds should be vaccinated against SE and ST**

**646/2007**
- Defining targets for broiler flocks

**Salmonella360.com, for information and education on comprehensive Salmonella prevention**

**2160/2003**
- Extension to primary production (broiler) flocks
- Provision of targets
- Include the complete food chain
- National control programmes (feed, primary production, processing)
- All Salmonella serotypes
- Turkeys, breeding and slaughter pigs

**1168/2006**
- Defining targets for laying hen flocks

**Creation of LAG (Lohmann & Co. Aktiengesellschaft)**

**Foodborne Zoonoses Prevention / Marketing Plan 2013 - 2014**
Comprehensive product portfolio

Cuxhaven
- AviPro SALMONELLA DUO
- AviPro SALMONELLA VAC E
- AviPro SALMONELLA VACT

Winslow
- AviPro MEGAN® VAC 1
- AviPro MEGAN® EGG
- AviPro 329 ND-IB2-SE4
- AviPro 329 ND-IB2-SE4 Conc.
- AviPro 109 SE4
- AviPro 109 SE4 Conc.
The “Gold Standard” in *Salmonella* Prevention

- Maximum safety (MDM)
- Live vaccine administered via drinking water
- Easy application that parallels the natural path of infection, triggering the most efficient defense against *Salmonella* infections (Secretory IgA).
- Easy differentiation from the field strains
- Claim against *Salmonella* Gallinarum in specific countries.
- Billions of doses in more than 60 countries, including the most demanding markets worldwide.
**AviPro**

**SALMONELLA VACT**

The pioneering Protection against *Salmonella*

- First licensed vaccine attenuated for chickens
- Maximum safety (MDM)
- Live vaccine administered via drinking water
- Easy application that parallels the natural path of infection, triggering the most efficient defence against *Salmonella* infections (Secretory IgA).
- Easy differentiation from the field strains
- Demonstrated homologous protection against the emerging monophasic *S. Typhimurium 1,4,[5],12:i:-*
AviPro®
SALMONELLA DUO

The Bivalent solution for crucial Homologous Protection

☑ Maximum safety (Metabolic Drift Mutant)
☑ First bivalent live vaccine (coverage of groups D and B)
☑ Easy application that parallels the natural path of infection, triggering the most efficient defence against Salmonella infections (Secretory IgA).
☑ Easy differentiation from the field strains
☑ Early and long-lasting protection (at least 62 w for ST and 68 w for SE)
☑ Demonstrated homologous protection against the emerging monophasic S. Typhimurium 1,4,[5],12:i:-
☑ First licensed vaccine for ducks and turkeys (Coming soon)
☑ Ensured genetic stability for both vaccine strains (Co-fermentation)
Co-fermentation as added value in the production of AviPro® Salmonella Duo
The spray *Salmonella* for day old chicks

- Live attenuated *Salmonella Typhimurium* vaccine (live culture).
- Protection against *Salmonella Typhimurium*, *S. Enteritidis* and *S. Heidelberg* infections.
- Easy administration with either drinking water or coarse spray application.
- Does not interfere with *Salmonella* monitoring programs.
MEGAN® EGG

The spray *Salmonella* for laying hens

- The first live *Salmonella* vaccine in the USA specifically developed to protect egg layers against *Salmonella Enteritidis* (SE) infection.
- Protection against *Salmonella Enteritidis* lasting through lay.
- Coarse spray vaccination makes your control program easy and an alternative to injections.
- Does not interfere with *Salmonella* monitoring programs.
- Proven to protect hens during molt.
Inactivated vaccine, containing four different phage types of *Salmonella Enteritidis* (8, 14B, 23, 24), suspended in a stable water-in-oil emulsion.

Recommended for the vaccination of chickens as an aid in the reduction of *Salmonella Enteritidis* colonization of internal organs, including the reproductive tract.
Inactivated vaccine, containing four different phage types of *Salmonella Enteritidis* (8, 14B, 23, 24), suspended in a stable water-in-oil emulsion.

Recommended for the vaccination of chickens as an aid in the reduction of *Salmonella Enteritidis* colonization of internal organs, including the reproductive tract.

The same amount of antigen that is used in our regular AviPro® SE4 is concentrated into 250 ml of bacterin, suspended in a stable oil emulsion. This concentrated form (0.25 ml) causes less reactivity, keeping body weights and egg production.
AviPro®
329 ND-IB2-SE4

One shot - inactivated *Salmonella* Enteritidis, ND and IB.

- Inactivated vaccine for laying stock, containing sufficient quantities of inactivated Newcastle Disease virus strain LaSota; inactivated Infectious Bronchitis virus, Massachusetts type and Arkansas type; and four different phage types of inactivated *Salmonella* Enteritidis, to induce high and consistent protection against all three pathogens.
- One shot - inactivated *Salmonella* Enteritidis, ND and IB.
- Ideal vaccine to cover major diseases of layer.
- Only product on the market which has the highly cross protective effect against both IB serotypes (Massachusetts and Arkansas).
AviPro®

329 ND-IB2-SE4 CONC

One shot - inactivated *Salmonella Enteritidis*, ND and IB.

- Inactivated vaccine for laying stock, containing sufficient quantities of inactivated Newcastle Disease virus strain LaSota; inactivated Infectious Bronchitis virus, Massachusetts type and Arkansas type; and four different phage types of inactivated *Salmonella Enteritidis*, to induce high and consistent protection against all three pathogens.
- One shot - inactivated *Salmonella Enteritidis*, ND and IB.
- Ideal vaccine to cover major diseases of layer.
- Only product on the market which has the highly cross protective effect against both IB serotypes (Massachusetts and Arkansas).
- Available also in concentrated form (0.25 ml) which causes less reactivity, keeping body weights and egg production.
Tailor-made “Integrated Solutions” along the value-added chain

- **Consultancy** focusing on foodborne zoonoses prevention, animal health and animal welfare.

- **Multi-disciplinary, experienced team** supports egg and poultry meat producers and **Integrators** world-wide along the value-added chain.

- **Proactive** and highly customized **prevention projects**, services, tools and technical solutions to meet the challenges of today and be already prepared for the challenges of the future.
This pioneering story allows our practical success in the field and sets the fundamentals for our Global Expertise.
“Statements for our Global Expertise”

1. Comprehensive Portfolio

Cuxhaven
- SALMONELLA DUO
- SALMONELLA VAC E

Winslow
- MEGAN® VAC 1
- MEGAN® EGG
- 329 ND-IB2-SE4
- 109 SE4
Chromosomal attenuation based on the principle of the “metabolic drift mutation” (MDM) which gives the vaccine strain three safety functions:

1. Shedding of the vaccine strain by chicks is limited to a maximum of 21 days (Linde et al., 1993; Hahn et al., 1993).

2. The strain's reduced survival in the environment entails a faster extinction (Linde & Randhagen, 1986).

3. Its sensitivity to antibiotics (doxycyclin and others) used for human therapy is increased fourfold (Linde & associates, 1993).
Reliable differentiation between vaccine strain and field strains. Also used for antibiotic susceptibility testing of isolated field bacterial strains: AviPro® Plate.
“Statements for our Global Expertise”

Science-driven technical services in the field by a staff of more than 30 specialists in animal production, bringing local solutions considering global contexts, working in close co-operation with our “Salmonella scientific network”.

4.
Glocal Service
“Statements for our Global Expertise”

Lohmann has more to offer than Avian Vaccines and Feed Additives. We also provide innovative consultancy services to master current and future challenges (e.g. Foodborne Zoonoses) worldwide and along the entire production chain.

“Our proprietary Zoonosis Risk Index (ZRI), applied farm by farm, results in a quick “traffic light” guided SWOT analysis that helps you pinpoint areas that could be optimized”. Solutions Department
“Statements for our Global Expertise”

Our “Gold standard” in *Salmonella* Prevention, based on thousands of satisfied customers in more than 50 countries (more than 5 billion doses sold to date).

- **14 years** with AviPro® Salmonella Vac E
- **19 years** with AviPro® Salmonella Vac T
- **1 year** with AviPro® Salmonella Duo

“Live vaccines administered via drinking water, with maximum safety (e.g. Metabolic Drift Mutation attenuation technology), reliable differentiation and easy application that parallels the natural path of infection, triggering the most efficient defence against *Salmonella* infections (Secretory IgA)”.
“Statements for our Global Expertise”

- The first live vaccine attenuated for chickens under the MDM principle
  AviPro® Salmonella Vac T

- Only product on the market ONE SHOT; protecting simultaneously against SE4 and both IB serotypes (Massachusetts and Arkansas)
  AviPro® 329 ND-IB2-SE4

- The first manufacturing technology based on the principle of “Co-cultivation”, which ensures the genetic stability for both vaccine strains.

  The first licensed *Salmonella* vaccine for ducks.

  The first bivalent live vaccine on the market conferring homologous protection against SE and ST
  AviPro® Salmonella Duo
“Statements for our Global Expertise”

An innovative website for information and education on comprehensive *Salmonella* prevention:

- Understanding the **Holistic Approach** → comprehensive knowledge
- Accessing the **Information Hub** → up-to-date news, technical and scientific publications
- Enjoying the **Educational Platform** → Live webinar sessions and panel of experts
- Experiencing the **Genuine Interaction** → Relationship oriented

8.

Interactive Experience
A pioneering story leading to a Global Expertise
Prevention first.