DIVA Vaccines in Animal Health: Development and Practical Applications

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OBJECTIVES

- To introduce the basic concepts of DIVA vaccines.
- To explain the different types of vaccines that could be used in a DIVA strategy.
- To describe DIVA strategies for several diseases that are important in animal health.
- To describe different DIVA vaccines against Classical Swine Fever.
- To design a DIVA strategy against Classical Swine Fever Virus.

DIVA VACCINES APPLICATIONS

Table 1. Description of different DIVA strategies against several diseases that are relevant in animal health

Disease	DIVA vaccine	Marker antigen	Diagnostic test	References
Aujeszky	Attenuated or inactivated vaccine with gE and/or thymidine kinase deletion	gE	anti gE ELISA anti gE-LAT ELISA	van Oirschot, 1999; Pasick, 2004; Meeusen et al., 2007; Singh, 2015
Infectious Bovine Rhinotracheitis (IBR)	Attenuated vaccine with gE deletion	gE	anti gE ELISA	van Oirschot, 1999; Meeusen et al., 2007; Singh, 2015
Foot and Mouth Disease (FMD)	Inactivated vaccine is not expressing non-structural proteins (NSP)	NSP	anti NSP ELISA	Pasick, 2004; Uttenthal et al., 2010
Avian influenza	Live viral vector vaccine (fowlpox virus expressing H5 antigen)	Nucleoproteins (NP) or matrix proteins (M)	anti NP/ M ELISA anti NP/ M AGID	Meeusen et al., 2007; Uttenthal et al., 2010
	Chimera H5N3 virus	N3/N1	anti N3/N1 ELISA Indirect immunofluorescence	Meeusen et al., 2007; Singh, 2015

DIVA VACCINES AGAINST CLASSICAL SWINE FEVER VIRUS (CSFV)

Table 2. Types of marker vaccines developed against CSF

Type of vaccine	Marker antigen	Diagnostic test	References
E2 subunit vaccine	Inoculation of the E2 glycoprotein	anti NS3 ELISA anti Erns ELISA	Dong y Chen, 2007; Huang et al., 2014; Singh, 2015
Peptide vaccine	Inoculation of peptides from antigenic domains of E2	anti NS3 ELISA anti Erns ELISA	Dong y Chen, 2007; Huang et al., 2014
DNA vaccine	Inoculation of plasmids that encode E2 sequence	anti NS3 ELISA anti Erns ELISA	Dong y Chen, 2007; Huang et al., 2014
Chimeric pestivirus	E2 encoding sequence are inserted into a BVDV backbone or viceversa	anti E2 ELISA anti NS3 ELISA anti Erns ELISA	Dong y Chen, 2007; Huang et al., 2014; Singh, 2015
Viral vector vaccine	Expression of E2 integrated into the genome of others viruses	anti NS3 ELISA anti Erns ELISA	Dong y Chen, 2007; Huang et al., 2014

CONCLUSIONS

- Currently, the use of conventional vaccines remains essential for disease control and eradication, especially in endemic countries.
- Although some of the DIVA strategies look promising, it is necessary to continue working in this area to improve the different types of vaccine as their corresponding diagnostic tests.
- Chimeric vaccines are the most promising DIVA strategy against CSFV but further research must be implemented.
- E2 subunit vaccines are economically and technically easy to produce. If their effectiveness and their diagnostic tests are improved, this type of DIVA vaccines will be a very promising strategy.

INTRODUCTION

The term DIVA is an acronym for "Differentiating Infected from VAccinated individuals" introduced by J.T van Oirschot. The DIVA strategy is formed by a vaccine and its companion diagnostic test (van Oirschot, 1999).

Countries that want to acquire the disease free-status following the vaccination path should introduce a DIVA strategy.

Also the introduction of a DIVA strategy is an alternative to the stamping out strategy that disease free countries follow to control the outbreaks (Singh, 2015).

DIVA STRATEGY AGAINST CSFV

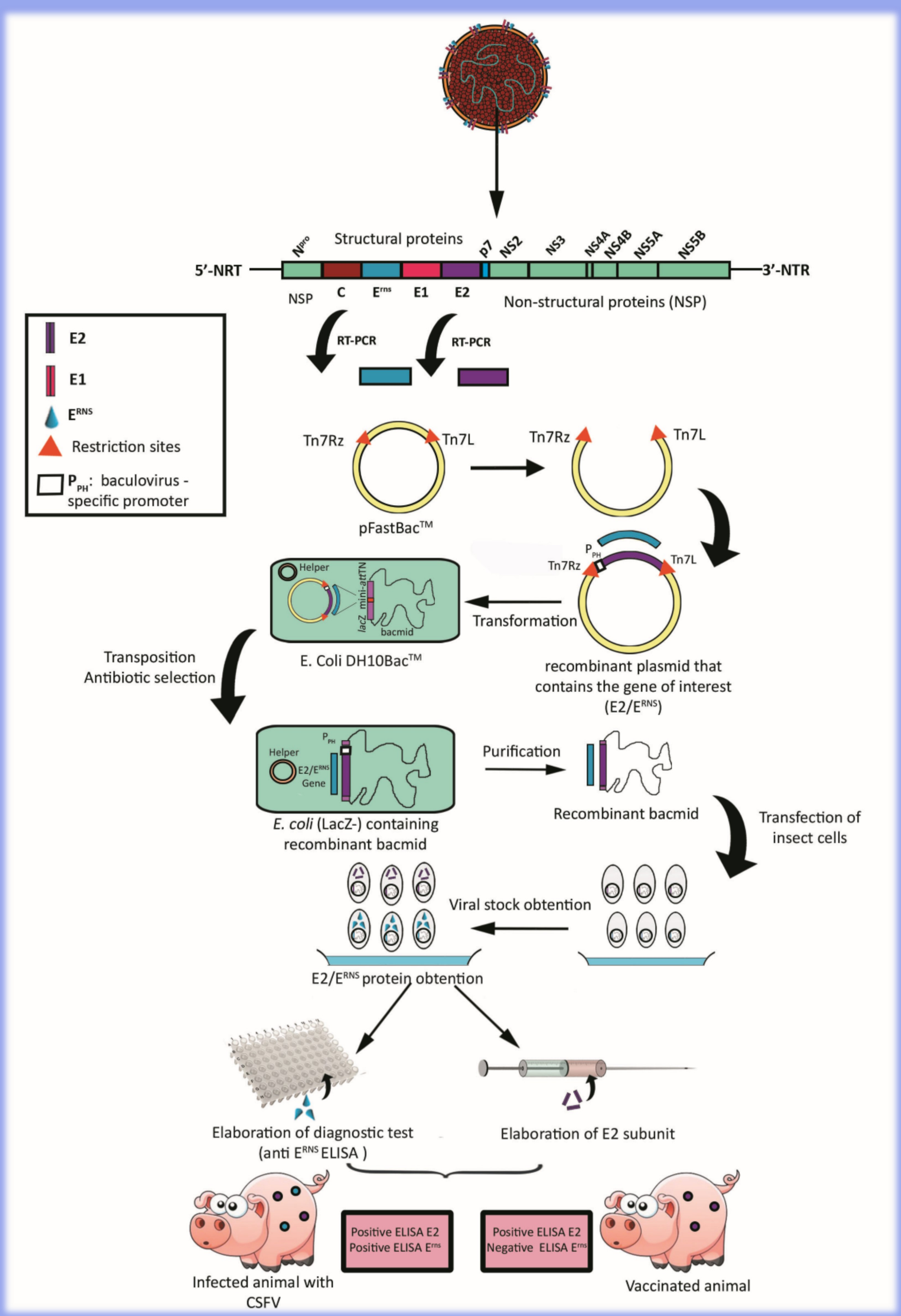

Fig 1. Schematic description of the process to obtain an E2 subunit vaccine and its companion diagnostic test

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