

**EADGENE** European Animal Disease Genomics Network of Excellence for Animal Health and Food Safety

**Genomics for Animal Health: Outlook for the Future**  
 13- 14th October 2009, Muséum National d'Histoire Naturelle, Paris, France

**Technology transfer**  
**SNP-assisted selection for resistance to Salmonella carrier-state**

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**EADGENE** Introduction

**Objectives**

- To search for SNP markers associated with resistance to Salmonella carrier-state
- To test the efficiency of SNP assisted selection for increased resistance to Salmonella carrier-state

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**Resistance to carrier-state**

- Animal's ability to get rid of bacteria
- ≠ resistance to disease
- To increase food safety

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**Animal material**

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**Differences between chick and adult resistance**

$R_g = -0.4$

Beaumont *et al* 2009 Genet Research

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**Modelling Salmonella propagation**

Percentage of hens (%)

Days

— Sal+ line  
 — base line  
 ..... Sal- line

Prevost *et al* 2008 Vet Res

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### Which genetic control?

- Which genes control differences between Sal+ and Sal- lines?
- Are genes identified in experimental lines involved in these differences?
- Are genes controlling chick and adult resistance different?

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### Previous results

#### Some genes common to different lines

QTL analysis Inbred lines N and 61  
Tilquin et al 2005 GSE

Confirmation Sal+/Sal- lines  
Calenge et al 2009 An Genetics

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### Previous results

#### Genes differ according to chicken's age

In the divergent Sal+/ Sal- lines:

**SLC11A1, QTL 1-1**      **SLC11A1, MHC**

Calenge et al 2009 An Genetics

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### Experiment 1 : chicks

400 chicks issued from 10 sires and 80 dams

SNP typing 1536 SNP - PTP - Illumina      artificial infection with *S. Enteritidis*

Analysis by INRA in collaboration with members of Club of interest.

Mating of animals with extreme values and hatches (Hendricks)

Measures of 100 chicks issued from 4 sires and 12 dams (INRA)

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**EADGENE** Methods

### Experiment 2 : adults

200 hens issued from 6 sires and 48 dams

SNP typing 1536 SNP - PTP - Illumina      artificial infection with *S. Enteritidis*

Analysis by INRA in collaboration with members of Club of interest.

Mating of animals with extreme values and hatches (Hendricks)

Measures of 50 hens (INRA)

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### Artificial infection - INRA ...achieved

400 chicks (Saly-, Saly+)      200 hens (Saly-, Saly+)

1 week      peak of lay

Salmonella Enteritidis infection Oral infection

5 weeks      4 weeks

Phenotyping

Caecal load (log(ufc))      Presence in spleen/ caeca/ liver

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**SNP typing - PTP** ...just achieved

1536 SNP panel made of:  
1342 SNPs from IAH's panel - Genome scan  
194 SNPs within 3 QTL regions

- ▶ **GGA1**  
QTL confirmed in the Sal+/Sal- lines (chicks)
- ▶ **GGA2**  
QTL identified in the N and 6 lines (F2)
- ▶ **GGA5**  
QTL *SAL1* (6. and 151 lines, BC) (Mariani *et al* 2001 Immunogenetics)

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**Genetic evaluation - INRA** ...underway

- **Association analysis**
  - Evaluation of each SNP effect on carrier state variation (Meuwissen *et al* 2001 ; Legarra and Misztal 2008 J Dairy Sci 91: 360-366)
  - Evaluation of each animal's genetic value
- **SNP assisted selection**

Ch **Phenotypic selection** of the best genetic values as established with SNPs

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**Conclusion**

- **Achieved to date:** artificial infections, phenotypic selection and SNP typing.
- **Underway:** association analysis.
- **Expected outcomes:**
  - identification of SNPs associated with carrier state resistance variation,
  - genetic differences between chicks and adults.

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IAH Compton  
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