

Impact of thermal manipulation during embryogenesis on hepatic metabolism in mule ducks

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DUBROVNIK September 19, 2018



UMR NUREA
40 000 Mont de Marsan, France

Director: Stéphane Davail
Co-director: Marianne Houssier





Context of foie gras

- France: 1st world producer of « foie gras » with 20.000t/year
- Southwest products 72%



♂ Muscovy
Cairina moschata



♀ Pekin
Anas platyrhynchos

- Societal pressures

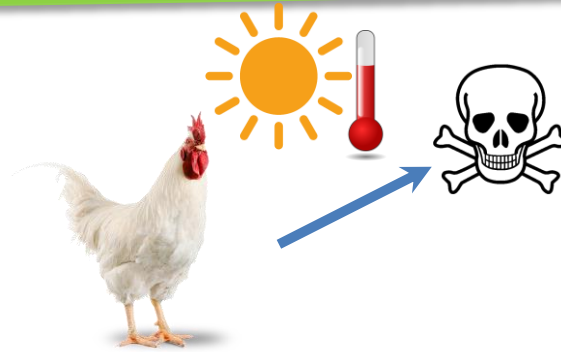
- Find new solutions



mule

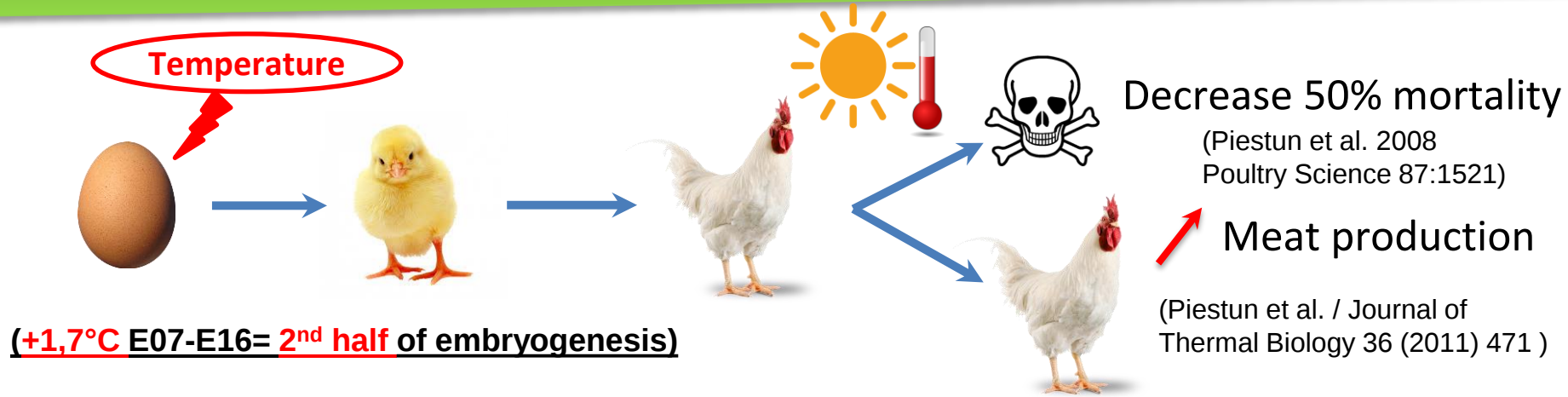


Actual data



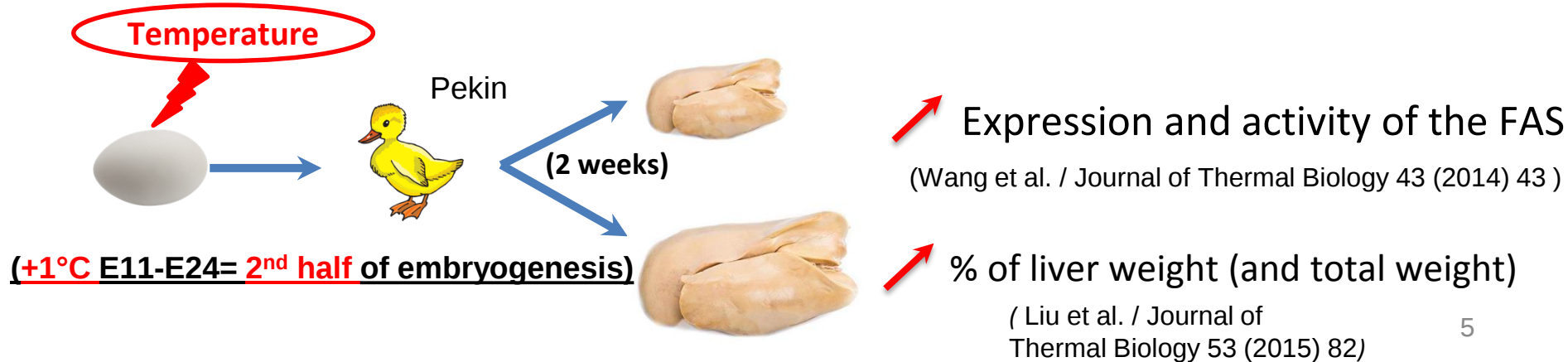
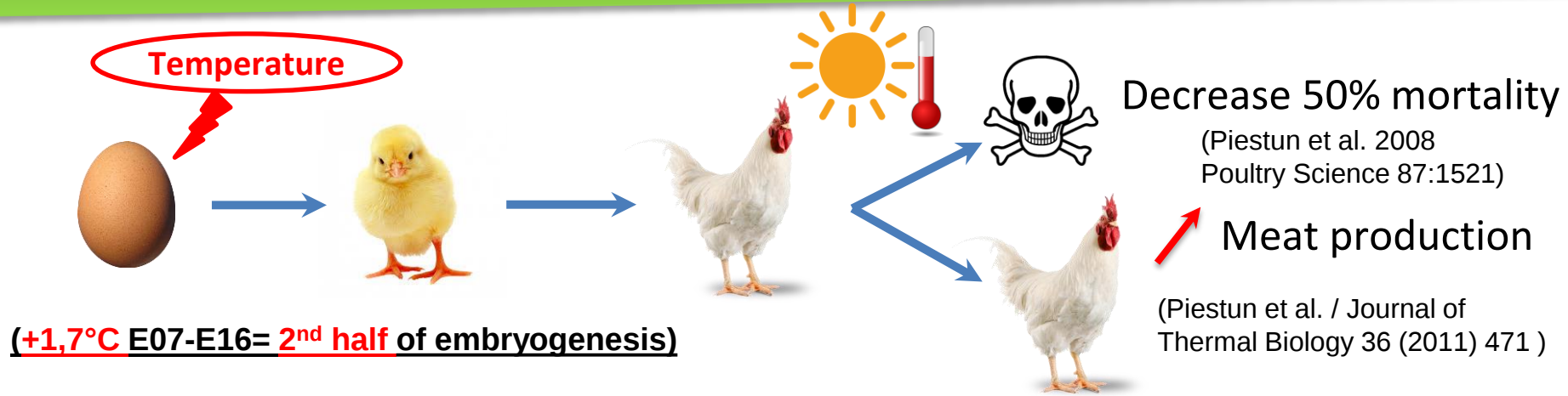


Actual data





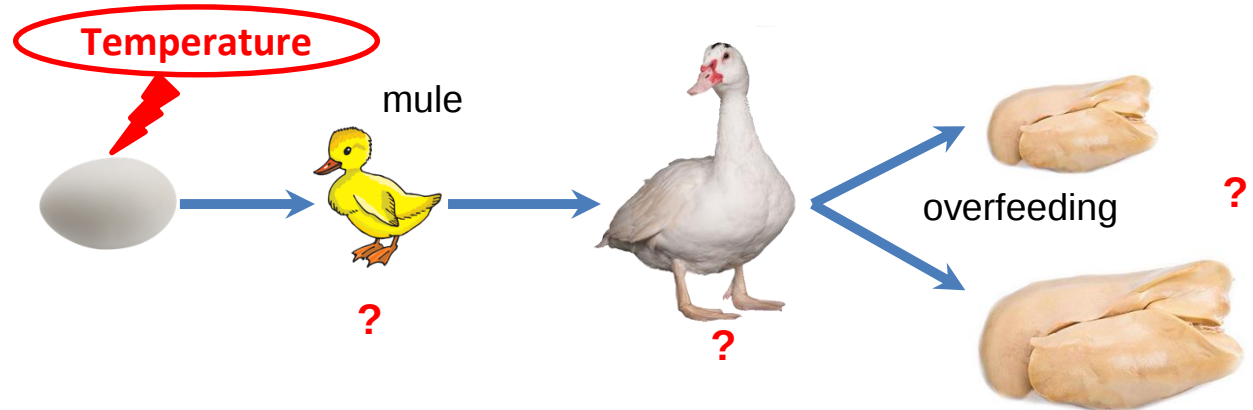
Actual data





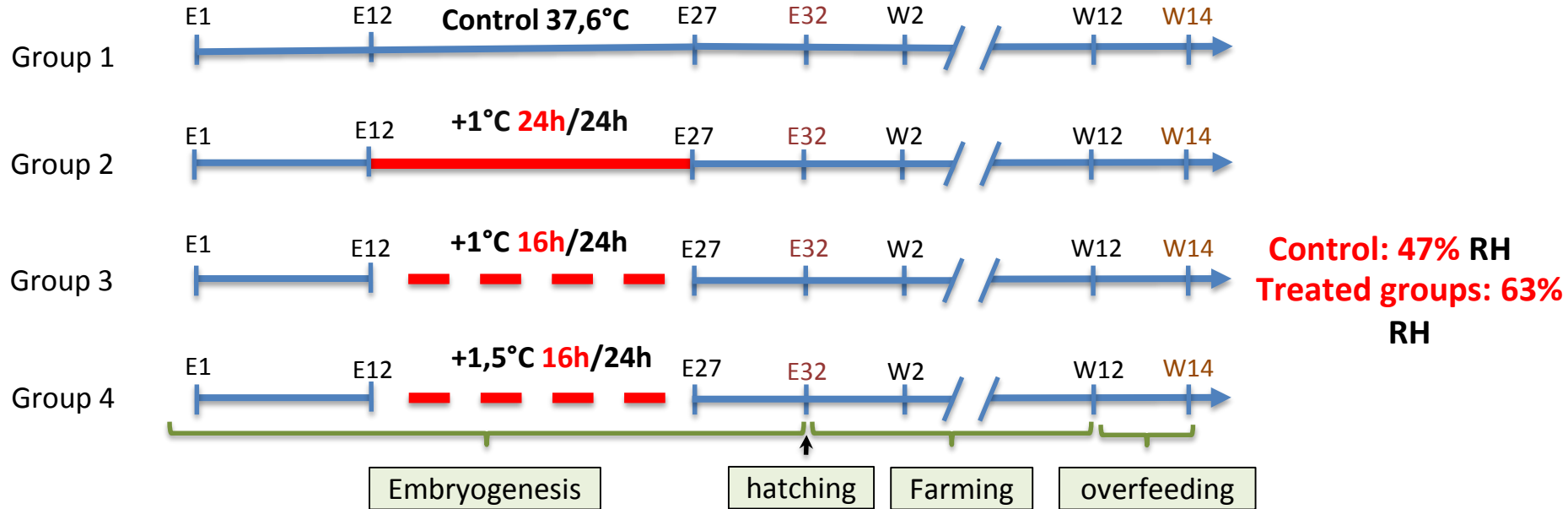
Phd project: Objectives

Thermal manipulation



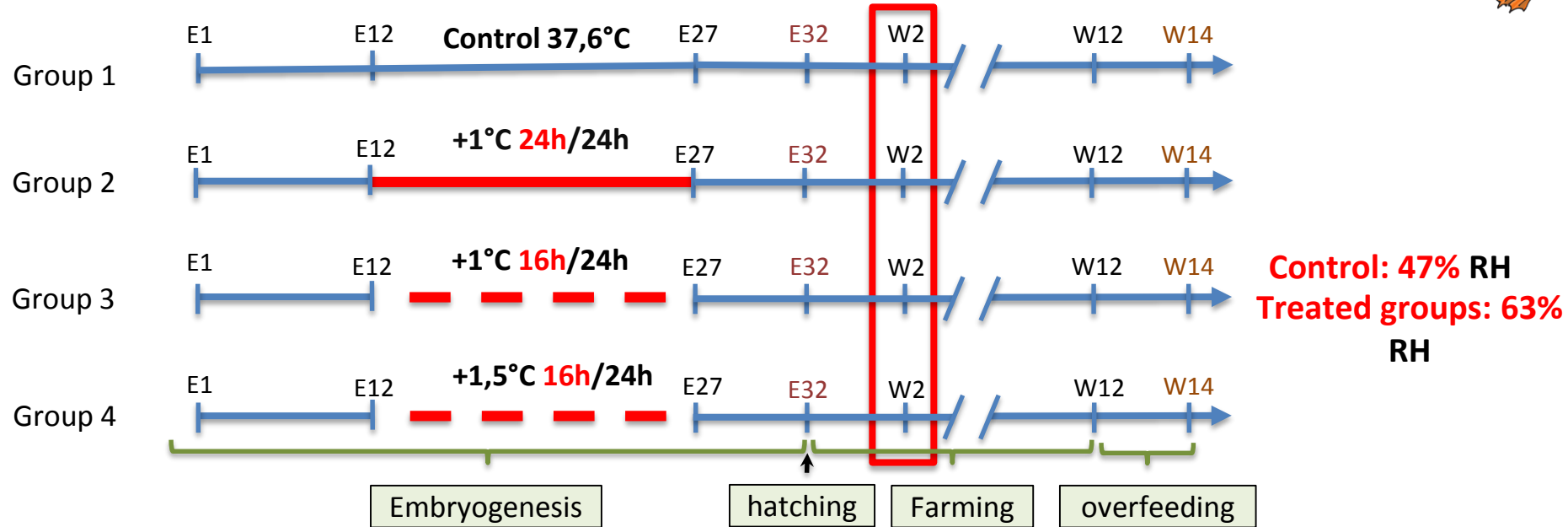


Study: Thermal programming



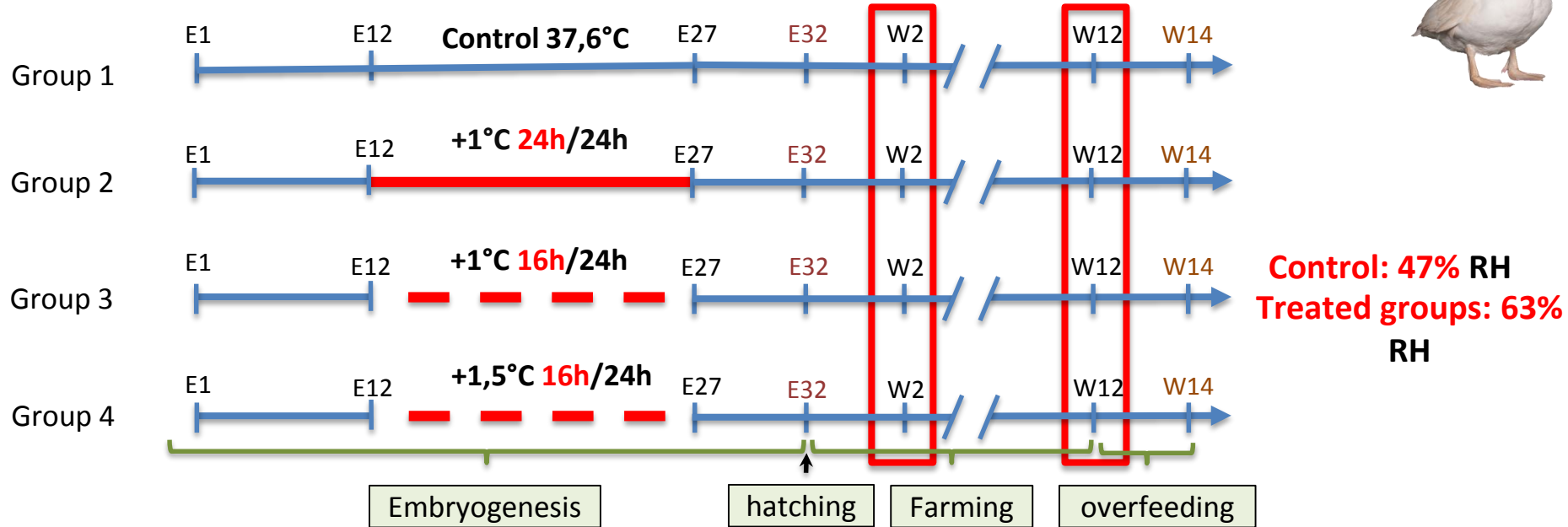


Study: Thermal programming



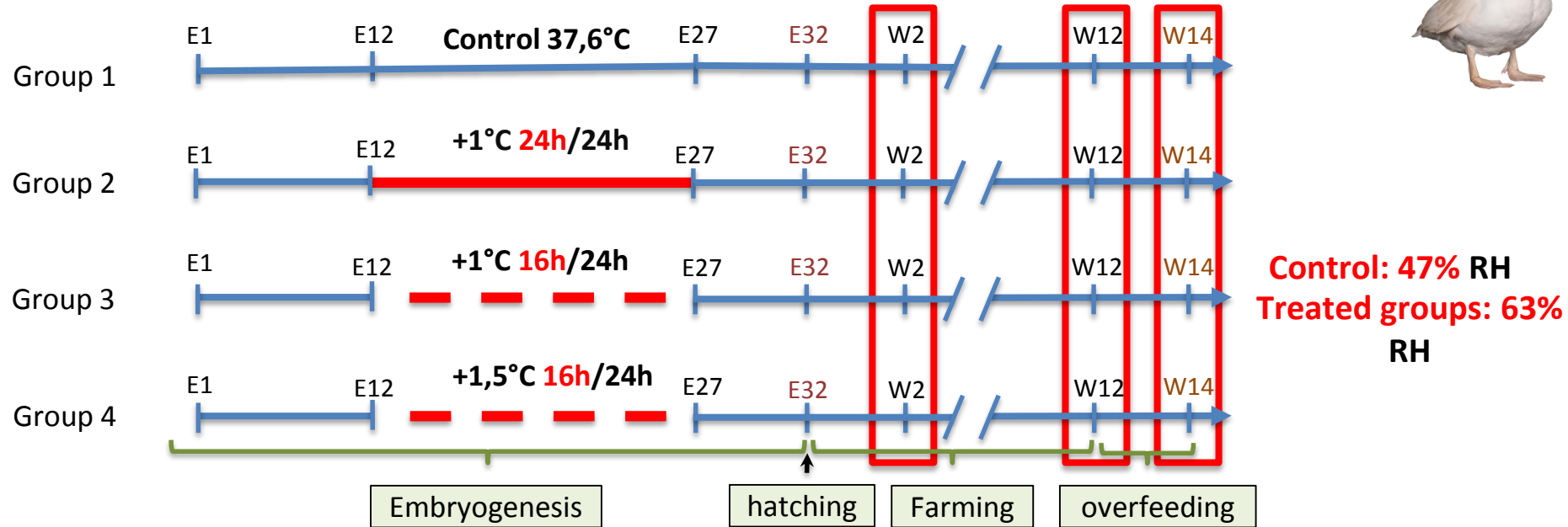


Study: Thermal programming

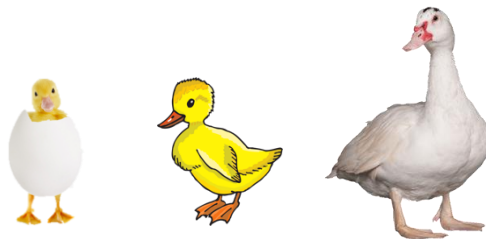




Study: Thermal programming

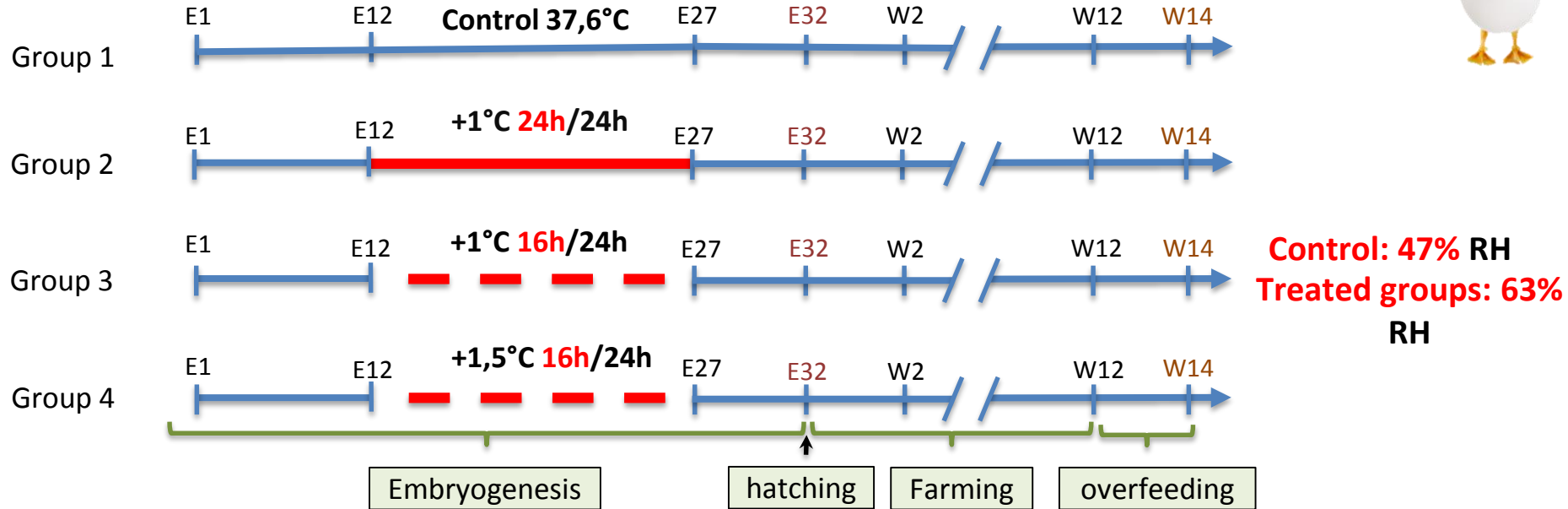


Zootechnical Results



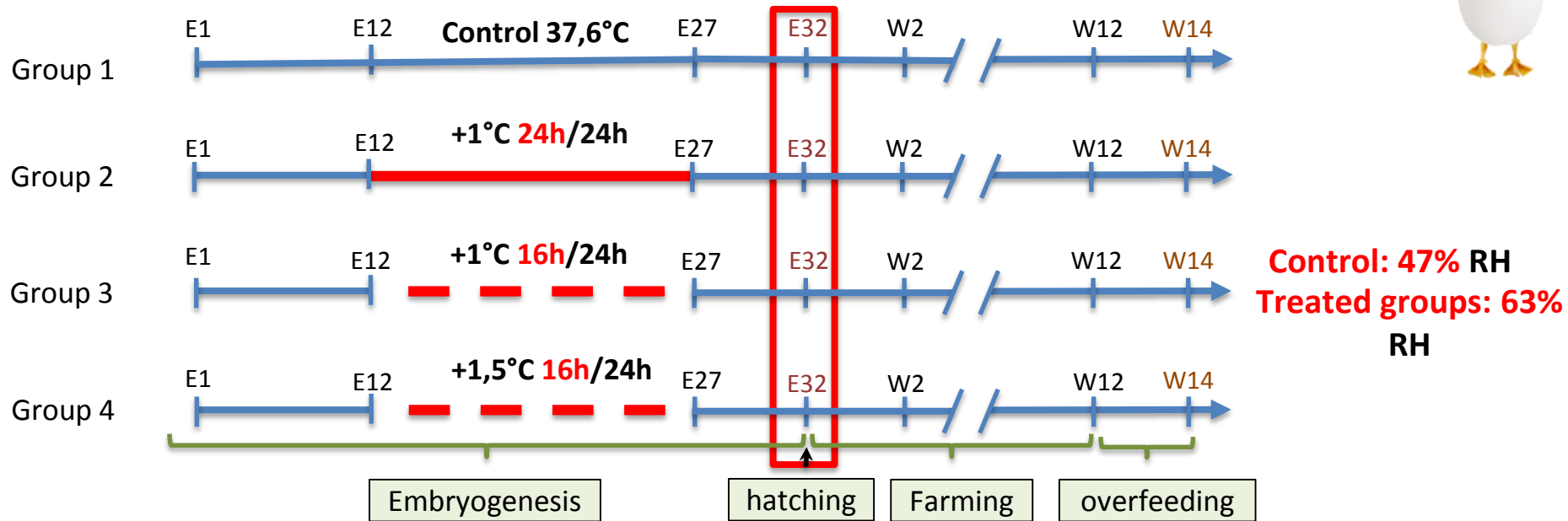


Results at hatching



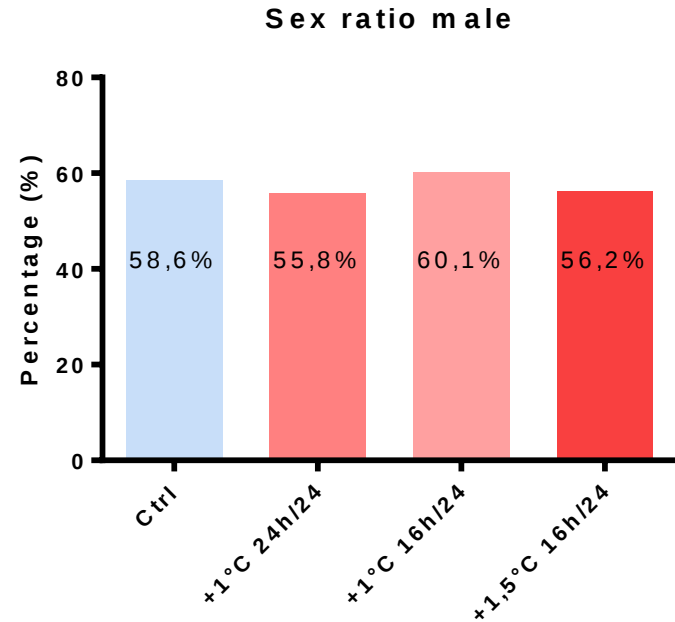
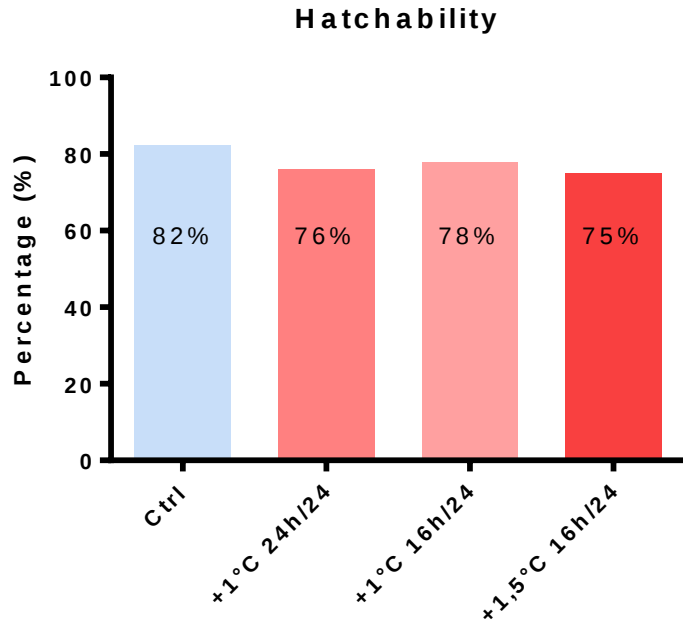


Results at hatching





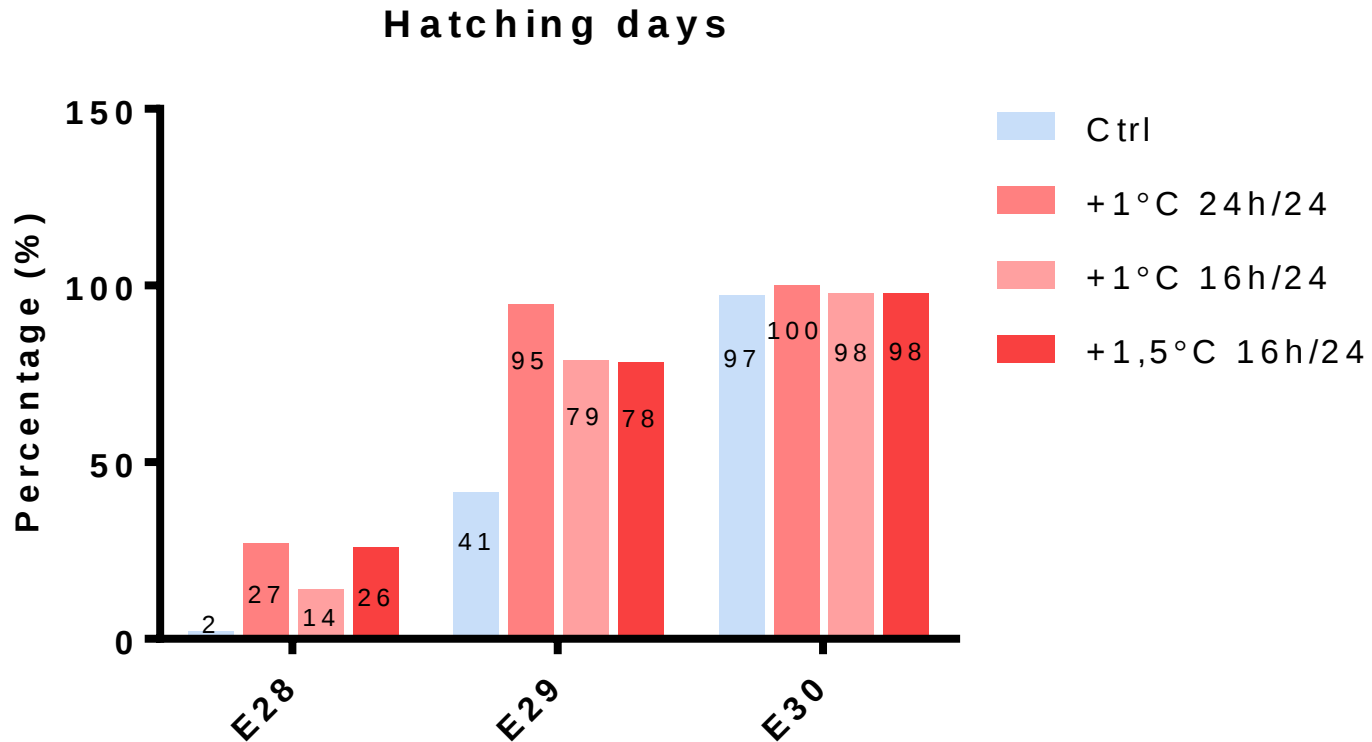
Hatchability results



- No impact of thermal manipulation on hatchability and a stable sex-ratio

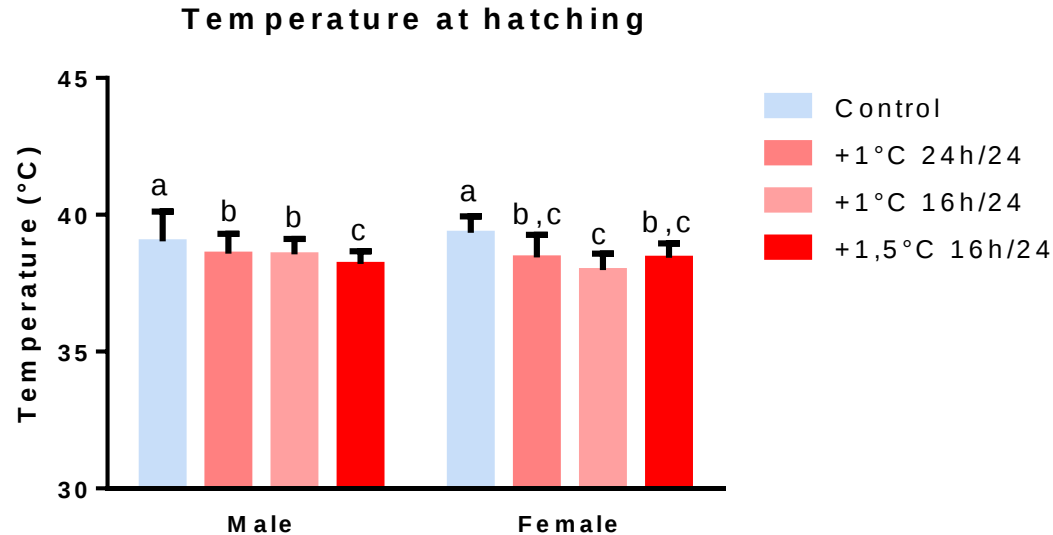


Hatchability results



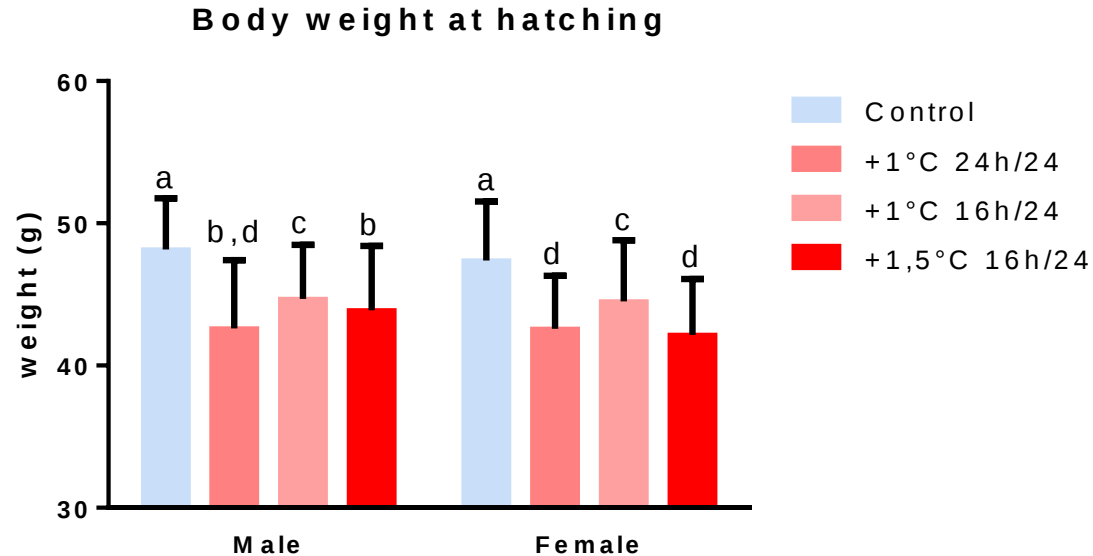
- Thermal manipulation accelerates the embryonic development

Results



	P value	Summary
Interaction	< 0,0001	****
Sex	0,4834	ns
Temperature	< 0,0001	****

- Decrease of body temperature for all thermal manipulated groups

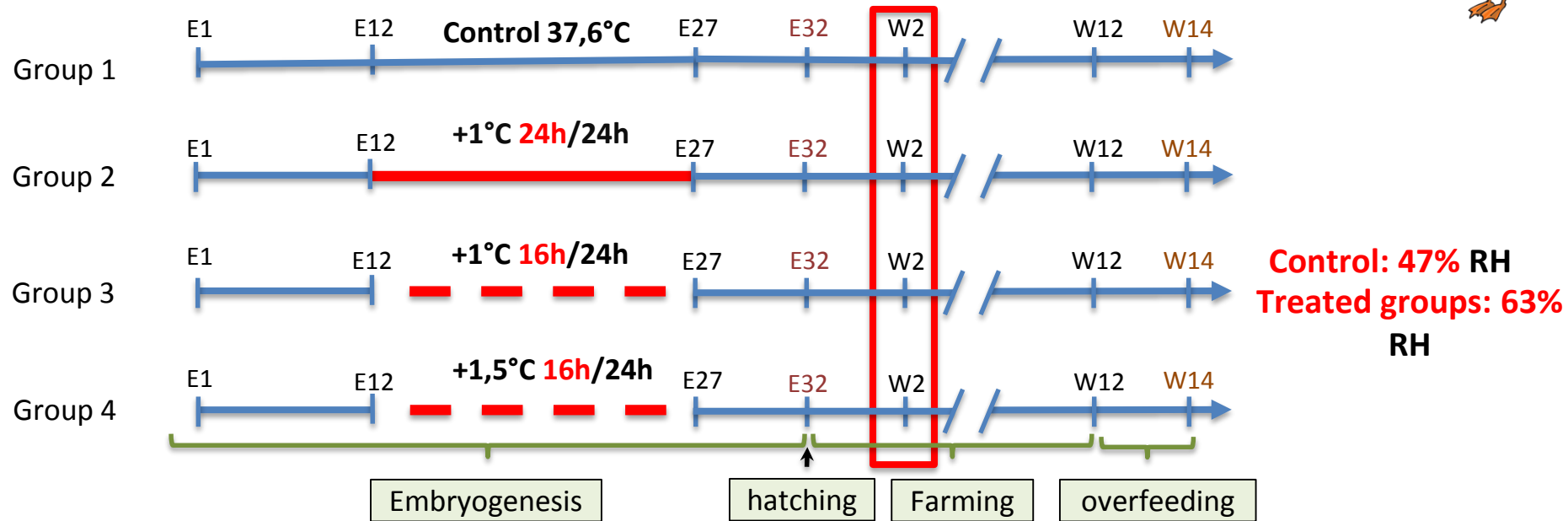
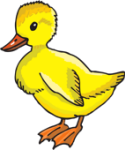


	P value	Summary
Interaction	0,1271	ns
Sex	0,0139	*
Temperature	< 0,0001	****

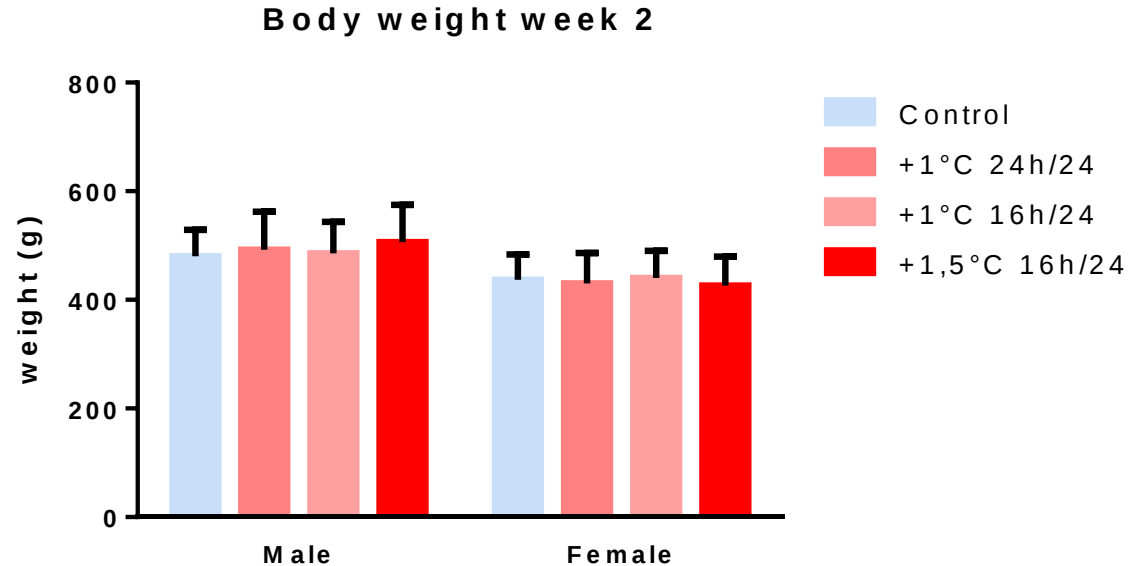
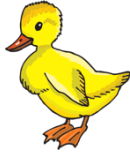
- Decrease of body weight for all thermal manipulated groups



Results



Results

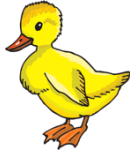


	P value	Summary
Interaction	0,4073	ns
Sex	< 0,0001	****
Temperature	0,9337	ns

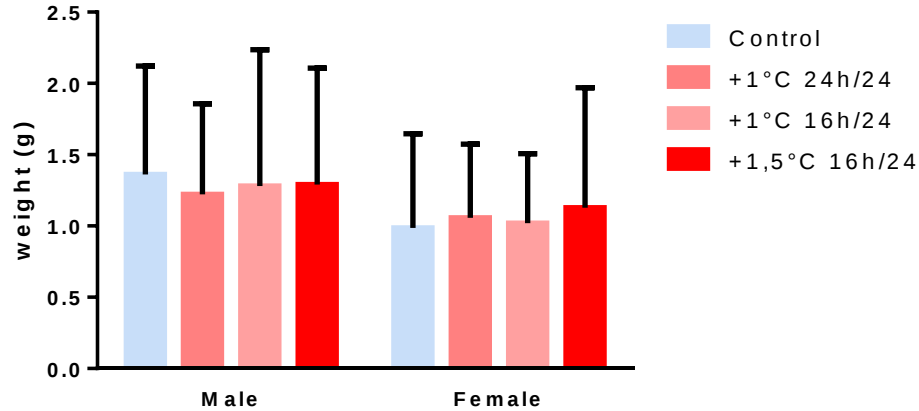
- All thermal manipulated groups have caught up with their growth retardness



Results

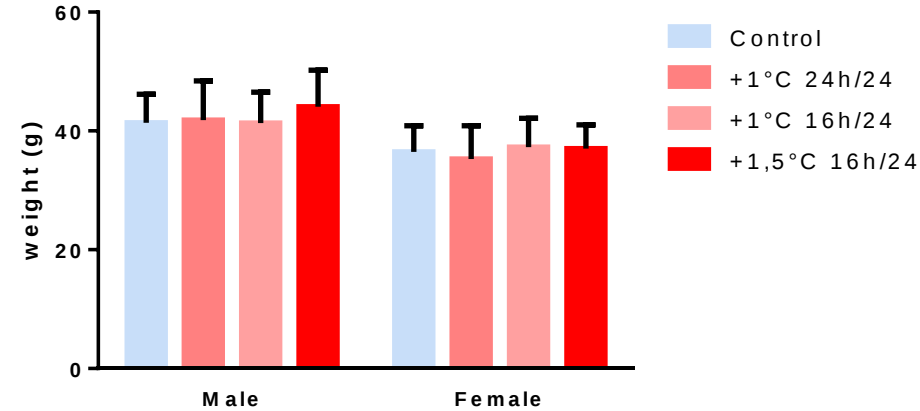


Abdominal fat week 2



	P value	Summary
Interaction	0,8815	ns
Sex	0,0264	*
Temperature	0,9689	ns

Leg muscle week 2

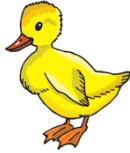


	P value	Summary
Interaction	0,4892	ns
Sex	< 0,0001	****
Temperature	0,3037	ns

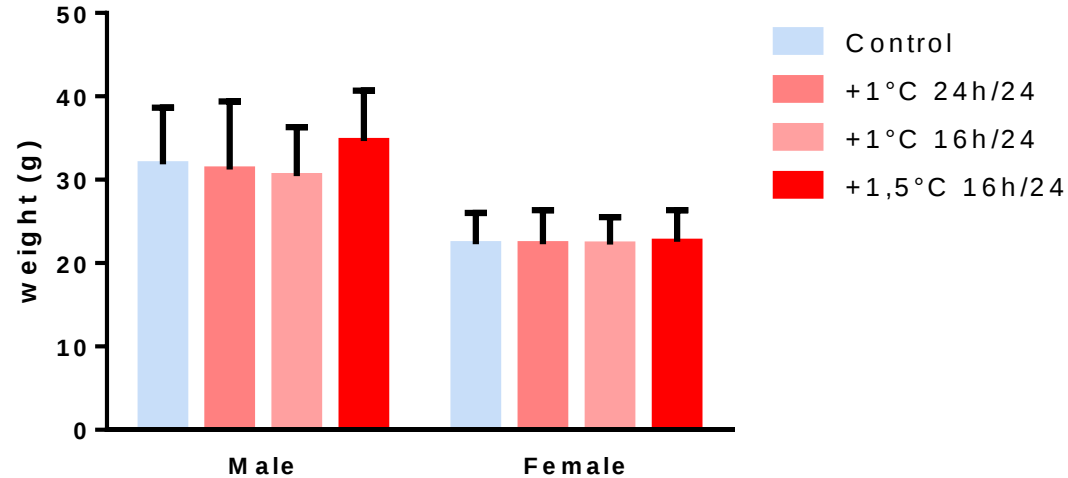
- No impact of thermal manipulation but still a sex effect



Results

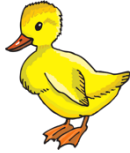


Liver weight week 2

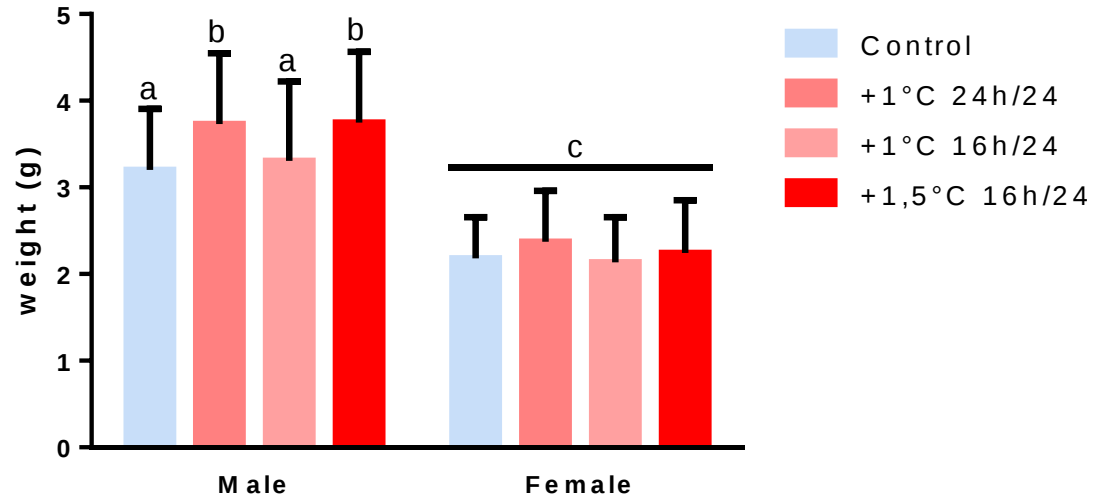


	P value	Summary
Interaction	0,3942	ns
Sex	< 0,0001	****
Temperature	0,249	ns

- No impact of thermal manipulation, we don't reproduce Pekin duck results



Pectoralis muscle weight at week 2

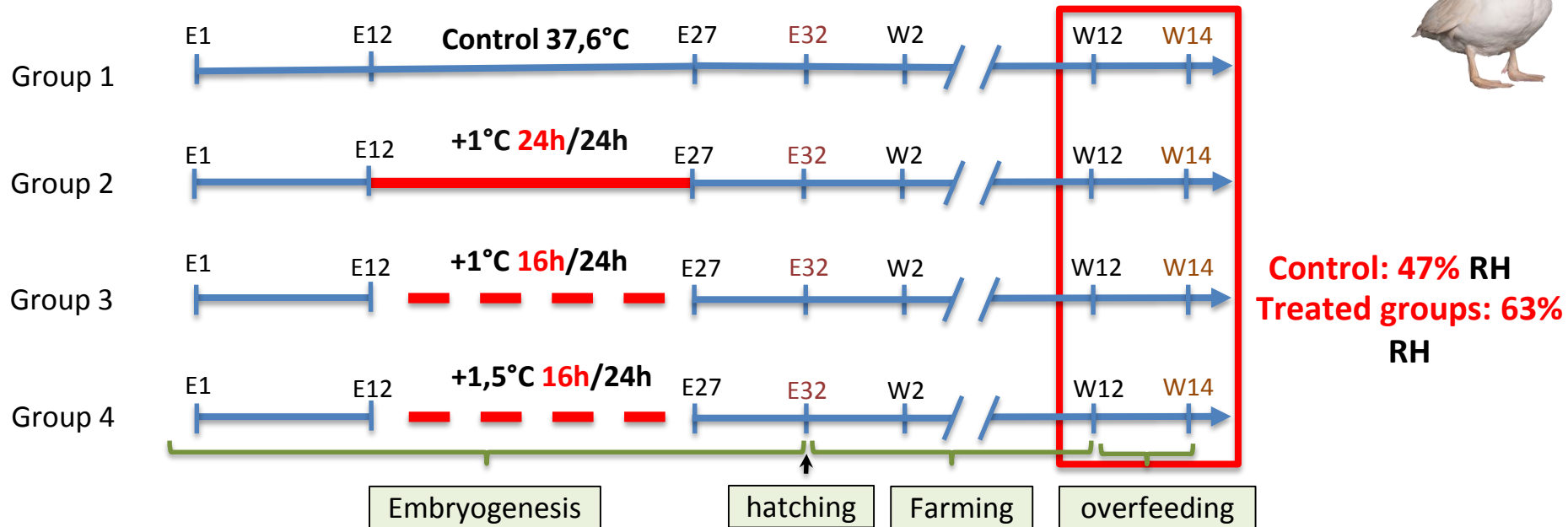


	P value	Summary
Interaction	0,3901	ns
Sex	< 0,0001	****
Temperature	0,0267	*

- Significant increase for 2 of 3 thermal manipulated groups for pectoralis muscle weight

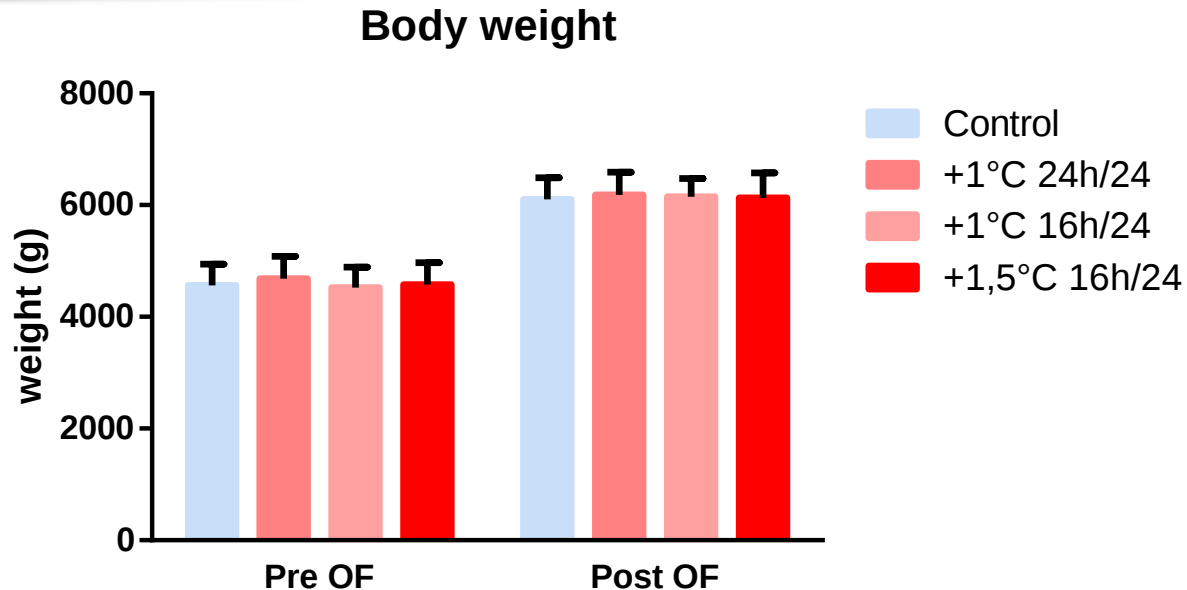


Results





Results before and after overfeeding



	P value	Summary
Interaction	0,5944	ns
Overfeeding	< 0,0001	****
Temperature	0,1118	ns

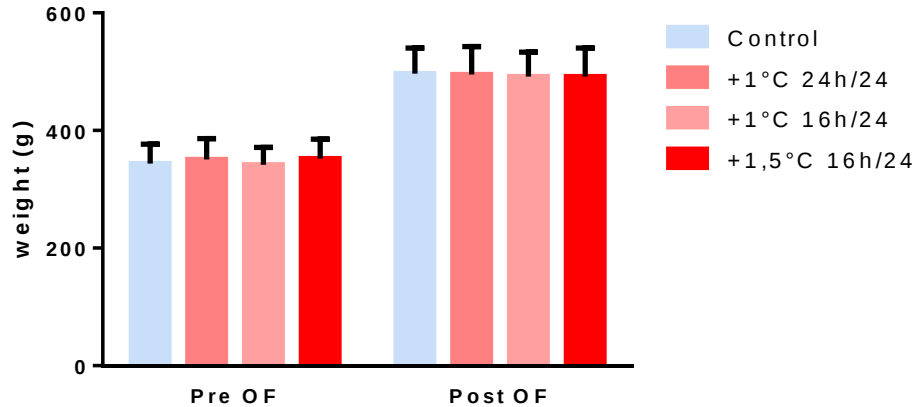
- Overfeeding induce a strong increase of body weight



Results before and after overfeeding

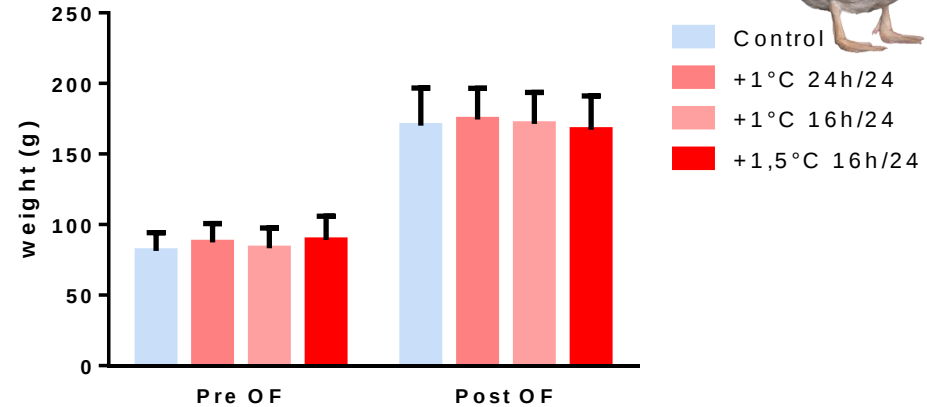


Leg muscle



	P value	Summary
Interaction	0,6993	ns
Overfeeding	< 0,0001	****
Temperature	0,7345	ns

Subcutaneous Fat

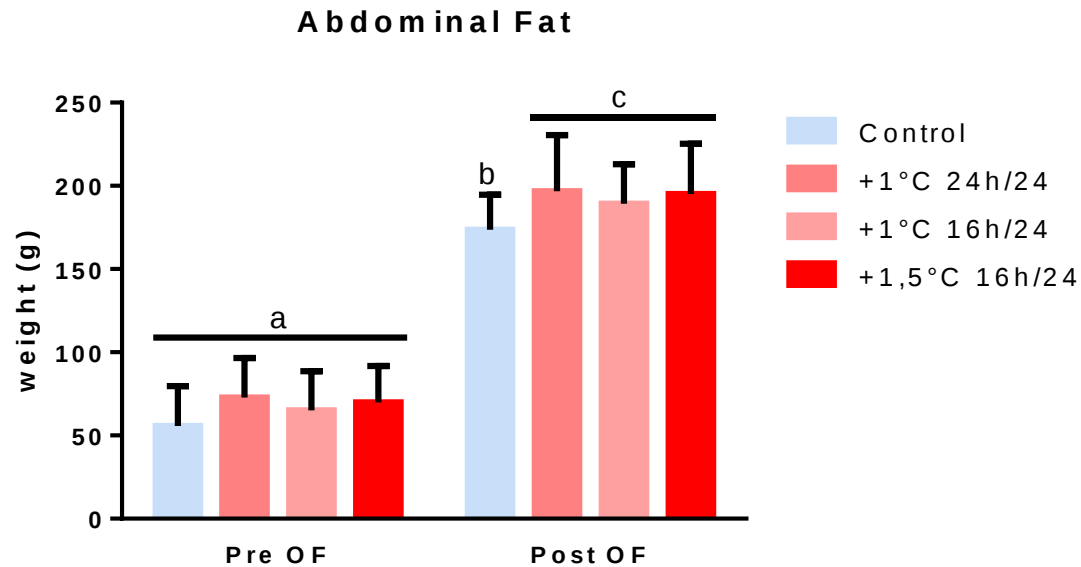


	P value	Summary
Interaction	0,2806	ns
Overfeeding	< 0,0001	****
Temperature	0,3942	ns

- No impact of thermal manipulation but an increase of weight induce by overfeeding



Results before and after overfeeding

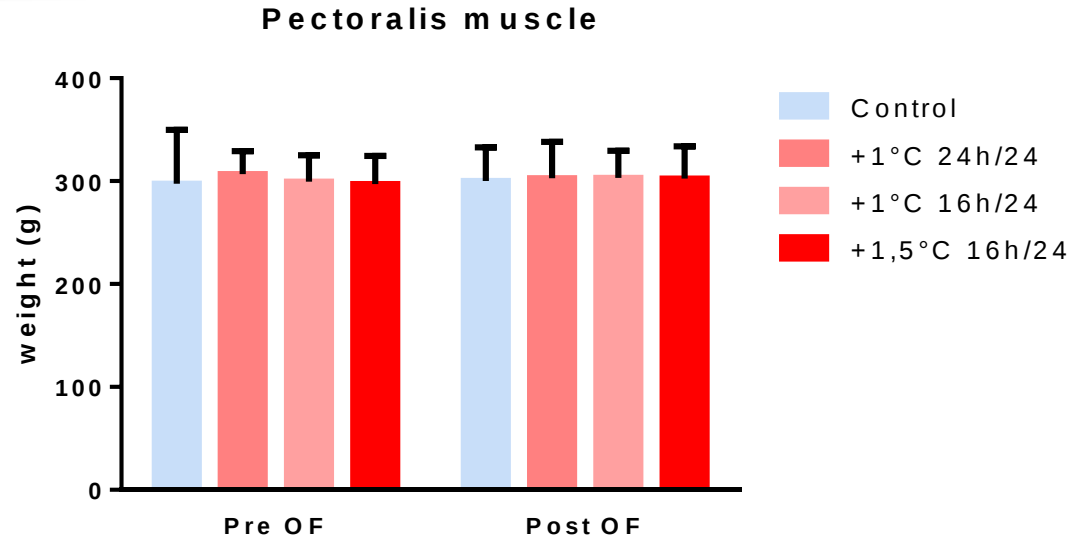


	P value	Summary
Interaction	0,7873	ns
Overfeeding	< 0,0001	****
Temperature	< 0,0001	****

- Impact of thermal manipulation after overfeeding for abdominal fat weight



Results before and after overfeeding

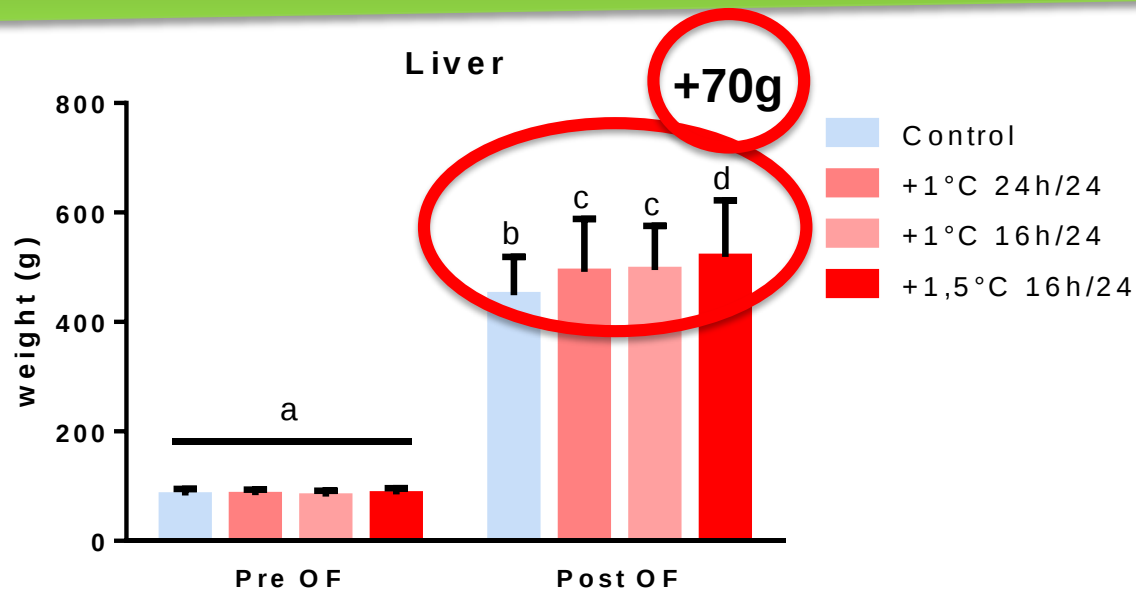


	P value	Summary
Interaction	0,8114	ns
Overfeeding	0,5838	ns
Temperature	0,6215	ns

- Pectoralis muscles are not impacted by overfeeding neither by thermal manipulation



Results before and after overfeeding



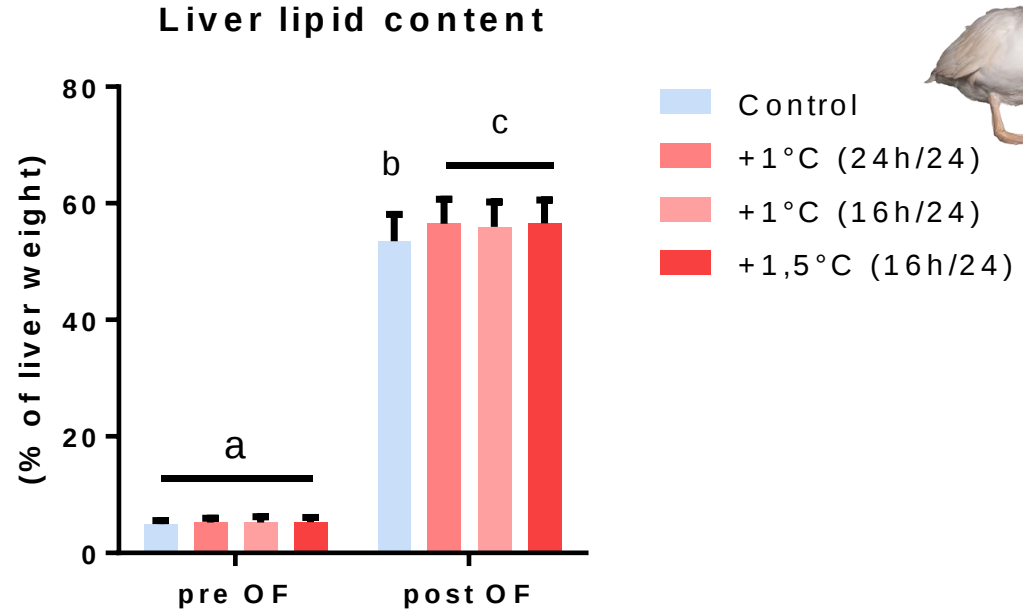
	P value	Summary
Interaction	0,0119	*
Overfeeding	< 0,0001	****
Temperature	0,0077	**

- Thermal manipulation induce a significant increase of liver weight in all treated groups

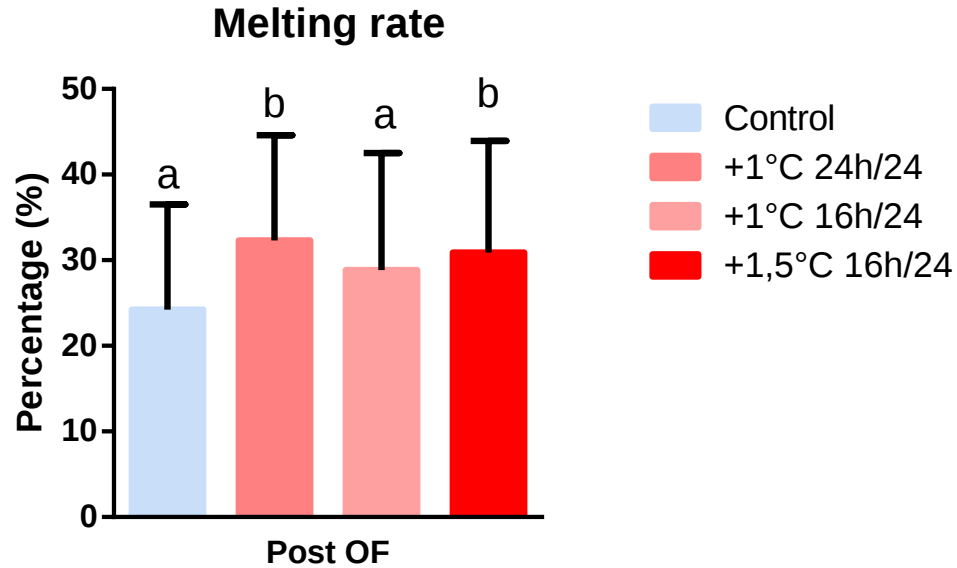


Results before and after overfeeding

	P value	Summary
Interaction	0,0225	*
Overfeeding	< 0,0001	****
Temperature	0,0021	**



- Thermal manipulation induce an increase of lipid content in the 3 treated groups after overfeeding



- Increase of melting rate for 2 thermal manipulated groups

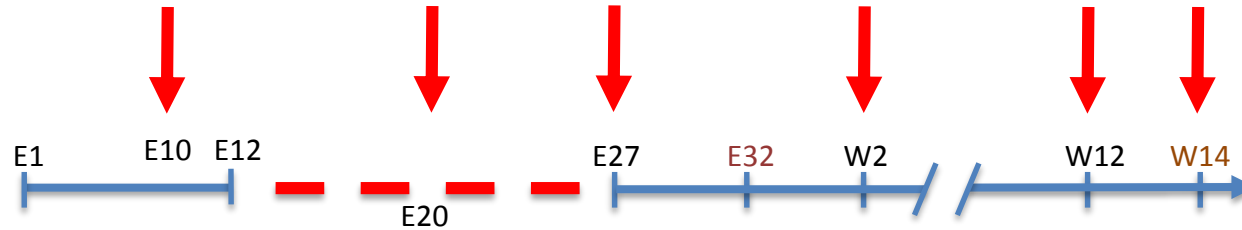


Embryonic thermal manipulation

- Has no impact on hatchability
- Has no impact on muscle production
- Increase fatty liver production after overfeeding



Molecular Biology



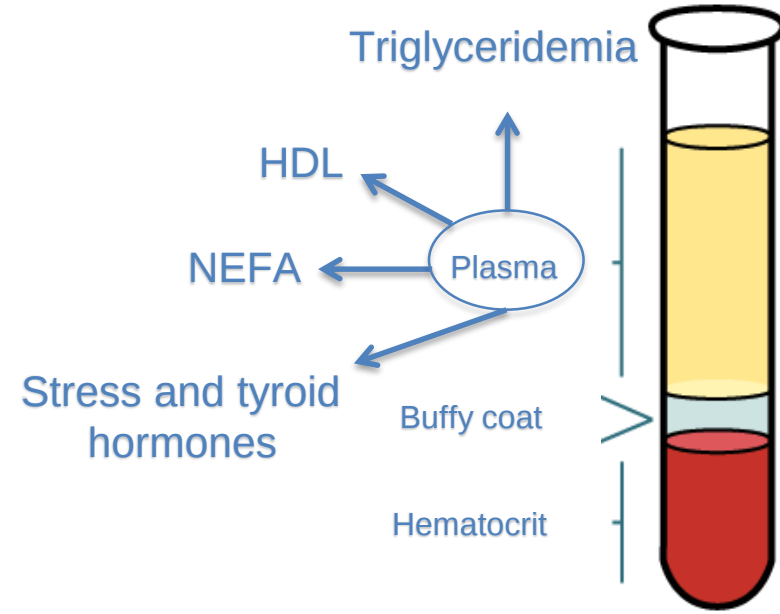
Expression analysis:

- Hepatic metabolism (FASN, DGAT2)
- Glucose and lipid transport (VLDLR, FABP4, ApoB, MTTP)
- Cellular stress (HSP90, HSF)



Biochemistry

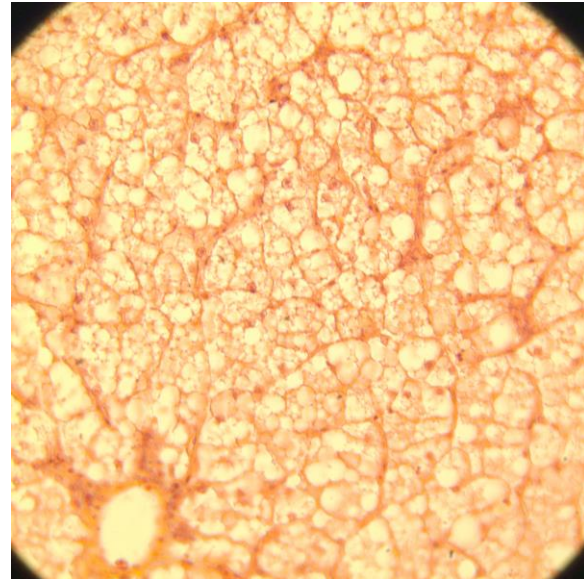
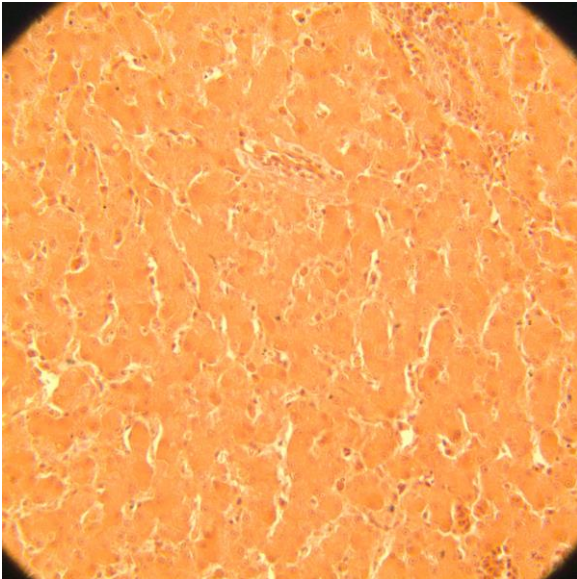
- Triglyceridemia
 - NEFA
 - HDL
- } Lipid exportation ?
- Stress hormones
 - Thyroid hormones T3 and T4





Histology

- H&E and Masson's Trichrome
- Create scoring system





THANK YOU



The French branch of WPSA is gratefully acknowledged for its support to the participation of William Massimino to the EPC 2018 congress



Tracy Pioche
Karine Ricaud
Karine Gontier
Stéphane Davail
Stéphane Panserat
Marianne Houssier



Cécile Bonnefont
Hélène Manse
Mireille Morisson

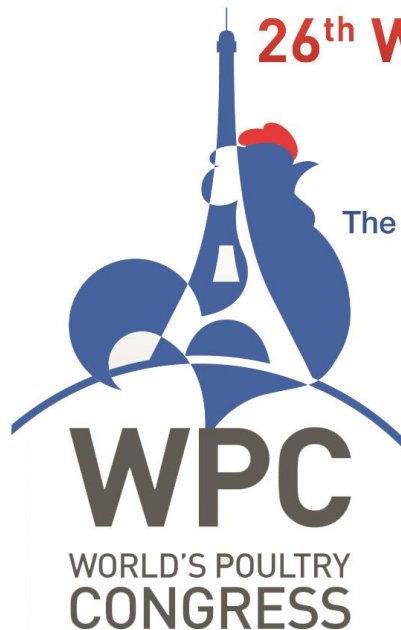


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Philippe Morganx
Jean-Marc Mallet
Joel Darbo

Département
des Landes

26th World's Poultry Congress



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