Influence of Hypoxia During Incubation on Broiler Embryo Metabolism and Development: A Tale of Two Genetic Lines.

Amit Haron, Rotem Rafaelli, Dima Shinder, Shelly Druyan

Institute of Animal Science,

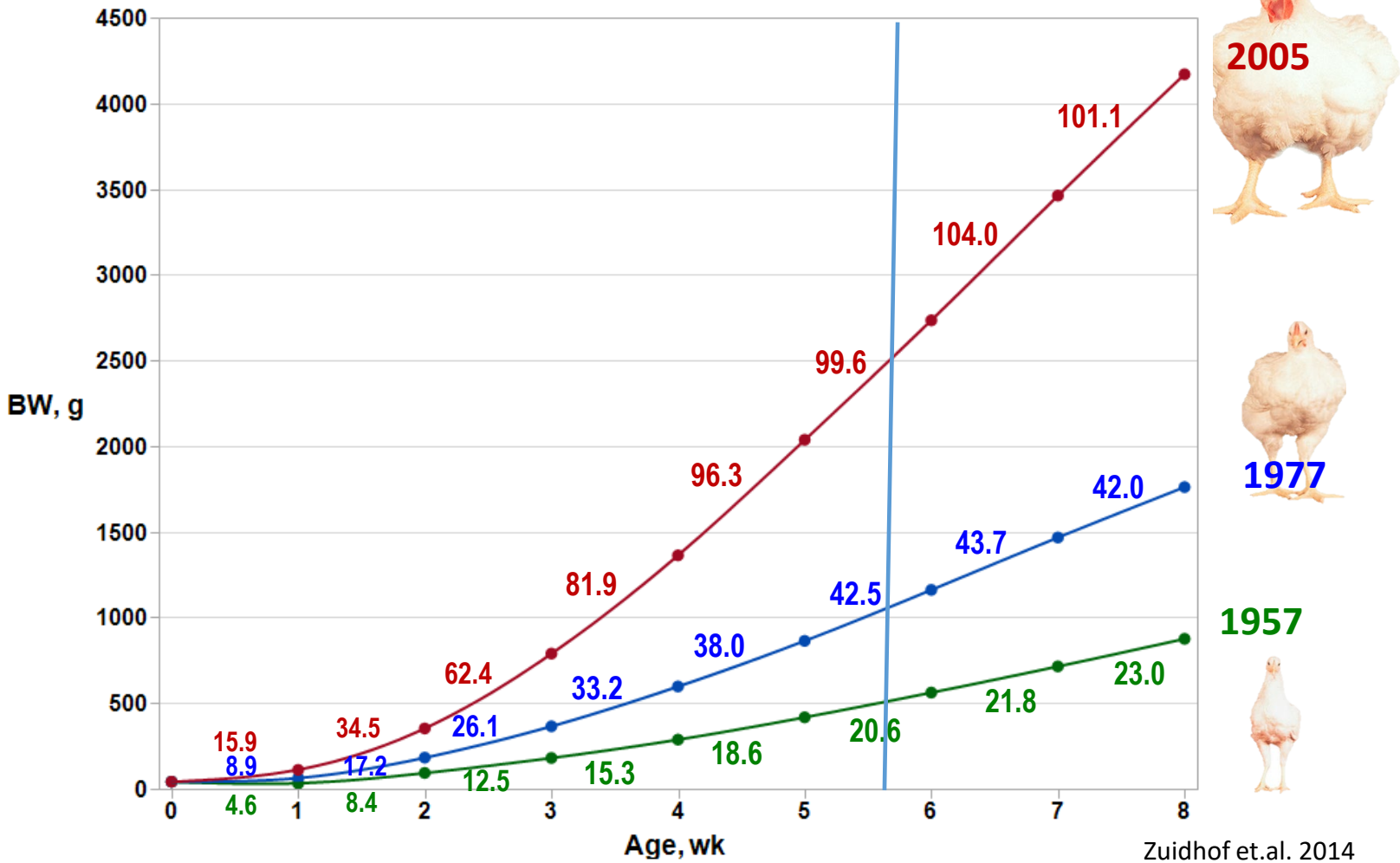
ARO, the Volcani Center,

HaMaccabim Road, Rishon Le Zion, Israel

Genetic improvement in growth of broilers since 1950's

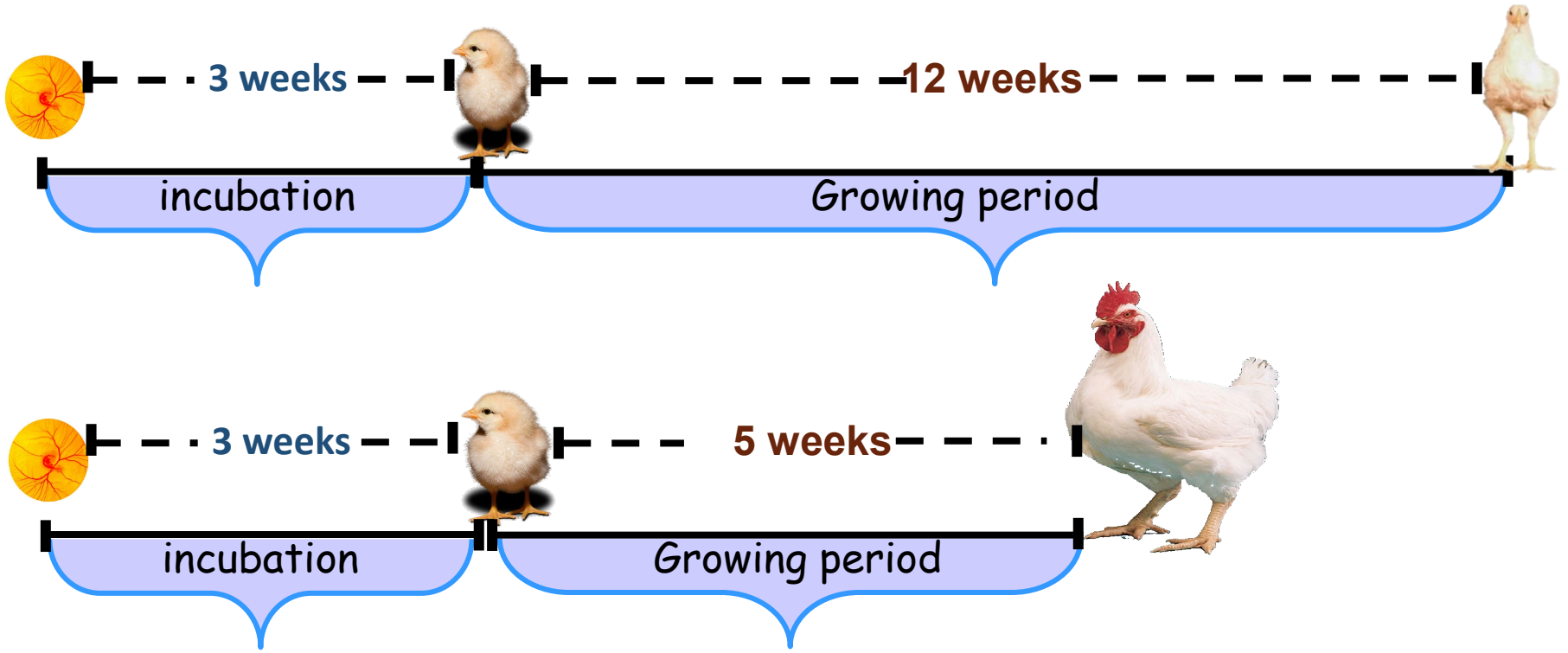
Growth curves of two strains kept without selection from 1957 and from 1977,
and of **Ross 308 broilers (in 2005), show weekly means of body weight (BW)**

The weekly average daily BW gain (grams per day) are also shown on the graph



Zuidhof et.al. 2014

Genetic and physiological manipulations may enhance the durability of broilers in their struggle with the environment.



Environmental alterations during embryogenesis may induce changes in the development of some physiological regulatory systems, causing permanent phenotypic changes in the embryo.

Hypoxia was found to be a major trigger for development.

Various levels of hypoxia at divers time points during embryogenesis were found to affect both anatomical and physiological morphogenesis.

The actual effects of hypoxia on embryo development depend on the critical period, level, and duration of exposure.

Objective:

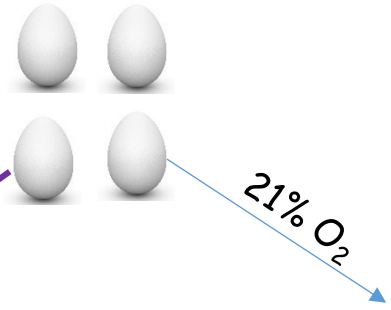
- To examine the affect of selection on embryonic development

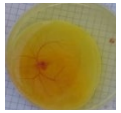
- To study the affect of selection on the response of the embryo to hypoxic (17% O_2) stress.

Experimental design:

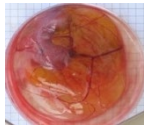
Cobb

1986





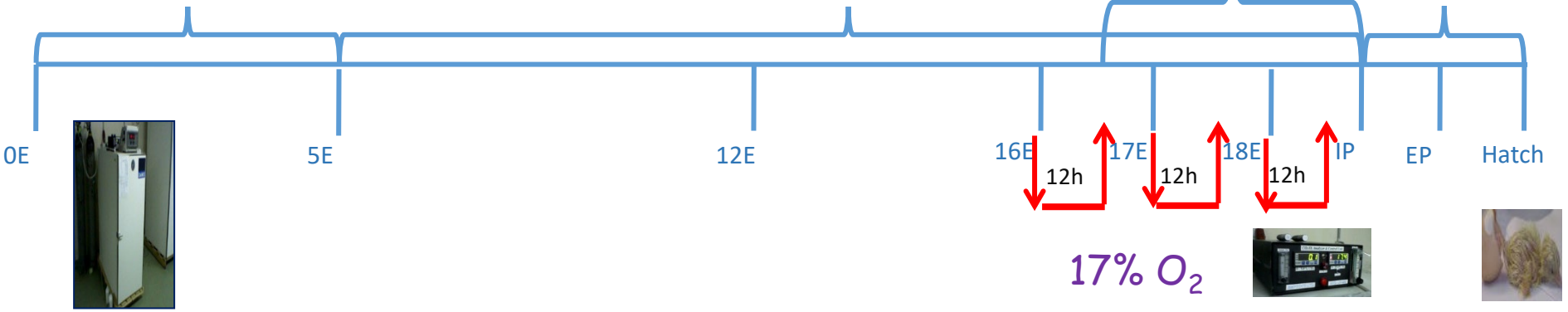
Yolk sac



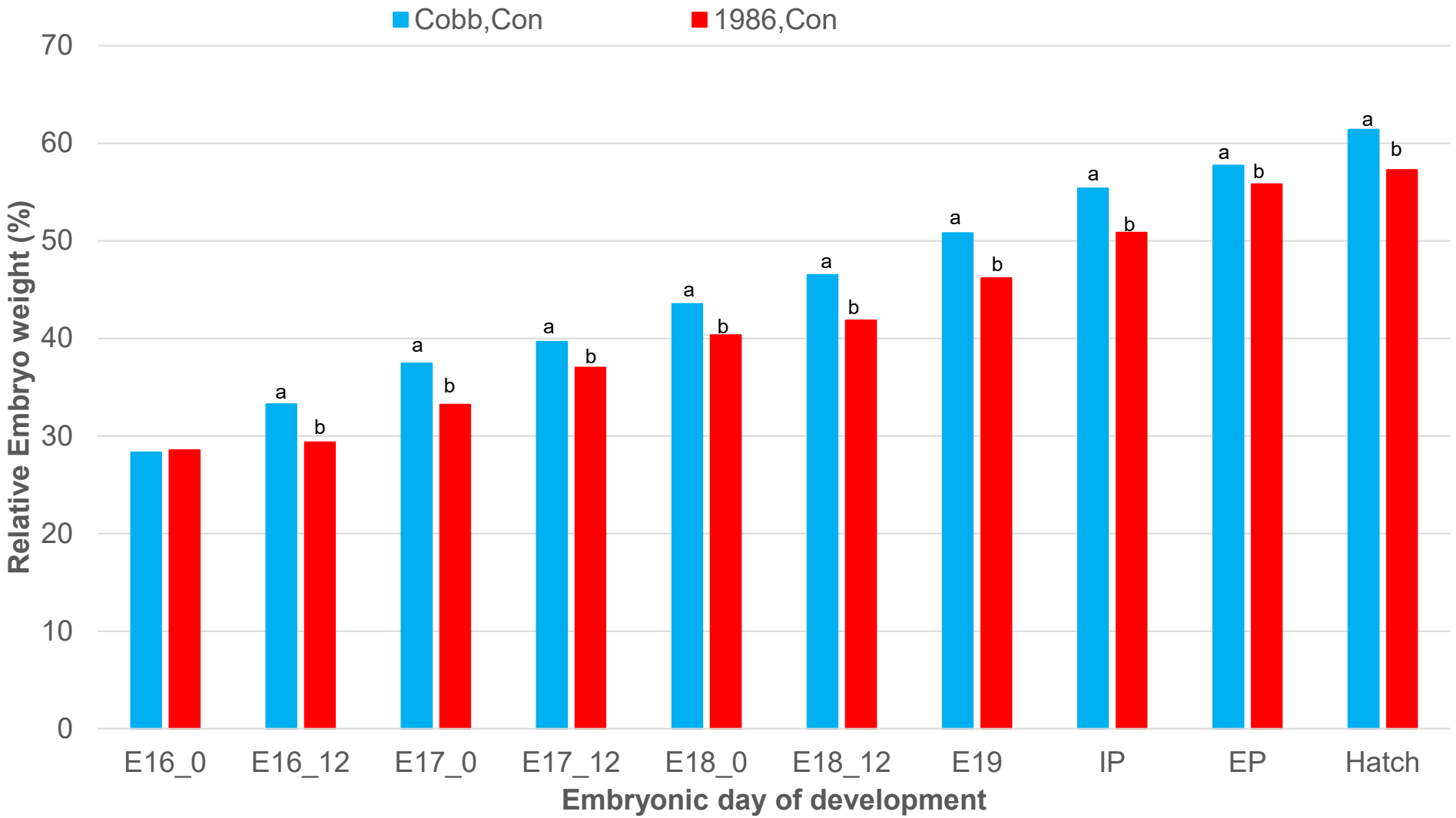
Chorioallantoic membrane

Plateau period

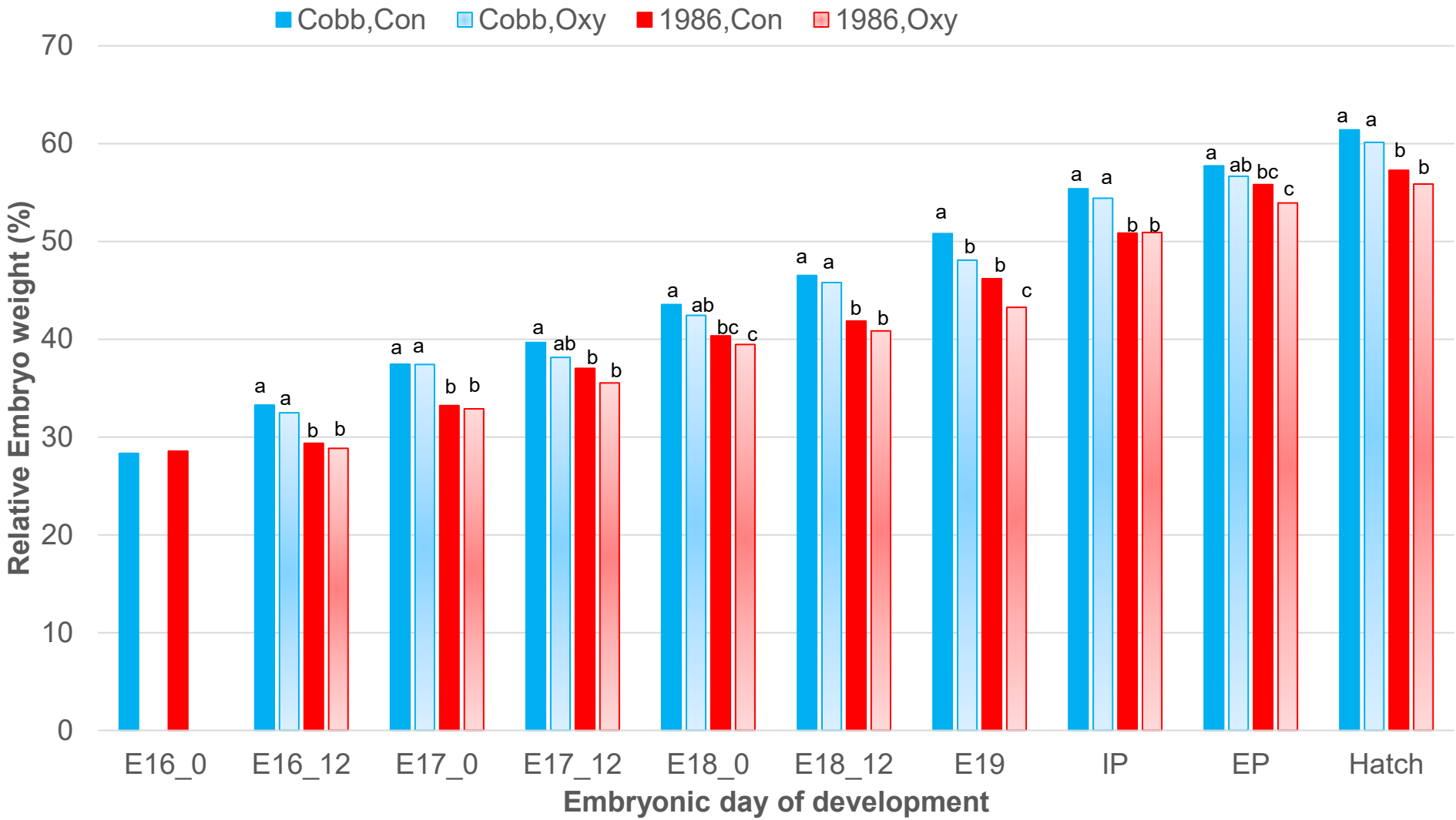
Lungs



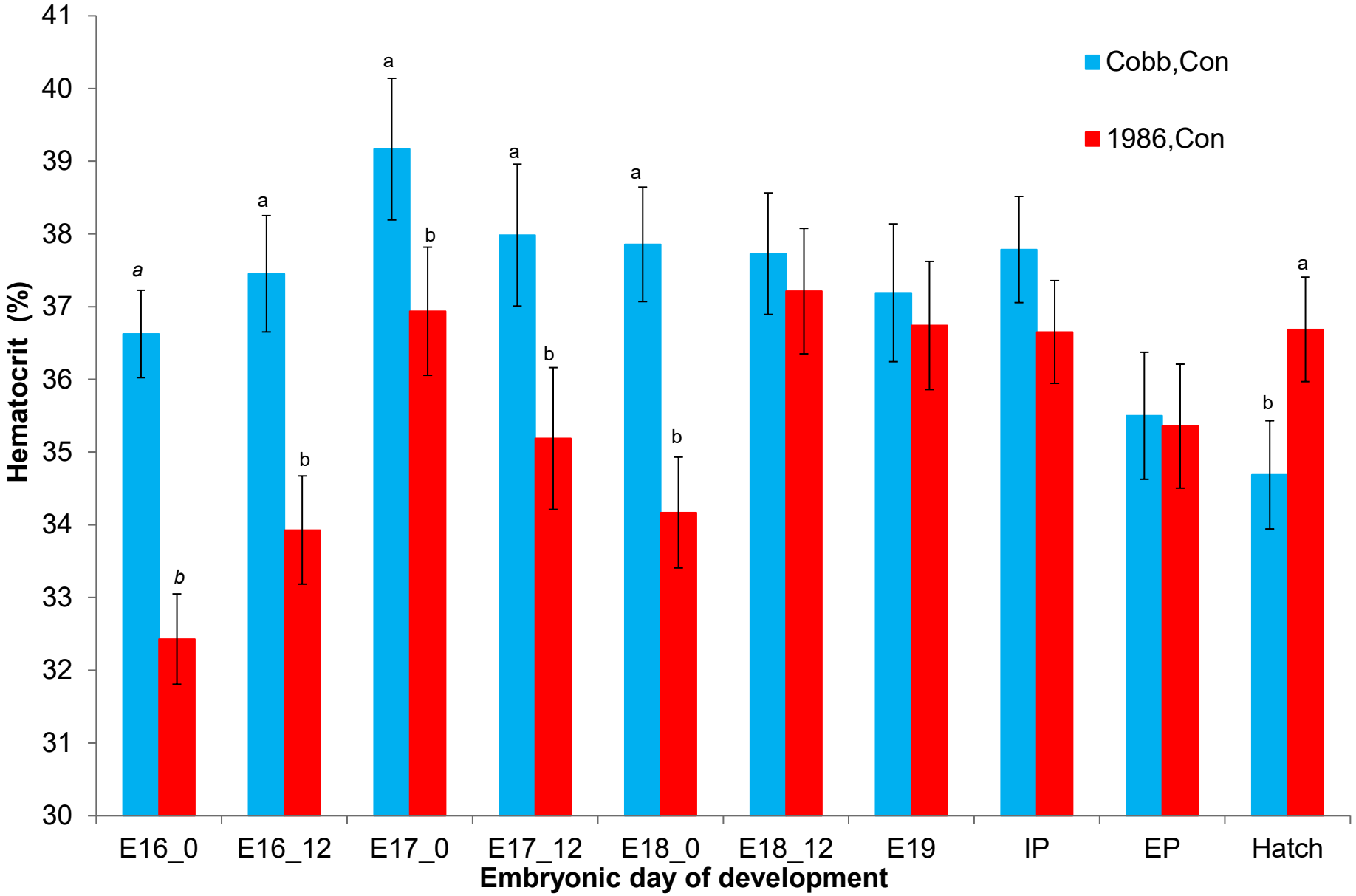
Free embryo weight as a percentage of initial egg weight for Cobb and 1986 embryos



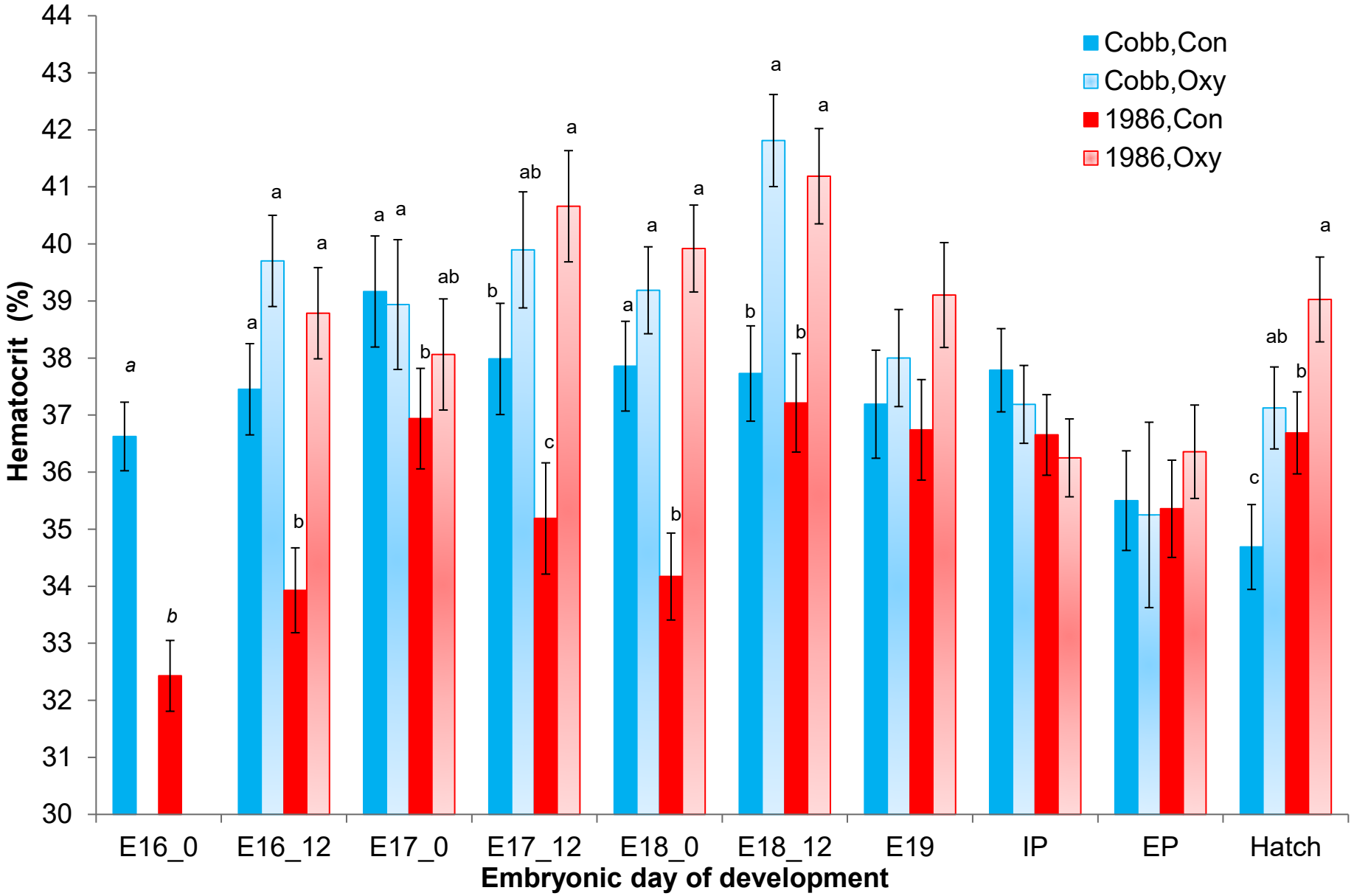
Free embryo weight as a percentage of initial egg weight for Cobb and 1986 embryos, incubated under different oxygen regimes from E16 to E19.



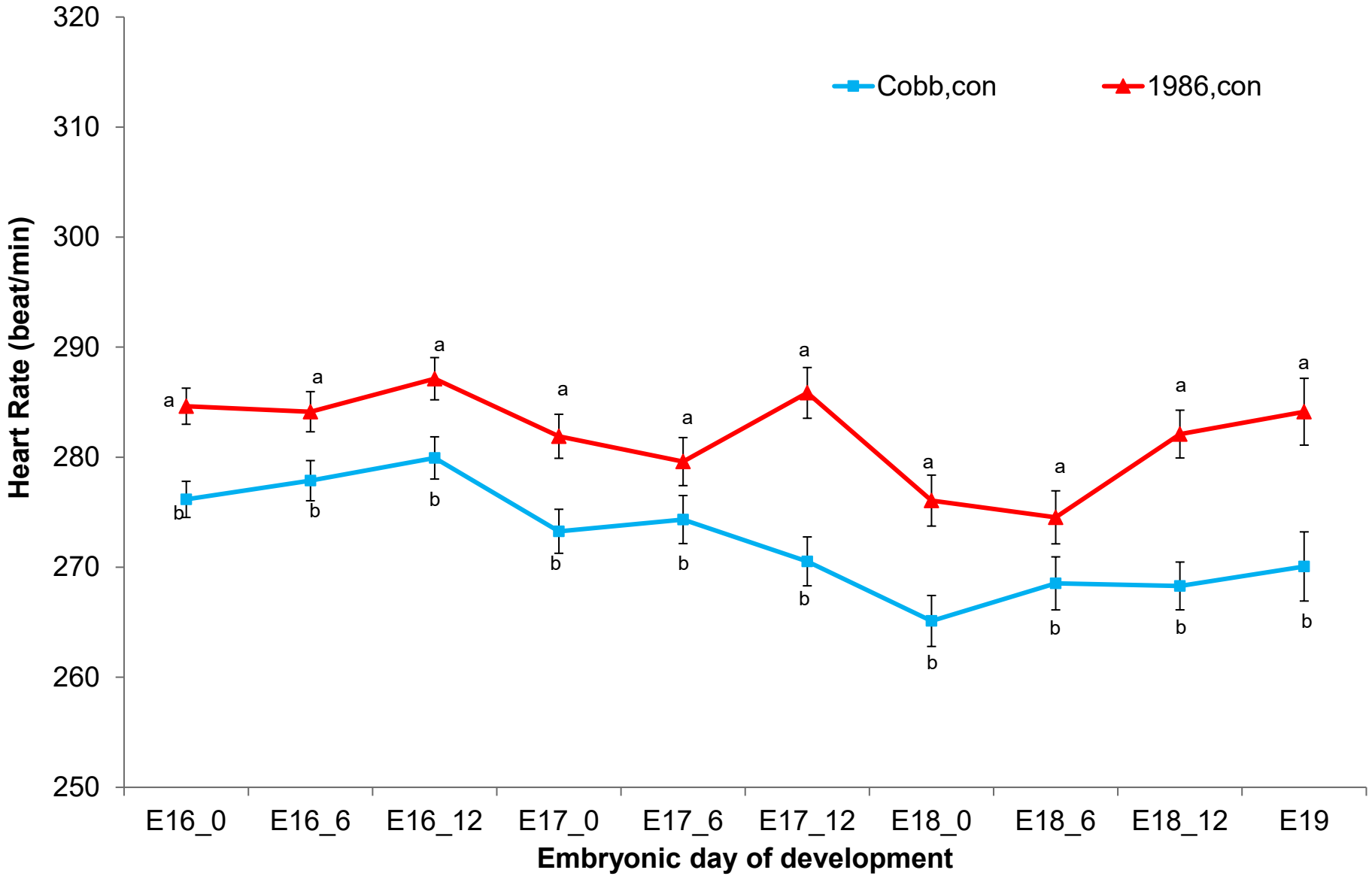
Hematocrit (%) of Cobb, and 1986 embryos



Hematocrit (%) of Cobb, and 1986 embryos incubated under differing oxygen regimes from E16 to E19



Mean heart rate (bpm) of Cobb, and 1986 embryos



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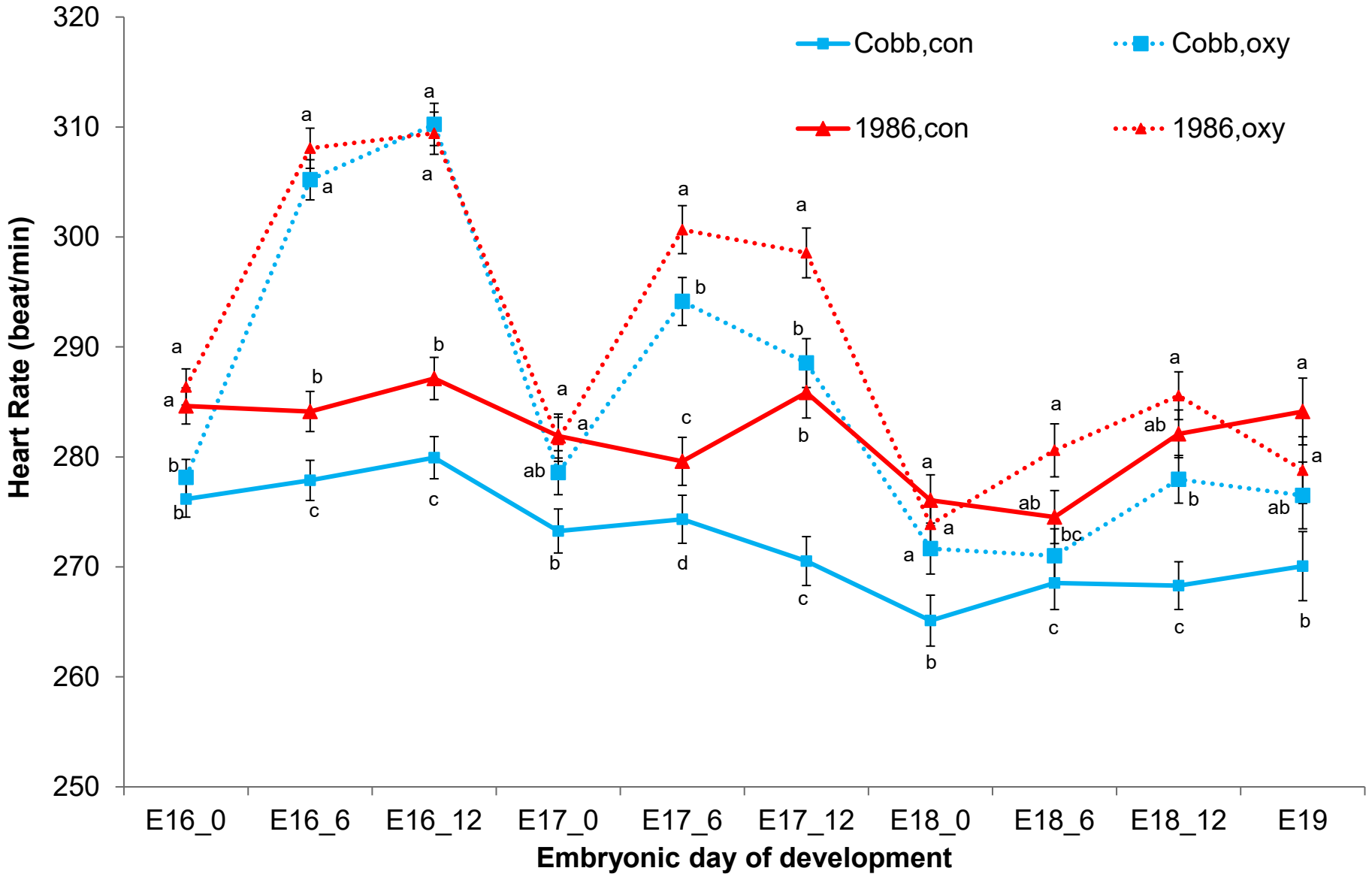
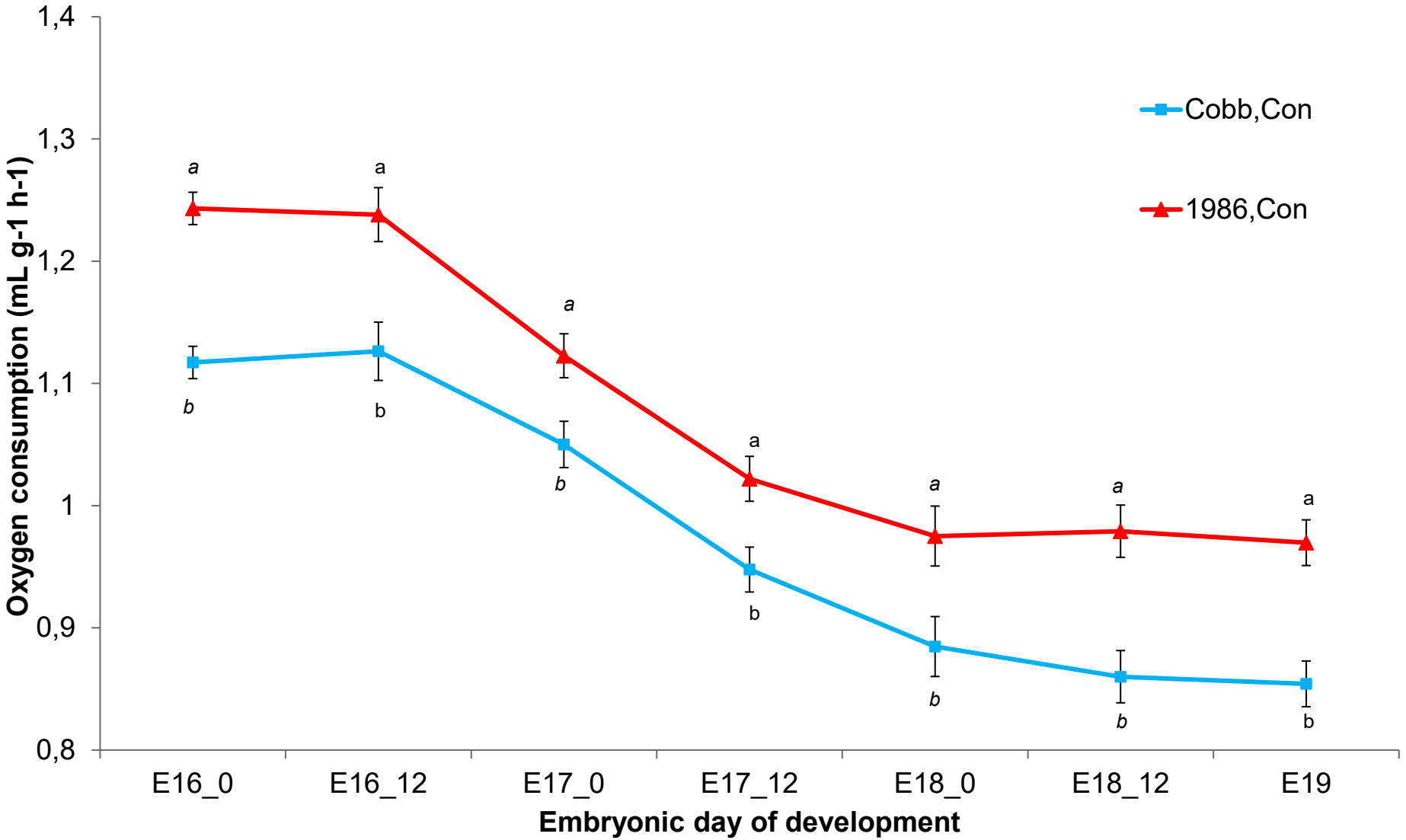


Oxygen consumption (mL g^{-1} h^{-1}) of Cobb, and 1986 embryos.



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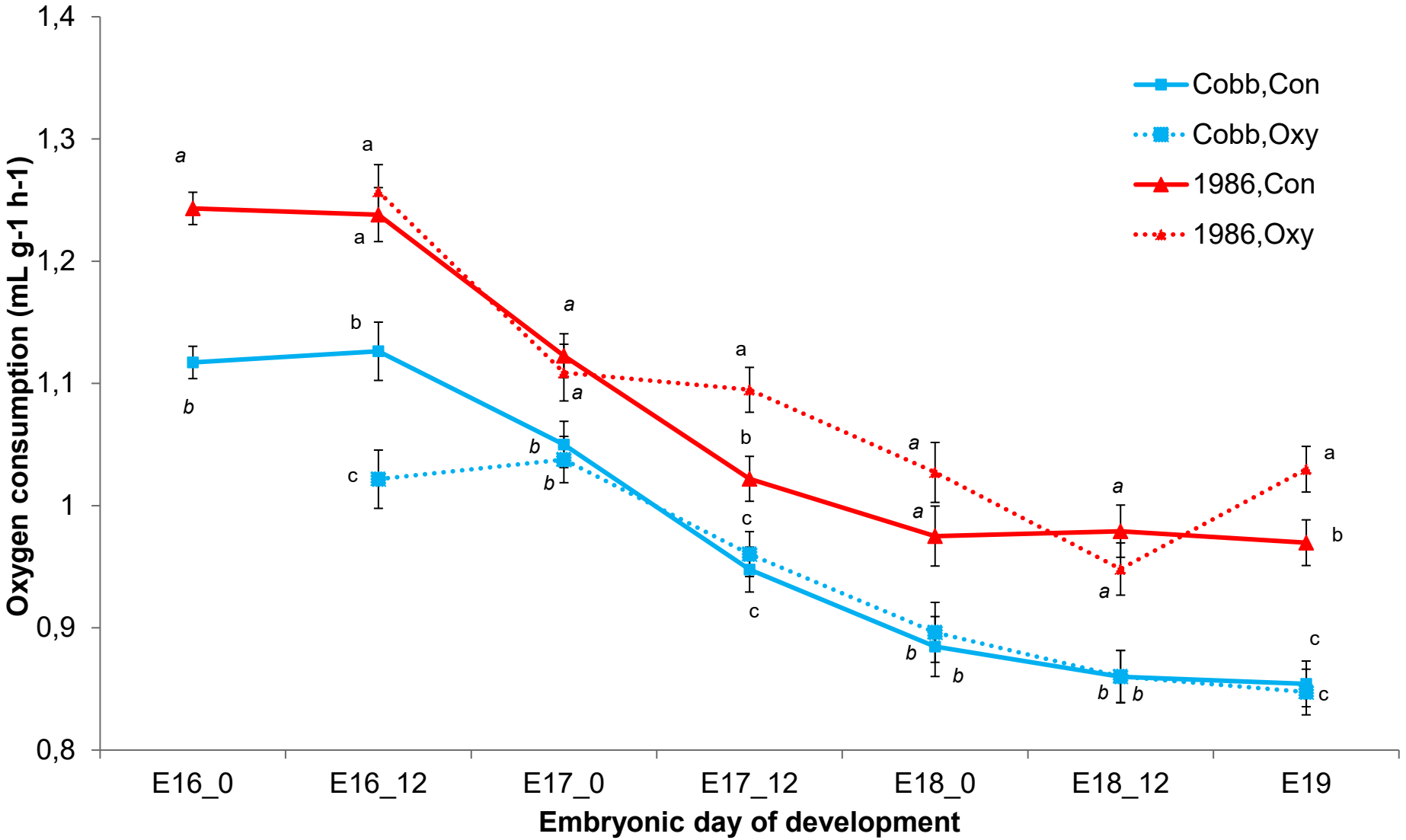
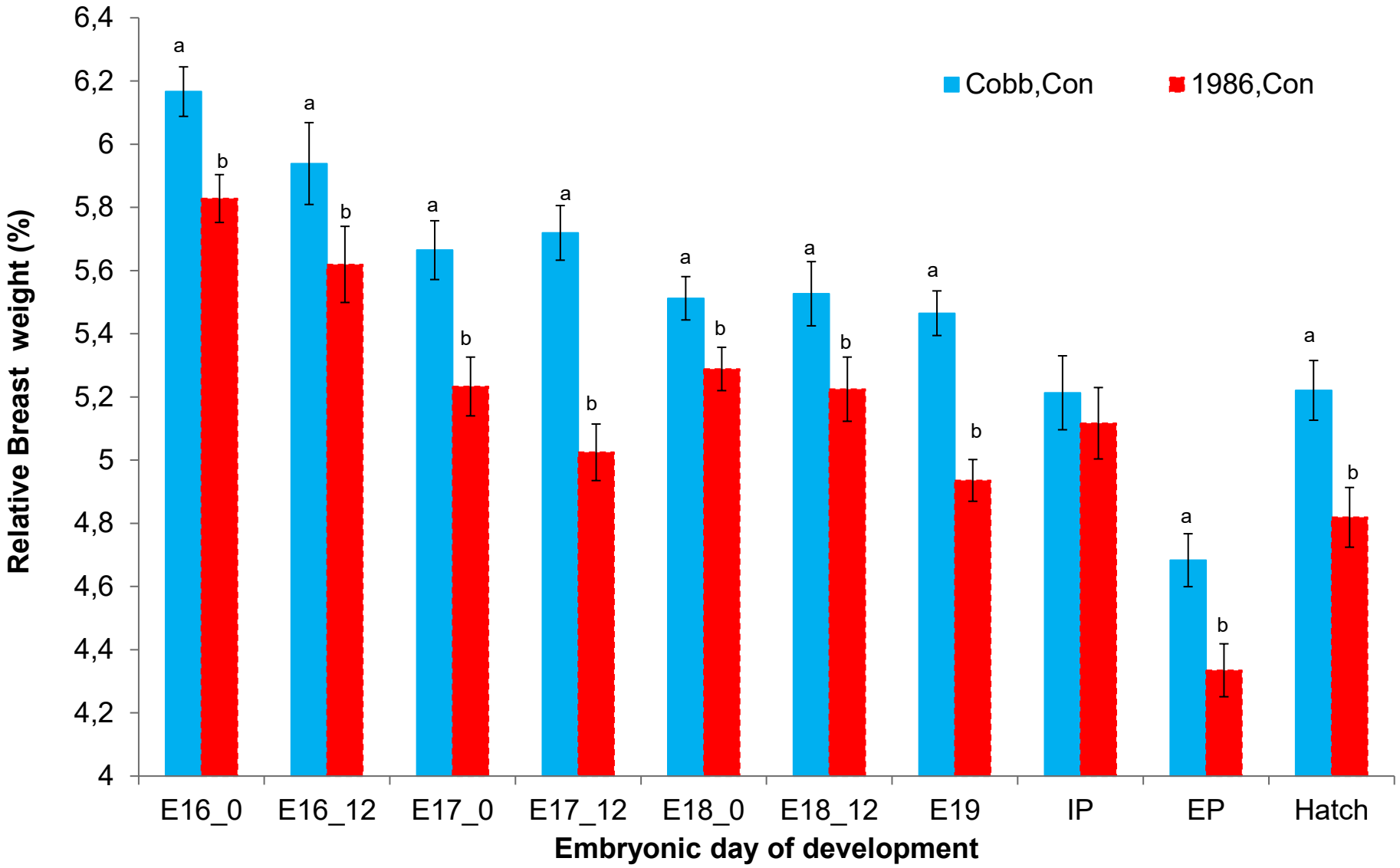


Relative Breast weight as a percentage of embryo weight for Cobb, and 1986 embryos.



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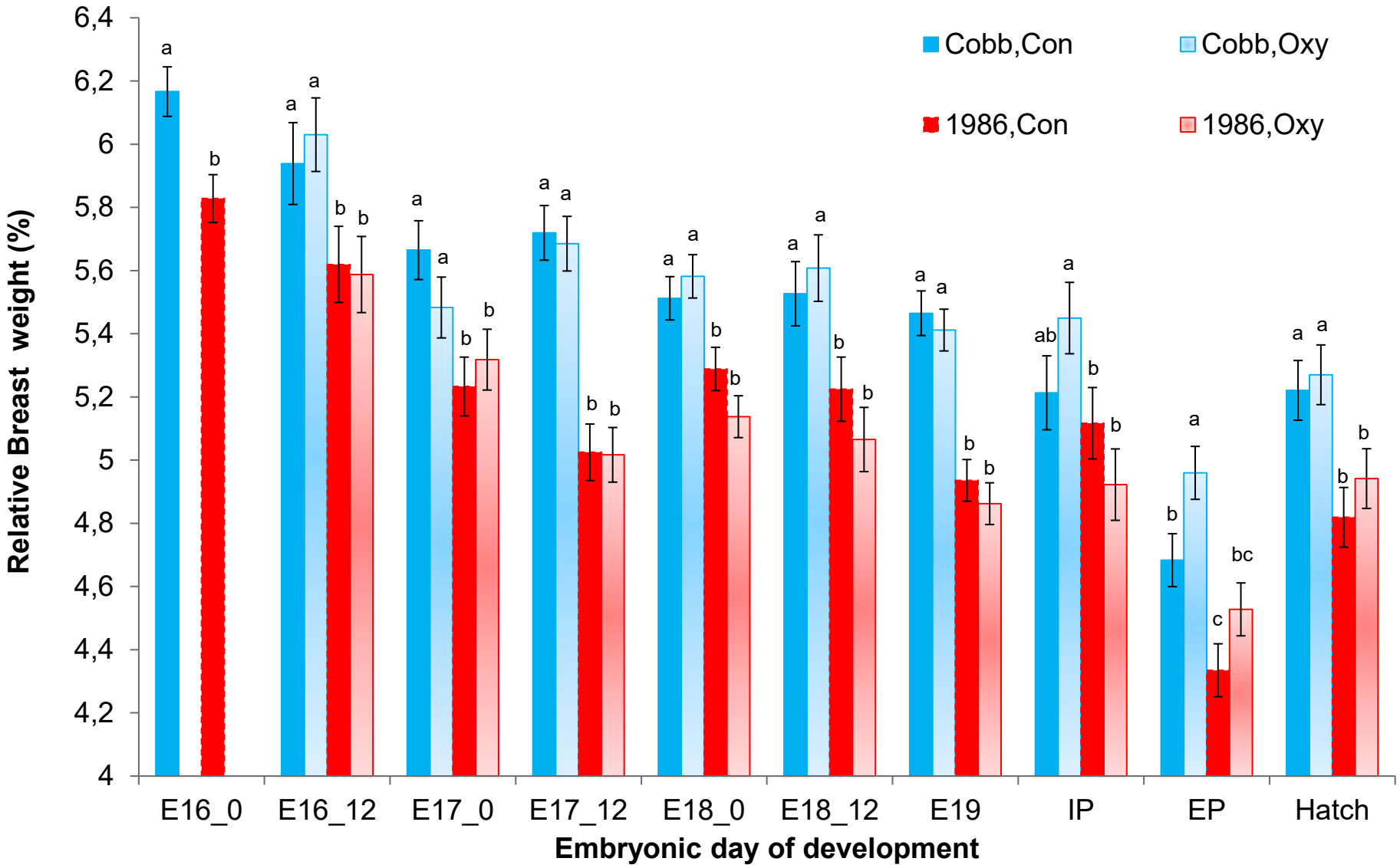
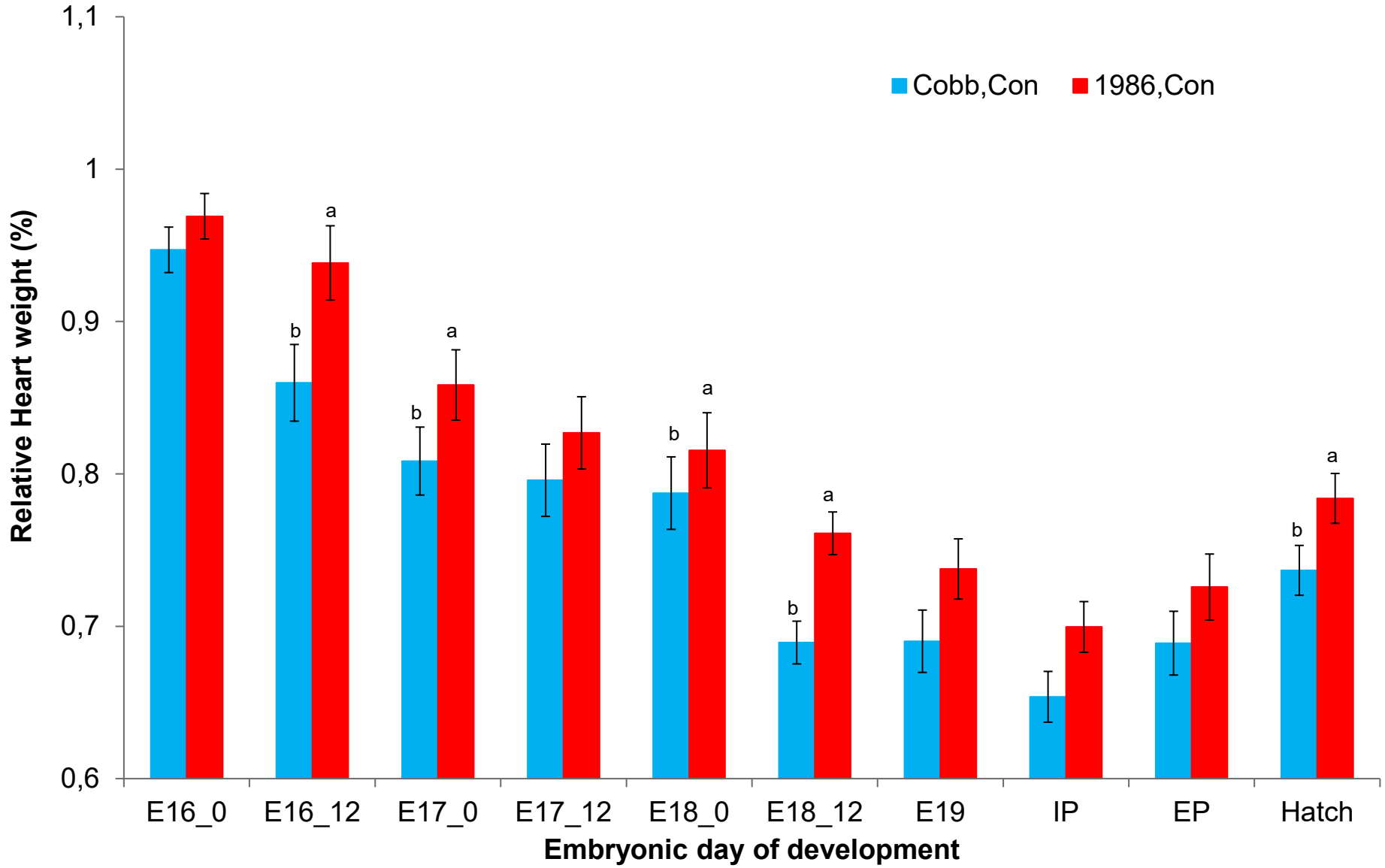


Relative heart weight as a percentage of embryo weight for Cobb, and 1986 embryos.



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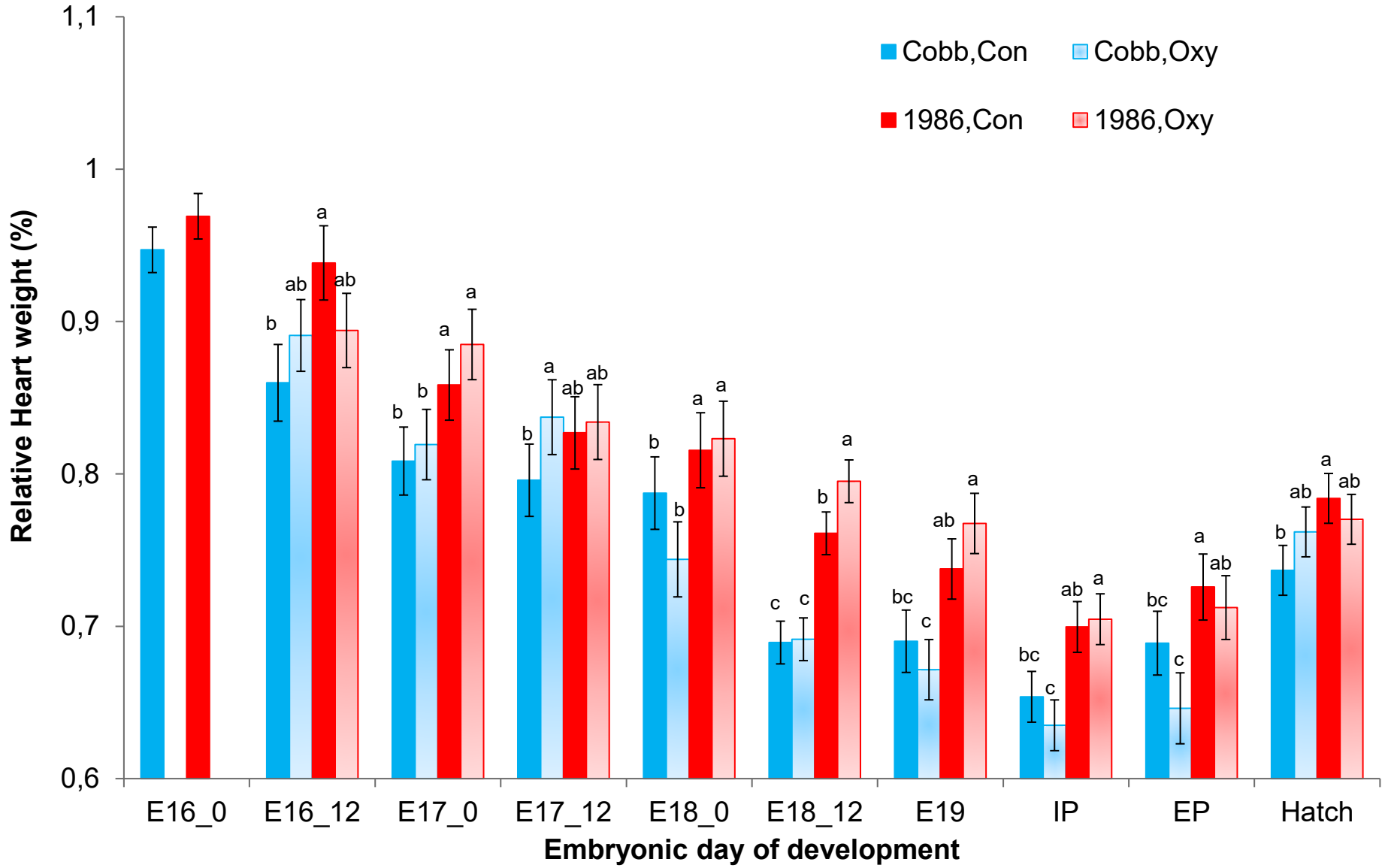


Summary

Genetic selection has influenced embryonic development

↑ Growth

↑ Metabolism

↑ Increase in oxygen demands

↓ Oxygen consumption

Summary

Adaptation of the cardio-vascular system

Hematocrit concentration

Heart rate

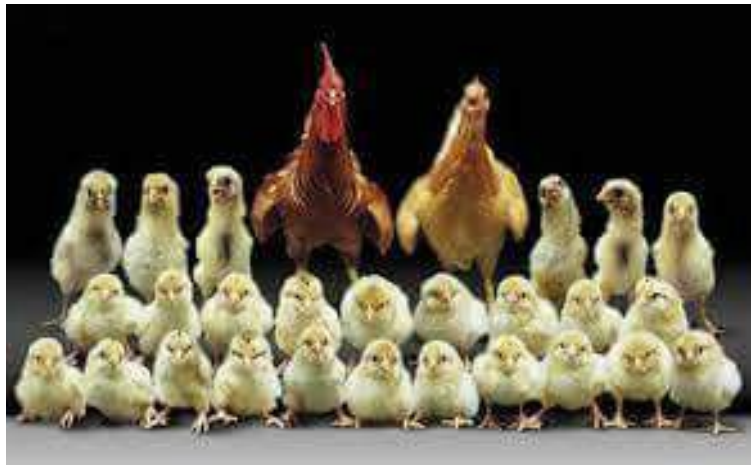
Blood viscosity

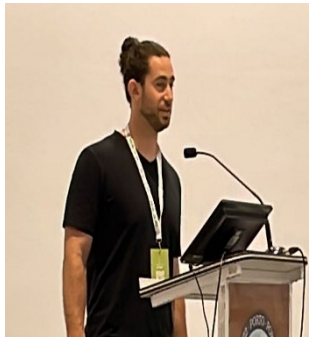
Allometric adaptation

Cardiac output

no parallel improvement

Acknowledgements

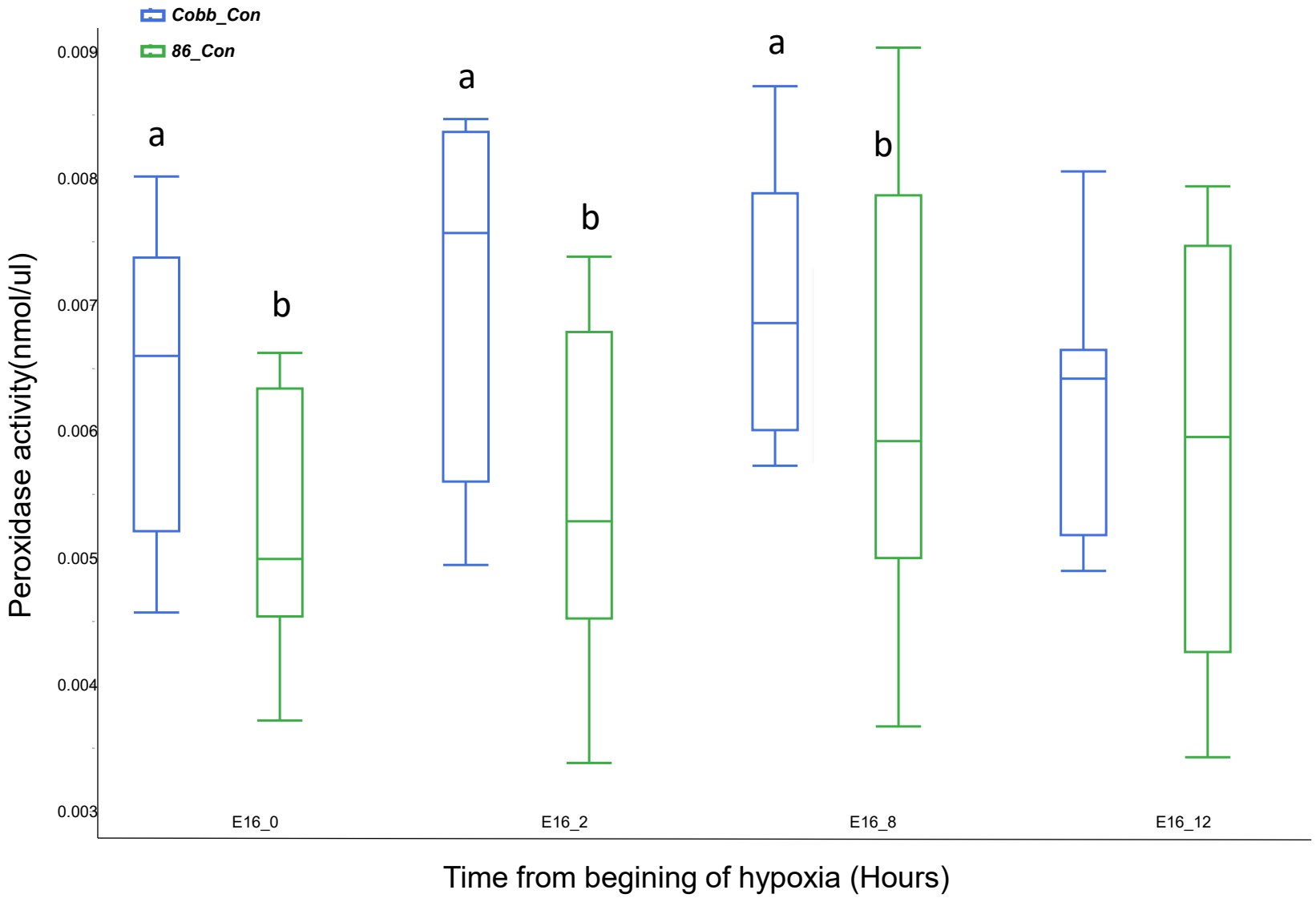




Thank you

Thankyou

Peroxidase activity in the heart tissue for Cobb, and 1986 embryos incubated under differing oxygen regimes from E16 to E19.



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