TESTIS DEVELOPMENT OF THE ZEBRA FINCH (*TAENIOPYGIA GUTTATA*)

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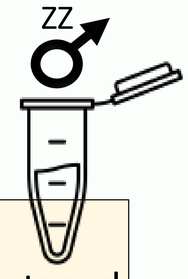
INTRODUCTION

Gonads play a crucial role in the sexual development process across various species. One intriguing aspect of gonadal development is their capacity to differentiate into either ovaries or testes, depending on the genetic sex of the individual. In birds, this process is closely linked to the sex determination mechanism governed by the combination of sex chromosomes (ZZ and ZW). Zebra finches are becoming an increasingly common avian species in research. Nonetheless, the gonadal development of these birds has not received extensive investigation. The objective of this study was to elucidate the early formation of gonadal ridges in zebra finches, the sexual differentiation of the gonads, and the subsequent development of testicular structure.

MATERIALS AND METHODS



The embryos and hatchlings of zebra finch were staged according to the Hamburger-Hamilton (HH) tables. The gonads were fixed in Bouin's solution, embedded in paraffin, and stained using a trichromatic method according to Dubreuill. Sex was genotyped using PCR with CHD-Z and CHD-W specific starters.

RESULTS

We observed a notable asymmetry in gonadal development, with the left gonadal ridge being larger than the right. Moreover, the left gonadal ridge displayed a notably higher number of PGCs compared to the right side, further accentuating the asymmetry (Fig. 1). Consequently, the developing left testis surpasses the right one in size (Fig. 2).

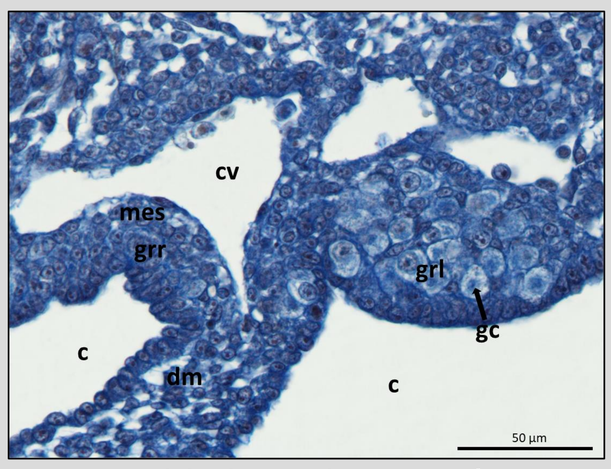


Fig 1. Gonadal ridges at the stage E3/HH21 (embryonic day 3/HH stage 21)

Fig 2. Developing testes at the stage E5/HH29

Differentiated testes were identified through two key characteristics: 1) the presence of a well-developed medulla containing the testis cords, and 2) the regression of the cortical region. In each analyzed individual, the right testis exhibited a normal structure with well-defined testis cords accompanied by a thin and sterile surface epithelium covering the gonad (Fig. 3). However, in certain numer of individuals, the left testis displayed a unique feature: it was enveloped by a thick, ovarian-like cortex containing numerous germ cells (Fig. 4-6). This gonadal structure indicated a hermaphroditic condition of the left testis.

Fig 3. The right testis at stage E8/HH37

Fig 4. The left testis with thick cortex at stage E8/HH37

Fig 5. The left testis with thick cortex after hatching

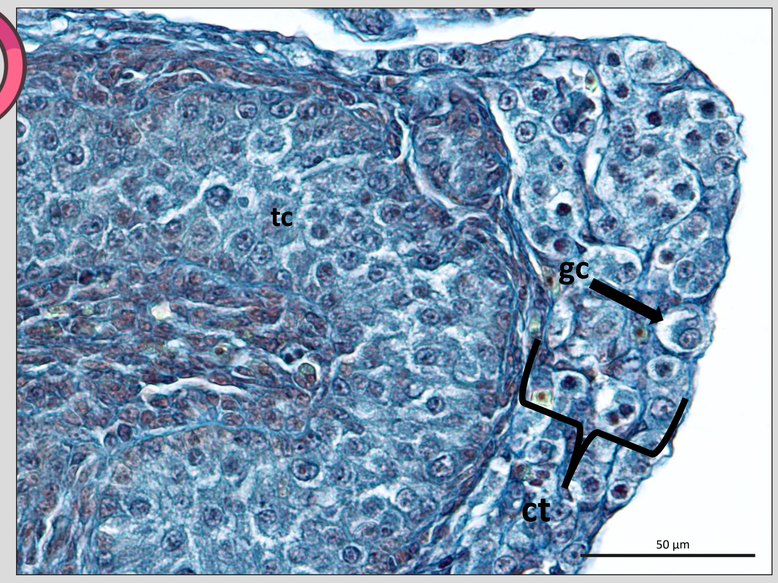


Fig 6. The left testis with thick cortex after hatching

Figure legend: c – coelomic cavity, ct – cortex, cv – cardinal vein, dm – dorsal mesentery, gc – germ cell, grl – left gonadal ridge, grr – right gonadal ridge, m – mesonepheros, md – medulla, mes – mesenchyme, tc – testis cords, tl – left testis, tr – right testis

DISCUSSION

The zebra finch, representing the Neoaves group, which encompasses nearly 95% of all known bird species, provides valuable insights into avian gonad development. This study unveils a unique trajectory of gonadogenesis, offering a deeper understanding of the complexity and diversity of gonad development in birds across species. We observed a hermaphroditic condition in the left gonad of ZZ (genetic males) zebra finch individuals. The function of the ovarian-like cortex in the left testis remains unclear and requires further investigation. It is possible that this cortex may have endocrinological roles. The potential impact of this condition in the left gonad on fertility also remains unexplored.

Exploring collaboration prospects – email: paulinamizia@doctoral.uj.edu.pl

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