Embryonic muscle stem cells in *Drosophila*: from dormant state to reactivation

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How stem cells specified during development keep their non-differentiated quiescent state, and how they are reactivated, remain poorly understood. We have previously characterized the *Drosophila* muscle stem cells called Adult Muscle Precursors (AMPs) that emerge during mid-embryogenesis, and express markers specific to muscle progenitors, such as the b-HLH transcription factor Twist (Figeac et al., 2010). The AMPs lie dormant during embryonic and most of larval life, and upon activation proliferate, providing a source of myoblasts that ensure adult muscle growth and the regeneration of a subset of thoracic flight muscles. We also followed the AMP cells in vivo using membrane-targeted GFP, and found that AMPs send out long cellular processes, and are interconnected (Figeac et al., 2010). Interestingly, the capacity to send out cytoplasmic extensions and make interconnections has also been documented for quiescent satellite cells sited on myofibers (Tavi et al., 2010). All these features make AMPs similar to vertebrate satellite cells, prompting us to analyze their homing behavior, and the mechanisms that drive their activation and exit from the dormant state.

We report that emerging AMPs send out thin filopodia that make contact with neighboring muscles. AMPs keep the filopodia-based association with muscles during their dormant state but also when they start to proliferate suggesting that muscles could play a role in AMPs reactivation. Indeed, our genetic analyses indicate that muscles send inductive dIlp6 signals that switch Insulin pathway ON in closely associated AMPs. This leads to a ligand-independent activation of Notch, which *via* dMyc positively regulates proliferation of AMPs. Altogether (Aradhya, Zmojdzian et al., 2015), we report that *Drosophila* AMPs display homing behavior to muscle niche and demonstrate the key role of niche-driven Insulin-Notch-dMyc cascade in setting the activated state of AMPs.

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REFERENCES

Figeac N, Jagla T, Aradhya R, Da Ponte JP, and Jagla K. 2010. *Drosophila* adult muscle precursors form a network of interconnected cells and are specified by the rhomboid-triggered EGF pathway. *Development* 137: 1965–1973.

Tavi P, Kornohn T, Hanninen SL, Booten JD, Loof S, Simon A, and Westerblade H. 2010. Myogenic skeletal muscle satellite cells communicate by tunneling nanotube. *J. Cell. Physiol.* 223: 376–383.

Aradhya R, Zmojdzian M, Da Ponte JP, and Jagla K. 2015. Muscle niche-driven Insulin-Notch-Myc cascade reactivates dormant Adult Muscle Precursors in *Drosophila*. *Elife* 4, e08497.

Prespermatogenesis and first spermatogenic wave in larval and juvenile anuran amphibians

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Studies on the earliest stages of male germ cells proliferation and entrance into the first meiotic cycle in developing testes of anuran amphibians are scarce. This early phase is known in mammals, including humans, as prespermatogenesis. It starts during fetal life, just after primordial germ cells (PGCs) invade the genital ridges and become gonocytes (G) that start mitotic divisions (M-prospermatogonia) and finally give rise to a pool of transient (T) prospermatogonia that are dormant until puberty. The T-prospermatogonia transform into spermatogonial stem cells (SSC) that are mitotically active and can either renovate adult spermatogonial pool or enter meiosis resulting in sperm production. Because completion of metamorphosis in amphibians may be considered as equal to birth in mammals (Tata, 1993), we compared tadpole prometamorphosis in frogs to fetal life in mammals, and the end of metamorphic climax to birth.

To the best of our knowledge, there are no studies on prespermatogenesis in amphibians and its similarity to prespermatogenesis in mammals. Bartmańska and Ogielska (2009) proposed that a period of spermatogonial proliferation in larval testes in amphibians is in fact prespermatogenesis. Here we argue that amphibian larval primary spermatogonia are homologues of the mammalian prospermatogonia, whereas primary spermatogonia in adults are equal to spermatogonial stem cells (SSC). We focused on morphology and ultrastructure of somatic and germ cells within developing male gonads, especially nuclei, mitochondria, and the Sertoli cells. We also estimated how many generations of secondary spermatogonia (A) are formed from a single SSC and discuss similarities and differences between amphibian and mammalian spermatogenesis.

REFERENCES

Ogielska M and Bartmańska J. 2009. Spermatogenesis and male reproductive system in Anura. Chapter 2 [in] Reproduction of Amphibians, Maria Ogielska (editor), *Science Publisher USA* pp. 34–99.

Tata J. 1993. Gene expression during metamorphosis: an ideal model for post-embryonic development. *Bioessays* 15(4): 239–248.

Origin of plant embryo polarity

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One of the first steps in the development of an embryo from a single celled zygote is the establishment of the main body axis. In model animals the orientation of this axis uses position information provided by surrounding maternal tissue or the sperm entry point. In most flowering plants, the apical-basal body axis is reflected by the asymmetric division of the polarized zygote. However the underlying mechanisms regulating axis formation remained enigmatic. Here we address which factors establish zygote polarity. We demonstrate that both, maternal and paternal, factors cooperate in the initiation of the embryo axis.