Monitoring naturally occurring synapse elimination in fluorescent neonatal mice

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My colleagues and I use transgenic mice that express fluorescent proteins in neurons to monitor the remodeling of synaptic circuits that takes place in the developing nervous system. This remodeling plays a critical part in the way young animals use experience to mold their nervous systems to conform to the world they live in. Our work focuses on the synaptic connection between motor neurons and muscle fibers. In adults each muscle fiber is innervated by exactly one motor neuron and at just one site, the neuromuscular junction. Each motor neuron however distributes its innervation to a number of muscle fibers. This pattern emerges in early postnatal life as synapses of different motor neurons that initially multiply innervate neuromuscular junctions are eliminated. Time-lapse imaging in vivo of muscles in which different axons express different colored fluorescent proteins reveals the way neuromuscular junctions undergo the transition from multiple to single innervation and motor axon branches are removed. 2P laser axotomy shows that the elimination is driven by competition between axons that transiently co-occupy synaptic sites. Serial TEM implicates a role for glia in the removal process.

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