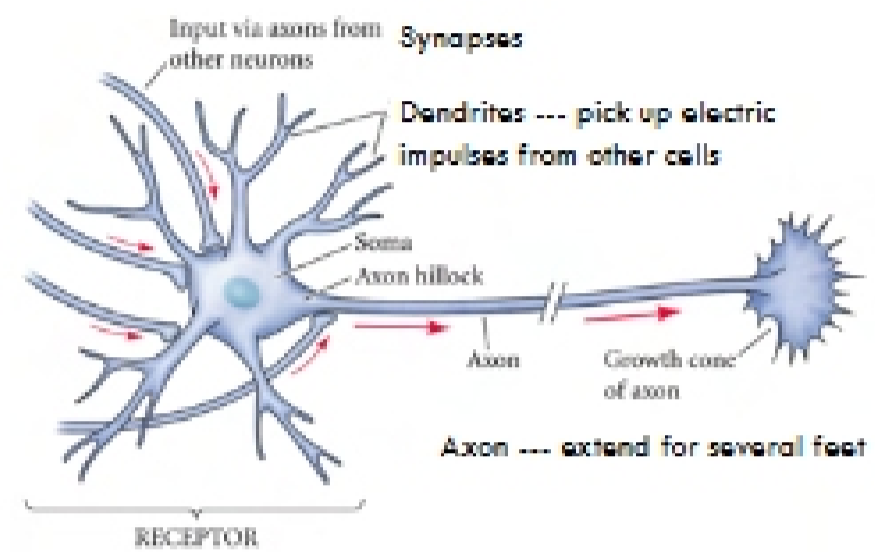




CHAPTER 13-2, NEURONAL SPECIFICATION AND AXONAL SPECIFICITY

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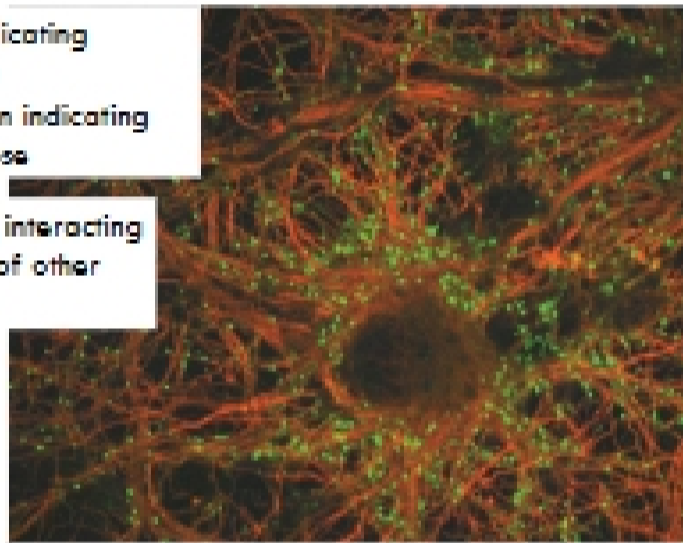
Diagram of a motor neuron



Connections of axons to a cultured rat hippocampal neuron

Red: Tubulin indicating dendrites
Green: Synapsin indicating the synapse

In human brain, interacting with thousands of other neurons.



Goodman & Doe list 8 stages of neurogenesis

1. Induction and patterning of a neuron-formation (neurogenic) region.
2. Birth and migration of neurons and glia.
3. Specification of the cell fates.
4. Guidance of axonal growth cones to specific targets.

Goodman & Doe list 8 stages of neurogenesis

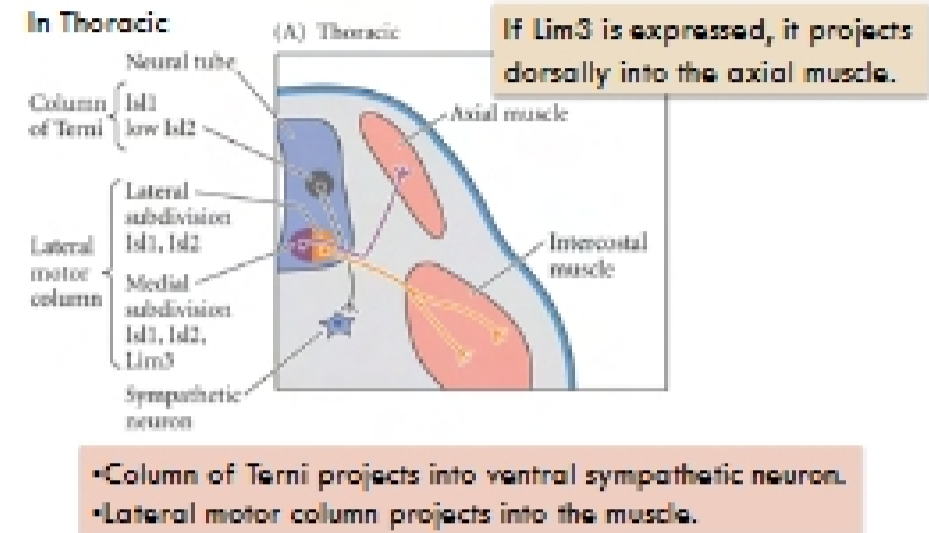
5. Formation of synaptic connections.
6. Binding of trophic factors for survival and differentiation.
7. Competitive rearrangement of functional synapses.
8. Continued synaptic plasticity during the organism's lifetime

The Generation of Neuronal Diversity

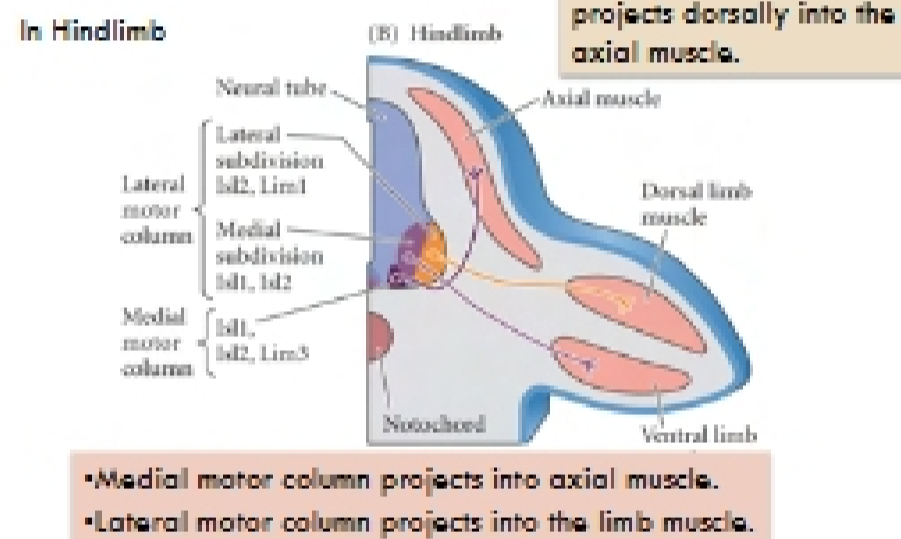
Specification of neurons in a

1. Whether a ectodermal cell will become a neuron, a neural crest cell, or epidermis.
2. What type of neuron? Motor neuron, sensory neuron, commissural neuron or some other type?
3. What is a specific target of the neuron?

Motor neuron organization and Lim specification in the spinal cord



Motor neuron organization and Lim specification in the spinal cord

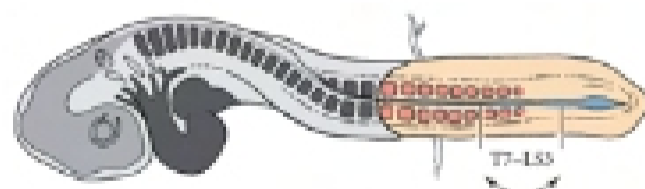


Lim transcription factors

- Lim transcription factors probably coordinate the projections of the motor neurons by specifying ephrin-A receptors.

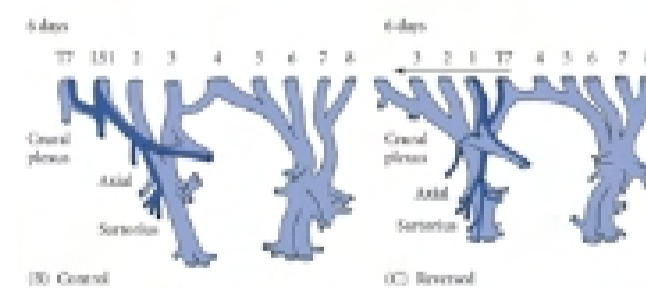
Compensation for small dislocations of axonal initiation position in the chick embryo

7th thoracic to 3-4 lumbo-sacral segment was reversed in 2.5 day chick embryo



Compensation for small dislocations of axonal initiation position in the chick embryo

At 6 days old embryo, neurons were found at their proper pathway.



The targets of these motor neurons are specified before their axons extend into the periphery.

Pattern Generation in the Nervous System

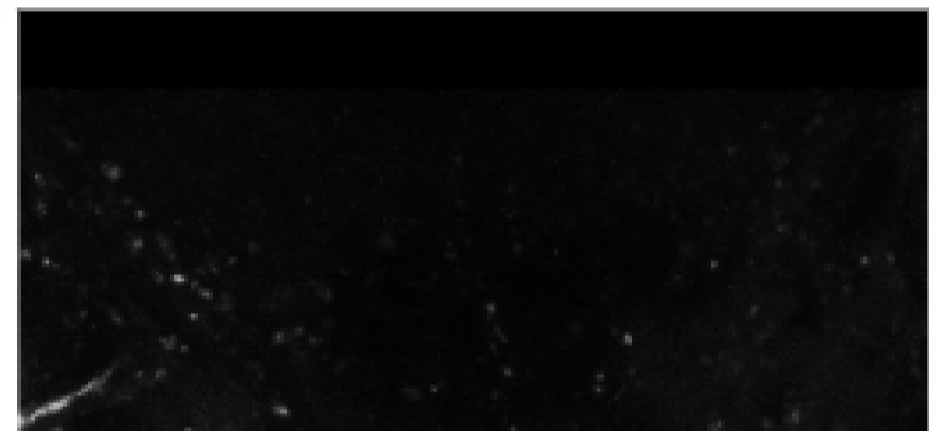
Pattern Generation in the Nervous System

Three steps specification of axonal connections

1. Pathway selection
 - Travel along a route Independent
2. Target selection
 - Recognize and bind to a set of the cells Independent
3. Address selection
 - Initial patterns are refined Several neurons

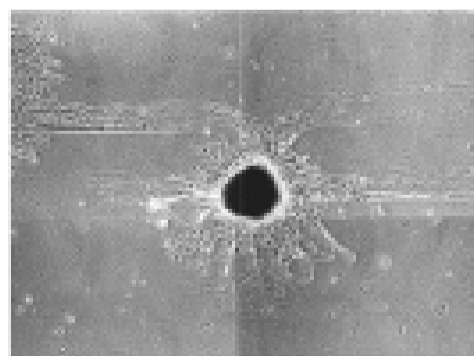
Motor neurons can establish their normal patterns of innervation in the absence of neuronal activity.

Cell adhesion and contact guidance by attractive and permissive molecules



Outgrowth of sensory neurons

Outgrowth of sensory neurons placed on a patterned substrate consisting of parallel stripes of laminin applied to a background of type IV collagen



Many of the roads appear to be paved with the glycoprotein laminin.

Guidance by specific growth cone repulsion