Nerve Injury and Repair

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MODE OF NERVE INJURY

- Ischemia
- Compression
- Traction
- Laceration
- Burn.

Neuronal response to Injury

1. Segmental Demyelination

   myelin that surrounds the nerve degenerates as a result of the damage

2. Wallerian Degeneration
   - degeneration of the axon distal to the injury
   - typically affects longest nerve fibers first
   - beginning distally and spreading proximally

3. Retrograde degeneration up to the nearest collateral

Neuronal response to Injury

4. Phagocytic cells invade the area
5. The cell body of the neuron undergoes chromatolytic reaction.- Chromatolysis

   decrease in Nissl Substance

   (swelling of the cell body, fragmentation of rough ER, eccentric nucleus, changes in protein synthesis and gene expression)
6. Presynaptic terminals on the cell body withdraw and enwrapped by glial cell processes.

Categories of Nerve Injury

Three Categories

- – Neuropraxia
- – Axonotmesis
- – Neurotmesis

Categories of Nerve Injury

- **Neuropraxia**
- Mildest form of nerve injury
- Involves motor and sensory function
- Involves segmental demyelination
- Results in a slowing or decreased conduction of AP at point of compression or ischemia
- Results in an interruption in conduction of the impulse down the nerve fiber,
- Loss of function which is reversible within hours to months

Categories of Nerve Injury

- **Axonotmesis**
- Damage to the axon (wallerian degeneration Damage to the axon)
- Loss of the relative continuity of the axon and its covering of myelin
- Preservation of the connective tissue frame work of the nerve (the encapsulating tissue, the epineurium and perineurium, are preserved).
- Recovery occurs only through regenerations of the axons
- Lesion may grow distally as fast as 2 to 3 mm per day

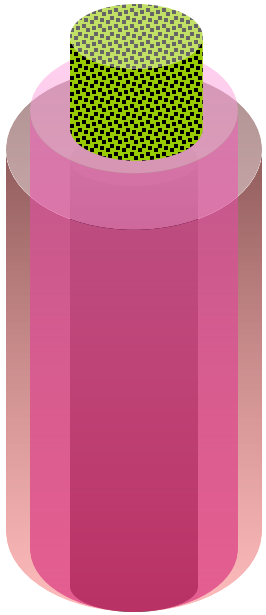
Categories of Nerve Injury

- **Neurotmesis**
- Most severe axonal lesion that occurs on severe contusion, stretch, lacerations
- Axon and the encapsulating connective tissue lose their continuity from inside (may still look intact)
- complete loss of motor, sensory and autonomic function

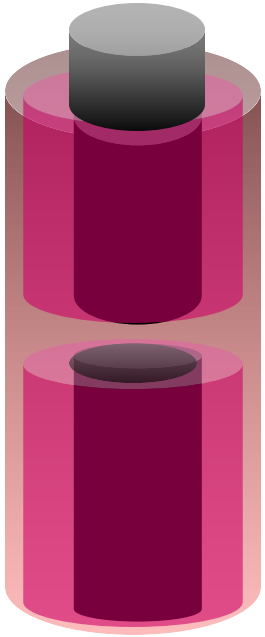
Classification of nerve injuries

(Seddon classification)

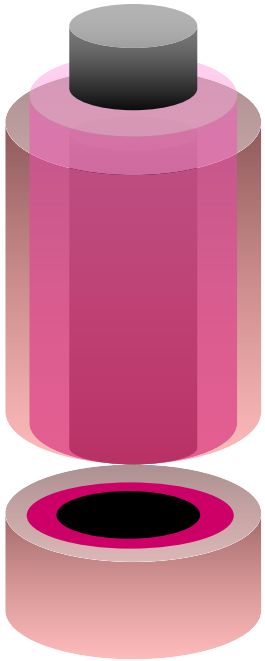
Normal axon



Neurapraxia



Axonotmesis



Neurotmesis

Nerve Regeneration

- Axonal sprouts grow from the proximal stump to the distal basal lamina tube

- Multiple
- Remyelination of the nerve
- cell body comes back to normal state.
- New functional nerve endings are formed.

- Several local factors promote this axonal growth
- (e.g. chemotactic factors secreted by Schwann cells)