CENTRAL NERVOUS SYSTEM

PERIPHERAL NERVE

APPROVED

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Objectives

- Recognize and describe the pathology of the common inflammatory/infectious, hereditary, nutritional/metabolic, toxic and traumatic peripheral neuropathies
- Describe the pathophysiology of the common forms of peripheral neuropathy

Symtoms associated with peripheral neuropathy are the same, regardless of the cause.

EM of cross section of peripheral nerve.

Myelin Sheath. Its thickness is a function of the axon diameter.

Schwann Cell

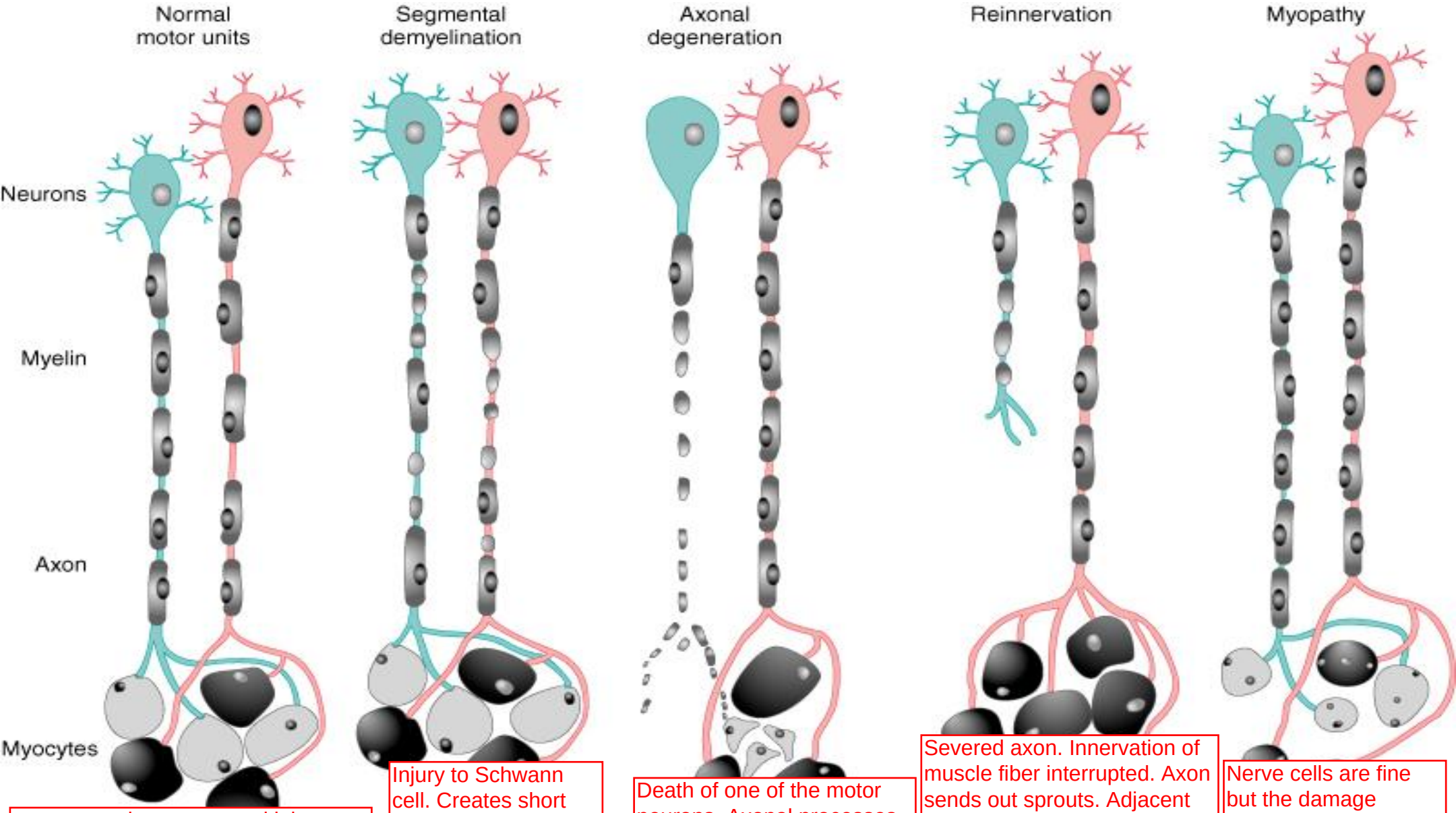
Axon

Pathological Terms Used

- Segmental Demyelination –Schwann cell injury
  - Remyelination – repair of injury to Schwann cells
- Axonal Degeneration – injury to nerve cell body or axon results in muscle fiber atrophy.
- Nerve Regeneration and Reinnervation – recovery from injury to axon (sprouts).
- Myopathy – disease of muscle

Demyelination and remyelination often occur together.

Regeneration occurs as long as cell body is still viable.



one neuron innervates multiple muscle fibers. Creates a patchwork pattern.

Injury to Schwann cell. Creates short segments of thin myelin. Innervation is the same.

Death of one of the motor neurons. Axonal processes associated with the neuron die but there's still partial innervation. Cause muscle

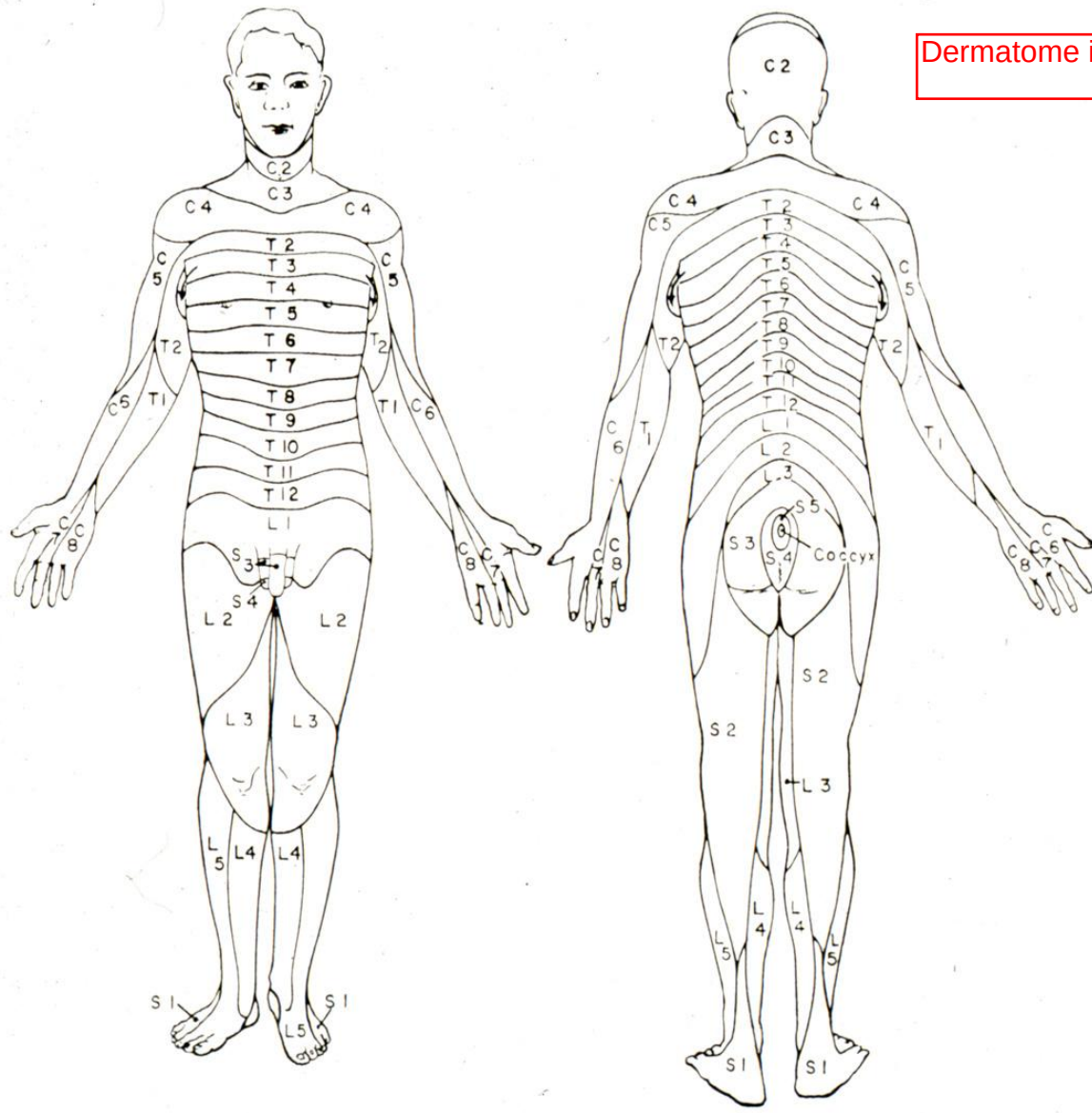
Severed axon. Innervation of muscle fiber interrupted. Axon sends out sprouts. Adjacent intact neuron takes over innervation but you no longer have patchwork pattern.

Nerve cells are fine but the damage occurs in the muscle.

Clinical Presentation

- Weakness
- Numbness
- Paresthesias Tingling sensations.
- Loss of sensation
- Symptoms correspond to dermatome

Dermatome innervations.



Read slide

PERIPHERAL NEUROPATHY

- The causes of peripheral neuropathy are diverse.
  - Inflammatory/ Infectious
  - Hereditary
  - Nutritional and Metabolic
  - Toxic
  - Traumatic

PERIPHERAL NEUROPATHY

Inflammatory/ Infectious Causes

- Guillain-Barré syndrome, acute
- Chronic inflammatory demyelinating polyradiculoneuropathy (CIDP) — Chronic form of Guillain Barre. Slower progression.
- Leprosy — Not common in the U.S.
- Diphtheria — Neurotoxin. Not common in U.S.
- Varicella-Zoster (Shingles) — Common in the elderly.

Read slide

Guillain-Barrè

- Rapid, life threatening ascending paralysis
  - 1-3 cases per 100,000 persons per year in US
- Inflammation and demyelination of spinal and peripheral nerves.
- Preceded by an acute flu like illness.
- Idiosyncratic T cell mediated immune response to peripheral nerve myelin.
- Usually resolves with support of respiratory function.

Chronic inflammatory demyelinating polyradiculoneuropathy (CIDP)

Read slide

- Chronic, slowly progressive form of Gullain-Barre
- Inflammation with demyelination and remyelination of peripheral nerves.
- Idiosyncratic T cell mediated immune response to peripheral nerve myelin.

Infectious Polyneuropathy

- Lepromatous leprosy – Schwann cells invaded by *M. leprae*
- Tuberculoid leprosy – inflammation associated with *M. leprae* injures the nerves less severe form of leprosy
- Diphtheria - exotoxin injures the sensory ganglia
- Varicella-Zoster (shingles)- reactivated chicken pox virus leads to painful vesicles along the dermatome

Shingles

ADAM.

PERIPHERAL NEUROPATHY

Hereditary Causes

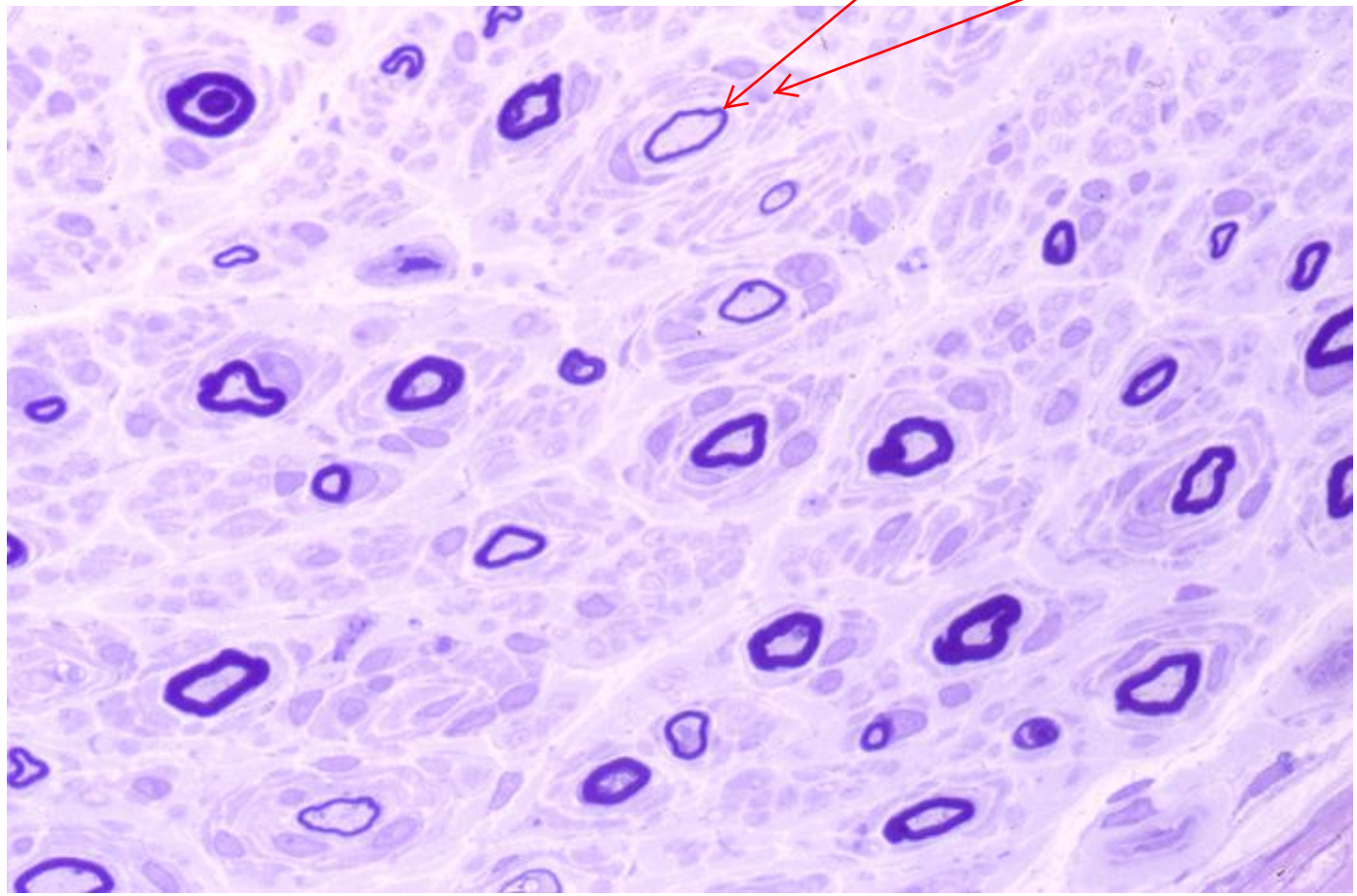
Compatible with normal life expectancy.

- Hereditary Motor and Sensory Neuropathies
  - HMSM I -Charcot-Marie-Tooth (hypertrophic neuropathy)– auto dom
  - HMSN II -autosomal recessive
  - HMSN III Dejerine-Sottas disease -auto rec
- Hereditary Sensory and Autonomic Neuropathies
- Neuropathy associated with inherited metabolic disease
  - Adrenoleucodystrohy
  - Refsum’s disease
  - Porphyria
  - Familial amyloid polyneuropathy

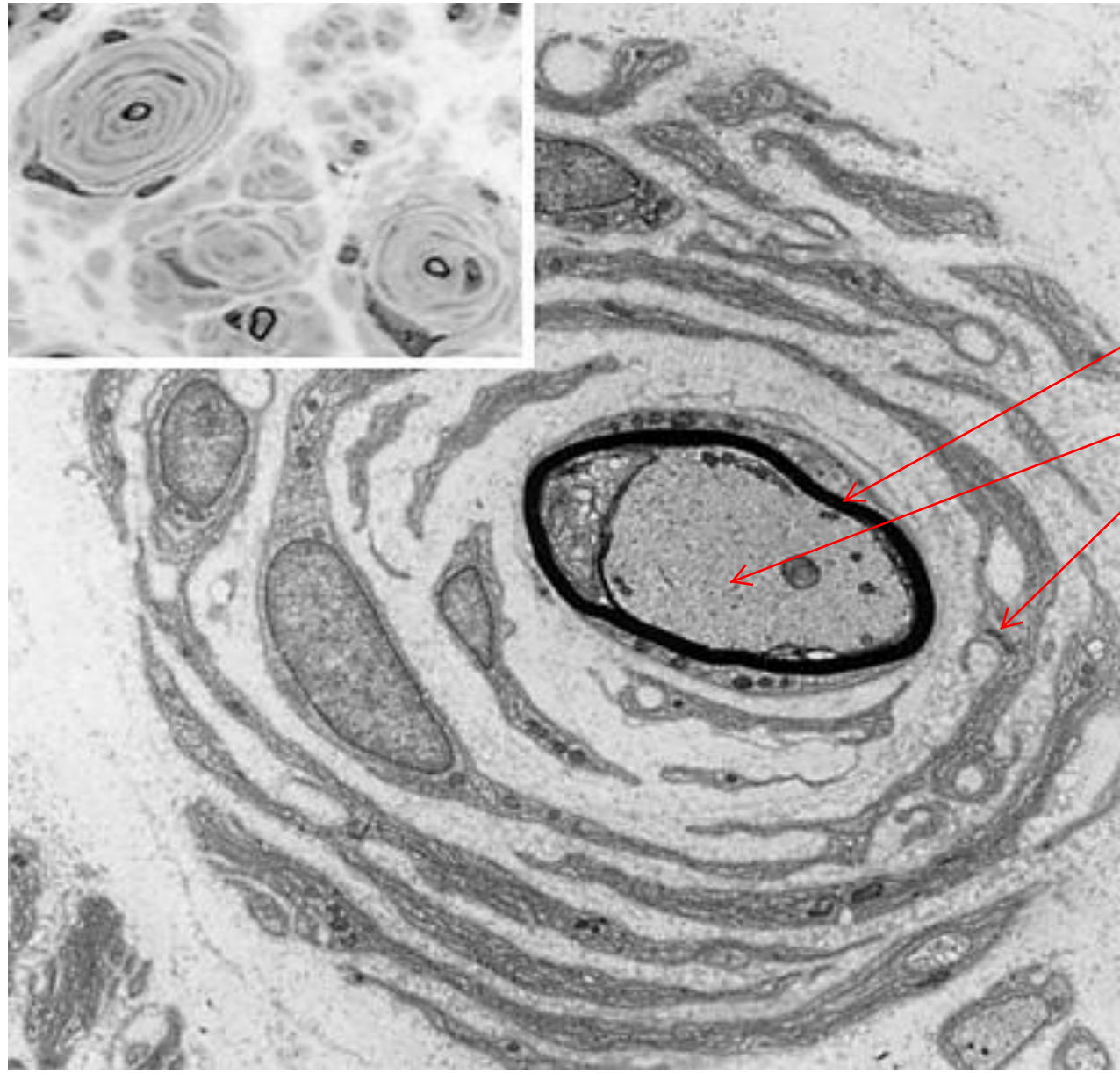
HEREDITARY NEUROPATHY

Charcot-Marie-Tooth (HMSN I)

Onion bulbs



Causes peripheral nerve to feel knotty which can be palpated on physical exam.


Same thing as previous slide on EM
Myelin
Axon
Schwann Cells

PERIPHERAL NEUROPATHY

Nutritional and Metabolic Causes

- Diabetes
  - Most common cause
- Renal failure
- Thiamine (B_1) deficiency
  - Consequence of alcohol abuse
  - Chemotherapeutic agents
- Other vitamin deficiencies
  - Cobalamin (B_{12})
  - Pyridoxine (B_6)
  - α-tocopherol (E)
- Ethanol

Impairs DNA synthesis.

Less common

Diabetic Neuropathy

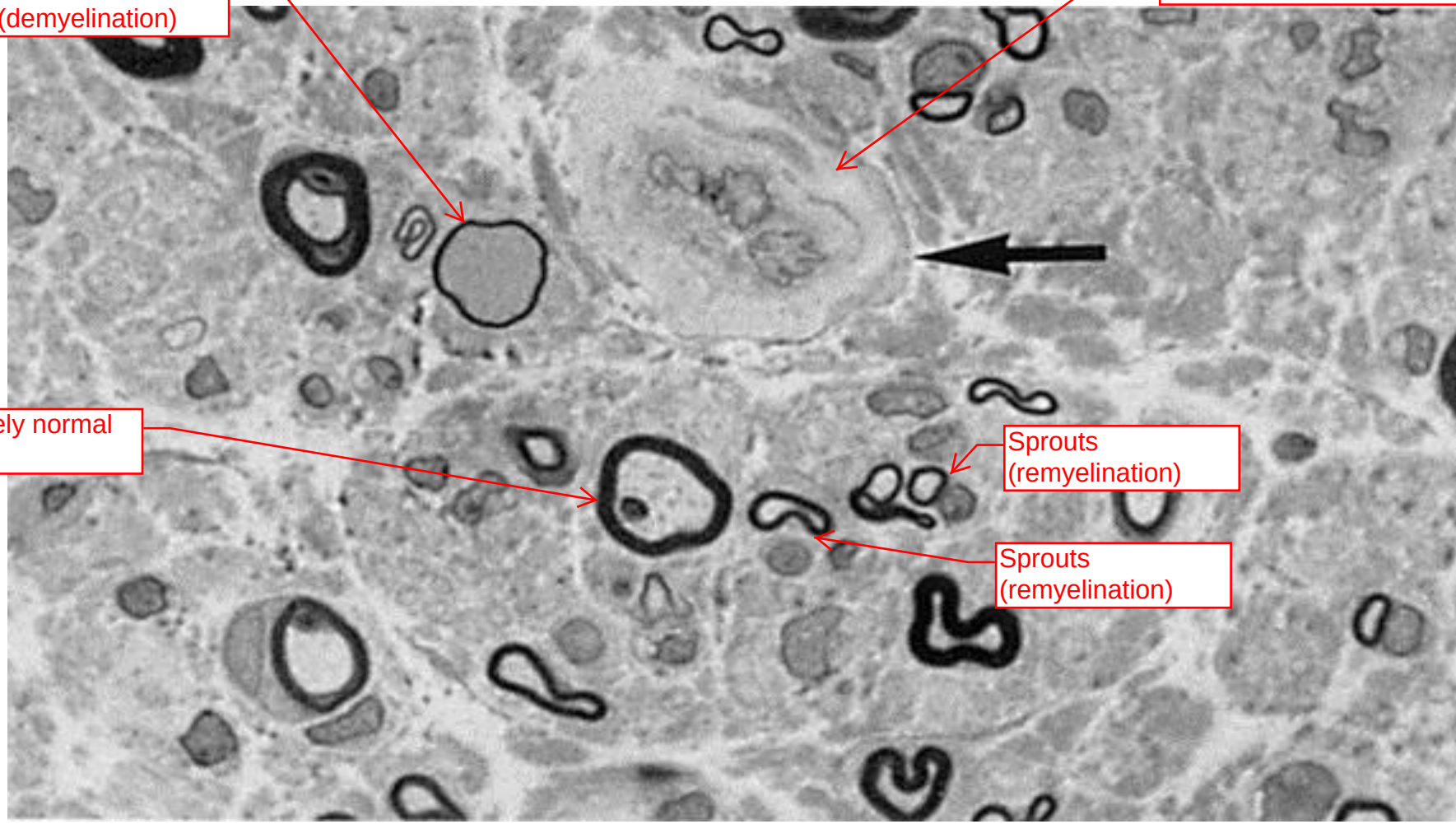
- 50% of diabetics will develop peripheral neuropathy after 25 years of disease
- Distal symmetric sensory or sensorimoter neuropathy
  - Decreased sensation in the lower extremities

Often leads to foot ulcers

- Autonomic neuropathy

Bowel and bladder dysfunciton

Diabetic Neuropathy



Segmental demyelination and remyelination!

PERIPHERAL NEUROPATHY

Toxic Causes

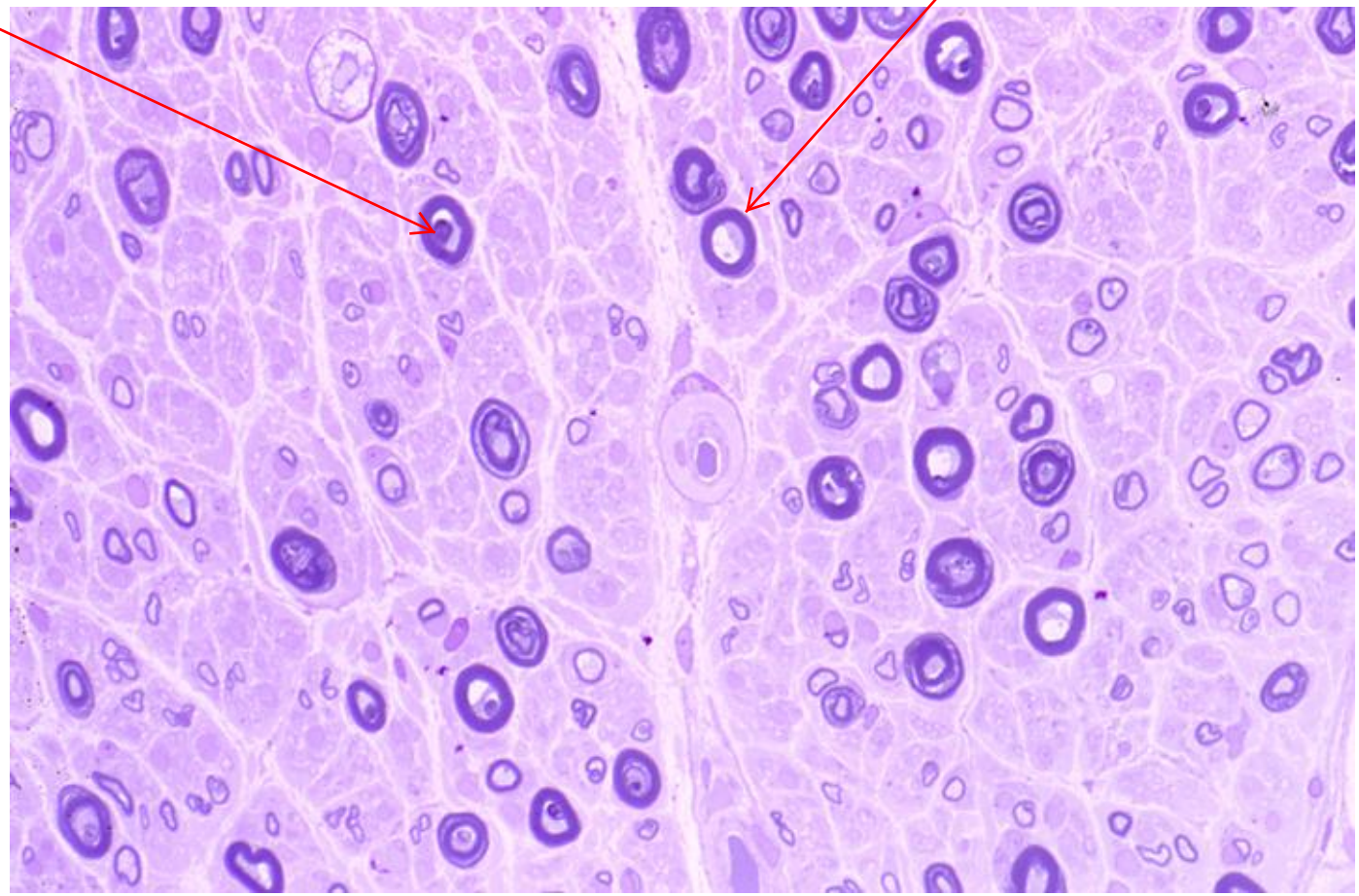
- Lead
  Still a problem in inner cities where lead based paint was used on houses.
- Arsenic
- Chemotherapeutic agents
  - Cisplatin
  - Vincristine
- Organic solvents
  - Glue sniffing
  - Industrial exposure

TOXIC NEUROPATHY

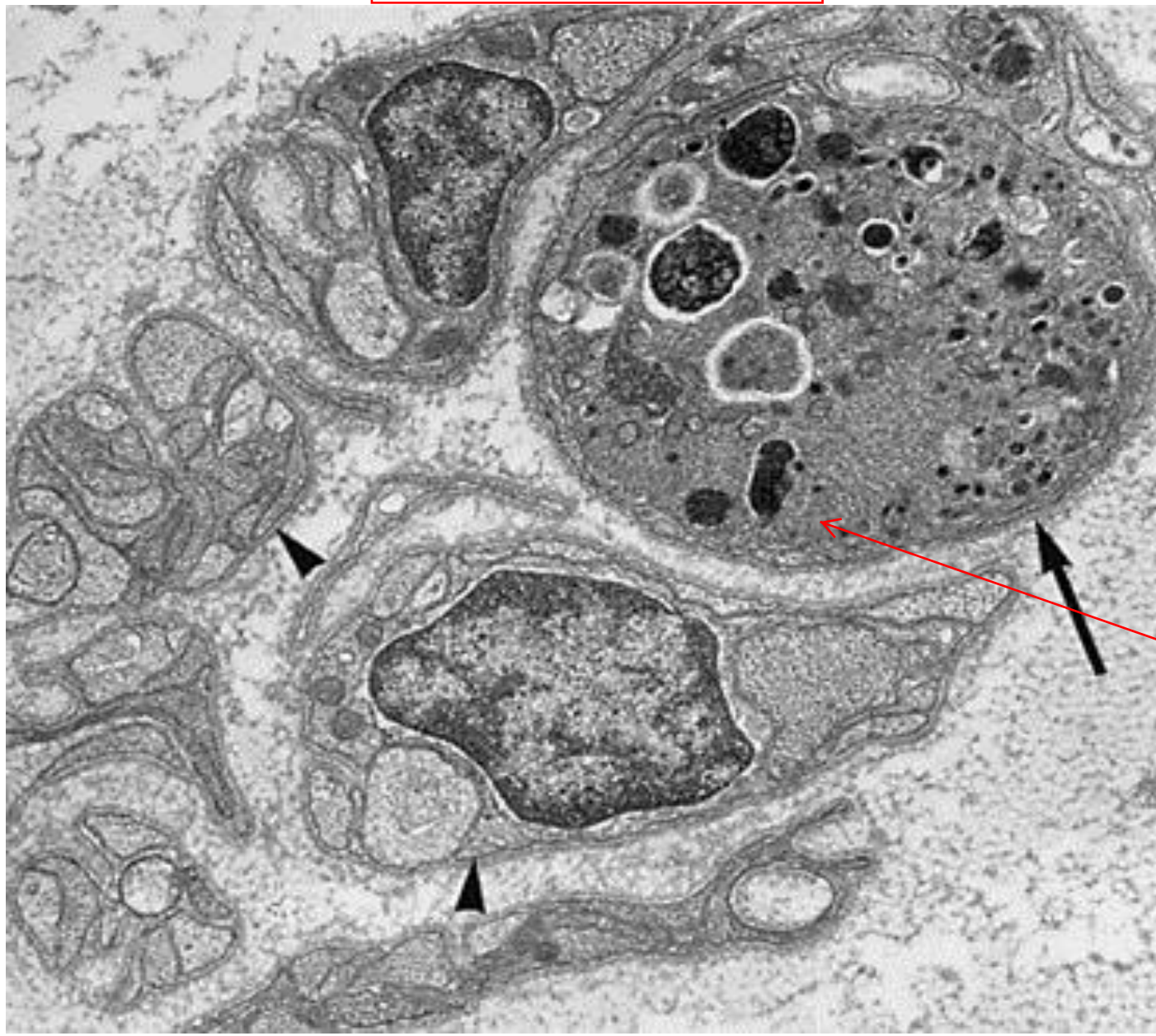
Wallerian degeneration of individual axons

Normal axon

Ovoid structures interrupt axoplasm. Represents degeneration. Schwann cells are fine, but the axons are damaged.



EM of same thing from previous slide



Axon with degenerating organelles in the cytoplasm.

PERIPHERAL NEUROPATHY

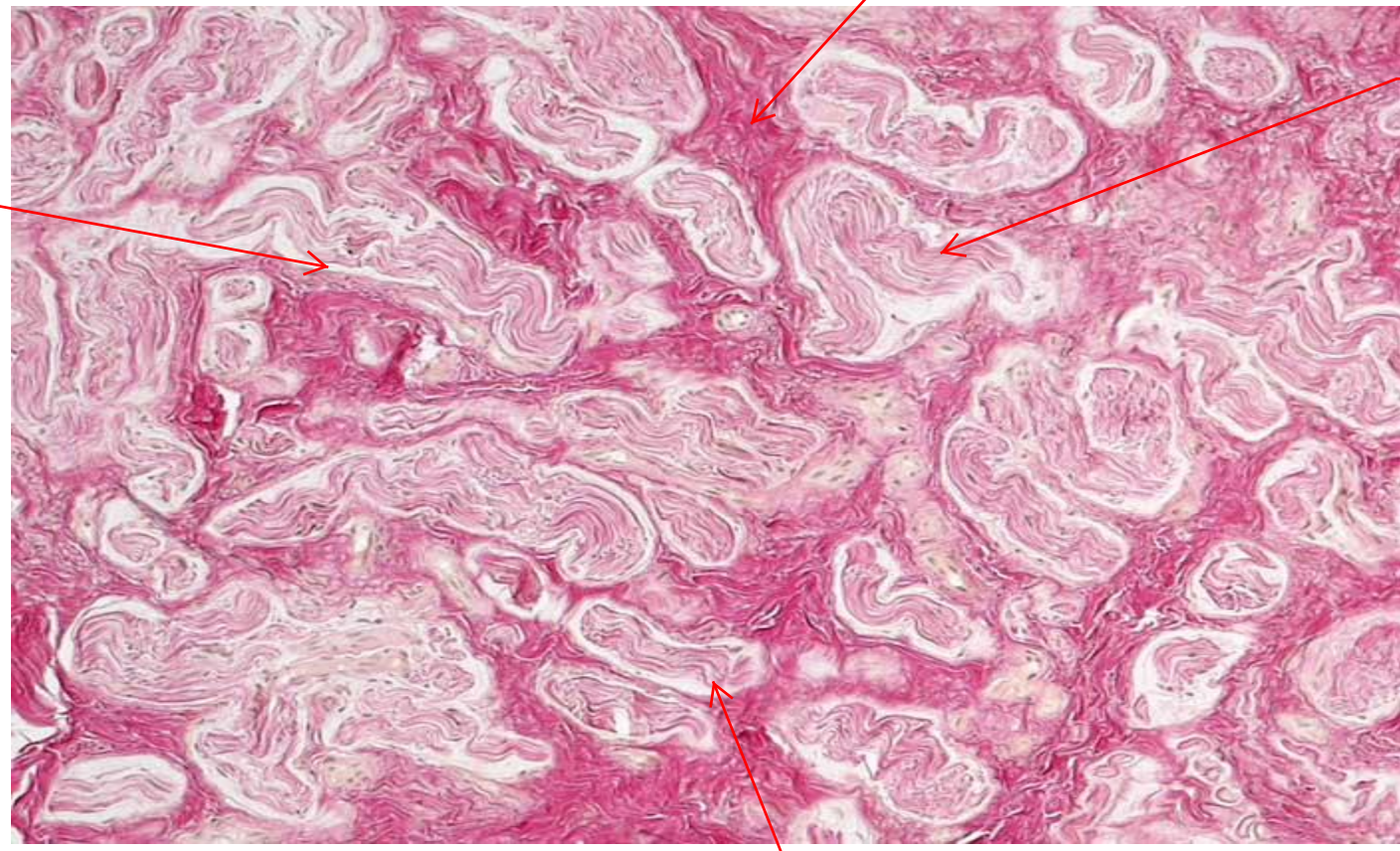
Traumatic

- Lacerations — Common in gun shot wounds
  - Wallerian degeneration
- Avulsion — Ex. Joint pulled out of socket which causes tearing of the nerve
  - Traumatic neuroma, proliferation of nerve twigs — Very painful
- Compression neuropathy — Fairly common
  - Carpal tunnel syndrome — common in office workers
  - Morton neuroma — Similar to carpal tunnel, but occurs in the feet

Traumatic neuroma

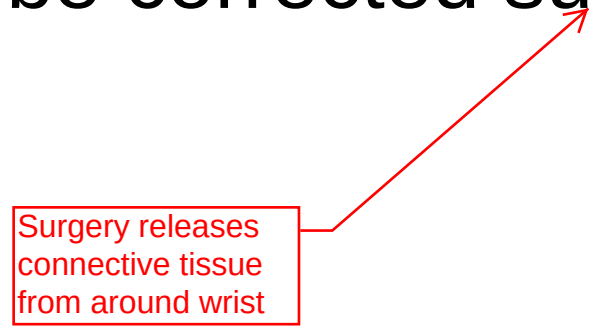
Proliferation of small nerves encased in perineurium

PathoPic image 7846



Carpal tunnel syndrome

- Occupational hazard
- Office workers
- Can be treated with physical therapy and anti-inflammatory agents
- Severe cases progress to neurological deficits which must be corrected surgically



The most common cause of numbing and paresthesias of the feet and hands (peripheral neuropathy) is

A. Charcot Marie Tooth Disease

B. Guillain-Barre syndrome

C. Arsenic poisoning

D. Shingles

E. Diabetes

PERIPHERAL NEUROPATHY

Neurogenic Atrophy of Muscle

(Type 2 fibers dark)