Pre-reading Manual
Part 1

PELVIC PAIN & DYSFUNCTION

Definitions, Biochemistry, and Mechanisms of Action

INTEGRATIVE DRY NEEDLING

IMPORTANT!

The intent of this addendum is to help healthcare professionals interpret the past, current, and future research on dry needling, vacuum therapy, and manual therapy. You will not be tested on the content but are expected to review the information before the course. This will provide relevance to the science behind the practical application of neurological dry needling being taught in the IDN courses.

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pH Scale 0-14 Neutral pH 7

- pH 6.3-6.6: Saliva, Urine, Milk
  - pH 5 Coffee
    - pH 2.5-3.5 Grapefruit Juice
      - pH 2 Lemon Juice; Vinegar
        - pH 0 Hydrochloric Acid
- pH 7.4 Blood
  - pH 8 Sea Water
    - pH 9.5 Baking Soda
      - pH 13.5 Bleach
        - pH 14 Liquid Drain Cleaner

Extracellular Matrix (ECM)

- Polysaccharides
  - Polymeric Carbohydrates
    - Long chain carbohydrated molecules
    - Composed of monosaccaride units
    - Units are bound by glycosidic linkages
    - React with water (hydrolysis: chemical rxn in which a molecule of water ruptures one or more chemical bonds) using amylase enzyme (catalyzes the hydrolysis of starch into sugars-monosaccharides or Oligosaccharides (saccharide polymer containing a small number of monosaccharides)
- Glycoaminoglycans GAGs/mucopolysaccharides
  - Long linear polysaccharides consisting of repeating disaccharide Units (double sugar units)
  - Highly polar and attracts water
  - Used in the body as a lubricant or shock absorber (Hyaluronic Acid)
- Proteoglycans
  - Proteins that are heavily glycosylated (enzymatic process that attaches glycans to proteins, or other organic molecules)
- Water
  - Interacts with hydrophilic substances
    - Takes on a gel like state/colloid chrystal in chemical structure adjacent to the hydrophilic substance
      - Exclusion zone (EZ) - Negative charge is next to the hydrophilic substance
      - Bulk water has Positive charge

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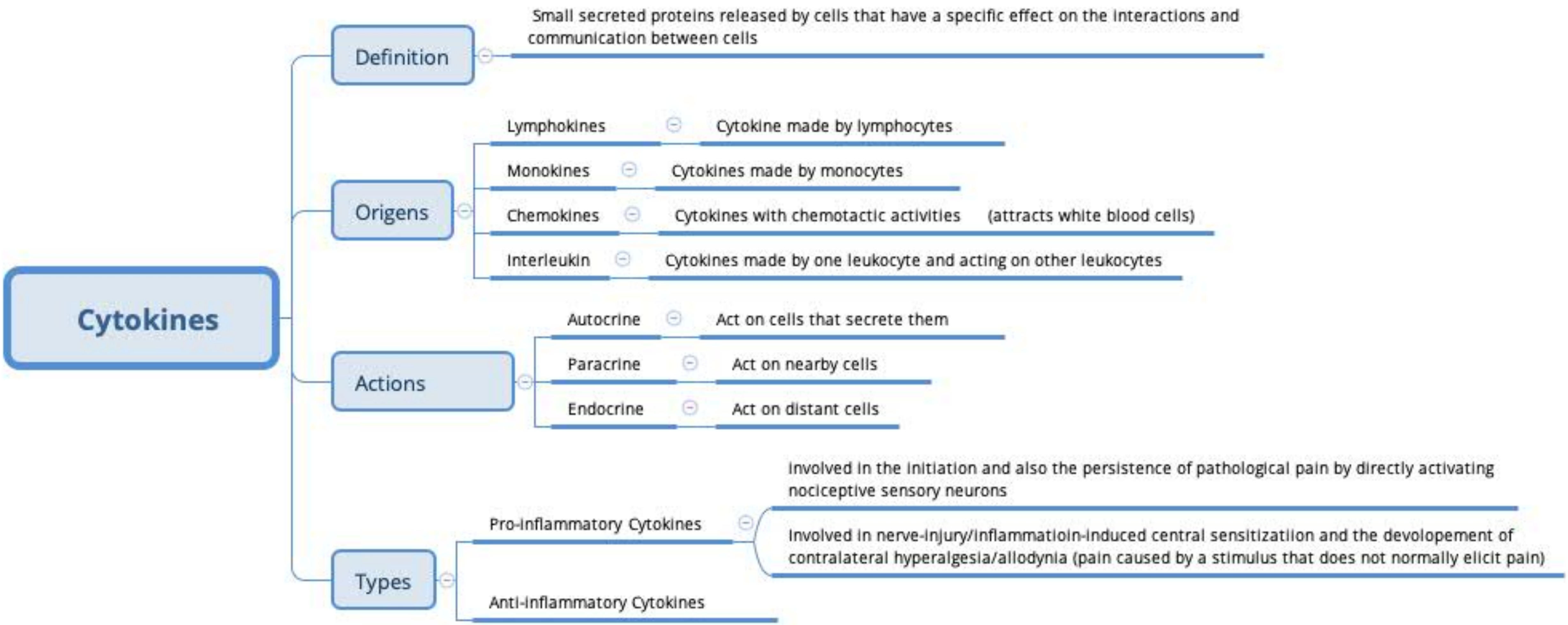
Cytokines
Definition
Small secreted proteins released by cells that have a specific effect on the interactions and communication between cells
Origens
Lymphokines
Cytokine made by lymphocytes
Monokines
Cytokines made by monocytes
Chemokines
Cytokines with chemotactic activities (attracts white blood cells)
Interleukin
Cytokines made by one leukocyte and acting on other leukocytes
Actions
Autocrine
Act on cells that secrete them
Paracrine
Act on nearby cells
Endocrine
Act on distant cells
Types
Pro-inflammatory Cytokines
Involved in the initiation and also the persistence of pathological pain by directly activating nociceptive sensory neurons
Involved in nerve-injury/inflammatioin-induced central sensitizatiion and the devolopement of contralateral hyperalgesia/allodynia (pain caused by a stimulus that does not normally elicit pain)
Anti-inflammatory Cytokines

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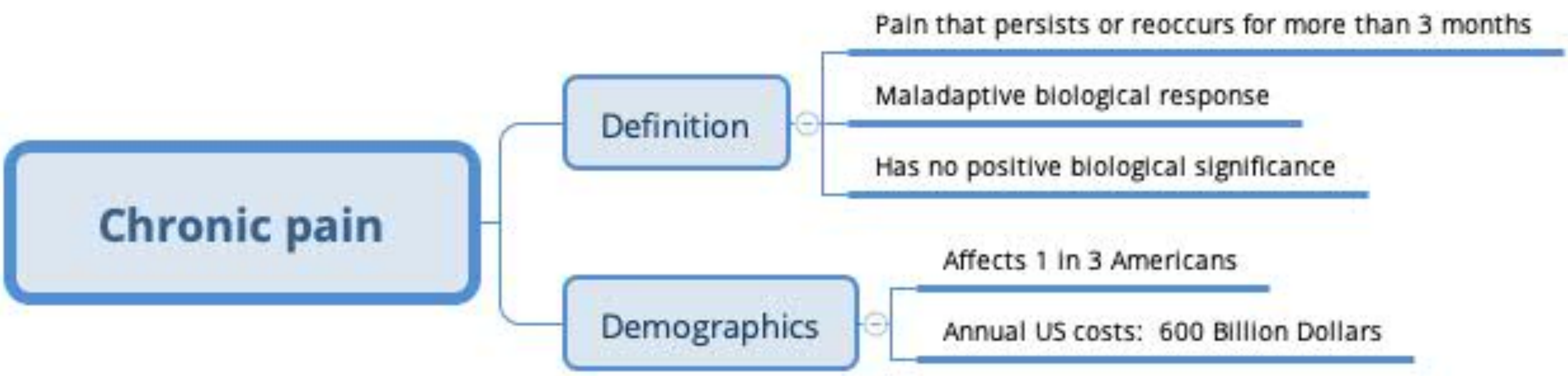
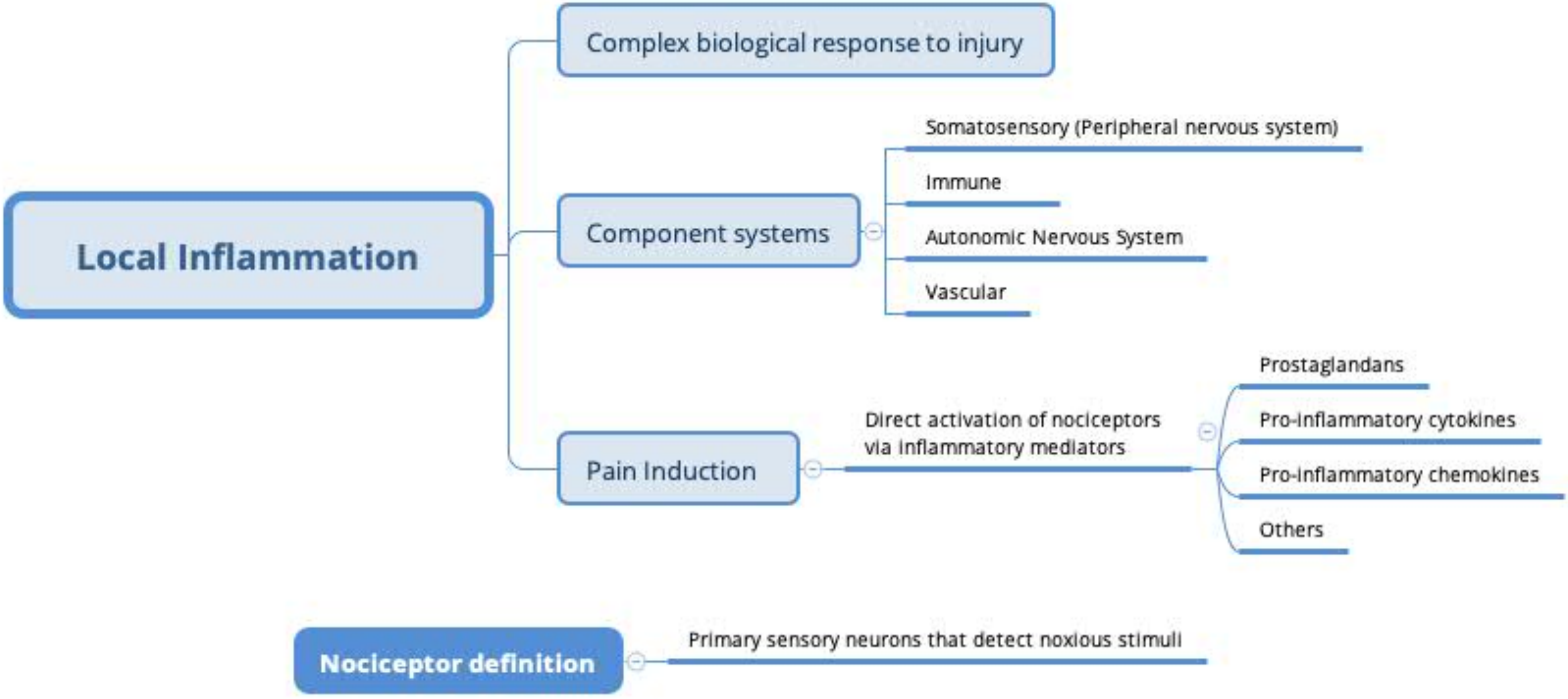

Chronic pain
Definition
Pain that persists or reoccurs for more than 3 months
Maladaptive biological response
Has no positive biological significance
Demographics
Affects 1 in 3 Americans
Annual US costs: 600 Billion Dollars


Acute Pain Biological Significance
Avoid potential tissue damage
Protect wounded tissue


Local Inflammation
Complex biological response to injury
Component systems
Somatosensory (Peripheral nervous system)
Immune
Autonomic Nervous System
Vascular
Pain Induction
Direct activation of nociceptors via inflammatory mediators
Prostaglandans
Pro-inflammatory cytokines
Pro-inflammatory chemokines
Others
Nociceptor definition
Primary sensory neurons that detect noxious stimuli

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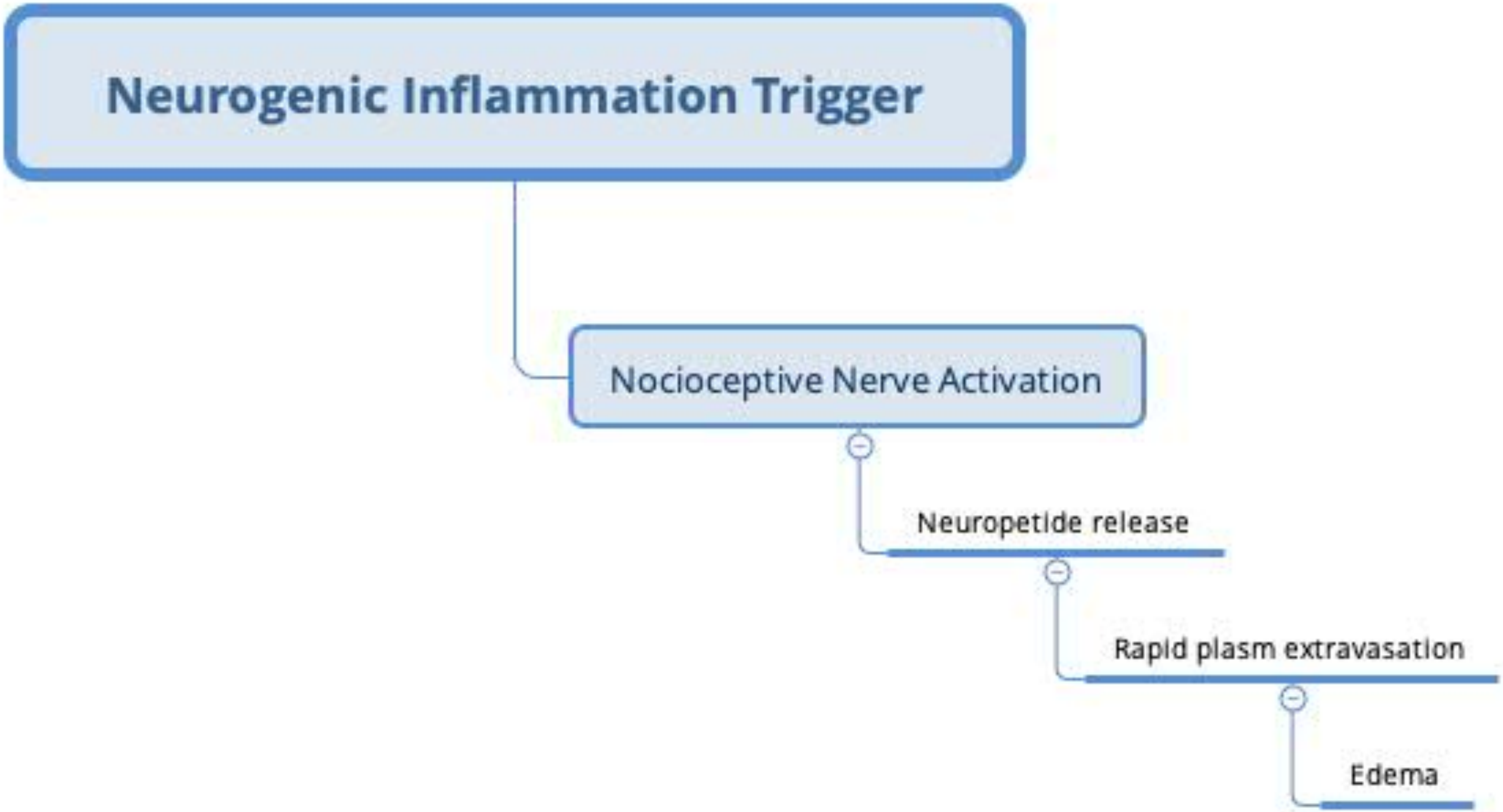
Neuroinflammation

- **Definition**
  - Localized inflammation in the peripheral nervous system (PNS)
  - Localized inflammation of the central nervous system (CNS)
- **Causes**
  - Activation of glial cells in the:
    - Dorsal Root Ganglia (DGR)
    - Spinal Cord
    - Brain
  - Glial cell activation results in production of:
    - Pro-inflammatory Cytokines in CNS and PNS
    - Pro-inflammatory Chemokines in CNS and PNS
- **Results in:**
  - Peripheral nervous system sensitization
  - Central nervous system sensitization
  - Alters regulation of different types of pain conditions

Glial Cells Definition

- Non-neuronal cells in the central nervous system (brain and spinal cord) and the peripheral nervous system that do not produce electrical impulses.[1] They maintain homeostasis, form myelin, and provide support and protection for neurons
- Include: Microglia, astrocytes and oligodendrocytes


Neurogenic Inflammation Trigger
Nocioceptive Nerve Activation
Neuropetide release
Rapid plasm extravasation
Edema

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Neurogenic Inflammation

- Noceptor Neurons
  - Orthodromic input to spinal cord and brain from periphery
  - Axon Reflex: Antidromic transmission from branch points back to peripheral neurons
- Mediated by Neuropeptides released from peripheral neurons/nociceptors
  - Calcitonin gene related peptide (CPRG)
    - **Vasodialtion effects**
  - Substance P (SP)
    - **increases capillary permeability**
      - plasma extravation and edema
  - Adrenomedullin
    - Vasodilator peptide hormone
  - Neurokinins A &B
    - A member of the tachykinin family of neuropeptide neurotransmitters. Tachykinins are important contributors to nociceptive processing, satiety, and smooth muscle contraction
  - Vasoactive intestinal peptide (VIP)
    - Vasodilation effect
  - Gastrin releasing peptide (GRP)
    - Nociceptive effect
- Mediated by other molecular mediators released from peripheral neurons/nociceptors
  - Glutamate
    - major excitory neurtransmitter in the central nervous system (CNS)
  - Nitric oxide (NO)
    - dual functions
      - Contributes to induction of pain and sensitization
      - Contributes to anti-nociceptive effects
  - Pro-inflammatory Cytokines
    - eotaxin
    - others
- Neuro-immune communication from neuropeptides and molecular mediators
  - Directly attract and activate immune cells
    - Innate immune cells
      - Basophils
        - Cells filled with basophil granules, found in numbers in connective tissue and releasing histamine and other substances during inflammatory and allergic reactions
      - Dendritic cells
        - Antigen-presenting cells of the mammalian immune system. Their main function is to process antigen material and present it to the surface of T cells. They act as the messengers between the innate and adaptive immune systems.
    - Adaptive immune cells
      - T lymphocytes
        - Type of white blood cell that develop from stem cells in the bone marrow and mature in the thymus.
        - Play a central role in the immune response
        - Immune related cell death (cytotoxic): "killer cells" can directly kill virus-infected cells and cancer cells
        - Use cytokines to recruit other cells when mounting an immune response
        - Helper T cells indirectly kill cells identified as foreign: they determine if and how other parts of the immune system respond to a specific, perceived threat. They also use cytokine signalling to influence regulatory B cells directly and other cell populations indirectly
- Protective Neurogenic Inflammation
  - Acute Tissue Damage
    - Facilitates physiologic wound healing
    - Facilitates immune defense against pathogens by activating and recruiting Immune cells
- Pathologic Neurogenic Inflammation
  - Facilitates and amplifies pathological and maladaptive immune responses
    - Pathophysiology of allergic diseases
    - Pathophysiology of auto-immune diseases
    - Primary sensory neurons play a central role in initiating and augmenting the activation of innate and adaptive immunity
      - allergic airway inflammation
      - colitis
      - psoriasis

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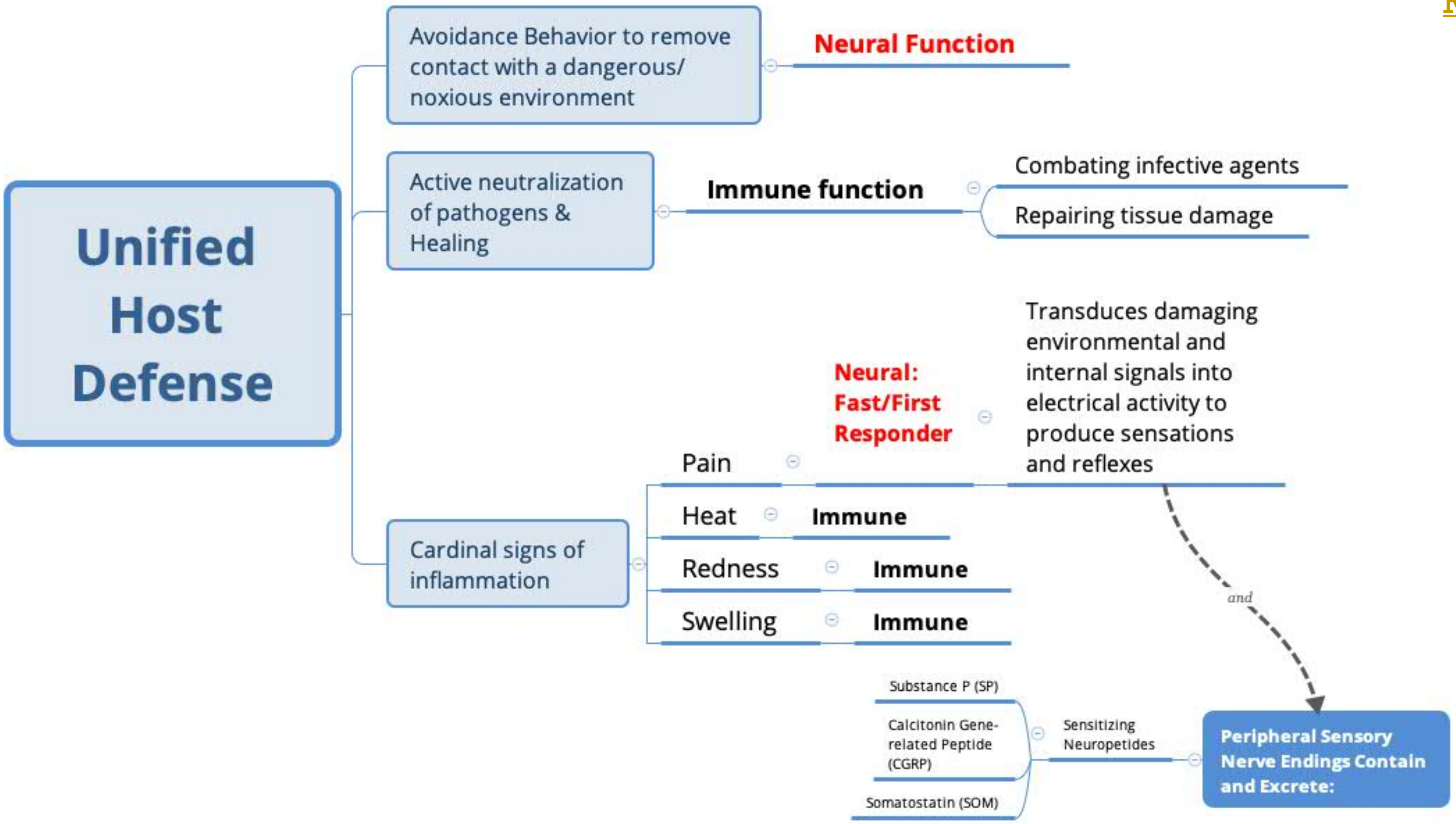
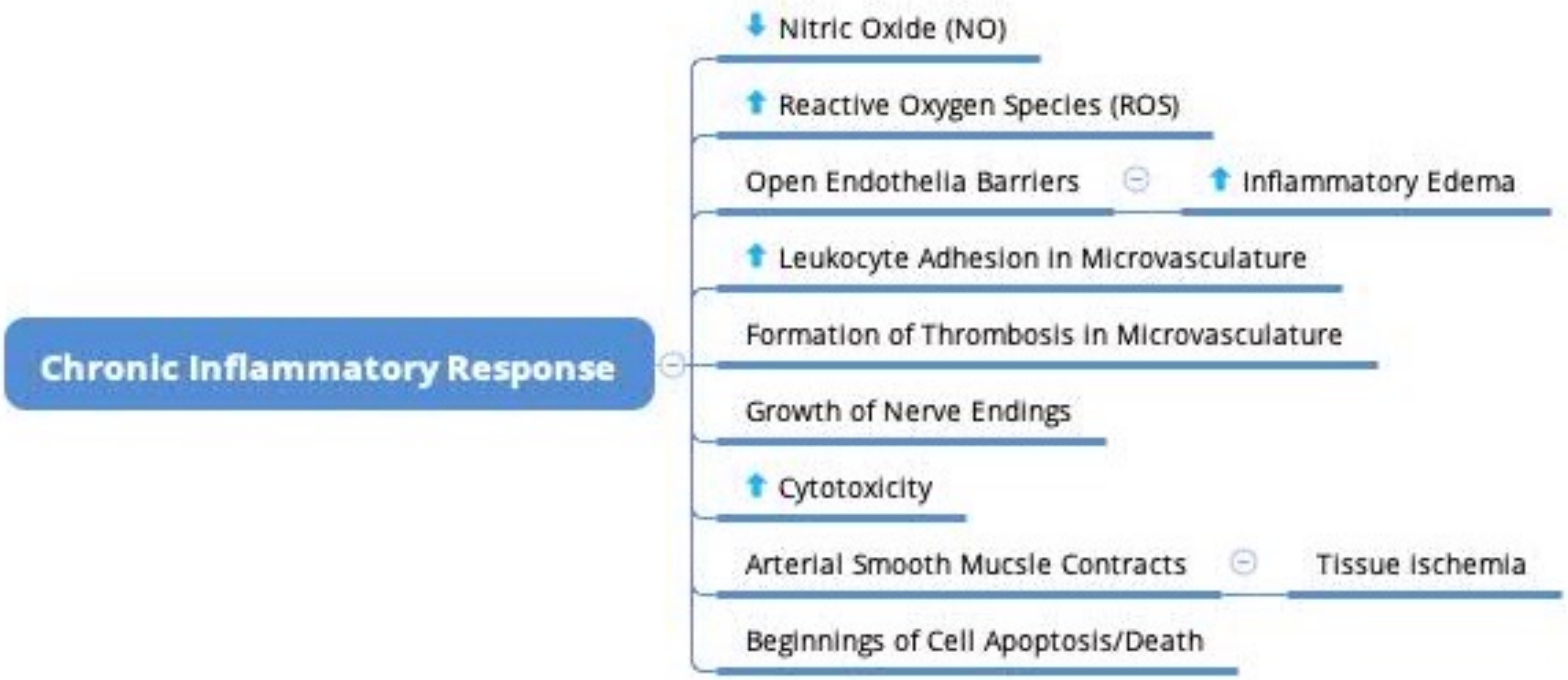

Unified Host Defense
Avoidance Behavior to remove contact with a dangerous/ noxious environment
Neural Function
Active neutralization of pathogens & Healing
Immune function
Combating infective agents
Repairing tissue damage
Cardinal signs of inflammation
Pain
Neural: Fast/First Responder
Transduces damaging environmental and internal signals into electrical activity to produce sensations and reflexes
Heat
Immune
Redness
Immune
Swelling
Immune
and
Substance P (SP)
Calcitonin Gene-related Peptide (CGRP)
Somatostatin (SOM)
Sensitizing Neuropeptides
Peripheral Sensory Nerve Endings Contain and Excrete:

Local Inflammatory Response and Peripheral /Central Nervous System Sensitization

- ↓ Pain Pressure Threshold (PPT)
- ↓ pH
  - pH Scale 0-14; 0 most acidic/14 most basic; Neutral ph is 7; Normal blood pH 7.4
    - Sensitizes nociceptors of sensory neurons
- ↑ Substance P (SP)
  - Neuropeptide; Potent vasodilator; Initiates expression of cytokines; Sensitizes nociceptors of sensory neurons
- ↑ Calcitonin Gene-related Peptide (CGRP)
  - Vasodilates capillary units; Sensitizes nociceptors of sensory neurons
- ↑ Bradykinon
  - Vasodilates capillary units; Sensitizes nociceptors of sensory neurons
- ↑ Serotonin
  - Vasoconstrics capillary units; Sensitizes nociceptors of sensory neurons
- ↑ Norepinephrine
  - Vasodilates capillary units
- ↑ Tumor Necrosis Factor
  - Inflammtory Cytokine
- ↑ Interleukin (1L-1 B)
  - Inflammatory Cytokine


Chronic Inflammatory Response
Nitric Oxide (NO)
Reactive Oxygen Species (ROS)
Open Endothelia Barriers
Inflammatory Edema
Leukocyte Adhesion in Microvasculature
Formation of Thrombosis in Microvasculature
Growth of Nerve Endings
Cytotoxicity
Arterial Smooth Mucsle Contracts
Tissue Ischemia
Beginnings of Cell Apoptosis/Death

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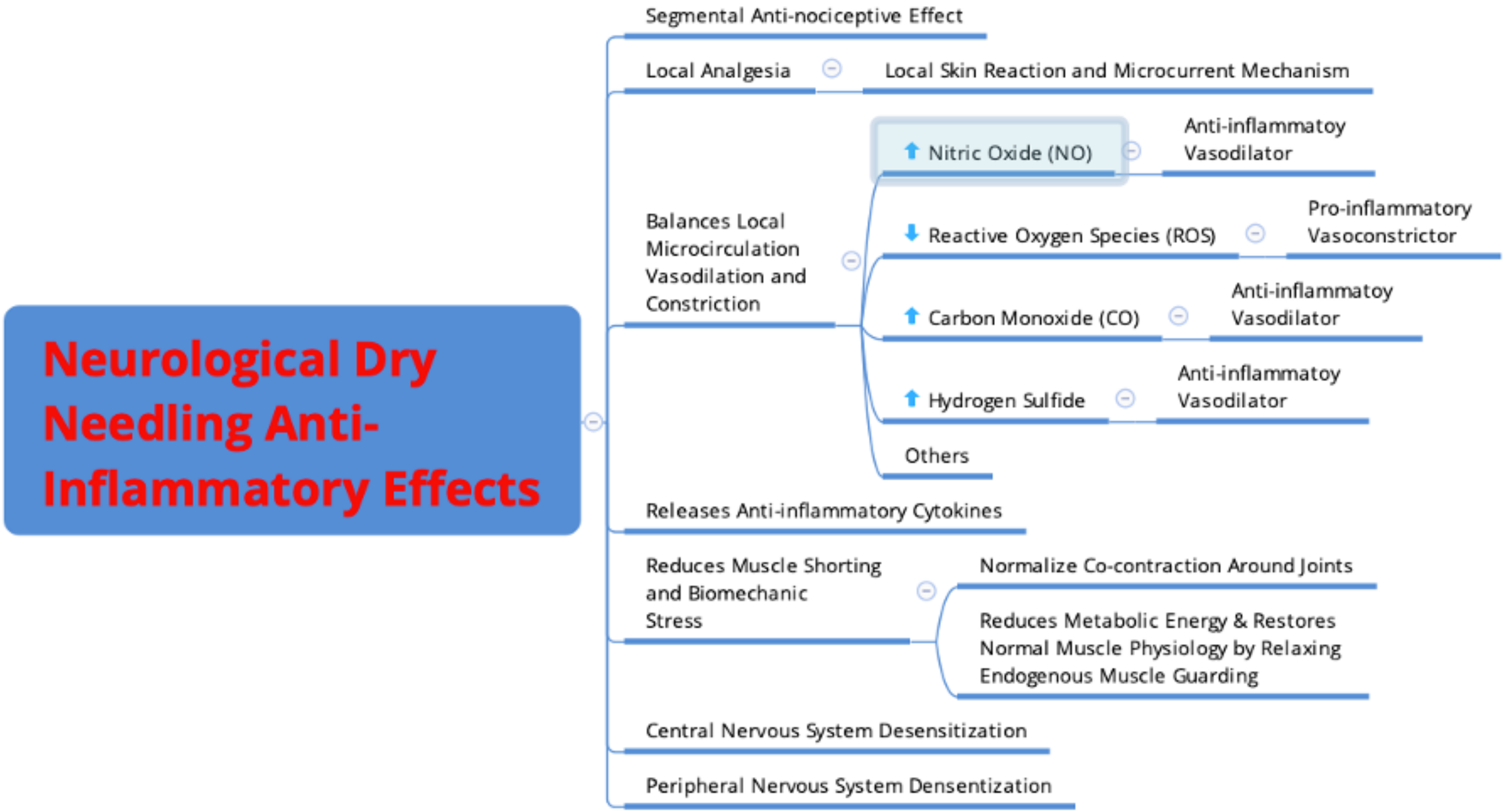
Acute inflammation Anti-inflamatory Mechanism

- Induces localized pain
- Also promotes resolution of pain by producing specialized pro-resolving mediators (SPMs)
  - Resolvins – RvD1, RvD2, RvD3, RvE1
  - Protectin – PD1
  - Neuroprotectin – NPD1
  - Maresin – MaR1 (also found in fish oil)
- SPMs produced during the resolution phase of acute inflammation
  - Exhibit potent anti-inflammator actions
  - Are potent analgesics
  - Inhibit and resolve inflammatory and postoperative pain

Dry needling

- Induces Microtissue injury
- Induces localized pain
- Induces local acute inflammation
- Promotes resolution of pain in part by inducing the the release production of pro-resolving mediators during the resolution phase of acute inflammation
- Most experimental minimal and mechanical injuries are regenerated within 7 to 10 days


Neurological Dry Needling Anti-Inflammatory Effects
Segmental Anti-nociceptive Effect
Local Analgesia
Local Skin Reaction and Microcurrent Mechanism
Balances Local Microcirculation Vasodilation and Constriction
Nitric Oxide (NO)
Anti-inflammatoy Vasodilator
Reactive Oxygen Species (ROS)
Pro-inflammatory Vasoconstrictor
Carbon Monoxide (CO)
Anti-inflammatoy Vasodilator
Hydrogen Sulfide
Anti-inflammatoy Vasodilator
Others
Releases Anti-inflammatory Cytokines
Reduces Muscle Shorting and Biomechanic Stress
Normalize Co-contraction Around Joints
Reduces Metabolic Energy & Restores Normal Muscle Physiology by Relaxing Endogenous Muscle Guarding
Central Nervous System Desensitization
Peripheral Nervous System Densentization

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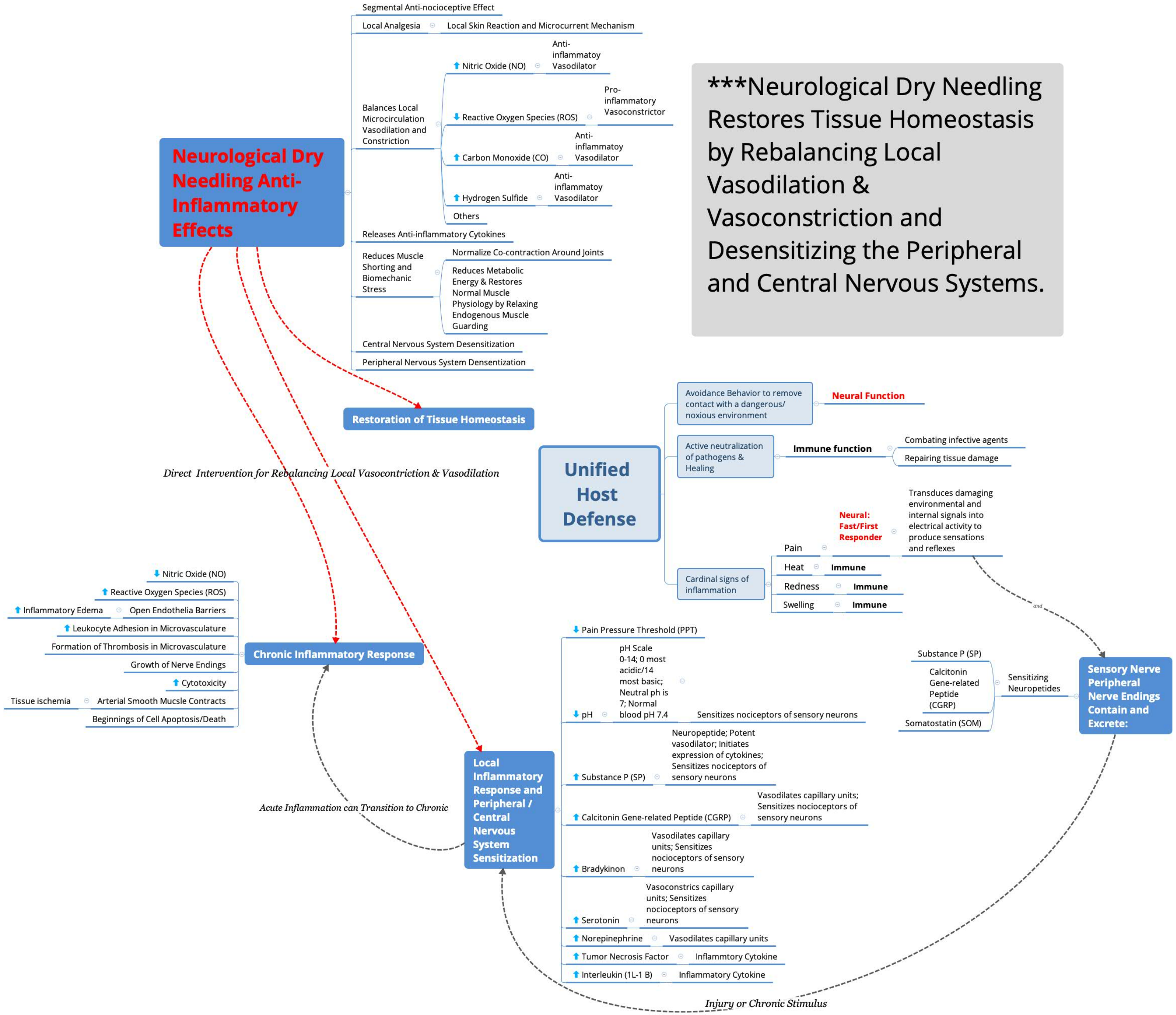
***Neurological Dry Needling Restores Tissue Homeostasis by Rebalancing Local Vasodilation & Vasoconstriction and Desensitizing the Peripheral and Central Nervous Systems.



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Dry Needling Tissue Inflammation and Muscle Tissue Regeneration Timeline in Mammal Model

- **24 Hours**
  - Complete inflammatory reaction of damaged tissue can be observed
- **72 Hours**
  - Muscle are in the initial phase of regeneration
  - Inflammatory reaction present
  - Inflammatory cell clean necrotic debis of the injured area while preserving healthy part of muscle tissue
- **Day 3-5**
  - Satellite cells are activated and transformed into myoblasts
  - Myoblast initiate a period of mitotic proliferation (Cell division)
  - Inflammatory cells coexist with myoblasts
  - Necrotic debris is complete phagocytosed by the inflammatory reaction
  - Myoblast fuse with each other and healthy parts of the injured muscle fibers
  - Myoblast fusion produces the myotubes
  - New myotubes start synthesis of actin and myosin (myofibrillogenesis)
- **Day 5**
  - Myotubules are in advances stage of myofibrillogenesis
  - Most cytoplasm is occupied by the neosynthesized contractile apparatus
  - Non-fused myoblast become satellite cells
- **Days 5-7**
  - Satellite cells clearly identified
- **Day 7**
  - Regeneration Complete

Myotube

- Form from myoblasts 3-4 days after damage from running or eccentric lengthening contractions
- In the stage of healing of the myotube, actin and myosin are synthesized to create sarcomeres
- Sarcomeres form in cytoplasm between 4-7 days depending on the severity of muscle injury

Satellite Cell

- Undifferentiate "sleeper" stem cells
- Reside on the surface of health adult mucle fibers
- When muscle in damaged they become myoblasts
- Myoblasts from satellite cells initiate a period of mitosis from 9-15 hours
- myoblasts resulting from this mitosis period fuse with each other and with the muscle fibers surrounding the area of injury. The resulting structure is a cell called a myotube

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Dry Needling and Intramuscular Nerve Regeneration in Mammal Model

Day 1

- Fragmented axons of intramuscular nerves observed from the point of injury to the synaptic contacts

Day 2-3

- Motor endplates reinnervated by very fine axons covering a spread out postsynaptic component

Day 3

- Axonal growth cone visualized as an axonal dilatation beyond its endplate
- Scatter receptors regroup under fine axons and axonal growth cone
- Receptors aggregate below the axon and take the shape of normal adult synapses
- Reinnervation after nerve damage by repetitive mechanical injury (dry needling) was rapid and complete by day 3. Neuromuscular synapses were reoccupied.

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Definitions

- **Extrafusal muscle fibers**: Standard skeletal muscle fibers that are innervated by the alpha motor neuron allowing for skeletal movement
- **Alpha motor neuron**: Large, multipolar lower motor neurons of the brainstem and spinal cord. They innervate extrafusal muscle fibers of skeletal muscle and are directly responsible for initiating their contraction
- **Gamma Motor Neuron**: Innervate the muscle spindle at each end. They allow contraction of the intrafusal fibers and increase their sensitivity to stretch. In this way the gamma motor neurons form an important muscle stretch reflex mechanism that acts in conjunction with the alpha motor neurons.
- **Muscle Spindle**: Stretch receptors within the body of a muscle that primarily detect changes in the length of the muscle. They convey length information to the central nervous system via Ia afferent nerve fibers. This information can be processed by the brain as proprioception. Their afferent innervation is via the gamma motor neuron.
- **Golgi Tendon Organ**: A mechanoreceptor that conveys muscle tension to the central nervous system via its Ib afferent nerve fibers. They send force information to the spinal cord, where interneurons receive input from the brain that specifies the amount of force that a muscle should produce. If that muscle's force level exceeds this set point, the GTO inputs inhibit the alpha motor neurons innervating that muscle, which lowers the force produced unless some other mechanism cancels that signal.
- **Renshaw cell**: The alpha motoneuron axon has a recurrent collateral in the spinal cord that synapses onto the Renshaw cell. Similarly to the neuromuscular junction, the neuro- transmitter onto the Renshaw cell is acetylcholine. The Renshaw cell then directly inhibits the alpha motoneuron using glycine as the neurotransmitter. This is called recurrent inhibition. It provides inhibitory feedback to the pool of alpha motoneurons to prevent excessive output.
- **Inhibitory Internuncial Pool**: Inhibitory neurons in the gray matter of the spinal cord interposed between and connecting two other neurons

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General Somatic Afferents(GVA): Peripheral Sensory Nerve Types

- Large myelinated fibers with a high conduction rate
  - Type Ia (A-alpha: muscle spindle)
    - Associated with muscle proprioceptive sensory receptors-muscle spindles
  - Type Ib (A-alpha: golgi tendon organ)
    - Associated with golgi tendon organs
  - Type II (A-beta: touch and pressure)
    - Associated with secondary receptors of muscle spindles
    - Associated with all cutaneous mechanoreceptors
    - Associated with some nociceptors
- Thin & myelinated and send impulse faster than unmyelinated nerves
  - Type III (A-delta: Free nerve endings, cold)
    - Associated with free nerve ending of touch and pressure
    - Associated with nociceptors of the neospinothalamic tract
    - Associated with cold thermoreceptors
    - Primarily related to acute pain to facilitate a withdrawal reflex upon synapse in the dorsal horn of the spinal cord.
- Unmyelinated and slow conducting
  - Type IV (C: Slow pain, heat)
    - Associated with nociceptors of the paleospinothalamic tract
    - Associated with warmth thermoreceptors
    - Responsible for the slower onset of deeper pain after an initial insult relayed by the faster A-delta fibers.
    - Require a higher threshold of stimulus than Type III (A-delta fibers)

Summary

- Proprioceptors
  - Type Ia/Type Ib (A-alpha) , Type II (A-beta)
- Mechanoreceptors
  - Type II (A-beta), Type III (A-delta)
- Nociceptors & Thermoreceptors
  - Type III (A-delta), Type III (C-fibers)

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Peripheral Motor Nerve Types

- **Type A Fiber:** Large myelinated fibers with a high conduction rate
  - **Type Ia**: Large nerve fibers from anterior horn cells of the alpha motor neuron system associated with extrafusal muscle fibers/skeletal muscle
  - **Type 1b**: Large nerve fibers associated with the intrafusal muscle fibers / muscle spindle

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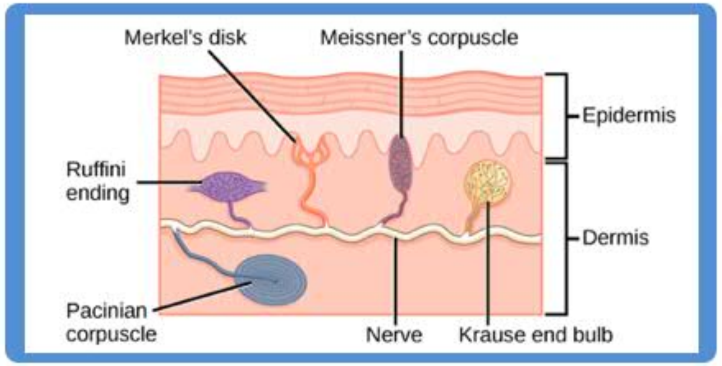

Tactile Skin Mechanoreceptors

- **Markel's Disks**
  - Slow adapting, unencapsulated nerve endings
  - Respond to and detect light touch
  - Located in upper layers of skin that has hair or is glabrous/hairless
  - Densely distributed in finger tips and lips
  - Receptive fields are small with well defined borders that make them very sensitive to boarders.
- **Meissner's Corpuscles**
  - Rapidly-adapting, fluid filled encapsulated neurons
  - Respond to and detect fine touch, pressure, and low-frequency vibration
  - Located in the upper dermous and project into the epidermis of glabrous skin on finger tips and eyelids
  - Have small well defined boarders which are responsive to fine details
- **Ruffini Endings**
  - Slow adapting, encapsulated mechanoreceptors
  - Respond to and detect:
    - Skin stretch
    - Deformation within joints
    - Warmth-due to depth of these receptors, humans perceive cold before warmth
  - Located in the deeper dermis of glabrous and hairy skin
  - Provide valuable feedback for gripping objects and controlling finger position and movement
  - Contribute to proprioception and kinesthesia
- **Pancinian Corpuscles**
  - Rapidly-adapting, deep receptors
  - Respond to compression and detect transient deep pressure and high-frequency vibration
  - Located in:
    - The deeper dermis of glabrous and hairy skin
    - Bone periosteum
    - Joint Capsules
    - Pancreas and other viscera
    - Breast
    - Genitals
- **Krause end bulbs**
  - Respond to and detect cold and temperature change
  - Located in:
    - Conjunctiva of eye
    - Mucous membrane of lips and tongue
    - Epineurium of nerve trunks
    - Penis and clitoris

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Joint Mechanoreceptors

- **Group I: Golgi Ligament Ending**
  - Location: Ligaments
  - Sensitivity: Stretch of ligaments
  - Distribution: Found in most joints except in vertebral Column
- **Group I-II: Ruffini endings**
  - Location: Outer layer of joint capsule
  - Sensitivity:
    - Stretch of joint capsule
    - Changes in fluid pressure
    - Changes in joint position
  - Distribution: Found in highest concentrations in proximal joints
- **Group II: Outer layer of joint capsule**
  - Location: Outer layer of joint capsule
  - Sensitivity:
    - High frequency vibration
    - Acceleration
    - High velocity of changes in joint position
  - Distribution: Found in highest concentrations in distal joints
- **Group II-III Golgi-Mazzoni corpuscles**
  - Location: Inner layer of joint capsule
  - Sensitivity: Compression of joint capsule
  - Distribution: Found in knee joint and most other joints
- **Group IV-V free nerve endings**
  - Location: Throughout the joint capsule and in ligaments
  - Sensitivity:
    - Mechanical stress
    - Biomechanical stimuli
  - Distribution: Found in many joints and ligaments

Reflexive Influences on Alpha Motor Neuron-The Summation of Facilitatory and Inhibitory Activity on the Alpha Motor Neuron will Determine the Response of the Muscle

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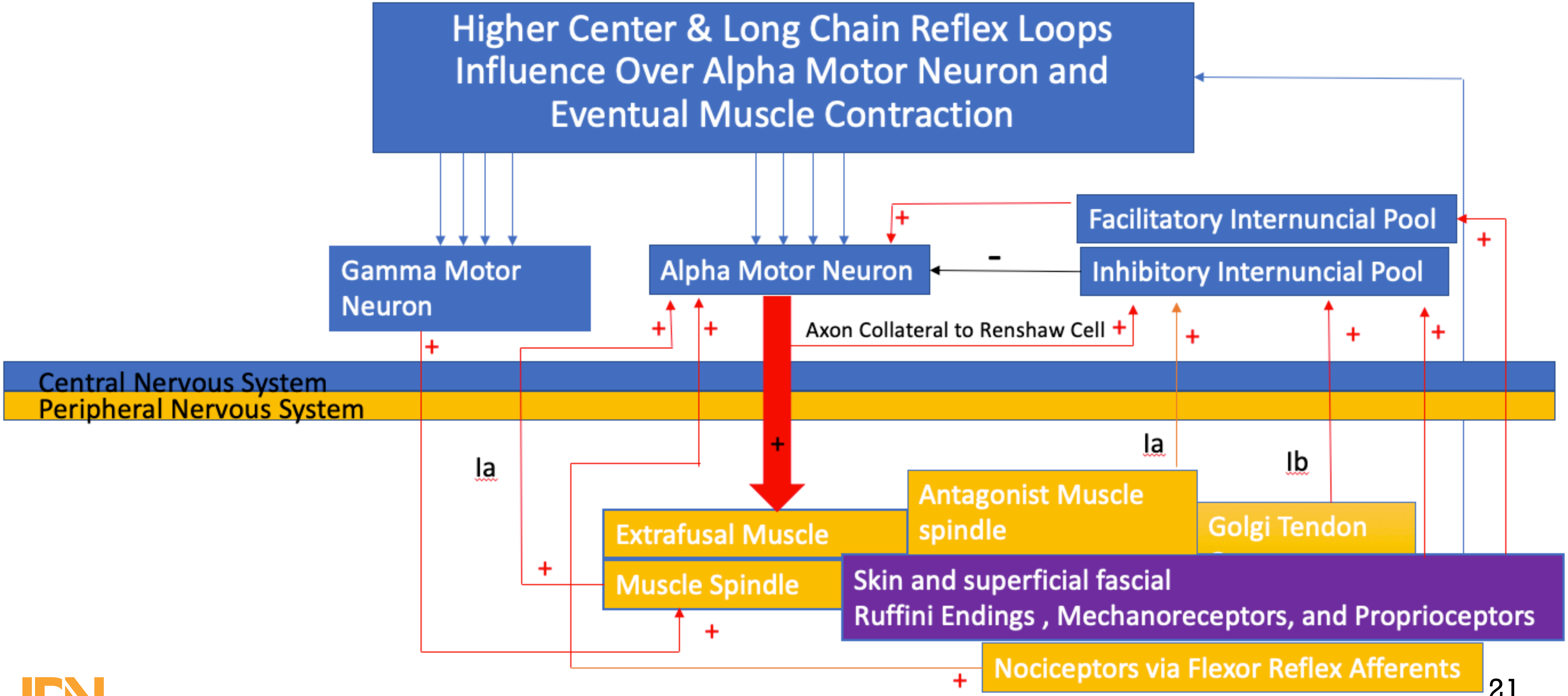

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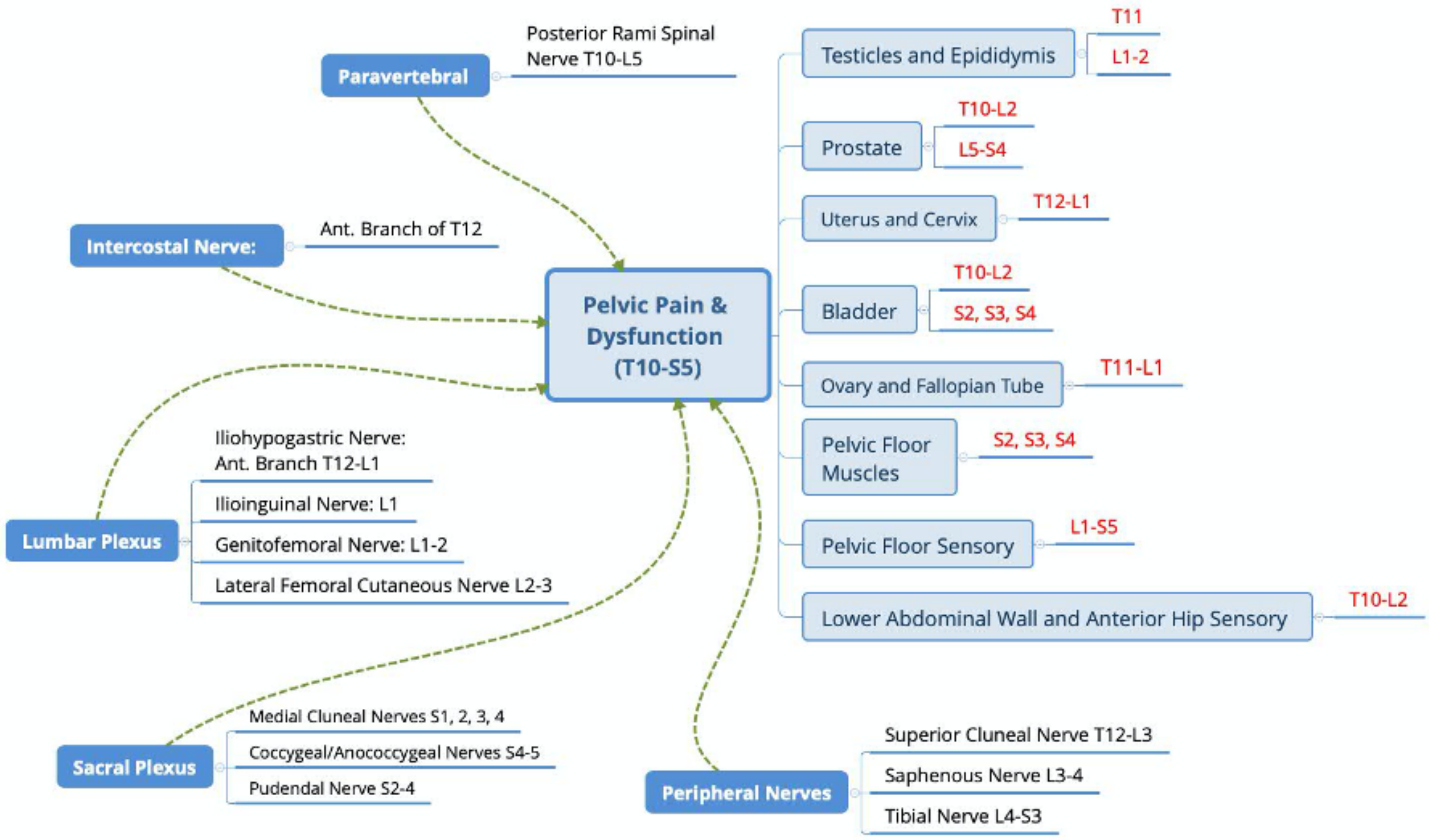
Paravertebral
Posterior Rami Spinal Nerve T10-L5
Intercostal Nerve:
Ant. Branch of T12
Pelvic Pain & Dysfunction (T10-S5)
Lumbar Plexus
Iliohypogastric Nerve: Ant. Branch T12-L1
Ilioinguinal Nerve: L1
Genitofemoral Nerve: L1-2
Lateral Femoral Cutaneous Nerve L2-3
Sacral Plexus
Medial Cluneal Nerves S1, 2, 3, 4
Coccygeal/Anococcygeal Nerves S4-5
Pudendal Nerve S2-4
Peripheral Nerves
Superior Cluneal Nerve T12-L3
Saphenous Nerve L3-4
Tibial Nerve L4-S3
Testicles and Epididymis
T11
L1-2
Prostate
T10-L2
L5-S4
Uterus and Cervix
T12-L1
Bladder
T10-L2
S2, S3, S4
Ovary and Fallopian Tube
T11-L1
Pelvic Floor Muscles
S2, S3, S4
Pelvic Floor Sensory
L1-S5
Lower Abdominal Wall and Anterior Hip Sensory
T10-L2

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Non-Visceral Afferent vs Visceral Afferent Conscious Sensory Experiences

- General Somatic Afferent (GSA)-Non-visceral
  - Pain
  - Touch
  - Pinch
  - Heat/cold
  - Cutting
  - Crush
  - Vibration
  - Chemical Stimuli
- General Visceral Afferents (GVA)-Visceral
  - Pain
  - Organ filling
  - Bloating & distention
  - Nausea
  - Cramping
  - Chemical Stimuli

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Visceral Pain and Somatic Pain Referral Patterns

- Visceral pain is diffuse in character and poorly localized
- Visceral pain is commonly associated with greater emotional valence and exaggerated autonomic reflexes
- <7% of spinal afferents (sensory) in the dorsal root ganglia project to the viscera
- Sparse innervation from visceral afferents is compensated for in the spinal cord by visceral afferent nerve terminations arborizing widely over several spinal segments and to the contralateral spinal cord
- Spinal neurons that recieve visceral afferent input also recieve input form skin and deeper structures including other visceral to produce sensations referred somatic pain.
- Peripheral and central nervous system sensitization can occur with chronic stimuli
- Visceral afferents sensitize after organ insult, giving increased responses to both innocuous and noxious intensities of stimulation
- Most low-threshold mechanosensitive visceral afferents encode into the noxious range and generally give greater responses than their high-threshold counterparts

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General Visceral Afferent (GVA): Visceral Sensory Nerves

- Transmits sensory information from visceral organs to spinal cord and brain stem
  - Pain
  - Stretch
  - Temperature
  - Chemical changes
- Run with general somatic afferent fibers (GSA) to the gray matter of the dorsal horn of the spinal cord and brain stem
  - Causes referred pain
  - Referred pain takes place in the dermatome of the corresponding spinal segment of the signal-producing internal organ
- Signals from the GVA is interpreted by the brain as conscious sensations of:
  - Nausea
  - Gas
  - Cramping
  - Somatic/Dematomal pain
  - Bloating
  - Organ filling (Fullness)
  - Dyspnea (Difficult or labored breath)
  - Pain
- GVA Sensory nerve endings
  - Primitive, unenccapsulated nerve ending with no specialized structures
  - Intraganglionic laminal endings (IGLE's)
    - Low-threshold mechanoreceptors
  - Intramuscular arrays (IMA's)
    - Low-threshold mechanoreceptors
  - Sensitize after organ insult, giving increased responses to both innocuous and noxious intensities of stimulation
- General visceral afferent encode different types of information for conscious experiences, i.e.:
  - The sensation of nausea does not arise from the skin
  - Cutting of the cannot be felt

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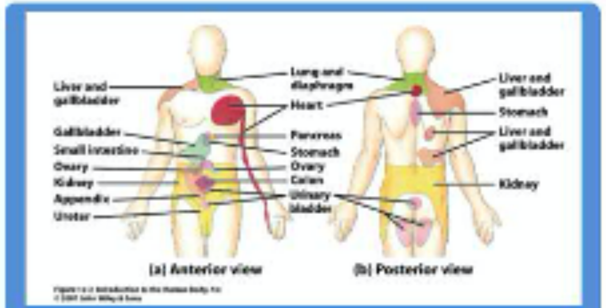
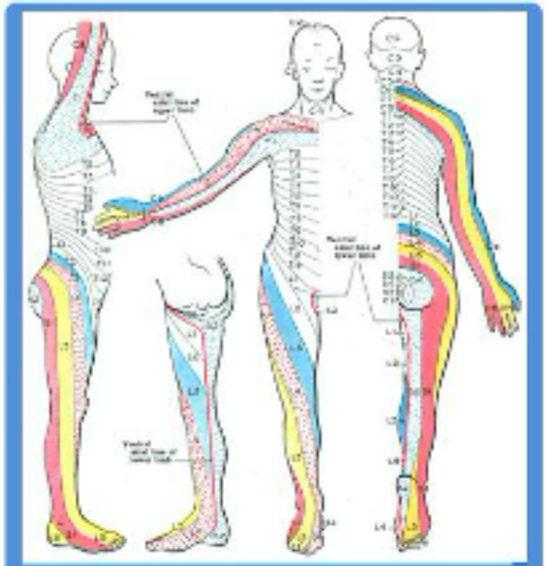


Visceral Pain Referral Patters.

Patterns of Referred Visceral & Parietal Pain

- C4 Dermatome — Central Diaphram
- T2-T6 Dermatome — Lungs
- T1-L2 Dermatome — Aorta
- T1-4 Dermatome — Heart
- T3-8 Dermatome — Esophagus
- T5-T10 Dermatome — Pancreas and Spleen
- T6-9 Dermatome — Stomach, liver, and gallbladder
- T8-L1 Dermatome — Adrenals
- T9-11 Dermatome — Small intestine
- T10-L1 Dermatome — Colon
- T10-L1 Dermatome — Kidney, ovaries, testes
- T11-L2 Dermatome — Uterus
- S2-4 Dermatome — Bladder and Prostate
- S2-4 Dermatome — Urethra and rectum



Dermatomes

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Rhythmic Vibration Via (Dry Needling) Electrical Nerve Stimulation (ENS)

- **Local Mechanical Effects**
  - Reduction in Tissue Tension
  - Reduction of Tissue Adhesion
  - Reduction of Tension in Scar Tissue
- **Local Physiological Effects**
  - Restores Vasoregulation of Blood Flow
  - Restores Lymphatic flow
  - Reduces Inflammation
  - Enhanced Analgesic Effect Over Dry Needling Alone
- **Central Nervous System Effects**
  - Stronger Pattering in the Central Pain Matrices
  - Increased fMRI Signaling in Supplemental Brain Areas
  - Increased Activity in the Periaqueductal Grey Area
- **Local Tissue Effects**
  - Activates Local endogenous Opioids
  - Activates Local Sympathetic Nerve Fibers
  - Increases Muscle Oxygenation
- **ENS Parameters**
  - Frequency: 4-10 Hz
  - Pulse Width: 100-150
  - Time: Seconds to 5+ Minutes
- **Precautions**
  - All Contraindication and Precautions for Dry Needling
  - All Contraindication and Precautions for Specific Electrical Device
  - Do not use in the vicinity of implanted Electrical Devices
  - Avoid Contact and Areas Close to Metal Implants
  - Avoid Areas of Sensory Denervation
  - Avoid Areas where Circulation is Compromised
  - Avoid Anterior Neck Region
  - Use Care in over stimulating Posterior Cervical Region
  - Avoid Using Across Chest Region ie AP to the Thorax

Pre-reading Manual
Part 2

PELVIC PAIN & DYSFUNCTION

Optimal Flexibility

Hypermobility Considerations in Pelvic Pain and Dysfunction: A Guide to Physiologic Norms for Human Range of Motion

INTEGRATIVE DRY NEEDLING

The intent of the flexibility addendum is to provide a review of physiologic norms for most joints. Of particular relevance to pelvic pain & dysfunction are commonly prescribed stretching programs that promote joint hypermobility and "overstretching" of muscles. Consistent "overstretching" can cause pathologic changes in ligament & tendon structure, alterations of normal muscle length-tension relationships, and impairment of the normal muscular protective co-contraction around joints. In particular, "overstretching" of the medial hamstrings, adductors, anterior hip, and abdominal wall all contribute to loss of ilial control and contribute to an asymmetric pelvic outlet and compensatory scoliosis.

Dry needling and manual therapy will not correct these impairments. Patients who "overstretch" will be challenged to improve their conditions. In addition, a timeline of fitness and biomechanical literature is presented to provide perspective of how most fitness trends pre-date current understandings of joint physiology, structure, and function. While taking a patient's medical history, it is important to understand all activities that involve "stretching" and provide guidance to what is appropriate relative to our current understanding of joint structure and function.

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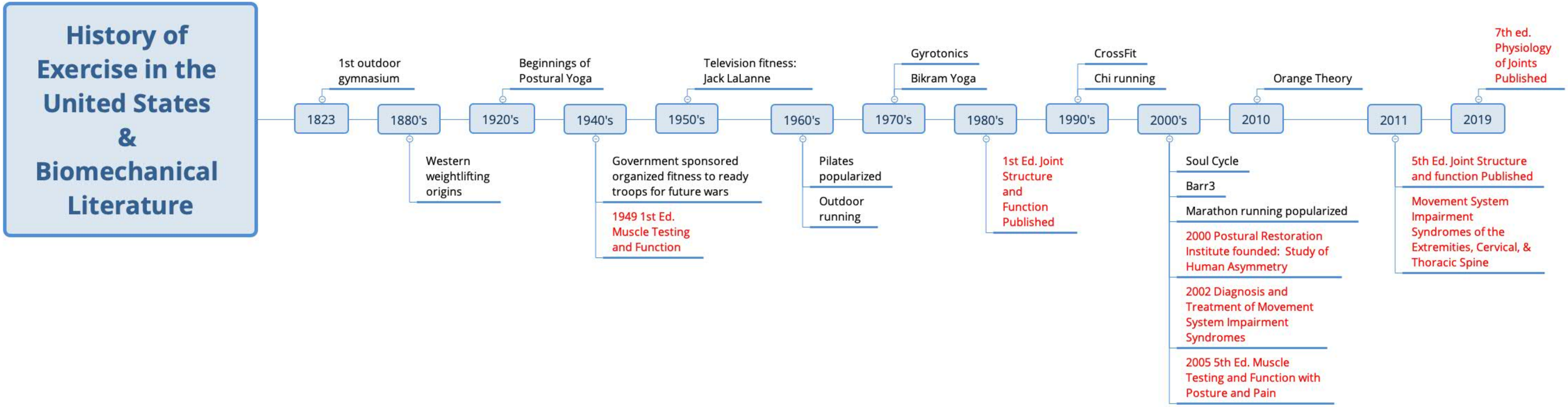
History of Exercise in the United States & Biomechanical Literature



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Symptoms of Joint Hypermobilty

- Fatigue
- Headaches
- Anxiety
- Abdominal Complaints:
  - Pain
  - Bloating
  - Constipation
  - Irritable Bowl
- Genitourinary Complaints:
  - Pelvic organ prolapse
  - Pelvic Pain
  - Incontinence
- Orthostatic Hypotension:
  - Decrease of systolic BP of 20mm or diastolic BP of 10mm within 3 min of standing compared to sitting or supine BP
- Chronic Pain

Clinical note: Postural Orthostatic Tachycardia Syndrome (POTS)/Dysautonomia (Lying to standing causes abnormally large increase in heart rate) and Joint Hypermobility Syndromes are sometimes associated with each other.

IDN

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Beighton Score

Measures generalized hypermobility in age >16 years

Maximum Score: 9

- Apposition of thumb to the flexor aspect of the forearm — 1 point for each side (Max. score of 2)
- Passive dorsiflexion of the metacarpophalangeal Joint to 90 degrees — 1 point for each side (Max. score of 2)
- Passive hyperextension of the elbow >10 degrees — 1 point for each side (Max. score of 2)
- Passive hyperextension of the knee >10 degrees — 1 point for each side (Max. score of 2)
- Standing forward flexion with hand flat on floor & knees extended — 1 point for the procedure (Max. score of 1)

Major Criteria

- Score of 4 or more
- Arthralgia > 3 month in 4 or more joints.

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Maximum Straight Leg Raise:

85-90 Degrees

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Maximum Normal Sit and Reach:

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"Downward Dog" Maintaining Joint Physiology

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- Ankle Dorsiflexion: Maximum 20 degrees
- Straight Hip Flexion: Maximum 85 degree
- Mid-thoracic Spine: No Midback Extension Between T8-L3.
- Shoulder Flexion: Maximum 180 Degrees
- Wrist Extension: Maximum 85 Degrees

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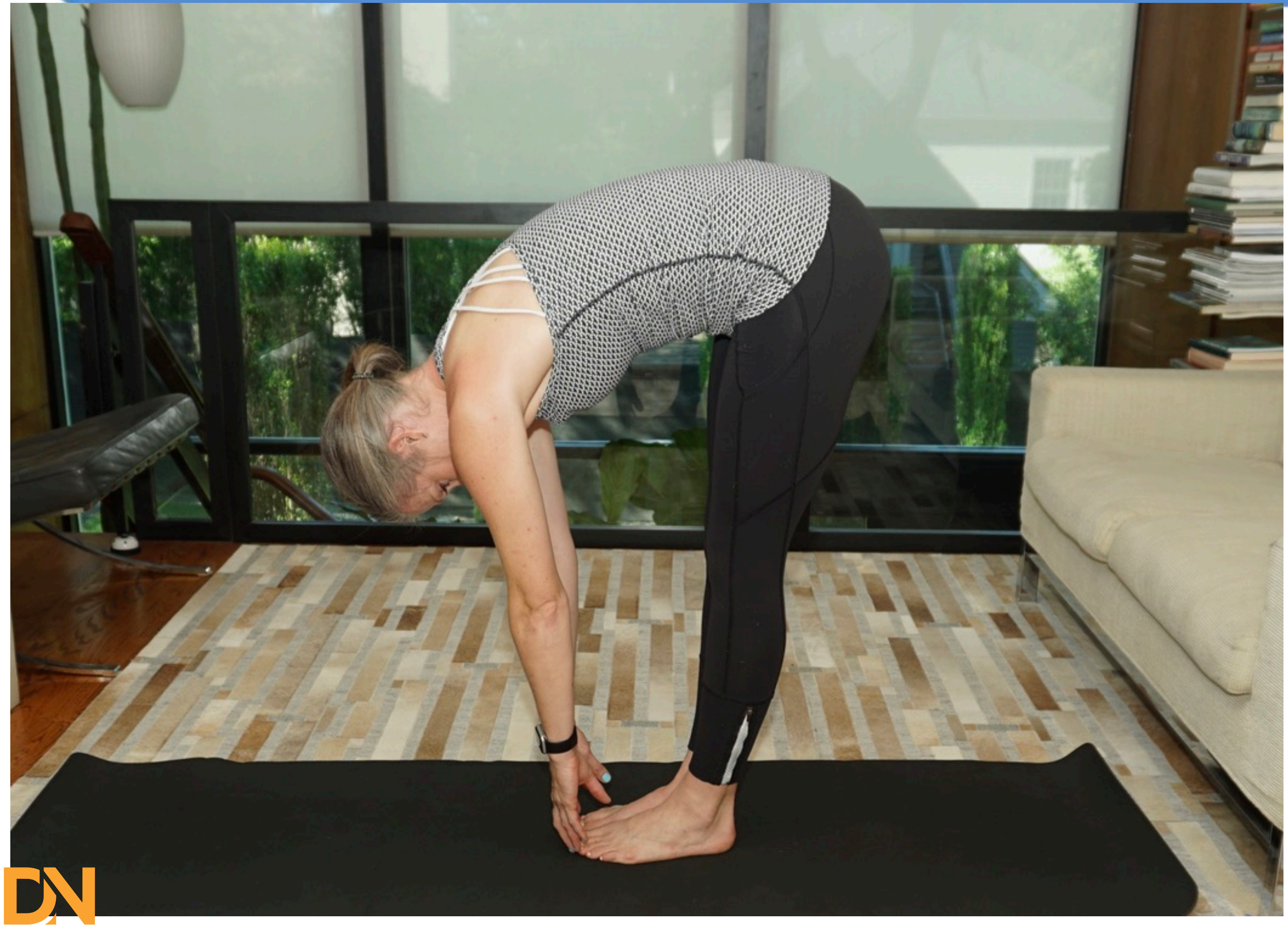
Maximum Normal Standing Forward Bend



- Hip Straight Leg Flexion: Maximum 85 Degrees
- Lumber Flexion: Maximum Normal 60 Degrees
- Thoracic Flexion: Maximum Normal Flexion 40 Degrees
- Cervical Flexion: Maximum Normal Flexion 35 Degrees

*Relatively symmetrical segmental distribution of flexion is optimal

Maximum Normal Hip Flexion for Single Leg Forward Bend

85 Degrees

- Hip Straight Leg Flexion: Maximum 85 Degrees
- Neutral Cervical, Thoracic, and Lumbar Spine

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Maximum Passive Hip Flexion:

145 Degrees

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Maximum Passive Hip Flexion:

145 Degrees

Maximum Hip Abduction

45 Degrees

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Maximum Normal Hip Abduction (30-45 degrees)/ External Rotation (60 degrees)

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Maximum Normal Hip Abduction (30-45 degrees)/ External Rotation (60 degrees)

IDN

Maximum Normal Hip External Rotation

45 Degrees

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Maximum Hip Extension

0-30 Degrees

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Kneeling Combined Joint Range of Motion Normals

- Toe Dorsiflexion: Maximum 85 Degree
- Ankle Plantar Flexion: Maximum 50 Degree
- Knee Flexion: Maximum 160 Degrees

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Maximum Normal Upper Thoracic/Lower Cervical Flexion

Maximum Normal Lumbar Extension

20-30 Degrees

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Optimal Clavicular Position

- 10 Degrees Above Horizontal
- Axis of Glenohumeral Rotation is T1

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Maximum Combined Spinal Lateral Flexion

75 Degrees

- Cervical: 35 Degrees
- Thoracic: 20 Degrees
- Lumbar: 20 Degrees

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Maximum Normal Shoulder Flexion and Behind the Back Internal Rotation

- Flexion: 180 Degrees
- Internal Rotation: 100 Degrees

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Maximum Normal Shoulder Horizontal Adduction/Abduction

- Adduction: 140 Degrees
- Abduction: 30 Degrees

Maximum Normal Shoulder Extension

45-60 Degrees

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Maximum Normal Wrist Flexion/Extension

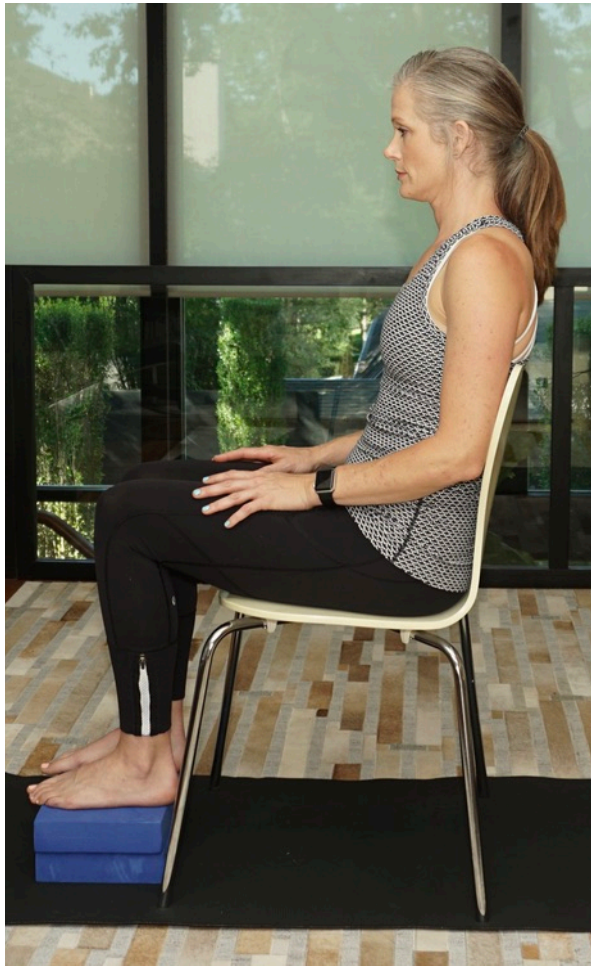
- Wrist Flexion: 85 Degrees
- Wrist Extension: 85 Degrees

Sitting Postures

Return TOC

Extension Oriented Posture: Short Term Sympathetic Dominant Posture.

Neutral Thoracic Spine Posture: Long Term Parasympathetic Posture



Suboptimal Cervical Posture