#ideaworld

IDEA WORLD CONVENTION

FITNESS • NUTRITION • BUSINESS

INFLAMMATION:
What it is. How it works. Why it helps and why it hurts.

PRESENTED BY

Rick Richey, DHSc, MS, LMT

Inflammation

- What is inflammation?
- How does inflammation work?
- How does inflammation help?
- Why does inflammation hurt?
- What is the role of exercise in creating acute inflammation and easing both acute and chronic inflammation?

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Too Much Of A Good Thing…

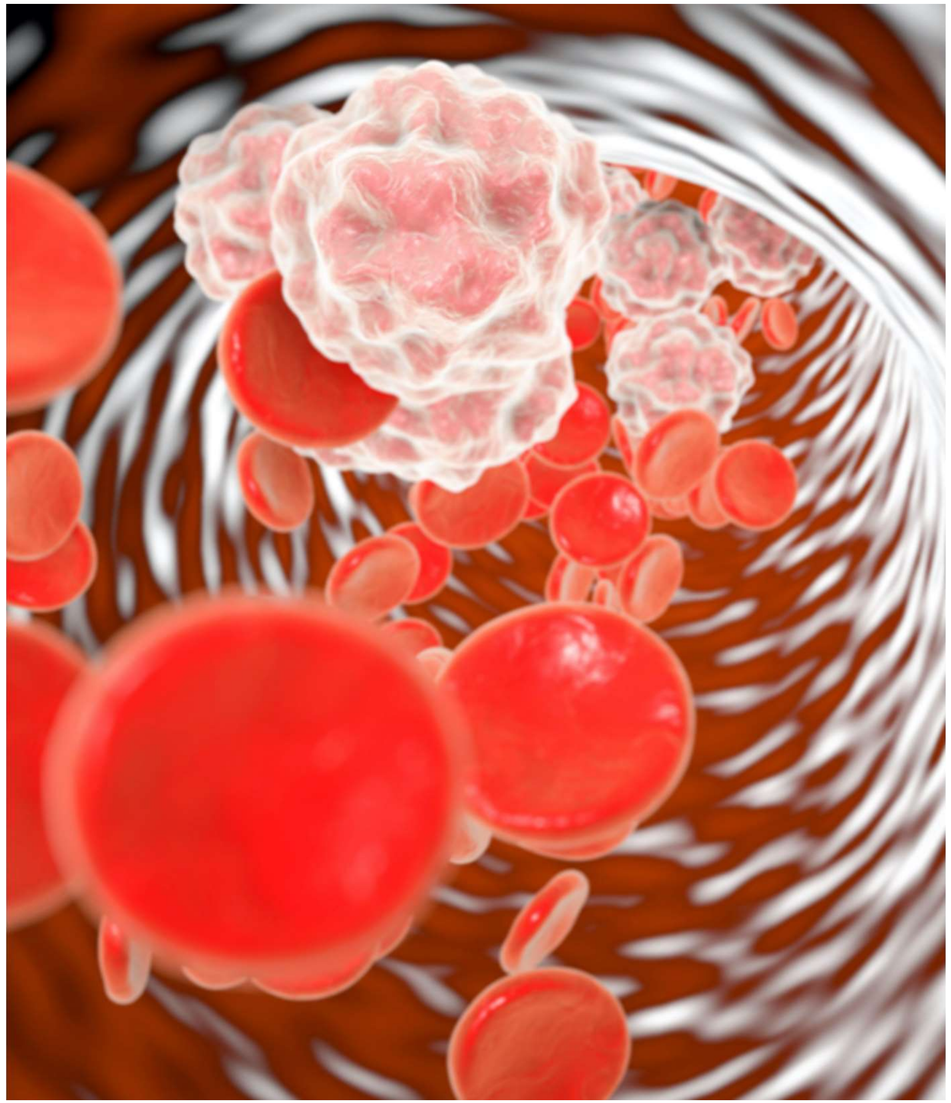
Inflammation is GOOD…

… until it isn’t

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

What is Inflammation?



Trauma to Vascularized Tissue

Regardless of the cause of injury

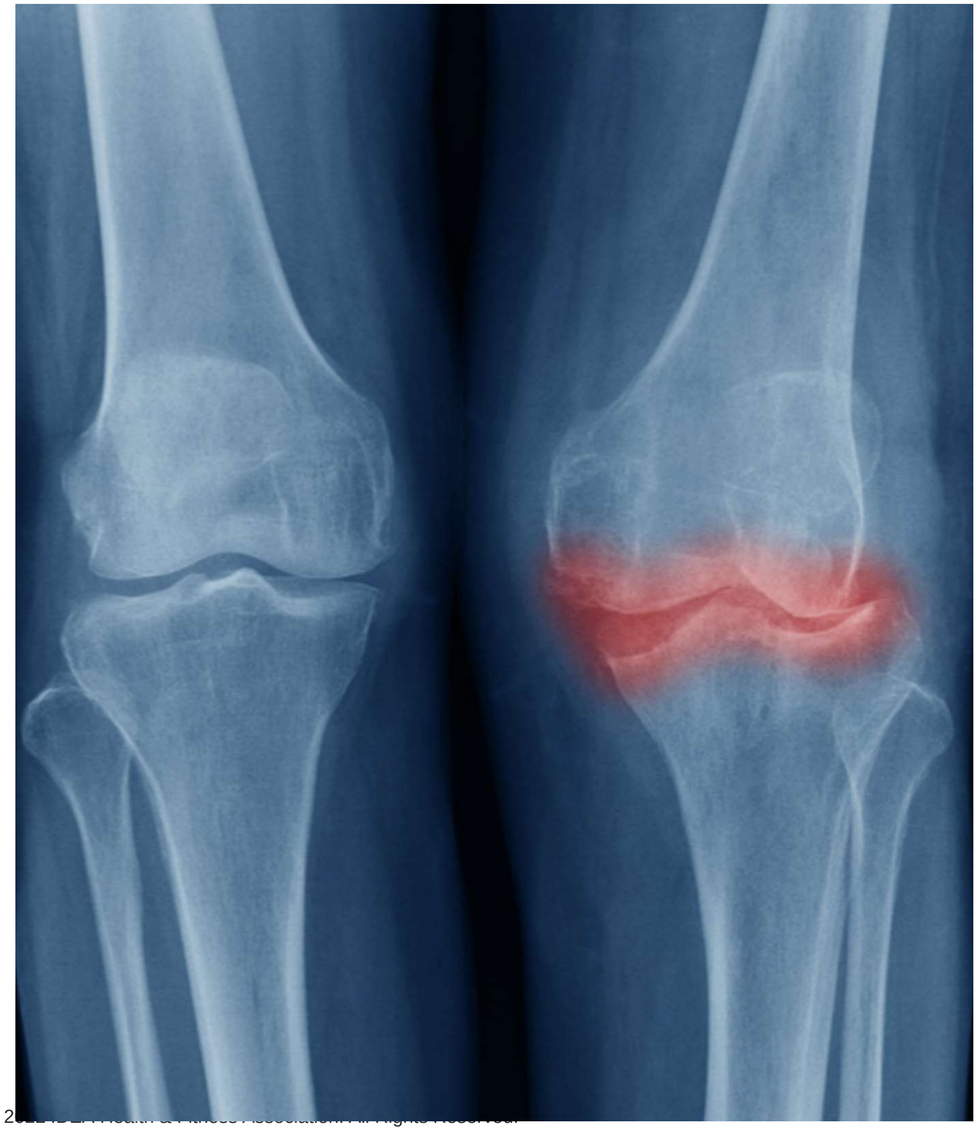
- Impact - bruising
- Mechanical – strains and sprains
- Chemical – topical or ingested
- Microbes – bacteria and viruses
- Radiation – sunburn

Similar to Hans Selye's General Adaptation Principle (GAS) regarding stress.

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Other Inflammatory Conditions



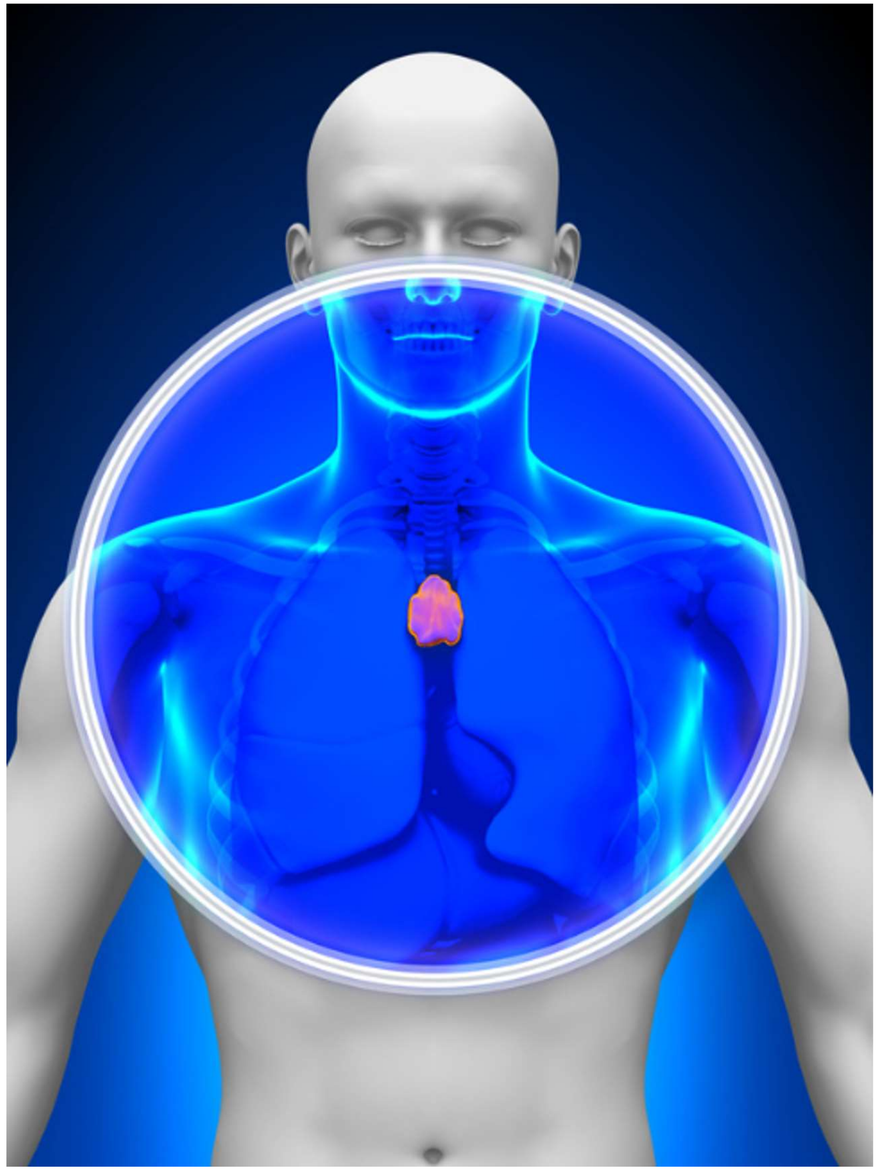
Clients may complain of…

- Arthritis
- Bursitis
- Tendonitis
- Appendicitis
- Infection
- Inflammatory bowel disease (IBD)
- Allergies
- AUTOIMMUNE DISEASES … such as?

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Autoimmune Diseases…



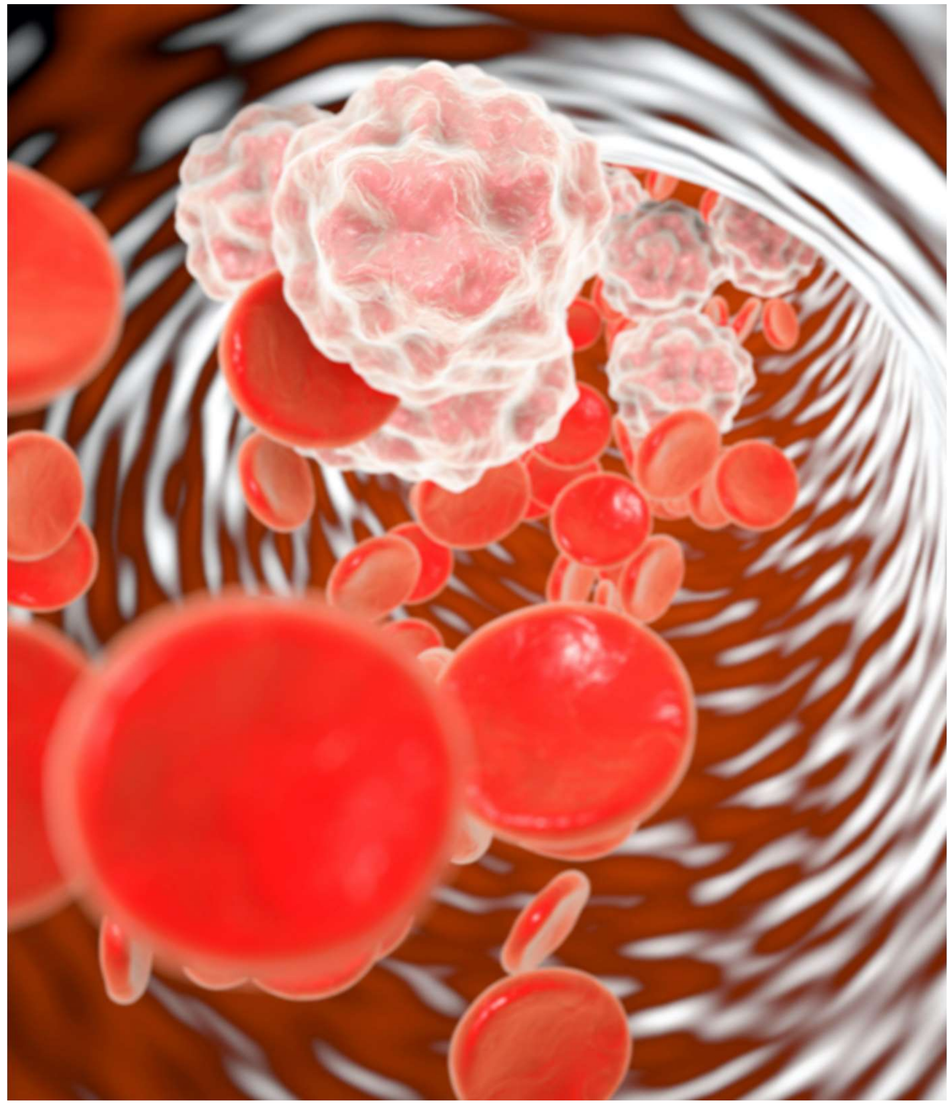
- Rheumatoid arthritis
- Type 1 diabetes
- Alopecia
- Lupus
- Multiple sclerosis
- Celiac disease

This is a response due to a failure of the thymus to recognize “self” during its mission to protect the body Against invaders. The protect cells are called T-cells Which are named after the thymus.

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

What is the Purpose of Inflammation?



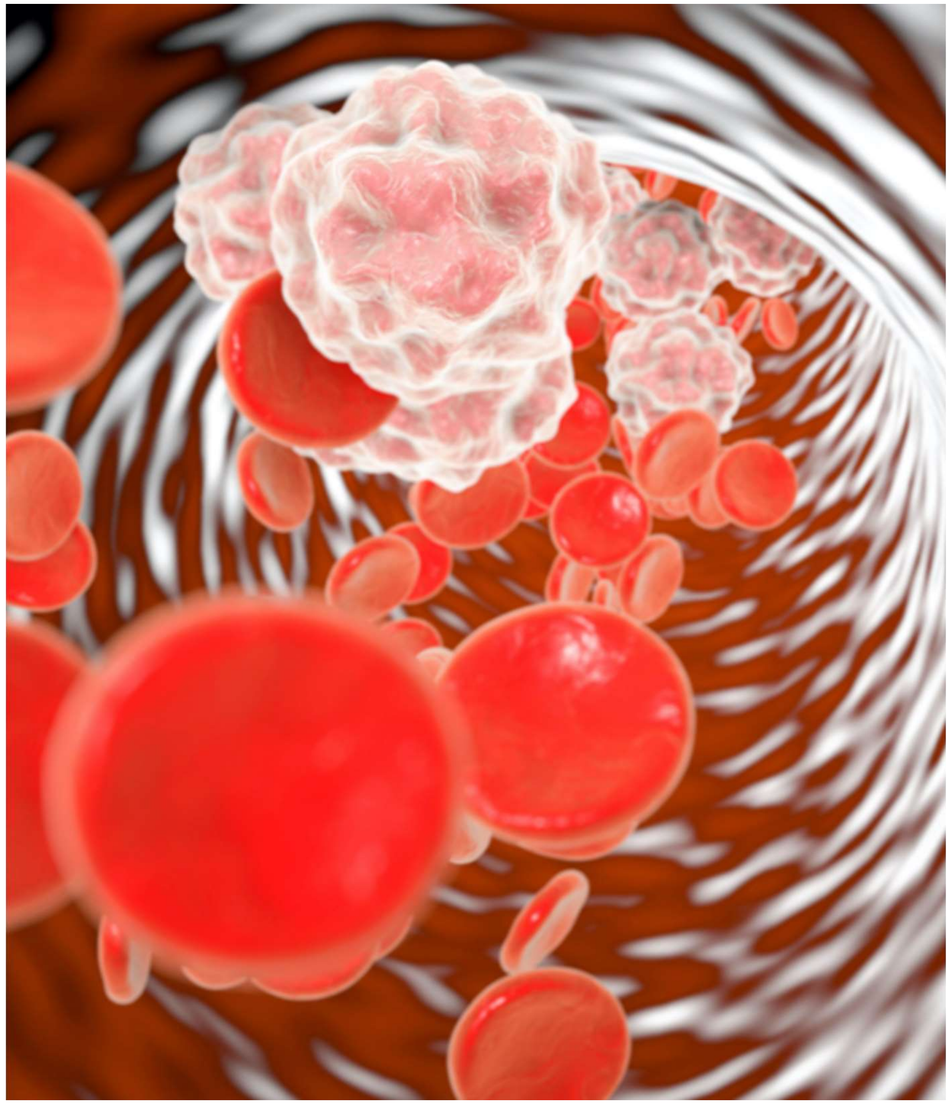
Protect the injured tissue by…

- Protect from damage
- Wall off damage
- Clear out damage
- Bring defense mechanisms to the area of injury

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

What is the Purpose of Inflammation?



Protect the injured tissue by…

- Protect from damage
- Wall off damage
- Clear out damage
- Bring defense mechanisms to the area of injury

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

INJURY – Impact: Kettlebell Wrist Bruise

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

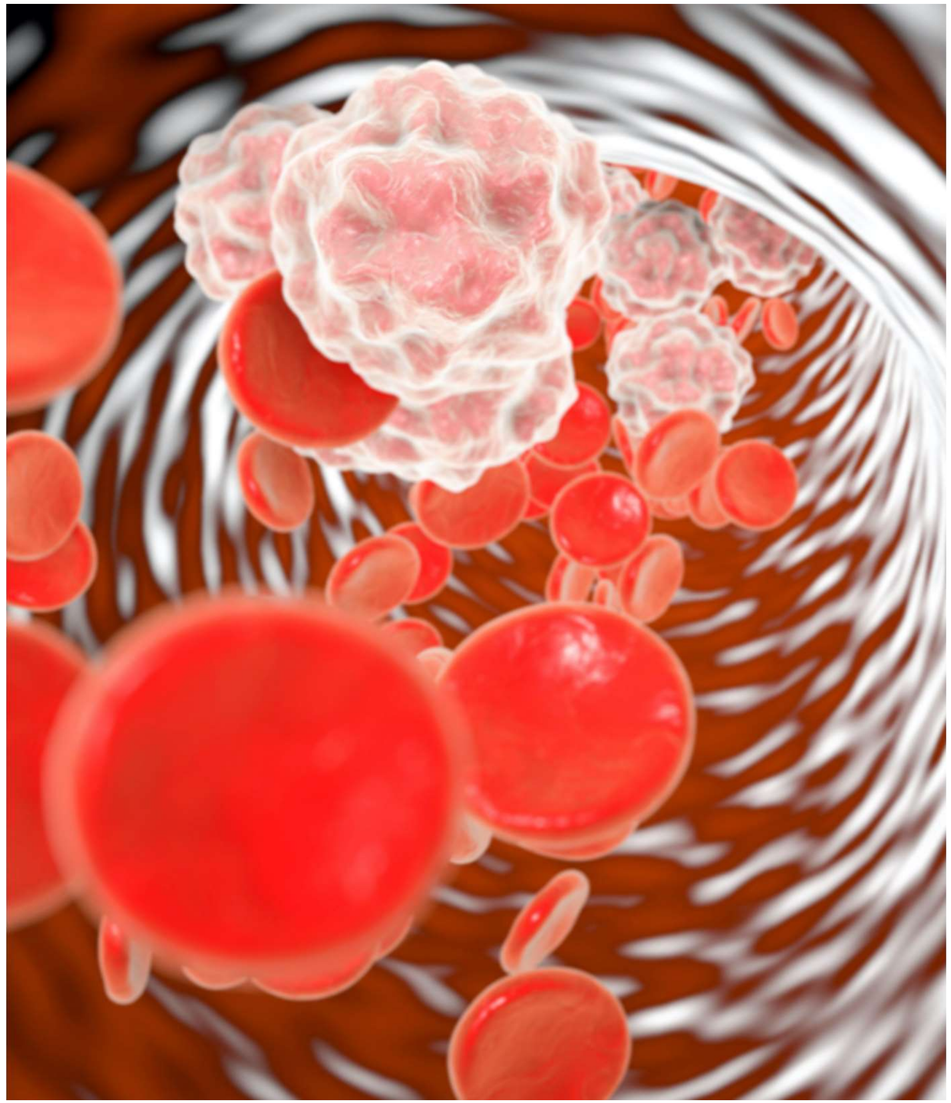
#ideaworld

INJURY – Impact: Kickboxing Loss

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Inflammatory Mediators



Messengers that promote inflammation

- Inflammatory Interleukins
- TNF (tumor necrosis factor)
- Catecholamines
- Inflammatory cytokines
- Inflammatory chemokines
- Histamines
- ROS
- Nitric Oxide (not nitrous oxide)
- Etc…

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

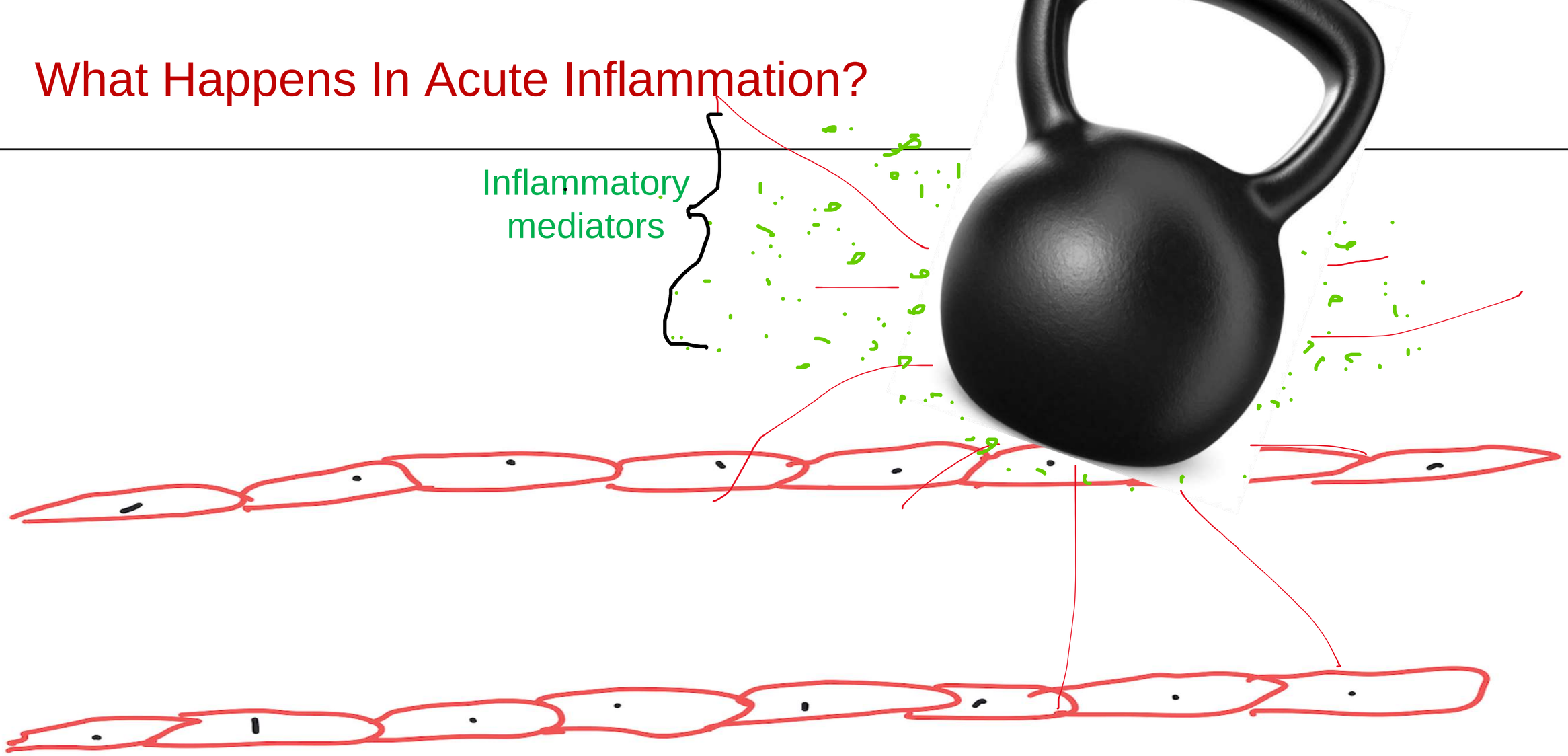
Acute Injury

Symptoms of Acute Injury

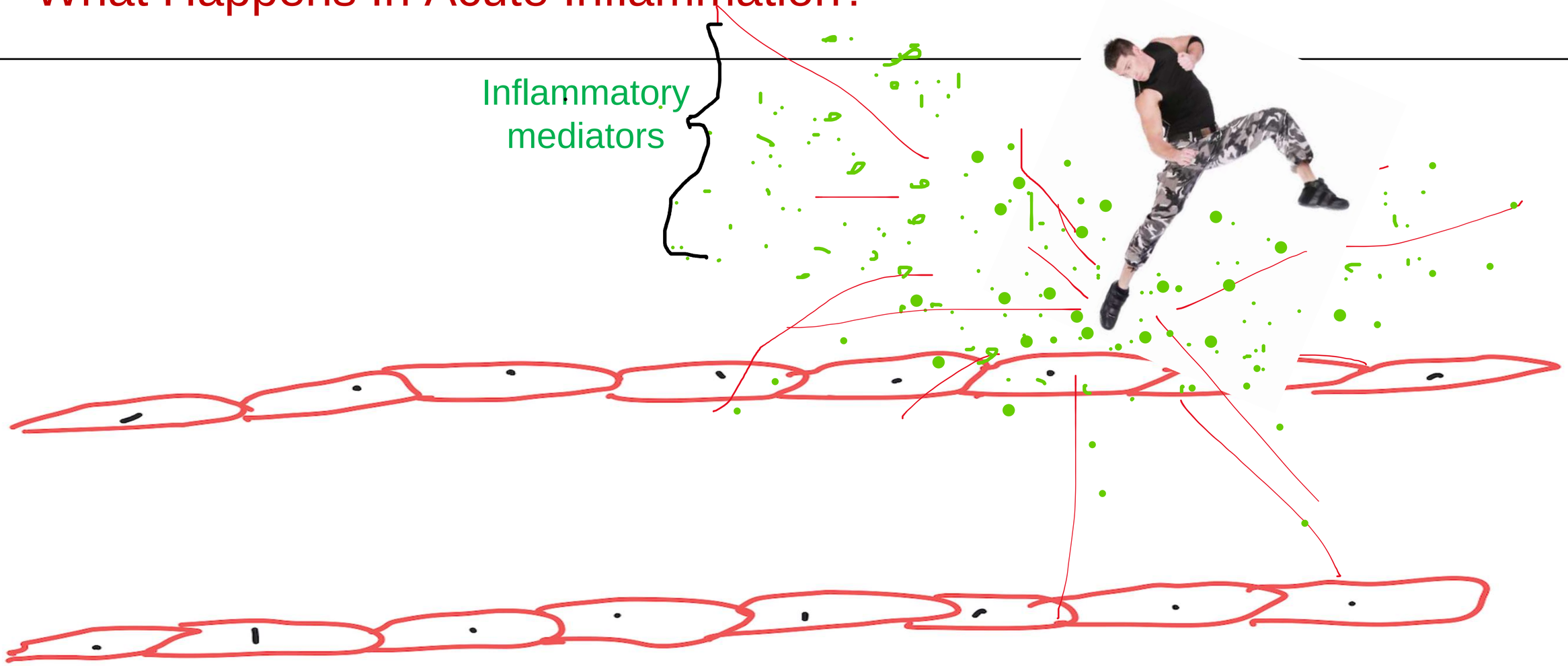
Example of Impact Trauma

- Redness (rubor)
- Swelling (tumour)
- Heat (calor)
- Pain (dolor)
- Loss of function (functio laesa)

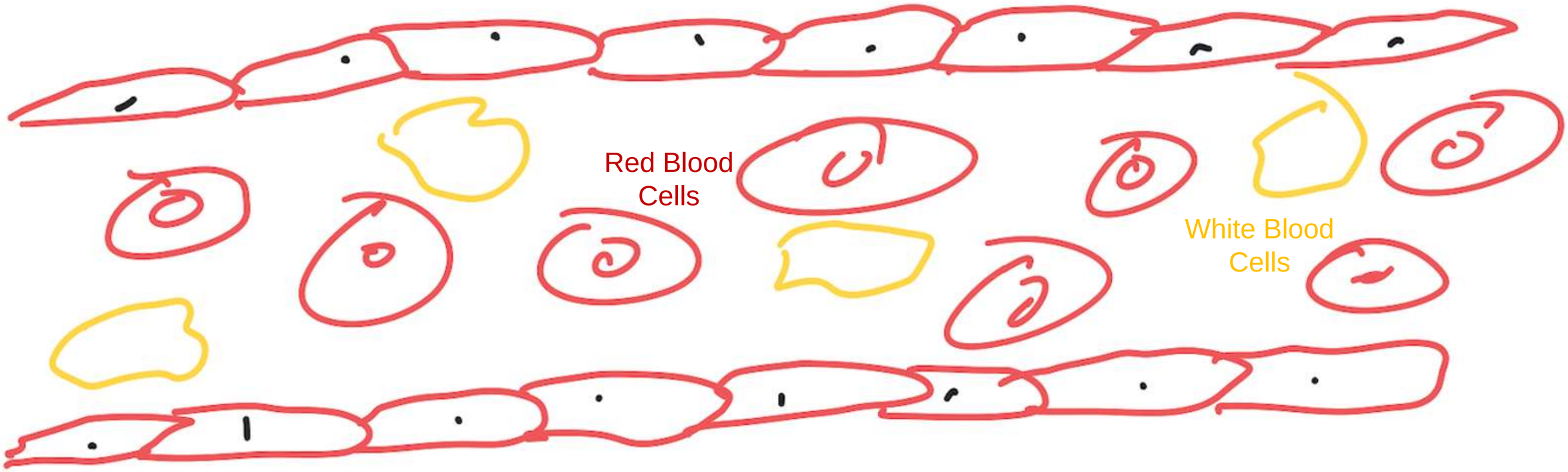
What Happens In Acute Inflammation?



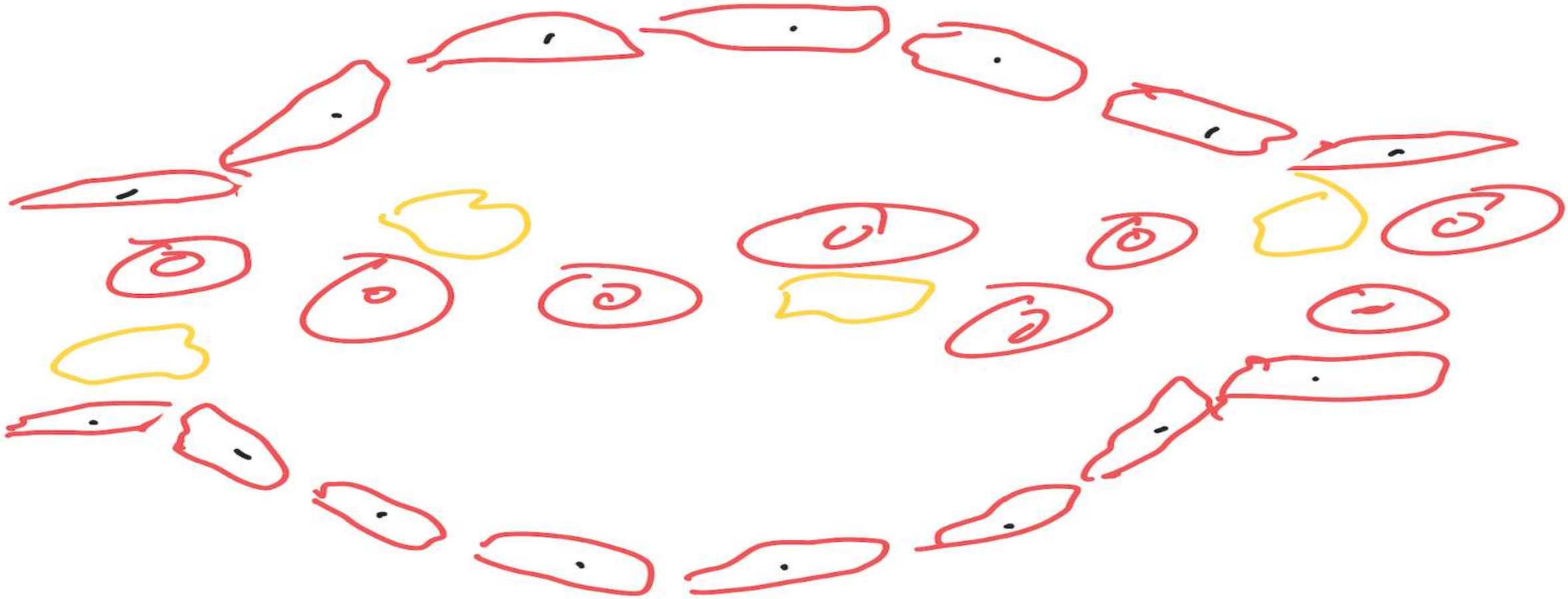
What Happens In Acute Inflammation?



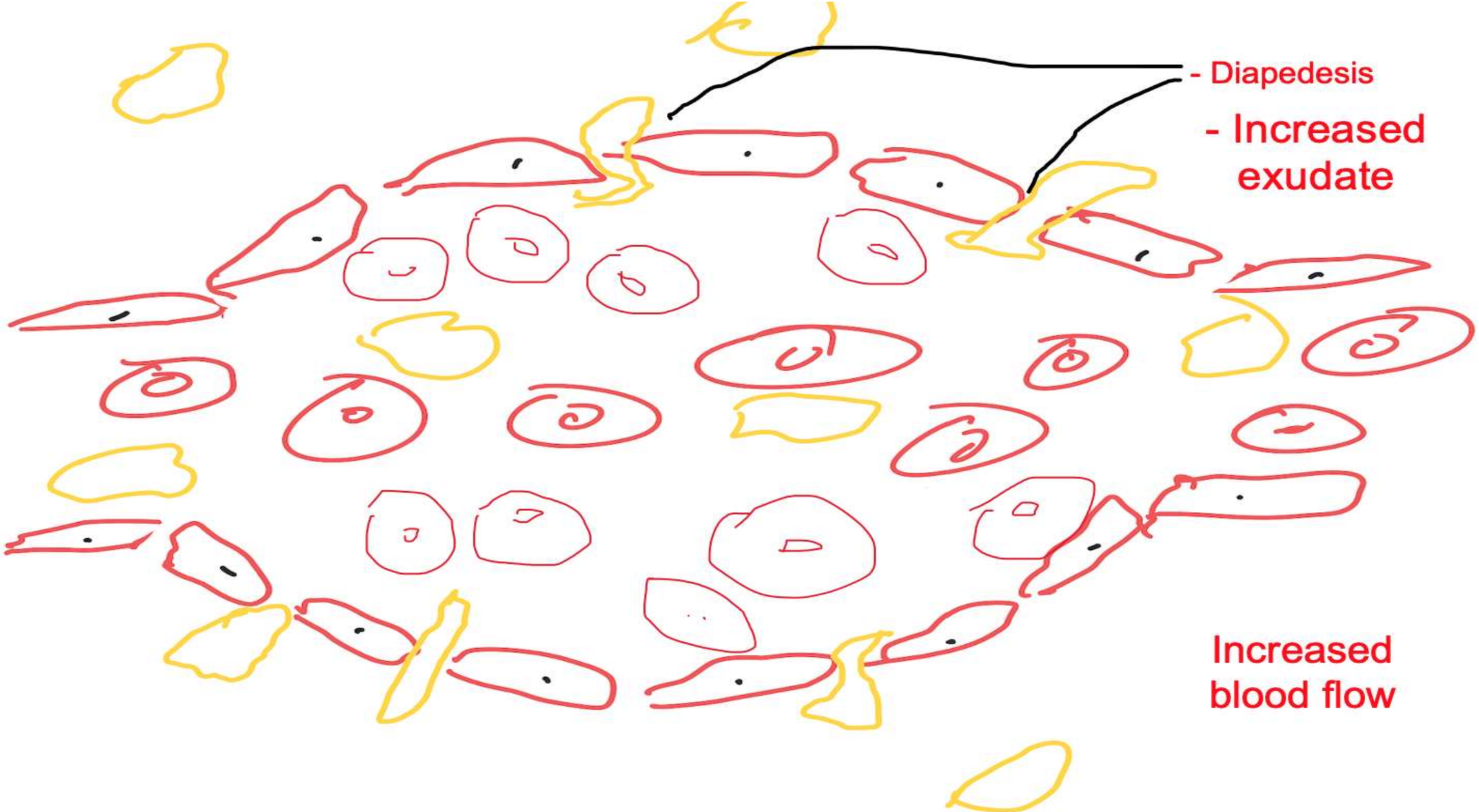
What Happens In Acute Inflammation?



What Happens In Acute Inflammation?

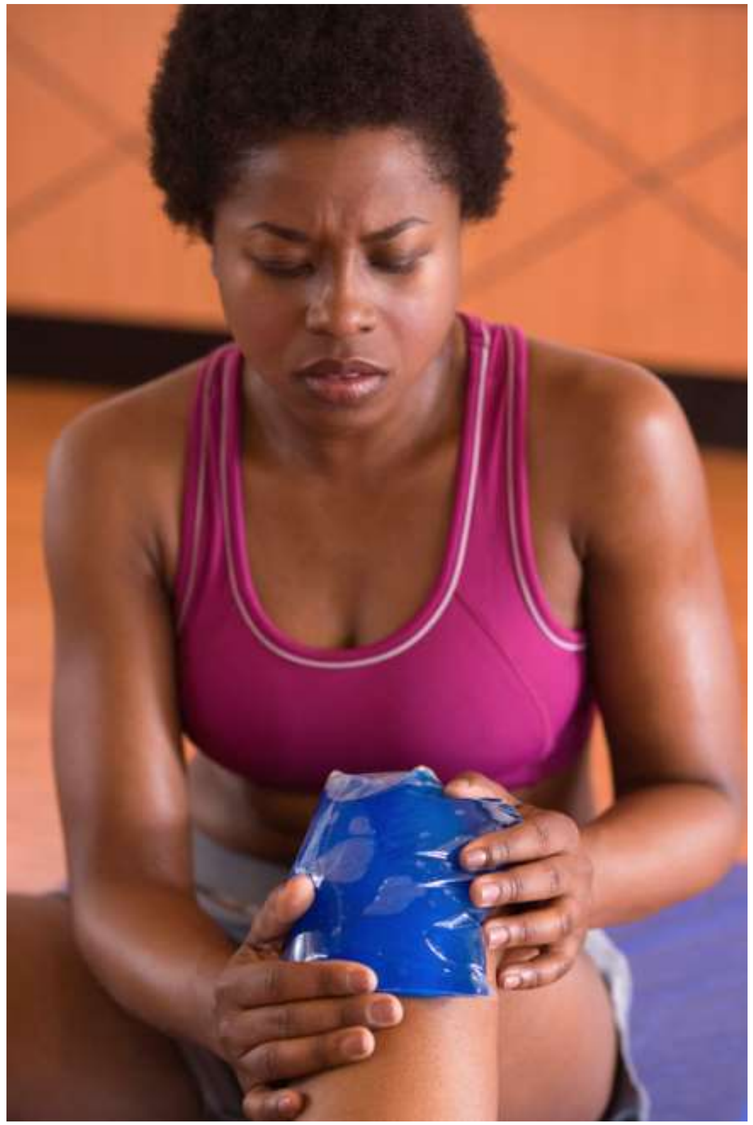


What Happens During Inflammation?



What Happens During Inflammation?

Common Address for Local Inflammation



RICE

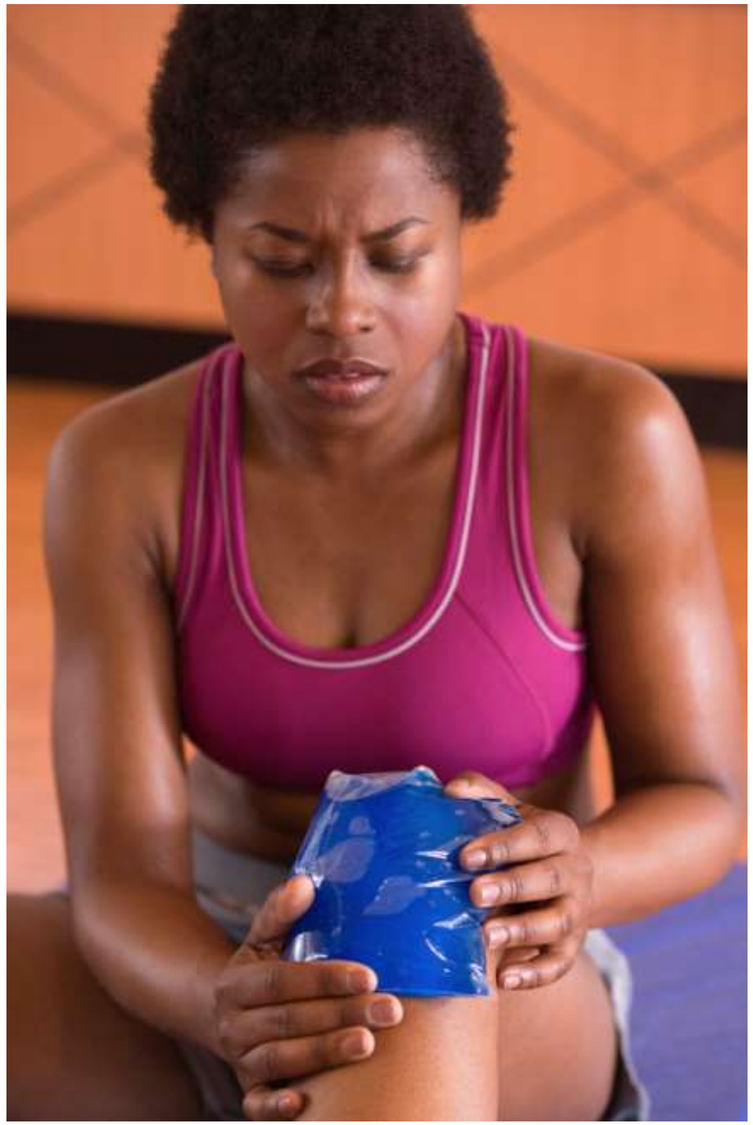
- R – Rest
- I – Ice
- C – Compress
- E – Elevate

- Reasons why it decreases inflammation…
- Reasons why it may not be the best choice…later…☺

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

What Does R.I.C.E. Do?



IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

FOUR Phases of Wound Healing

- Homeostasis
- Inflammation
- Proliferation
- Remodeling

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Homeostasis

- Equilibrium and Stability of interdependent variables

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

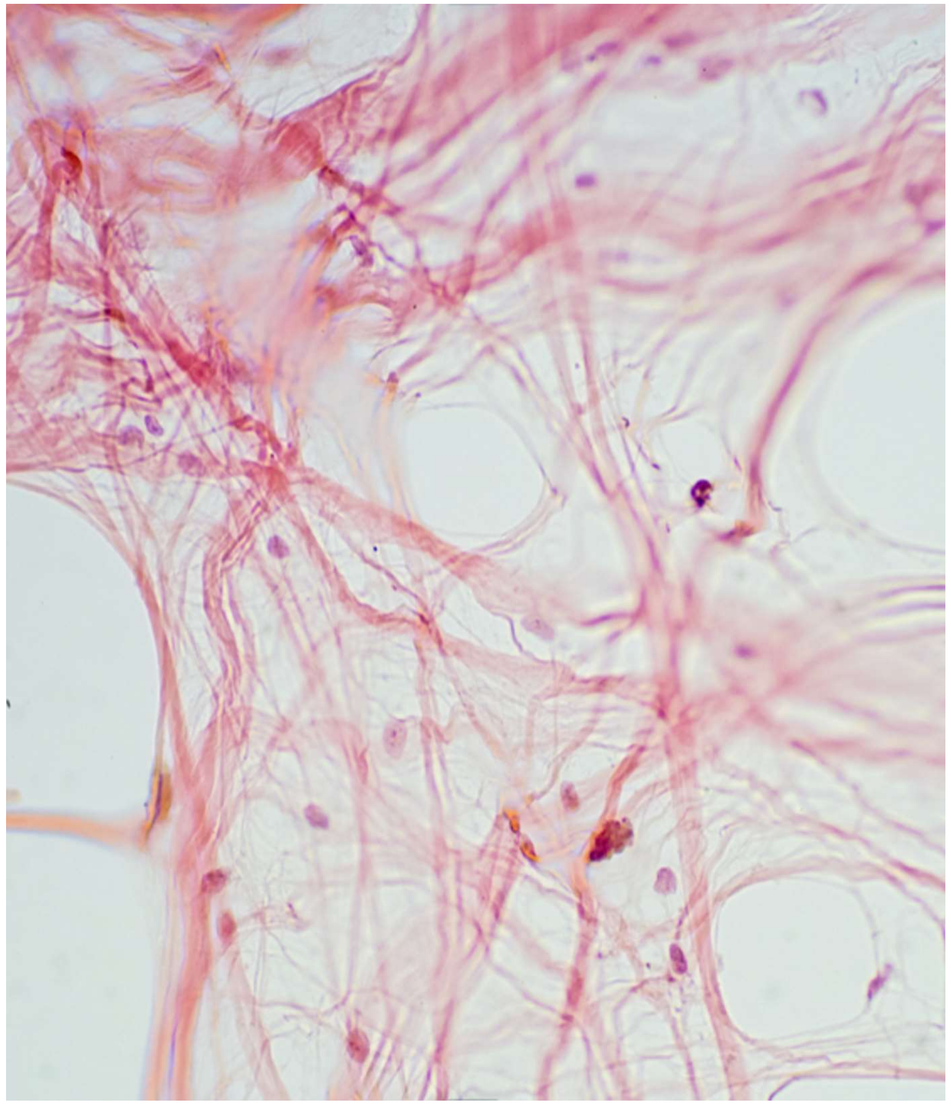
#ideaworld

Inflammation

Landén, N. X., Li, D., & Ståhle, M. (2016). Transition from inflammation to proliferation: a critical step during wound healing. *Cellular and molecular life sciences : CMLS*, *73*(20), 3861–3885. https://doi.org/10.1007/s00018-016-2268-0

- Phagocytosis of microbes
- Clearance of cellular debris
- Production of pro-inflammatory mediators
- Inflammation usually lasts 2-5 days (immune response lasts until wound is resolved)
- Neutrophils follow the chemokine gradient to the most concentrated area
- Monocytes differentiate into macrophages and “eat” debris and help healing in the next phase

Proliferation Phase



Day 1 up to a month

- Continued healing does not equal continued inflammation
- Fibroblast (and macrophages) come in mass “granulation tissue”
- Lay down collagen matrix (randomly placed)
- Reconstruct damaged tissues
- Wound contraction takes place
- Restoration of vascular network “angiogenesis”

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Remodeling Phase

Weeks to a year or more

(depending on wound size and type)

- Collage shifts into a different type which aligns fibers with tension
- Assist soft tissue realignment with stretching, contraction, weightbearing activities (Davis's Law)
- In bones it's called Wolff's Law
- Reduce the occurrence of scar tissue
- Scar tissue is considered only 80% at most the strength of the original tissue

Schilling J. A. (1976). Wound healing. *The Surgical clinics of North America*, *56*(4), 859–874. https://doi.org/10.1016/s0039-6109(16)40983-7

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

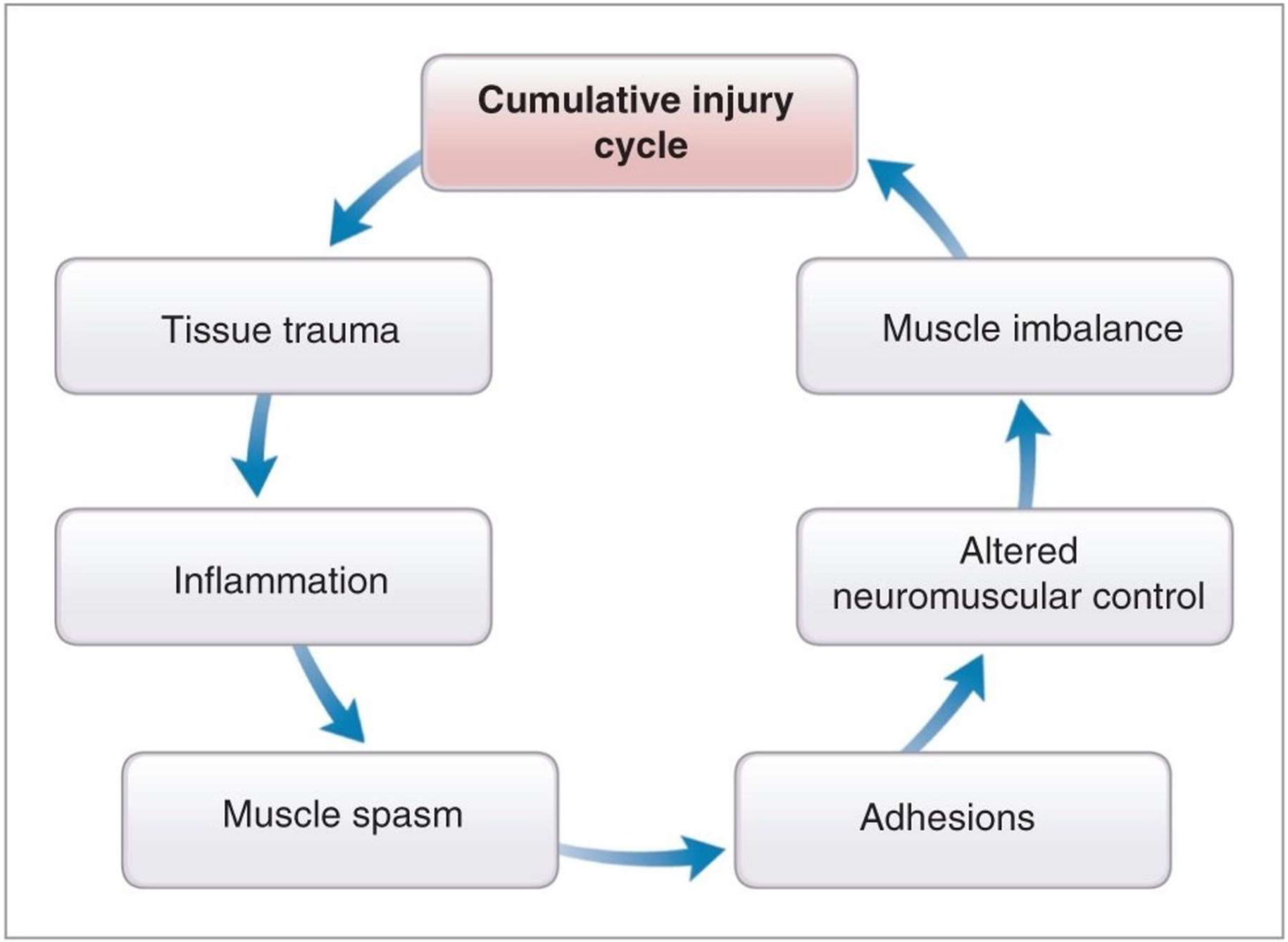
#ideaworld

INJURY – What Did the KB Wrist Bruise Hurt?

- Pain is a protective mechanism to minimize additional damage
- Inflammation can increase pain due to swelling which can put pressure against already facilitated nerve endings
- Advanced acute phases lead to a loss of function
- My repeatedly strained calf muscle is not a chronic condition but a repeated acute trauma and reinjury … which can lead to a chronic issue.

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld



Acute vs. Chronic Inflammation

Acute Inflammation:

- Fights infection
- Speed recovery
- Similar regardless of issue (trauma, antigens, burns, etc.)
- Redness
- Heat
- Swelling
- Pain
- Loss of function
- 1-3 days in the initial phases and up to a month

Acute vs. Chronic Inflammation

Chronic Inflammation:

- Not enough inflammation to overcome (continued) trauma
- WBC end up attacking healthy tissues and organs
- Obesity is an inflammatory state
- Chronic inflammation is associated with
  - Heart disease
  - Diabetes
  - Cancer
  - Arthritis
  - Crohn’s disease
  - IBS
- Testing for chronic inflammation – C-reactive protein
  - 1-3mg/liter shows low but likely continuous inflammation

What About DOMS?

MacIntyre, D. L., Sorichter, S., Mair, J., Berg, A., & McKenzie, D. C. (2001). Markers of inflammation and myofibrillar proteins following eccentric exercise in humans. *European journal of applied physiology*, *84*(3), 180–186. https://doi.org/10.1007/s004210170002

- "The purpose of this study was to examine the time-course and relationships of technetium-99m (99mTc) neutrophils in muscle, interleukin-6 (IL-6), myosin heavy chain fragments (MHC), eccentric torque, and delayed onset muscle soreness (DOMS) following eccentric exercise…
- Blood draw at 0, 2, 4, 6, 20, 24, 48, 72 h, and 6 and 9 days
- The neutrophils were greater in the exercised muscle than the non-exercised muscle.
- The DOMS was increased from 0 to 48 h, eccentric torque decreased from 2 to 24 h, and myosin heavy chain fragments (MHC) peaked at 72 h post-exercise.
- Significant relationships were found between IL-6 and 2 h and DOMS at 24 h post-exercise and assessment of the magnitude of change between IL-6 and MHC.
- These findings suggest a relationship between damage to the contractile proteins and inflammation, and that DOMS is associated with inflammation but not with muscle damage.

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Chronic Inflammation and Exercise

Dimitrov, S., Hulteng, E., & Hong, S. (2017). Inflammation and exercise: Inhibition of monocytic intracellular TNF production by acute exercise via β_2-adrenergic activation. *Brain, behavior, and immunity*, *61*, 60–68. https://doi.org/10.1016/j.bbi.2016.12.017

Authors show that 20-minutes of moderate intensity treadmill walking may protect against chronic conditions with low-grade inflammation.

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Chronic Inflammation and Exercise

Hong, S., Dimitrov, S., Pruitt, C., Shaikh, F., & Beg, N. (2014). Benefit of physical fitness against inflammation in obesity: role of beta adrenergic receptors. *Brain, behavior, and immunity*, *39*, 113–120. https://doi.org/10.1016/j.bbi.2013.12.009

- "Evidence shows that both poor physical fitness and obesity are linked to low-grade inflammation and inflammatory diseases."
- Among the overweight or obese participants, greater cardiorespiratory fitness was a strong predictor of lower levels of TNF and IL-1β after controlling for the covariates.
- Cardiorespiratory fitness protects against obesity-related low-grade inflammation.
- Given the significance of beta adrenergic receptors (β-AR) function in pathogenesis of various diseases, clinical implications of its role in the fitness-inflammation association among the obese are profound.

Chronic Inflammation and Exercise

Pinto, A., Di Raimondo, D., Tuttolomondo, A., Buttà, C., Milio, G., & Licata, G. (2012). Effects of physical exercise on inflammatory markers of atherosclerosis. *Current pharmaceutical design*, *18*(28), 4326–4349. https://doi.org/10.2174/1381612812802481192

- Regular exercise is an established therapeutic intervention with an enormous range of benefits.
- Findings confirm that physical activity induces an increase in the systemic levels of a number of cytokines and chemokines with anti-inflammatory properties.
- MYOKINES produced during muscular contractions … contribute to provide anti-inflammatory actions.
- Analysis of available researches seem to confirm the efficacy of regular physical training as a nonpharmacological therapy having target chronic low-grade inflammation.
- Physical exercise could be considerate a useful weapon against local vascular and systemic inflammation in atherosclerosis.

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Regular Exercise for Disease Prevention and Treatment

Gleeson, M., Bishop, N. C., Stensel, D. J., Lindley, M. R., Mastana, S. S., & Nimmo, M. A. (2011). The anti-inflammatory effects of exercise: mechanisms and implications for the prevention and treatment of disease. *Nature reviews. Immunology*, *11*(9), 607–615. https://doi.org/10.1038/nri3041

- "Regular exercise reduces the risk of chronic metabolic and cardiorespiratory diseases, in part because exercise exerts anti-inflammatory effects."

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Better Immunology – Not Just Anti-Inflammatory

Pedersen, B. K., & Saltin, B. (2015). Exercise as medicine - evidence for prescribing exercise as therapy in 26 different chronic diseases. *Scandinavian journal of medicine & science in sports*, *25 Suppl 3*, 1–72. https://doi.org/10.1111/sms.12581

“This review provides the reader with the up-to-date evidence-based basis for prescribing exercise as medicine in the treatment of 26 different diseases.”

- Psychiatric diseases (depression, anxiety, stress, schizophrenia)
- Neurological diseases (dementia, Parkinson's disease, multiple sclerosis)
- Metabolic diseases (obesity, hyperlipidemia, metabolic syndrome, polycystic ovarian syndrome, type 2 diabetes, type 1 diabetes)
- Cardiovascular diseases (hypertension, coronary heart disease, heart failure, cerebral apoplexy, and claudication intermittent)
- Pulmonary diseases (chronic obstructive pulmonary disease, asthma, cystic fibrosis)
- Musculo-skeletal disorders (osteoarthritis, osteoporosis, back pain, rheumatoid arthritis)
- Cancer.

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Exercise and Parasympathetic Nervous System

Daniela, M., Catalina, L., Ilie, O., Paula, M., Daniel-Andrei, I., & Ioana, B. (2022). Effects of Exercise Training on the Autonomic Nervous System with a Focus on Anti-Inflammatory and Antioxidants Effects. *Antioxidants (Basel, Switzerland)*, *11*(2), 350. https://doi.org/10.3390/antiox11020350

- Autonomic Nervous System
  - Sympathetic Nervous System
    - SNS has been shown to have both pro- and anti-inflammatory effects
  - Parasympathetic Nervous System
    - PNS has anti-inflammatory effects
    - Exercises conducted on a daily basis can cause the ANS to adapt to parasympathetic dominance.

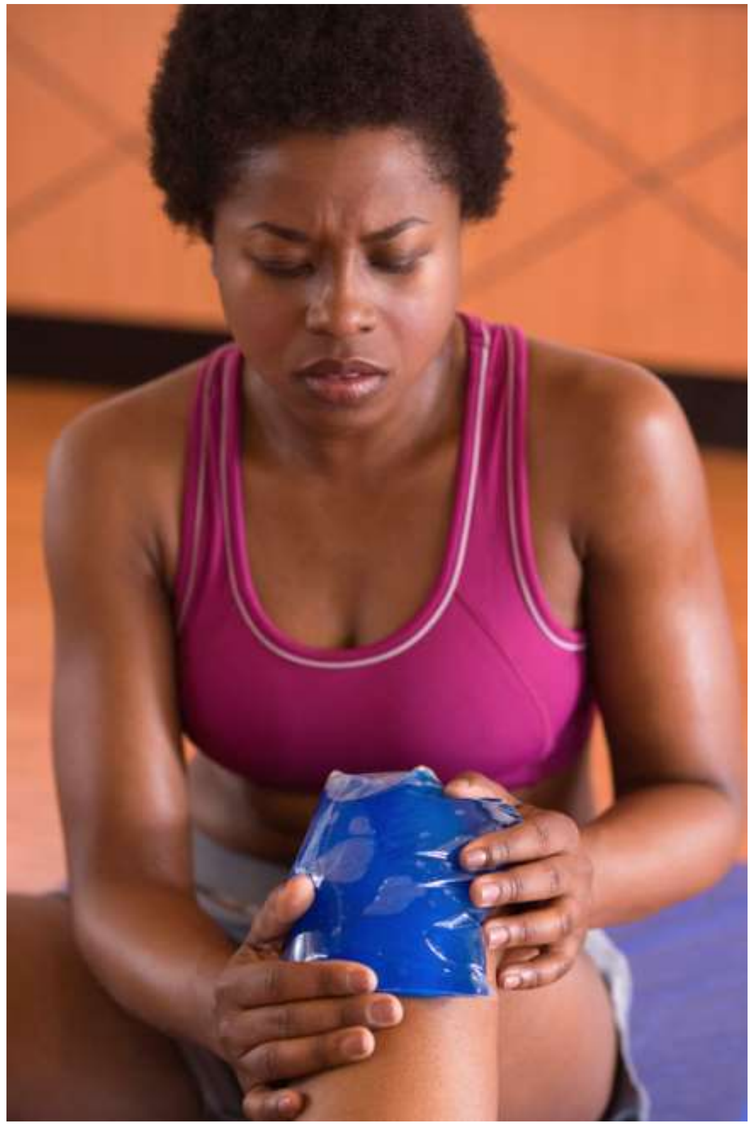
RICE vs MEAT

RICE vs MEAT

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Common Address for Local Inflammation



RICE

- R – Rest
- I – Ice
- C – Compress
- E – Elevate

- It seems to (only) delay inflammation. Once the tissues warm inflammation resumes.
- Update to RICE…

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Updated Address for Local Inflammation

MEAT

- M – Move
- E – Exercise
- A – Analgesics
- T – Treatment

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Inflammation Overview

What is inflammation?

- A protective response from the body to help protect and heal traumatized vascular tissue.

How does inflammation work?

- Inflammatory markers call WBCs and fibroblasts to the area to remove debris and protect the area.

How does inflammation help?

- Inflammation brings help for healing and starts the process of proliferation and remodeling

Why does inflammation hurt?

- There is already pain in the area plus swelling/edema as well increasing pain to minimize function as not to reinjure.

What is the role of exercise in creating acute inflammation and easing inflammation?

- New and intense exercise can lead to acute inflammation
- Moderate exercise can minimize systemic chronic inflammation

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld

Inflammation: What it is. How it works. Why it helps and why it hurts.

Rick Richey, DHSc, MS, LMT

Presenter's Email: rick.richey@nasm.org

NASM Website: www.nasm.org

IDEA WORLD CONVENTION
FITNESS • NUTRITION • BUSINESS

#ideaworld