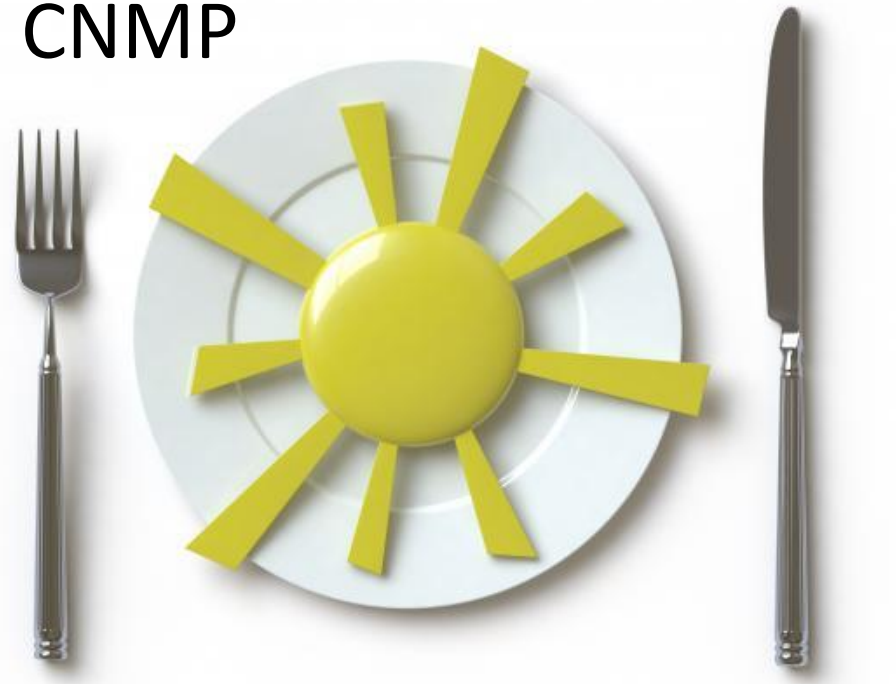
Vitamin D should be prescribed by doctors to treat chronic musculoskeletal pain, according to research

- Heralded as potentially effective treatment for chronic non-specific musculoskeletal pain (CNMP)
- Vitamin D should be standard prescription given from doctors to patients suffering from CNMP



Chondroprotection and the Prevention of Osteoarthritis Progression of the Knee

Conclusion: For patients with or at risk for osteoarthritis, the use of glucosamine and chondroitin sulfate may serve as a non-operative means to protect joint cartilage and delay osteoarthritis progression.

Gallagher B, Fotios P, et al. *The Am J of Sports Med*. 2015;43(3):539-541.

Chondroitin sulfate for knee O/A

- 800mg of pharmaceutical-grade chondroitin sulfate as good as celecoxib in reducing pain and improving joint function in symptomatic knee O/A
- Those used in this study was of pharmaceutical grade

Annals of Rheumatic Diseases, May, 2017

3 phases of care (cont'd)

Phase 3: Nutritional support for ongoing care and wellness after injury

Dr. Rob's Super 5

1) Phytomulti

2) Omega-3 fatty acids

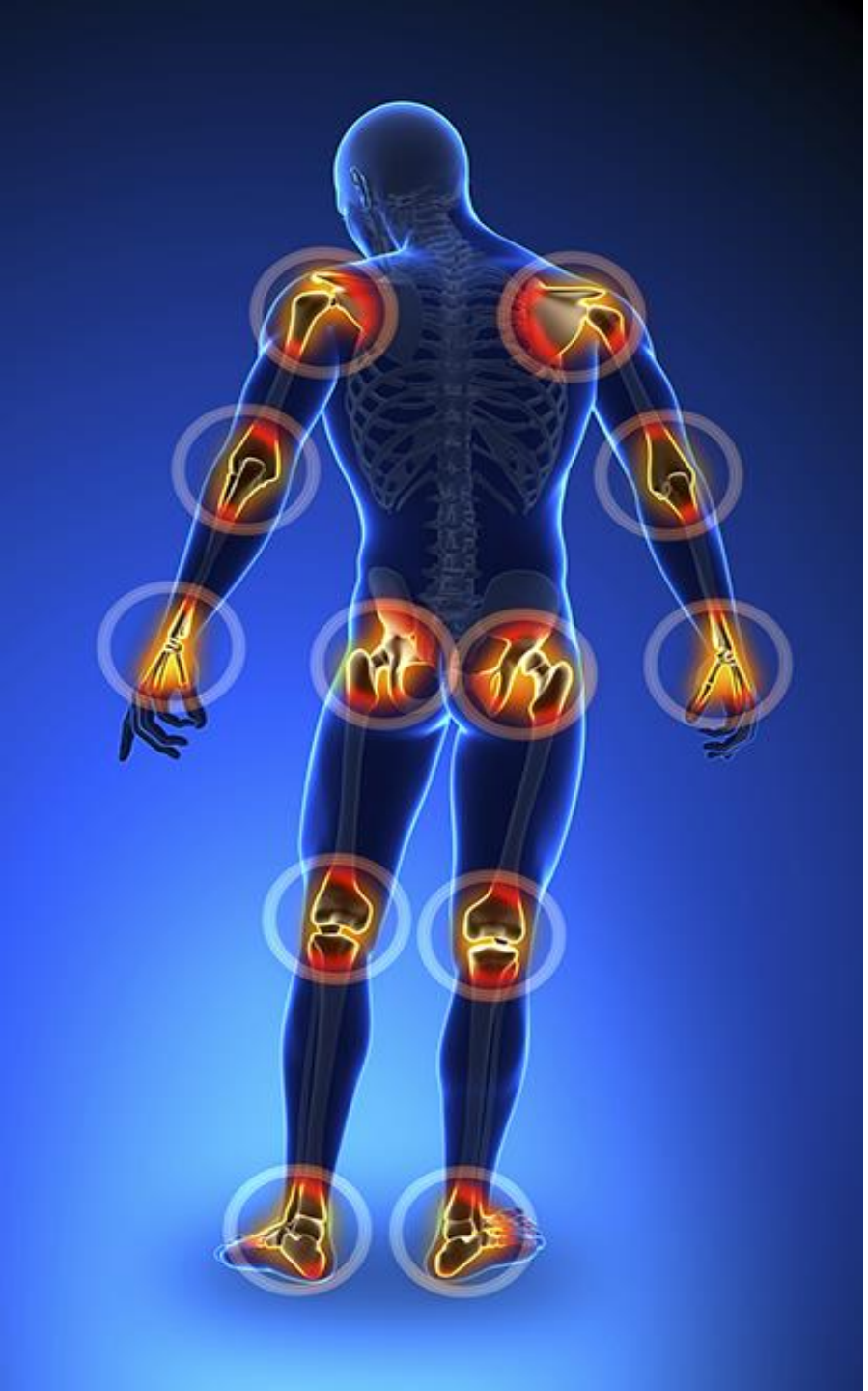
3) Vitamin D

4) Probiotics

5) Organic superfruits and greens drink

ReCap

- **Phase 1: Acute**
  - Tissue swelling
  - Tissue congestion
  - Pain modulation
- **Phase 2: Sub-acute**
  - Reducing scar tissue formation
  - Aid in connective tissue remodeling
  - Support joint health
  - Reduce risk of re-injury and degeneration
- **Phase 3**:
  - Continued connective tissue remodeling
  - Support wellness care:
    - Maintaining foundation nutrition
    - Reducing risk of re-injury



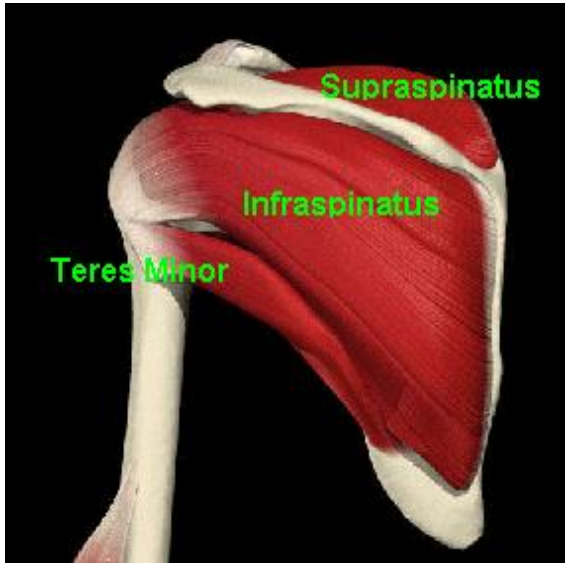
Nutritional Approaches for Joint Injury

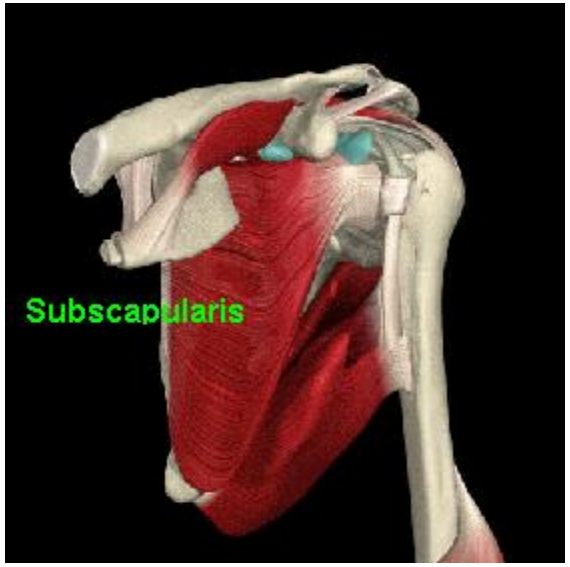
- Hops Extract
- Undenatured type II collagen
- Magnesium
- Probiotics – L.acidophilus NCFM, B-lactis Bi-07
- Pro-resolving Mediators (PRMs)

Nutritional Protocols for the Management of Sports Injuries

Rotator Cuff (Impingement Syndrome)

- Rotator cuff – sits muscles
- Dynamic stabilizers and compressor of the humeral head
- The cuff helps to lift and rotate the arm





Rotator Cuff (Impingement Syndrome): Causes

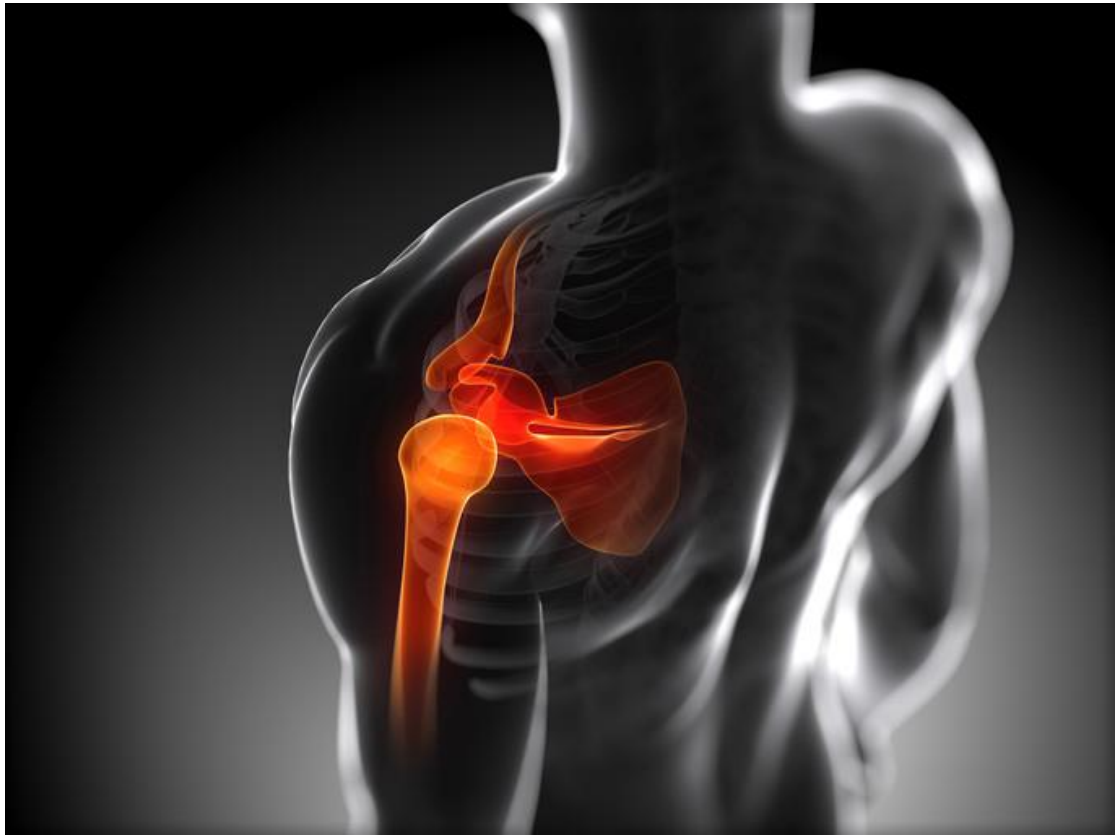
- Tendinopathy
- Wear and tear – collagen breakdown
- Poor posture
- Scapula orientation
- Falling – overstretch arm, bracing with arm
- Repetitive stress
- Heavy lifting activities

Risk Factors

- Age, being an athlete, posture, weak shoulder muscles

The shoulder dysfunction continuum

- Scapular dyskinesis
- Anterior impingement syndrome
- Rotator cuff tear
- Rotator cuff rupture



Scapular upward rotator morphologic and forward head posture

Conclusion:

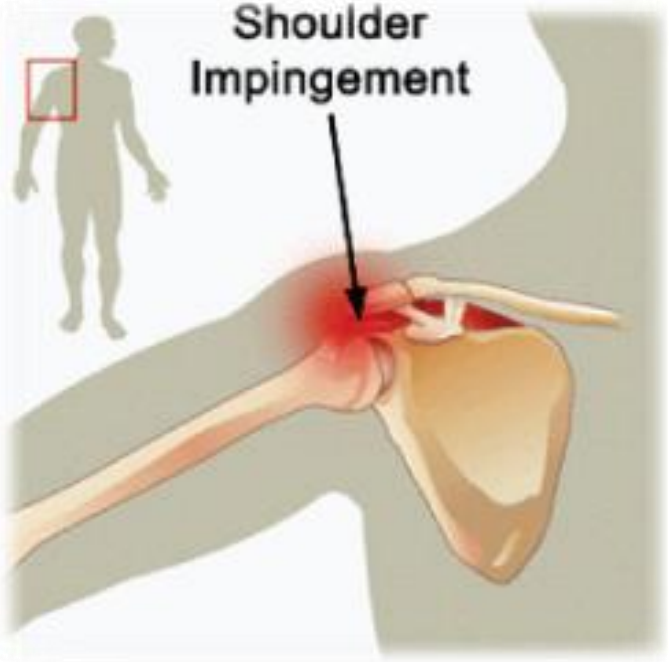
- Forward head posture appears to be related to atrophy of the serratus anterior muscle
- Contributes to the development of shoulder problems

Khosravi F, Peolsson A, et al. *J Ultrasound Med* 2018 May 15

Shoulder proprioception – with subacromial impingement syndrome

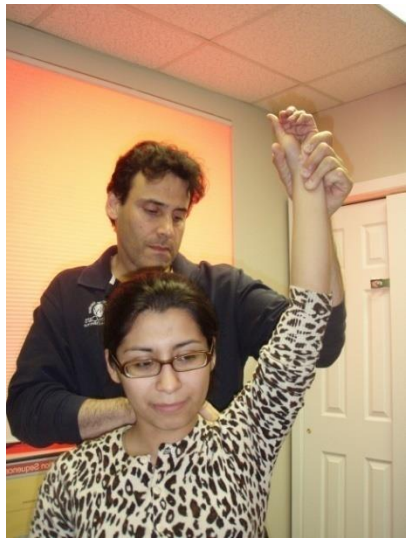
Conclusion:

- Study showed impaired shoulder proprioception in patients with SIS
- Proprioceptive impairment also found in uninvolved shoulders in patients with SIS



Sahin E., et al. *Musculoskeletal Rehab*, 2016

Tests



- ROM
- Palpation of muscles
- Rotator cuff tear
- Subacromial impingement
- Labrum
- Shoulder cross-over test:
  - Scapular assistance test
  - Scapular retraction test
- D/D other shoulder pathologies and/or cervical post syndrome

Rotator cuff tear

Supraspinatus

- Jobe test – 88% sensitivity, 62% specificity
- Full-can test – 70% sensitivity, 81% specificity

InfraSpinatus

- Hornblower sign – 96% specificity
- Lag sign – 0 degrees of shoulder abduction – 98%
- External rotation lag sign – 20% of shoulder abduction - supraspinatus

Am J Phys Med Rehab 2017;176-83

Diagnostic Accuracy of Clinical Tests for Subacromial Impingement Syndrome (SIS)

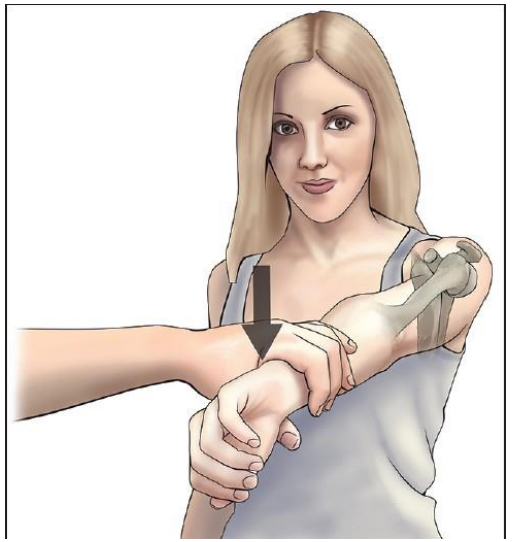
Results:

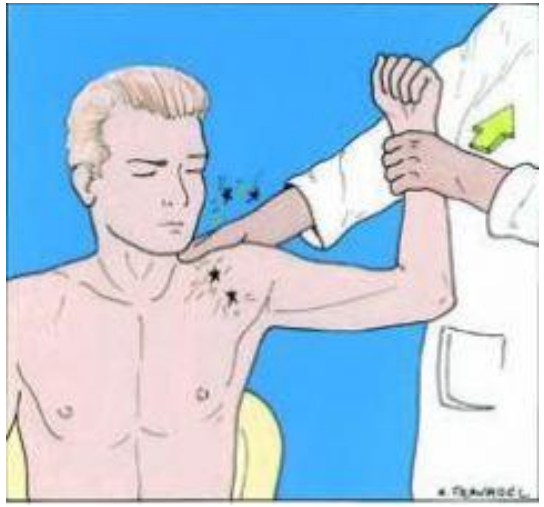
1) The Hawkins-Kennedy test, Neer's sign, and empty can test shown to be more useful for ruling out rather than ruling in SIS
2) The drop-arm test and lift-off test more useful for ruling in SIS if test is positive

Archives of Physical Medicine and Rehabilitation, Feb. 2012, vol. 93(2):229-36

Ortho test

- O’Brien’s test
- Biceps load test
- Crank test





Biceps Load I/II

Exercises to Rehab

- Pendulum exercise
- Posterior shoulder stretch
- Active training of the scapula muscles
- Upper trap/levator scapular stretch
- Door-way pectoralis major stretch
- Ext/int rotation
- “Y”, “W”, “T” stability exercise on ball
- Prone external rotation
- KB packing the shoulder
- Dowel shoulder packing
- Wall “Y” exercise
- Wall angels

Nutritional Protocol for Rotator Cuff

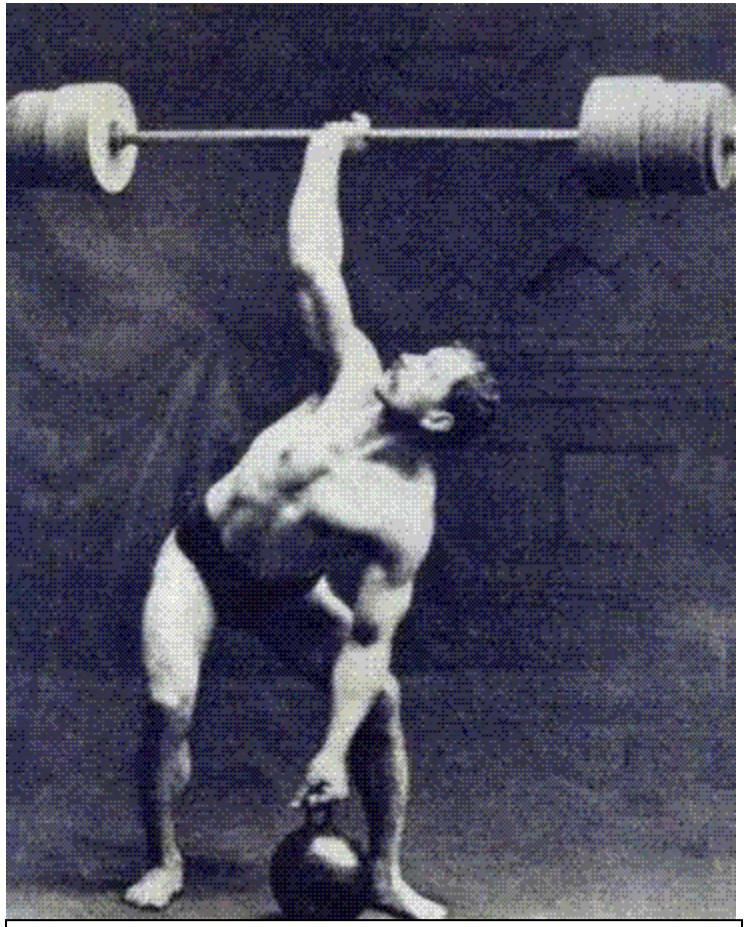
Nutritional protocol for the first 72 hours:

- Bromelain, papain, pancreatin, peptizyme, rutin – early onset inflammation and removal of cellular debris
- Natural anti-inflammatory/joint discomfort:
  - Boswellia, turmeric, ginger, black pepper
- Nutrients to relax muscle tissue:
  - Calcium, magnesium, lemon balm, valerian, hops extract, passion flower extract
- Pro-resolving mediators

Nutritional Protocol for Rotator Cuff (cont'd)

Nutritional protocol Day 4 → 8 weeks

- Formulation providing targeted nutritional components involved in the biochemical processes that support growth and construction of connective tissue:
  - Glucosamine HCl, chondroitin, MSM, vit. C, hyaluronic acid, ginger, turmeric, boswellia, black pepper
  - Mg, hops extract, undenatured collagen 2
- A specific formulation including L-arginine
- Vitamin D3 plus K2: 5,000 IUs daily



“Acute administration of some amino acids, especially arginine, can cause acute increase in growth hormone secretion” (pg. 887)

Textbook of Medical Physiology 7th Edition; Guyton; © 1986 W.B. Saunders Co., page 887
ISBN: 0-7216-1260-1

Effect of Diet-Induced Vitamin D Deficiency on Rotator Cuff Healing in a Rat Model

- The biomechanical and histological data from this study suggest that low vitamin D levels may negatively affect early healing at the rotator cuff repair site

The American Journal of Sports Medicine, vol. 42(1)

Nutritional Protocol for Rotator Cuff (cont'd)

Nutritional support for ongoing care and wellness

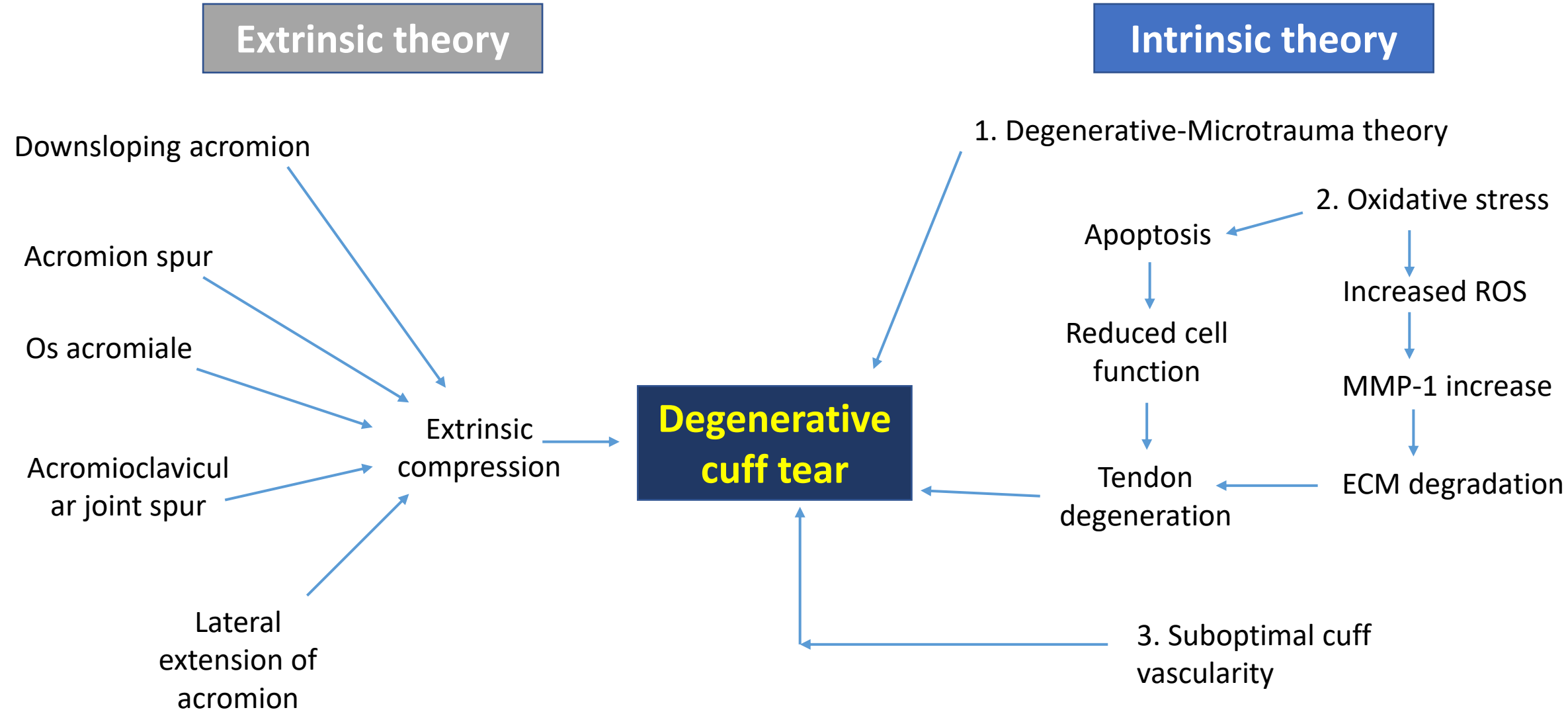
Tissue integrity, wellness, fatty acid utilization:

- An Excellent Multivitamin and mineral formula
- A Phytonutrient Formula to quench free radicals, aid in cell protection and improve DNA stability
- Collagen complex with fruit/vegetable complex

Improve Fatty Acid Profiles:

- EPA/DHA

Summary of extrinsic and intrinsic pathways of rotator cuff tear



Science Direct, Feb. 2015 online

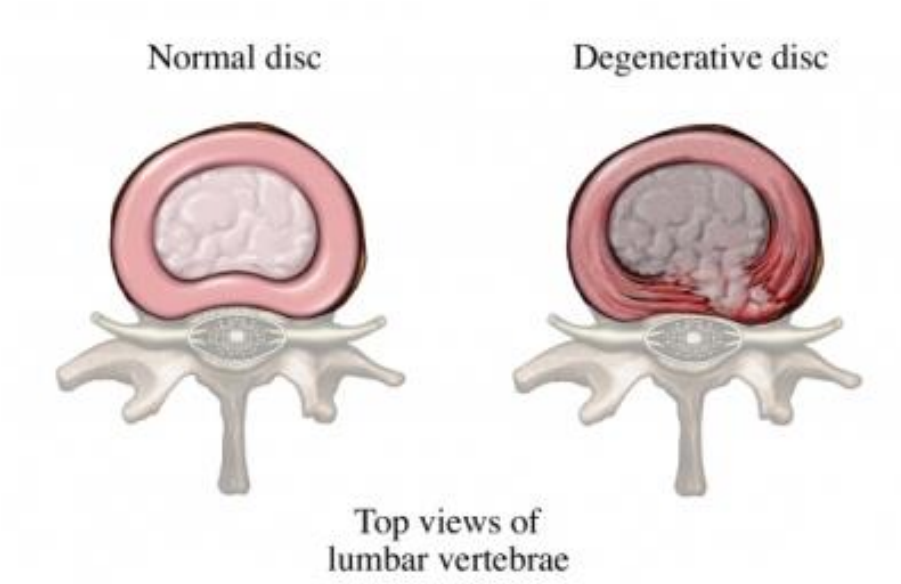
Carpal Tunnel – Laser Therapy and Nutritional Solutions that Work!

Nutritional Support

- Formulation for support of healthy tendon, muscle, and nervous system function
  - Vitamin B5
  - Vitamin B6
  - Vitamin B12
  - Folate
  - Niacinamide
  - PABA
  - Inositol
- Omega-3 fatty acids to reduce inflammation
- Standardized herbal relief for minor pain
  - Tumeric
  - Boswelia
  - Ginger
  - Black peppper

Intervertebral Disc Disease

- IVD – the largest structure in the body without vascular supply



Top views of
lumbar vertebrae

Intervertebral Disc Disease (cont'd)

- Nucleus – gel-like substance
  - Water (80%)
  - Type II collagen fibers (17%)
  - Proteoglycans (PG) (65%)
  - Small amount of elastin fibers
- Annulus – 65% water:
  - Outer layer (thinner): made up of more disorganized collagen bundles and a greater proportion of vertical fibers (almost all type-1 collagen)
  - Inner layer: made up of more water, PG, and predominantly type-II collagen

Intervertebral Disc Disease (cont'd)

- IVD deteriorate over years (from nucleus outward)
- Influenced by:
  - Genetic inheritance
  - Metabolite transport
  - Age-related deterioration can be accelerated by physical disruption
- Degeneration most often occurs in lower lumbar discs

Healing of disc periphery has potential to relieve discogenic pain by re-establishing a physical barrier between nucleus and nerves, and reducing inflammation.

Spine care

- Totals include direct medical expenses and indirect expenses such as lost earnings
- Spine-care costs:
  - $100 billion US
  - £10.6 billion ($13.6 billion) UK
  - A$1.2 billion ($950 million) Australia
  - Australia: 1992-2012 – prescription opioid dispensing increased 15-fold
  - Cost Australian government 32-fold

Glucosamine & Chondroitin Sulfate Combined May Support Overall Musculoskeletal Integrity

BMC Complement Altern Med. 2003 Jun 10;3:2. Epub 2003 Jun 10.

Glucosamine and chondroitin sulfate supplementation to treat symptomatic disc degeneration: biochemical rationale and case report.

van Blitterswijk WJ, van de Nes JC, Wuisman PI.
Division of Cellular Biochemistry, The Netherlands Cancer Institute, Antoni van Leeuwenhoek Hospital, Plesmanlaan 121, 1066CX Amsterdam, The Netherlands. w.v.blitterswijk@nki.nl

BACKGROUND: Glucosamine and chondroitin sulfate preparations are widely used as food supplements against osteoarthritis, but critics are skeptical about their efficacy, because of the lack of convincing clinical trials and a reasonable scientific rationale for the use of these nutraceuticals. Most trials were on osteoarthritis of the knee, while virtually no documentation exists on spinal disc degeneration. The purpose of this article is to highlight the potential of these food additives against cartilage degeneration in general, and against symptomatic spinal disc degeneration in particular, as is illustrated by a case report. The water content of the intervertebral disc is a reliable measure of
objectively determined by Magnetic Resonance Imaging (
glucosamine and chondroitin sulfate for two years associa
in a case of symptomatic spinal disc degeneration. We pro
efficacy of these nutraceuticals. They are bioavailable to c
biosynthesis and inhibit the breakdown of their extracellu
**suggests that long-term glucosamine and chondroitin su
disc degeneration, particularly at an early stage.** Howeve
trials with these food supplements, in which disc de-/rege
number of biochemical reasons (that mechanistically nee
may have cartilage structure- and symptom-modifying eff
osteoarthritis in general.

"The case suggests that long-term glucosamine and chondroitin sulfate intake may counteract symptomatic spinal disc degeneration."

BMC Complement Altern Med. 2003 Jun 10;3:2

Glucosamine & chondroitin sulfates

Well-researched nutrients – help form the “shock-absorbing” components of cartilage (proteoglycans and glycosaminoglycans) and heal articular surfaces.

Glucosamine and chondroitin sulfate shown to reduce pain and inflammation and slow cartilage loss.

Hardington, T. Chondroitin Sulfate and Joint Disease. *Osteo Cart* 1998;6 (suppl A):3-5

Methyl-Sulfonyl-Methane (MSM) an Effective Synergist/Sulfur Donor

NutraIngredients-usa.com
Breaking News on Supplements & Nutrition in the USA

MSM, glucosamine combo have faster effect on arthritis

22/07/2004

Combining the sulphur-containing nutrient MSM with well-known joint health supplement glucosamine appears to speed up the anti-inflammatory effect and further reduce pain in patients with osteoarthritis, report Indian researchers.

Glucosamine, derived largely from shrimp shells, is widely used by arthritis patients but it is less commonly found in combination with MSM, or methylsulfonylmethane, which is the isoxidised form of dimethyl-sulfoxide (DSMO).

It is however often taken along with chondroitin sulphate.

In the new study, both glucosamine and MSM improved osteoarthritis symptoms in subjects but when taken together the effect was greater than either alone.

"Combination therapy showed better efficacy in reducing pain and swelling and in improving the functional ability of joints than the individual agents," report the researchers in the June issue of *Clinical Drug Investigations* (vol 24, no6, pp 353-363).

More than 7 million adults in the UK – 15 per cent of the population - have long-term health problems due to arthritis and related conditions, according to the Arthritis Research Campaign, and 550,000 have moderate to severe osteoarthritis in their knees.

And across Europe the number of arthritis sufferers will continue to escalate as the population ages and other major risk factors, such as obesity, also increase.

Dr P Usha and M Naidu from Nizam's Institute of Medical Sciences in Hyderabad, India randomised 118 people with mild to moderate osteoarthritis to receive either 500mg glucosamine, 500mg MSM, a combination of both or placebo capsules three times daily for 12 weeks.

Patients were evaluated at prior to the study and several times during treatment for efficacy and safety.

After 12 weeks, the average pain score had fallen from 1.74 to 0.65 in those taking only glucosamine. In MSM-only participants, it fell from 1.53 to 0.74. However, in the combination group, it fell from 1.7 to 0.36. The researchers also found that the combination treatment had a faster effect on pain and inflammation compared to glucosamine alone.

"It can be concluded that the combination of MSM with glucosamine provides better and more rapid improvement in patients with osteoarthritis," write the researchers.

Editor: philippa.nuttall@novisgroup.com

Additional Ingredients

- **ETArol™** - a proprietary extract of New Zealand green-lipped mussels that contains the essential fatty acids, eicosatetraenoicacids (ETAs). Play key role in reduction of joint swelling due to arthritis. Studies show that ETA oils from sea mussels more effective in reducing inflammation than aspirin or ibuprofen
- **Hyaluronic Acid (HA)** – a key, natural component of all connective tissue in the body. Production of HA declines with age and this deficiency causes numerous age-associated problems. HA supports resiliency, reduces friction, and acts as natural shock absorber. HA, found in high concentrations in cartilage and synovial fluid in all joints, helps regulate the repair process during injury, inflammation, and surgery
- **Avocado/Soybean Unsaponifiables (ASU)** – research shows that production of specialized joint collagen and articular cartilage can be increased significantly by adding avocado/soybean unsaponifiables (ASU) to cartilage cultures
- **Nettle Leaf** – an anti-inflammatory remedy. Suppresses cytokine production and has been shown to suppress a common NF-kappaB pathway

Omega-3 fatty (n3-FA) acid supplementation reduces intervertebral disc degeneration (IVD)

- EPA/DHA in a 2:1 ratio used
- 4-6 gram needed
- Reduction of blood AA/EPA ratios from 40 to 20 demonstrated after 1 month of daily supplementation

Conclusion:

- n-3 FA dietary supplementation reduces systemic inflammation by lowering AA/EPA ratios
- Has potential protective effects on the progression of spinal disc degeneration

NaPier Z, Kanim LEA, Arabi Y, et al. *Med Sci Monit,* 2019 Dec 14;25:9531-9537

Lower back pain (LBP)

Conclusion: Subjects with vitamin D deficiency or insufficiency 2.3 times more likely to exhibit LBP than subjects with normal vitamin D3 concentration

BMC research notes. Dec 1, 2019

Vitamin D for disc degeneration (DD)

- Type-II diabetes risk factor for DD
- Diabetes damages small blood vessels
- Adversely affects discs with poor nutrient supply
- Vitamin D reduces inflammation and improves markers of insulin resistance

Vitamin D Council. Jun 7, 2017

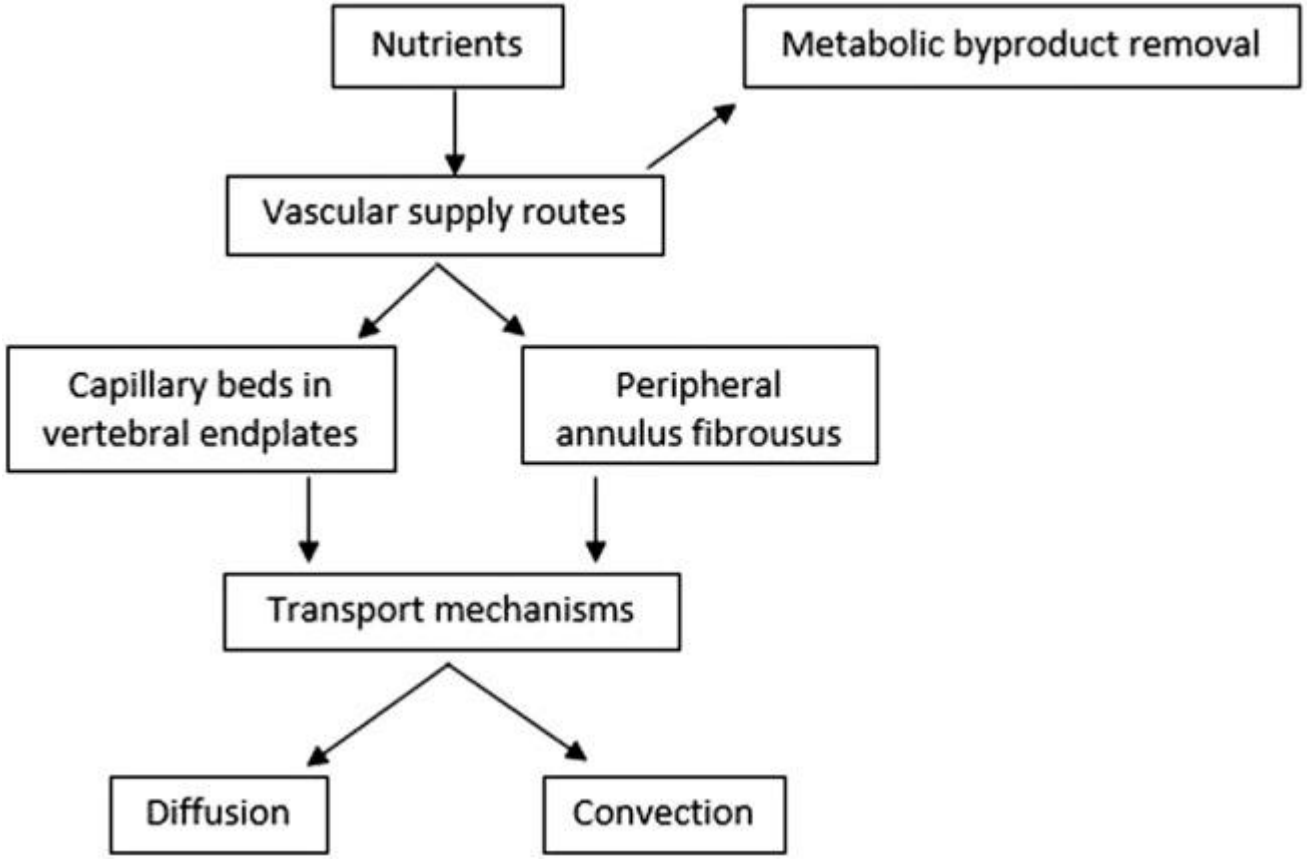
Vitamin D for disc degeneration (DD) (cont'd)

Study found:

- Degenerative changes in discs with type-II diabetes
- TGF-beta and IGF-1:
  - Were lowered in diabetic group than normal group
  - Highest in group without type-II diabetes
  - Significantly higher in experimental group compared to control group

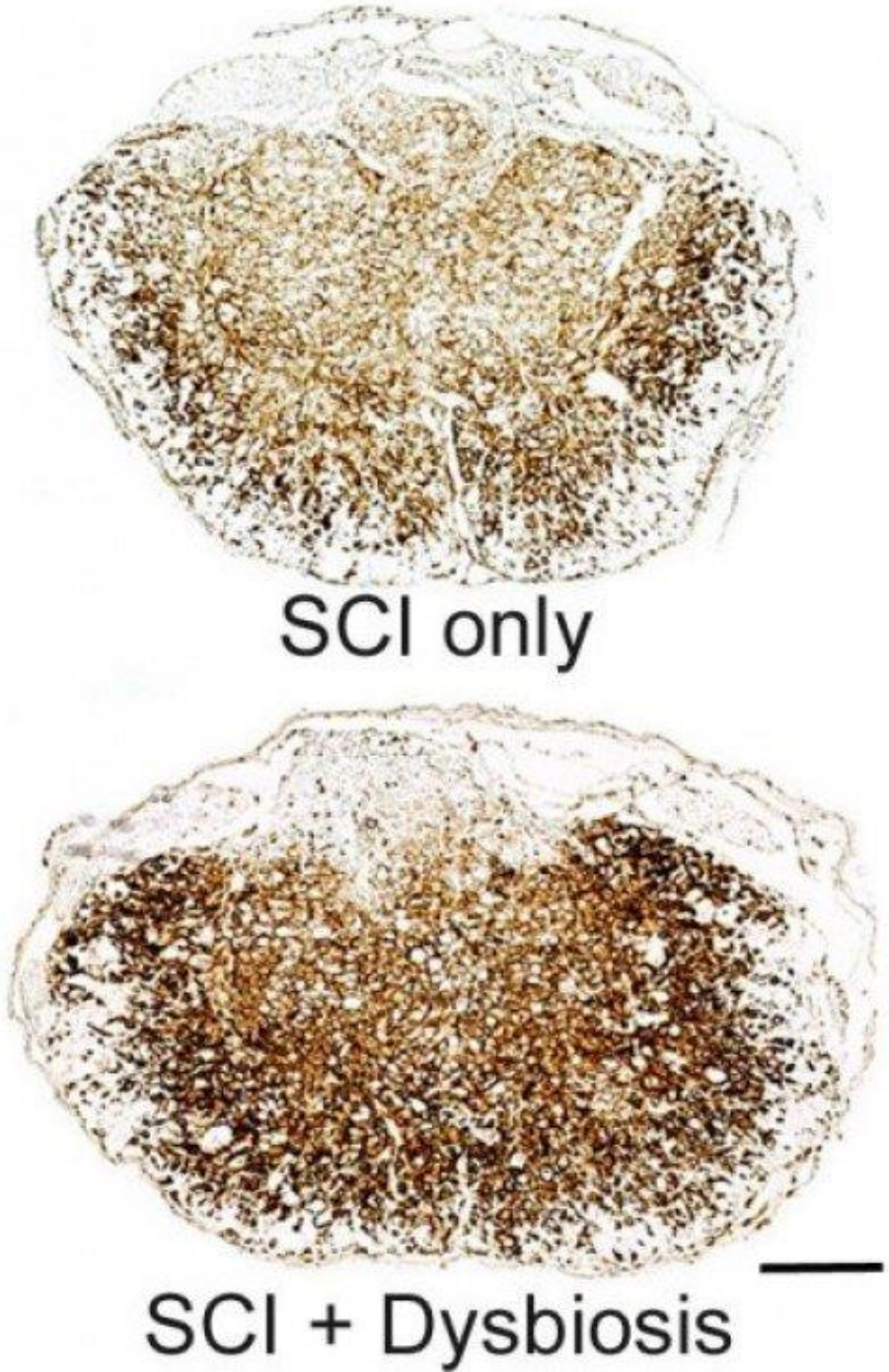
Vitamin D Council. Jun 7, 2017

Nutrient delivery mechanisms to the intervertebral disk



Physical activity attenuates fibrotic alterations to the multifidus muscle associated with intervertebral disc degeneration

CM De Geer. *J Chiropr Med*. 2018 Jun; 17(2): 97–105



Disrupting the gut microbiome with antibiotics before spinal cord injury (bottom) increases the number of inflammatory cells (brown) in the damaged region of the spine

Credit: Kigerl et al., 2016

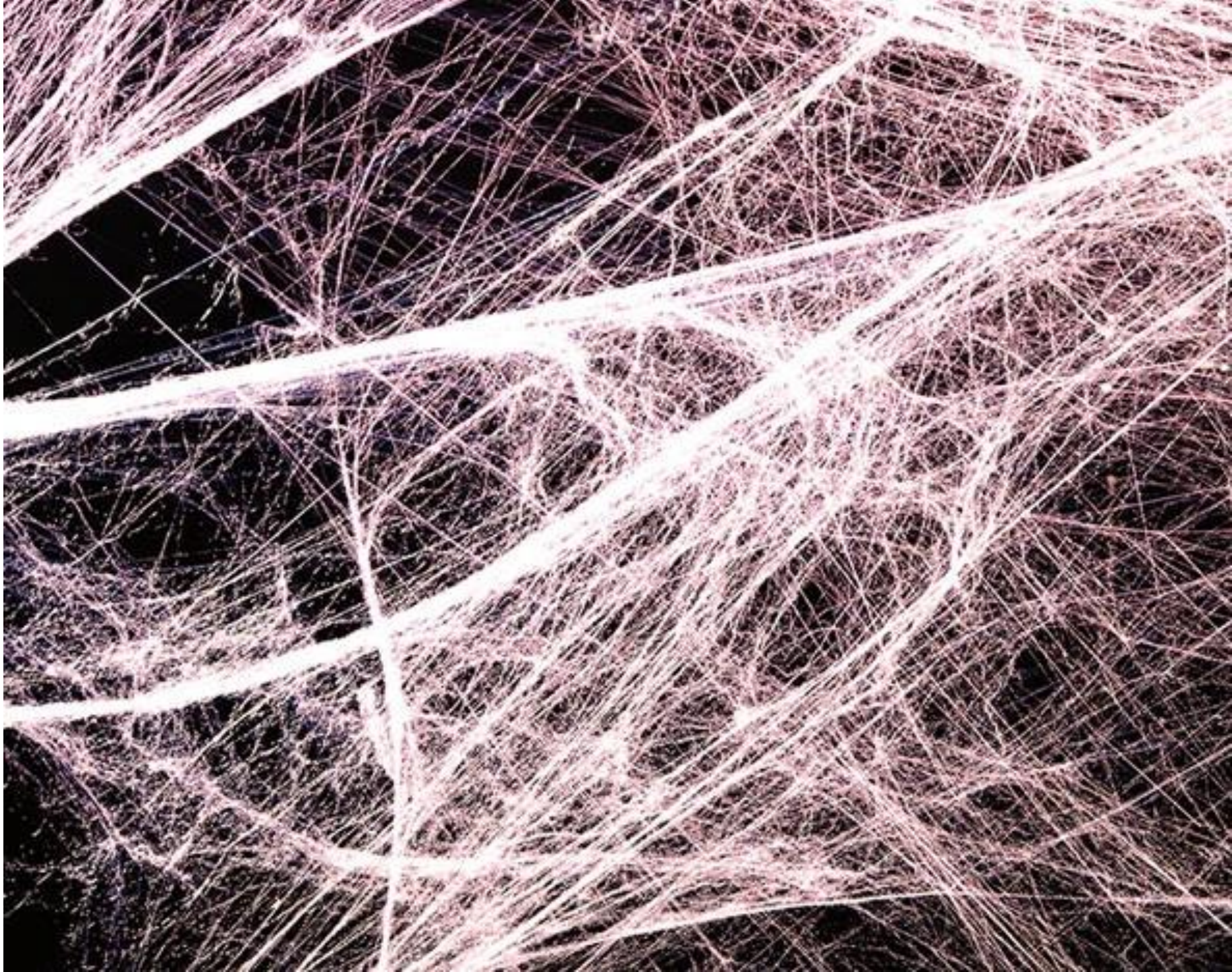
Gut dysbiosis impairs recovery after spinal cord injury

- Spinal cord injury alters type of bacteria living in the gut
- These changes can exacerbate extent of neurological damage and impair recovery of function
- These changes with probiotics could aid patients' recovery from spinal cord injuries

The Journal of Experimental Medicine 2016

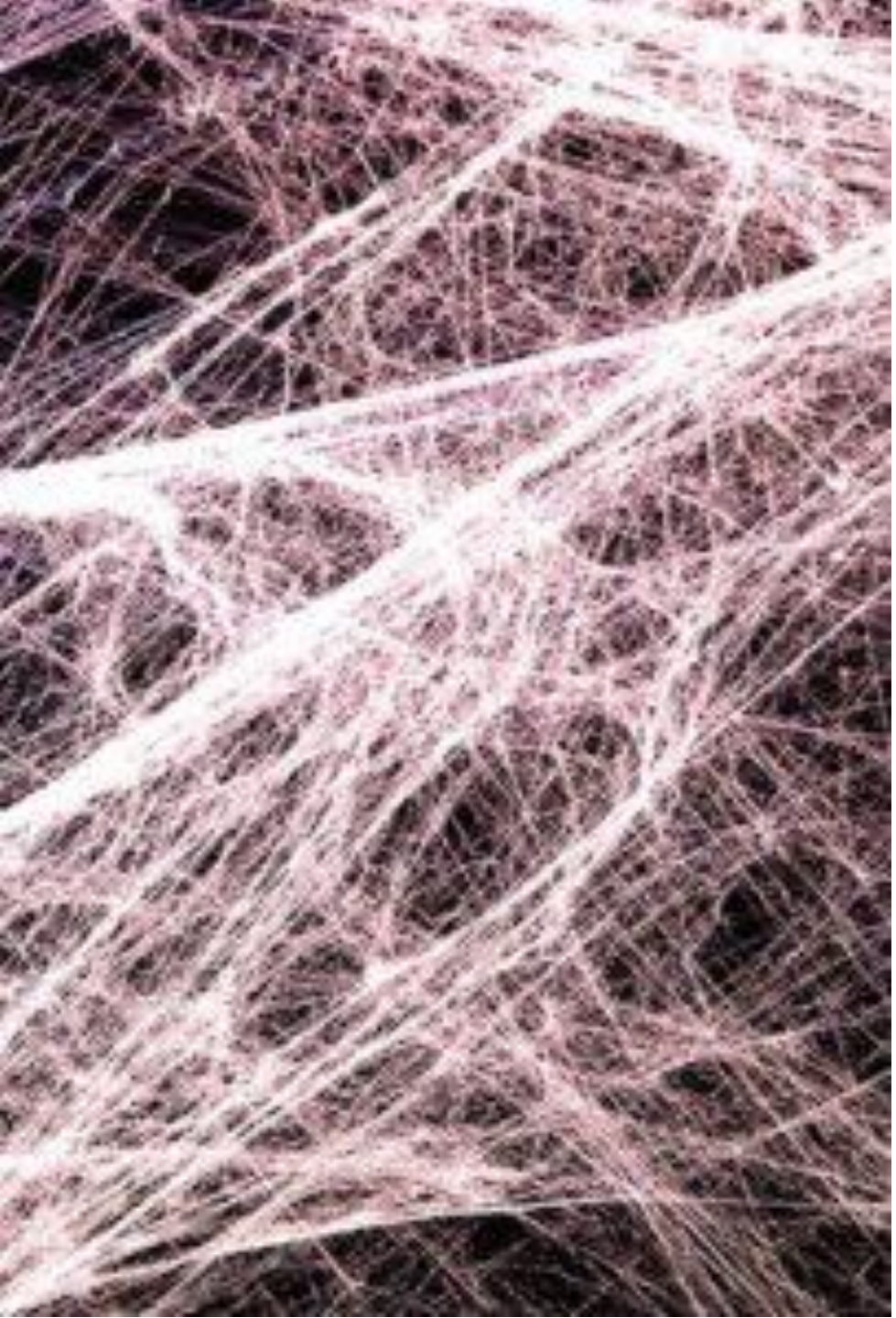
Fascia

- Living matrix
- Full-body “wetsuit”
- Connective tissue
- Sheath in the body
- Below skin and above muscle
- Lymph nodes live in fascia
- Nerves are in fascia
- Our sensory organ
- Meridians in fascia
- Accounts for 20% of body mass



Back pain/fascia

- Fascia plays role in pain
- Interconnected system
- Transfer one region to another
- Ability to slide
- Plays role in back pain
- Without pain slide 75%
- With pain reduced to 50%



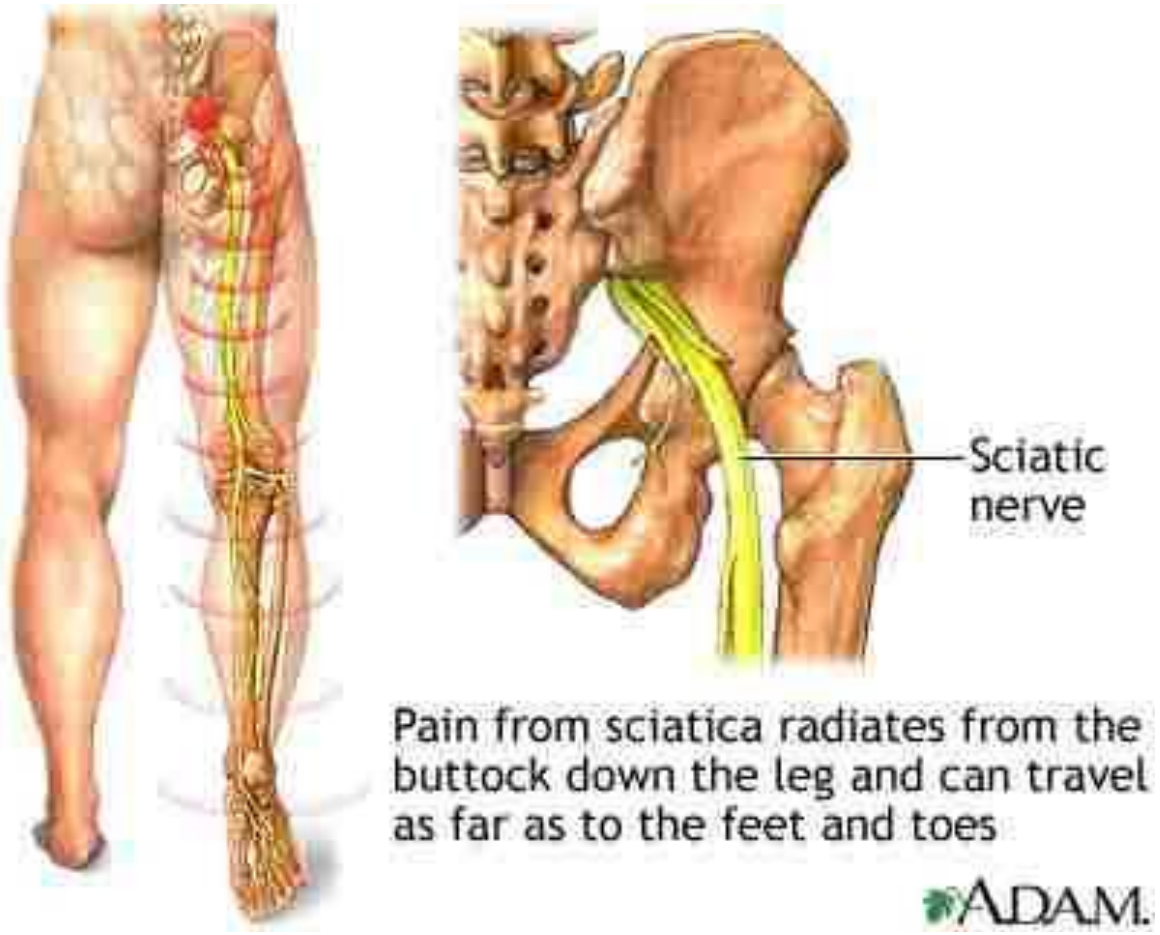
Nutrients for fascia healing

- Collagen
- Glucosamine/chondroitin sulfate
- Bioflavonoids
- Vitamin C
- SOD
- Zinc
- Hops
- Magnesium
- Sulforaphane

Fascia food

- Collagen/bone broth
- Water
- Omega-3 fatty acids
- Healthy fats (avocado, coconut)
- Foods high in antioxidants
- Magnesium (before bed)

Sciatica


Sciatic nerve
Pain from sciatica radiates from the buttock down the leg and can travel as far as to the feet and toes
A.D.A.M.

Nutritional Support

- Ginger, curcumin + fenugreek, boswellia, hops extract, black pepper extract:
  - Works by interfering with signals in the body that initiate productions of damaging compounds that cause minor pain and negatively impact cartilage and other joint tissue
- Alpha lipoic acid
- Pro-resolving mediators

Evidence

- Recent research: supplementing with a combination of GLA (360 mg) and ALA (600 mg) is effective in treating low-back pain and sciatica
- ALA/GLA groups saw significant improvements in feelings of numbness and tingling in the lower leg
- Dramatic decrease in reports of stabbing and burning pain in lumbar region
- No clear evidence that surgery is more beneficial than conservative treatment in the form of GLA/ALA supplement plus rehabilitation

Int J of Immunopathology and Pharmacology, 2009 (22);45-50
J of Brachial Plexus and Peripheral Nerve Injury, 2010 (5);15

What is Alpha-Lipoic Acid (ALA)

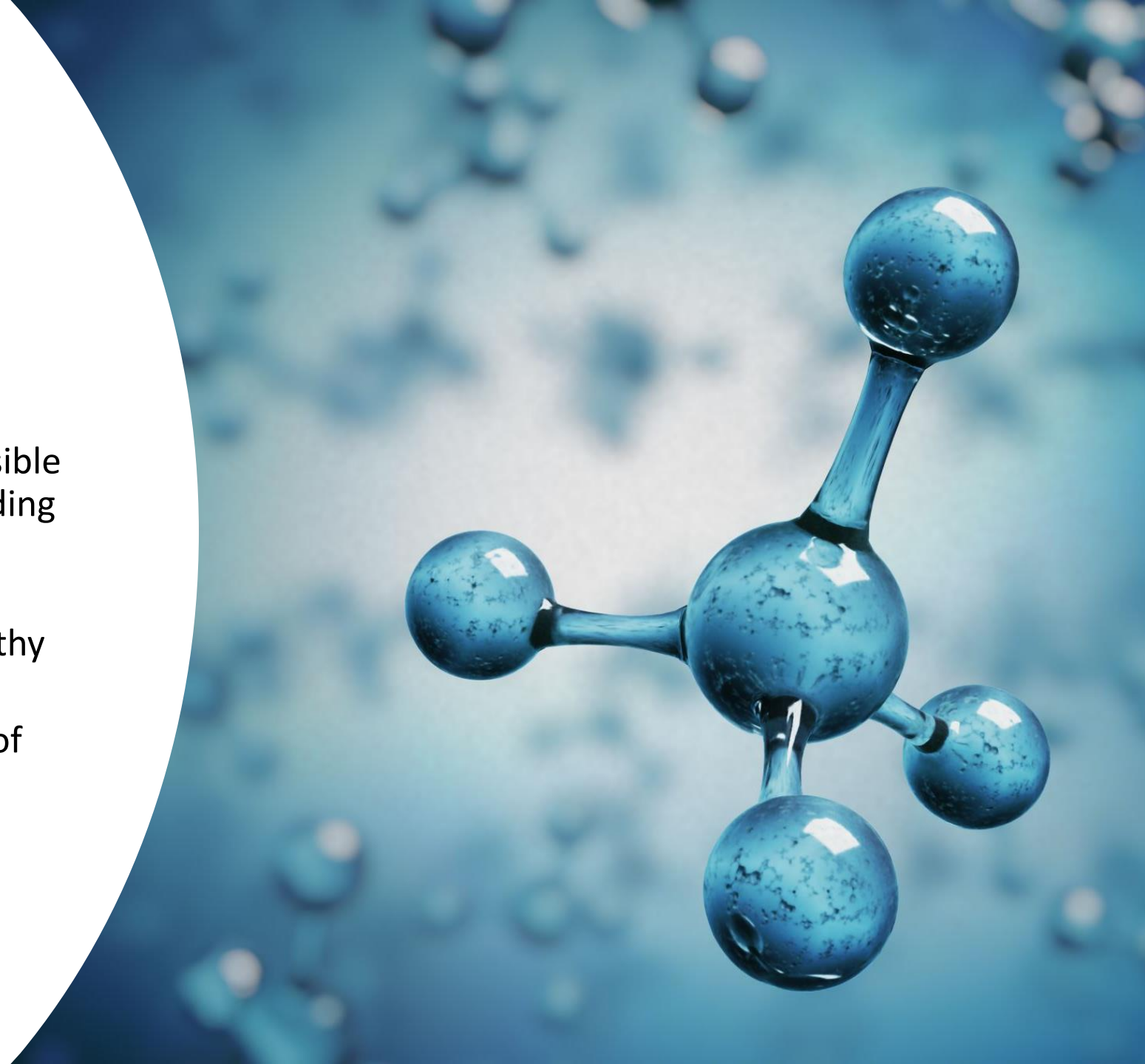
- ALA – potent ingredient that supports healthy inflammatory response
- Contains multiple antioxidant properties
- Supports healthy glutathione levels in body's cells
  - Most important and potent antioxidants
  - Naturally produced in the body – can become depleted due to aging, poor diet or sedentary lifestyle
- Clinical studies – PEA and ALA work together to promote healthy inflammatory response

Maddaloni E, et al. *Diabetes*. 2018;67(1S)
Hesselink JMK. *J Pain Relief*. 2015;4(6)

Palmitoylethanolamide (PEA)

Pronounced:
Pal mit oyl ethanol amide

- PEA – bioactive lipid – plays key role in endocannabinoid system (ECS) responsible for promoting balanced systems, including central nervous system and peripheral nervous system
- ECS helps promote relaxation and healthy nerve function
- PEA – produced naturally in every cell of the body in biological response to inflammatory markers



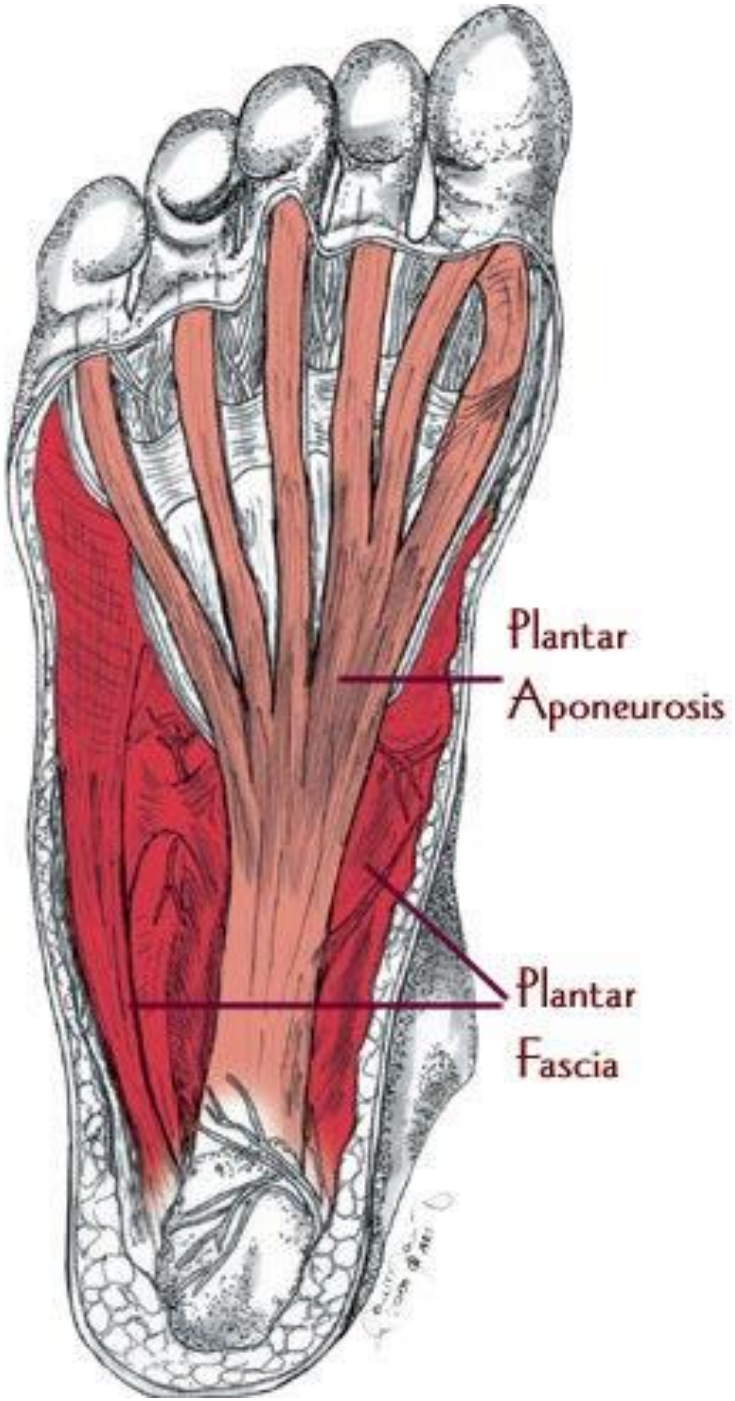
curcumin accelerates repair of sciatic nerve injury

Conclusion: Curcumin accelerated injured sciatic nerve repair through reducing Schwann cells apoptosis and promoting myelinization

BioMed Pharmacother, 2017 Aug;92:1103-1110. doi: 10.1016/j.biopha.2017.05.099. Epub 2017 Jun 12

Plantar Fasciitis

- Facts
- Symptoms
- What it is
- What causes it
- Clinical assessment
- Treatment



Nutritional Protocol for Plantar Fasciitis

Nutritional protocol for the first 72 hours:

- Bromelain, papain, pancreatin, peptizyme, rutin – early onset inflammation and removal of cellular debris

- Natural anti-inflammatory/joint discomfort:
  - Boswellia, turmeric, ginger, black pepper
- Nutrients to relax muscle tissue:
  - Calcium, magnesium, lemon balm, valerian, hops extract, passion flower extract
- Pro-resolving mediators

Nutritional Protocol for Plantar Fasciitis (cont'd)

Day 4:

- Ginger, curcumin + fenugreek, boswellia, hops extract, black pepper extract:
  - Works by interfering with signals in the body that initiate productions of damaging compounds that cause minor pain and negatively impact cartilage and other joint tissue
- Collagen complex with fruit/vegetable complex
- Muscle relaxation formula: supplies minerals involved in muscular contraction and relaxation responses:
    - Calcium, magnesium, passion flower extract, valerian root, lemon balm, hops extract

Nutritional Support for Neurogenic Plantar Fasciitis

- A formula with unique combination of nutrients that support healthy nerve tissue integrity, nutritive blood flow, and nerve conduction:
  - Vitamin B5
  - Vitamin B6
  - Vitamin B12
  - Folate
  - Niacinamide
  - PABA
  - Inositol
- Muscle relaxation formula: supplies minerals involved in muscular contraction and relaxation responses:
  - Calcium, magnesium, passion flower extract, valerian root, lemon balm, hops extract
- Omega 3 fatty acids to reduce inflammation

Ankle Sprains

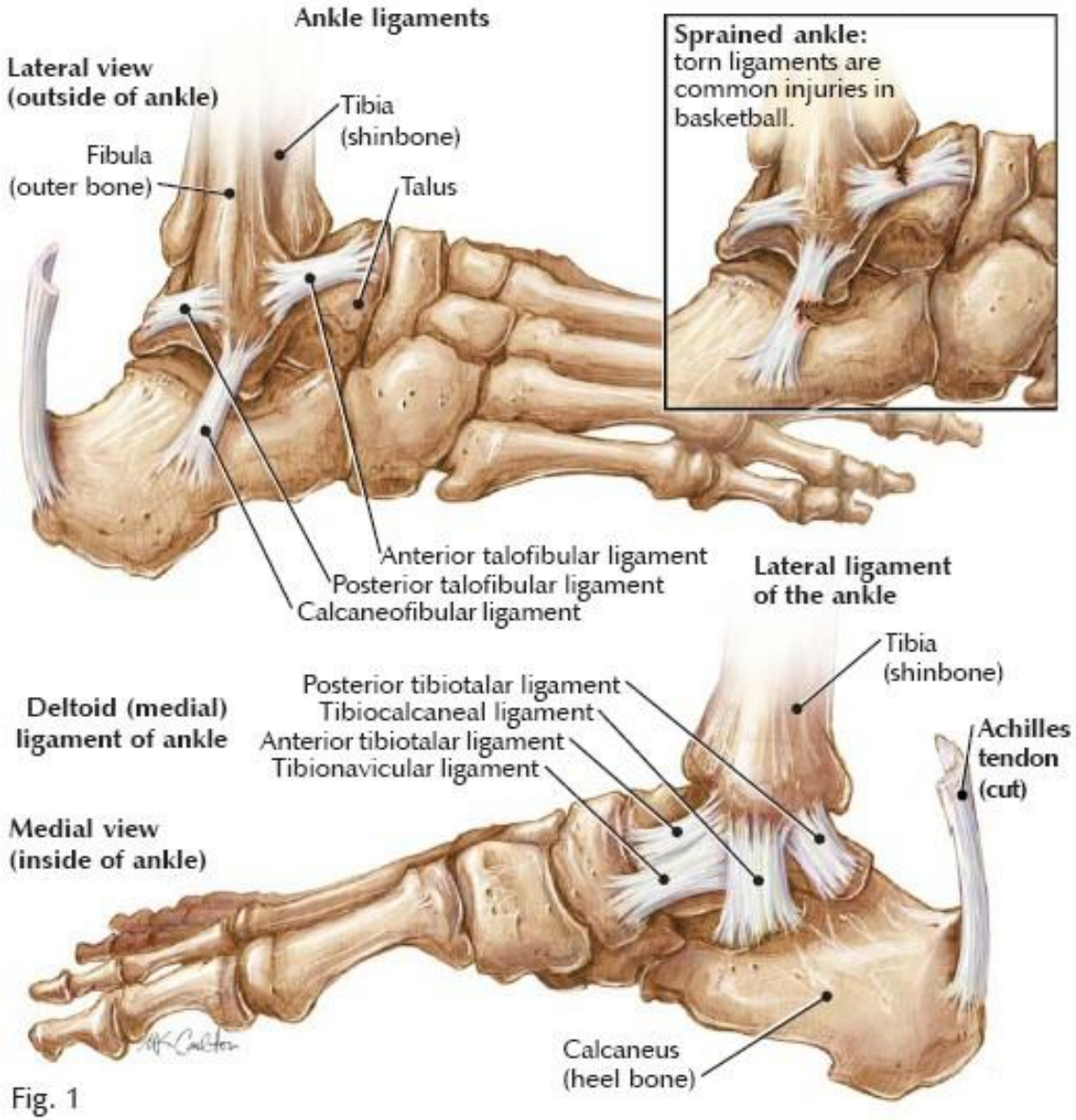


Fig. 1

Ankle sprain stats

- Inversion sprains: 1/3 note symptoms at 1 year
- 25% report pain instability, crepitus weakness, stiffness or swelling at 3 years
- 80% re-injury rate
- Early return to activity is key
- Exercise/treatment promote joint motion and weight bearing

Journal of Orthopaedic & Sports Physical Therapy, 2013;43(9):A1–A40

Ankle sprains and opioids

- 25% of adults with sprained ankles were prescribed opioids in the ER
- Median prescription 15 tablets (over 3 days)

Annals of Emergency Medicine. July 24, 2018 online

Clinical benefits of joint mobilization (JM) on ankle sprains

Conclusion: JM beneficial for improving dynamic balance immediately after application and dorsiflexion range in the short term

Weerasekara I, Osmotherly P, Snodgrass S, et al. *Arch Phys Med Rehab*. July 2018;99(7):1395-1412

Ankle sprain rehab

- 150 patients with inversion ankle sprains:
  - Treatment with early motion and weight bearing
  - 1 month: 90% of patients demonstrated pain-free gait
  - 97% had increased work ability
- Exercises included:
  - Ankle alphabet
  - Standing gastral/soleus stretch
  - Single-leg stance
- Balance training – decreased incidence of ankle sprains by 38%
- **Key is promotion of dorsiflexion**

De Vasconcelos GS, Cini A, Sbruzzi G, et al. *Clin Rehabil* 2018 Jul 1:269215518788683. doi: 10.1177/0269215518788683. [Epub ahead of print]

Predictors of chronic ankle instability

- Dynamic balance deficits present in participants with CAI
- Reaction of peroneal muscles delayed in participants with CAI
- Peroneus brevis reaction time most contributing factor to CAIT score
- Posteromedial and lateral directions of SEBT also contribute to CAIT score

Rafael SG, Fernando J, Javier AV. *Clinical Biomechanics*, Mar 2018

Nutritional Protocol for Ankle Sprains

Nutritional protocol for the first 72 hours:

- Bromelain, papain, pancreatin, peptizyme, rutin – early onset inflammation and removal of cellular debris:
- Natural anti-inflammatory/joint discomfort:
  - Boswellia, turmeric, ginger, black pepper:
- Nutrients to relax muscle tissue:
  - Calcium, magnesium, lemon balm, valerian, hops extract, passion flower extract
- Pro-resolving mediators

Nutritional Protocol for Ankle Sprains (cont'd)

Nutritional protocol of sprained ankle Day 4 ⟶ 8 weeks

- If swelling still present:
  - Bromelain, papain, pancreatin, peptizyme, rutin – early onset inflammation and removal of cellular debris:
- Formulation providing targeted nutritional components involved in the biochemical processes that support growth and construction of connective tissue:
  - Glucosamine HCl, chondroitin, MSM, vit. C, hyaluronic acid, ginger, turmeric, boswellia, black pepper
  - Mg, hops extract, undenatured collagen 2

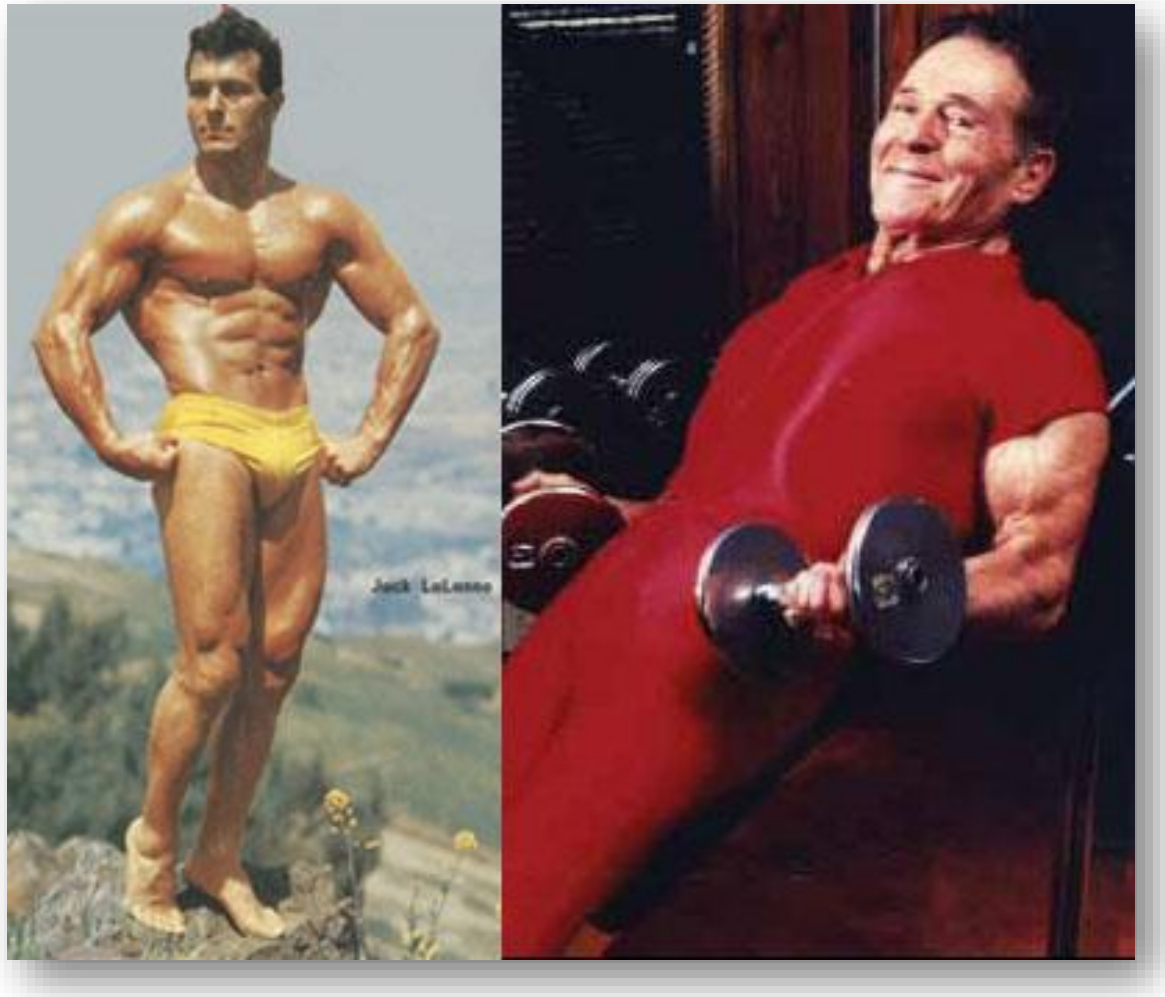
Nutritional Protocol for Ankle Sprains (cont'd)

Nutritional protocol of sprained ankle Day 4 ⟶ 8 weeks

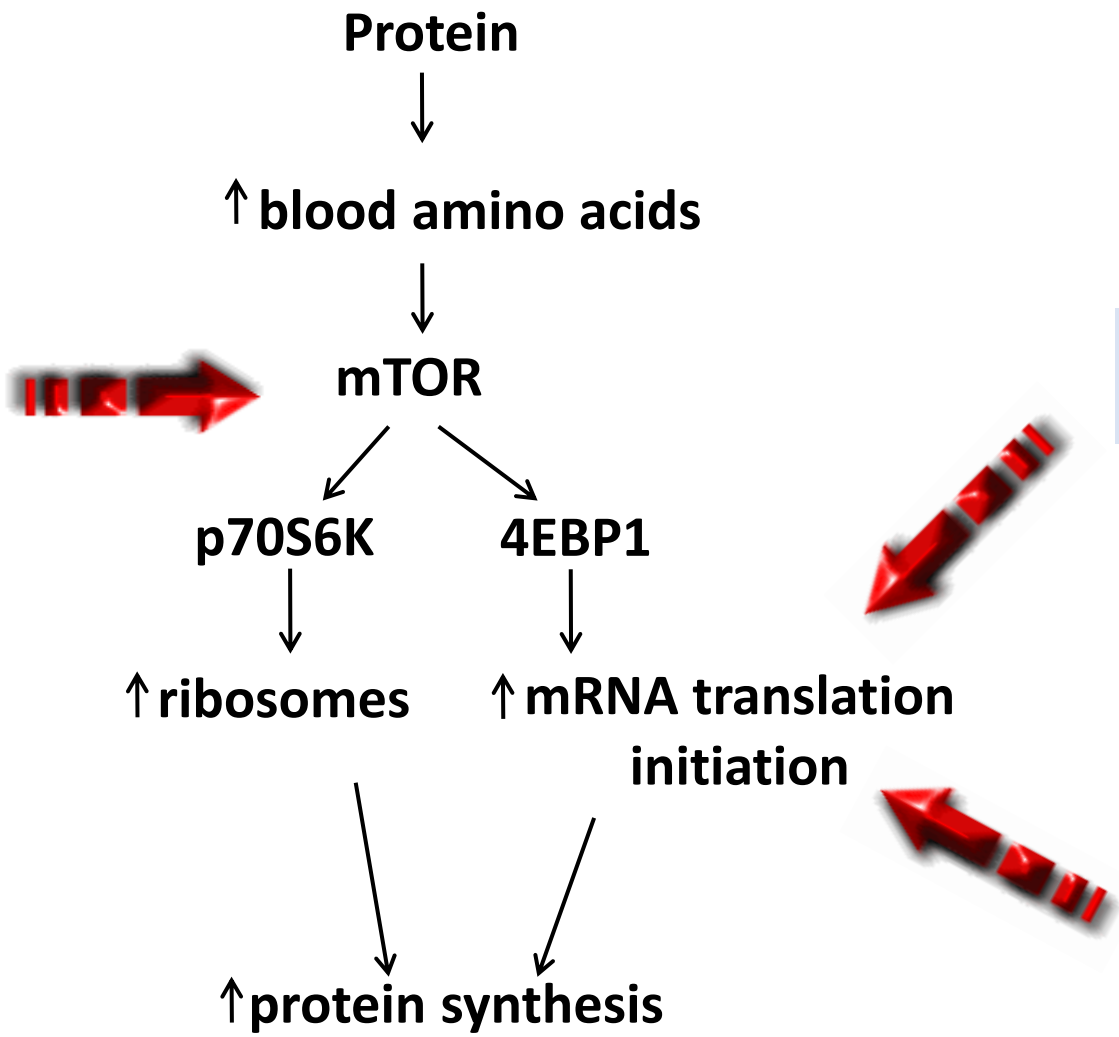
- Collagen complex with fruit/vegetable complex
- Omega-3 fatty acids to reduce inflammation
- Continue with pro-resolving mediators

Body Composition:

Three year study on aging at Tufts University – body-composition *(muscle mass) is the most important factor* in determining how healthy we will be in our later years



Protein Synthesis Pathway



BCAA (leucine) increase protein synthesis by stimulating the MTOR pathway

European Journal of Applied Physiology. 114:935-742, 2014

Aging individuals have less genes turned on

Rivas DA, Lessard SJ, et al. *The FASEB Journal*. Sept. 2014

L-carnitine positively effect gene expression (avoiding sarcopenia)

BMC Genomics. 2014, 15:512

Dynamic Performance Drink
Ingredients

- BCAA
- Flax seed oil
- Ribose
- Vitamins (A, C, E), selenium
- 5-loxin and ginger extract
- Arginine
- Creatine
- NAC
- Lipoic acid
- L-carnitine
- D-aspartic acid
- Mg and Zn

Dr. Rob's
Sports Nutrition Guidelines

Goals:

- Provide adequate fuel for activity
- Replenish glycogen stores
- Build and repair tissue
- Reduces fatigue
- Supports physical and immune health

Foods should be consumed before, during and after exercise:

- Maintain blood glucose levels
- Maximize performance
- Improve recovery time

Nutrient intake surrounding activity

When	Protein	Carbohydrate	Fat	Comment
Pre-exercise	20-30 g. especially for resistance training	200-300 g.	Limit due to gastrointestinal distress	If athlete is carb-loading, may consume 8-10 g/kg body weight/day for 1-3 days prior to competition
During exercise	Not needed	30-60 to 90 g/h depending on length of activity	Not needed	Hydration only if activity < 60 mins. Should be liquid/gel-form carbs for easy digestibility
Post-exercise	20-30 g. within 30 mins.	60-120 g. within 30 mins. (1:3-4 ratio w. protein)	In normal ratio with protein and carbs	Continue re-feeding with post-workout meal for regular refueling needs depending on exercise intensity

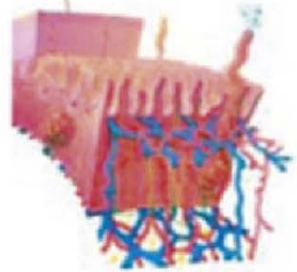
Recreated from *Sports Health.* Fueling for Performance, Nov. 27, 2017;10(1)

Summary of hydration guidelines

When	How much to consume	Comment
Pre-exercise	12-20 oz. water/sport drink, 8 oz just prior to event	Consider small salty snack for fluid retention
During exercise	6-12 oz. water/sport drink every 15-30 mins	No energy drinks. Consider sodium replacement in endurance events
Post-exercise	16-24 oz. of fluid for every pound lost	May obtain sodium and electrolyte replacement from a wide variety of foods

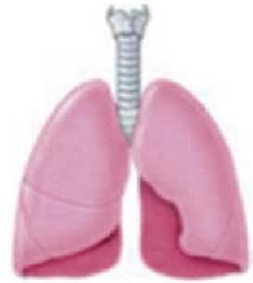
Recreated from *Sports Health.* Fueling for Performance, Nov. 27, 2017;10(1)

↑ **Heat production and dehydration**
↑/↔/↓ Blood flow
Metabolism?



↑↓ Neural activity
↔ Blood flow
↑ Blood distribution
↕ Metabolism

↑/↔/↓ Blood flow
↑↑ Metabolism
↑ **Free fatty acid release**



↑↑↑ Ventilation and gas exchange
↑↑↑ Blood flow
↑ Blood distribution?

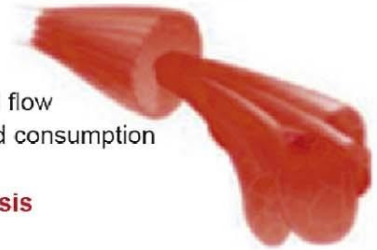
Liver:
↓ Blood flow
↑ Metabolism

↑↑↑ Cardiac output
↑↑↑ Coronary blood flow
↑↑↑ Oxygen consumption
↑ Blood flow distribution?

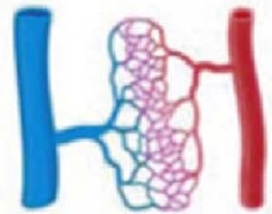
Pancreas, gut, and kidneys:
↓ Blood flow?
↑ Metabolism?
↑ **Intestinal permeability**

↑ Hemoconcentration
↑ Oxygen content
↔/↑ Levels of energy substrates

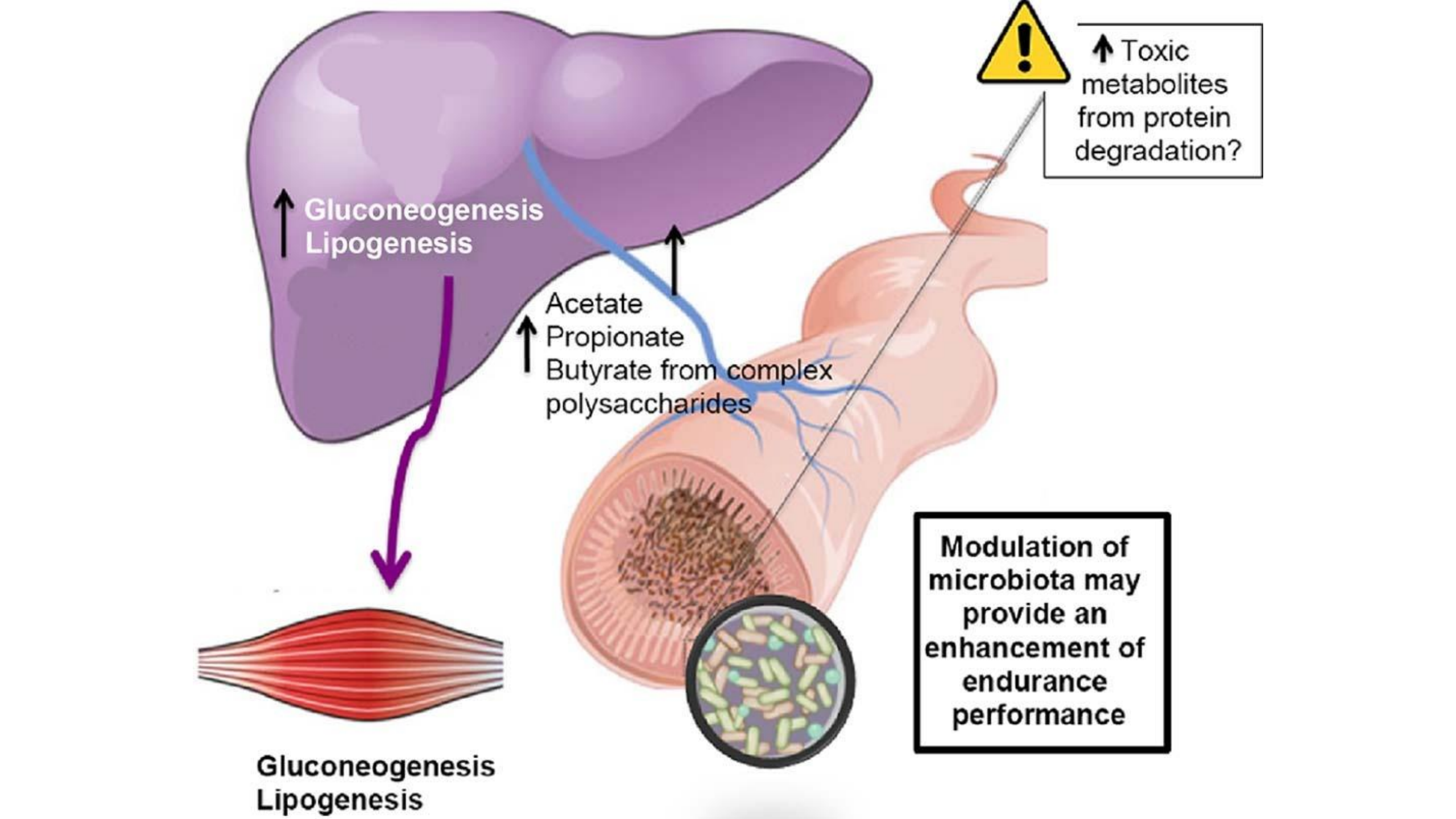
↑/↔ Blood flow
↑↑ Mechanical strain
↑↑ Release of stem cells
↑ **Systemeic inflammatory and immune response**

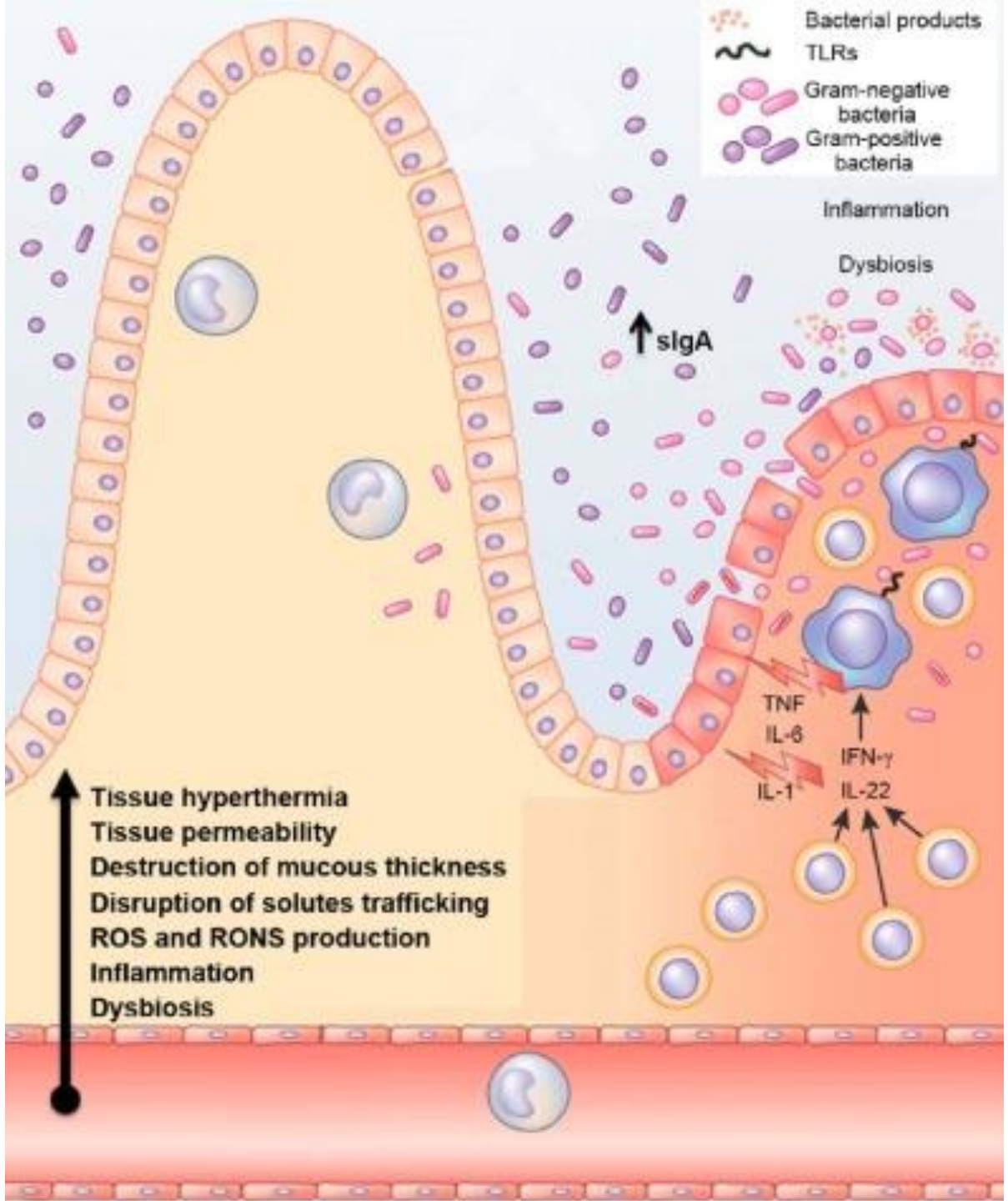


↑↑↑ Metabolism and blood flow
↑↑↑ Oxygen extraction and consumption
↑ **Oxidative stress**
↑ **Mitochondrial biogenesis**
↑ **Muscle damage**



↑↑↑ Arterial dilatation
↑↑ Capillary pressure and energy substrate exchange
↑ Blood distribution
↑ Venoconstriction


↑ Toxic metabolites from protein degradation?
↑ Gluconeogenesis
Lipogenesis
↑ Acetate
Propionate
Butyrate from complex polysaccharides
Modulation of microbiota may provide an enhancement of endurance performance
Gluconeogenesis
Lipogenesis


Bacterial products
TLRs
Gram-negative bacteria
Gram-positive bacteria
Inflammation
Dysbiosis
sIgA
TNF
IL-6
IL-1
IFN-γ
IL-22
Tissue hyperthermia
Tissue permeability
Destruction of mucous thickness
Disruption of solutes trafficking
ROS and RONS production
Inflammation
Dysbiosis

Factors that can enhance recovery

- Nutrition and rest
- Nutrition promotes:
  - Muscle regeneration
  - Glycogen restoration
  - Reduces fatigue
  - Supports physical and immune health
  - Helps athlete prepare for next competition

Sports Med, July 12, 2017;2201-18

Factors that can enhance recovery (cont'd)

- Protein
  - Role in recovery:
    - Facilitating muscle repair
    - Muscle remodeling
    - Immune function
    - BCAA accelerates recovery from muscle damages exercise
    - MPS enables muscle remodeling
- Leads to synthesis of AA into functional contractile myofibrillar proteins and energy producing proteins

Sports Med, July 12, 2017;2201-18

ACSM issues sports nutrition guidelines

The American College of Sports Medicine made the following recommendations for optimizing nutrition in active athletes:

- Consume adequate calories during high-intensity or long-duration training
- Eat a variety of foods to help you stay healthy and injury free
- The ideal body composition depends on sex, age, genetics and sport
- Carbohydrates are critical for the brain and muscles, particularly during intense exercise
- Consume 1.2 to 2.0 g. of protein/kg of bodyweight
- Consume 20-35% of calories as fat
- Meet RDA for all micronutrients

Medicine Science Sports Exercise. 2016, 116:501-528

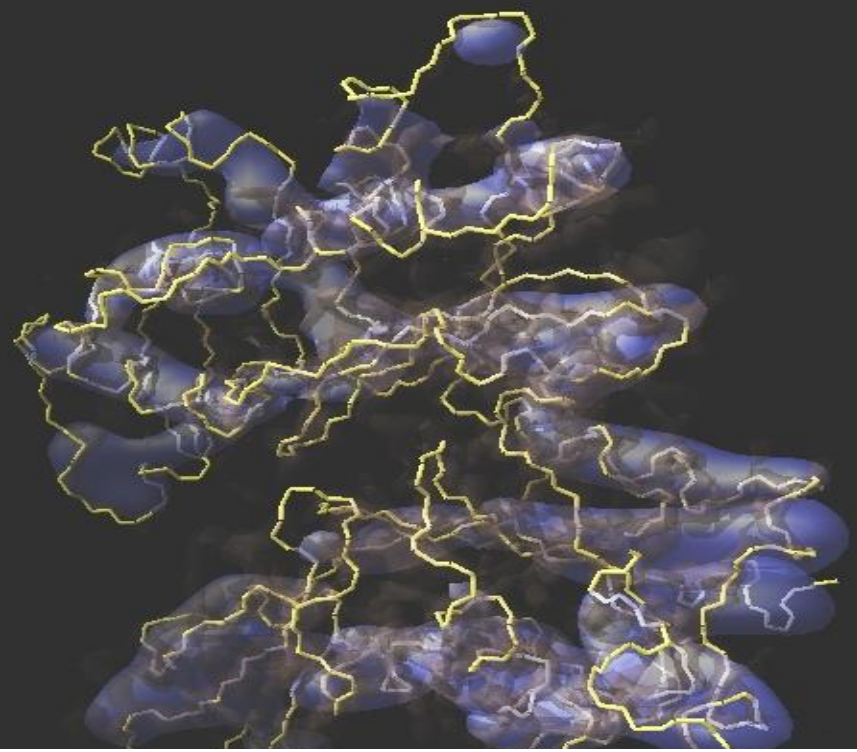
ACSM issues sports nutrition guidelines (cont'd)

The American College of Sports Medicine made the following recommendations for optimizing nutrition in active athletes:

- Maximize carb intake in sports, dependent upon carb availability
- Foods and fluids consumed before exercise contribute to carb stores, so pre-game and pre-practice nutrition is important
- During recovery, replace fluids lost during exercise
- Consume carbs during prolonged endurance events
- Restoration between intense training sessions requires appropriate intake of fluids, electrolytes, calories and carbs

Optimal nutrition can make the difference between success and failure in sports

Medicine Science Sports Exercise. 2016, 116:501-528



Supplements for Sports Performance

Elite 8

- Creatine
- Glutamine
- BCAA
- Omega-3 fatty acids
- Curcumin
- Probiotics
- L-arginine
- Co-Enzyme Q10

Detox.
Deep Dive.

"You can't be a clean fish in a dirty bowl."

The Hidden Load

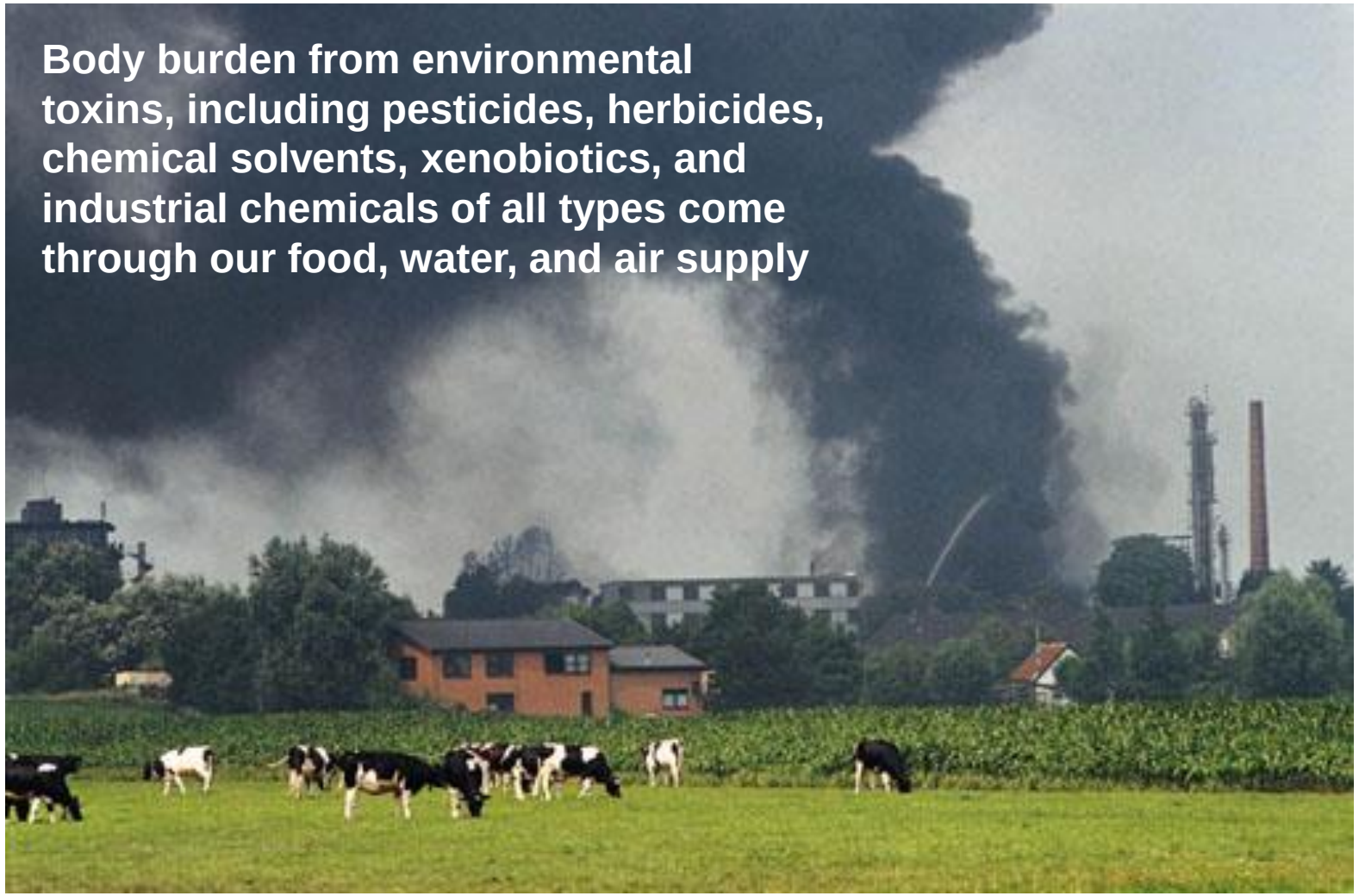
What's invisible ***is*** hurting us!

Environmental Toxins

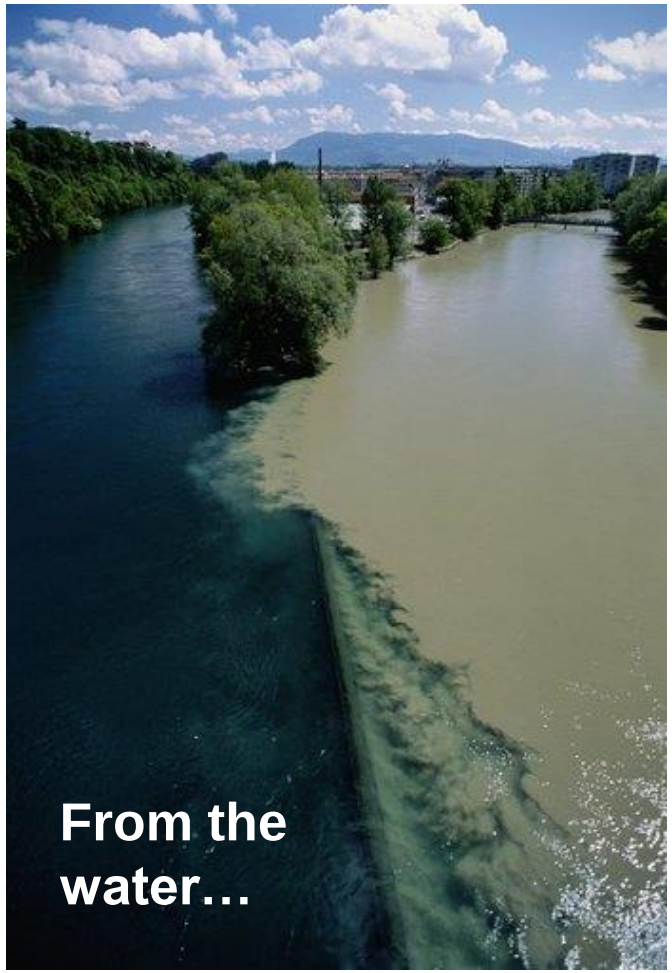
All of us live in an ever-increasing toxic world…

Many of the toxins abundant in our environment today did not even exist 30 years ago!

The Need for Detoxification



Toxic Overload



Since WWII, 80,000 new synthetic chemicals have been released into the environment and **less than half** have been tested for potential toxicity to **adult** humans

Neurotoxins were found in 33% of a random sampling of drinking water (diazinon from insecticide)

More than 287 toxic chemicals

have been found in newborn cord blood

"Specific genes are turned on and off at certain time intervals, and any disruption of this finely-tuned DNA methylation regulation may persistently alter gene expression. The fetal epigenome is most susceptible during this developmental period to epigenetic modifiers in the maternal environment. An error during such a crucial time might lead to an abnormal phenotypic outcome in the offspring.

Kanherkar, et al. Epigenetics across the human lifespan. *Frontiers in Cell and Developmental Biology* September 2014 (2):49


How many of your patients could benefit from a detoxification program?

Common Signs of Toxin Buildup

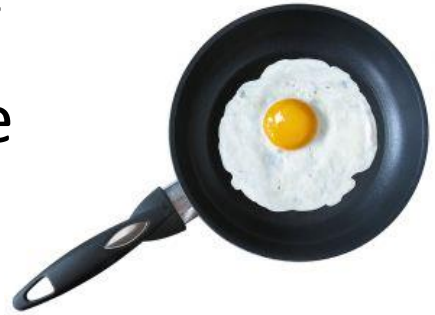
- Fatigue
- Allergies
- Joint Pain
- Headaches
- Constipation
- Mood Swings
- Immune Weakness
- Skin Conditions
- Abdominal Pain
- Sinus Congestion
- Chronic Backache
- Hormonal Imbalance
- Weight Loss Resistance
- Difficulty Concentrating

People Most At Risk

- Couples wanting to conceive
- Individuals with multiple exposures (jobs and hobbies)
- Individuals with a compromised immune system
- Individuals with a compromised nutrient status
- Those who are losing weight, or who have undergone bariatric surgery
- Older individuals due to lifelong toxin accumulation and vulnerabilities

Exposure to Toxins

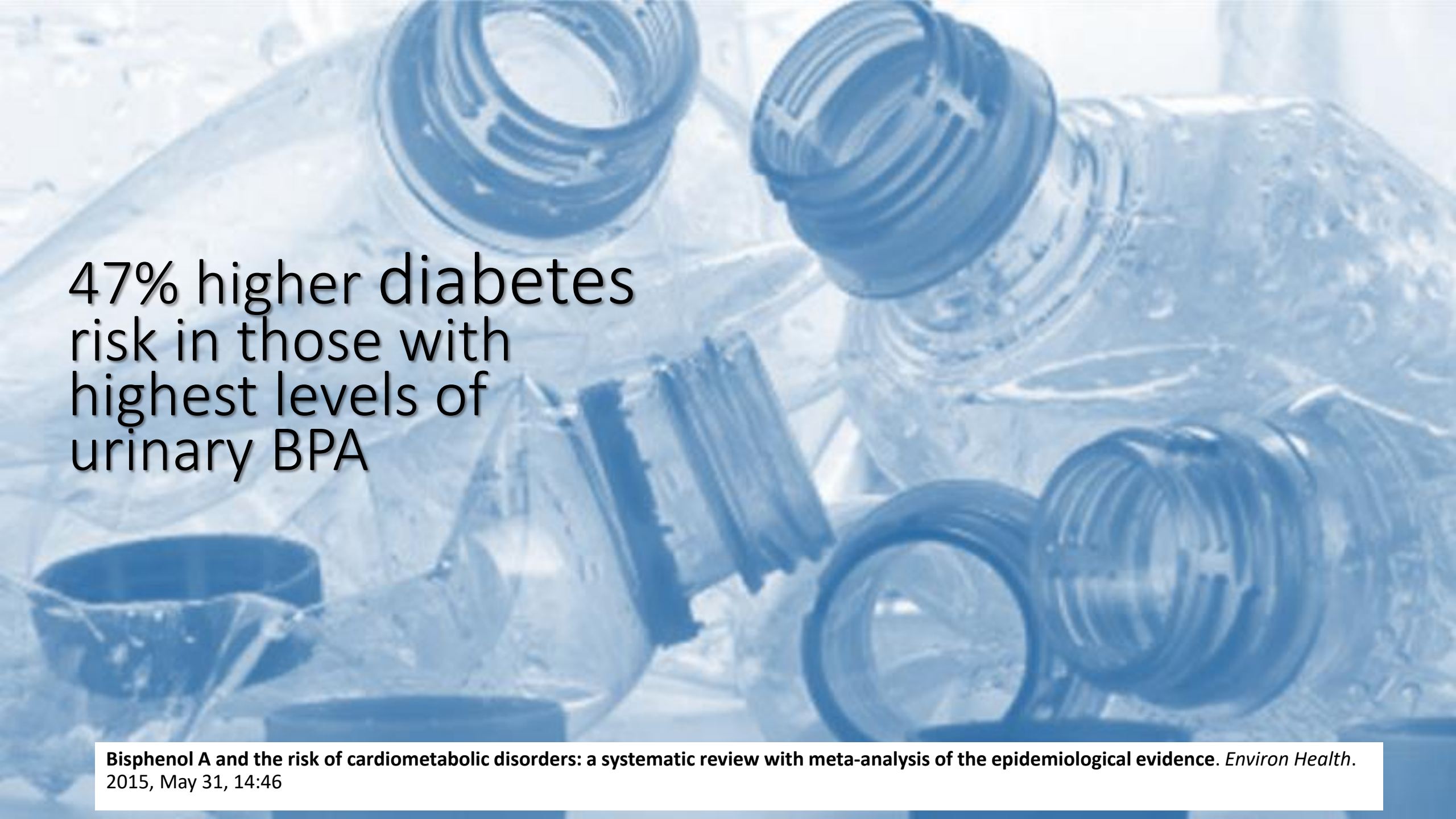
- Polybrominated diphenyl ethers (PBDEs): used as flame retardant
- Bisphenol A (BPA): packaging plastics
- Perfluorooctanoic acid (PFOA): non-stick cookware
- Acrylamide: a) carbs at high temperature; b) coffee
- Mercury: seafood
- Methyl tert-butyl ether (MTBE): a) second-hand smoke; b) gasoline additive



Association between urinary Bisphenol A concentration and obesity prevalence in children and adolescents

Conclusion: Urinary BPA concentration was significantly associated with obesity in this cross-sectional study of children and adolescents

JAMA 2012:308(11):1113-1121



47% higher diabetes risk in those with highest levels of urinary BPA

Bisphenol A and the risk of cardiometabolic disorders: a systematic review with meta-analysis of the epidemiological evidence. *Environ Health*. 2015, May 31, 14:46

Plastic particles found in bottled water

- Tests on major brands bought in nine different countries found nearly all contained tiny particles of plastic
- 93% of bottled water tested showed signs of microplastic contamination
- 10.4 particles per liter bigger than 100 microns
- 314 particles per liter smaller than 100 microns which are probably plastic

BBC News. March 15, 2018

BPA-autoimmunity to brain and nerve tissue

- BPA impacts the brain:
  - Binds to human tissue
  - Can cause immune response that triggers autoimmunity to myelin (coats brain and nerve fibers)
- Avoid BPA for those with brain inflammation, M/S, autism

Kharrazian D., Vojdani A. Correlation between antibodies to bisphenol A, its target enzyme protein disulfide isomerase and antibodies to neuron-specific antigens*. J Appl Toxicol*, 2017, Apr;37(4):479-484

Bisphenol A

may cause

testosterone reduction by adversely

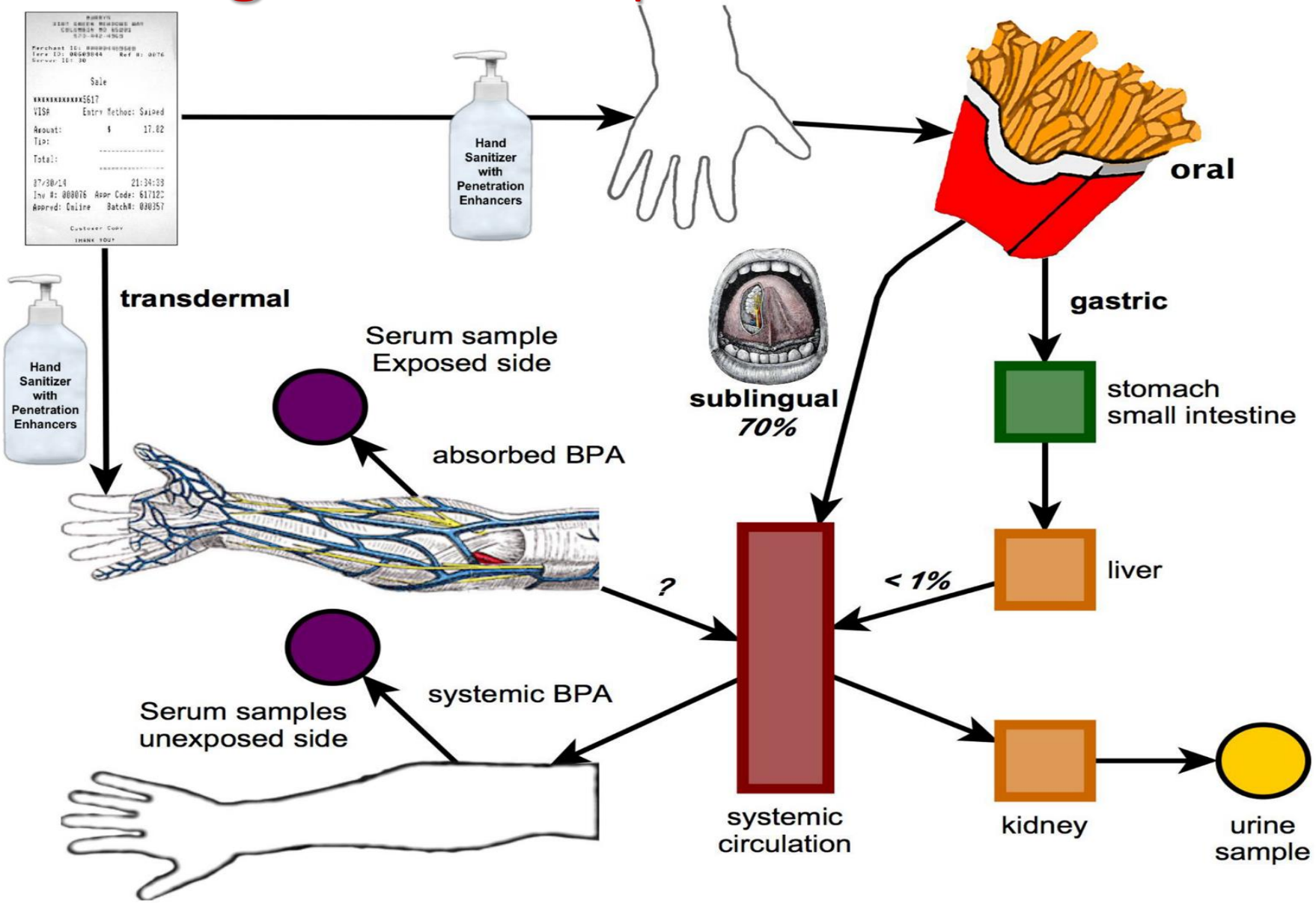
affecting both

testis and pituitary systems

similar to estradiol

Toxicol Lett. 2010 Apr 15;194(1-2):16-25. Epub 2010 Feb. 6

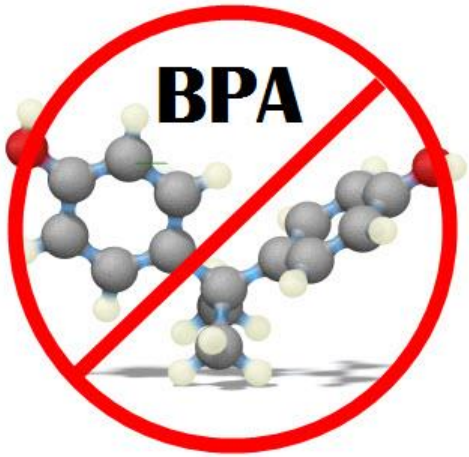
Cash Register Receipts – A Source of BPA



http://dx.plos.org/10.1371/journal.pone.0110509

BPA is an Ovarian Toxicant

- “I think more scientists working today agree that BPA is an ovarian toxicant” – Dr. Flaws
- Review research published in Environmental Health Perspectives: ovarian toxicity among the most consistent and strongest effects found “in both animal models and in women”



BPA has adverse effects on in-vitro fertilization

<u>Conclusion</u>: Exposure to BPA may lead to reduced quality of embryos during reproduction. This study shows that BPA could be the cause for decreases in the frequency of implantation pregnancy and live birth rates in couples seeking in-vitro fertilization

Endocrine disruptors: Manmade and natural estrogens: opposite effects on assisted reproduction. *Nature Reviews Endocrinology* 2016

BPA replacements cause reproductive problems

Arrays of alternative bisphenols now used to replace BPA in BPA-free bottles, cups, cages and other items can cause reproductive problems

Tegan SH, Hannah P, Crystal L, et al. *Replacement Bisphenols Adversely Affect Mouse Gametogenesis with Consequences for Subsequent Generations. Current Biology*, 2018; DOI:10.1016/j.cub.2018.06.070

BPA alternative disrupts normal brain-cell growth, is tied to hyperactivity

University of Calgary: Thinks it's research is first to show that bisphenol-S – ingredient in many products bearing "BPA-free" labels – causes abnormal growth surges of neurons in an animal embryo

Health & Science