The role of Hands-On Treatment for Chronic Pain
(Ohio Society of Addiction Medicine)

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Disclosures

- I have no financial disclosures to make
- I have a 100% “hands-on” medical practice; I teach Osteopathic Manipulation; my wife is licensed Massage Therapist
- I do have a free website www.drrobrehab.com that provides functional-focused exercises for MSK pain

Learning Objectives – focus on muscle fatigue

- Overview of some of the types of “hands-on” therapies
- To understand the role of normal muscle physiology in fatigue and pain
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- Provide a working theory on the role of ‘hands-on’ therapies based upon our current understanding on muscle physiology
- To explain why “hands-on” therapy goal is not to reduce pain…it is to improve exercise tolerance
- Have time for Q & A

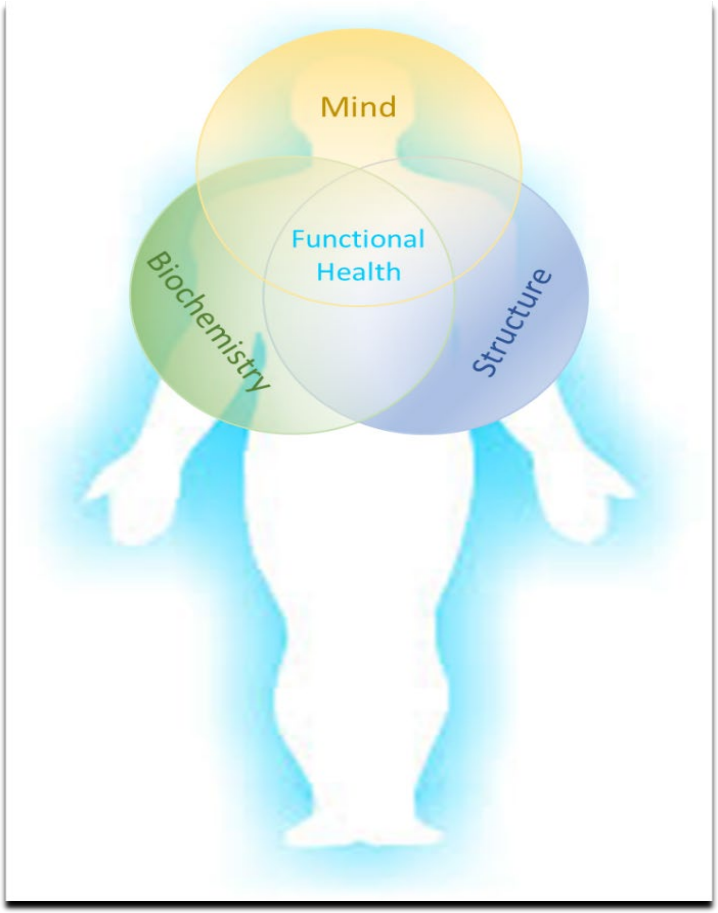
Case Scenerio #1

- 23 yo f, in running attire, brought in by EMS at noon on a hot, muggy day:
  - Altered Mental Status and unable to follow commands well
  - Tachycardia and Tachypnea
  - Hypotensive
  - Cr 2.0
- From “multi-disciplinary” perspective:
  - Neurology and Psychiatry
  - Cardiology
  - Nephrology
- Or, 3 L of NS and restoring **homeostasis** leads to neurological reflexes in the vascular system that restores her to ***near*** baseline

Case Scenerio #2

- 83 yo f with hx of CHF brought in by EMS at noon on a hot, muggy day:
  - Altered Mental Status and unable to follow commands well
  - Tachycardia and Tachypnea
  - Hypotensive
  - Cr 2.0
- From “multi-disciplinary” perspective:
  - Neurology and Psychiatry
  - Cardiology
  - Nephrology
- Will she be restored by 3 L NS?
- Does failure of NS to restore **homeostasis** diminish the value of IV fluids?

Osteopathic Teaching Model



Homeostasis can be defined as the result of the stability of physiological systems that maintain life maintained within a narrow range for the current life history stage

The Narrative arc of this talk is using a structural-biomechanical approach to improving homeostasis

Definitions

- **Hands-on Therapies**: Any modalities in which the healthcare worker physically touches the patient with the intention of using mechanical force to make positive changes

- Osteopathic physicians; Chiropractor
- Physical Therapists with a manual emphasis
- Licensed Massage Therapists and Bodywork practitioners
- Acupuncture

Definitions
Treede, et al. *Pain*; 2015

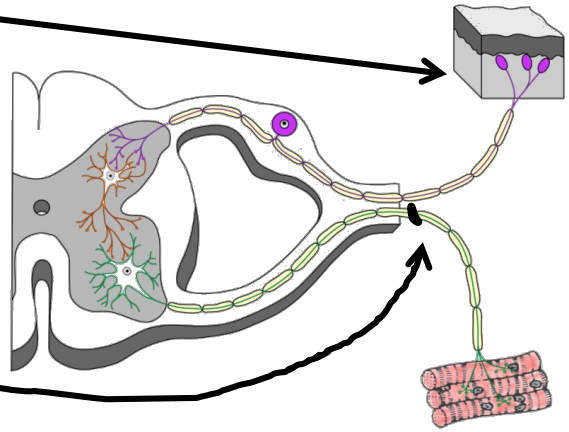
- **Chronic Pain**: Chronic pain was defined as persistent or recurrent pain lasting longer than 3 months – **generally assume some type of tissue damage**

- **Chronic Primary Pain**: Chronic primary pain is pain in 1 or more anatomic regions that persists or recurs for longer than 3 months and is associated with significant emotional distress or **significant functional disability** (interference with activities of daily life and participation in social roles) and that cannot be better explained by another chronic pain condition. (**unknown etiology**)

- **Chronic musculoskeletal Pain**: Chronic musculoskeletal pain is defined as persistent or recurrent pain that arises as part of a disease process directly affecting bone(s), joint(s), muscle(s), or related soft tissue(s)

Nociceptive vs. Neuropathic Pain

- **Nociceptive pain results from the stimulation of pain endings.**
  - "Pain that arises from actual or threatened damage to non-neural tissue and is due to the activation of nociceptors." - IASP
  - This is "physiological."
- **Neuropathic pain results from stimulation or injury to nerves.**
  - Central or Peripheral
  - "Pain caused by a lesion or disease of the somatosensory nervous system." - IASP



IASP – International Association for the Study of Pain

Current Approach to Chronic Pain
Qaseem, et al Ann Intern Med, 2017

- **American College of Physicians (2017) Guidelines for Acute, Subacute, and Chronic Low Back Pain**

- *Recommendation 2: For patients with chronic low back pain, clinicians and patients should initially **select non-pharmacologic** treatment with exercise, **multi-disciplinary rehabilitation**, **acupuncture**, mindfulness-based stress reduction (moderate-quality evidence), tai chi, yoga, motor control exercise, progressive relaxation,electromyography biofeedback, low-level laser therapy, operant therapy, cognitive behavioral therapy, or **spinal manipulation** (low-quality evidence). (Grade: strong recommendation)*
- "Non-pharmacologic interventions are considered as
- first-line options in patients with chronic low back pain
- because fewer harms are associated with these types of
- therapies than with pharmacologic options."

Muscle Fatigue is very common in low back pain

- Many studies have documented an association between chronic low back pain (cLBP) and suboptimal back muscle function, manifest as disturbances in muscle activation during free dynamic movements, reduced muscle strength, increased muscular fatigability, and alterations in the muscles' size and internal structure.

- Consensus: pain causes the muscles fatigue…Really?

  - Mannion, A Taimela, S Montener, M, Dvorak,J Active Therapy for Chronic Low Back Pain Part 1. Effects on Back Muscle Activation, Fatigability, and Strength. *Spine*. Vol 26, No 8, 2001

A few studies about muscle fatigue

- Mannion, A Taimela, S Montener, M, Dvorak,J Active Therapy for Chronic Low Back Pain Part 1. Effects on Back Muscle Activation, Fatigability, and Strength. *Spine*. Vol 26, No 8, 2001
- Silva, R, Vieir, E Cabrera, M, Altimari, L, Aguiar, A. Back muscle fatigue of younger and older adults with and without chronic low back pain using two protocols: A case-control study *Journal of Electromyography and Kinesiology* 25 (2015) 928–936
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- Bandpei, M, Rahmani, N Majdoleslam, B Reliability of Surface Electromyography in the Assessment of Paraspinal Muscle Fatigue: An Update Systematic Review. (J Manipulative Physiol Ther 2014;37:510-521
- Correia, JP Oliveira, R Vaz, J Trunk muscle activation, fatigue and low back pain in tennis players Journal of Science and Medicine in Sport 19 (2016) 311–316

Supplemental Slides

What do we know about muscle physiology?

- "We are only at the tip of the iceberg." (Direct conversation with Marcus Amann, exercise physiologist, U of Utah)
- There is stimulation of the nociceptors to such an extent as to cause discomfort and pain but there is no tissue damage.

- Thus…not all pain IS due to tissue damage.

- Combination of muscle, lymphatic, mechanical-sensory neurological reflexes and feed-back loops, and sympathetic nervous system physiologies…sounds a little multi-disciplinary to me..

What do we know about muscle physiology?

- tissue damage or repetitive or static high tension states:

- Collectively this increases mechanical stress on:
  - Peripheral nociceptors
  - Vessels
  - Muscle Fibers

  - Disrupts muscle physiology homeostasis

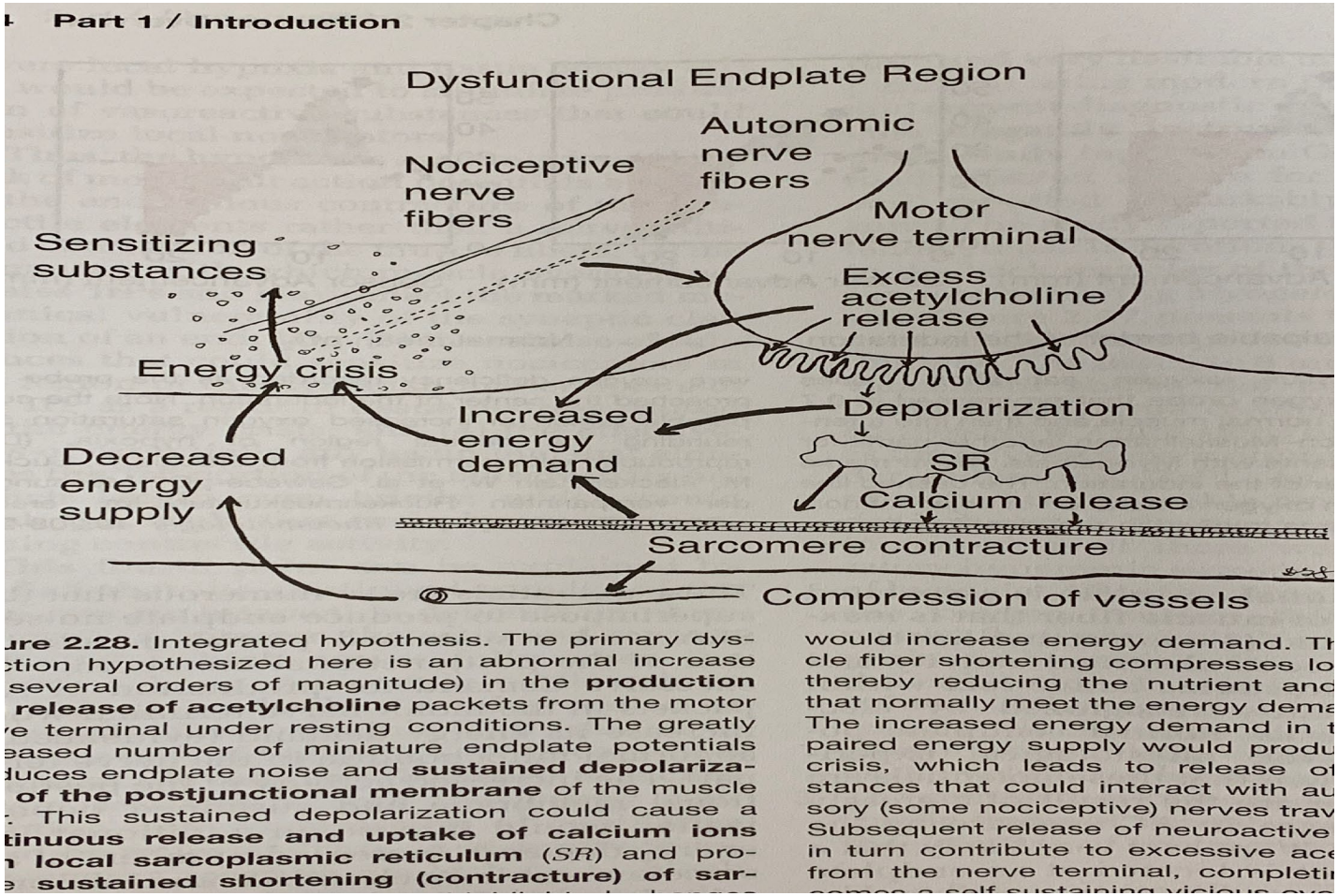
Myofascial Trigger Points – Janet Travel, MD and David Simons, MD

- A hyperirritable spot in the skeletal muscle that is associated with a hypersensitive palpable nodule in a taut band.

- A Cluster of electrically active loci each of which is associated with a contraction knot and a dysfunctional motor endplate in the skeletal muscle

- These trigger points are associated with exaggerated autonomic responses to the surrounding tissue as well as referred pain

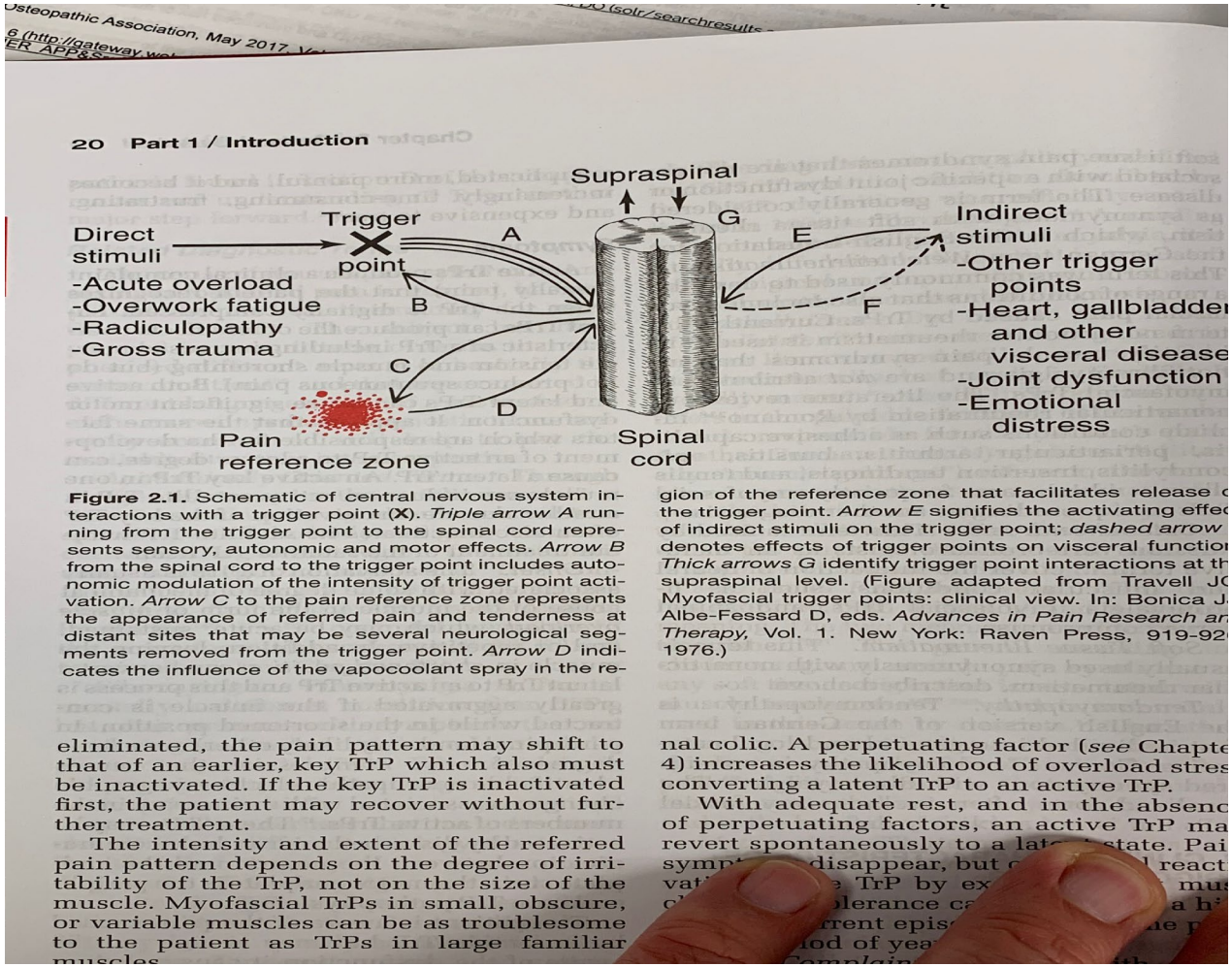
Myofascial Trigger Points



ure 2.28. Integrated hypothesis. The primary dys-ction hypothesized here is an abnormal increase several orders of magnitude) in the **production release of acetylcholine** packets from the motor e terminal under resting conditions. The greatly eased number of miniature endplate potentials duces endplate noise and **sustained depolariza- of the postjunctional membrane** of the muscle . This sustained depolarization could cause a **tinuous release and uptake of calcium ions local sarcoplasmic reticulum** (*SR*) and pro- **sustained shortening (contracture) of sar-**

would increase energy demand. Th cle fiber shortening compresses lo thereby reducing the nutrient and that normally meet the energy dema The increased energy demand in t paired energy supply would produ crisis, which leads to release of stances that could interact with au sory (some nociceptive) nerves trav Subsequent release of neuroactive in turn contribute to excessive ace from the nerve terminal, completi

Myofascial Trigger Points



Osteopathic Association, May 2017

20 Part 1 / Introduction

Figure 2.1. Schematic of central nervous system interactions with a trigger point (✕). *Triple arrow A* running from the trigger point to the spinal cord represents sensory, autonomic and motor effects. *Arrow B* from the spinal cord to the trigger point includes autonomic modulation of the intensity of trigger point activation. *Arrow C* to the pain reference zone represents the appearance of referred pain and tenderness at distant sites that may be several neurological segments removed from the trigger point. *Arrow D* indicates the influence of the vapocoolant spray in the region of the reference zone that facilitates release of the trigger point. *Arrow E* signifies the activating effect of indirect stimuli on the trigger point; *dashed arrow* denotes effects of trigger points on visceral function. *Thick arrows G* identify trigger point interactions at the supraspinal level. (Figure adapted from Travell JG, Myofascial trigger points: clinical view. In: Bonica JJ, Albe-Fessard D, eds. *Advances in Pain Research and Therapy,* Vol. 1. New York: Raven Press, 919-926, 1976.)

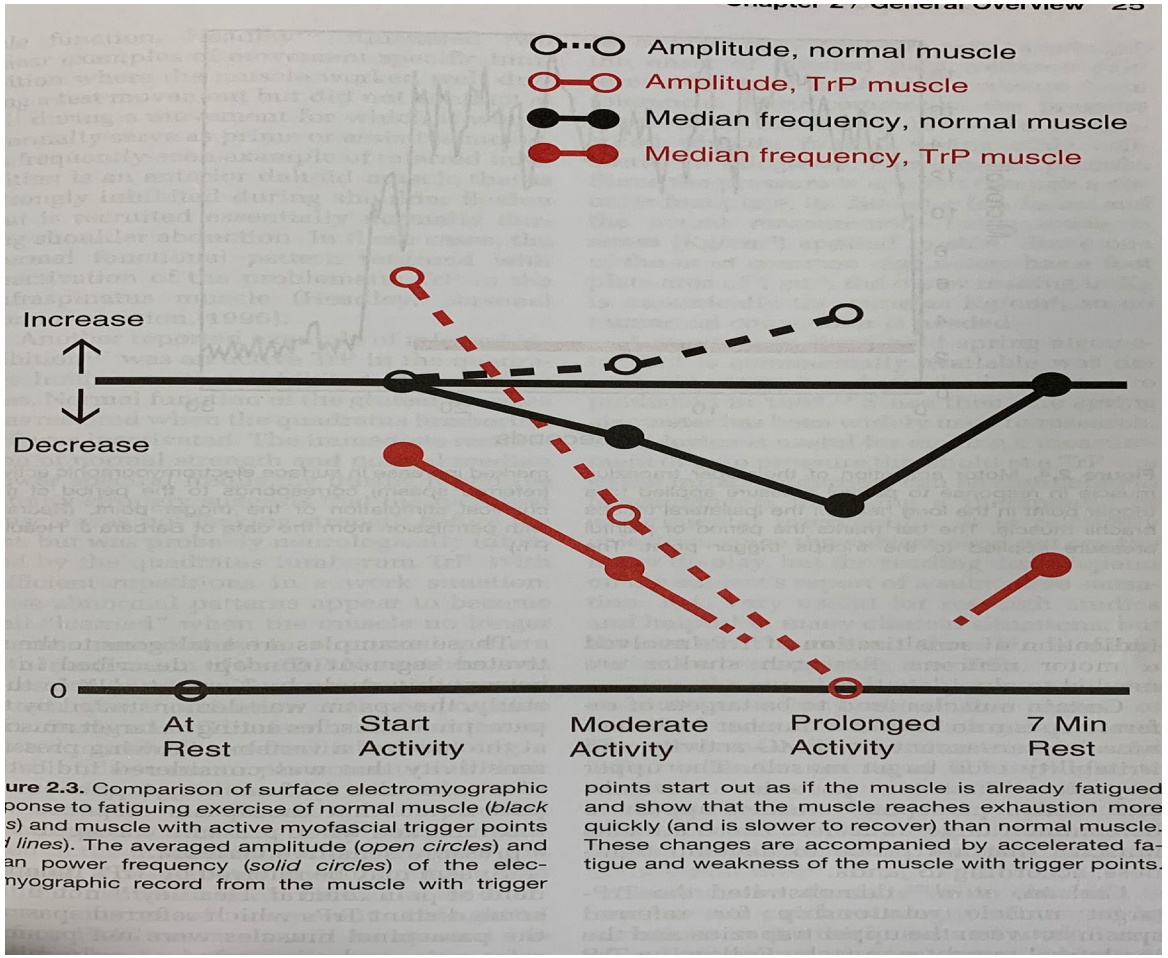
eliminated, the pain pattern may shift to that of an earlier, key TrP which also must be inactivated. If the key TrP is inactivated first, the patient may recover without further treatment.

The intensity and extent of the referred pain pattern depends on the degree of irritability of the TrP, not on the size of the muscle. Myofascial TrPs in small, obscure, or variable muscles can be as troublesome to the patient as TrPs in large familiar muscles

nal colic. A perpetuating factor (*see* Chapter 4) increases the likelihood of overload stress converting a latent TrP to an active TrP.

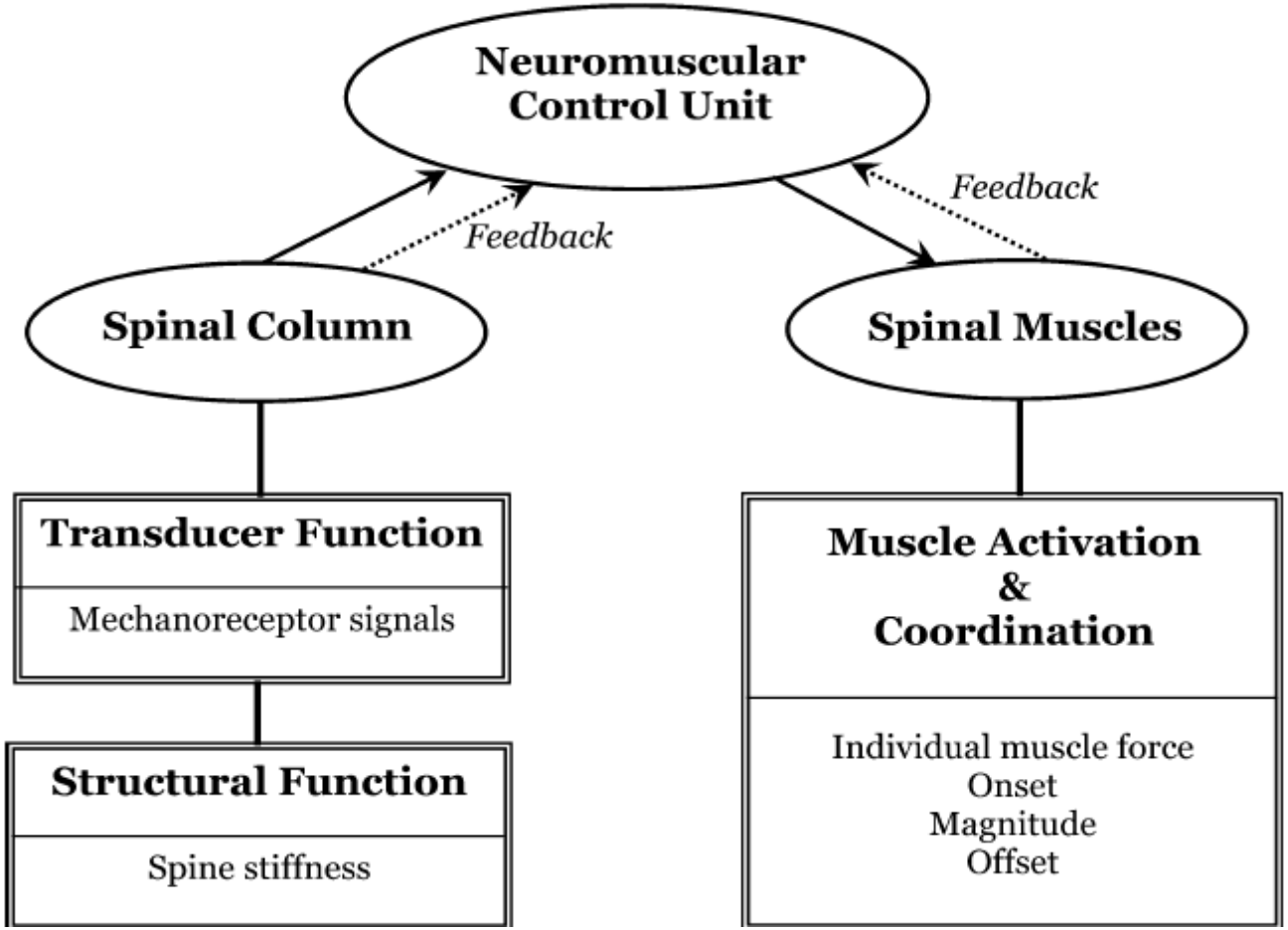
With adequate rest, and in the absence of perpetuating factors, an active TrP may revert spontaneously to a latent state. Pain symptoms disappear, but the TrP by exercise, tolerance can

Myofascial Trigger Points and Fatigue

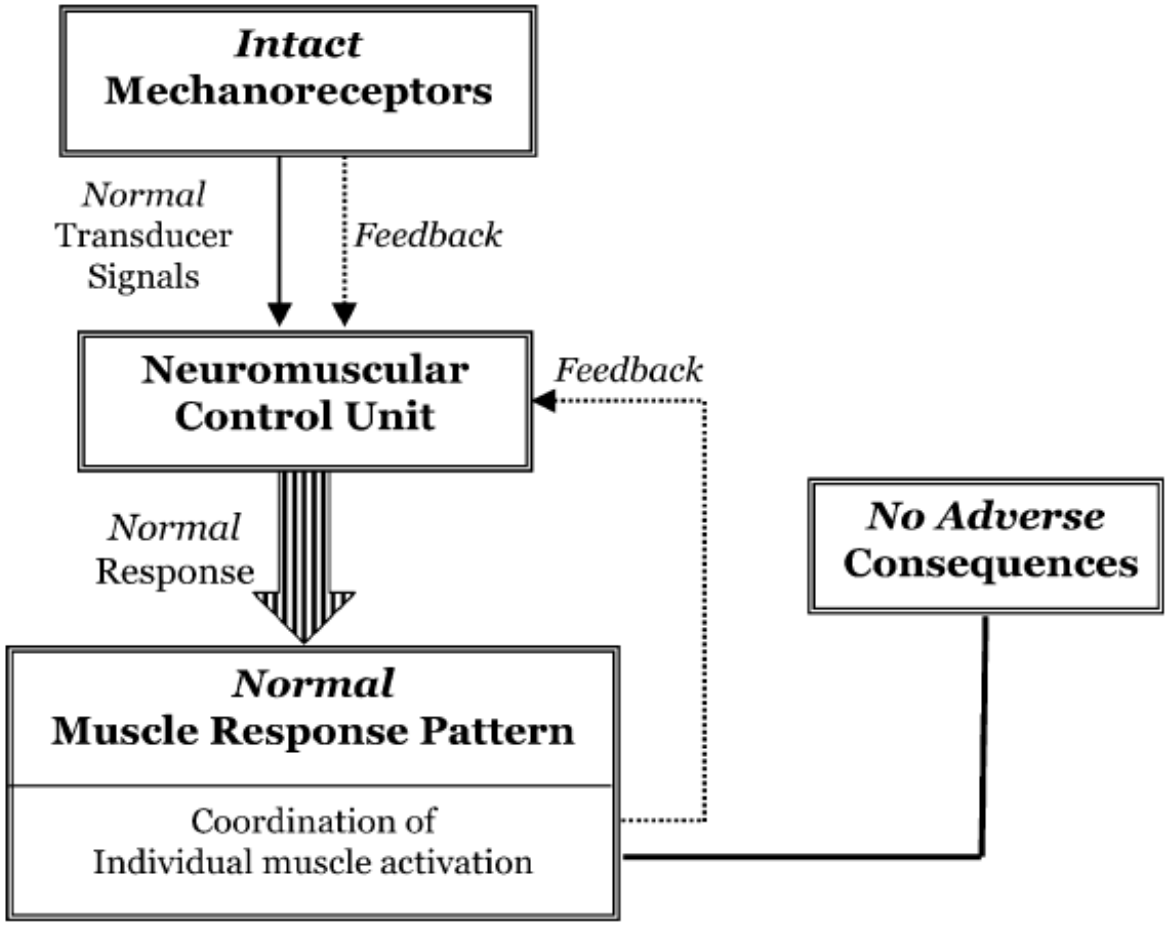


ure 2.3. Comparison of surface electromyographic ponse to fatiguing exercise of normal muscle (*black* s) and muscle with active myofascial trigger points *l lines*). The averaged amplitude (*open circles*) and an power frequency (*solid circles*) of the elec- nyographic record from the muscle with trigger points start out as if the muscle is already fatigued and show that the muscle reaches exhaustion more quickly (and is slower to recover) than normal muscle. These changes are accompanied by accelerated fatigue and weakness of the muscle with trigger points.

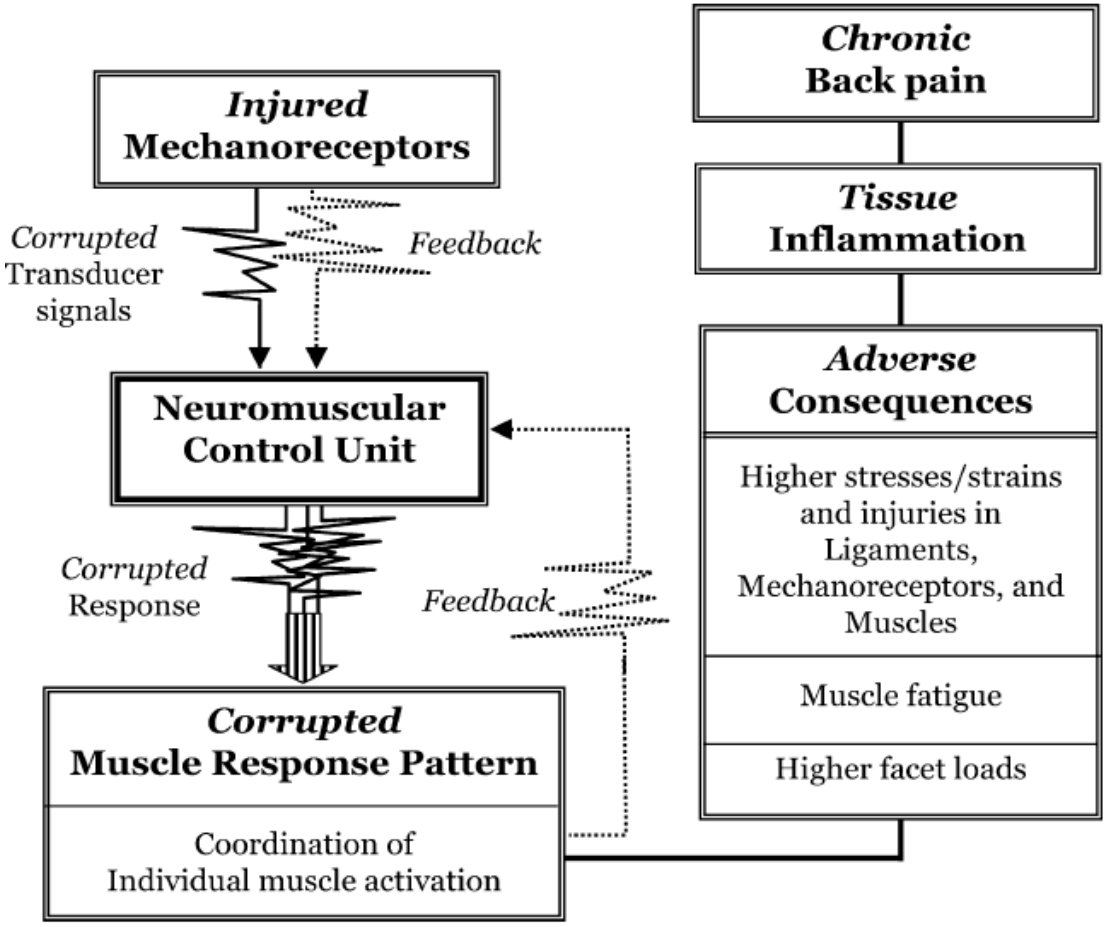
Panjabi, 2006 - spinal stabilizing system



Normal Circumstance



Sub-Failure injuries



Myofascial Trigger Points – Janet Travel, MD and David Simons, MD

- The treatment of MTrPs is primarily a biomechanical one:
  - Massage
  - Joint manipulation
  - Stretching
  - Muscle Energy stretching

  - But also lidocaine and dry needling injections

A non-tissue damage model of pain?

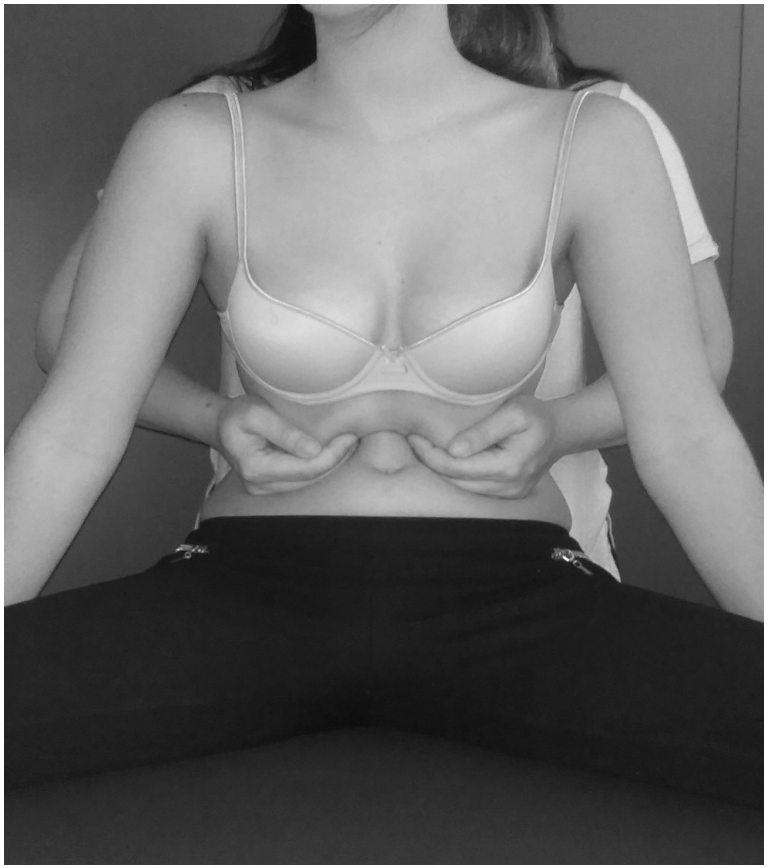
- A biomechanical imbalance (poor posture, repetitive movement, post-injury compensation)
- Muscles(s) develop excessive metabolic waste leading to central fatigue and persistent low-grade inhibition and pain
- Pain-spasm-pain cycle begins
- Autonomic nervous system dysfunction
- Other muscles are recruited by the nervous system to off-set the muscles not working well
- This overloads the muscles, leading to more metabolic waste cycle
- Enough nociceptors are stimulated to cause persistent pain

What are the implications?

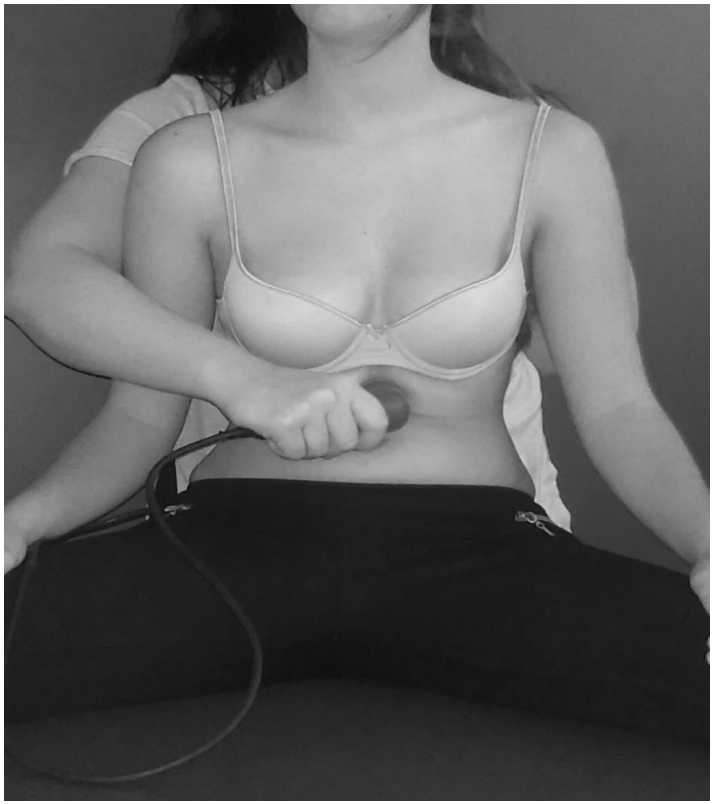
- Can hands-on treatment have a positive impact on the neuro-muscular system?

Diaphragm Doming Technique

Treatment Arm



Sham Treatment



What do we know about hands-on therapies

- Direct stretching of the diaphragm (5 minutes) can have a reflexive benefit to Cervical, Thoracic, and Lumbar motion and improve hamstring flexibility
- Manual therapies act to disrupt the pain-spasm-pain cycle, working at the neural-reflex, feed-back loop level
- Thoracic Osteopathic Manipulation using a thrust (“popping”) made significant changes in R-R intervals of the heart rate, implying an immediate shift towards parasympathetic activity
- Single session of thoracic Mobilzation (“popping”) improved lower trapezius strength

What do we know about hands-on therapies

- Deliberate Mobilization of the L2-L3 lumbars had immediate post-treatment improvement in non-low back pain participants with unilateral weakness of hip flexor (iliopsoas)
- Manual Therapy program on hip function was superior to exercise therapy program in patients with hip OA
- Immediate improvement in Gluteus Maximus strength due to anterior hip capsule mobilization
- Immediate improvement in hamstring (semimembranous) after sub-occipital muscle inhibition
- Improved quadriceps strength with sacroiliac join manipulation

So, what?

- Rehabilitation model:
  - Passive treatment ("hands-on" therapy)
    - "jump start" muscles-joint-fascial through mechanical means
  - Active treatment
    - Physical Therapy
    - Pilates
    - Yoga
    - Fitness routine

Hands-on Therapy specifics

- Osteopathic Manipulation:
  - Technique that focus on joints, muscles, fascia
- Chiropractic
  - Techniques primarily on joint and many get extra training in soft tissue but many incorporate LMT
- License Massage Therapist (LMT): Techniques focus on muscles and fascia
- Acupuncture: address fascia and sympathetic nervous system

Practical value in hands-on treatments

- Improve MSK function
- Reduce pain
- Reduce sympathetic tone
- Allow for greater likelihood of engaging in Active Therapeutic exercise
- Emotional support
- "A sympathetic health practitioner who affirms their chronic pain situation through touch treatment.“
- Very low risk of dependency/addictive physiological consequences

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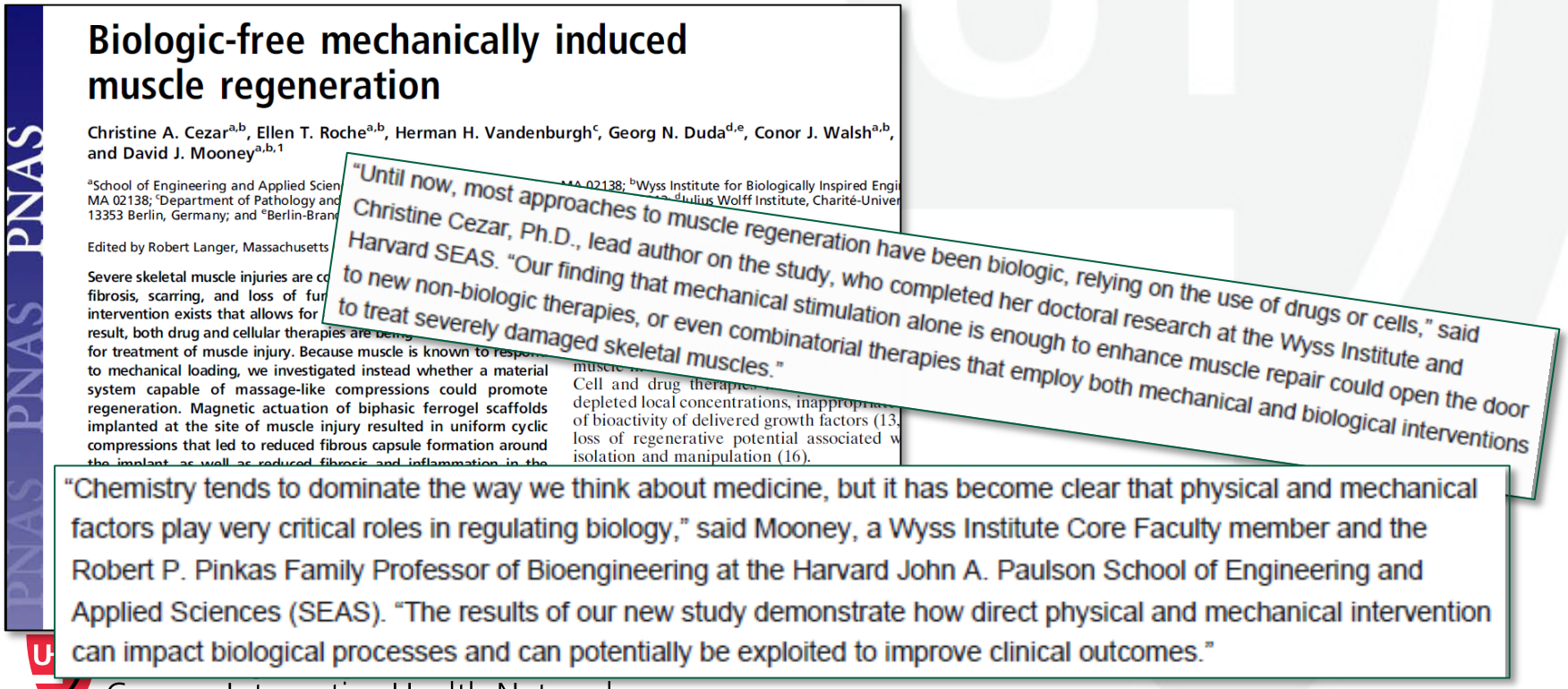
Why a New Model using “hands-on”?

- **Mechanotherapy may replace drug and cellular therapies for injured muscle**
- **tissue**
- January 28, 2016 – Kurzweil News.
- Review and Interview with authors of January 25, 2016 article published in *Proceedings of the National Academy of Sciences*

- Wyss Institute for Biologically-Inspired Engineering at Harvard U.

Why a new model?



Biologic-free mechanically induced muscle regeneration

Christine A. Cezar[a,b], Ellen T. Roche[a,b], Herman H. Vandenburgh[c], Georg N. Duda[d,e], Conor J. Walsh[a,b], and David J. Mooney[a,b,1]

[a]School of Engineering and Applied Scien… MA 02138; [b]Wyss Institute for Biologically Inspired Engi… MA 02138; [c]Department of Pathology and… [d]Julius Wolff Institute, Charité-Univer… 13353 Berlin, Germany; and [e]Berlin-Bran…

Edited by Robert Langer, Massachusetts …

Severe skeletal muscle injuries are c… fibrosis, scarring, and loss of fu… intervention exists that allows for … result, both drug and cellular therapies are be… for treatment of muscle injury. Because muscle is known to respo… to mechanical loading, we investigated instead whether a material system capable of massage-like compressions could promote regeneration. Magnetic actuation of biphasic ferrogel scaffolds implanted at the site of muscle injury resulted in uniform cyclic compressions that led to reduced fibrous capsule formation around the implant, as well as reduced fibrosis and inflammation in the muscle … Cell and drug therapies … depleted local concentrations, inappropri… of bioactivity of delivered growth factors (13,… loss of regenerative potential associated w… isolation and manipulation (16).

"Until now, most approaches to muscle regeneration have been biologic, relying on the use of drugs or cells," said Christine Cezar, Ph.D., lead author on the study, who completed her doctoral research at the Wyss Institute and Harvard SEAS. "Our finding that mechanical stimulation alone is enough to enhance muscle repair could open the door to new non-biologic therapies, or even combinatorial therapies that employ both mechanical and biological interventions to treat severely damaged skeletal muscles."

"Chemistry tends to dominate the way we think about medicine, but it has become clear that physical and mechanical factors play very critical roles in regulating biology," said Mooney, a Wyss Institute Core Faculty member and the Robert P. Pinkas Family Professor of Bioengineering at the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS). "The results of our new study demonstrate how direct physical and mechanical intervention can impact biological processes and can potentially be exploited to improve clinical outcomes."