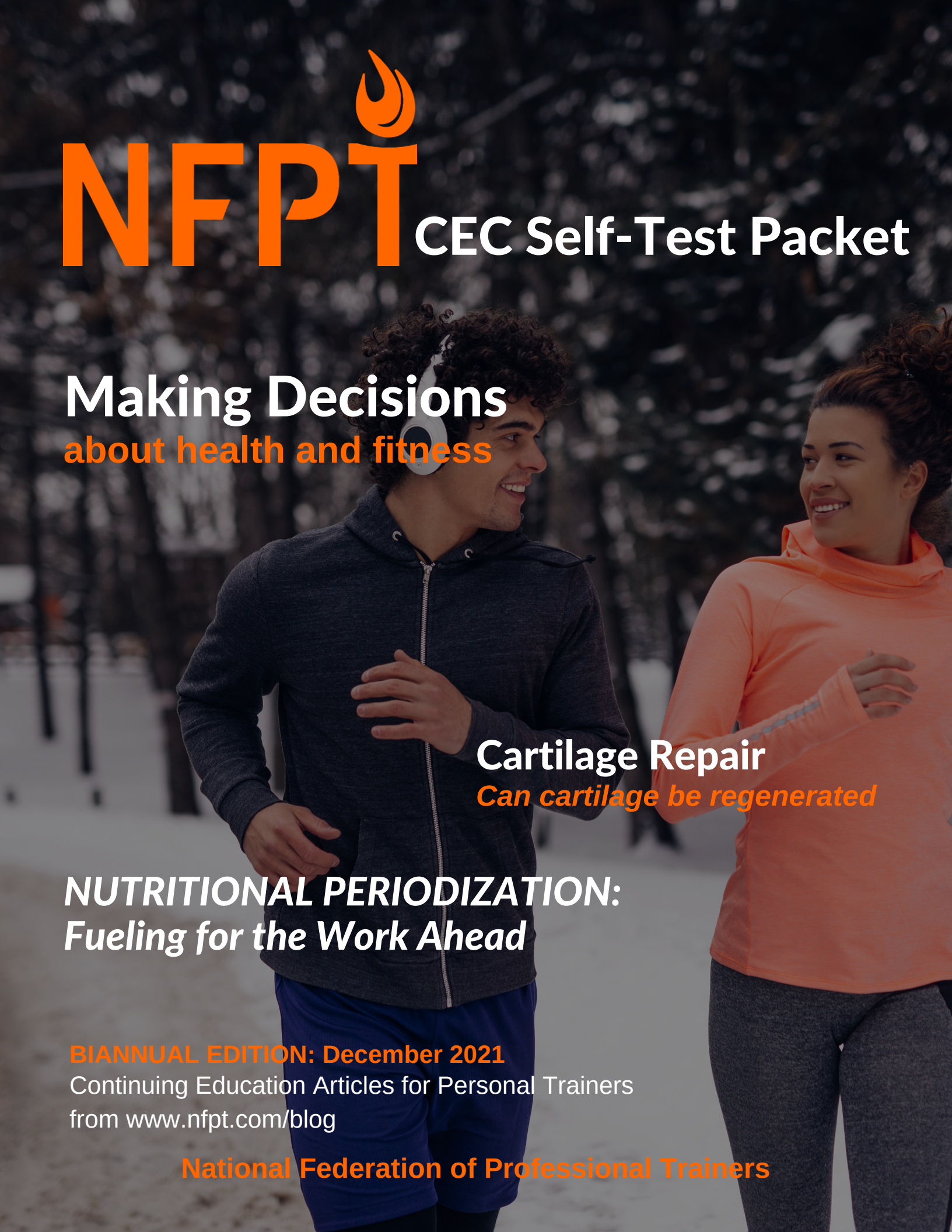
NFPT CEC Self-Test Packet



Making Decisions
about health and fitness

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BIANNUAL EDITION: December 2021

Continuing Education Articles for Personal Trainers
from www.nfpt.com/blog

National Federation of Professional Trainers

NFPT SELF - TEST

DECEMBER 2021 EDITION

Hello NFPT-CPT! Welcome to the winter edition of NFPT's Self-Test for CECs! This continuing education publication is provided to you as part of your personal trainer certification maintenance; we want to contribute to your certification maintenance and professional development in a way that will help you to receive CECs towards your certification. Take the self-test for a NFPT credit award, but don't stop there! Professional development is key to your trainer success. Don't let your CPT credential carry the load of your industry experience, there's so much more to gain from consistent personal enrichment. NFPT offers three specialty courses and many more continuing education courses too. We work with a wide variety of recognized continuing education providers that offer hundreds of options for CECs as well; visit us at www.nfpt.com/continuing-education to learn more.

This packet includes continuing education articles that come from NFPT's Blog. Articles for this December 2021 self-test edition are from the publication months July 2021 to November 2021. All articles are enclosed here to assist you with answering the questions in the back of this packet. If submitting your answers in hardcopy, complete the bubble sheet provided (include your name and contact information) and return to:

NFPT Headquarters
ATTN: CEC Self-Test
PO Box 4579
Lafayette, IN 47903

You are required to obtain 2.0 CECs per each certification year (starting *after* your first full year of certification). Self-tests are provided each June and December as a convenient continuing education method for obtaining credit awards that will go towards the 2.0 credits required for your certification maintenance and recertification. NFPT Self-Tests are worth 0.6 CECs (for a total of 1.2 CECs newly published each year). You may review your CE Report and also complete this self-test online by visiting your NFPT account at www.nfpt.com/account

NOTE: there are articles in this packet which contain links and/or references to resources and information only available online. Go to: www.nfpt.com/blog/cec for these additional resources.

We thank you for your commitment to the fitness industry and to the NFPT organization of trainers. Please contact us at 800-729-6378 or at info@nfpt.com with any questions, or to just be in touch. *We wish you continued success in your endeavors!*

Contents

The DEXA Scan: How They Are Helpful for Fitness Clients with or without Osteoporosis

Many personal trainers wear a health and wellness cap, with interests going far beyond exercise, though it's all interwoven. Osteoporosis and bone fractures are common issues, especially in our aging population. A DEXA scan is a non-invasive test that measures bone mineral density to assess if a person is at risk of osteoporosis or fracture. Some companies and organizations may abbreviate the scans as DXA. Understanding how screening tests like DEXA scans and prevention measures work, may be of interest to fitness professionals.

What is a bone mineral density test's role in detecting Osteoporosis?

A bone mineral density test, sometimes just called a bone density test, detects whether an individual has osteoporosis. The word osteoporosis is a word that comes from Greek and literally means "porous bone." People diagnosed with osteoporosis have weak, thin bones which are more likely to break. It's referred to as a "silent condition. This means afflicted individuals don't feel any symptoms. Usually a person will find out they have osteoporosis after a fall and resulting fracture of a bone such as the hip. Typically, people without osteoporosis would experience the same fall and an injury but most likely not a hip fracture. Without a bone density test, individuals may not realize they have osteoporosis until they break a bone.

What does DEXA Stand for and how does it work?

DEXA stands for ***dual energy x-ray absorptiometry***. Essentially, this test utilizes x-rays to measure the thickness of a client's bones. It also measures how much calcium and other minerals are contained in the bones along with lean and fat tissue in the body. The mineral content makeup of a human body's bones indicates how dense and strong they are. The denser and stronger the bones are, the less likely they are to break or fracture. **The lower the mineral content, the higher the chance of a broken bone.**

What to Expect

Typically, the test examines the bones in your spine, hip, and forearm because these are the bones that are most likely to break when an individual has osteoporosis.

There are two types of bone density tests and they take less than 15 minutes:

Central DXA

This test looks at the spine and hip bones and tends to be more accurate.

During the test, an individual lies down on a padded platform, fully clothed. A machine arm passes above the individual, sending low-dose X-rays through the body. Based on how much

the X-rays change after passing through the body's bones, the machine comes up with an image of the body's skeleton. The image is then read by a trained and credentialed professional.

Peripheral test

This test measures bone density at the heel, finger, and wrist. It is less thorough since it doesn't examine the hips or spine.

The device for the Peripheral Test is portable, so it can be brought to your location or wherever the test will be done. This makes the Peripheral test accessible to more people who may not be able to get the central DXA test and is also more cost effective. Also, for clients who are in the morbidly obese category or exceptionally long-limber, they may not be able to fit the Central DXA machine, so the Peripheral test can be used in these cases.

Both are accurate measures, but the Central DXA is recommended if the client has the resources and ability to get one. This is due to the fact that the Central DXA test focuses on the spine and hips and injuries to these areas would be more debilitating than the heel, finger, or wrist. For optimal results, a client could get both the Central DXA and the Peripheral Test, but this isn't necessary.

How to Prepare for a DEXA scan

The general instructions are to avoid wearing clothes with metal zippers, belts, or buttons. There might be others if a medical condition is present, so it's best to check with the doctor beforehand. Overall, there is very little risk to taking the test. The human body is exposed to very low levels of radiation, less than a chest X-ray or an airplane flight.

Interpreting the Results

There will be two scores after the bone density test is completed and these scores will be compared to a reference database much like when a BMI is taken and the result is compared to a normative reference.

T score: This score compares bone density with a healthy, young adult of the same gender. The score lets the client know if the bone density is normal, below normal, or at the levels that indicating osteoporosis.

Here's what the T score means specifically:

- -1 and above: Your bone density is normal
- -1 to -2.5: Your bone density is low, and it may lead to osteoporosis
- -2.5 and above: You have osteoporosis

Z score: This score allows the client to compare how much bone mass is present as compared with people of the same age, gender, and size.

A Z score below -2.0 means that the client has less bone mass than someone of the same age and that this could be caused by something other than aging.

Who should get a DEXA scan?

Since the DEXA Scan is a bone mineral density test, those at risk for osteoporosis are recommended to get it done.

Anyone can get osteoporosis. However, older women are more susceptible. Yet, men can get it too and the chances/prevalence increases as one ages. It is recommended to discuss this with a trained and credentialed medical prover about the test.

The doc may recommend it if any of the following criteria are met:

- A woman 65 or older
- A postmenopausal woman 50 or older
- A woman at the age of menopause and have a high chance for breaking bones
- A woman who has already been through menopause, younger than 65, and have other things that give you a higher chance of osteoporosis
- A woman who has undergone cancer therapy forcing her into an early menopause
- A man 50 or older with other risk factors
- Posture has gotten more hunched
- A broken bone after 50
- Loss of more than 1.5 inches of your adult height
- Back pain without any known cause
- History of an organ transplant
- Menses have stopped or are irregular although you're neither pregnant nor menopausal
- Decrease in hormone levels
- If there's a history of certain medications that cause bone loss such as:
    - Cortisone (Cortone Acetate)
    - Glucocorticoids
    - Dexamethasone (Baycadron, Maxidex, Ozurdex) (used to treat
    - Prednisone (Deltasone)

How DEXA Scans can help fitness clients

1) DEXA Scans can help clients understand their body composition

The DEXA scan provides an overview into a client's overall level of fitness from a body composition point of view.

If a client is in the at-risk category for osteoporosis, the Fit Pro would have the results to see if the client has it or not and can modify exercise selection and programming. If the client has osteoporosis, the Fit Pro can track how the training is impacting it.

2) Measure Effectiveness of Training

Requesting a client to get a DEXA scan at various points in training can help the fit pro understand how training is affecting the client's body composition. True, there are other ways to measure body composition, but DEXA Scans (because their use of dual-energy x-ray absorptiometry tend to be more accurate). Client's love seeing and tracking positive results, and this is another way do it.

3) Allows clients and fit pro's to have a baseline in case of injury

Injuries can result in temporary changes in the client's body composition. Knowing and having accurate initial body composition values helps Fit Pro's establish a baseline that the can be used for comparison as their client recovers. For example, if a client sprains an ankle, because of immobilization, it may atrophy. Once the client is cleared to return to exercise, having a baseline scan pre-injury can allow a Fit Pro to ensure lean mass returns to pre-injury level and potentially helping the client to prevent re-injury.

4) DEXA Scans Can Provide a Motivational Component

Because clients can be competitive or a Fit Pro can create a competition/contest between clients, the results can be motivating. One contest to consider is to offer a prize to the most documented improvements in body composition after X days/weeks/months.

Or simply, it can motivate clients to do better during their exercise program/package (i.e.: This is where you are at baseline, this is where we'd like you to be.)

5) Optimizing Exercise Design and Programming and Exercise Selection:

Because body types vary (ectomorph, mesomorph, endomorph), how they adapt to training varies. Other factors influencing exercise adaptations include age, gender, baseline/start fitness level, metabolism, nutrition, recovery rate, and the client's physical condition/health history. Yet another one is the type of sport/exercise the client participates in. Long-distance runners versus short-burst sprinters or sprinting type activity athletes would call for differing exercise selection and programming and adaptation.

How Often Should One Get Tested?

If a client is taking medication for osteoporosis, it is recommended to do a bone density test every 1 to 2 years. Otherwise, it would depend on the client's exercise program and goals.

How much does a DEXA scan cost?

Some insurances are starting to cover it, but many do not. Some companies will have discounts through an Employee Assistance Program or allow a Health Savings Account (HSA) payment. However, for the most part, these scans are out of pocket. Due to COVID-19 closures and now re-openings, many businesses are having specials that clients can use. Also, COVID-19 or not, many locations will offer discounted package rates. It's best to research what's available in your area. If there is a medical condition such as osteoporosis present, it may be covered by insurance. In this case, it is best to contact the insurance provider.

The DEXA scan can be a vital tool in detecting osteoporosis or early signs of it. It can also be used by Fit Pro's for motivational reasons and to optimize exercise programming, design, and selection. It can also help gauge and track a client's progress. It's just another amazing tool in a Fit Pro's tool belt to be able to talk to clients about. If you're a Fit Pro that has your business, you may also get benefits by networking with the local DEXA Scan providers to help each other's businesses and clients out.

Understanding and Preventing Delayed Onset Muscle Soreness (DOMS)

Every single person who has ever endeavored to take on a new exercise program learned what delayed onset muscle soreness (DOMS) feels like, even if they don't understand why it occurs. Even conditioned athletes and seasoned fitness enthusiasts are likely to experience DOMS on the regular. Personal trainers may come to find that some clients are affected more than others, as are different muscle groups, or perhaps different kinds of activities prove to elicit more or less DOMS. What is really happening when we feel sore for several days after a workout and is there anything we can do to recover more quickly or mitigate this sometimes unpleasant experience?

What is DOMS?

Delayed onset muscle soreness is the experience of tenderness or pain in a muscle that was challenged or taxed occurring within 12 to 96 hours of an activity. While this is a temporary condition, it can often be debilitating for some people, and certainly can discourage beginners from returning to a workout when they quite literally cannot walk the next day.

For most people, DOMS is most likely to occur when:

- Beginning a new exercise program
- Re-starting a program after an extended break
- Incorporating a brand new movement into your routine with which your body is unaccustomed
- When focusing on eccentric lifts, which are known to result in more soreness
- Engaging in an endurance activity longer than normal

This baffling experience is actually not fully understood by scientists. What they do know is that a number of clinical measurements are affected during the experience of DOMS. These include "elevations in plasma enzymes, creatine kinase, myoglobinemia (condition in which myoglobin–an oxygen-binding iron protein–is present in higher than normal amounts), and abnormal muscle histology and ultrastructure; exertional rhabdomyolysis appears to be the extreme form of DOMS,".

The theories of what may be happening include:

1) **Structural damage**: The high tension created as in the lengthening of a muscle under resistance (such as in the eccentric phase of a contraction) creates tears in the muscle fibers that, similar to other injuries, need to be repaired and hence, protected from further injury. The experience of pain itself signals to our bodies that we need to protect that area or body part to prevent further injury. This makes sense since we know muscle recovery is important for muscle growth, and soreness may be a necessary signal allowing that recovery to take place.

2) **Muscle fiber necrosis and metabolic damage**: The damage to the muscle cell membrane damage leads to disruption of Ca++ homeostasis in the injured fibers; cell death will then peak

about two days post-exercise. How might this explain pain? We need calcium ions for muscle contraction. If calcium can't enter the cell because of membrane damage, and the cell dies. Simply, when a cell dies, an inflammatory response is triggered in order to promote healing. While this is also a mysterious, not-well-understood process, suffice it to say the body sends out "danger signals" when inflammation occurs. Pain is one of those signals.

This is *not* to say that inflammation itself is the cause of the pain. On the contrary, the inflammation is occurring in response to the "something" that caused the pain and is a protective mechanism. This is why taking any anti-inflammatory drugs while effective in reducing the experience of pain, may also slow the important work of muscle recovery.

3) **Nerve irritation**: Without getting too technical, the byproducts of post-exercise repair activity accumulate in the interstitium (the space between cells and tissue), which then irritate free nerve endings of the muscle's sensory neurons. This can potentially contribute to the experience of DOMS.

Why might some people experience more DOMS than others?

Genetics

The gene alpha-actinin-3 or ACTN3 is present in all of us, but has three different variations (of which you will have one). One of those variations fails to produce the ACTN3 *protein* that is linked to speed, power, and strength, and instead produces more ACTN2 protein that is linked to muscle endurance activities. It's hypothesized that those in the latter group will have a harder time building and recovering muscle tissue, and hence, may experience DOMS more severely than the ACTN3 protein synthesizers.

Another gene, Myosin Light Chain Kinase gene, is expressed in one of two forms—homozygote CC or heterozygote CA, the former of which was found to be linked in decreased muscle power following a marathon. Researchers hypothesized that decreased muscle power was indicative of *more* muscle damage, supported by the higher levels of creatine kinase in their blood. **Subjective scores were not taken, but DOMS was inferred to be higher because of the increased creatine kinase.**

Hormones

Women have higher levels of estrogen and subsequently lower levels of creatine kinase. The research is mixed but some have concluded that women with high estrogen will not experience the same degree of muscle damage, and therefore experience less soreness. However, others postulate that they actually do experience as much muscle damage but just recover more quickly.

What can we do about soreness?

Like anything else with unsettled science, the ideas and answers here vary, and I advocate for trying it all to see what works. Some of the suggested approaches include:

- massage
- foam-rolling
- anti-inflammatories (They may help reduce pain but may also hinder muscle growth)
- arnica or other pain rubs
- exercising the same muscle group with gentle active recovery
- kinesiology taping
- heat or warm bath with epsom salts
- ice or cold bath
- following an anti-inflammatory diet
- curcumin/turmeric supplements

What *doesn't* work:

- not moving at all (tempting, but you will likely reduce blood flow, slow healing, and feel *more* sore and stiff)
- going right back at it like nothing (see gentle active recovery above!)
- stretching (that's right, static stretching will not make the pain go away)
- fixating and fearing it (*mind over matter*—trust your body will heal and focus on what you *can* do)

Advising clients

Firstly, being properly prepared for the possibility of DOMS and working out smart ensures your clients don't overdo it. With first-time clients especially, encourage them to be well hydrated the day before their first workout. Don't try to "wow" them with what a tough trainer you are the very first session and scare them away from exercise forever. Ease them into an introductory workout in the muscle endurance training phase, beginning with a proper warm-up and ending with an adequate cool-down (to includes foam-rolling, found to be especially helpful in reducing DOMS when performed post-workout).

Of all the suggested techniques, foam-rolling appears to have the most merit and efficacy. A 2015 study took a very close look at this and experimented with athletes who served as their own controls. They found that foam rolling significantly reduce soreness and improved speed, power, and muscular endurance scores when employed post-exercise.

Above all, encourage clients who are scared or put off by the experience, and contrarily, remind them they don't *always* have to be sore to know they got a good workout. While eccentric motions are more likely to produce DOMS and also build strength more efficiently, the degree of soreness one experiences does not have a linear relationship with strength and muscle growth.

Understanding Connective Tissue: Fascia and Programming for Integration

The human body is a dynamic machine. We have been designed and created to move, react, create force, withstand being pulled, twisted, and undergo various stressors. However, when the human body exceeds a certain threshold, muscle and connective tissue, might give way to injury. One important contractile element that can withstand such stressors and while also providing static and dynamic support is called *fascia*. Having a deeper understanding of fascia and its functional properties is important for every fitness professional.

To be covered below: areas of common fascial restriction, functional anatomy, the biomechanics of spinal movement, ways to manage fascial issues, and incorporation of stabilization and functional strengthening exercises that correct fascial dysfunctions.

What is Fascia?

The ends of the muscle are attached to bones by tendons and aponeuroses, and individual muscles and groups of muscles are held in place and separated by connective tissue sheets called fascia. Fascia has sheets of fibrocollagenous support containing bundles of collagen fibers arranged in different planes to resist forces from several different directions.

Three general types of fascia are usually discussed:

https://www.braceability.com/blogs/articles/remedy-thoracolumbar-fascia-pain

1. **superficial**: comprised of a loose, fat-filled layer that connects the skin and the deep fascia.
2. **deep**: principle somatic fascia which invests and penetrates between various structures that form the body wall and limbs. It is the most extensive of the three types
3. **subserous fascia**: lies within the body cavities, forming the fibrous layer of the serous membrane covering and supporting the viscera and attaching the parietal layer of the serous membranes to the deep fascia of the internal surfaces of the body wall.

Role of Fascia

The role of the lumbodorsal fascia is generally underemphasized in spine biomechanics, yet it is perhaps the most important structure ensuring the integrity of the spine. **The viscoelastic**

property of collagen has a direct impact on the way the muscles are used and forces are channeled from the ground to the upper extremities.

Fascia plays a vital role in supporting the musculoskeletal system by withstanding stress with movement or even excessive movement. The thoracolumbar fascia consists of three layers (the anterior, middle, and posterior layers) and acts as “nature’s back belt” supporting muscles and contractile elements of the lumbar spine. Of these layers, the posterior layer has the most important role in supporting the lumbar spine and abdominal musculature. Lack of exercise or even injury can cause the fascia to adapt and shorten, known as *adaptive shortening.*

Fascial Restrictions

Although fascia is woven throughout the entire body, a greater concentration can be seen in the thoracolumbar fascia region (lower back), middle back, and upper neck region. As such, it can develop adhesions known as trigger points or generaly overactivity, leading to the experience of pain.

According to Travell, when fascia is compressed (shortened), it can give rise to referred pain and tenderness leading potentially to **myofascial pain syndrome**. Based on the work of both Janda and Travell, fascial restrictions occur primarily in the neck musculature, upper trapezius, middle back, lumbosacral regions. These are the areas that can benefit most from both massage and stretching maintaining optimal flexibility.

Forces and Effect on Spine

When you bend forward or attempt to lift something , there are direct loads applied to the lumbosacral junction and thoracolumbar fascia. **With increased trunk flexion the fascia is anatomically subjected to the greatest amount of force and stress compared to the muscles performing the movement.**

There are increased stressors when lifting an object from the ground in a neutral spine vs. a hyperflexed spine. Gracovetsky states that the maximum load the erector spinae can support is about 50 kg, which is well below what can be achieved by strong men. A 250 kg lift requires the fascia to support four times what the spinal musculature can do. **Loss of or diminished support by fascia will severely weaken the spine and result in an abdominal increase in spine compression and torsion, the primary sources of injury intervertebral joints.**

Functional Anatomy and Biomechanics of Spinal Movement

Functional Anatomy

In order for the upper body to move, muscle, joints, and contractile tissue must work harmoniously in conjunction with the nervous system. The erector spinae is a group of deep muscles within the back separated from the superficial layer by the thoracolumbar fascia. The erector spinae muscles contract to control forward bending or side-bending, and require an

eccentric contraction of the whole group during forward bending and side bending to the opposite side as seen in figure five.

Biomechanics of Spinal Movement

During bending forward (trunk flexion) the vertebrae move forward causing the vertebrae (bone) shift to widen the intervertebral foramen (spinal canal), forcing the nucleus on that side and propulsus to shift posteriorly (backward), creating a compression load on tension in the opposite direction. The anterior disc and tension load the posterior annulus. During extension, the opposite occurs as seen in figure six. During side bending, there is an opening on the opposite side and narrowing on the same side.

As the trunk rotates, there is both tension and shear developed in the annulus portion of the disc half of the annular fibers becomes taught(tight) while the other half of the annular fibers slacken. This creates an increase in intradiscal pressure, narrowing the joint space, creating a shear force in the horizontal plane as well as tension force in the fibers oriented in the opposite direction.

The disc is most susceptible to injury and most commonly injured when there is a combination of rotation/unilateral side bending performed. Here the disc is exposed, undergoes tremendous shearing and rotational forces.

Stretching and Training exercises for your clients

In order to keep muscles flexible which is innervated by fascia, self-myofascial release should be part of both a preparatory warm-up and cool-down. In addition, there are several key upper and lower body stretching exercises that you can show your clients to perform after exercising.

Core Strengthening

Core strengthening and its importance has been validated with research over the years. It is vital that all training programs should start with core activation and progress to strengthening exercises. The most effective core strengthening exercises strengthen the weak links in our bodies and provide synergistic stabilization.

Summary

Fascia plays an essential role in our body withstanding various stressors while providing static and dynamic support. With regular stretching, massage, education, performing core strengthening exercises, clients can achieve optimal health and wellness and prevent movement dysfunctions from occurring.

Bring On the Tension: Understanding Leverage Versus Compression Movements

Throughout any given day, our muscles perform both big and little movements which help shape our mobility. Tension always plays a role, but tension can be applied in different manners having various impacts. Learn about the different types of tension and how to balance them creatively within a client's workout.

Analyzing the Anatomy

Regardless of its location or function, all muscles in the human body bear one thing in common: the duet of muscle tissue itself and muscle fibers. The fibers, responsible for contracting and creating tension, generate what we refer to as *compression tension*, experienced when executing a deadlift or squat.

Fascia, which wraps around the muscle fibers, aids in the stabilization of the body. Holding a steel mace provides a good example of this function, known as *leverage* tension.

Here the discussion attempts to highlight the benefits of each form of tension, whether your client enjoys recreational weightlifting or participation in competitive sports.

Utilizing Leverage to the Client's Advantage

Stability is best targeted with Leverage Based Tension. *These exercises involve asymmetrical loads and/or holding a weight far away the midline of the body*. This form of training can help many clients push past plateaus and unlock their strength potential.

There are several means through which a personal trainer can create asymmetrical loads when designing a workout program:

-Utilizing a single weight on one side of the body. Think, Farmer's Walk holding only one weight

-Choosing two different weights on either side of the body.

-Positioning the client's body into either a split stance, single-arm/leg, or alternating.

The Steel Mace, or the Core Hammer (developed by one of our own NFPT trainers) a unique piece of equipment not yet available in all fitness centers, utilizes loading only on one end. It resembles a weighted globe welded onto a long lever. When using the mace bell as a bodybuilding tool, the athlete holds it such that the load lies far away from the centerline of the body. As such, it confers a significantly uneven weight distribution. Even "lighter-weight" mace bells start to feel surprisingly heavy due to the long-levered offset design.

Advantages of Leverage Training

- Improves Grip Strength
- Increases Shoulder Strength/Mobility
- Builds Rotational/Total Body Strength

The handle of a steel mace bell, typically thicker than the average barbell, fosters the development of forearm and grip strength. In addition, leverage movements create strength in the ligaments, tendons, and muscles while improving shoulder mobility.

Training the Transverse Plane

Leverage-based training enables one to move through all three planes of motion, with primary emphasis on the transverse plane. This plane controls both rotational movements as well as their resistance, making such training advantageous for sports performance. A strong, powerful core that comfortably rotates *and resists* rotation creates a foundation upon which the client can build balance, coordination, and acceleration/deceleration in all directions.

Leverage-based tension training is comprised of *open-chained movements*, whereby the end of the chain farthest from the body — usually the hand or foot, referred to as the "distal aspect of the extremity" — moves freely, not fixed to an object.

Variations on a Theme

If mace training does not quite suit your client, offer another great option to consider: dip-to-pushup supersets.

Whether performed on rings or standard dip bars, transitioning from dips to any type of pushup position significantly alters the leverage of the body. Another such superset example, the dumbbell fly-to-dumbbell bench press, serves several purposes. The motion involved in changing levers helps the client derive the most out of both exercises.

Perhaps trainers have witnessed, or themselves experienced, how using too heavy a weight when executing a dumbbell fly puts the shoulder at an increased risk of injury. In choosing this set of movements, or any superset utilizing higher volume repetitions, a lighter dumbbell suffices; one can retain the value of the exercise while reducing some of the potential risks.

Symmetrical Compression and Tension

When executing compression-based exercises, clients train with symmetric weight distribution. Deadlifts and goblet squats serve as prime examples of this type of loading, both of which confer a tremendous amount of compression *straight down onto the muscles and joints*.

Compression-based tension is an example of a *closed chain kinetic movement.* CKC techniques emphasize the sequential movement and placement of functionally-related joints, and therefore require coordinated muscle activation patterns to control proper joint movement.

Closed-chain exercises work many muscle groups and joints at once, allowing for more return from the energy expended. They also better mimic the activities of daily living, which means they improve “functional” fitness. Athletes, too, make good use of such exercises, since a multitude of sports require the concurrent movement of multiple joints and muscles.

Utilizing proprioceptive feedback, closed chain kinetic exercises stimulate systems within the body which in turn initiate patterns of muscle activation. When moving through closed chain exercises, the end of the chain farthest from the body remains fixed. Picture a squat, in which the feet remain firmly on the floor while the torso moves along with the rest of the leg chain. In the closed chain, movement at one segment produces movement at all the other joints. When executing a squat, therefore, the movement at the knee joint joins with movement at the hip and ankle joints.

The Value of the Pairing

As we have learned, the combination of tension and stability not only defines one’s ability to perform mechanically but enhances it as well. Thus, we can see the importance of including both types of exercises in a single session, in an effort to provide clients with complete and balanced workouts.

How Veggie-Based Nitrates Enhance Muscle Function

Could dark green leafy vegetables soon join the list of elite pre/post-workout muscle fuel? Read on to learn how natural sources of nitrates can foster better muscle contractile properties, lower blood pressure, and so much more!

Biological Breakdown: Nitrates vs Nitrites

Nitrates (NO3) consist of one nitrogen atom and three oxygen atoms, while *nitrites* (NO2) contain one nitrogen atom and only two oxygen atoms. Nitrates occur in nature as "inert" (stable) molecules unlikely to elicit harm. The body's enzymes, however, can convert them into nitrites; herein lies the double-edged sword. **Nitrites can either turn into beneficial nitric oxide, or nitrosamines, the culprits responsible for harming health.**

In-depth toxicological investigative studies have yet to demonstrate a convincing relationship between nitrite exposure and carcinogenesis, leading scientists to question whether *all* food sources of nitrate threaten our well-being.

Maximizing Muscular Contraction

New research from Edith Cowan University, published in the prestigious *Journal of Nutrition,* extolls the virtue of diets heavily focused on vegetables. Scientists linked the abundance of naturally occurring nitrate in several common dark green leafy vegetables to the reported improvements in muscle function, *most notably in the legs*.

One such study from Australia, culling data from over 3700 participants during a 12-year period of time, found that diets including a plethora of dark green leafy vegetables (a rich source of nitrate) elicited 11% greater lower limb strength and up to a 4% increase in walking pace than meal plans containing less vegetable-sourced nitrate. These subjects' grip strength, too, jumped up by 4%, as compared to their non-greens-eating counterparts.

According to one study, humans obtain ~80% of their dietary nitrate from vegetables, with lettuce, spinach, kale, and even beetroot topping the list. Lead researcher Dr. Marc Sim also mentioned the added bonus of all the minerals/vitamins biologically available to the body through greens, as opposed to a daily nitrate capsule.

The Great Nitrate Debate

Food producers often add nitrates and nitrites to processed meats (bacon, ham, sausages, and hot dogs). These compounds enhance the products by contributing highly palatable salty flavor and the pinkish-red color we commonly associate with "processed lunch meats".

Research put out by the American Institute for Cancer Research, entitled *Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective,* heralded the following

recommendation: “Limit consumption of red meats (such as beef, pork, and lamb) and avoid processed meats”.

Current guidelines suggest that individuals may safely consume up to 500 grams of red meat (the equivalent of 18 ounces) over a 7-day period since fresh meats contain neither nitrite nor nitrate.

While extensive toxicological investigative studies report that regularly consuming processed meats may lead to various digestive tract cancers, including colorectal cancer, *review panelists could not determine a safe consumption level for the product(s).* Thus, experts continue to question whether *all* food sources of nitrate threaten our well-being.

Factory or Farm-Raised?

Laws today ensure that manufacturers limit the amount of nitrites used when processing meats, owing to the potential health hazards of excess nitrosamines. However, *natural and organic* ways of preserving meat often include celery salt, which also may contain nitrates. Cautious bacon aficionados may consider the following:

- Buy products locally or from farmer’s markets
- Find a supplier of bacon from pasture-raised pigs
- Fry or cook bacon at reduced heat for a longer amount of time, avoiding burning

Nitrates and Blood Pressure

A Danish study encompassing 53,150 participants delved into how regular consumption of nitrate-rich leafy vegetables might affect blood pressure. A follow-up after 23 years revealed that higher nitrate consumption did in fact correlate to lower diastolic and systolic blood pressure readings. Some speculation exists as to whether the lower blood pressure or the nitrates themselves rendered the individuals “healthier” since these subjects also demonstrated a decreased incidence of ischemic heart disease/stroke, heart failure, and hospital stays resulting from peripheral artery disease.

Leafy Additions to the *DASH* Diet

The Dietary Approaches to Stop Hypertension ***(DASH)*** studies found that diets rich in vegetables (8–10 servings/day) and low-fat dairy products can help decrease blood pressure, with results akin to those obtained by taking a single blood pressure medication. **The blood pressure–lowering effect of the DASH Diet, originally attributed to high levels of naturally-occurring calcium/potassium/fiber/polyphenols, may actually hail from the inorganic nitrate inherent in certain vegetables.** This compound can provide a substrate for reduction to nitrite, nitric oxide, and other metabolic products, which in turn foster vasodilation, decreased blood pressure, and improved cardiovascular function.

The *World Health Organization* suggests limiting nitrate intake to 222 mg /day for a 60-kg adult. Following a ***DASH*** dietary pattern with high-nitrate vegetable and fruit choices would exceed this by 550%. Even a single serving of spinach can exceed the recommended adult daily intake for nitrate. **The fact that typical consumption of vegetables/fruit seems in excess of current guidelines points to the need for professionals to re-evaluate such limits, acknowledging potential health benefits.**

Take-Home Messages

When your health and fitness clients seek advice/opinions on the risks and benefits of favorite foods, you can offer the following statistics garnered from research studies. Many fitness health experts and sports dietitians currently steer clients towards easing into a more plant-centered meal plan; as we have learned, the benefits can extend far beyond the confines of one's gym!

- Ingestion of nitrate, found in green leafy vegetables and beets, increases the production of nitric oxide (NO), a vasodilator with the potential to lower steady-state oxygen uptake during submaximal exercise, especially in fast-twitch type 11 muscle fibers.
- NO_3^- (dietary nitrate) intake improves muscle contractile function among healthy young and middle-aged individuals, athletes, those suffering from cardiac ailments, and the elderly.
- Dietary nitrate may enhance muscle blood flow during exercise, thereby facilitating endurance.
- Nitrate intake from vegetables shows an inverse relationship with vascular disease-related mortality, independent of lifestyle and cardiovascular disease risk factors.

Can Cartilage Be Regenerated?

Personal training clients may, from time to time, report some degree of cartilage damage or injury, frequently caused by overzealous participation in sports-related endeavors. Fortunately, there are various approaches to fostering new cartilage growth, and may prove to be *bona fide* game-changers in terms of restoring joint health.

Tissue Damage and Injury

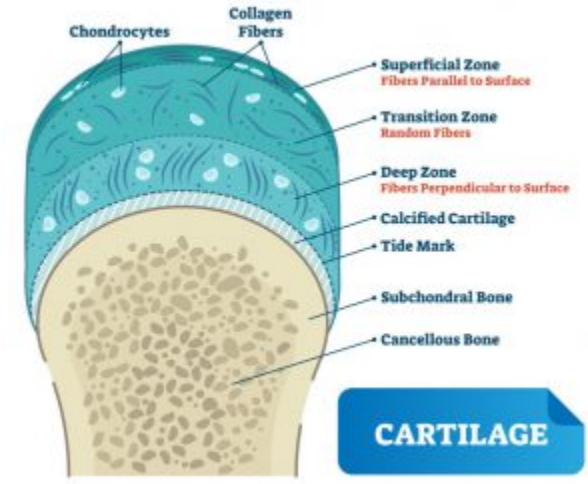
Cartilage, the tough yet flexible connective tissue covering the surface of joints, acts as the shock absorber between bones. Whether through the ravages of repetitive motions, osteoarthritis, frequent sports injuries, or simple wear-and-tear, cartilage damage *ranks as a primary cause of knee/hip/ankle problems*. While many such injuries can typically heal within a few weeks' time given appropriate rest and rehabilitation exercises, more severe cases may require invasive procedures or surgical repairs.

Cartilage Damage Symptoms and Treatments

Symptoms of cartilage damage bear a striking resemblance to those of sprains ~

- Pain that continues even when resting
- Swelling
- Stiffness
- Inability to bear weight
- "clicking", locking and/or giving way of the joint

Only a professional can accurately diagnose the source/severity of joint pain. If damage does not respond to less invasive treatments, surgical options exist that can offer positive outcomes.



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Rebuilding the Foundation

In addition to the all-too-common joint replacement operations, some new and innovative treatments have met with great success, most notably the *potential* of cartilage to repair itself**.** While much more research will help elucidate this process, scientists at Duke Health Center have found similarities to the manner in which salamanders and zebrafish regenerate limbs. This looks promising as a potential osteoarthritis treatment.

According to Virginia Byers Kraus, M.D., Ph.D., Professor of Medicine, Pathology and Orthopedic Surgery at Duke, "We believe that an understanding of this 'salamander-like' regenerative capacity in humans, and the critically missing components of this regulatory circuit, could provide the foundation for new approaches to repair joint tissues and possibly whole human limbs."

Drilling For Growth

Microfracture, a fairly new procedure, attempts to stimulate the growth of new cartilage by creating a fresh blood supply.

This surgical procedure utilizes a sharp tool to create multiple holes in the *subchondral bone*, the layer just under the cartilage. This process encourages a healing response by allowing blood to reach the surface of the joint. In theory, the newly emergent cells will form cartilage. To date, this procedure has seen great success.

Stem Cells Driven to Create Cartilage

In the field of tissue engineering, scientists attempt to isolate human growth factors to induce new cartilage formation. *Mesenchymal* stem cells obtained from healthy bone marrow have demonstrated the ability to yield cells similar to the host tissue when cultured in the proper environment. While this field still qualifies as "experimental", researchers hope to show how stem cells placed near a damaged joint surface may over time stimulate hyaline cartilage growth.

During the developmental stages of maturing bone, cells must first enter a cartilage-forming phase. Medical professionals propose halting bone-forming evolution at the point where cells begin forming cartilage utilizing a molecule known as VEGF (vascular endothelial growth factor). VEGF works by blocking further signaling molecules from completing the process.

The result of one such attempt yielded cartilage comprised of the same sort of cells as natural cartilage, with comparable mechanical properties. Even human tissue embedded into mice proved capable of driving bone growth, engineered to stop precisely at the stage of cartilage development.

Membrane-Induced Autologous Chondrocyte Implantation (MACI)

MACI, another fairly new surgical procedure, utilizes cartilage-forming cells, or chondrocytes, obtained from one's own body to help restore damaged cartilage in other joints. Once harvested through needle biopsy aspiration, chondrocytes can then multiply in a laboratory setting. Upon reaching a sufficient quantity, surgeons can implant the cells into a damaged joint area, where they will continue to proliferate.

Platelet-Rich Plasma Therapy (PRP)

Platelet-rich plasma refers to a volume of autologous plasma replete with a platelet concentration well above baseline. Normal platelet counts average about *200,000/1J.1; a mere 5 ml. of plasma containing PRP with 1,000,000 platelets/1J.1 seems to show success at enhancing the healing of both bone and soft tissue.*

Platelet-rich plasma contains an abundance of growth factors – seven in all — in their naturally occurring biological ratios, typically utilizing a clot as the carrier. However, PRP alone cannot induce new bone formation. Only bone morphogenetic proteins (BMPs) harbor this ability. With further study, scientists hope to demonstrate how PRP may accelerate the traditionally slow BMP activity.

PRP, Osteoarthritis, and Healing

A variety of factors can affect the progression of osteoarthritis (OA), including inhibition of inflammatory cytokines to ameliorate enzymatic expression. PRP therapy aims at mediating inflammation and catabolism through the secretion of anti-inflammatory factors. Many recent studies have demonstrated the clinical benefits of PRP in the non-operative management of OA. The future of PRP and its application for cartilage repair/regeneration looks promising, as scientists seek to focus on customization/tailoring of biological factors by targeting disease-specific markers.

A February 2021 study from the Department of General Surgery and Medical-Surgical Specialties, Orthopedics and Traumatology at the University of Catania, Italy yielded the following results:

"PRP supplies and releases cytokines, growth factors, and α-granules, all of which can offer a recovering stimulus and promote healing and tissue repair. The PRP injection can promote the release of fibrinogen, a substance that helps in wound healing or a ligament tear, interleukin-1 receptor antagonist as an anti-inflammatory, tissue growth factors, platelet-derived growth factors and vascular endothelial growth factors."

Each of these growth factors stops an overactive inflammatory response from degrading tissue, and modulates angiogenesis (the development of new blood vessels to facilitate healing). The

use of PRP directly at the site of cartilage injury most likely can stimulate natural healing by accelerating the cultivation of new tissue.

Additional Approaches

Supplementation, from vitamins to protein, remains a popular yet controversial route. Over-the-counter natural substances such as shark fin cartilage, glucosamine chondroitin, and MSM have enjoyed a high level of popularity, mostly through anecdotal evidence. Whether these products show any benefit when compared to growth of fresh cartilage cells remains uncertain, since strong evidence appears on both sides. We encourage personal trainers — and all readers — to continue seeking out innovative research data on this topic before making any recommendations to clients.

Lengthen and Strengthen with a Weights/Pilates Format

When personal trainers hear the word “Pilates” specific images may be conjured up, such as a quiet room full of women extending their bodies in any variety of positions, or perhaps teetering on reformers as they strive to improve their balance, posture, and core stabilizers.

While these assumptions aren’t far off the mark, the art of Pilates offers so much more than meets the eye including the ability to enhance even the most strenuous of bodybuilding workouts.

The Man and the Mission

Joseph Pilates, a boxer and self-defense instructor, created his namesake movement discipline in the early 1900s. After carefully watching as his cat stretched and elongated its body, Mr. Pilates reflected on the importance of developing the core muscles of the human body. By requiring participants to focus upon each and every muscular shift, the discipline of Pilates encourages not merely flexibility but also awareness, breathing techniques, and ideal posture.

Research on the exercise physiology/human kinetics aspects of Pilates offers some interesting findings. One such study examined the effects of Pilates exercises on abdominal endurance, hamstring flexibility, upper-body muscular endurance, posture, and balance.

Fifty subjects were recruited to participate in a 12-week Pilates class, one hour in duration, 2 times per week. Participants performed 25 exercises that comprise a basic mat routine, relatively low in intensity. The moves focused on muscular endurance and flexibility of the abdomen, low back, and hips during each session. As the study came to a close, results revealed a significant level of improvement in most of the aforementioned variables.

Pilates versus Cardiovascular Exercise

Many participants new to a Pilates class question its ability to truly “count” as aerobic exercise. To that end, another study compared the effects of Pilates exercises, aerobic exercises, and sessions blending the two disciplines, with respect to fatigue, depression, aerobic capacity, pain, sleep quality, and overall quality of life. Pilates movements produced similar effects to those brought about with aerobic exercises. **While the Pilates movements themselves may not cause a sustained increase in one’s pulse, the benefits seem quite similar.**

Pilates may serve as an alternative physical training method for individuals battling obesity. In a study spanning eight weeks, subjects engaged in an hour of either Pilates classes or aerobic walking, three times each week. The unique Pilates exercises afforded the ability to promote positive effects in cardiorespiratory fitness, body composition, abdominal strength and flexibility. **When compared to results from the aerobic exercise participants, those in the Pilates group also showed greater improvement in oxygen uptake.**

Joint Pain

A controlled trial recruited 42 women currently living with rheumatoid arthritis and/or fibromyalgia. Subjects participated in either mat Pilates or aquatic aerobic exercises, twice a week for 12 weeks. Participants of both groups reported significant improvements in symptoms over the duration of 12 weeks, with no notable or outstanding exceptions. For those joint pain sufferers unable or unwilling to gett in the water, Pilates offers a suitable alternative.

The Muscle Mindset

Serious bodybuilders tend to prioritize developing biceps, chest, and quadriceps muscles, and perhaps endeavor to attain a "six-pack" with little thought to deep core musculature. Yet, the core stabilizers – those muscles found in the abdomen including the TVA and pelvic floor, lower back, and hips — perform a valuable service when lifting heavy loads: *protecting the integrity of the back.*

A basic weightlifting regimen aimed at hypertrophy involves mostly concentric movements, which by their very nature cause muscle tissue to *shorten*. As a result, gains in lean muscle mass and strength often come at the expense of flexibility. Pilates movements can compensate for that by making use of lighter weight loads and more eccentric movements, thus *lengthening* the musculature.

Fitting In Pilates Without Overtraining

Trainers often tout the phrase "exercise volume", helping clients understand that pushing themselves harder or more frequently can produce the benefits they seek. However, a delicate balance exists between a *dedicated* athlete and an *overzealous* one, beyond which the amount of exercise performed does more harm than good. This tipping point, wherein the frequency of fitness endeavors suddenly limits/impairs performance, often occurs innocently enough, either by insufficient recovery time or poor quality refueling. Known as overtraining syndrome (OTS), such a pattern can over time prove detrimental to the clients' goals of improved fitness.

Fitness experts agree that, although very different in nature, engaging in Pilates and strength training on the same day can put an athlete at risk of overtraining. At the very least, such a practice often proves counterproductive. Trainers must sometimes remind go-getter clients that without appropriate rest, hypertrophy cannot progress.

According to the NFPT, lean muscle mass needs sufficient opportunity to grow stronger and thicker with adequate recovery. **In an effort to maximize both strength and balance/flexibility/postural awareness, trainers might consider drafting workout programs that allow for alternating Pilates exercises with strength training, making sure to include a full day of recovery.**

A sample weekly schedule might include the following ~

- Monday: Lower-body training
- Tuesday: Pilates
- Wednesday: Upper-body exercises
- Thursday: Pilates
- Friday: Full-body workout
- Saturday: Pilates
- Sunday: Rest

Another option could place the rest day in the middle of the week, depending upon the client's schedule.

Training the Trainer?

Now the question arises as to whether a certified personal trainer must also show proficiency in the art of Pilates, in order to appropriately draft such a combination program for clients. This author never aspired to earn a certification in Pilates, relying rather upon personal experience as well as the fundamental movement patterns of the human body. We need not put our clients through the contortionist positions one associates with work on a Pilates reformer. The exercises outlined in a basic mat Pilates format can definitely suffice for the purposes we seek, and are fairly simple to demonstrate for clients.

Putting It All Together

If trainers feel the need to diversify a client's workout or to encourage flexibility in a muscle-bound individual, Pilates movements serve as a simple yet effective tool in achieving maximum results. By alternating training formats, all dimensions of the human body, from postural awareness to bench-pressing prowess, receive the attention they deserve.

The Importance of Being Consistent with Exercise

Every personal trainer knows unequivocally that being consistent with diet and exercise produces desirable results. As obvious as this may be to us, don't mistakenly assume your clients have a deep understanding of what being consistent really means. Research on exercise frequency and consistency abounds; sharing with your fitness clients the importance of being consistent and what consistency really means may relieve some of the pressure they place on themselves and be more likely to attain their goals.

What Does Being Consistent Mean?

The being "consistent" according to Merriam-Webster is to be "marked by harmony, regularity, or steady continuity**:** free from variation or contradiction". I like the first half of that. Finding harmony–a rhythm–in one's routine is where the magic happens.

We've all had a client who blazes into their introductory session with the best of intentions, oozing with enthusiasm and ready to commit to a lifestyle change they believe to be achievable. They proclaimed they will exercise five days a week and you had no reason to doubt that. But, three months later, you've figured out that they are showing up to their bi-weekly sessions but not doing the additional work on their own.

That's okay. Let *them* know that it's okay.

We might feel compelled to explain how lifting four to five days a week will optimally produce the hypertrophic growth associated with increased strength and fat loss. However, if your client can only realistically adhere to two to three days a week, then your role is to support them in the commitment to *those* days and alleviate any guilt associated with the mistaken notion that more days is what is *necessary* to achieve their goals.

Your Role as Coach

Your job as a coach is to cultivate an understanding of who they are as a person, nail down their unique needs, and help them to capitalize on their strengths.

Results will be realized more slowly, yes. But, what's more likely to inhibit progress is a self-imposed guilt trip fueled by their trainer's judge-y line of questioning…."Did you get to the gym this week, Mary??"

Before you lose Mary as a client altogether, lower your own expectations for your client and allow them to lower theirs if initial goals are not being met. You might be surprised to learn that letting them off the hook for the days they aren't seeing through allows them to be more present for the days that they are. In that, they are still being *consistent* those two days a week.

The Consistency Trap

More important than frequency, then, is finding that rhythm and maintaining it *most* of the time. This means that life occasionally happens. Women have babies, professionals lose jobs, divorces upend families. Having a rhythm disrupted does not mean the song has to end. But some folks with an all-or-nothing mentality believe that once they have fallen off the horse, all is lost. Getting back on might feel like the most daunting task because they feel as though all the work they've put in has gone *poof*!

This is where you can teach them about muscle memory. Muscle memory is not just a phrase, it is a studied phenomenon. **Researchers have determined that a muscle that was previous hypertrophied, and yet subsequently atrophies, will regain its size far more quickly than muscle fibers never challenged.** [1]

This is an important concept for your clients to understand. While there is a definite mental hurdle to returning to exercise after a hiatus, the physical challenge will never feel quite as painful as the first time around.

Aside from major life disruptions stalling an exercise program, we can also have an off week time and again. Remind your clients that they deserve some grace, and that missing a workout *here and there* will not be the destruction of their fitness progress.

Still, current guidelines recommend a minimum amount of physical activity a week (150 cumulative minutes of moderate exercise) in order to attain certain health benefits. We all would do well to explain these guidelines and that truly our minimum goal should be to achieve that much. Your role as a coach is to support and encourage, however—never guilt or shame.

The take-home here is to know the person in front of you, set realistic expectations for them, and if goals are easily met, you can always raise the bar.

How to Encourage Consistency

Motivation, mindset, and consistency are all closely linked. Folks who are intrinsically motivated are also more likely to be more consistent. It's nice that they have you, but they don't *need* you to show up. **Good news—some research indicates you may be able to increase your client's intrinsic motivation.**

When we talk about goals at the beginning of the business relationship, they tend to be fairly long-term goals not to be realized until, well, consistency has had a chance to pay off. But the key is to set more *proximal* goals and to do so within each exercise session. One study found that increasing intrinsic motivation with proximal goals led to increased exercise frequency.[2]

At the start of each session with your clients, lay out what it is you plan to do with them and what it is you specifically *expect* them to do.

You might say, “Last week you sprinted on the treadmill for the first time at an 8.0 mph pace for 30 seconds. That was awesome! Today, you’re going to sustain it for 45 seconds and do it twice!”

OR

“I was so impressed last week that you nailed that deadlift technique with a barbell. That was a feat to be proud of! Today, we’re going to load that bar with weight and you’ll do three sets of six reps. I *know* you can do this and you will feel so powerful!” Naturally, you should have a clear understanding of your client’s abilities and never load them with weight you are uncertain they can handle! **The point here is to set a goal within the session that results in a novel and measurable outcome you know they can achieve.**

More practically, sticking with the same time of day to work out may also help improve consistency outcomes. One study determined that exercises that reported physical activity at the same time of day every time (and it didn’t matter if it was morning, afternoon, or evening) were more likely to be consistent than folks who were all over the map with workout times.[3]

Help your clients develop a routine by assigning consistent workout times that work for them and have them schedule it in their calendar.

More Reasons to be Consistent

Outside of exercise outcomes, it turns out exercising consistently has a positive impact on social measures and cognition. A study of 364 exercisers found that those that perceived themselves to be consistent exercisers reported higher self-regulatory efficacy and those that felt they were inconsistent reported more exercise-related cognitive errors. [4]

Ultimately, it’s important to impress upon your clients that results are obtained from being consistent, but their version of consistency may look different than someone else’s. Support and encourage them regardless; being results-oriented will help illustrate how being consistent will pay off.

Garden of Eatin' ~ The Perks of Plant-Based Protein

The word "protein" hails from the Greek *proteios*, meaning "of prime importance". Throughout history, meat-based meals have tended to reflect affluent lifestyles, relegating "substandard" plant-based diets to the lower class. As fitness/health professionals, we can ***help dispel the myth that meals built around plant-based protein sources do not adequately support the body's myriad of processes.*** Rather, we see more evidence pointing to plant consumption as serving our bodies in the best possible way, including building strength.

The Body and Muscles Adapt

In recent years, the inclusion of plant protein sources in the American diet has grown, and evidence continues to accumulate on the integrity of plant protein sources with regard to stimulating muscle protein synthesis (MPS), exercise training adaptations, and post-workout recovery. A multitude of studies concur that plant-based proteins consumed over 8-12 weeks (considering *only* those sources offering adequate amounts of essential amino acids, especially leucine) can stimulate training results on par with those seen from consumption of animal protein sources.

Plant-Based Protein Popularity

Many plant-based protein advocates highlight a greater level of economic sustainability than what we observe with diets rich in animal protein. An interesting piece of data reveals that ~ 60% of dietary proteins consumed worldwide originate from plant sources; in fact, **an estimated four billion individuals worldwide exist on primarily plant-based meal plans.** Given that plant-based diets are routinely linked with a reduction in the occurrence of many kinds of cancers as well as type II diabetes and cardiovascular diseases, we can see why this culinary culture deserves attention.

Ample Anabolism

Many factors contribute to the anabolic potential of a protein source, including its total number/type of amino acids, essential amino acids, and branched-chain amino acids contained therein. A protein's level of digestibility also figures prominently. Biological values for common plant sources range from 56–74 out of a possible 100, while most animal-derived protein sources come in anywhere from 77-100. A similar dichotomy exists for net protein *utilization* values; plant sources range from 53–67 while animal sources range from 73–94, once again on a 100-point scale. While not as high as animal-sourced foods, plant-based protein foods can serve as a significant source of protein; eating more plants is never a bad thing!

Looking to Leucine

The leucine content of a protein source functions as a reliable predictor of MPS rates. **When comparing different protein sources, most trainers already know that whey protein boasts the highest percentage of leucine (~12–14%), which aligns with its superior ability to**

stimulate muscle protein synthesis. Moreover, animal protein sources generally contain greater amounts of leucine (8–9% for non-dairy animal sources, >10% for dairy protein sources) while plant sources typically contain only 6-8% leucine.

Several strategies exist to facilitate the anabolic potential of various protein sources:

- co-ingestion of plant proteins with additional amino acids or other protein sources
- supplementing plant sources with those amino acids deemed to be low or limiting
- increasing the size of the protein serving.
- some preliminary research shows that consuming omega-3 fatty acids with an amino acid infusion after resistance training can boost anabolic muscle activity.

"Complete" versus "Total" Protein

While not every plant-based food provides a "complete" protein, consuming a wide variety of plant sources ensures a sufficient intake of essential amino acids. The human body can inherently make use of the total amino acids ingested over the course of a day to provide the fuel necessary for muscle building.

Research has shown that *all* plants contain protein, and at least 14% of the total calories of every plant come from protein. If an individual consumes 2000 calories a day from plant sources containing a minimum of 14% protein, the total number of calories ingested from protein is 280. Given that a gram of protein provides 4 calories, dividing 280 calories by 4 reveals that such a meal plan can offer 70 grams of protein. An average female body requires a minimum of anywhere from 30-50 grams of protein per day, while men typically need 50-70 grams. Thus, it appears that if a person meets caloric needs with plant-based nutrition, protein requirements get satisfied. Though, muscle-building athletes may require more.

Plant-Based Powerhouses

For a nutrition-minded personal trainer with vegetarian/vegan clients, it comes as no surprise to learn that beans (27% protein), lentils (36%), chickpeas (33%), peas (30%), and kale (22%) provide the greatest culinary opportunity to acquire sufficient protein. However, beans and lentils do not stand alone as quality sources of plant protein, but when combined with grains like rice, fulfill the need for all essential amino acids.

Nature's bounty does offer many additional tasty, plant-based choices that fit the bill in rounding out a complete protein.

One cup of cooked **quinoa** provides approximately 8 grams of protein, in addition to more magnesium, iron, and zinc than most other grains. A 3-ounce serving of **tofu** provides approximately 8 grams of protein; the same amount of **tempeh** contains 11 grams of protein. Similar to quinoa, both of these sources come packed with fiber and iron, as well as potassium and calcium.

In addition to being a source of complete protein, **hemp** offers a healthy dose of linoleic acid (omega-6) and alpha-linolenic acid (omega-3), both considered essential fatty acids. Three tablespoons of raw, hulled hemp seeds boast 10 grams of protein along with iron, phosphorus, potassium, magnesium, and zinc. **Chia seeds**, too, provide 6 grams of protein and 13 grams of fiber, plus the added benefits of iron, calcium, selenium and magnesium.

Seitan, derived from the main protein in wheat, may not figure prominently in a gluten-free plant-based diet; but at 25 grams of protein per 3.5-ounce serving, seitan reigns as the richest of all plant protein sources. When cooked, this unique compound actually resembles the appearance of meat, a highly desirable quality among more discerning vegetarian/vegan chefs.

Other sources of complete plant proteins include amaranth, spirulina, buckwheat, sprouted grain bread, and nutritional yeast (this being an excellent additional to a vegan diet due to its high vitamin B content).

Powdered Plant-Based Protein Supplementation

Personal trainers often refer avid bodybuilding clients towards the use of protein powders, an easy way to boost intake following a strenuous workout. Unfortunately, the majority of popular brands derive from animal-based sources such as whey or casein.

A few high-quality protein powders on today's shelves do cater to vegan/vegetarian athletes, and make excellent use of plant-derived protein sources. Here we highlight some of the best from which to choose ~

- Peas
- Sprouted navy/garbanzo/lentil beans
- Flax/pumpkin/chia seeds
- Quinoa
- Almonds
- Alfalfa
- Rice

By combining various plant-derived protein sources in a single supplement powder, manufacturers increase the odds of delivering a highly diverse amino acid panel, replete with as much muscle protein synthesis power as what one finds from animal-sourced protein powders.

Final Thoughts

Whether you or your clients currently embrace a wholly plant-based approach to nutrition, more and more individuals have jumped on the interest bandwagon. Smart, sustainable, healthy and more potent than we perhaps realized, protein derived from the garden can go a long way towards helping athletes achieve the lean muscle mass they desire.

Decisions, Decisions- Making Decisions About Health and Fitness

In the realm of fitness and wellness, much of our new clients' judgment may rely on anecdotal evidence, celebrity marketing influence, short/long-term goals, and popular slogans that have woven their way into the cultural vernacular. Hard-to-break habits add to the dilemma. Read on to understand the collective feedback processes of the brain, and help your clients make better lifestyle decisions!

Choice Complexity

The complex decisions regarding lifestyle choices associated with food and exercise habits come packed with biological, social, and emotional variables. To avoid getting caught up in such tangled webs, many individuals seek out the simpler, more straightforward route, or what we might call "emotional choices"; in this arena, marketing experts and social media platforms exploit consumers by promising quick and easy fixes, regardless of their veracity. This inauthenticity contributes to the rapid decline of public health, hand in hand with skyrocketing healthcare costs.

Dual Decision Systems at Play

Seymour Epstein coined the term ***cognitive-experiential self-theory*****,** describing two distinct cognitive processes which guide our decision-making behavior:

System 1: a quick, almost automatic emotional response, also called intuitive/experiential

System 2: an analytical/rational response that works logically and methodically, similar to how the brain solves a mathematical equation

System 1 governs the decisions often made as knee-jerk responses, such as which door to use when entering an office building, or where to sit in a waiting room. While these choices seem innocuous, *some very important decisions — including those that influence our short-term and long-term health –often fall prey to System 1 thinking*.

Today's advertising industry knows just what words and images to use—for example, "Just Do It" or "No Pain, No Gain" — in order to tap into our System 1 decision-maker, where misled behaviors potentially turn into detrimental choices.

System 2 requires more time, as it harnesses intellectual lifestyle/health decisions. When attempting to devise a fitness program, or choosing among a myriad of eating plans for optimal health, the logistics of System 2 processing tend to yield a more personalized approach rather than the convenient "cookie-cutter" plan favored by System 1 thinking.

The Psychology of Decisions

The science of choice and decision-making encompasses a host of psychological processes. Research endeavors have included studies on attention span, information integration, and learning styles as well as the effects of goals and memories. The aforementioned Systems 1 and 2, defined by automatic versus deliberate processes, have led psychologists to consider the following:

- how and why we make certain mindful decisions
- how fitness/wellness professionals can help clients first comprehend how they made these decisions
- learn to then sidestep poor lifestyle choices in favor of healthier ones

Defining and Recognizing "Wellness"

Wellness, defined by some as an integration process above all, serves the all-important triad of mind-body-spirit. Personal trainers and lifestyle coaches may consider viewing wellness as an approach to life that enables clients to manifest the best possible version of themselves, given circumstances in their world at any given point in time. Including wellness in one's daily lifestyle is best attained by being fluid and adaptable to changes.

Clients often confess to personal trainers that intellectually they *know* the best course of action required to achieve healthy goals, yet either choose not to act on it, or having tried it, eventually slide back into poor behaviors. Human nature leads us to struggle against two very important principles: self-regulation and habits.

Habits, Regulation, and Energy

Self-regulation allows individuals to act in accordance with their optimal value system. At the same time, the downside of self-regulation is the high demand of mental energy required to persevere in this commitment.

Habits, on the other hand, do not require much brain effort whatsoever. According to Charles Duhigg, author of the bestseller *The Power of Habit: Why We Do What We Do in Life and Business*, **"Any behavior that can be reduced to a routine is one less behavior that we must spend time and energy consciously thinking about and deciding upon."**

The efficiency of habits, therefore, grants them power. Experts postulate that habits govern up to 40% of our daily behavior. As we move through life, then, both good and bad habits carry the ability to dictate (or at least influence) our health and wellness choices.

Once formed, habits weave their way into our brains, changing only when replaced with an even more compelling action. Rewiring our brains to move in a better direction ranks as one of

the most difficult human tasks. Self-awareness and regulation can play a huge part in cultivating more positive lifestyle changes.

Recognizing Obstacles and Forging Successful Decisions

Success in health and fitness endeavors mirror that of any other undertaking in our lives. Let's consider the commonly asked fitness question, "When is the best time for me to work out?" Personal trainers tend to respond to such an inquiry by telling clients to *exercise when energy and/or motivation can work in their favor*.

Self-awareness propels us to "act" when we feel the most productive. We must acknowledge, for example, that as a true early riser, one will undoubtedly fail at attempts to habitually exercise late at night. Knowing oneself also helps when deciding upon which mode of exercise to pursue. A thrill-seeker mountain bike enthusiast, for example, will never find success engaging in calming yoga or Pilates classes three times a week.

Self-awareness and choices enable us to make sound judgments regarding healthy decisions. Starting with the decision to commit a certain amount of time each week to forging a wellness-based lifestyle, we can begin to create healthier habits, purposefully strengthening them to function in our best interests. Armed with the knowledge and understanding of ***cognitive-experiential self-theory***, fitness professionals can help clients in their quest to discover/create the best possible version of themselves.

Does Leucine Lessen Longevity? Unraveling Mysterious mTor

The branched-chain amino acid leucine, long considered the kingpin of essentials for muscular growth, recently came under attack by some scientists as potentially lessening one's lifespan. Read more to learn about the debate, the details, and discerning the truth.

Counterpoint

Research has uncovered a previously little-known aspect of leucine that instigated some potentially unwanted attention. Leucine interacts with the body's mechanistic/mammalian target of rapamycin, known as mTOR, which serves to rid the body of damaged and older cells, making way for regeneration. As a result, leucine-induced rapamycin plays an important role in supporting longevity. mTOR may also provide an antiapoptotic (preventing cell death) function. **However, if excess leucine flowing through the body interrupts the action of rapamycin, some scientists believe one's life expectancy decreases.**

Maintenance of skeletal muscle mass depends entirely upon the balance between the body's anabolic and catabolic processes. The kinase known as ***mTOR*** plays an evolutionarily conservative role in balancing anabolic and catabolic processes. **mTOR controls, and attempts to strike an appropriate balance between, the competing processes of protein synthesis and preserving lean muscle tissue**. This holds true regardless of age.

A Good System Gone Awry?

The long-term outcome of mTOR activation may lead to different results from what one derives in the short term. While greater mTOR activity aids in muscular growth, it may not bode well for overall health; several studies implicate it in cellular processes potentially causing the uncontrolled growth of cancer cells.

mTOR controls the cell's protein synthesis. Excessive cell division supports the progression of certain types of cancers, especially those that utilize glycolysis for energy. Since mTOR increases production of those enzymes required to initiate glycolysis, some professionals feel that over-activating the mTOR pathway may pave the way for the development of certain malignancies. Turning on mTOR requires the presence of ample leucine in the body; some data exists to reveal that high levels of circulating BCAAs lead to insulin resistance and other metabolic diseases.

The Plant-Based Leucine Theory

According to functional medicine specialist Dr. Frank Lipman, the overall effects of protein on the human body shift as we age, and so do the amounts needed. Lipman goes so far as to say that after age ~45, animal protein can directly affect the genes responsible for one's longevity.

To this point, Dr. Lipman advocates the ever-popular shift to a more plant-based protein diet. His reasoning points to the inclusion of more collagen in one's daily consumption, derived from

animals yet typically looped in with plants. “Collagen is the one animal-derived protein that does not have [much BCAA] amino acids,” says Lipman. “It’s a great source of protein that doesn’t have a negative effect on longevity genes.” Fewer circulating BCAAs (including leucine), he reasons, will not overly stimulate mTOR. “**You don’t want to stimulate [mTOR] if you want to age well**,” Lipman adds. *This particular viewpoint remains a topic of much debate.*

More Good Science, Less Discouraging Observations

Other encouraging scientific news seems clearly dismantle this leucine/mTOR/longevity theory. After the age of 40, muscles become less sensitive to the effects of leucine and insulin. The body begins to move more towards *more wasting* in the absence of sufficient protein. While metabolism does slow down with age, requiring fewer overall calories, boosting protein remains critical with age. **Studies show that it takes a greater leucine spike from food to activate mTOR in a 70- year-old than a young adult**; the bodybuilder for whom 20g of whey protein suffices may need upwards of 40g for successful muscle building through the later years.

The molecular switch for stimulating muscle protein synthesis, mTOR is activated by training with weights and prudent consumption, most notably protein sources with a high leucine count. **It would run counter to intuition and most scientific evidence to think that synthesis over the breakdown of lean muscle mass could possibly lead to a shorter, less desirable lifespan.** Afterall, frailty is highly predictive of a number of negative health outcomes but also hospital readmission and death. In addition, in rodent studies, diets rich in BCAAs have a positive effect on the mean lifespan of male mice.

Conservation of Energy

Dr. Michael B. Zemel posed an interesting question to his research team: what was the energy source behind leucine’s mTOR activation? “What drove my curiosity was all of the work that said that leucine was an mTOR activator. I wanted to know where the energy came from. Because if it’s stimulating mTOR, and you’re building protein from mTOR, that’s energetically expensive – you’ve got to fuel it somehow. So where does the fuel come from?”

As it turns out, mTOR activation energy relies on the ability of leucine to stimulate an increase in the catabolism of fatty acid. “That was curious, because you’ve got something that stimulates both anabolism and catabolism,” says Zemel. “Biology doesn’t usually work that way, where you concurrently upregulate oppositely directed pathways, and I found that very bothersome. So, I began to dig into it a little more.”

Zemel’s further research revealed that *the concentration of leucine responsible for building muscle protein differed greatly from that required to drive catabolism.* “We began looking at several systems and, after doing some experiments found that leucine was a direct allosteric activator of SIRT1 [a gene closely correlated with longevity],” he concludes.

mTOR, Leucine, and Aging

Trainers know that post-workout supplement shakes tend to contain more than an adequate supply of BCAAs. Ample leucine ingested post-workout targets mTOR signaling as well as phosphorylation of compounds called downstream effectors. This in turn directly increases protein synthesis, exactly the desired outcome of heavy resistance training. The importance of this increases as we age.

Reduced muscle mass and strength, both well-documented predictors of frailty, lead to an increase in falls among older adults. Scientists found that sarcopenia — age-related diminishing of strength/muscle mass – may in fact result from the anabolic resistance of aged muscle to nutrition, most particularly the sensitivity to essential amino acid stimulation. Once again, post-exercise supplementation of protein or simply BCAAs alone seems to enable older adults to preserve hard-earned muscle mass. As the leucine contained therein increases muscle protein synthesis, it also attenuates muscle breakdown, keeping older individuals stronger. Strength offers a higher quality of life in our later years, regardless of longevity.

Offering Other Explanations

The research pointing to excess leucine consumption as shortening lifespan may have more to do with variables other than leucine. If protein ingestion has led to excess circulating leucine, perhaps said individuals overconsume in general, meaning excessive calories overall. We already understand how that contributes to morbidity and mortality. Another speculation takes into account one's level of physical activity. Individuals who both overconsume and lead sedentary lives further increase their chances of dying sooner…no fault of the extra leucine.

The take-home message: these theories need vastly more research to elucidate the mechanisms of leucine and mTOR as they potentially relate to lifespan.

Nutritional Periodization: Fueling for the Work Ahead

Prudent nutrition plays a key role in promoting hypertrophy, power, and strength when coordinated expertly with resistance training. If we take that concept and adjust it to fit the *training periodization model*, personal trainers can propel an athlete's progress light-years ahead utilizing nutritional periodization.

Pairing Food with Fitness

Over the last decade, in support of training periodization our industry embraced an emergence of the concept *"nutritional periodization"*. Periodization within the fitness realm refers to a division of training cycles, typically based upon a 12-month time frame. Training gets broken down into specificities: *microcycles*, which sometimes may last only one week; *mesocycles*, which typically last a quarter of the year; and *macrocycles*, long-range year-long planning. The difference between cycles lies in the manipulation of training volume, frequency, intensity, and time. Experts now see the benefit of similarly matching an athlete's nutritional needs with his training cycle, since each of these protocols places unique demands upon the athlete's body.

In 2007, the *International Association of Athletics Federations Nutrition Consensus* provided the first basic guidelines for nutrition periodization. In his 2017 article entitled "Periodized Nutrition for Athletes", Asker Jeukendrup defined this novel concept as "the planned, purposeful, and strategic use of specific nutritional interventions to enhance the adaptations targeted by individual exercise sessions or periodic training plans, or to obtain other effects that will enhance performance in the longer term." This applies to all forms of serious and/or competitive athletics, where energy demands must get prioritized.

BMR and Energy Output

The Basal Metabolic Rate (BMR) of the human body encompasses an estimate of the energy required to achieve every cellular and tissue process that sustain daily physiological activities. This number, roughly estimated by multiplying one's weight in kilograms by 24, must further take into account one's energy expenditure in terms of physical output. Experts suggest the following multipliers: 1.3 for low activity/sedentary individuals, 1.4 for those who stay moderately active, and/or 1.5 for highly active and often professional bodybuilders.

Once armed with the above value, the detail that follows takes into consideration the various macronutrient requirements to match an activity level. When pairing nutrition appropriately with training periodization, one's calories/macronutrient ratios will certainly change, in an effort to maximize favorable adaptation.

Carb-Focused Nutrition Periodization

A very important aspect of resistance training rests in the *body's ability to enhance the various metabolic pathways which serve to improve the rate/storage of adenosine triphosphate (ATP) production*. Some highly trained and competitive athletes look to increase the body's

stores/availability of endogenous fuels, as well as and enhancing the body's ability to utilize exogenous fuels consumed just prior to exercise. Scientists have delved even deeper than this in their research, seeking ways to improve the delivery of nutrients and oxygen to working muscles, lower the level of by-products, and raise the body's efficiency at producing ATP, the ultimate energy source.

The science-based athletic community has come to realize the positive effects of prudent dietary plans when paired with resistance training. **We now recognize that a myriad of substrates, including muscle glycogen and free fatty acids, act as cellular regulators of the body's adaptation to strength training, in addition to serving as muscular fuel.**

More recently, the concept of periodization of CHO availability has been explained using the theoretical model of "fueling for the work required", or adjusting CHO availability to better align with the goals/demands of that specific training session. Scientists studying in this field demonstrated how short-term (3-10 weeks) training programs, in which ~50% of workouts start with reduced muscle glycogen stores and/or provide for sub-optimal exogenous CHO, show little to no difference on training outcomes when compared to engaging in exercise sessions with ample glycogen stores.

They concluded that the concept lacks any evidence that might prove how such dietary alterations enhance training ability or improve performance. **It would appear that the knowledge of just how much a particular workout specifically requires in terms of carbohydrate demands remains elusive at best; studies must continue to determine the optimal method of carb-fueling for each period within the training cycle.**

Strategies to Promote CHO Utilization During Exercise

Carbohydrates from any source provide impactful fuel for all athletic performance. **When compared to fat oxidation, carbohydrates can elicit ~5.5% more ATP per liter of oxygen consumed.** This knowledge laid the groundwork to which most athletes adhere: that ample availability of CHO optimally provides for the substrate needs of a training session. Still, not all sports nutritionists concur on this point. The rationale for deliberately promoting low CHO availability in relation to a training session lies in the belief that such an environment may potentially activate signaling pathways that in turn increase adaptations such as mitochondrial biogenesis, angiogenesis, and increased lipid oxidation.

The plates below show a visual example of how to apply this protocol to your clients' meal planning, simply through variations in consumption of carbohydrates, protein, and fat.

Source: Reguant-Closa, Alba & Roesch, Andreas & Lansche, Jens & Nemecek, Thomas & Lohman, Tim & Meyer, Nanna. (2020). The Environmental Impact of the Athlete's Plate Nutrition Education Tool. Nutrients. 12. 2484. 10.3390/nu12082484.

Consider the client seeking to maximize his adaptation process throughout the bulking phase. To increase expenditure of energy, this time period requires an increase in calories, allowing for muscle growth while also adequately supporting training intensity and/or volume. With carbohydrates catering to energy demands, protein intake stays about the same regardless of the training cycle; however, many athletes choose to up their protein consumption during competition phase, helping hormone function and the all-important recovery.

CHO Limiting

Training low, a term that refers to exercising with low-carbohydrate availability, includes reduced muscle /liver glycogen, low-carbohydrate intake post-workout, or a combination of the two. While such a practice does not always fit a traditional model of eating, the rationale makes sense: training adaptations, which come about as a result of small changes in protein synthesis, might tweak a particular phenotype and thus enhance the athlete's performance. Nutrition influences many of these cellular processes –transcription, translation, stable messenger RNA, unique stress signals, and enough amino acids amino acids for protein synthesis — lending even more credence to the advantage of specific consumption.

"Feeding" Off of Each Other

In a symbiotic relationship, one's training results become a function of the macronutrient fuel entering the body, just as nutritional protocols depend upon resistance training demands/goals. Nutrition Periodization meets the energy fluctuations and goals of each training phase. While every client's body will react differently to dietary alterations, proper nutrition periodization that matches output demands enables clients to train harder, adapt faster, build greater endurance, and ultimately, better meet their goals.

Understand the Glycemic Index and Glycemic Load

Food consumed as fuel for life's demanding activities not only provides energy, but also has a direct effect on circulating blood glucose levels. Understanding a food's glycemic index and glycemic load–two different terms–helps us aid clients in strategizing the most beneficial meal plan for their needs.

The Origins of GI

The glycemic index (GI) concept was originally introduced to examine different sources of carbohydrate-rich foods and their effect on post-meal blood sugar levels. This concept provided a reliable and useful system of classifying carbohydrate-containing foods according to how fast they are digested and absorbed during the 2-hour period following consumption. **Low-GI foods typically get broken down slowly, whereas high-GI foods provide a more rapid fuel, resulting in different glycemic responses.** In general, low GI foods include most fruits and vegetables, beans and legumes, and whole-grain products. Refined grain products and potatoes have a higher GI.

The Carb-Colon Connection

The concept of a food source's effects on the body's insulin response has been studied intensively, yet scientists agree on the necessity of more research in order for a full picture to emerge. One study attempted to determine the possible differences in glycemic index (GI) based upon either the "available" or "unavailable carbohydrate" load. This selection separates carbs based upon their content of simple/complex, sugars/starches, and available/unavailable carbohydrates. Available carbohydrates in a food exclude indigestible carbohydrates, commonly referred to as dietary fiber. Unavailable carb sources incorporate the quantity of total starch minus resistant starch.

Starchy foods that lead to a relatively flat glycemic response include legumes, barley/bulgur/rice/pasta, and whole-grain breads, especially pumpernickel. Adding these foods into a regular meal plan helps to reduce blood glucose, insulin and lipid levels. The addition of fiber almost always lowers the glycemic response even for foods with a high GI; these results could prove useful as a strategy for crafting meal plans, particularly for diabetics.

The large intestine or colon bears the responsibility of breaking down foods that we consume. As soon as contents of the small intestine pass into the colon, millions of bacteria begin a fermentation process to break down the carbohydrates. Carbohydrate fermentation benefits the host: the bacteria acquire energy while simultaneously releasing necessary short-chain fatty acids. Since the higher fiber content of low GI food sources lessens/slows their digestibility, more of the carbohydrate can enter the colon, thereby increasing both colonic fermentation and short-chain fatty acid production.

Glucose and ATP

Our bodies utilize glucose, the product of carbohydrate breakdown, to manufacture ATP (Adenosine Triphosphate), the preferred energy fuel. **Therefore, nutrition experts recommend consuming predominantly medium-to-low GI complex carbs throughout the day in order to sustain energy levels for peak performance of daily functions.** Simple carbohydrates such as fruit, which ranks higher on the GI scale, serve the body well at times when depleted liver glycogen needs replenishing, either upon waking in the morning or immediately following a workout.

Glycemic Load Lends Clarity

The closely related concept of glycemic load (GL) accounts for the *amount of carbohydrates in a food serving*. **The GL provides a more accurate picture of a food's impact on circulating blood sugar levels.** "The glycemic index ranks foods based on how quickly they're digested and raise blood glucose levels," says Sandra Meyerowitz, MPH, RD, owner of Nutrition Works in Louisville, Kentucky. "It's glycemic load that takes into consideration every component of the food as a whole, so it's a different number. It changes everything," she adds. Some dietitians and physicians believe that individuals living with the challenges of diabetes might find both the GI and the GL of foods helpful in avoiding spikes and crashes of blood sugar levels. Scientists at the University of Sydney, the first to present the idea of glycemic load, have developed a formula for determining the glycemic load of a food: *multiply the GI of the food by the grams of available carbohydrates in a serving of the food, then divide this total by 100.*

We can use an apple as an example, a food with a glycemic index of 40 and containing 15 grams of available carbohydrates. Glycemic load =40 x 15 divided by 100, or 6. Such a low GL would deem apples a safe snack during the day for individuals tracking their blood sugar. In sharp contrast, consuming a single serving of white potatoes, packing a GI of 102 and 37 grams of available carbs, nets a GL of 38. Calculations get muddled a bit for a food such as watermelon. While its GI ranks high, a serving contains relatively few grams of available carbs. Therefore, even with a high glycemic index, the glycemic *load* remains low.

Worth the Work?

Although clients often seek our opinions on the most appropriate foods to choose either before or immediately following exercise, the majority may not wish to devote the time necessary to tackle these mathematical equations. However, similar to the workouts themselves, understanding the complexity of GI /GL and choosing the best meals for effective fuel *requires a willingness on the part of the client to ensure he derives the most out of the investment he chose to make for better health and an improved physique.* Once we have a firm grasp on these concepts, we can better serve our clients by providing a more complete program for achieving their goals. Timing of nutrient intake, the nutrients themselves, and the effects they have on blood sugar and insulin release all contribute to a more successful body transformation.

DECEMBER 2021: SELF TEST

1. The word 'Osteoporosis' literally means:
    a. Little bone
    b. Bone density
    c. Porous bone
    d. Bone problem

2. Dual energy x-ray absorptiometry (DEXA) is a test that:
    a. Measures bone thickness
    b. Measures calcium and other minerals in the bones
    c. Measures lean and fat tissue in the body
    d. DEXA measures all of these

3. Which of the following bones are most likely to break when an individual has osteoporosis?
    a. Bones in the spine, hip and forearms
    b. Bones in the hip, hands and ankles
    c. Bones in the hands, legs and feet
    d. Bones in the forearms, ankles and fingers

4. What is DOMS?
    a. Disabled Operating Muscle Syndrome, a permanent condition that prohibits regular exercise
    b. Damaged Operating Muscular System, a temporary condition that may become permanent if not surgically corrected
    c. Delayed Onset Muscle Soreness, a temporary condition of muscle tenderness or pain occurring after a muscle is taxed
    d. Displaced Occurrence of Muscular Structure, a correctable condition that occurs after an injury to muscles of the same group

5. DOMS is most likely to occur when:
    a. Beginning a new exercise program or re-starting a program after a long break
    b. Incorporating a new movement that your body is unaccustomed to and/or focusing on eccentric lifts
    c. Engaging in endurance activities longer than normal
    d. All of these can cause DOMS

6. Fascia is:
    a. The tendons and aponeuroses on the ends of bones that keep them from rubbing together
    b. Connective tissue sheets of fibrocollagenous bundles which aid in the stabilization of the body
    c. The superficial layer of facial skin that acts as an anti-aging compound
    d. The thin layer of protective film around organs which aids in keeping antigens from entering

7. Fascia is anatomically subjected to the greatest amount of force and stress with:
    a. Increased trunk flexion
    b. Decreased trunk flexion
    c. Dynamic stretching
    d. Static stretching

8. All training programs should start with:
    a. Side bending
    b. Jump activities
    c. Bench pressing
    d. Core activation

9. Leverage Based Tension encourages stability with exercises that:
    a. use asymmetrical loads and/or holding a weight far away from the body's midline
    b. involve balanced loads in the same plane of motion with minimal weight
    c. use movements past the range of motion to stress joint structures
    d. None of these are correct ways to use leverage for gaining stability

10. Advantages of leverage training are:
    a. Improves grip strength
    b. Increases shoulder strength and mobility
    c. Builds rotational and total body strength
    d. All of these are advantages of leverage training

11. Pairing Compression-based tension with Leverage-based stability exercises in a single training session will:
    a. increase occurrences of injury
    b. enhance ability to perform mechanically
    c. support digestive function
    d. decrease improvements in strength

12. Nitrates occur in:
    a. Nature
    b. Nitrites
    c. Both
    d. Neither

13. The largest percentage of dietary nitrates come from _____ and are linked to improvements in _____.
    a. red seeded fruits / joint inflammation
    b. fresh water fish and tree nuts / digestive health
    c. dark green leafy vegetables / muscle function
    d. carbohydrates in grain breads and pastas / stability and flexibility

14. Increasing the intake of green leafy vegetables in a more plant-centered meal plan may have significant benefits for:
    a. production of nitric oxide
    b. blood flow in muscles during exercise
    c. decreasing risk of cardiovascular disease
    d. All of the above are benefits

15. Cartilage is:
    a. the tough yet flexible connective tissue covering the surface of joints
    b. a shock absorber between bones
    c. Both of these
    d. Neither of these

16. Microfracture is:
    a. a procedure intended to stimulate growth of new cartilage
    b. a small break in the cartilage at a joint
    c. a procedure that removes cartilage and repairs area with a cartilage substitute
    d. a fracture that occurs in the bone at a joint where cartilage is damaged

17. Platelet rich plasma (PRP) therapy is used to:
    a. mediate inflammation and catabolism through the secretion of anti-inflammatory factors
    b. act as a non-operative management of osteoarthritis
    c. promote the release of fibrinogen which helps with wound healing or ligament tears
    d. PRP is used for all of these

18. The discipline of Pilates encourages flexibility and:
    a. muscle size
    b. breathing techniques
    c. power jumping
    d. long distance running

19. Pilates can counterbalance weightlifting by making use of _____ _____, more eccentric movements, thus _____the musculature.
    a. heavier weights / shortening
    b. lighter weights / lengthening
    c. heavier weights / lengthening
    d. lighter weights / shortening

20. Researchers have determined that a muscle that was previously hypertrophied, yet subsequently atrophies, will:
    a. regain its size far more quickly than muscle fibers that were never challenged
    b. regain its size much more slowly if those muscle fibers have been challenged in the past
    c. have no impact on how long it will take for the muscle to become hypertrophied again
    d. never be able to reach the same hypertrophied size

21. When exercise is performed at the same time of day every time, it will:
    a. increase the likelihood of consistency and positive outcomes
    b. have no impact on consistency or outcomes of exercise

22. Plant-based proteins consumed over 8 to 12 weeks that can stimulate training results are:
    a. those that offer adequate amounts of fatty acids especially vitamin D
    b. those that offer significant amounts of vitamins and minerals especially calcium
    c. those that offer adequate amounts of essential amino acids especially leucine
    d. never as adequate as those from the consumption of animal proteins sources

23. Which of the following strategies facilitate the anabolic potential of various protein sources?
    a. Decreasing the size of the protein serving
    b. Co-ingestion of plant proteins with additional amino acids or other proteins sources
    c. Supplementing plant sources with fatty acids and red meats
    d. Fasting every other day

24. When combined with grains, like rice, which of the following is the best source of plant protein fulfilling the need for all essential amino acids?
    a. Beans and lentils
    b. Fruits and vegetables
    c. Fish and poultry
    d. Peanut butter and yogurt

25. Cognitive-experiential self-theory describes:
    a. two distinct cognitive processes
    b. a quick 'knee-jerk' response
    c. an analytical rational response
    d. all of these are part of this theory

26. Human nature leads us to:
    a. do all the right things all of the time
    b. struggle against self-regulation and habits

27. Which of these cultivates more positive lifestyle changes?
    a. Self awareness
    b. Habits
    c. Antidepressants
    d. Social pressure

28. Maintenance of skeletal muscle mass depends entirely upon the balance between:
    a. environmental factors of elevation and sea levels
    b. the number of workout sessions and nights of sleep per week
    c. mitochondrial and metabolic regeneration
    d. the body's anabolic and catabolic processes

29. Leucine is a _____ which serves to rid the body of damaged and _____.
    a. fatty acid / unused protein
    b. branched-chain amino acid / older cells
    c. fatty acid / older cells
    d. branched-chain amino acid / unused protein

30. Leucine interacts with:
    a. mTOR
    b. ATP
    c. mHR
    d. ADP

31. Ample leucine ingested post-workout will, in turn:
    a. increase protein synthesis
    b. decrease benefits of the workout
    c. increase metabolic acidosis
    d. decrease hypertrophy

32. Periodization within fitness refers to:
    a. a period of time where the training focus changes, within 1 workout session
    b. a period of time where the focus is on training and then switches to nutrition, generally done over a 6 week period
    c. a division of the training cycles, typically based upon a 12-month time frame
    d. a division of the nutritional cycle, typically based upon a 6-month time frame

33. In periodization, cycles get broken down into:
    a. microcycles, mesocycles, and macrocycles
    b. fiscal, annual, and monthly
    c. microperiods and macroperiods
    d. sessions, bouts, and periods

34. An estimate of the energy required to achieve every cellular and tissue process that sustains daily physiological activities is:
    a. Basal Metabolic Rate, BMR
    b. Karvonen Estimate, KE
    c. Weekly Caloric Intake, WCI
    d. all of the above are factors

35. A very important aspect of resistance training rests in the body's ability to enhance the various metabolic pathways which serve to improve the:
    a. growth/new production of muscular glycogen cells
    b. rate/storage of adenosine triphosphate (ATP) production
    c. movement/delivery of fatty acids to adenosine diphosphate (ADP) production
    d. transformation of carbohydrates into usable protein

36. ‘Training Low’ is a term used to describe:
    a. Exercising lower body only
    b. Exercising with low-carbohydrate availability
    c. Exercising with low protein availability
    d. Exercising that is low impact and low intensity

37. The origin of the glycemic index was to:
    a. examine the different sources of carbohydrate rich foods and their effect on post-meal blood sugar levels
    b. research the impact of various carbohydrate rich food on the blood sugar levels of diabetics
    c. compare calories counts between carbohydrates and proteins in various foods
    d. display the impact on various protein rich foods with fat gains per serving

38. Low-GI foods typically get broken down _____, whereas high-GI foods provide a more ____ fuel.
    a. quickly / long-term
    b. quickly / rapid
    c. slowly / consistent
    d. slowly / rapid

39. The Glycemic Load (GL) accounts for:
    a. the amount of fat in food
    b. the number of calories in food
    c. the number of carbohydrates in food
    d. the amount of protein in food

40. The GI ranks foods based on:
    a. how effectively their nutrients are transported to all systems
    b. how quickly they’re digested and raise blood glucose levels
    c. how slowly they’re digested and lower blood sugar levels
    d. how efficiently they’re used by the body and support cardio function

SIDE 1

○ RESCORE ○ MARK ✓ ○ TOTAL ONLY/BOTH SIDES

Trans-Optic® forms by NCS Pearson MM19641-2 654321

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42	Ⓐ	Ⓑ Ⓒ Ⓓ Ⓔ
43	Ⓐ	Ⓑ Ⓒ Ⓓ Ⓔ
44	Ⓐ	Ⓑ Ⓒ Ⓓ Ⓔ
45	Ⓐ	Ⓑ Ⓒ Ⓓ Ⓔ
46	Ⓐ	Ⓑ Ⓒ Ⓓ Ⓔ
47	Ⓐ	Ⓑ Ⓒ Ⓓ Ⓔ
48	Ⓐ	Ⓑ Ⓒ Ⓓ Ⓔ
49	Ⓐ	Ⓑ Ⓒ Ⓓ Ⓔ
50	Ⓐ	Ⓑ Ⓒ Ⓓ Ⓔ

KEY ITEM COUNT

0	0	0
1	1	1
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7
	8	8
	9	9

1 FEED THIS DIRECTION

NFPT ID

0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9

MARKING INSTRUCTIONS

Use a No. 2 Pencil

Ⓐ ● Ⓒ Ⓓ Ⓔ
Fill circle completely

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
Erase cleanly

SCORE		# CORRECT
		% CORRECT
RESCORE		# CORRECT
		% CORRECT
ROSTER NUMBER		SCORE
		RESCORE

NAME _____

SUBJECT **DEC 2018 CEC Self Test**

PERIOD _____ DATE _____

TEST ANSWER SHEET B
Form No. 19641

NCS Pearson™

tape here

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tape here

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PLACE
STAMP
HERE

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