#### **Z-Health Performance**

Presents

### **Essentials of Elite Performance**

Day 1



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### You ARE Your Brain!

"Everything you have ever felt or done in your life was due to brain function. At the most basic level, the intricate firing rates and patterns of your brain both determine who you have been and, more importantly, who you will become. All human change represents changes in that individual's nervous system. All that we are is brain-derived."



### Why Is The Brain So Important?

You can change the tires, improve the struts, work on the transmission, and change the decals on the outside of car. However, most of those changes will make little difference if the engine is malfunctioning. The same is true of the human body!





# Let's Begin With Neurology Simplified

<u>The Nervous System Does 3 Things</u>

1.Receives Input (Afferent)

2.Decides What the Input Means and What to Do About It (Interpretation & Decision)

3. Creates Motor Output (Efferent)



## **Neurology Simplified: Inputs**

<u>Exteroception:</u> Monitoring the external environment

- 1. Sight
- 2. Smell
- 3. Hearing
- 4. Taste
- 5. Touch



### Neurology Simplified: Inputs



Interoception: Awareness of bodily sensations & feelings

Heart Rate
 Respiration
 Visceral Organs
 Thermoregulation
 Sense of Ownership



# Neurology Simplified: Inputs



#### Proprioception:

- Awareness of limb & body position in space
- 1.Mechanoreceptors2.Baroreceptors3.Thermoreceptors4.Chemoreceptors5.Electromagnetic Receptors6.Nociceptors

#### **Everything CAN Matter!**



#### How Many of These Inputs Do We Typically Assess?



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### Neurology Simplified: Interpretation & Decision



#### Interpretation:

- Integration with other senses, memories, and predictive processes.

1.Old Brain First 2.THEN New Brain

#### Decision:

- Can be made at
  - either level.



**Conscious Thought Decision Making** Movement **Conscious Sensation** 

#### Your Brain Divided

### Basic Brain "Functional" Divisions

#### The Old 1st Brain

- Old Brain
- Non-Reasoning, Non-Rational
- Seat of Emotion
- Reviews and Judges All Incoming Stimulus
- Acts as GATEKEEPER to 2<sup>nd</sup> Brain
- Brainstem, Superior Colliculus, Inferior Colliculus, Limbic Lobe
- Only Interested in Answering 1
   Question:

#### IS IT SAFE?



### The New 2<sup>nd</sup> Brain



#### The New 2nd Brain

- New Brain NeoCortex
- Conscious Thought
- Memory
- Language
- Creativity
- Decision Making
- Movement
- Conscious Sensation
- Vision
- Enacts Decisions

### Neurology Simplified: Outputs



PAINDizzinessFatiguePoor MovementInflexibilityPoor BalanceImmobilityMigraines

Pain Free Movement Great BalanceHigh CoordinationEndocrine HealthStrengthImmune HealthSpeed

### Your Expectation Creates Your Reality...

#### 400,000,000,000 (400B)

Total Signals/sec.

2,000

Unconscious Awareness/sec.

40

Conscious Awareness/sec.

7 (+/-2)





### Job #1 – Survival!

Is The Body More Oriented Toward Survival or Performance?



#### How Does The Brain Keep Us Alive?



Survival processing in the human brain can be summed up in two words:

#### PATTERN RECOGNITION (or more simply: PREDICTION)



#### How Does The Brain Keep Us Alive?



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Two Things Your Brain Needs To Stay Alive:

1. Fuel (Oxygen, Glucose)

2. Activation (Use It or Lose It)



#### Your Brain's Basic Feeding Pattern

Bottom To Top
 Back to Front





#### Frontal Lobe

- Executive Function
- Decision Making
- Cognitive Thinking
- Inhibition
- Voluntary Movement

#### Three Reasons To Focus On The Nervous System

- 1. The Governing System
- 2. The Fastest System
- 3. The Most (Anatomically) Stable and (Functionally) Plastic System



# Movement Neuroanatomy



In terms of movement neurology in this course, we are primarily interested in 3 different brain regions:

- 1. Cerebellum Coordinates and "Fixes" Movement Errors
- 2. Frontal Lobe (Cortex) Initiates Movement
- 3. Pontomedullary Reticular Formation (PMRF) – Posture, Global Muscle Tone, and Autonomic Control

# The Cerebellum

Cerebellum – Integrates (and simplifies) the complex data generated from all of our body systems and cognition. The cerebellum performs these tasks in movement:



- 1. Coordinates complex movements ipsilaterally.
- 2. Is responsible for the movement ABC's (Accuracy, Balance, Coordination)
- 3. Directly stimulates the contralateral cerebral cortex (frontal lobe)

# **R-Phase Neurology Rules:**

1. All sensory input eventually goes to the contralateral cortex, except smell.

2. Voluntary movement is created by the contralateral cortex, and controlled by the ipsilateral cerebellum (remember Accuracy, Balance, Coordination).



# 8 Levels of Performance Model



#### Understanding the Neurology of Movement

- Healthy, strong movement requires healthy, active neurologic signaling
- If deficits exist in the Cerebellum, Cortex, or PMRF then movement and strength suffers!



# Inputs to the PMRF

Increase activation of the PMRF by stimulating:

Ipsilateral Cortex
 Ipsilateral Cerebellum
 Ipsilateral Vestibular
 System



# Nervous System Inputs... Expanded



#### Job #2 – Movement!

"Movement is the basic currency of health, fitness and performance. Great movement produces healthy, pain-free, high-level performance. Bad movement promotes pain, dysfunction, and progressive decreases in movement, which themselves lead to progressive decreases in brain function and health."

#### Movement Is Life.





#### **Movement Creates Structure**



The body you have is the body you've earned by the way that you move.



### Wolff's Law and Davis' Law



Bones and soft tissues remodel along lines of chronic stress.

#### Form Follows Function!

In most cases, WALKING is the single strongest, most chronic, full-body loading event our bodies undergo. So, if you want to fix both short and longterm problems, as well as increase performance and efficiency – fix their gait.



### Ground Forces Math – Load in Ibs

#### How Hard Do We Strike the Ground?

- During Walking: 1.07-1.2x Bodyweight
- During Running: 2.0-2.9x Bodyweight
- During Sprinting: 4.60-5.5x Bodyweight

#### <u>The Math</u>

- Average Male: 200lbs
- Average Steps Per Day = 8,341
- 200lb x 1.2= 240lb/Step
- 240lb x 8,400 = 2,016,000lb per day
- 2,016,000 x 7 = 14,112,000lb per week
- 14,112,000 x 52 = 733,824,000lb per year

#### Do you think a small joint issue could become a major problem? www.zhealtheducation.com



#### R-Phase Gait Assessment & Neurology

#### **4 Common Functional Neurologic Presentations In Gait**

- 1. Bobblehead
- 2. Loss of Arm Swing
- 3. PMRF Gait Patten
- 4. Cerebellar Gait Pattern

#### Two Vital Assessment Concepts



 If you're not assessing, you're guessing.

2. Change occurs at the speed of the nervous



### Forms of Assessment #1

#### Active Range of Motion (AROM)

- 1. Shoulder Flexion (Arm To Front)
- 2. Shoulder Abduction (Arm To Side)
- 3. Shoulder Extension (Arm Behind)
- 4. Trunk Forward Bend
- 5. Trunk Rotation





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#### Forms of Assessment #2

#### Strength

Rate of Perceived Exertion (RPE)

Grade the difficulty of the movement using a 1-10 scale:

1 - - - - - 10 Extremely Extremely Easy Hard

### Forms of Assessment #3



#### Single-Leg Balance

Eyes Open or Eyes Closed



### Forms of Assessment #4

#### **Functional Activities**

Improved quality of movement, decreased pain, and increased movement speed all indicate a positive adaptive response in the nervous system.



### Input Drill #1 - Digit Span Testing

#### Sensory Input for Cortex & Cerebellum

- 1. Have the client hold their hands out, fingers spread, with eyes closed.
- 2. Trainer touches 2 fingers at the same time.
- 3. Client is asked to say how many fingers are <u>in between</u> the two that were touched.
- 4. Re-Assess after 10 attempts.





### Input Drill #2 - Pencil Pushups

#### The Drill: Pencil Pushups

Training to maintain single focus from near to far, and far to near

- 1. Begin at arm's length, holding the pen directly in front of the eyes.
- 2. Slowly bring the pen toward the <u>bridge of the</u> <u>nose</u>, watching it with both eyes.
- 3. <u>STOP</u> moving the pen when the target doubles.
- 4. Slowly return to the starting position, watching the target with both eyes.
- 5. Re-Assess after 1-2 repetitions.



#### Input Drill #3 - Near/Far

#### The Skill: Near/Far Focusing

The ability to change focus quickly and accurately from one distance to another.





### Respiration Drill #1 - Diaphragm Stretch 1

- 1. Supine, arms overhead.
- 2. Perform a posterior pelvic tilt.
- 3. Inhale fully.
- 4. Open your mouth and throat and create a forceful, deep exhale.
  When you think you have reached the end of your exhalation capacity, exhale even more deeply.
- 5. Feel for a deep stretch in your upper lumbar and low-to-mid thoracic spine.





### Respiration Drill #2 - Diaphragm Stretch 2

- 1. Supine, arms by your side.
- 2. Perform a posterior pelvic tilt.
- 3. Inhale fully as you raise arms to the overhead position and simultaneously perform a standard hip-bridge
- 4. In the top position, open your mouth and throat and exhale fully.
- 5. Hold this full exhale as you return to the ground while maintaining a posterior pelvic tilt. Try to widen your ribs laterally as you do this.
- 6. Feel for a deep stretch in your upper lumbar and low-to-mid thoracic spine.
- 7. When performed correctly, this will create a "vacuum" effect in the abdomen, deeply stretching the diaphragm while maintaining abdominal muscle www.relaxation.tom.



#### Respiration Drill #2 - Diaphragm Stretch 2





### The Goals of R-Phase Training

#### 1. Injury Rehabilitation

#### 2. Neural Re-Education

#### 3. Mobility Restoration



### What is Proprioception?



The body's 3-D map of itself in space and time.

AKA our movement &

awareness map.



# The Proprioceptive System



- 1. The Brain
- 2. The Spinal Cord
- 3. Peripheral Nerves
- 4. Many Different Types of Nerve Endings

Remember That Proprioception LIVES In The Brain!



### **3 Proprioceptive Nerve Endings**

- Nerve endings that provide many different types of information to the nervous system such as:
- 1.Mechanoreceptors
- 2.Baroreceptors
- 3. Chemoreceptors
- **4.**Thermoreceptors
- **5.Nociceptors**



courtesy of http://www.hhp.uh.edu/clayne/6397/Unit4\_files/image019.jpg

#### Proprioception = All The Body, All The Time







#### Two Most Critical Components of Proprioception



# Mechanoreceptors (Fast) Nociceptors (Slow)



### The Sensory-Motor Cortex





# The Sensory Homunculus







# The Motor Homunculus



# Side By Side





# What Is The Startle Reflex?



Our genetically hard-wired response to threat!

It is characterized by TWO primary muscular actions:

**Flexion & Adduction** 



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# The Elements of Startle



- 1. Head The head moves forward and down to protect the throat.
- 2. Face –The startle reflex tenses all facial and jaw muscles and closes the airways.
- 3. Shoulders The trapezius muscles contract bilaterally and raise shoulders up toward ears.
- 4. Chest Anterior chest muscles contract and pull the shoulders forward and down.
- 5. Ribs The intercostals muscles tighten and lock down the ribs.
- 6. Abdomen All abdominal muscles, deep spinal muscles and pelvic floor muscles contract cooperatively to flex the body forward.
- 7. Gluteals The gluteals also contract bilaterally to tip the pelvis forward.
- 8. Legs The adductors, hips, and gastroc/soleus group contract to stabilize and balance the body.

### The Arthrokinetic Reflex



- 1. A reflex based on joint movement and position.
- 2. One of the <u>Missing Links</u> in performance enhancement.
- 3. Remember this, <u>"Jammed or</u> <u>immobile joints create weak</u> <u>muscles. Mobile joints create</u>

strength!"



# Contraindications

- 1. Joint Hypermobility
- 2. Joint Effusion
- 3. Inflammation
- 4. Malignancy
- 5. Bone Disease
- 6. Fractures
- 7. Total Joint Replacements
- 8. Post-Surgical

Most of these are RELATIVE. If in doubt, always obtain doctor's approval prior to working with a client.

### Specific Adaptation To Imposed Demand (SAID)

- This is the FUNDAMENTAL LAW of human physiology.
- The classic definition: "The body adapts to whatever it does."
- The Z-Health definition: "The body <u>ALWAYS</u> adapts to <u>EXACTLY</u> what it does."
- The take home message here is that if you want a certain result, you must train with PRECISION.



### The Training Rules



- 1. Never move into pain
- 2. If you have pain, slow down or decrease the range of motion
- 3. Long Spine/Long Body Position
- 4. Concentrate
- 5. Relax as much as possible



# The Neural Hierarchy



# The Three Systems Used for Prediction

1.Visual

2.Vestibular

3. Proprioceptive

