Applied Functional Science™
Chain Reaction – Proprioceptors:
Ambiguously Clear

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Gray Institute
PROPRIOCEPTORS: AMBIGUOUSLY CLEAR

The body needs a clear picture of all its moving parts. The less the body knows, the less successful it will be. And the more likely it will be injured.
PROPRIOCEPTORS: AMBIGUOUSLY CLEAR

THE INFORMATION FROM EACH SINGLE PROPRIOCEPTOR CAN MEAN MORE THAN ONE THING TO THE BODY (AMBIGUOUS)

INFORMATION FROM MULTIPLE PROPRIOCEPTORS ELIMINATES THE AMBIGUITY
PROPRIOCEPTORS: AMBIGUOUSLY CLEAR

THE PROPRIOCEPTORS RESPOND TO MOVEMENT.

THE MORE AUTHENTIC AND FUNCTIONAL THE MOVEMENT, THE MORE VALUABLE THE INFORMATION PROVIDED BY THE PROPRIOCEPTORS.

A PROPRIOCEPTOR SENSES A PHYSICAL FORCE AND CONVERTS (TRANSDUCES) IT INTO AN ELECTRICAL SIGNAL.
PROPRIOCEPTOR: **PACINIAN CORPUSCLE**

- Stimulated by acceleration and deceleration
- Located in capsule – more in distal joints
- Low threshold before firing
- Rapidly adapts to constant stimulus

**ISSUE:** Is the movement speeding up or slowing down?
FUNCTIONAL APPLICATION: 

**PACINIAN CORPUSCLE**

LUNGING FOR SUCCESS EXAMPLE:

TWO STRATEGIES TO STIMULATE

A. LUNGE IN THE MOST SUCCESSFUL PLANE AND THEN MOVE TO OTHER 2 PLANES, THEN COMBINE PLANES

B. LUNGE WITH ALL 3 PLANES COMBINED TO ENHANCE SUCCESS AND THEN MOVE TO SINGLE PLANES WHERE THERE IS LESS SUCCESS
FUNCTIONAL APPLICATION: PACINIAN CORPUSCLE

LUNGING FOR SUCCESS EXAMPLE:

INCREASE COMPLEXITY BY USING PIVOT LUNGES TO CHANGE DIRECTIONS IN DIFFERENT SEQUENCES

ALWAYS START WITH SUCCESS, THEN TWEAK THAT SUCCESS TO BUILD MORE SUCCESS AND SAFETY

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PRORIOCEPTOR:
GOLGI-MAZZONI CORPUSCLE

STIMULATED BY COMPRESSION
PERPENDICULAR TO THE SURFACE

LOCATED IN THE CAPSULE
NEAR ATTACHMENT TO BONES

HIGH THRESHOLD BEFORE FIRING

SLOW ADAPTING TO CONSTANT STIMULUS

ISSUE: IS IT GOOD OR BAD TO BE AT END RANGE?
FUNCTIONAL APPLICATION: **GOLGI-MAZZONI**

SOME FUNCTIONAL MOVEMENTS OCCUR AT THE END-RANGE OF JOINTS

OTHER MOVEMENTS ARE PERFORMED AWAY FROM END-RANGE, BUT YOU USE END-RANGE TO STIMULATE FOR MORE INFORMATION, AND THEN GRADUALLY TWEAK TOWARD THE MORE FUNCTIONAL POSITION

WHEN USING END-RANGE POSITION, A SAFE ENVIRONMENT MUST BE CREATED
PROPRIOCEPTOR: *RUFFINI ENDINGS*

STIMULATED BY SPEED AND TENSION

LOCATED IN CAPSULE
MORE IN PROXIMAL JOINTS

MEDIUM TO HIGH THRESHOLD BEFORE FIRING

SLOW ADAPTING TO CONSTANT STIMULUS

ISSUE: IS THE SPEED GOOD OR BAD?
FUNCTIONAL APPLICATION:  
**RUFFINI ENDINGS**  
CATCHING A BASKETBALL  
MOBILE STABILITY EXAMPLE:

HIP HAS TWO GOALS:  
A. CONTRIBUTE TO THE STABILITY OF THE LOWER EXTREMITY  
B. SERVE AS THE FOUNDATION FOR THE CORE TO ALLOW FOR REACHING

RUFFINI ENDINGS MUST SUPPLY INFORMATION TO ALLOW FOR BOTH FUNCTIONS AT ONCE
FUNCTIONAL APPLICATION:

**RUFINI ENDINGS**

OPTIONS FOR TRAINING SUCCESS

A. CHANGE WHERE BALL IS THROWN

B. CHANGE WHERE FEET ARE POSITIONED

C. SHIFT GRADUALLY TO SINGLE LEG STANCE

NEED TO TWEAK SEQUENTIALLY IN ORDER TO TRAIN FOR BOTH SAFETY AND SUCCESS AT THE SAME TIME

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FUNCTIONAL APPLICATION:  
**RUFFINI ENDINGS**

IF HAVING PROBLEMS WITH MOBILE-STABILITY THEN THE DUAL-TASK SUCCESS WILL FAIL

CAN PRIORITIZE ON SAFETY AND FAIL TO CATCH THE BALL

Or

PRIORITIZE ON SUCCESS AND RISK INJURY
PROPRIOCEPTOR: GOLGI LIGAMENT ENDINGS

STIMULATED BY TENSION

LOCATED IN LIGAMENTS

LOW AND HIGH THRESHOLDS TO FIRE

SLOW ADAPTING TO CONSTANT STIMULUS

ISSUE: ARE THEY STIMULATED IN NORMAL FUNCTION?
PROPRIOCEPTOR:
GOLGI LIGAMENT ENDINGS

MEDIAL COLLATERAL LIGAMENT-KNEE VALGUS EXAMPLE:

THE KNEE MOVES INTO A VALGUS POSITION

HIGH THRESHOLD ENDINGS WARN OF TEAR
HIGH FORCE = SAFETY

LOW THRESHOLD ENDINGS INFORM ABOUT NORMAL MOTION
LOW FORCE = HELPFUL INFORMATION
PROPRIOCEPTOR: GOLGI LIGAMENT ENDINGS

IF IN TRAINING AND REHAB, THE MOTION THAT CAUSED AN INJURY IS AVOIDED, THE SYSTEM IS DEPRIVED OF VALUABLE INFORMATION.

DURING FUNCTION, WHEN THE GOLGI LIGAMENT ENDINGS FIRE, THE INFORMATION WILL CONFUSE THE SYSTEM BECAUSE IT WAS ABSENT DURING TRAINING.
FUNCTIONAL APPLICATION: GOLGI LIGAMENT ENDINGS

LATERAL ANKLE SPRAIN EXAMPLE

USUALLY START WITH SAFETY, BUT CAN START WITH SUCCESS IN A SAFE ENVIRONMENT, THEN TWEAK SUCCESS TOWARD SAFETY

POSITION B.A.P.S. BOARD TO PROMOTE DORSIFLEXION AND EVERSION WHILE INHIBITING PLANTARFLEXION AND INVERSION

TRAIN GOLGI\(_s\) WITH MOTION TO ASSIST SAFETY
PROPRIOCEPTOR:  
FREE NERVE ENDING

STIMULATED BY NOXIOUS AND  
NON-NOXIOUS STIMULI

PROVIDE IMPORTANT INFORMATION

EXACTLY HOW THAT INFORMATION IS USED IS  
UNCLEAR
PROPRIOCEPTOR: 
**GOLGI TENDON ORGAN**

STIMULATED BY TENSION

LOCATED IN TENDON

LOW AND HIGH THRESHOLDS

SLOW ADAPTING TO CONTANT STIMULUS

LOW AND HIGH THRESHOLD INDICATED SAFETY AND SUCCESS FUNCTIONS

ISSUE: CAN TRAINING INCREASE MAX FORCE?
PROPRIOCEPTOR: 

GOLGI TENDON ORGAN

WHEN HIGH THRESHOLD GTOs FIRE
THE MUSCLE MAY BE INHIBITED TO
PREVENT INJURY

LOW THRESHOLD GTOs LIKELY GIVE
INFORMATION TO THE MUSCLE ABOUT
THE LEVEL OF TENSION

TRAINING WITH HIGHER LEVELS OF FORCE
WILL DESENSITIZE INHIBITORY EFFECTS,
AND MAY ALLOW FOR MORE FORCE TO BE
GENERATED BY THE MUSCLE
FUNCTIONAL APPLICATION: GOLGI TENDON ORGAN

DECELERATING AFTER THE THROW EXAMPLE

INCREASE LOAD IN THE TENDON TO MAKE IT STRONGER, BUT ALSO TO ACTIVATE THE GTOs

DECELERATION OF THE ARM IS A SYSTEM TASK, AND THE OPPOSITE HIP PLAYS A CRITICAL ROLE

IN ADDITION TO ADDING MORE LOAD TO THE HAND OTHER MUSCLES IN THE SYSTEM CAN BE “TWEAKED IN OR OUT” TO GRADUALLY SHIFT MORE OF THE RESPONSIBILITY TO THE SHOULDER MUSCLES
PROPRIOCEPTOR: MUSCLE SPINDLE

STIMULATED BY CHANGES IN LENGTH OF THE MUSCLE

LOCATED WITH THE MUSCLE FIBERS

UNIQUE SENSOR BECAUSE IT DIRECTLY AFFECTS THE MUSCLE, AND BECAUSE THE SPINDLE HAS A SECTION THAT CONTRACTS

ISSUE: WHY DOES IT HAVE A CONTRACTILE SECTION?
PROPRIOCEPTOR:  
**MUSCLE SPINDLE**  
THE MUSCLE SPINDLE ACTS LIKE A TENSION (STRAIN) GAUGE

THE INFORMATION FROM THE SPINDLE WOULD BE MUCH DIFFERENT WHEN THE MUSCLE CHANGES LENGTH IN A SHORTENED POSITION COMPARED TO A LENGTHEND POSITION

THE CONTRACTING SECTIONS MAY ADJUST FOR DIFFERENT MUSCLE LENGTHS; MAKING THE SPINDLE LONGER WHEN THE MUSCLE IS SHORT (AND VICE VERSA)
PROPRIOCEPTOR: MUSCLE SPINDLE

THE SENSITIVITY OF THE MUSCLE SPINDLE MAY VARY IN PATHOLOGICAL CONDITIONS.

OFTEN A CLIENT MAY HAVE GOOD MOTION LYING ON A TABLE, BUT SEEM VERY RESTRICTED DURING FUNCTION.

THIS “RESTRICTION” DURING FUNCTION MAY BE THE RESULT OF MUSCLE SPINDLES SENDING IMPROPER INFORMATION TO THE MUSCLES.
FUNCTIONAL APPLICATION: 
**MUSCLE SPINDLE**

TRAINING THE SPINDLES AT DIFFERENT MUSCLE LENGTHS

NEED TO UTILIZE MOVEMENTS FOR LOADING AND EXPLODING IN POSITIONS WHERE THE MUSCLE IS BOTH SHORTENED AND LENGTHENED

WANT INFORMATION FOR THE SYSTEM THAT IS VALID AND RELIABLE IN DIFFERENT LENGTHS OF THE MUSCLE

ONCE TASK SUCCESS HAS BEEN ACHIEVED, USE DIFFERENT COMBINATIONS OF ECONCENTRIC S
PROPRIOCEPTORS: **FASCIAL TISSUES**

At least 3 different proprioceptors have been identified in fascia.

Fascia has a physical role in force transmission and attenuation.

Fascia may have a more important role in providing information that helps to organize all the parts of the body.
FUNCTIONAL APPLICATION: FASCIA

RIGHT HIP FLEXOR STRETCH EXAMPLE:

NEED TO POSITION ENTIRE BODY RELATIVE TO THE TASK (RUNNING)

THIS PUTS THE FASCIA IN THE FUNCTIONAL DEGREE OF TENSION WHEN THE MUSCLE NEEDS TO BE LENGTHENED

IT ALSO ADDS PROPRIOCEPTOR INFO FROM THROUGHOUT THE BODY, INCREASING THE CHANCE THAT THE INCREASED MOTION WILL BE USED