Margaret Rood gave this approach for PTs and OTs. Her treatment was designed for Cerebral Palsy, but she believed it was applicable to any patient with Motor Control Problems.

**Principles**

- Motor patterns are developed from fundamental reflex patterns present at birth, which are utilized and gradually modified through sensory stimuli until the highest control is gained.
- Appropriate sensory receptors utilized in normal sequential development will help to elicit normal motor response.

**Other Applications**

Can also be used for patients with Rheumatoid Arthritis, Osteoporosis, Soft tissue injury and post fractures.

- To reduce the protective muscle spasm, increase soft tissue range and to elicit normal postural reactions.

**Essential Features**

- Identification of Goals.
- Identification of factors contributing to poor function.
- Following a sequence of positions and activities of normal motor development and selecting those most relevant to individual needs.

- Selection of appropriate afferent stimuli to exploit potentially of tissues to change at molecular level. This facilitates attainment of motor goals and helps to prevent perpetuation of abnormal influences imposed by pathological changes.
- Timing of stimuli: Ensuring repetition in association with the environments and thus lasting effect is obtained.
Components of Rood's Theory

- Normalization of tone and evocation of desired muscle response by sensory stimuli.
- Sensory Motor Control is developmentally based, and therefore must start at the patient's level of development and progress him sequentially to higher and higher levels of Sensory Motor Control according to sequences.
- Movement is purposeful. Use of activities for purposeful movement.
- Repetition of Sensory Motor Responses is necessary for learning.

Motor Homunculus

A cortical homunculus is a distorted representation of the human body, based on a neurological “map” of the areas of the human brain dedicated to processing Motor functions or sensory functions, for different parts of the body.
Sensory + Motor = Movement

**Sensory Organization**

- **ANTERIOR SPINOThALAMIC TRACT & LATERAL SPINOThALAMIC TRACT**
- **LEMNISCAL / DORSAL COLUMNS**
- **PROPRIOCEPTIVE TRACTS (Dorsal Spinocerebellar)**

**INTEROCEPTORS**
- Spinothalamic Tract, Dorsal Column, Lemniscal

**EXTEROCEPTORS**
- Free Nerve Endings
  - Located skin and viscera
  - Non-specific receptors: pain, crude touch, temperature
  - Unmyelinated C / myelinated nerve fibers
  - Activated with thermal or brushing techniques
  - Causes state of arousal
  - Ice packs & rubbing alleviates acute pain
  - Synapse with gamma motor neuron and bias the muscle spindle through the fusimotor system

**HAIR END ORGANS**
- Type of free nerve ending wrap around the base of hair follicle
  - Activated by bending: displacement of hair
  - Associated with light touch or brushing of skin
  - Have a muscle spindle through the fusimotor system

**MEISSNER CORPUSCLES**
- Found just beneath the epidermis in hairless skin
  - Thicker A beta (group II) fibers
  - Responsible for fast tactile discrimination
  - Important for exploration and sensory substitution skills (reading braille)
  - Responsive to low frequency vibration

**PACINIAN CORPUSCLES**
- Found beneath layers of skin, viscera, meninges, ligaments, muscle
  - Thicker A beta (group II) fibers
  - Most rapidly adapting receptors
  - Respond to deep pressure but not sensitive to light touch
  - Stimulated by high frequency vibration
  - Plays a role in spine's vibratory reflexes
  - Stimulation of affective afferent skin in children who exhibits tactile defensiveness
  - Responsible for perceptions at the conscious level
  - Calming effect

**MEKEL TACTILE DISKS**
- Found deepest epidermis in hairless skin
  - Wide surface of touch, for mechanism generation
  - Fast conducting A beta group II fibers
  - Mostly adapting touch pressure receptors
  - Responsible for slow movements among the skin's surface
  - Related to awareness of tickle and pleasurable touch sensation
KINESIOCEPTORS / JOINT RECEPTORS
- Transmitted to the cerebral cortex
- Located in joint capsule, ligaments, tendons
  1. Ruffini end organs
  2. Golgi – Mazzoni corpuscles
  3. Van-Pacini corpuscles
  4. Golgi-type endings

GOLGI TENDON ORGANS
- Greater sensitivity to muscle contraction

MUSCLE SPINDLE

SEQUENCE OF MOTOR DEVELOPMENT
1. RECIPROCAL INHIBITION (INNERVATION)
   i.e. MOBILITY
   - Activity governed by spinal & supraspinal centers
   - Subserves a protective function
   - Phasic and reciprocal type of movement
   - Contractions of agonist and antagonist

2. CO-CONTRACTION (CO-INNÉRATIÖN)
   i.e. STABILITY
   - Simultaneous agonist & antagonist contraction with antagonist supreme

3. WORK
   i.e. CONTROLLED MOBILITY
   - Stockmeyer: "mobility superimposed on stability"

4. SKILL
   - Crawling, walking, running, activities requiring coordinated use of hands

"IF IT WERE POSSIBLE TO APPLY THE PROPER SENSORY STIMULI TO THE APPROPRIATE SENSORY RECEPTOR AS IT IS UTILIZED IN NORMAL SEQUENTIAL DEVELOPMENT."

Rood, 1954
A muscular response is first evoked reflexively using sensory stimulation; then responses used in developmental patterns and finally the patient uses response for purposeful movement. Muscles contract through their range with reciprocal inhibition of the antagonist.

Muscles around the joint contract simultaneously to provide stability. Proximal muscle contraction than distal muscles. Proximal segment is stabilized and distal segment moves.

Muscle contraction around the joint simultaneously provides stability. Proximal muscles than distal muscles. Proximal segment is stabilized and distal segment moves.

SUPINE WITHDRAWAL
Total flexion response before total flexion at T10.
Requires reciprocal innervation with heavy work of proximal segments.
Aids in integration of TLR: RECOMMENDED
Patients dominated by extensor tone.
Patients with no reciprocal flexion.
Aids in integration of TLR.

ROLLOVER TOWARD SIDE-LYING
Stability pattern for extremities and lumbal back muscles.
RECOMMENDED
Patients dominated by some reflex patterns in supine.
Non-dominant contraction amongst which contracts the neck & extracocular muscles.

PIVOT PRONE
Demands full-range extension neck, shoulder, trunk and lower extremities.
Recommends to assess and educate.
Important role in preparing for functional and upright pattern.
Associated with labarotory vestibular movements of the head.
INTEGRATION: STNR & TLR.
NECK CONTRACTION
- First real stability pattern
- Activates both flexors & tonic neck extensor muscles
- Recommended for patients needing neck stability & extra ocular control.

PRONE ON ELBOWS
- Stretching the upper trunk
- Influences shoulder girdle, scapular, and glenohumeral stability
- Gives better visibility of the environment
- Allows weight shifting from side to side
- Recommended for patients needing to inhibit STNR.

QUADRUPED
- A skill of upper trunk because it frees upper extremities for manipulation
- Integration: Righting reaction & equilibrium

WALKING
- Sophisticated process requiring coordinated movement patterns of various parts of body
- "Support the body weight, maintain balance, & execute the stepping motion" - Murray

NORMAL DEVELOPMENT: POSTURAL CONTROL
- "In the development of normal motor development, the infant first learns to maintain balance and posture before attempting locomotion." - Reference: "Further" by M. New York, 1979, with permission.

NORMAL DEVELOPMENT: LOCOMOTOR SKILLS
1. Normalize muscle tone

1. Treatment begins at the developmental level of functioning

1. Movement is directed towards functional goals

1. Repetition is necessary for the re-education of muscular response

Facilitating and inhibiting techniques are used. Proper positioning during method is important. If the child is in TLR position, response may change.
**Facilitatory Techniques:**
- Light moving touch
- Fast brushing
- Icing
- Proprioceptive facilitatory techniques:
  - Heavy joint compression
  - Stretch
  - Intrinsic stretch
  - Secondary ending stretch
  - Stretch pressure
  - Resistance
  - Tapping
  - Vestibular stimulation
  - Inversion
  - Therapeutic vibration
  - Osteopressure

**Inhibitory Techniques:**
- Gentle shaking or rocking
- Slow stroking
- Slow rolling
- Light joint compression
- Tendinous pressure
- Maintained stretch
- Rocking in developmental stages

**Treatment:**
Stimulation of appropriate type of stimuli for facilitation and inhibition.

- The point at which the patient is easily doing the task represents highest level of development.
- Treatment starts at the level where patient has to struggle to do the pattern.

Rood stated that brushing applied both affected and non-affected side.
- Fast brushing over the posterior rami of L1-2 will cause bladder retention.
- Light stroking of skin activates A-size sensory fibers to activate the muscles.
- Light stroking over dorsum of palm and foot will have withdrawal response.
- Icing have same effect as brushing and stroking.

Icing is a high threshold stimulus that stimulates posture via C sensory fibers by presenting ice for 3-5 seconds.
- Icing is the application of quick swipes of the ice cube to evoke a reflex withdrawal same like light touch.
- Dorsal aspects palm and feet leads to withdrawal.
- Quick icing is used for flaccid types only.

Tactile stimulation is offered in 2 ways, fast brushing and light stroking.
- The revolving brush is applied on each skin area over the muscle to be stimulated.
- It is done on the skin of the dermatome for 5 seconds each and repeated 3-5 times.
- It stimulates C-size sensory fibers which helps to gain motor response and maintains posture.
Tapping of the tendon or belly of the muscle has the same effect as quick stretch.
Pressure on the muscle belly facilitates stretch response.
Resistance is a form of stretch in which many or all of the muscles are stimulated.
Rood utilized special senses to facilitate and inhibit the muscles.
Auditory and visual stimuli can be used to facilitate and inhibit the CNS of the patient.

SPECIFIC FACILITATION TECHNIQUES USED IN TREATMENT:

<table>
<thead>
<tr>
<th>Technique</th>
<th>Mechanism</th>
<th>Procedure</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light moving touch</td>
<td>Alpha sensory fiber</td>
<td>Applied with a fingernail, camel hairbrush, or cotton swab</td>
<td>Activate A delta sensory fibers synapses with fusimotor system reciprocal innervation (phasic withdrawal response)</td>
</tr>
</tbody>
</table>

SPECIFIC FACILITATION TECHNIQUES USED IN TREATMENT:

Fast freezing C fibers
Apply ice cube to the skin serving the same spinal segment of the muscle to be stretched. Response may take as long as 30 minutes.

SPECIFIC FACILITATION TECHNIQUES USED IN TREATMENT:

A-Icing
Ice cube is pressed to the skin serving the same spinal segment of the muscle to be stretched. Response may take as long as 30 minutes.

SPECIFIC FACILITATION TECHNIQUES USED IN TREATMENT:

Ice Cube

SPECIFIC FACILITATION TECHNIQUES USED IN TREATMENT:

Cold

Patients hypotonia
Are in state of relaxation
Alerts the mental processes

ACTIVATES SUPERFICIAL MOBILIZING MUSCLES: light work group that performs skilled task
STIMULATES A-delta sensory fibers synapses with fusimotor system reciprocal innervation (phasic withdrawal response)
STD: camel hair, finger tip, brush, cotton swab
**Ice bag**

Promotes RECIPROCAL PATTERN between diaphragm & abdominal muscles.

Increases breathing, voice production and general vitality.

<table>
<thead>
<tr>
<th>Procedure/Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Approximation</strong></td>
</tr>
</tbody>
</table>
| Facilitates contraction of the p. combined with developmental patterns. Does manually or use of weights and sandbags.

**Squeezing**

Facilitatory Approximation

Proprioceptive Facilitatory Technique

- **Procedure/Effect**
  - Facilitates contraction of the p. combined with developmental patterns. Does manually or use of weights and sandbags.

**Vibration**

- **Technique**
  - Can be used for muscle vibration or desensitization 
  - Proprioceptive skin and to produce tone changes in muscles.
  - Vibratory stimuli applied over a muscle belly to activate the Ia afferents of muscle spindle, causing contraction of the muscle spindle and suppression of the stretch reflex. This response is called the volley facilitation effect and is best elicited by a high frequency osteus that delivers 100-200 Hz. The duration of the vibration should not exceed 15-20 sec repetitions because heat and friction will small.
  - The prone position may be best while viewing these muscle groups and the supine position may enhance the stretch muscle. It is best to have the patient in prone environment because the neuroreceptors are the closer threshold for firing.

<table>
<thead>
<tr>
<th>Skin Caress</th>
</tr>
</thead>
</table>
| Promotes stability of the stretch receptor muscle spindle, weight on the other side of the muscle and promoting reactive group.

<table>
<thead>
<tr>
<th>Resistance</th>
</tr>
</thead>
</table>
| Reduces muscle tension to stimulate bilateral and secondary endings of the muscle spindle. It is used in anatomical fashion in developmental fashion to influence the extensors. When a muscle contracts against resistance, resistance, the path length increases the muscle spindle to contract so they maintain the elongated length. It is called "tensing" the muscle spindle and is more sensitive to stretch.

**Tap**

- **Technique**
  - Taping with the fingers or percussion 1/4 to 1/2 of the distance between the digits, being the distal end is voluntary contracting the muscle. This stimulates the effect of the muscle spindle and increases the tone of the underlying muscles.

<table>
<thead>
<tr>
<th>Nonvibratory Stimulation</th>
</tr>
</thead>
</table>
| Stimulation of muscle spindle in a powerful type of proprioception. The technique is used to activate the ragidness muscles and change their muscle spindle with the sensory endings of the muscle spindle. The sensory effect causes, stretch, dynamic proprioceptive, stretch reflex function, flexed gestures, ballistic movements, deep Percussion and eye position. It is stimulated through many dermatomal transitions between the vertebrae and spinous processes.
In the inverted position, static vestibular system produces increased tonicity of the muscles of the neck, midline trunk extensors and selected extensors in the limbs. The head must be in normal alignment with the neck.

**VIBRATION**

- Light joint compression can be used to inhibit spastic muscles.
- Slow stroking is used as an inhibitory technique.
- Pressure on the tendinous insertion of a muscle inhibits that muscle.
- Maintained stretch can inhibit the same muscle.

**GENTLE SHAKING OR ROCKING**

- Gentle shaking or rocking
- Rhythmical circumduction of the head and slight approximation can also be used in the UE and LE

**SLOW ROLLING**

- Pt. is rolled slowly from a SI position to prone and back in a rhythmic pattern; use on both sides of the body.

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**Table: Techniques and Effects**

<table>
<thead>
<tr>
<th>Technique</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral warmth</td>
<td>Affects temperature receptors in the hypothalamus and PSNS, used for pts with hypertonia.</td>
</tr>
<tr>
<td>provoked</td>
<td></td>
</tr>
<tr>
<td>Slow rolling</td>
<td>SMOOTH ROLLING FROM THE OCCIPUT TO THE COCCYX AND ALTERNATED TO BOTH SIDES OF THE BODY</td>
</tr>
<tr>
<td>Tendinous pressure approximation</td>
<td>Manual pressure applied to the tendon insertion of a muscle; can be used in spastic or tight mm.</td>
</tr>
<tr>
<td>Wrapped with a blanket</td>
<td>For 5-20 minutes.</td>
</tr>
<tr>
<td>Pt feels relaxed and decreased in tone.</td>
<td></td>
</tr>
<tr>
<td>Slow stroking</td>
<td>Pt prone while the therapist provides a rhythmical, moving deep pressure over the dorsal distribution of the posterior rami of the spine; done from occiput to coccyx and alternated.</td>
</tr>
<tr>
<td>Shifting the weight forward and backward, progressing to side to side then diagonal patterns.</td>
<td></td>
</tr>
</tbody>
</table>
No treatment follows a set pattern but should be planned to meet individual needs and will be adjusted as evaluation of its effectiveness indicates.

Hypokinesia

- Causes: LMN lesions, dense sensory loss, flaccid stage of hemiplegia
- Skin brushing can be used to facilitate key muscles.
- Total movement will facilitate any weak component.
- Stimuli from bone taps, quick ice and vibration should be used as appropriate.

4. Deep muscles can be activated by choosing positions with the distal end of segments fixed, and then applying compression and resistance distally to gain co-contraction.
5. Rocking movements prepare for subsequent activity with the distal part free.

Bradykinesia

- The SCCs are stimulated by using a revolving chair, passive or active head and shoulder rotation, or activities such as alternately punching a suspended target placed so that the patient must reach up and forward to reach it.
- It is possible to modify a rigid walking frame to provide a tactile and auditory stimulus as each step is taken.

Syndromes - Low or fluctuating postural tone, involuntary movements and incoordination. Ontogenic sequences are used with emphasis on positions and stimuli to increase postural tone. In all positions, support must be given while using stimulation of mechanoreceptors until the deep muscles are able to contract and hold the position.
If correct positions are obtained then weights or weighted garments can then be used to improve stability.

Heavy work patterns are used and activities with facilitation.

Spasticity varies so much in type, distribution and severity that it requires careful selection of suitable techniques followed by an evaluation of their effectiveness.

Spasticity with some voluntary movement

1. Light brushing to facilitate key muscles which oppose spastic groups.
2. Follow the sequences described above and adapt them according to needs, e.g. omit total extension and pivot patterns if extensor tone is strong.
3. Use a slow stretch to reduce tone in the soleus muscle, quadriceps limb and cervical extensor muscles, and the shoulder girdle retractor muscles.

Use non-resisted repeated contractions to reduce spasticity in the adductor muscles of the shoulder and hip joints, flexor muscles of elbow joint and the long flexor muscles of the fingers.

Released Grasp Reflex

Firm, slow massage using the heel of the hand applied to the non-weight-bearing areas of the patient's palm or the medial side of the sole of the foot will inhibit a retained grasp reflex in an infant or a released grasp reflex in an adult. The operator must avoid contact with the finger tips or the ball of the foot.
Facilitation of swallowing and speech

- Light brushing to the upper lip, face and throat avoiding the undersurface of the floor of the mouth.
- Application of ice to the lips and tongue.
- Resisted sucking and
- Application of a wipe of ice to the lower neck anteriorly.