Tremor Phenomenology
“Neurotransmitter deficits in patients with ET have not been identified, the manner by which reported microscopic pathology might lead to tremor is still unknown, the source and mechanism of pathological oscillations are not known, and the genetic defects that cause ET have not been identified .... All drugs for treatment of ET have been discovered by chance and were originally developed for other diseases.”

Tremor:
Rhythmical involuntary oscillatory movement

- Location
- Frequency
  - Low <4 Hz
  - Medium 4-7 Hz
  - High >7 Hz
- Amplitude
- Rest
- Action
  - Postural
  - Kinetic
  - Intention
  - Task Specific
Rest Tremor

- Occurs when the muscles are not activated
- Best tested when body part is fully supported against gravity
- May recur during posture (re-emergent rest tremor)
Rest Tremor
Action Tremor

• Occurs when muscles activated
  – Postural: against gravity
  – Kinetic: during movement
  – Intention: during targeted movements
Postural Tremor
Intention Tremor
Task Specific Tremor
Physiologic Tremor

• Normal
• Ubiquitous
• All voluntary muscles
Generation of Physiologic Tremor

• Mechanical Resonance
  – The tendency of a system to oscillate at maximum amplitude at a certain frequency
  – Broughton Suspension Bridge
    • Oscillations occurred causing collapsed when soldiers marched across in step
  – Finger 25Hz
  – Wrist 9Hz
  – Elbow 2Hz
Generation of Physiologic Tremor

• Feed back Oscillation
  – Synchronized firing of motor units
  – Synchronized firing of motor neurons
  – Peripheral stretch reflex
    • Short latency reflex
    • Long latency reflex
    • 10Hz

• Central Oscillators
Generation of Physiologic Tremor

McAuley J H, Marsden C D Brain 2000;123:1545-1567
Generation of Physiologic Tremor
Enhanced Physiologic Tremor
Enhanced Physiologic Tremor

• Exercise
• Fatigue
• Stress
• Strong emotion
• Hypoglycemia
• Alcohol Withdrawal
• Medications
Pathologic Tremor

McAuley J H, Marsden C D Brain 2000;123:1545-1567

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Pathologic Tremor

- Essential Tremor
- Parkinson Tremor
- Cerebellar Tremor
- Orthostatic Tremor
- Dystonic Tremor
- Holmes Tremor
Essential Tremor

- Most common movement disorder (6%)
- Probably underdiagnosed
- Postural and intention tremor
- Bilateral upper extremities, head, voice
- Usually symmetric
- Mid/high frequency
- Benign (?)
Essential Tremor

Postural Tremor
Arms Outstretched

RATING=0
Essential Tremor

Tremor Action Network footage
Parkinsonian Tremor

- Rest tremor
- Low frequency
- Starts unilaterally
Parkinsonian Tremor
Parkinsonian Tremor
Parkinsonian Tremor
Ataxia/ Cerebellar Tremor

- Low frequency
- Intention tremor
- Involves any body part
- Causes
  - Stroke
  - Alcoholism
  - Hereditary disease
Ataxia/Cerebellar Tremor
Dystonic Tremor

• In patients with concurrent Dystonia
• Maybe in same body part or other
• Postural and kinetic
• Less rhythmic
• Distinguishing feature: responds to geste antagoniste (sensory trick)
Dystonic Tremor
Rubral Tremor

- Holmes Tremor
- Unilateral
- Rest tremor and intention tremor
- Low Frequency
- “Course” less rhythmic
- Injury to brain stem/ red nucleus
Rubral Tremor

Before anticholinergic therapy.
Rubral Tremor
Other Movements

• Chorea
• Myoclonus
• Asterixis (negative myolonus)
• Clonus
• Tics
Chorea
Myoclonus
Myoclonus
Epilepsia Partialis Continua

Segment 1
Before BoNT-A injection

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What is the movement?
3. Brain. 2000; 123, 1545-1567
4. Movement Disorder Society Video library