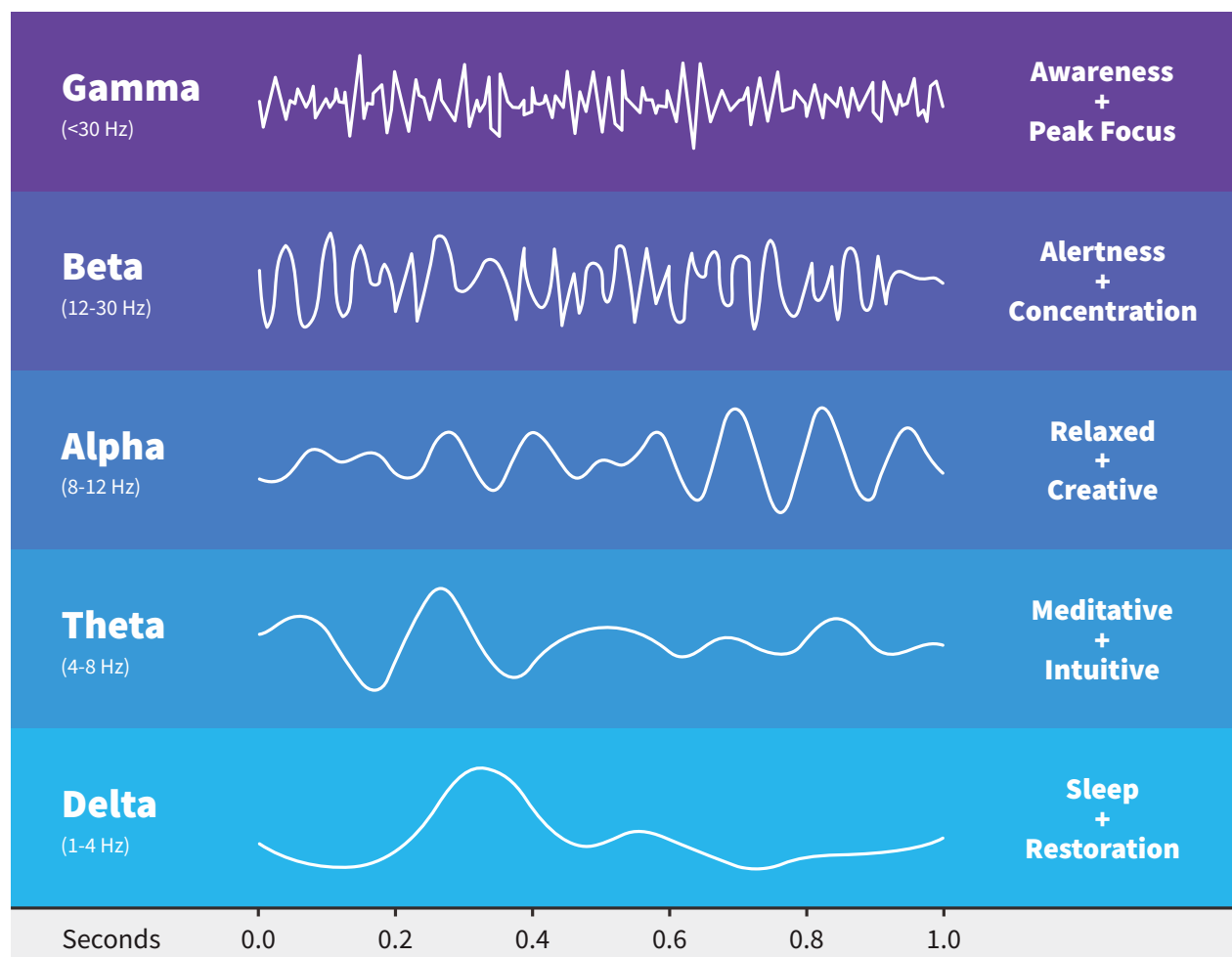




Brain Waves Patient Handout

Brain Waves: Types, Functions, and Regulation

Brain waves, rhythmic electrical patterns measured by EEG, are the mind's symphony, each frequency band playing a distinct role in cognition, emotion, and behavior. Neurofeedback harnesses these waves, regulating their amplitude, distribution, and coherence to optimize function. Understanding their types, functions, and how they're shaped offers clinicians a lens into the brain's language and neurofeedback's transformative power.





Here's a Deep Dive Into the Five Primary Bands and Their Regulation

- **Delta (0.5-4 Hz):** The slowest waves, delta dominates deep sleep, supporting physical healing, memory consolidation, and immune function. In waking states, excess delta signals pathology—drowsiness, brain injury (e.g., TBI), or developmental delay. A QEEG might show delta spiking at F3 post-concussion; neurofeedback suppresses it there, lifting alertness 50-70% (Thornton & Carmody, 2009). Too little delta in sleep, though, disrupts restoration—training delta up at Pz can deepen rest.
- **Theta (4-8 Hz):** Theta bridges conscious and subconscious, surging in light sleep, meditation, and creativity. It's the daydreamer's wave, hypnagogic imagery flickers as theta rises. In excess, it marks dysfunction: high frontal theta at Fz flags ADHD's inattention or fatigue (theta/beta ratio >2:1). Neurofeedback reduces it while boosting beta, cutting distractibility 70-80% (Arns et al., 2012). Theta's upside shines in alpha/theta training for PTSD, enhancing it at Pz with alpha cuts intrusive memories 70% (Peniston & Kulkosky, 1991), easing trauma's grip.
- **Alpha (7-12 Hz):** The brain's idle mode, alpha emerges in relaxed wakefulness, eyes closed, fostering calm and mental clarity. It's a bridge, linking conscious focus to subconscious insight. Healthy alpha peaks at O1/O2, dropping with stress or trauma (alpha blocking). Low occipital alpha might signal anxiety; training it up there restores balance, reducing rumination 60-75% (Hammond, 2005). Excess alpha frontally, though, can dull alertness. Depression's left-right asymmetry often shows this, corrected by boosting right beta (Baehr et al., 2001).
- **Beta (12-30 Hz):** The workhorse of active cognition, beta powers focus, problem-solving, and alertness. Low beta (13-15 Hz, SMR) stabilizes attention—ADHD training at Cz lifts it, improving concentration 70% (Arns et al., 2012). High beta (20-30 Hz) reflects intensity; excess at Fz or T3/T4 fuels anxiety's overdrive, calmed by alpha or theta upregulation (60-75% relief, Hammond, 2005). Beta's range demands nuance, too little saps focus, too much sparks tension. Neurofeedback fine-tunes this balance, aligning it with mental demands.
- **Gamma (30-100 Hz):** The fastest waves, gamma binds brain regions during peak cognition, memory retrieval, perception, insight. It spikes in "aha" moments, tying prefrontal and temporal lobes. Deficits link to autism (disrupted coherence) or dementia (memory loss); excess may signal epilepsy. Measuring gamma is tricky as muscle artifacts overlap, so neurofeedback rarely targets it directly. Emerging research (e.g., Keizer et al., 2010) suggests gamma training at Fz boosts IQ 10-15 points, hinting at future potential.