Normal and Abnormal EEG Findings

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Normal and essentially normal EEG background
Bipolar montage. EEG electrode placement using the International 10-20 electrode placement system.

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Ipsilateral ear referential montage. EEG electrode placement using the International 10-20 electrode placement system.

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Mu rhythm, left and right central regions, longitudinal bipolar montage.

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Mu rhythm, right central region, longitudinal bipolar montage.

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Nonspecific frontal theta during drowsiness, longitudinal bipolar montage.

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Lambda over posterior head regions when viewing complex picture, longitudinal bipolar montage.

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Prominent photic driving response, longitudinal bipolar montage. Photic stimulus shown as red ticks at bottom of figure.

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Photic driving response, ipsilateral ear reference montage. Photic stimulus marked as red ticks at bottom of figure.

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Photic driving response, longitudinal bipolar montage. Photic stimulus marked by grey ticks at bottom of figure.

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Electroretinogram (ERG) artifact caused by retinal depolarization induced by photic stimulus shown in FP1 and FP2 derivations on a longitudinal Laplacian montage. Ocular source of waveforms established by covering the right eye, which blocked stimulation of the right retina eliminating ERG in the FP2 derivation.

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EEG benign variants
Wicket waves, left temporal region with phase-reversal at T7, longitudinal bipolar montage.

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Rhythmic temporal theta of drowsiness, bitemporal left greater than right, longitudinal bipolar montage. Noted are notched rhythmic waveforms localized to the temporal regions, some of which are sharply contoured. This artifact was formerly referred to as the “psychomotor variant”.

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BSSS (benign small sharp spikes) aka BETS (benign epileptiform transients of sleep) on ipsilateral ear reference (left) and longitudinal bipolar montage (right). Note steep descending slope of low amplitude spike and small aftercoming slow wave, particularly at T7-TP11.

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6 hertz ("phantom") spike and wave, longitudinal bipolar montage. This is the posterior variant sometimes referred to as the FOLD ("female occipital low-amplitude drowsiness") subtype. An anterior variant known as WHAM ("Wake high amplitude male") subtype has also been described (not shown).

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Subacute rhythmic epileptiform discharges in adult (SREDA) pattern, longitudinal bipolar montage. Black brackets show onset of periodic posterior-predominant sharply contoured waveforms, becoming rhythmic, then resolving at latter portion of figure. Patient asymptomatic during discharge.

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Abnormal EEG
Right temporal delta activity, longitudinal bipolar montage.
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Frontal intermittent rhythmic delta activity (FIRDA), longitudinal bipolar montage.

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Occipital intermittent rhythmic delta (OIRDA), longitudinal bipolar montage.
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Generalized delta activity in encephalopathic child, longitudinal bipolar montage.
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Generalized triphasic waves, longitudinal bipolar montage. Waveforms show characteristic anterior to posterior lag (see waveform marked by black arrow).

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Periodic lateralized epileptiform discharges (PLEDs) left parieto-occipital; asymmetry alpha decreased left, longitudinal Laplacian referential montage.

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Periodic lateralized epileptiform discharges (PLEDs) left temporal region.

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Polyphasic PLEDs ("Poly-PLEDs") localized to the left parietal-posterior temporal region, longitudinal bipolar montage.

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Asymmetric periodic complexes in patient with Creutzfeld-Jakob disease (CJD), longitudinal bipolar montage. This recording was obtained 3 weeks after symptom onset. The waveforms in this patient are most prominent over the right hemispheric region which correlated with the patient’s MRI findings, and are triphasic in morphology.

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Burst-suppression pattern in patient following cardiac arrest, longitudinal bipolar montage.

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Generalized theta coma pattern in comatose patient post cardiac arrest, longitudinal bipolar montage. To establish the diagnosis of theta coma or any of the coma patterns (e.g., alpha, spindle and beta coma), one must demonstrate through stimulation of the patient that the pattern is invariant and does not alter in response to external stimuli.

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Generalized anesthetic pattern in patient undergoing routine carotid endarterectomy. Note diffuse anterior predominant alpha frequencies superimposed on a generalized 0.5-1.0 Hz baseline.

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Marked asymmetry, noted by suppression of EEG amplitude over left hemispheric derivations in post-hemispherectomy patient, longitudinal bipolar montage.

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Epileptiform discharges
Generalized 3 Hz spike and wave, during slight sleep, longitudinal bipolar montage. Copyright 2013. Mayo Foundation for Medical Education and Research. All rights reserved. Courtesy of Dr. Jeffrey W. Britton, MD.
Generalized 3 Hz spike and wave, ipsilateral ear referential montage.

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Generalized atypical spike and wave, longitudinal bipolar montage.

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Generalized atypical spike and wave, ipsilateral ear referential montage.

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Generalized photoparoxysmal response in patient with idiopathic generalized epilepsy, ipsilateral ear referential montage.

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Generalized slow spike and wave in child with Lennox-Gastaut syndrome, ipsilateral ear referential montage.

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Ictal/Spell EEG Patterns
Syncope Part 1. Recorded syncope during venipuncture on compressed time base (Part 1). Normal awake tracing followed by onset of asystole (marked by star). The EEG begins to show diffuse delta activity, then becomes suppressed at the end of the epoch shown.

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Syncope Part 2. Recorded syncope during venipuncture on compressed time base (continued). EEG shows diffuse suppression in initial portion of the epoch shown. Sinus rhythm has returned, correlating with first resumption of diffuse delta then theta activity, then return of normal background in the latter portion of the figure.

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Recorded absence seizure showing generalized 3.0-3.5 Hertz generalized spike and wave discharge, longitudinal bipolar montage.

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Generalized non-convulsive status epilepticus in confused patient showing continuous generalized anterior predominant sharp activity (labeled “Pre-Lorazepam”). Resolution of generalized sharp activity shown post-lorazepam infusion. Longitudinal bipolar montage.

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Recorded generalized tonic seizures leading to drop attacks (each recorded event marked by star). Patient stood up in a harness system in order to safely record typical events. Onset of each event in this patient is correlated with occurrence of a high amplitude generalized slow complex (marked by filled arrow), followed by an electrodecremental response (marked by open arrow).

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Generalized tonic-clonic seizure (Part 1). Onset of generalized tonic-clonic seizure, longitudinal average ear referential montage. Generalized spike and wave and polyspikes noted at seizure onset (filled arrow), evolving to continuous activation during tonic phase (open arrow).

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Generalized tonic-clonic seizure (Part 2). Seizure progresses to clonic phase, showing intermittent bursts of diffuse high frequency activity with progressively longer intervals of suppression between bursts. Post-ictal phase marked by diffuse suppression as noted in the latter portion of the epoch shown.

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Left temporal onset seizure discharge with onset showing rhythmic delta localized to the left anterior temporal region, with phase-reversal noted over the F7-T7 and F9-T9 derivations (filled arrow). Discharge evolves into rhythmic left temporal theta (open arrow) towards end of the epoch shown. Longitudinal bipolar montage with left hemispheric derivations upper half, right hemispheric lower half.

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Recorded seizure right frontal onset, longitudinal Laplacian referential montage. Seizure onset manifested as rhythmic sharp activity involving FP2 and F8 (filled arrows). Discharge evolves into a rhythmic delta discharge involving the midline and right frontal derivations (open arrows).

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Left occipital onset seizure, longitudinal bipolar montage, left hemispheric derivation upper half, right hemispheric derivation lower half. Onset P3-O1 and P7-O1 (filled arrows).

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Hypsarhythmia pattern and electrodecremental response (see bracketed area) during epileptic spasm in patient with West syndrome.

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Recorded seizure (Part 1) in patient with bitemporal depth electrodes (right, labeled R1 thru R8 -AV; left, labeled L1 thru L8-AV) and scalp electrodes recording showing longitudinal average referential montage. Seizure onset shown in right anterior medial temporal depth contacts (R1-R3).

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Recorded seizure (Part 2) in patient with bitemporal medial temporal depth electrodes and scalp recording, showing rhythmic high frequency activity maximal in right anterior medial temporal depth contacts (R1-R3). Note absence of scalp electrode discharge showing limited sensitivity of scalp recording in this patient.

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Further progression of seizure (Part 3) in patient with bitemporal medial temporal depth electrodes and scalp recording, showing rhythmic 8 Hz activity involving both medial temporal depths and bitemporal temporal scalp electrodes.

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Parts 1 and 2 show two recorded seizures in non-lesional patient with left lateral frontal seizure focus. Recordings acquired via left lateral frontal subdural grid electrodes. Seizure onset in Part 1 consists of rhythmic spike and wave activity at LG36-CZ and LG44-CZ (black arrow) evolving into a rhythmic high frequency discharge in same distribution (open arrow). In latter portion of the epoch, low amplitude diffuse high frequency activity present.

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In Part 2, new seizure arises in same patient as depicted in Part 1 as focal rhythmic spike discharge involving LG36-CZ, LG27-CZ and LG28- CZ (black bracket).

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