EPILEPSY

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INTRODUCTION

- **PERIODIC AND UNPREDICTABLE SEIZURES CAUSED BY THE RHYTHMIC FIRING OF LARGE GROUPS OF NEURONS**
- **MAY RANGE FROM MILD TWITCHING TO LOSS OF CONSCIOUSNESS AND UNCONTROLLABLE CONVULSIONS**

SOME FAMOUS PEOPLE WHO WERE AFFLICTED

- **ALEXANDER THE GREAT**
- **JULIUS CAESAR**
- **NAPOLEON**
- **DOSTOEVSKY**
- **VAN GOGH**

CAUSES OF EPILEPSY

- **ACUTE**
- **CONGENITAL**

CAUSES OF ACUTE EPILEPSY

- **CORTICAL DAMAGE**
- **TRAUMA**
- **STROKE**
- **NEOPLASM**
- **AUTOIMMUNE EFFECTS (RASMUSSEN'S ENCEPHALITIS)**

CAUSES OF CONGENITAL EPILEPSY

- **DYSGENESIS (FAILURE OF CORTEX TO GROW PROPERLY)**
- **VASCULAR MALFORMATIONS**
- **AT LEAST EIGHT SINGLE LOCUS GENETIC DEFECTS ARE ASSOCIATED WITH EPILEPSY. MOST FORMS INVOLVE INHERITING MORE THAN ONE LOCUS. (EXAMPLES: JUVENILE MYOCLONIC, PETIT MAL)**

EPILEPTIC SEIZURE FOCI

- **MOTOR CORTEX: CAUSE MOVEMENTS ON CONTRALATERAL SIDE ACCORDING TO THE SOMATOTOPIC LOCATION OF THE SEIZURE FOCUS.**
- **SOMATOSENSORY CORTEX: CAUSE AN *EPILEPTIC AURA* IN WHICH A SENSATION IS EXPERIENCED. ALSO DEPENDS ON WHICH PART OF SOMATOTOPIC REPRESENTATION HOLDS THE FOCUS.**
- **VISUAL CORTEX: CAUSE A VISUAL AURA (SCINTILLATIONS, COLORS).**

EPILEPTIC SEIZURE FOCI (Cont.)

- **AUDITORY CORTEX: CAUSE AN AUDITORY AURA (HUMMING, BUZZING, AND RINGING).**
- **VESTIBULAR CORTEX: CAUSE A FEELING OF SPINNING.**
- **TEMPORAL LOBE: CAUSE COMPLEX BEHAVIORS.**
- **OLIFACTORY CORTEX: CAUSE MALODOROUS AURA.**
- **HIPPOCAMPUS: PARTICULARLY SUSCEPTIBLE AND A FREQUENT SOURCE OF EPILEPTIC ACTIVITY.**

TWO TYPES OF SIEZURES

- **PARTIAL**
- **GENERAL**

PARTIAL SEIZURES

- **IN MOTOR CORTEX - RESULTS IN LOCALIZED CONTRACTIONS OF CONTRALATERAL MUSCLES THAT MAY SPREAD TO OTHER MUSCLES FOLLOWING THE SOMATOTOPIC ORGANIZATION OF THE MOTOR CORTEX**
- **COMPLEX PARTIAL SEIZURES MAY OCCUR IN PSYCHOMOTOR EPILEPSY. THESE ORIGINATE IN THE LIMBIC LOBE AND RESULT IN ILLUSIONS AND SEMIPURPOSEFUL MOTOR ACTIVITY**
- **DURING AND BETWEEN FOCAL SEIZURES, SCALP RECORDINGS MAY REVEAL EEG SPIKES.**

GENERALIZED SEIZURES

- **INVOLVE WIDE AREAS OF THE BRAIN AND LOSS OF CONSCIOUSNESS**
- ***PETIT MAL***
- ***GRAND MAL***

TWO TYPES OF GENERAL SEIZURES

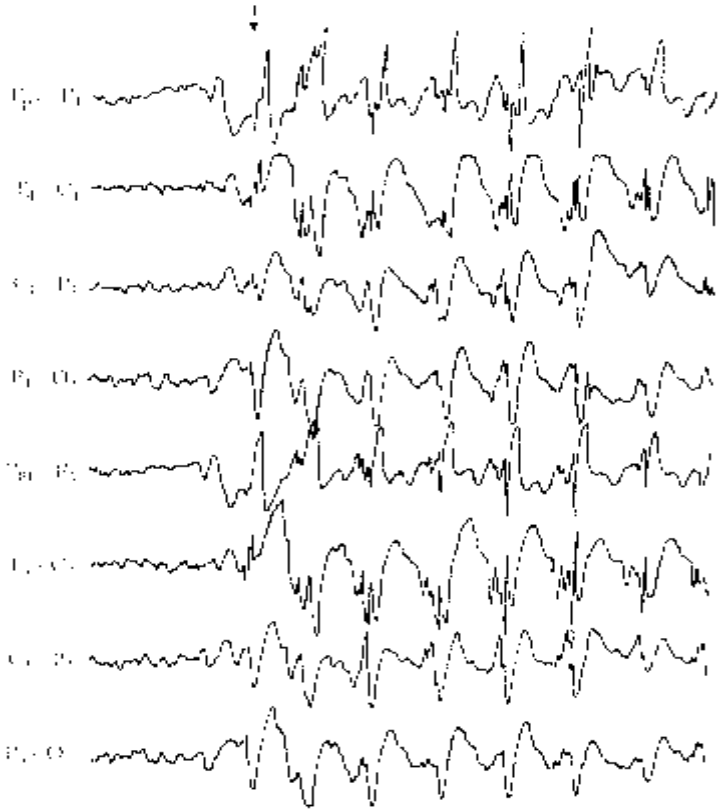
- **PETIT MAL SEIZURES: CONSCIOUSNESS IS TRANSIENTLY LOST AND THE EEG DISPLAYS SPIKE AND WAVE ACTIVITY.**
- **GRAND MAL SEIZURES: CONSCIOUSNESS LOST FOR A LONGER PERIOD AND THE INDIVIDUAL WILL FALL IF STANDING WHEN SEIZURE STARTS.**
  - **.TONIC PHASE: GENERALIZED INCREASED MUSCLE TONE.**
  - **.CLONIC PHASE: SERIES OF JERKY MOVEMENTS. BOWEL AND BLADDER MAY EVACUATE.**

ELECTROPHYSIOLOGICAL CORRELATES OF SEIZURE ACTIVITY

- **EEG SPIKES THAT OCCUR BETWEEN FULL-BLOWN SEIZURES ARE CALLED *INTERICTAL SPIKES*.**

- **THESE ARISE FROM LONG-LASTING DEPOLARIZATIONS CALLED *DEPOLARIZATION SHIFTS*.**

EEG TRACING OF EPILEPTIC SIEZURE



DEPOLARIZATION SHIFTS

- **TRIGGER REPETITIVE ACTION POTENTIALS IN CORTICAL NEURONS**
- **REGENERATIVE CALCIUM MEDIATED DENDRIDIC POTENTIALS IN CORTICAL NEURONS**
- **REDUCTION OF INHIBITORY INTERACTIONS IN CORTICAL CIRCUITS**
- **RELEASE OF POTASSIUM AND EXCITATORY AMINO ACIDS FROM HYPERACTIVE NEURONS**
- **EXCITATION OF NMDA- TYPE GLUTAMATE RECEPTORS [N-METHYL-D-ASPARTATE, GLUTAMATE ANALOG]. (CALCIUM ENTRY AND LONG TERM POTENTIATION [LTP]). SEIZURES ACTIVATE NMDA RECEPTORS AND STRENGTHEN CONNECTIONS BETWEEN EXCITED NEURONS.**

TREATMENTS FOR EPILEPSY

- **NO EFFECTIVE PREVENTIONS OR CURES KNOWN.**
- **SURGICAL METHODS**
- **SEIZURE INHIBITING DRUGS**

SURGICAL METHODS

- **SURGICAL REMOVAL OF EPILEPTOGENIC REGION**
- **CUTTING CORPUS CALLOSUM TO PREVENT SPREAD OF SEIZURES BETWEEN HEMISPHERES**

SEIZURE INHIBITING DRUGS

- **SEIZURES CAN ARISE FROM REMOVAL OF GABA INDUCED INHIBITION WHEN GABA LEVELS DROP**
- **VITAMIN B6 (PYRIDOXAL PHOSPHATE) IS IMPORTANT FOR GABA SYNTHESIS**
- **MOST GABA IS EVENTUALLY CONVERTED TO SUCCINATE BY GABA AMINOTRANSFERASE**
- **A GABA AMINOTRANSFERASE INHIBITOR, SODIUM DIPROPYLACETATE, IS WIDELY USED AS AN ANTICONVULSANT**
- **GABA IS MOST COMMONLY FOUND IN LOCAL-CIRCUIT INTERNEURONS**
- **DRUGS THAT ACT AS AGONISTS OR MODULATORS FOR POSTSYNAPTIC GABA RECEPTORS, SUCH AS BARBITURATES, ARE ALSO USED TO TREAT EPILEPSY**