

# Epilepsy 101

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Raphael (Raffaello Santi, 1483-1520): **The transfiguration.**  
Vatican Museums, Rome



...'Teacher, I brought my son to you, because he has an evil spirit in him and cannot talk. Whenever the spirit attacks him, it throws him to the ground, and he foams at the mouth, grits his teeth and becomes stiff all over.' (Mark 9, 17-18)

# Seizures & Epilepsy

## Overview

- what is a seizure?
- why do seizures occur?
- what is epilepsy?
- how do we investigate a child with seizures?
- how do we treat seizures?
- first aid

**+ 12 myths and misconceptions about seizures and epilepsy**

# The brain is a complex circuit

- the brain works on electricity
- each part of the brain has a specific function e.g. speech / movement / sensation / vision
- the electrical pattern is usually tightly controlled and highly organized, so we only do what we want, and only when we want to do it
- interruption of the normal electrical patterns can cause interruptions in normal brain activity and then abnormal function

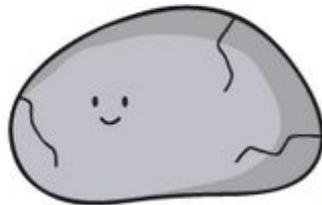
# What is a seizure?

- a seizure is a sudden, uncontrolled change in a person due to a change in the brain's electrical pattern from organized to disorganized
- the change in the person will depend on what part of the brain is affected by the disorganized activity
- seizures can be focal (restricted to one part of the brain) or generalised (all the brain is involved).
- some generalised seizures can start as focal seizures

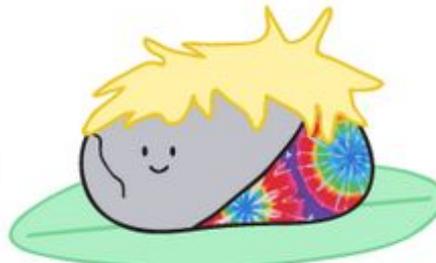
# Seizures - examples

- loss of consciousness with shaking of all limbs = generalised tonic clonic
- uncontrolled movement of one part of the body = focal motor
- an unusual sensation in one part of the body = focal sensory
- a change in behaviour and alertness without loss of consciousness = focal with impaired awareness

# Classification of Seizures



ROCK



SURF ROCK



PUNK ROCK

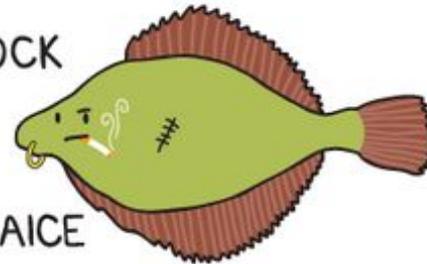


ROCKOON



ROCK

HARD PLAICE



ROCK AND ROLL



ROCKY

# Location, location, location

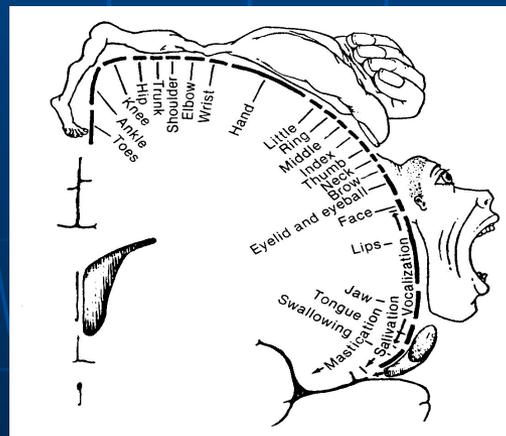
## Generalised seizures

- All of the brain is affected
- The person is unconscious



## Focal seizures

- One area of the brain is affected
- The person may have impaired consciousness or be fully aware



# **Operational classification of seizure types by the International League Against Epilepsy: Position Paper of the ILAE Commission for Classification and Terminology**

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*Epilepsia*, \*\*(\*):1–9, 2017

doi: 10.1111/epi.13670

# **ILAE classification of the epilepsies: Position paper of the ILAE Commission for Classification and Terminology**

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# ILAE 2017 Classification of Seizure Types Basic Version <sup>1</sup>

## Focal Onset

Aware

Impaired  
Awareness

Motor Onset  
Nonmotor Onset

focal to bilateral tonic-clonic

## Generalized Onset

### Motor

Tonic-clonic  
Other motor

Nonmotor (Absence)

## Unknown Onset

### Motor

Tonic-clonic  
Other motor

Nonmotor

Unclassified <sup>2</sup>

# ILAE 2017 Classification of Seizure Types Expanded Version <sup>1</sup>

## Focal Onset

Aware

Impaired  
Awareness

### Motor Onset

automatisms  
atonic <sup>2</sup>  
clonic  
epileptic spasms <sup>2</sup>  
hyperkinetic  
myoclonic  
tonic

### Nonmotor Onset

autonomic  
behavior arrest  
cognitive  
emotional  
sensory

focal to bilateral tonic-clonic

## Generalized Onset

### Motor

tonic-clonic  
clonic  
tonic  
myoclonic  
myoclonic-tonic-clonic  
myoclonic-atonic  
atonic  
epileptic spasms

### Nonmotor (absence)

typical  
atypical  
myoclonic  
eyelid myoclonia

## Unknown Onset

### Motor

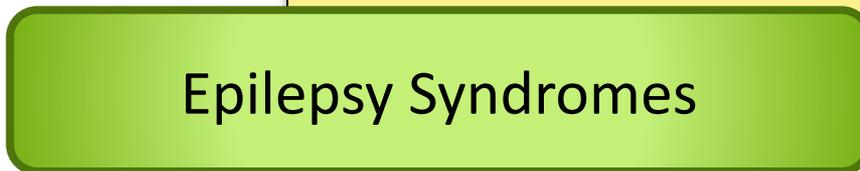
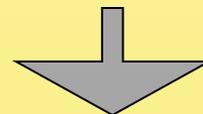
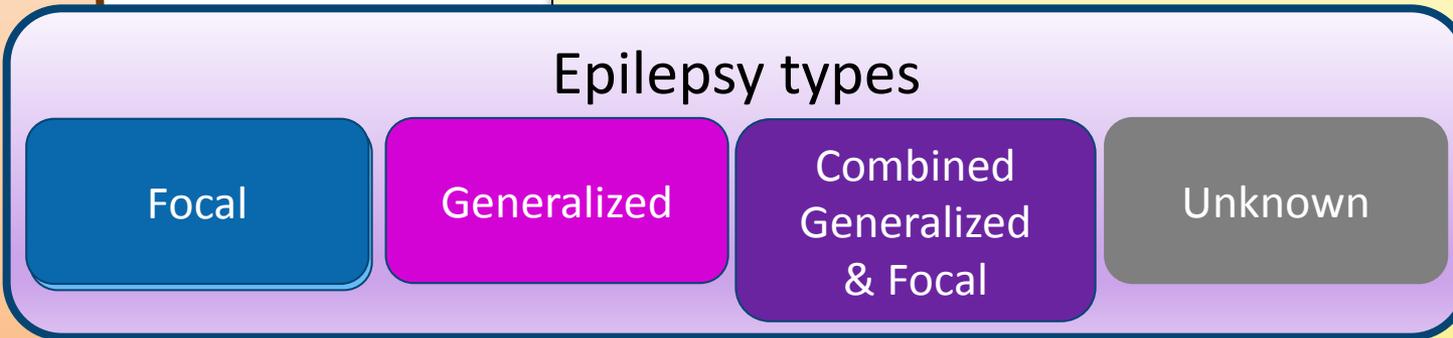
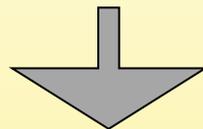
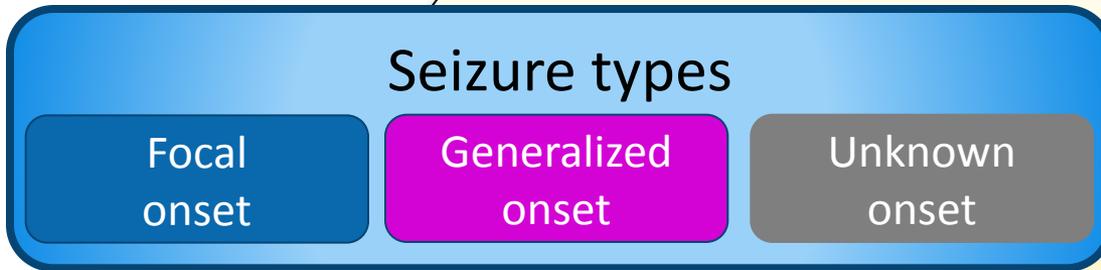
tonic-clonic  
epileptic spasms

### Nonmotor

behavior arrest

### Unclassified <sup>3</sup>

Co-morbidities



**Etiology**

Structural

Genetic

Infectious

Metabolic

Immune

Unknown

# Epileptic encephalopathy

R09:25:12

Fp2-F8

F8-T4

T4-T6

T6-O2

Fp1-F7

F7-T3

T3-T5

T5-O1

Fp2-F4

F4-C4

C4-P4

P4-O2

Fp1-F3

F3-C3

C3-P3

P3-O1

**Epileptic activity itself  
contributes to severe cognitive and  
behavioral impairment above and  
beyond that expected from the  
underlying pathology and that  
these can worsen over time**

**Berg et al**

Slide courtesy Dr Ingrid Scheffer

# *Developmental* and/or Epileptic Encephalopathy

- There is often a “developmental” component to the child’s symptoms *independent* of the epileptic encephalopathy
- The “developmental component” is the cause of the epilepsy, but also other symptoms such as developmental delay
- Developmental delay may precede seizure onset. If it becomes apparent after seizure onset, this does not always mean the seizures are the cause of the delay
- Outcome may be poor even though the seizures may become well controlled

# Myth 1

Seizures cause brain  
damage

# Seizures -why do they occur?

- seizures are a *symptom* of something “irritating” the cerebral cortex
- in over 50% of cases, no obvious cause for the seizures can be found despite all investigations
  - these are called “*idiopathic*” seizures, and now presumed to have a genetic basis
- when a cause can be found the seizures are called “*symptomatic*” seizures

# Symptomatic seizures

- low sugar
- trauma
- infection
- malformation
- metabolic (chemical)
- drug withdrawal
- poisons
- drugs
- bleeding
- neurodegenerative diseases
- stroke
- brain tumour

# Myth 2

Epilepsy is rare

# What is epilepsy ?

- epilepsy is **recurrent** seizures (i.e. >1)
- excludes febrile seizures
- ~10% of people will have at least 1 seizure in their lifetime
- ~1% of people have epilepsy
- epilepsy is not always permanent
  - ~50% of children will grow out of epilepsy

# Myth 3

Epilepsy is a disease

# Causes of epilepsy

## ■ Genetic

- the direct result of a known or presumed genetic defect in which seizures are the core symptom of the disorder

## ■ Structural/metabolic

- a distinct other condition or disease that is associated with a substantially increased risk of developing epilepsy

## ■ Unknown

- We just don't know

# Myth 4

Epilepsy has a high  
mortality

# Investigations for Seizures

- the aim of investigations is to:
  - Determine that the episodes are seizures
  - characterize the seizure type
  - localise the source of the seizures
  - find the cause and determine the best Rx
- good history, eye witness account, home video
- routine EEG and video-EEG monitoring
- brain imaging – MRI, PET, SPECT, MRS
- biochemical, metabolic, **genetic tests**

# Myth 5

An EEG is a test to  
diagnose epilepsy

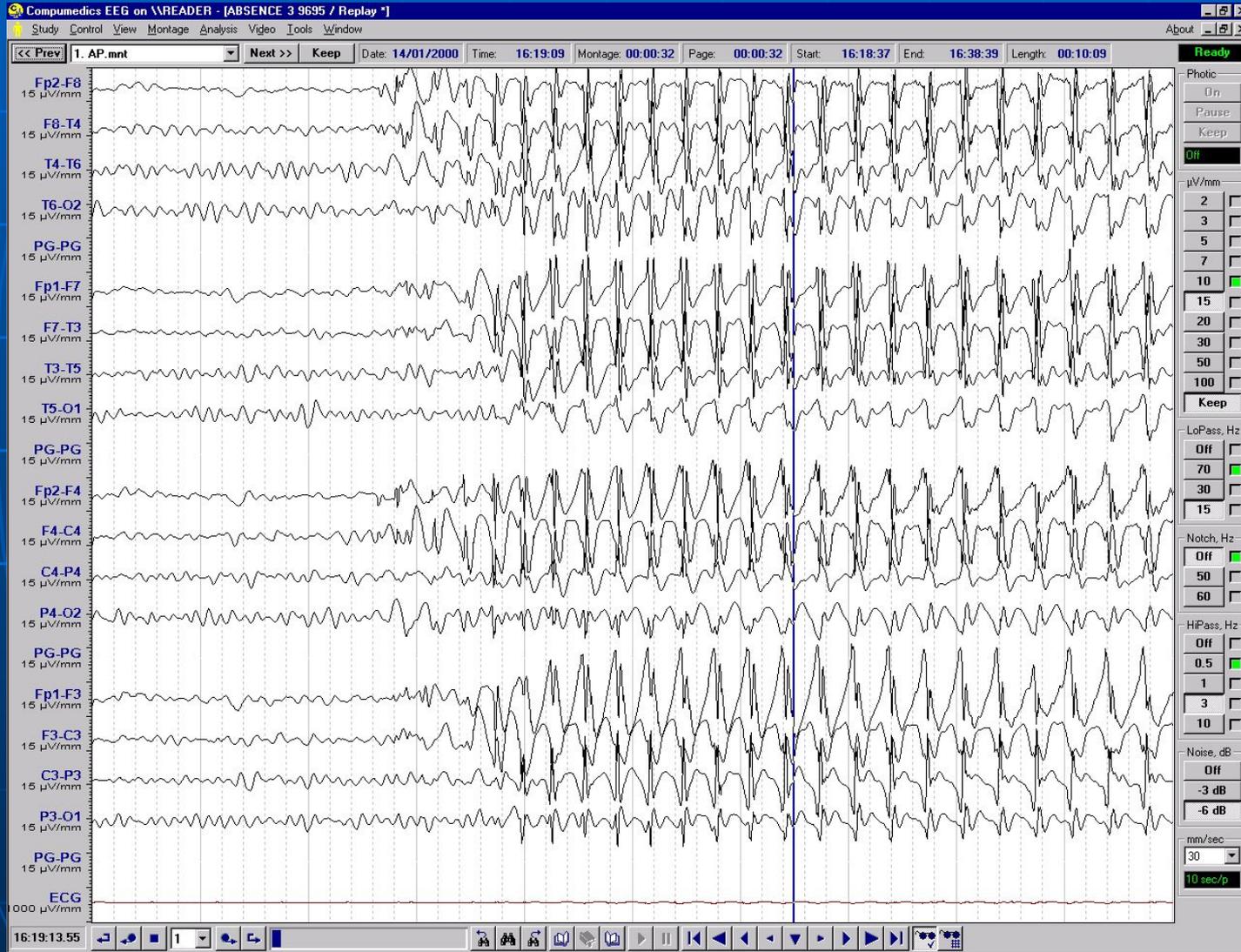
# EEG

- takes an electrical “picture” of the brain
  - may help identify if the episodes are seizures
  - helps identify where seizures come from
  - may help determine specific types of epilepsy = epilepsy syndromes
- note:
  - a patient with epilepsy may have a normal EEG between seizures
  - some people may have an abnormal EEG and will never have a seizure

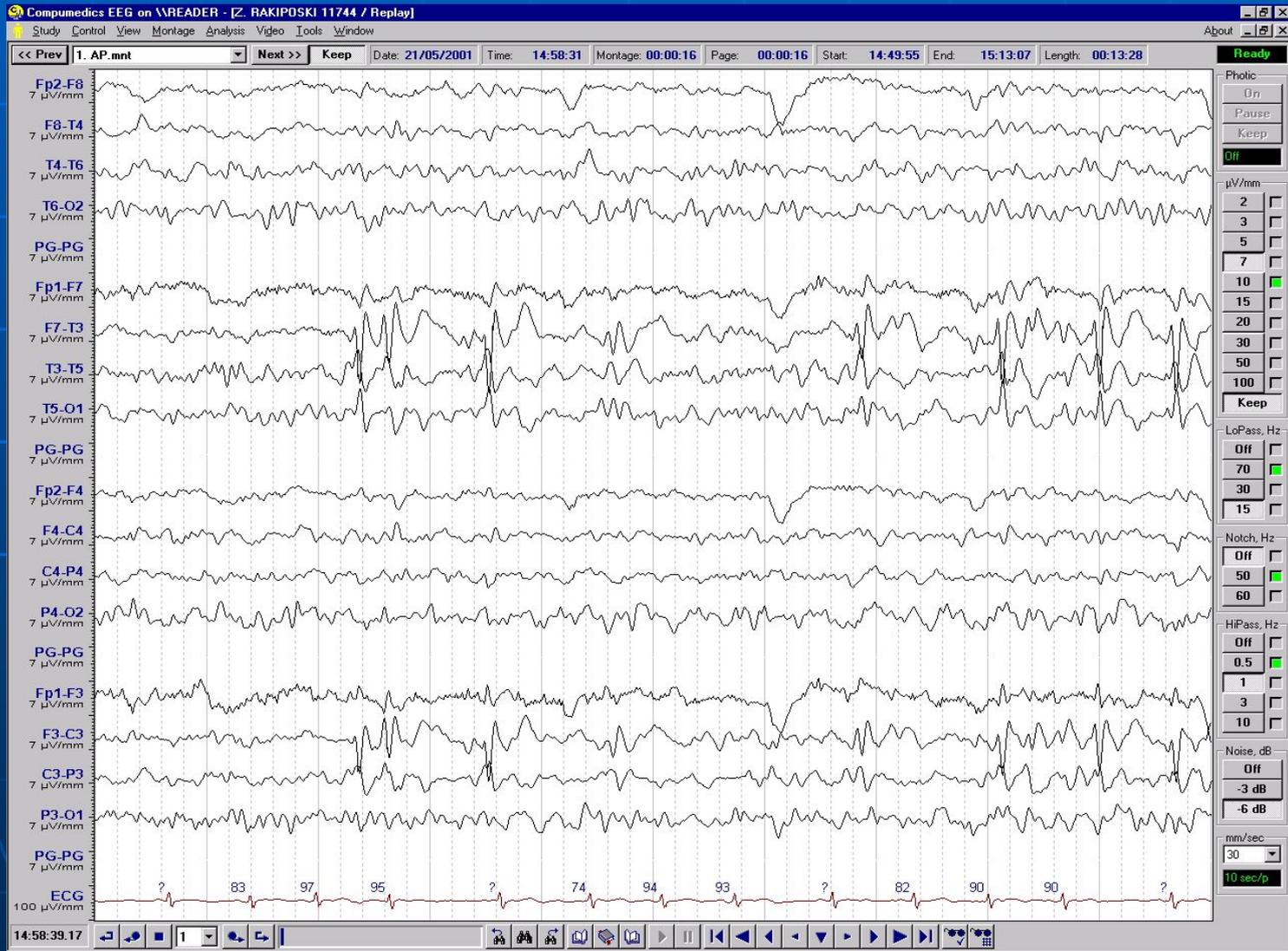
# EEG

- Three main things we report:
  - 1. The BACKGROUND
  - 2. EPILEPTIFORM ABNORMALITIES
  - 3. SEIZURES

# Generalised



# Focal



# Seizures - treatment

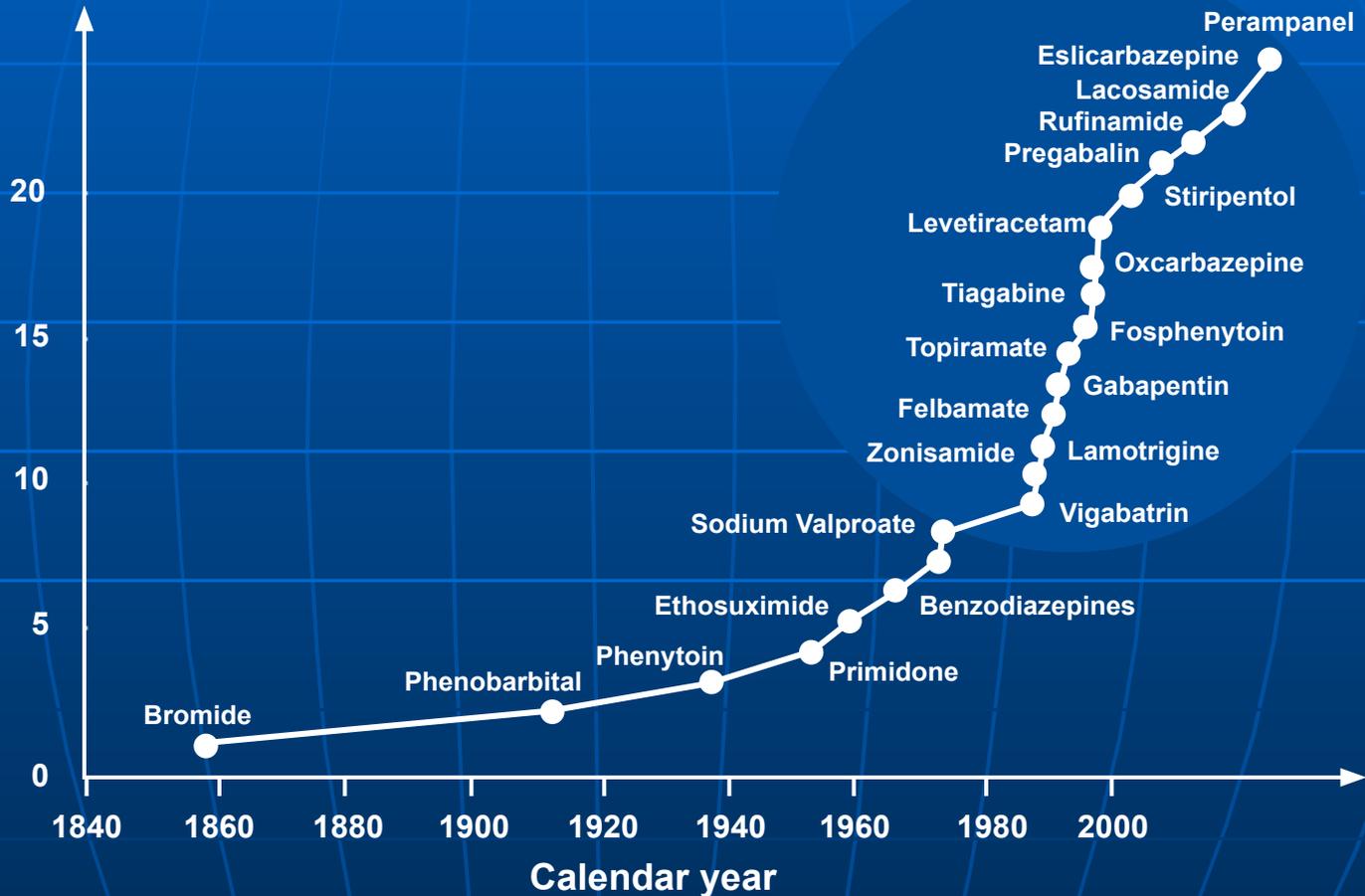
- TREAT THE CAUSE = not always possible
- Medications = *antiseizure medications* aka anticonvulsants / antiepileptics
  - control the seizures, but don't treat the cause
  - all have potential side effects
  - different drugs for different seizure types
  - may not always work
  - some can be monitored by blood levels

# Myth 6

Antiepileptic drugs are  
antiepileptic

# Introduction of new AEDs

## Antiepileptic drugs



*Adapted from Brodie and Sills. Seizure. 2011;20:369-375. Courtesy, Prof Terry O'Brien*

## Myth 7

Some anticonvulsants are stronger than others

## Myth 8

The “new” anticonvulsants  
are better than the “old”  
ones

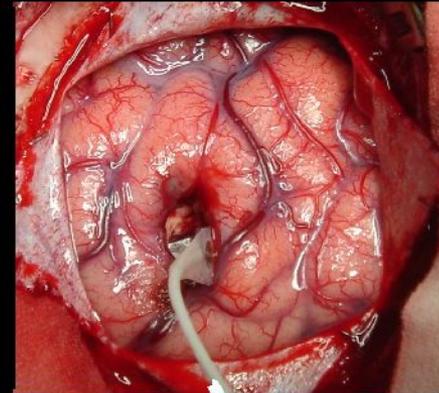
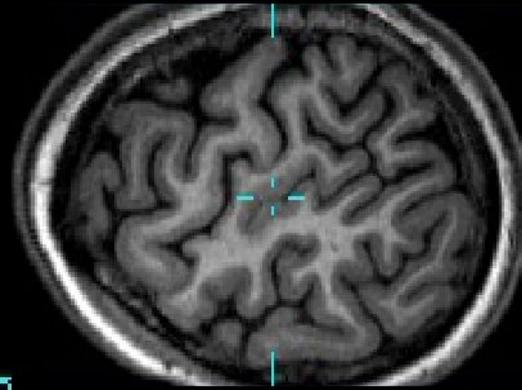
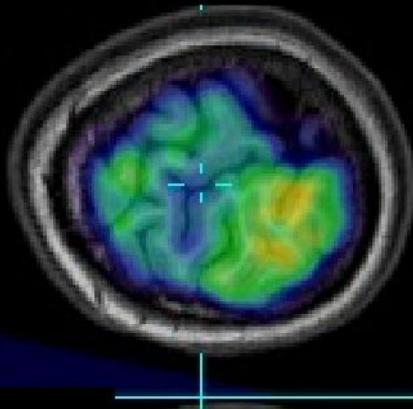
# Treatment of drug resistant epilepsy

- new antiepileptic drugs
- epilepsy surgery
- vagus nerve stimulation
- the ketogenic diet
- cannabidiol

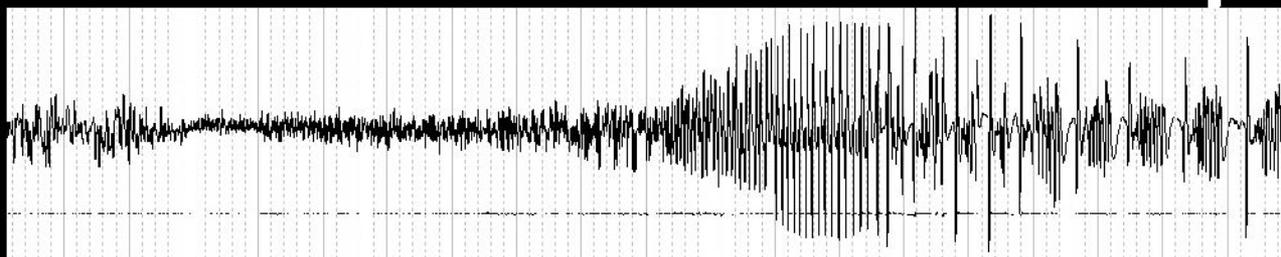
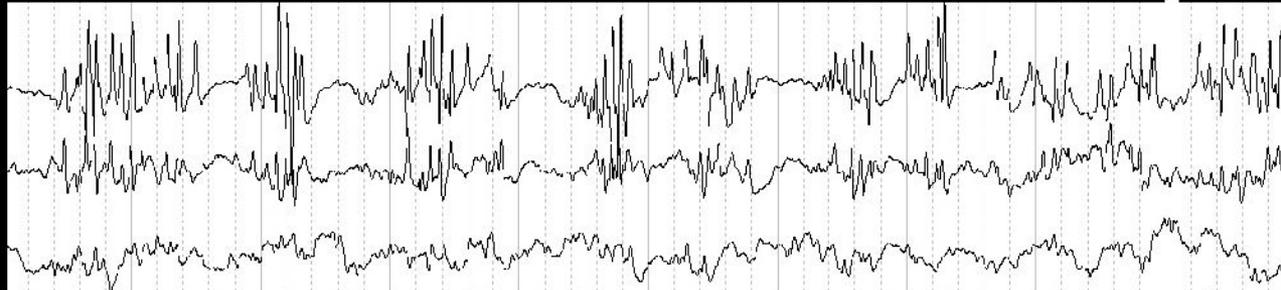
## Myth 9

Epilepsy can be cured by surgery if medicines fail

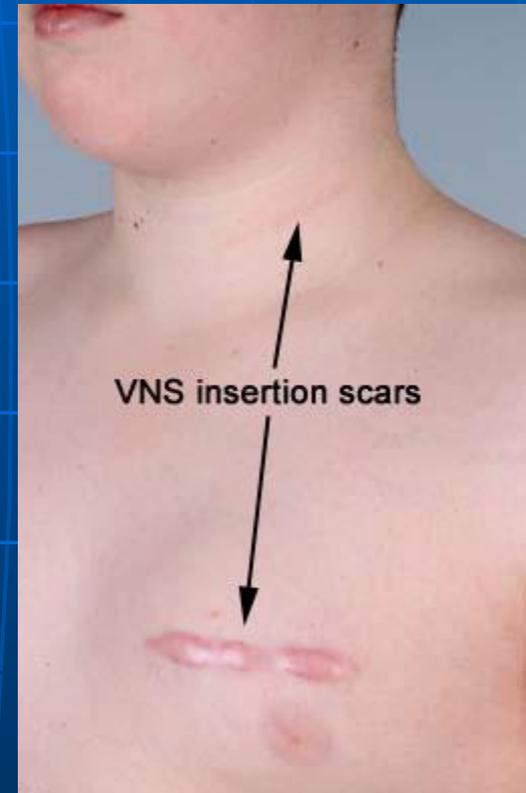
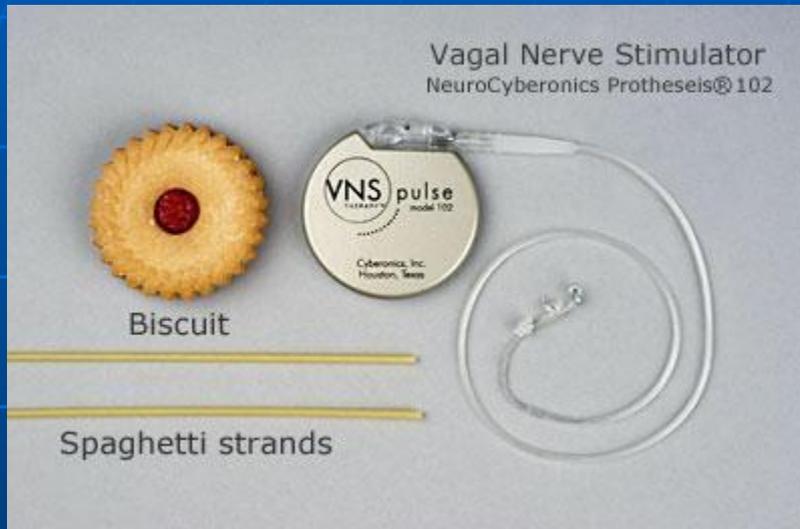
# Epilepsy surgery



left parietal dysplasia (BC+) and continuous SW on ECoG



# Vagus nerve stimulation

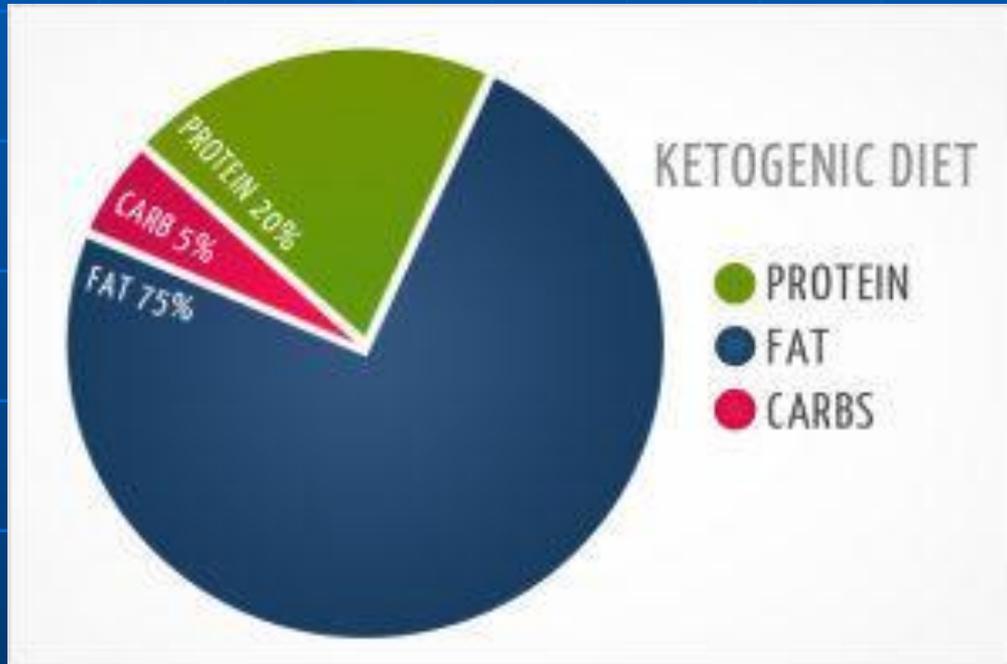


~ 50% of children have a least a 50% reduction in seizures,  
but this effect may not be seen until up to 18 months

## Myth 10

There is a natural diet that  
can cure epilepsy

# Ketogenic diet



~ 50% of children have a least a 50% reduction in seizures

# Myth 11

Cannabis is a natural  
treatment for epilepsy

# Cannabidiol

<b>Psychoactive</b>		<b>Non-psychoactive</b>
<b>THC</b>		<b>CBD</b>
<chem>CC1=C(C(=O)OC2C=CC(=C2)C(C)C)C=C(O)C1</chem>		<chem>CCCCC1=CC(=O)C2=C1O[C@H]3[C@@H](O)C=C[C@H]3O2</chem>



30- 50% of children have a least a 50% reduction in seizures

# Seizures - first aid

## ■ DO

- learn CPR
- lie child on side
- remove child from danger
- call 000 if seizure lasts > 5 minutes
- comfort child after seizure
- notify child's doctor if seizures long / frequent

## ■ DO NOT

- put anything in child's mouth
- restrain the movements
- leave child alone
- rush child to hospital whilst seizing
- panic - most seizures will stop after 1-2 min

## Myth 12

The most important part of treating a child with epilepsy is to stop all the seizures