

# Genetic Testing in Paediatric Epilepsy

## Who needs testing?

- Severe early onset epilepsy (first few years of life)
- Epilepsy and developmental delay or intellectual disability
- Children not responding to anti-seizure medications
- Children suspected of having an underlying genetic syndrome due to physical features or issues in other organs
- Distinctive seizure types
- Family history of seizures

## Why do genetic testing?

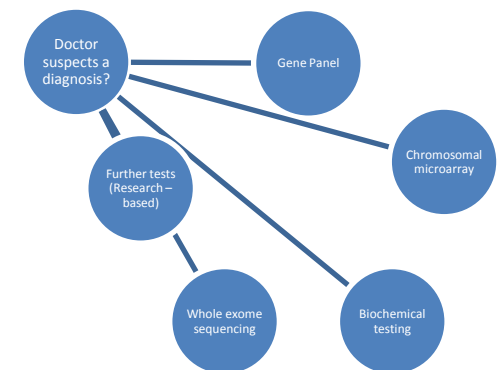
- A genetic diagnosis provides a **reason** and gives the family a sense of belonging and **empowerment**
- It may provide a prognosis and may influence treatment choices. It is important to diagnose **treatable** causes of epilepsy as early as possible
- It may help **avoid further tests**, multiple consults, repeat MRI's and invasive monitoring
- With a genetic diagnosis, families can get accurate counseling regarding **recurrence risks** and can make informed decisions in **family planning**.

## Final Thoughts...

- Epilepsy gene testing is worth the effort in selected cases, not all epilepsy is genetic
- New technologies are rapidly influencing understanding of genetic basis of epilepsies
- Next generation technologies are reducing costs of testing and providing new information almost on a daily basis.
- The future – gene-specific treatments, enzyme replacement therapies, gene editing approaches etc. holds the promise of providing personalized gene based therapies.
- Genetic counselling is critical for families when a child is diagnosed with genetic epilepsy.

## Resources for Families

- **Paediatric Epilepsy Program**  
Website: <https://www.lhsc.on.ca/paediatric-epilepsy-program>
- **Epilepsy Southwestern Ontario**: <https://epilepsyswo.ca/>
- **About Kids Health Genetics in Epilepsy**: <https://www.aboutkidshealth.ca/Article?contentid=2059&language=English>
- **International League Against Epilepsy**: <https://www.ilae.org/patient-care/epilepsy-and-genetics>

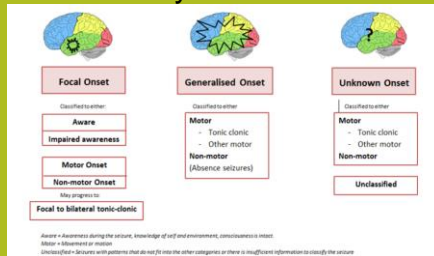


# What is Epilepsy?

Epilepsy is a disorder of the brain which generates seizure activity.

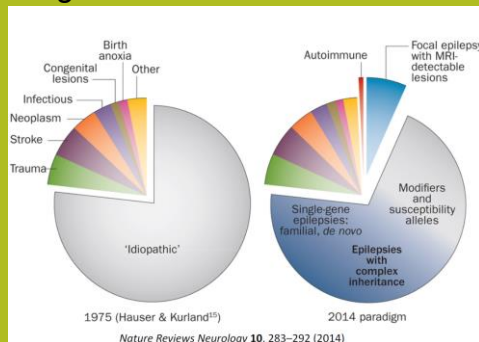
## Seizure Classifications:

- **Generalized Onset** involves both hemispheres of the brain.
- **Focal Onset** involves one hemisphere of the brain but may spread to both.
- **Unknown Onset** means that there is not enough information to classify the seizure.



# What Causes Epilepsy?

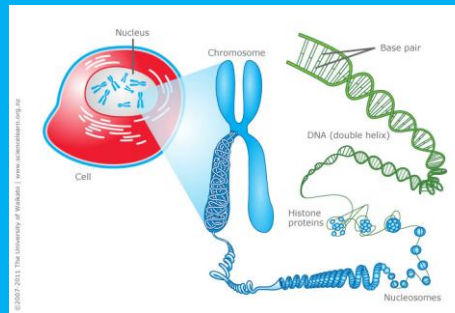
- **Epilepsy can be caused** by a variety of insults to the brain: birth related injuries, infection, trauma, structural abnormalities, tumours, and genetic factors.



# Epilepsy and Genetics

## Genetics 101: Chromosome vs Gene

- We are all made up of cells and our genetic material, DNA, is inside the cell.
- To fit inside the cell, DNA curls itself up into “chromosomes.”
- “Genes” are portions of DNA that each have different functions.
- We have about 22,000 genes. They come in pairs. One from our mother, one from our father.
- Genes are like books, that are stacked on shelves (chromosomes) inside our library (genome).
- Genetic epilepsy can occur when there is a specific change (mutation) to a chromosome or a gene.



# How do we diagnose genetic epilepsy?

## Phase 1

- An epilepsy diagnosis is made
- Physical examination is completed
- Development is assessed
- Clarify seizure type (clinical/video EEG)
- Age of Onset
- Family history is completed

## Phase 2

- Video EEG study
- MRI or CT to image the brain
- Patient selection for genetics consult (epileptologist's opinion based on criteria set by an expert panel at the provincial level)

## Genetics Assessment:

- History, family history, and physical examination by clinical geneticist
- Depending on assessment, one or more of the below may be offered to the family:
  - Microarray and biochemical testing
  - Single gene testing (panels)
  - Select cases may get exome sequencing (parental samples needed)
  - If all negative, may be enrolled in research studies to find a genetic cause
  - Genetic counselling

