New Horizons in Pediatric Neurology:
Innovations Shaping the Future

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Disclosure

I utilized ChatGPT to assist with the following aspects of this work:

- Brainstorming ideas
- Developing an outline
- Generating visual materials

Outlines

- Importance
- Revolution in Neurogenetics
- Epilepsy Rx Breakthroughs
- Paradigm Shift in Neuroimmunology
- Advances in Neonatal Neurology
- Tele-Neurology & Digital Health
- Neuromodulation & NeuroTechnology
- Targeted Rx in Neurooncology
- Global Challenges & Equity

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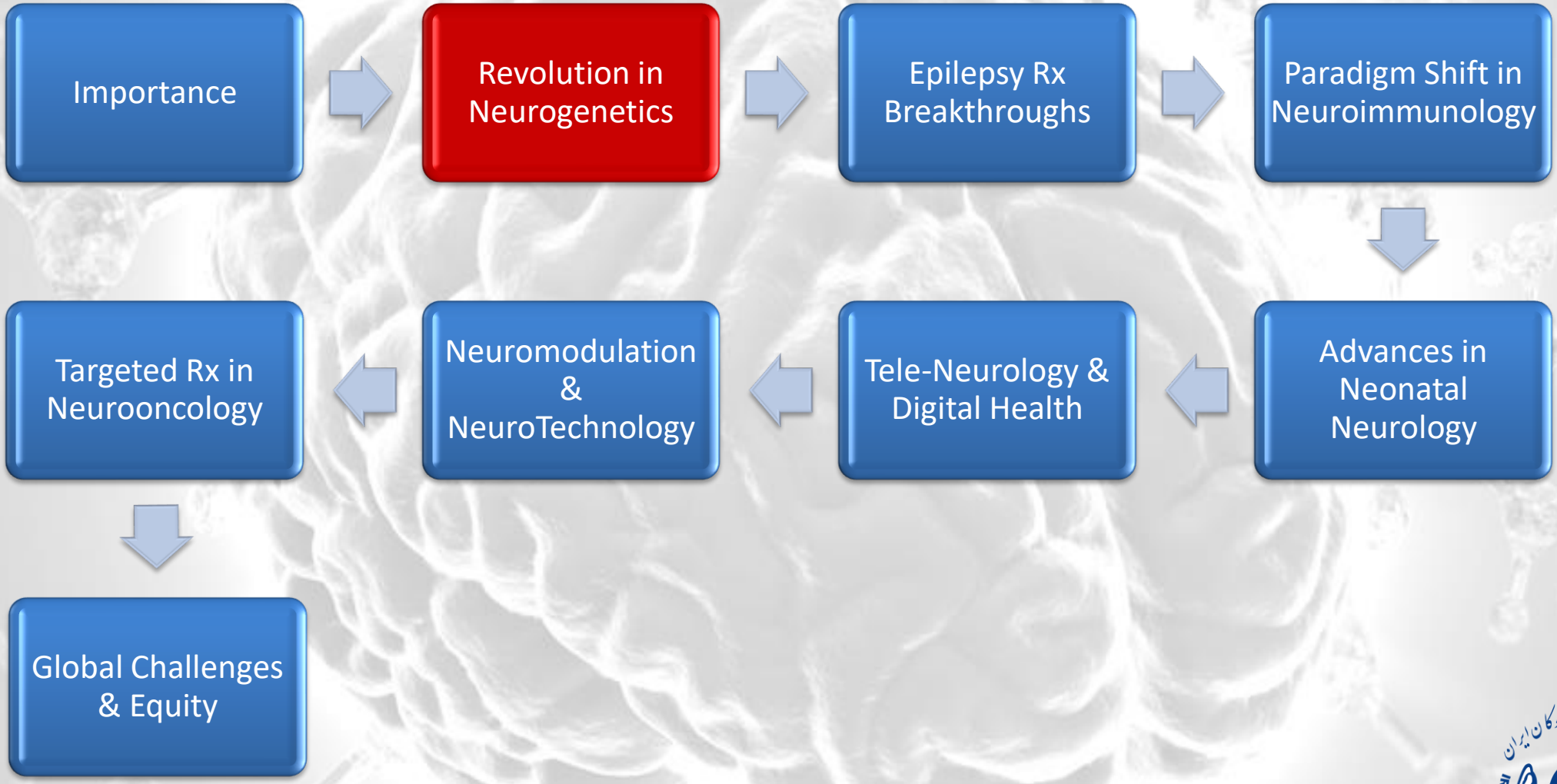
Importance

- ✓ Pediatric neurology's evolution: From symptom management to precision medicine.
- ✓ Why now? Explosion of Hi-techs (genomics, AI), novel therapies, and global collaboration.
- ✓ Advance Goal: Highlight transformative, impactful diagnoses, treatments, and patient outcomes.

Outlines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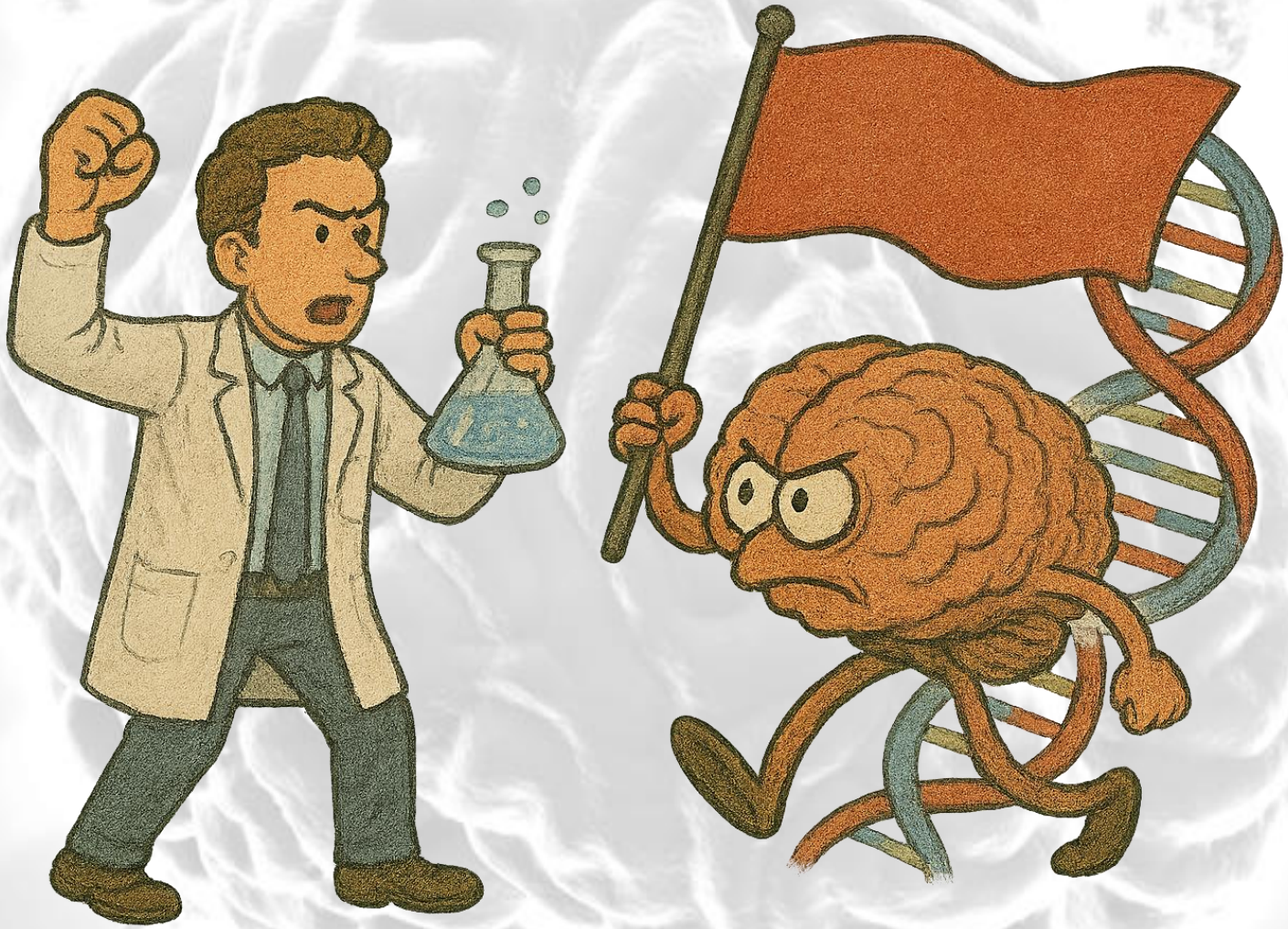
Revolution in Neurogenetics



Revolution in Neurogenetics

- New generation sequencing (NGS): Diagnosing 40%+ of previously idiopathic NDDs.
- Gene-specific therapies: e.g., Zolgensma and Risdiplam for SMA.
- CRISPR/Cas9: Early trials for Rett syndrome, Dravet syndrome.

WGS Workflow

Sample Preparation → DNA Sequencing → Data Analysis → Interpretation →

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Breakthroughs in Epilepsy Management

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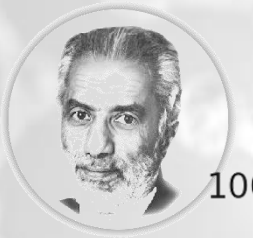
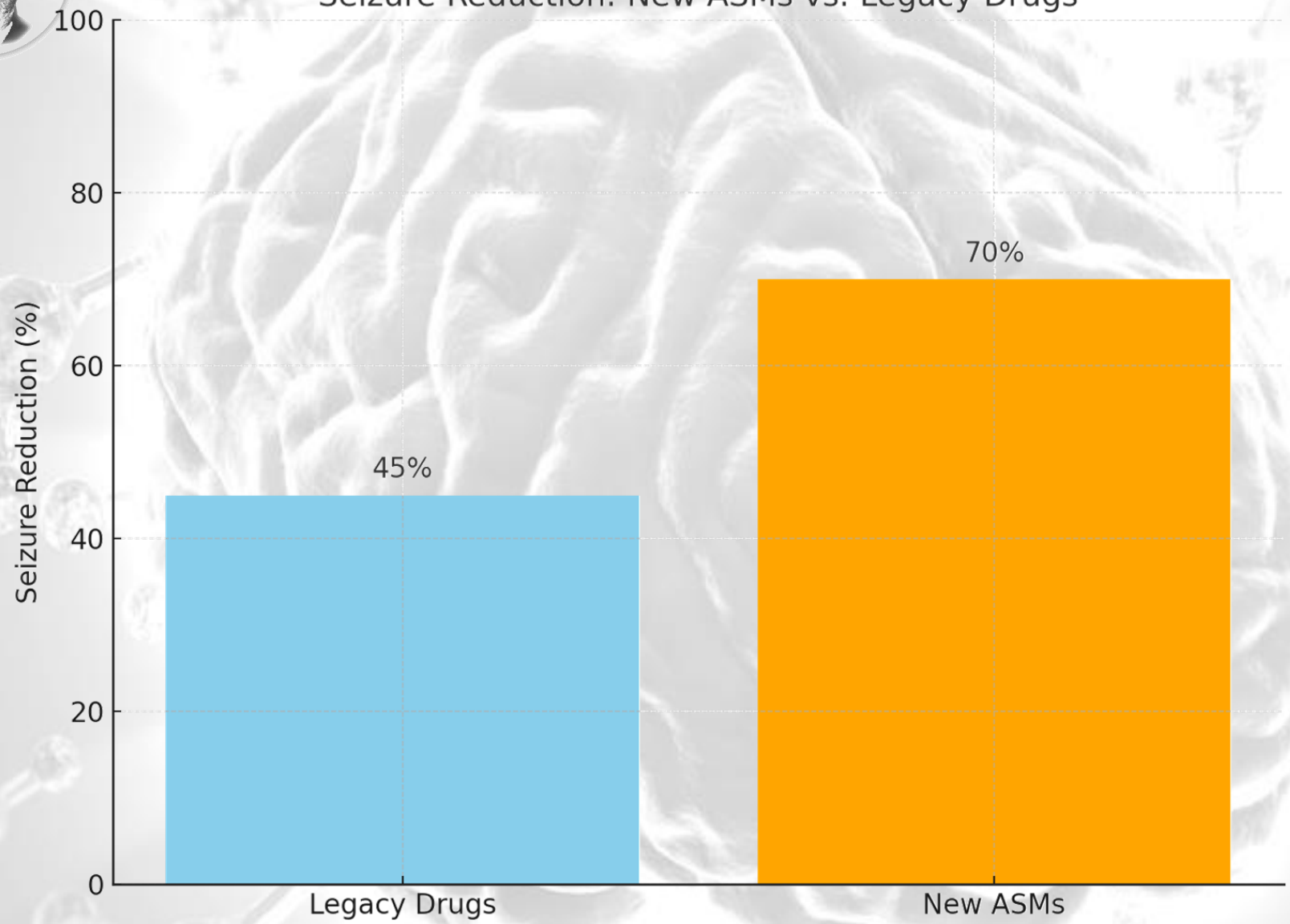
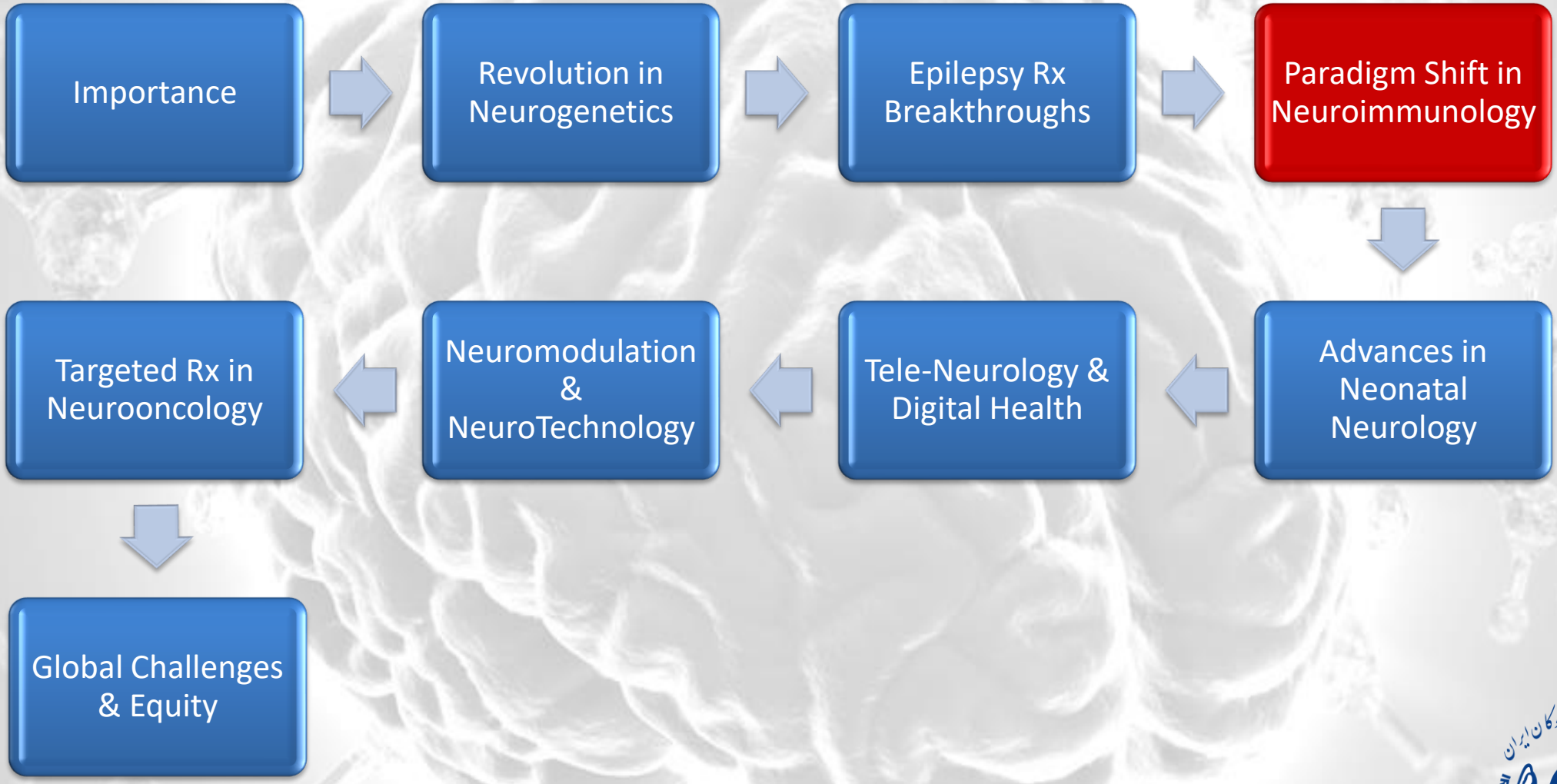
- New ASMs: Cenobamate (ultra-refractory epilepsy), Fenfluramine (Dravet/Lennox-Gastaut).
- Non-pharmacologic: Responsive neurostimulation (RNS) in children >4 yrs; MRI-guided laser ablation, DNS, VNS.
- Dietary: Ketogenic diet variations (modified Atkins) with improved adherence, Gut-Brain Axis (Probiotics).




Seizure Reduction: New ASMs vs. Legacy Drugs
Seizure Reduction (%)
100
80
60
40
20
0
45%
70%
Legacy Drugs
New ASMs

Outlines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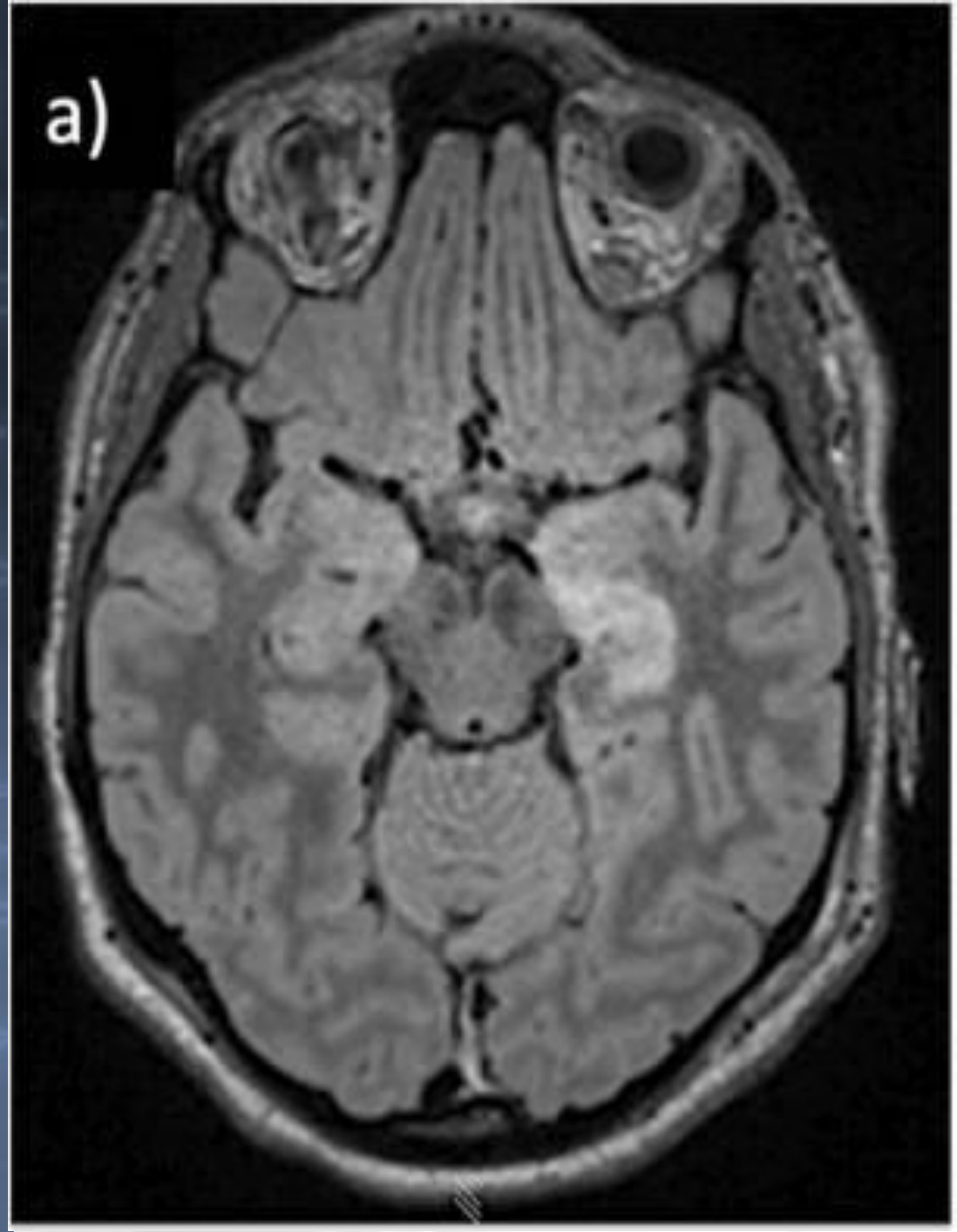
Neuroimmunology: Paradigm Shifts

- Autoimmune encephalitis (AE): Anti-NMDA, anti-MOG antibody testing now routine; IVIG/rituximab first-line.
- Early DMTs: Ofatumumab (B-cell depletion) for pediatric MS.
- Biomarkers: CSF neurofilament light (NfL) predicting relapse.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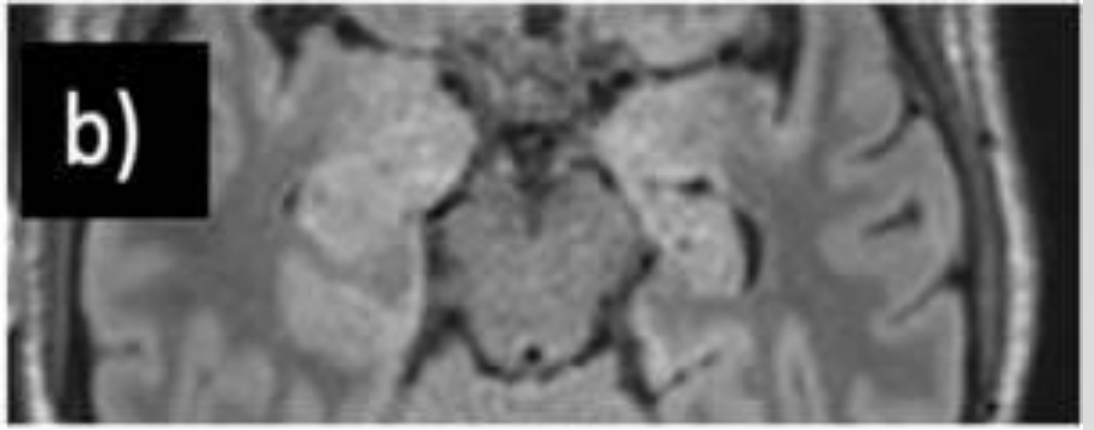
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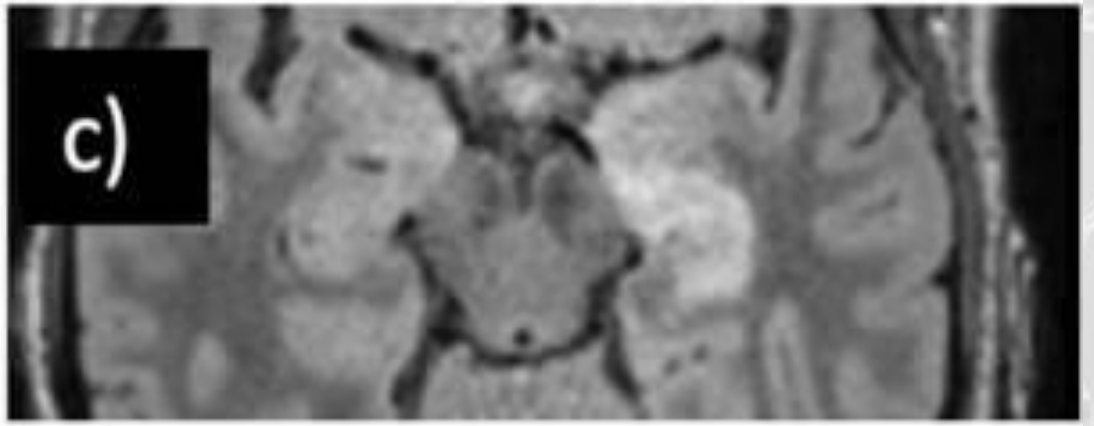
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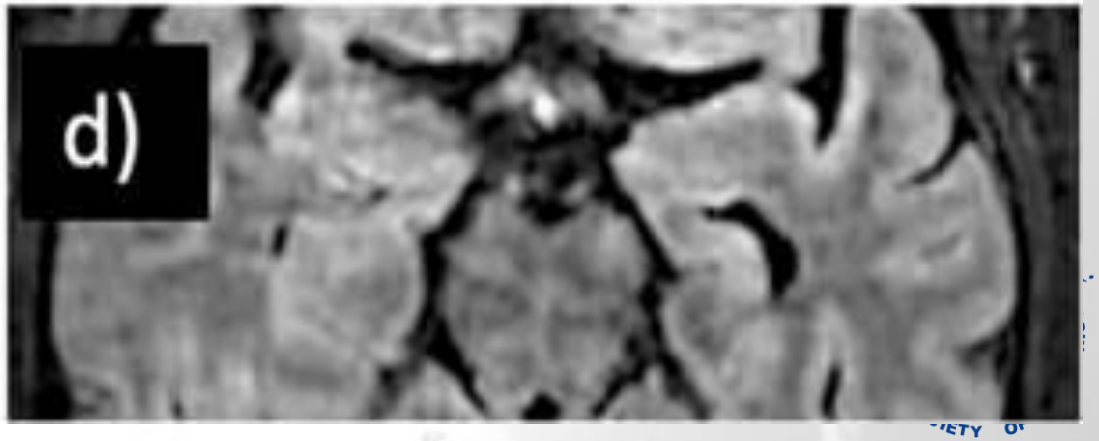
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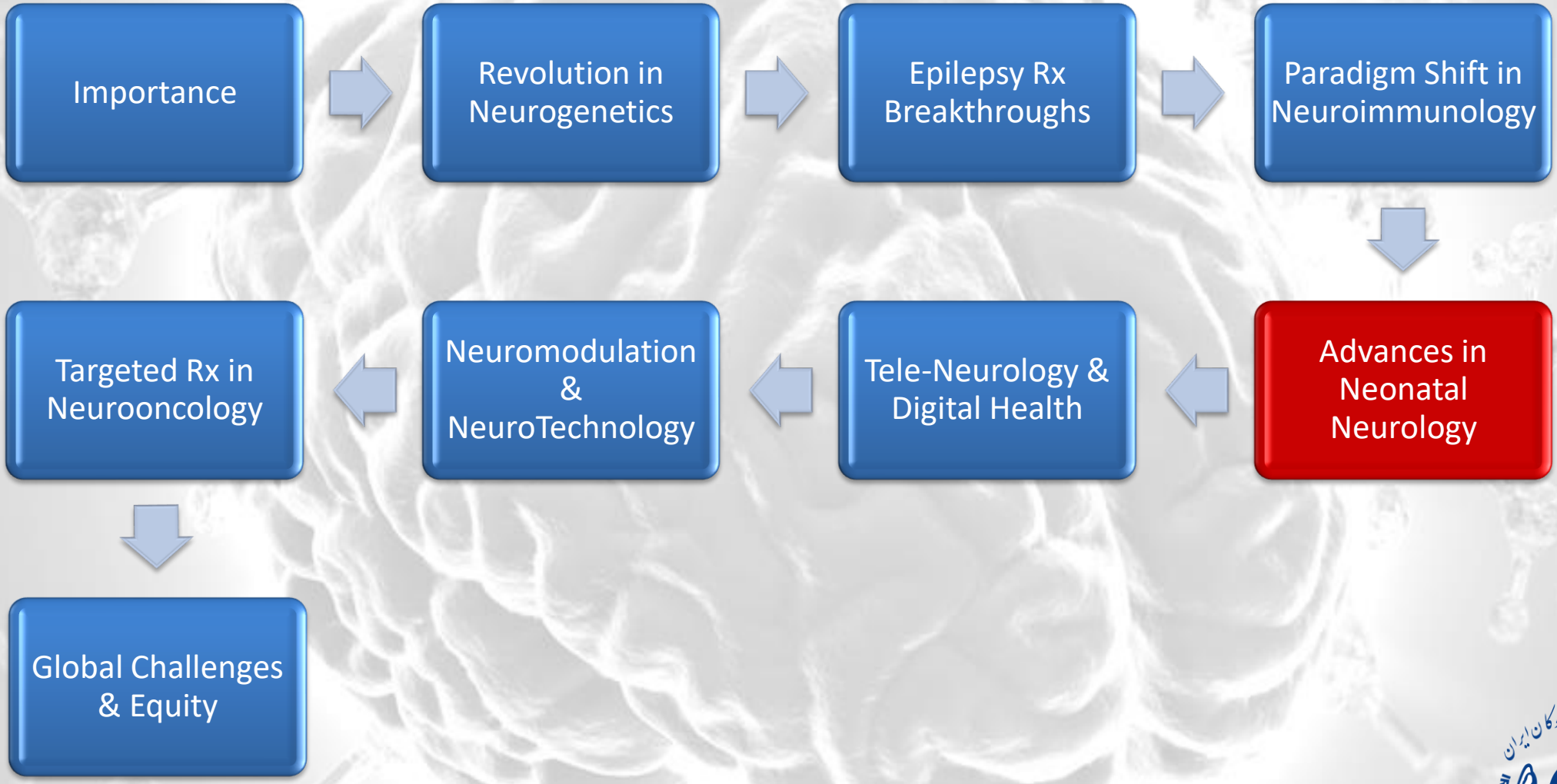
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Neonatal Neurology Advances

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- Therapeutic hypothermia + adjuncts: Erythropoietin for HIE neuroprotection (phase III trials).
- Neonatal seizure detection: AI-powered EEG analysis (Algorithms >2x faster than manual).
- Preterm brain injury: Stem cell therapy (allogenic UBC) reducing cerebral palsy risk.

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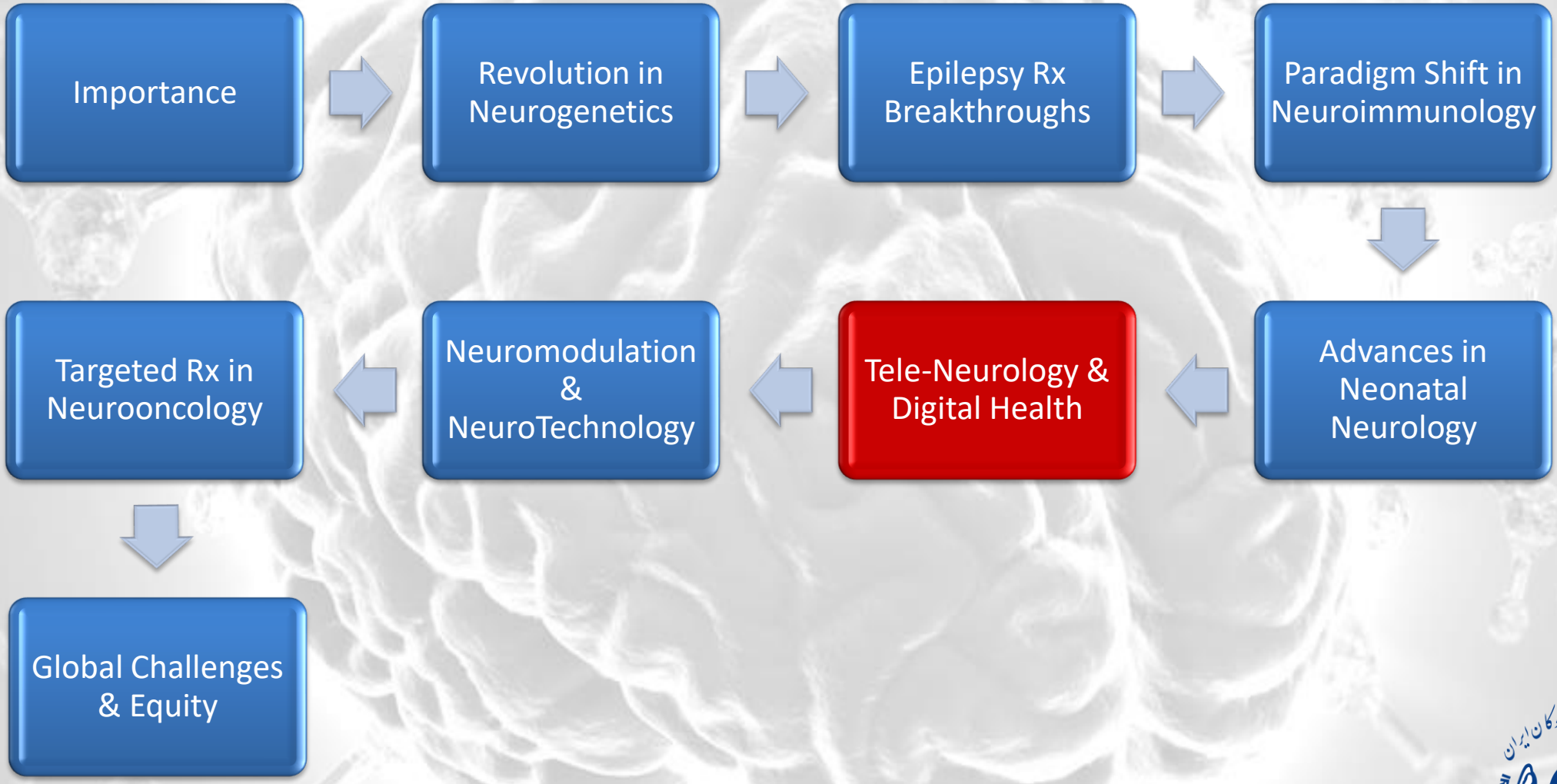
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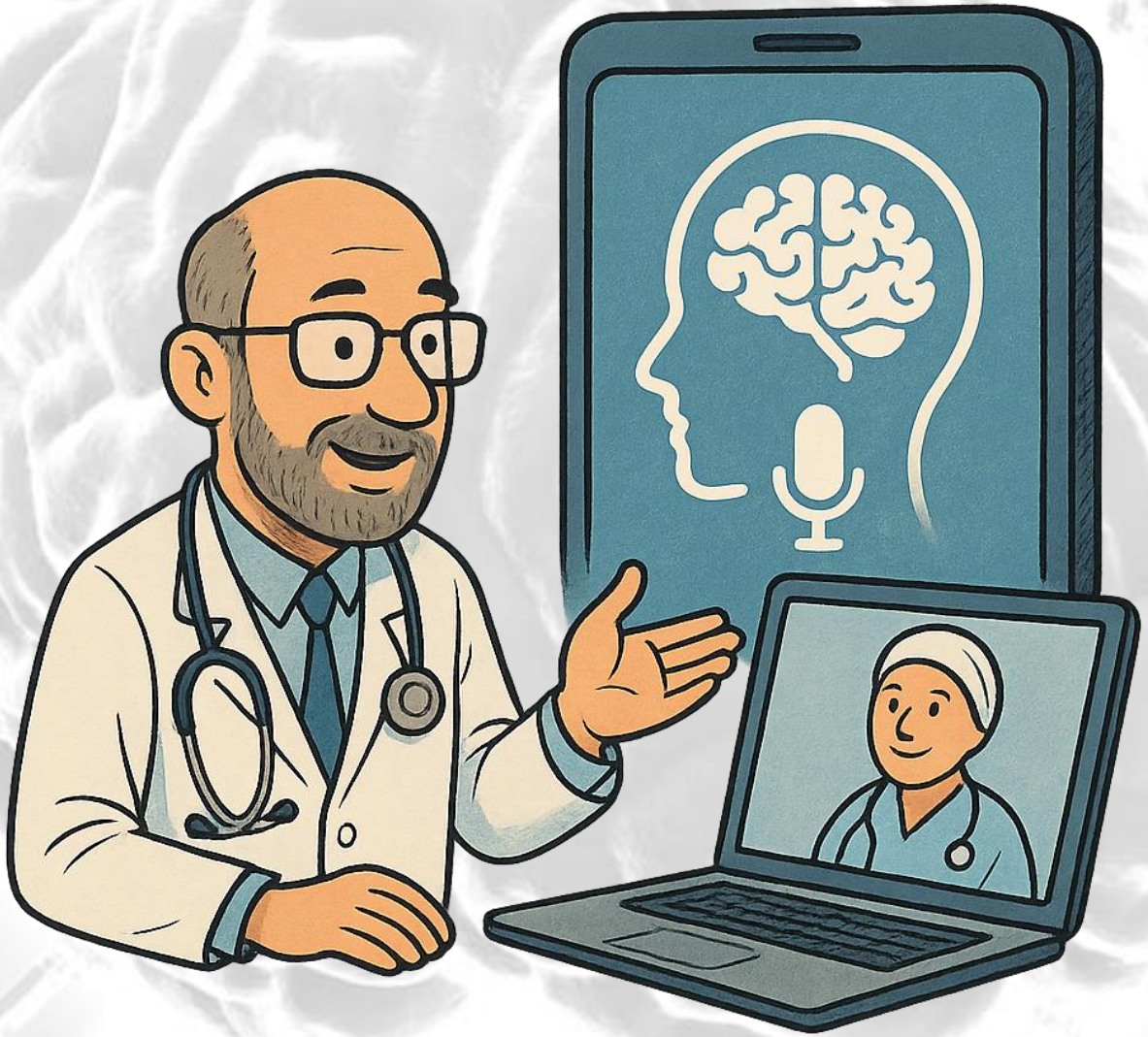
Digital Health & Tele-neurology



Digital Health & Tele-neurology

- Remote monitoring: Wearable EEGs (e.g., Embrace2) detecting seizures in real-world settings.
- AI diagnostics: FDA-cleared tools for autism risk assessment (e.g., Cognoa).
- Global reach: Tele-neurology bridges gaps in LMICs (e.g., Project ECHO).

Wearable Devices

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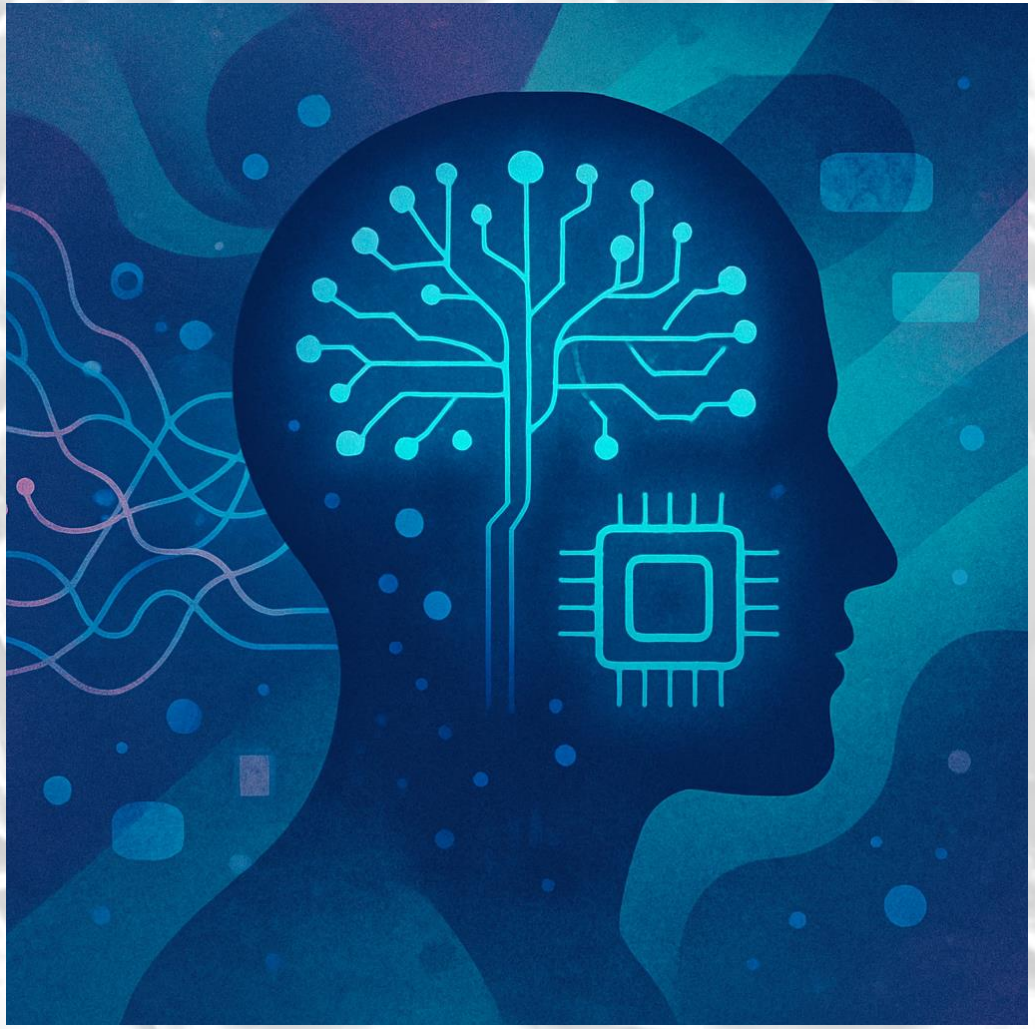
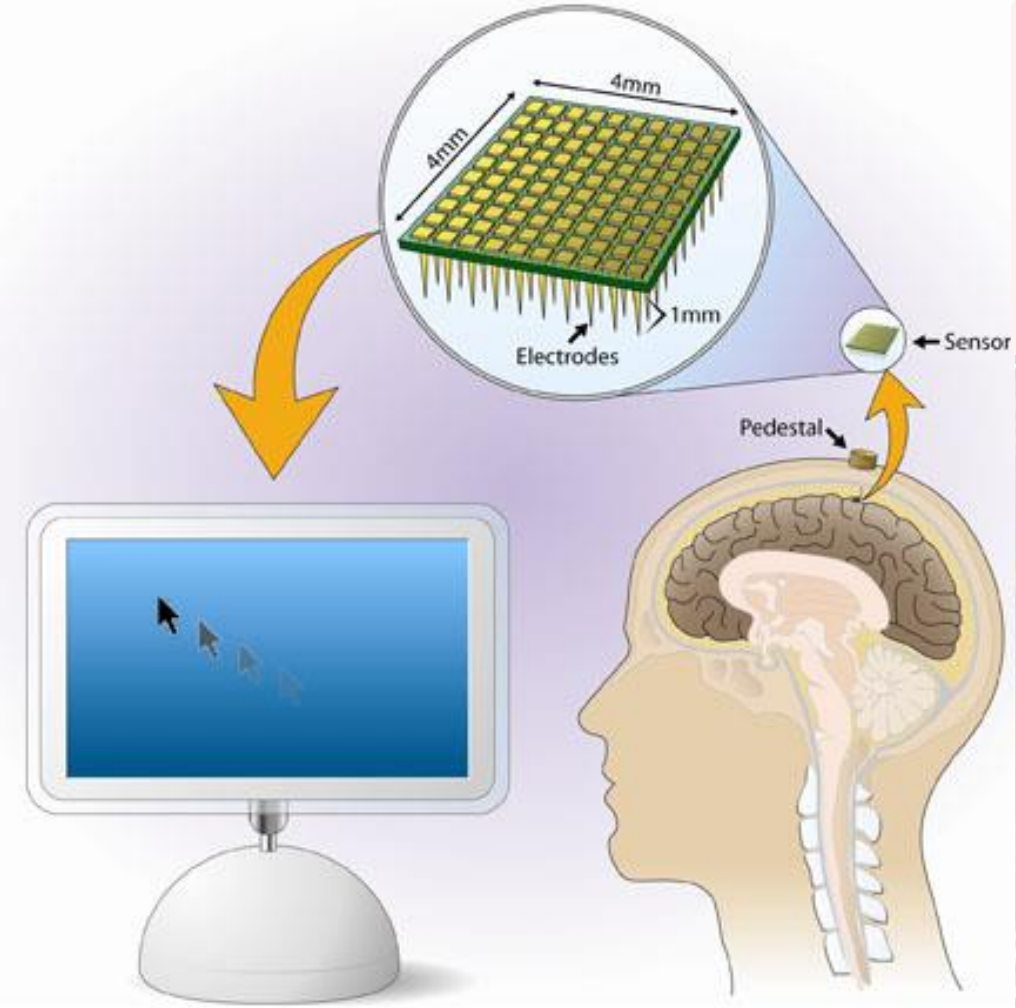
Neuromodulation & Neurotechnology

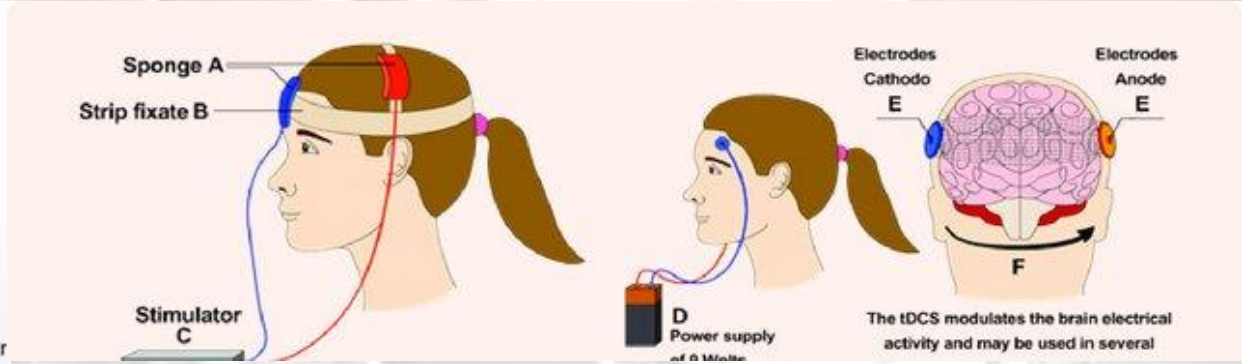


Neuromodulation & Neurotechnology

- tDCS/TMS: ?Improving motor/cognitive outcomes in cerebral palsy.
- BCIs (Brain-Computer Interfaces): Allowing communication in locked-in syndrome (e.g., BrainGate).
- VR: Motor rehabilitation in stroke/TBI.

Neuromodulation & Neurotechnology





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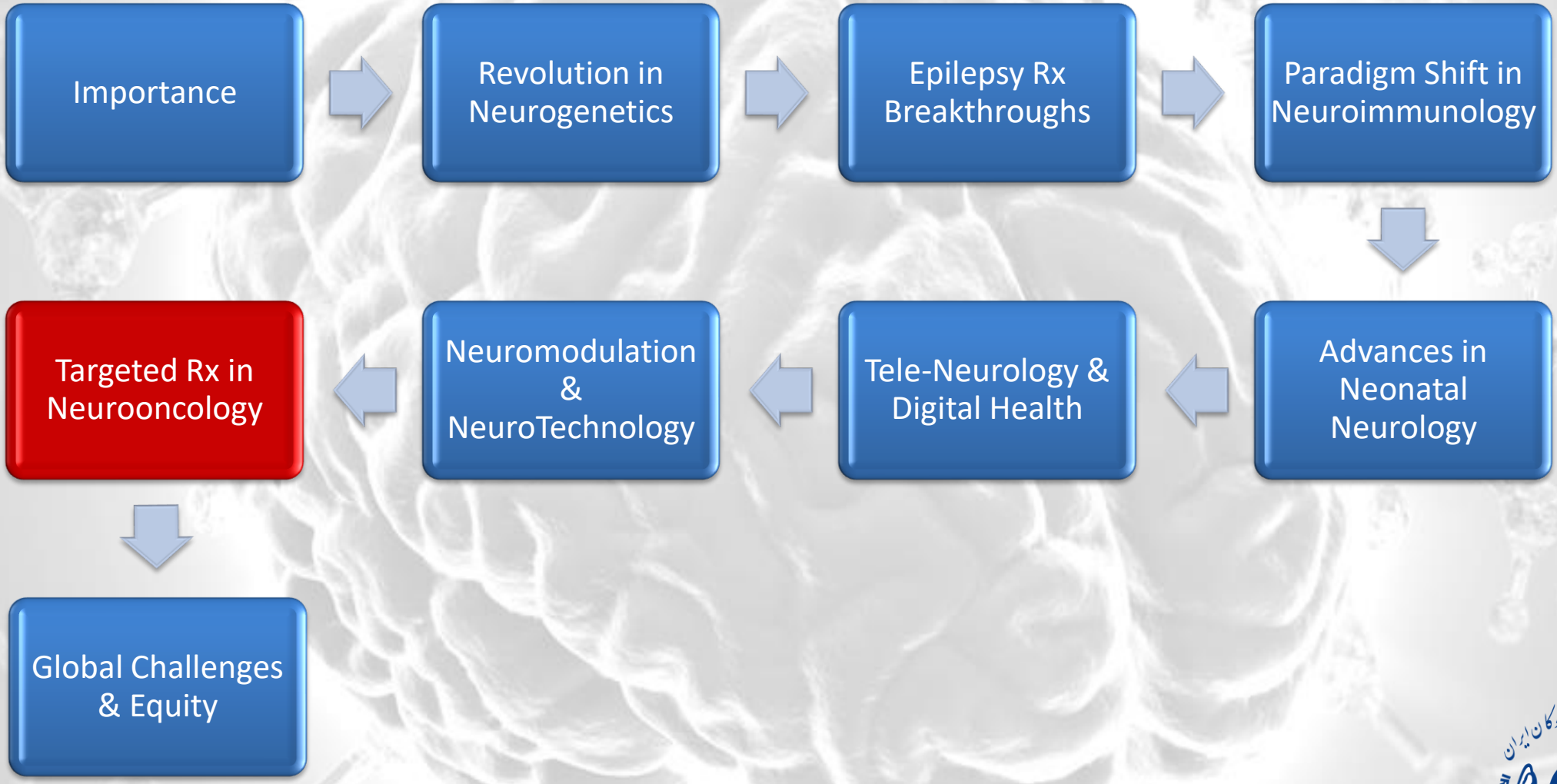
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Neuro-oncology: Targeted Therapies

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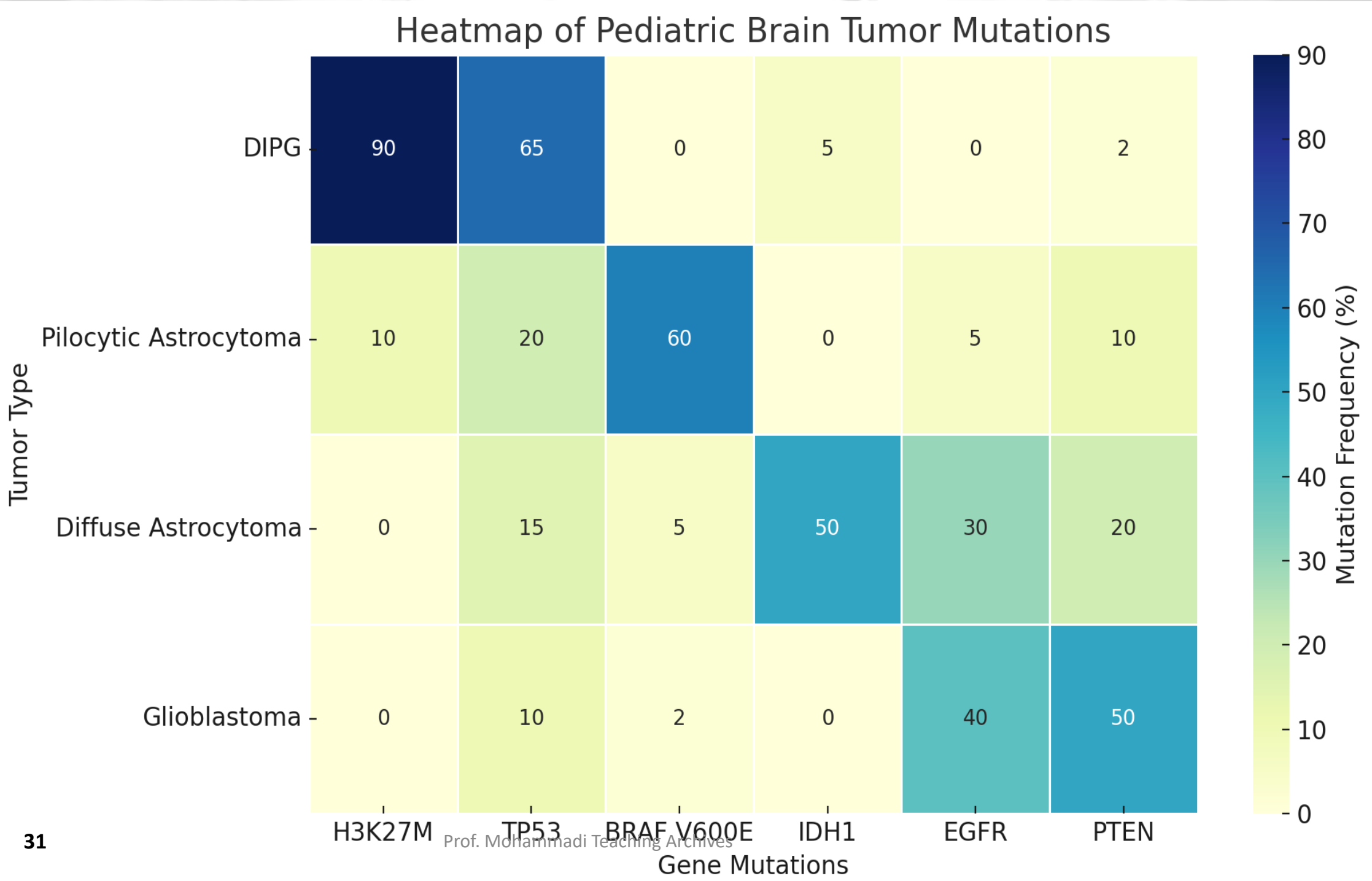
- Molecular subtyping: DMG-H3K27M—ONC201 (Dopamine receptor blocker) extending survival.
- CAR-T: B7-H3 CAR-T trials for refractory medulloblastoma.
- Liquid biopsy: ctDNA for treatment response monitoring.



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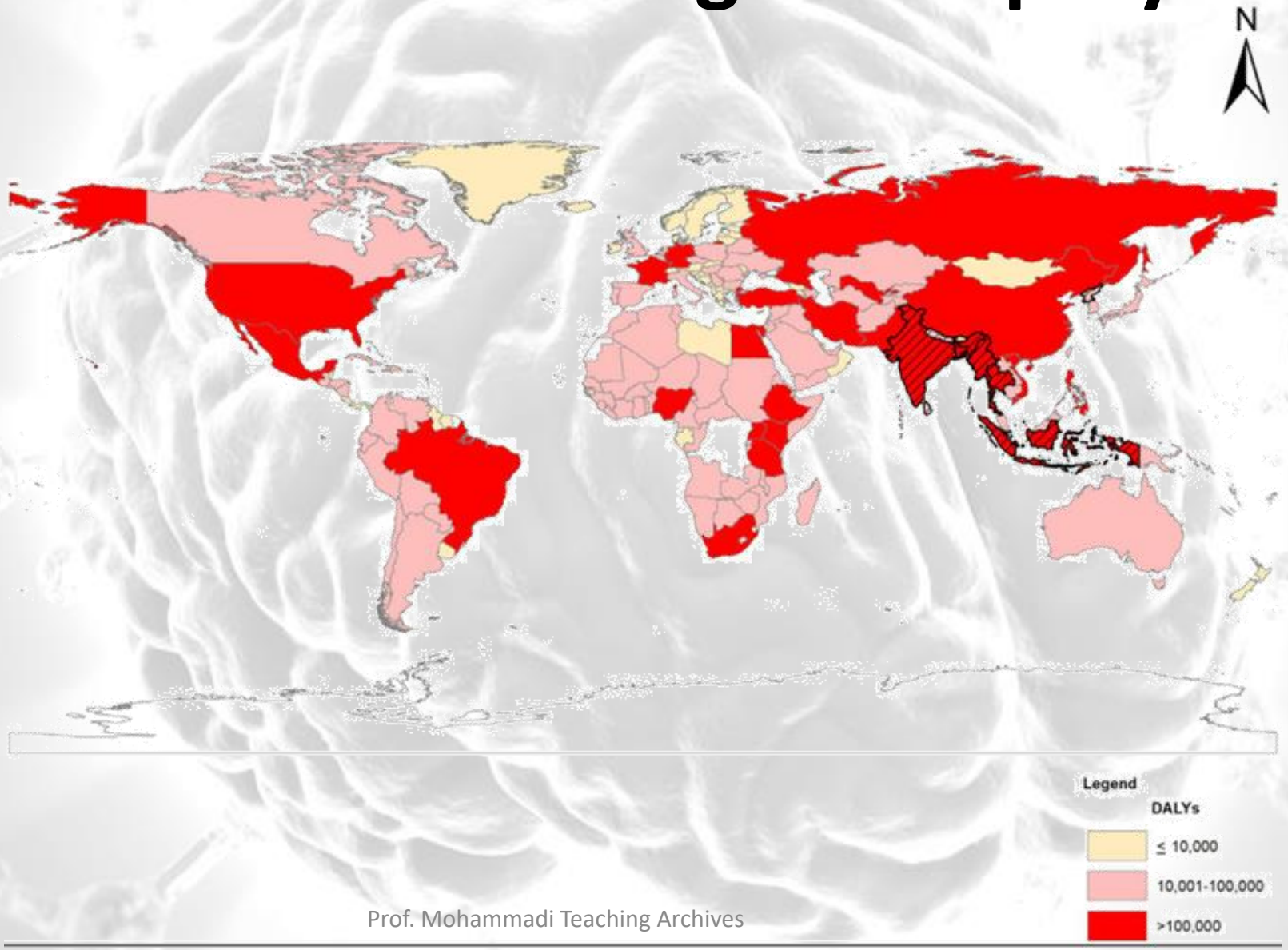
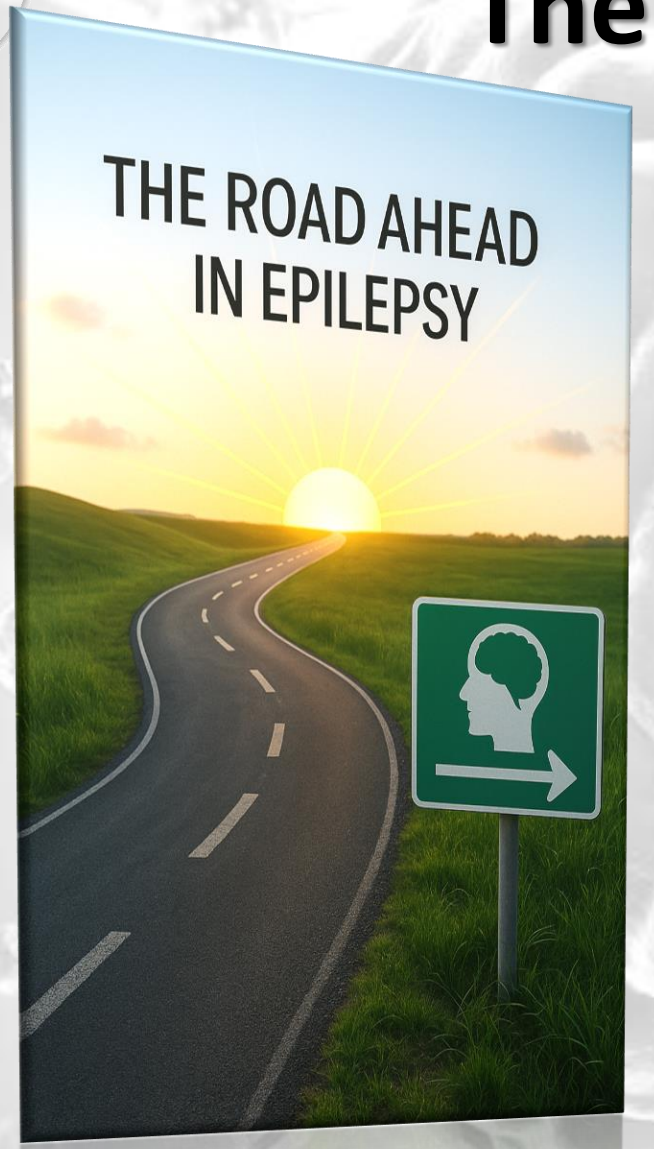
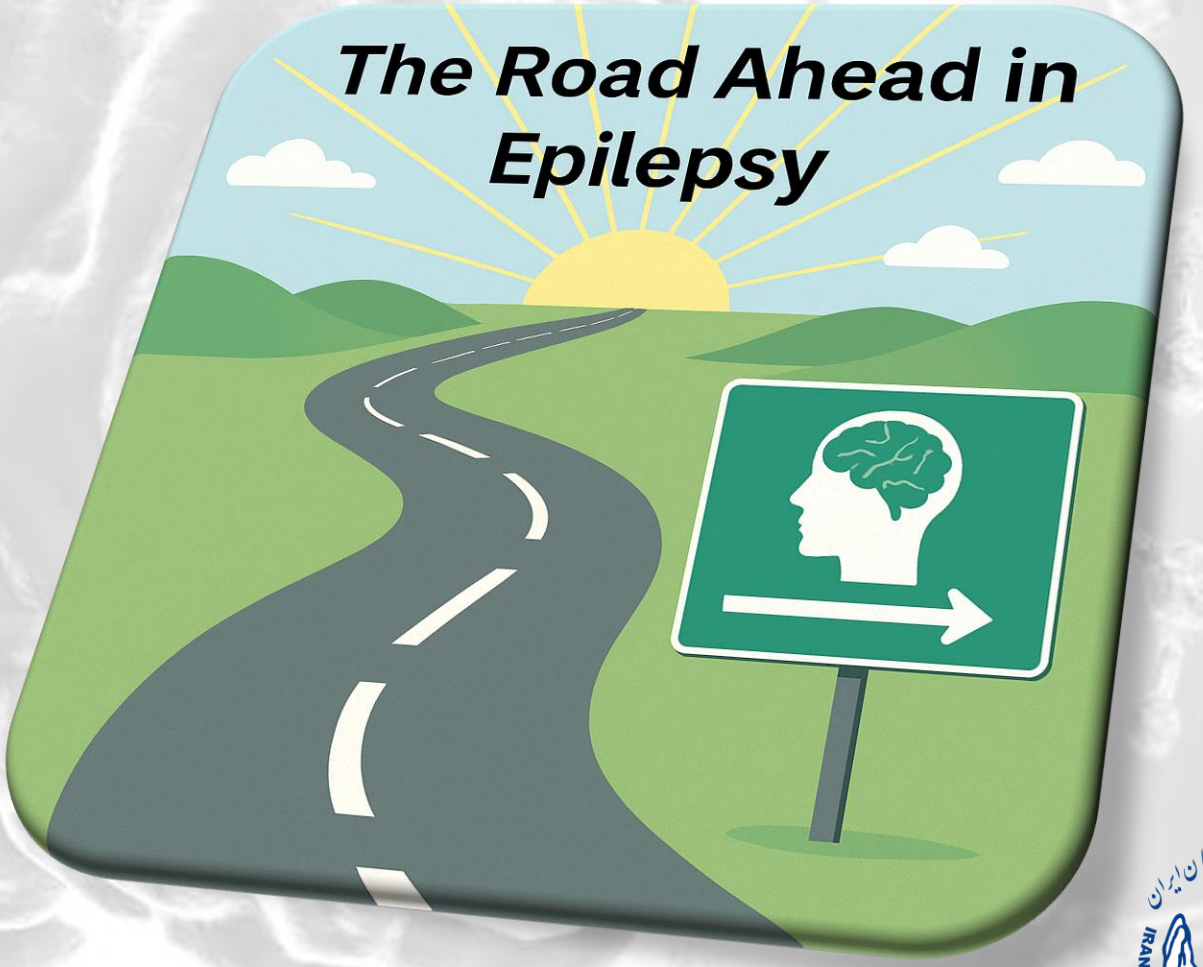
- Disparities: 75% of epilepsy patients in LMICs lack treatment access.
- Solutions: Low-cost EEG devices ($50), WHO neurology modules for primary care.
- Ethics: Genetic data ownership, AI bias.

Global Challenges & Equity



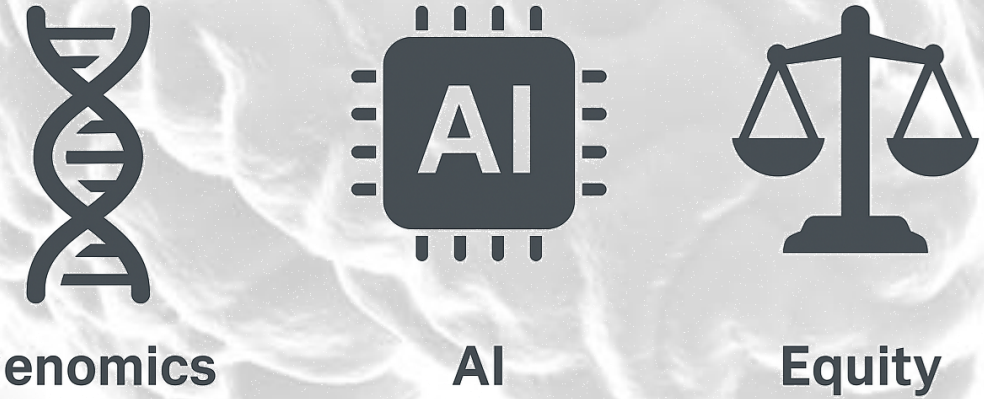
The Road Ahead





The Road Ahead

- Hot topics: Gene editing ethics, gut-brain axis in NDDs, prenatal neuroprotection.
- Call to action: Collaborative trials (e.g., Pedi-Neuro Consortium), patient registries, and campaigns for equity.



- Precision medicine is here!
- The future is on AI
- Equity must be central to innovation.
- Pediatric neurologists should always stay updated and apply the best knowledge to practice.

Thanks, Any Question?