

Anna Harutyunyan, PhD

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I am a computational neuroscientist with over eight years of professional research experience. My research employs network-based computational models and high throughput "omics" technology to investigate the molecular mechanisms underlying pathology, develop reliable disease biomarkers and identify targets for precision medicine.

CORE COMPETENCIES

In vitro

- Immunohistochemistry
- Fluorescence microscopy
- Recombinant DNA techniques
- Viral vector engineering
- Gene delivery techniques
- Cell culture/aseptic technique
- Cell and protein assays

In vivo

- Stereotaxic surgery
- Intracranial injection
- Behavioural assessment
- Electrophysiology & EEG
- Live calcium imaging
- Colony management
- Perfusion and dissection

In silico

- RNAseq (bulk & sc)
- Proteomics & metabolomics
- Multi-omic integration
- Network analysis
- Machine learning models
- Predictive statistics
- Image analysis

Programming languages: Python, R, MatLab, Unix/Shell-based command line tools

EDUCATION

- **Doctor of Philosophy, *Computational Neuroscience***

Dept. of Medicine, The University of Melbourne, VIC, Australia (2019 – 2023)

Thesis: Investigating the synergy between Alzheimer's Disease and epilepsy through data-driven molecular networks

Honours: Thesis nominated for Chancellor's Prize for Excellence, awarded fee remission and Melbourne Research Scholarship

- **Bachelor of Science, *Molecular Biology, Inorganic Chemistry*** (dual major)

Wilson College, PA, United States (2013 – 2016)

Pennsylvania State University College of Medicine, PA, United States (2016 – 2017)

**(Joint degree, equiv. of Honours, GPA: 3.87/4.0)*

Thesis: Synthesis of Fe³⁺Azidothymidine and its effects on human hepatocytes and hepatocellular carcinoma cells

Honours: Phi Beta Kappa, Magna Cum Laude, Pennsylvania Academy of Science Award, Disert scholar, awarded a full academic scholarship

RELEVANT RESEARCH EXPERIENCE

Research Fellow, Dept. of Neuroscience, Central Clinical School,
Monash University, Alfred Hospital, VIC, Australia (2023-present)

- Led the bioinformatic analysis of multiple preclinical studies including the “Sodium Selenate for Drug-resistant Temporal Lobe Epilepsy” study, informing the ground-breaking SELECT clinical trial;
- Analysed and integrated terabytes of preclinical data of various modalities and architectures (imaging, EEG, RNAseq) deriving joint representations that capture correlations between different data types;
- Co-supervised and trained graduate students in fundamentals of experimental design, laboratory/experimental procedures, data analysis and interpretation;
- Presented research outcomes at various national and international conferences as a featured speaker

Graduate researcher/PhD Candidate, Dept. of Medicine, Royal Melbourne Hospital
University of Melbourne, VIC, Australia, (2019 – 2023)

- Designed and carried out multi-cohort live animal studies involving electrophysiology, behavioural, molecular biology and histology experiments;
- Developed an integrative bioinformatic data analysis pipeline for high throughput multi-omics
- Applied network analysis and pathway analysis algorithms, utilizing both open-source (WGCNA, Cytoscape, OmicsAnalyst) and commercial tools (IPA, KEGG), to study critical biological pathways
- Published two first-author papers and three collaborative papers in high impact peer-reviewed journals

Research Officer, Western Centre for Health Research and Education
University of Melbourne, Sunshine Hospital, VIC, Australia (2021 – 2022)

- Designed and carried out histological experiments involving triple antibody immunostaining
- Developed and validated analysis protocols for image segmentation, tracking and three-dimensional object detection for fluorescence microscopy images/confocal stacks
- Assisted in grant applications, research publications and ethics applications

Research Associate, [Lois Lab](#), Dept. of Biology and Biological Engineering,
California Institute of Technology (Caltech), CA, United States (2017 – 2019)

- Collaborated closely with interdisciplinary teams, including Data Science and Clinical Development groups, to define project objectives and implement data generation and analytics strategies;
- Developed and validated genetic manipulation strategies and transgenic tools for studying neuronal circuits underlying learning and memory in mammals;
- Managed the laboratory rodent and avian colonies (e.g. breeding, health monitoring, genotyping);

Research Assistant, [Grigoryev Lab](#), Dept. of Molecular Biology and Biochemistry,
Pennsylvania State University College of Medicine, PA, United States (2016-2017)

- Carried out structural proteomics experiments utilizing recombinant gene delivery techniques (e.g. molecular cloning of recombinant plasmids, engineering viral vectors for transfection)
- Optimised and streamlined experimental protocols for molecular cloning, protein and DNA purification, chromatin reconstitution for electron microscopy
- Assisted in laboratory management, equipment maintenance, purchasing consumables as well as training junior staff and students

SELECTED PEER-REVIEWED PUBLICATIONS

**for a full list of publications please refer to my Google Scholar page by clicking on the Google Scholar icon on top of this document*

- **Harutyunyan, A.**, Chong, D., Li, R., *et al.*, An Integrated Multi-Omic Network Analysis Identifies Seizure-Associated Dysregulated Pathways in the GAERS Model of Absence Epilepsy. *International Journal of Molecular Sciences*, 2022 <https://doi.org/10.3390/ijms23116063>
- **Harutyunyan, A.**, Jones, N.C., Kwan, P., & Anderson, A. Network preservation analysis reveals dysregulated synaptic modules and regulatory hubs shared between Alzheimer's Disease and temporal lobe epilepsy. *Frontiers in Genetics, Computational Genomics*, 2022 <https://doi.org/10.3389/fgene.2022.821343>
- Casillas-Espinosa, P. M., Anderson, A., **Harutyunyan, A.**, *et al.* Disease-modifying effects of sodium selenate in a model of drug-resistant, temporal lobe epilepsy. *Elife*, 2023 <https://doi.org/10.7554/eLife.78877>
- Dejakaisaya, H., **Harutyunyan, A.**, Kwan, P. & Jones, N.C. Altered metabolic pathways in a transgenic mouse model suggest mechanistic role of amyloid precursor protein overexpression in Alzheimer's disease. *Metabolomics* 17, 2021 <https://doi.org/10.1007/s11306-021-01793-4>
- Gonzalez W.G., Zhang H., **Harutyunyan A.**, Lois C. Persistence of neuronal representations through time and damage in the hippocampus. *Science*, 2019 <https://doi.org/10.1126/science.aav9199>
- Buckwalter, J.M., Norouzi, D., **Harutyunyan, A.**, *et al.* Regulation of chromatin folding by conformational variations of nucleosome linker DNA. *Nucleic Acids Research*, 2017 <https://doi.org/10.1093/nar/gkx562>

SELECTED CONFERENCE PRESENTATIONS

- Integrative DL/AI model identifies multi-modal biomarkers of cognitive impairment. *Society for Neuroscience Annual Conference*, Washington DC, USA, 2023
- Investigation of synergy between amyloid pathology and recurrent seizures through data-driven molecular networks. *American Epilepsy Society*, Orlando, FL, USA, 2023
- The role of immediate early genes and complement system in synergistic pathology of epilepsy and Alzheimer's Disease. *35th International Epilepsy Congress*, Dublin, Ireland, 2023
- The synergy between Alzheimer's Disease and seizures is mediated by neuroinflammation and dysregulated astrogliosis. *13th FENS Forum of Neuroscience*, France, 2022
- Identification of seizure-associated modules in rodent models of epilepsy. *Asian and Oceanian Epilepsy Congress, Virtual*, 2021
- Integrative multi-omic approaches for identification of seizure-associated modules. *Translational Neurogenetics Conference*, VIC, Australia, 2021
- Network view of disease. *Epilepsy Society of Australia Annual Conference*, Virtual, 2020
- Synthesis and effects of Fe-AZT on viability of hepatocytes and hepatocellular carcinoma cells. *Pennsylvania Academy of Science Annual Conference*, PA, United States, 2017

SELECTED GRANTS AND AWARDS

- Hagop Bogigian Scholarship (Bogigian Fund USA, 2013-2017)
Total value of ~200.000 USD
- Melbourne Research Scholarship (University of Melbourne, 2019-2023)
Total value of ~300.000 AUD
- Epilepsy Society of Australia Travel Fellowship (ESA, 2023)
- Graduate Student Support Grant (MDHS, University of Melbourne, 2022)
- Best Platform Presentation Award (Asian & Oceanian Epilepsy Congress, 2021)
- Special Commendation Award for best poster (Epilepsy Society of Australia, 2021)
- ILAE Epilepsy Congress Bursary (ILAE, 2021)
- AusBiotech Student Scholarship (AusBiotech/AusMedtech, 2020)
- European Molecular Biology Laboratory travel grant (EMBL Australia, 2020)
- Margaret Criswell Disert Honours Award (Commonwealth of Pennsylvania, USA, 2017)
- Davison Grove Award for Excellence in Senior Research (Wilson College, USA, 2017)
- Outstanding Research Grant (Pennsylvania Academy of Science, USA, 2017)
- E. Grace White Summer Scholarship (Wilson College, USA, 2016)
- NOVA Student Research Grant (Nova Corporation, USA, 2016)
- Varter Derarian Scholarship (Wilson College, USA, 2013-2017)
- Edward McElwain prize for the best student in Mathematics (Wilson College, USA, 2014)

PRESS RELEASE

- <https://www.monash.edu/medicine/news/latest/2022-articles/link-between-alzheimers-disease-and-epilepsy-explored>
- <https://www.sciencedaily.com/releases/2019/08/190823140729.htm>
- <https://www.wilson.edu/research-role-model>

EXTENDED LIST OF SKILLS AND TECHNICAL COMPETENCIES

Laboratory research

General

- Trained in compliance with OHS requirements, animal ethics requirements
- Authorized to work with biohazardous agents (up to PC3/live viruses), radioactive substances, controlled/scheduled drugs, and various live animal models
- Skilled at building custom equipment (pedestals for miniscopes, EEG cables, circuits, behaviour assessment chambers)
- Experience in lab management - record maintenance, sensitive data management, chemical inventories, dispensing controlled substances, purchase of equipment and software, international shipping of biohazardous samples)

Molecular biology

- DNA/RNA recombinant techniques
- Immunohistochemistry and fluorescence microscopy (e.g. tissue dissection, fixation, cryopreservation, sectioning, immunolabeling, imaging) *follow the [link](#) for examples of my work
- Aseptic technique, extensive experience in cell culture work

- Designed and constructed over 100 recombinant plasmids
- Genotyped over 3000 mice and 500 finches

Live animal research (surgical and behavioural)

- Extensive experience in preclinical model research (mice, rats, non-human primates, zebra finches and drosophila)
- Experience in writing animal ethics applications and animal colony management: mice (over 200 cages) and zebra finches (over 300), including breeding, health management, experimental procedures and eventual euthanasia.
- Animal surgery survival rate of 96%, conducted over ~300 stereotaxic surgeries on mice including intracranial injections, implantation of mini scopes for calcium imaging
- Extensive experience in animal model behavioural research
 - Simultaneous optogenetic stimulation and calcium imaging of freely moving mice
 - Cognitive behavioural tests (e.g. Morris water maze, Y maze, novel object recognition)

Data analysis

- Image analysis with NIS.ai GA3, FIJI/ImageJ, IMARIS, iLastic, and various Python libraries
- Programming languages: Python, R, MATLAB, SQL
- Proficient in bioinformatic methods of analysis of high throughput NGS / omics data such as:
 - Transcriptomics (bulk and scRNAseq, microarray)
 - Mass spectrometry-based proteomics, metabolomics, lipidomics
 - Whole genome/exome sequencing
- Correlation network analysis via Bioconductor toolkits/packages in R and RStudio
- Comfortable with all aspects of high dimensional data mining, manipulation and analysis (event detection, sequence-to-sequence, signal separation, time series regression)
- Predictive modelling (linear, network-based and deep learning)
- Electroencephalography and EEG data analysis
- Data visualization (*follow the [link](#) for recent examples of visualizations*)

Other certifications

- First Aid, cardiopulmonary resuscitation (trained first aid officer)
- Authorized to work with scheduled/controlled drugs and radioactive substances
- Working with children clearance (exp. 2025)
- Languages: fluent (95th percentile) – English, Russian, Armenian, (80th percentile) – Georgian