

VINOSHENE PILLAI RAJAN

EDUCATION

November 2015-October 2021

PhD in Biophysical Sciences,
Scuola Normale Superiore
Pisa, Italy

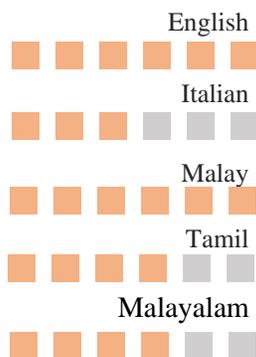
2011-2015

Masters in Organic Chemistry
National University of Malaysia (UKM) &
National Science University of Malaysia
(USM)
MY

2009-2011

Bachelors in Chemistry
National University of Malaysia (UKM)
MY

LANGUAGE



RESEARCH EXPERIENCE

November 2015 - present:

Intravital imaging of glioblastoma mouse models

- ❖ Cellular signaling is an important mechanism of communication. In glioblastoma (GBM), calcium (Ca^{2+}) signaling has been identified to promote its progression and malignancy. Using fluorescence time lapse imaging (two photon microscopy), intracellular Ca^{2+} activity of tumor cells in a murine GBM model (GL261 model) were analyzed and quantified. Heterogeneity in Ca^{2+} dynamics and its relationship with *in vivo* tumor cell migration were established.
- ❖ As a qualitative evaluation of brain tumor activity, wide-field imaging, which is currently a popular technique to visualize brain activity at a mesoscale level was employed.
- ❖ Custom made MATLAB scripts were written to analyse obtained data.
- ❖ Exploited a new molecular technique to produce an inducible murine GBM model. This model closely resembles the human pathology and allows us to study GBM in a developmental model.

In vivo detection of murine glioblastoma through multimodal imaging technique

- ❖ The aim of this project is to discriminate healthy brain from GBM tissues in GL261 mouse model through the combination of Raman and reflectance spectroscopies. It is a proof-of-concept study showing that a combination of optical spectroscopic techniques has potential to improve the *in vivo* detection and delineation of malignant brain tumors and to guide their surgical removal.
- ❖ Murine model generation and two photon imaging experiments were carried out.

Modelling genetic mosaicism of neurodevelopmental disorders *in vivo* by a Cre-amplifying fluorescent reporter (Beatrix)

- ❖ The comprehension of the mechanisms behind genetic mosaicism in neurodevelopmental disorders requires the generation of sparse mosaic models, where each neuron is univocally identified by the expression of a fluorescent protein *in vivo*.
- ❖ Beatrix is a novel tool that can be used to create mosaicism with tuneable degree.
- ❖ *In utero* electroporation was performed in order to generate a mouse model of the human disease Type II Focal Cortical Dysplasia and electrophysiological experiments that provided the first available description of the physiological phenotype of this disease were carried out.

PCDH19 female epilepsy

- ❖ PCDH19 is a neurological condition characterized by early-onset seizures, intellectual disability, and autism. It is caused by the X-chromosome gene PCDH19 that encodes for the protein protocadherin-19, whose function in the brain remains unknown.
- ❖ Preliminary *in vivo* electrophysiological recordings and early data analysis that indicates PCDH19 involvement in synaptic transmission were performed.
- ❖ A master's degree student was trained on experimental techniques used in this project.

Diurnal regulation of intracellular chloride *in vivo*

- ❖ Fast synaptic inhibition relies on the regulation of intracellular chloride ($[\text{Cl}^-]_i$). In this project, it was discovered that neuronal $[\text{Cl}^-]_i$ concentration follows a circadian regulation where there is high $[\text{Cl}^-]_i$ at night and low $[\text{Cl}^-]_i$ during day.
- ❖ A major hypothesis is that by lowering $[\text{Cl}^-]_i$ concentration, it raises synaptic inhibitory function and therefore, reduces epileptic pathophysiology at the time of sleep.
- ❖ *In vivo* electrophysiology experiments were performed on anesthetized mice to study susceptibility to induced epilepsy at different time of the day. Electrophysiological experiments were also done in behaving mice with chronic implants.

ddGCaMP: A new tool for intracellular calcium imaging

- ❖ Calcium (Ca^{2+}) imaging is a powerful tool to study changes in intracellular signaling at a single cell level. However, Ca^{2+} sensors like GCaMP6 binds with Ca^{2+} ions to transduce changes in cellular Ca^{2+} into changes in fluorescence. By binding with Ca^{2+} ions, the sensor acts as a buffer, that could reduce magnitude of actual Ca^{2+} changes and producing a proportional slowing of the rates of change.
- ❖ Prolonged expression of GCaMP is harmful especially during development. Thus, to overcome this issues, a version of GCaMP that is fused with a destabilization domain is produced. It causes rapid degradation of the protein.

The expression of the sensor can be 'switched on' for a short time window by introducing an antibiotic that suppresses protein degradation.

October 2011 - October 2015:

Isolation, characterization and pharmaceutical properties of secondary metabolites from lichens (*Parmotrema* species)

- ❖ Lichens are exceedingly tough organisms. Medicinal usage of lichens can be traced back to the 18th dynasty. They produce a variety of unique secondary metabolites that are known to be potential bioactive agents against pathogens and oxidative damage. Moreover, they are also known to be potential indicators for pollution as different species have different sensitivities in absorbing and accumulating trace metals.
- ❖ Four species of lichens, i.e. *Parmotrema praesorediosum*, *P. rampoddense*, *P. reticulatum* and *P. tinctorum* from Parmeliaceae family were collected from highland areas of Malaysia and their bioactives were isolated, identified, characterized and tested for their antibacterial and antioxidant activity.

Year 2009 - 2011:

Analysis of elements in hair and their relation to poisoning or health of workers using the inductively coupled mass spectrometry technique (ICP-MS)

- ❖ Hair is considered to be an excretory product in which the content elements found in hair reflects the mineral content in the body metabolism. Thus, in this study, it is used to determine the level of toxicity in the body of an individual based on his/her work using the ICP-MS technique.
- ❖ Samples were taken from heavy metal industry workers, students and homemakers and analyzed. Based on the findings, it is evident that the concentrations of elements found in hair are associated and influenced by the workplace environment and lifestyle.

PUBLICATIONS

1. Pracucci, E., **Pillai, V.**, Lamers, D., Parra, R., Landi, S. (2021). Neuroinflammation: a signature or a cause of epilepsy? *International Journal of Molecular Sciences*.
2. Trovato, F., Parra, R., Pracucci, E., Landi, S., Cozzolino, O., Nardi, G., Cruciani, F., **Pillai, V.**, Mosti, L., Cwetsch, A. W., Cancedda, L., Gritti, L., Sala, C., Verpelli, C., Maset, A., Lodovichi, C., Ratto, G. M. (2020). *Modelling genetic mosaicism of neurodevelopmental disorders in vivo by a Cre-amplifying fluorescent reporter*. *Nature Communications*, 11, 6194.
3. Baria, E., Pracucci, E., **Pillai, V.**, Pavone, F. S., Ratto, G. M., Cicchi, R. (2020). *In vivo detection of murine glioblastoma through Raman and reflectance fibre-probe spectroscopies*. *Neurophotonics*, 7(4), 045010.
4. **Rajan, V. P.**, Gunasekaran, S., Ramanathan, S., Murugaiyah, V., Samsudin, M.W., Din, L.B. (2016). Biological activity of four *Parmotrema* species of Malaysian origin and their chemical constituents. *Journal of Applied Pharmaceutical Science*, Vol. 6(08), pp 036-043.
5. Gunasekaran, S., **Pillai Rajan, V.**, Ramanathan, S., Murugaiyah, V., Samsudin, M.W., Din, L.B. (2016). Antibacterial and antioxidant activity of lichens *Usnea rubrotincta*, *Ramalina dumeticola*, *Cladonia verticillata* and their chemical constituents. *Malaysian Journal of Analytical Science*, 20 (1), 1-13.

CONFERENCE PROCEEDINGS

1. Baria, E., Pracucci, E., **Pillai, V.**, Pavone, F. S., Ratto, G. M., Cicchi, R. (2019). *In vivo* multimodal fibre-probe spectroscopy for glioblastoma detection in mouse model. Proc. SPIE 11073, Clinical and Preclinical Optical Diagnostics II, 11073N (19 July 2019).
2. **Pillai Rajan, V.**, Gunasekaran, S., Ramanathan, S., Murugaiyah, V., Samsudin, M.W., Din, L.B. (2015) Antibacterial activity of extracts of *Parmotrema praesorediosum*, *Parmotrema rampoddense*, *Parmotrema tinctorum*, and *Parmotrema reticulatum*. AIP Conference Proceedings, 1678, 050015-1 - 050015-4 (2015); doi: 10.1063/1.4931294.
3. **Rajan, V. P.**, Gunasekaran, S., Ramanathan, S., Murugaiyah, V., Samsudin, M. W., Din, L. B. (2015). Antibacterial and Antioxidant Activities of Four *Parmotrema* species of Malaysian Origin and their Chemical Constituents. 1st International Conference on Antioxidants and Degenerative Diseases 3-4 June 2015, NP-04, page 74.

PRESENTATIONS

Colloquium

- ❖ University Kebangsaan Malaysia, Faculty of Science and Technology, Postgraduate Colloquium, 15th -16th April 2015- Oral Presentation.

Conference

- ❖ “Stem Cells and Cancer” Gordon Research Conference, 24th-19th March 2019, Ventura Beach Marriot, Ventura, California- Poster Presentation.
- ❖ International Conference on Antioxidants and Degenerative Diseases- ICADD, Kuala Lumpur, Malaysia, 3rd-4th June 2015 (Best Poster Award).

Outreach Activities

- ❖ Institute of Neuroscience Virtual Retreat 2020- Oral Presentation, Consiglio Nazionale delle Ricerche, Pisa, Italy, 30th November 2020.
- ❖ Institute of Neuroscience Annual Retreat 2019- Poster Presentation, Consiglio Nazionale delle Ricerche, Pisa, Italy, 2nd-4th October 2019.
- ❖ NEST Congress- Highlights in Nanoscience, Aulla Dini, Scuola Normale Superiore, Pisa Italy, 10th & 11th June 2019.
- ❖ Nanomeeting 2018, Sala Azzura- Scuola Normale Superiore, Pisa, Italy, 29th October 2018.
- ❖ Researchers Night- BRIGHT Pisa, Poster Presentation, Brogo Stretto, Pisa, Italy, 5th October 2018.
- ❖ Researchers Night- BRIGHT Pisa, Poster Presentation, Logge dei Banchi, Consiglio Nazionale delle Ricerche, Pisa, Italy, 29th September 2019.

PROFESSIONAL TRAINING

Workshop

- ❖ Euro BioHighTech, Smart Health: Research for Business Innovation, Stazione Marittima di Treste, Italy, 26-27 September 2018.
- ❖ 2nd Nic@Iit Nanoscopy 2.0 Practical Workshop on Advanced Microscopy 1-4 December 2015- Nikon Imaging Center, Institute of Istituto Italiano di Tecnologia, Genoa, Italy.

Spring School

- ❖ International School of Biophysics «Antonio Borsellino» 43rd Course: Nanoscale biophysics: Focus on Methods and Techniques (Directors: A. Diaspro - P.Bianchini) - Erice, Sicily, Italy, 17-24 April 2016.

Workshop

- ❖ Why are cortical networks prone to seizures? (Andy Trevelyan, Newcastle University, UK), NEST Scuola Normale Superiore, 27th October 2017.
- ❖ Neuroscience Seminar-Cell cycle control of glioblastoma cancer stem cells by CLIC1 protein functional expression in the plasma membrane (Michele Mazzanti-CNR) 20th April 2017.
- ❖ The phasor analysis applied to fluorescence lifetime imaging of environmental probes: biophysical and technological applications (Antonella Battisti-NEST, NANO CNR) 17th November 2016.

Advance Courses

- ❖ Molecular Stratagem of Glioblastoma- Neuroscience School of Advance Studies @ San Servolo, Venice, Italy, 5th-12th May 2018.
- ❖ Sleep and Cognition- Neuroscience School of Advance Studies @ Certosa di Pontignano, Siena, Italy, 8th-15th July 2017.

