



Macquarie
Neurosurgery

Academic & Research Report 2019

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MQ Health

MACQUARIE UNIVERSITY
HEALTH SCIENCES CENTRE

www.mqneurosurgery.com.au

Macquarie Neurosurgery is one of Australia's largest academic neurosurgery groups. Macquarie Neurosurgery (MQN) includes ten neurosurgeons who are dedicated to not only perfecting their clinical and neurosurgical skills, but also educating future neurosurgeons and leading breakthrough research.

2019 was a stellar year of achievements for our group. With 31 scientific publications in international peer-reviewed journals, 40 invitations to deliver lectures at national and international conferences in the fields of neurosurgery and neurosciences, and several awards and grants, totaling more than 4 million dollars in research funds, Macquarie Neurosurgery has clearly shown its role of paramount importance in the Australian landscape of neurosurgery and academic research.

The use of cutting-edges tools and technologies have put Macquarie Neurosurgery at the forefront of innovation. Amongst other things, MQN has introduced the first use of the Gamma Knife machine for radiosurgery in Australasia, and pioneered innovative applications of Artificial Intelligence and computational modelling to study brain diseases. Moreover, MQN has introduced sophisticated visualisation and operative tools in the operating theatre, a new magnetic resonance imaging technique to detect genetic mutations in patients affected by brain cancer, the only research and training laboratory in cerebrovascular neurosurgery and syringomyelia, the first Computational NeuroSurgery Lab in the world, and the first Australian workshops aimed to teach white matter dissection and the use of intraoperative fluorescence for brain tumors' resection. This immense diversity of scope and pioneering achievements are demonstrations of Macquarie Neurosurgery's leadership role in the MQ Health paradigm of *Heal, Learn and Discover*.

The academic position to spread knowledge is also well demonstrated by the number of national and international visitors (including research and surgical fellows, PhD candidates and researchers), as well as by the number of teaching events held in 2019, including the inaugural Visiting Professor Program, in which invited leaders in the field have joined us to enhance our regular professional development program.

In this report, the main academic and scientific achievements of 2019 are summarised, to document our achievements in order to trigger new exceptional results and collaborations going forward in 2020.

Antonio Di Ieva

Academic Program Co-Ordinator, Macquarie Neurosurgery

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PUBLICATIONS

- Morgan MK, Guilfoyle M, Kirollos R, Heller GZ. *Remodeling of the feeding arterial system after surgery for resection of brain arteriovenous malformations: An observational study. Neurosurgery* 2019 Jan 84(1): 84-94.
- Gunawardena M, Rogers JM, Stoodley MA, Morgan MK. *Revascularization surgery for symptomatic non-moyamoya intracranial arterial stenosis or occlusion. J Neurosurg* 2019 Feb 8:1-6.
- Berliner JA, Woodcock T, Najafi E, Hemley SJ, Lam M, Cheng S, Bilston LE, Stoodley MA. *Effect of extradural constriction on CSF flow in rat spinal cord. Fluids Barriers CNS* 2019 Mar 26;16(1):7.
- Patel NJ, Bervini D, Eftekhari B, Davidson AS, Walsh DC, Assaad NN, Morgan MK. *Results of Surgery for Low-Grade Brain Arteriovenous Malformation Resection by Early Career Neurosurgeons: An Observational Study. Neurosurgery* 2019 Mar 1;84(3):655-661.
- Izard MA, Moutrie V, Rogers JM, Beath K, Grace M, Karle B, Ho A, Fuller JW. *Volume not number of metastases: Gamma Knife radiosurgery management of intracranial lesions from an Australian perspective. Radiother Oncol* 2019 Apr;133:43-49.
- Sliow A, Ma Z, Gargiulo G, Mahns D, Mawad D, Breen P, Stoodley M, Houang J, Kuchel R, Tettamanzi GC, Tilley RD, Frost SJ, Morley J, Longo L, Lauto A. *Stimulation and Repair of Peripheral*

- Nerves Using Bioadhesive Graft-Antenna. Adv Sci* 2019 Apr 3;6(11):1801212.
- **Li Ching Ng A, Rosenfeld JV, Di Ieva A.** *The cranial nerve nomenclature - Historical vignette. World Neurosurg* 2019 May 128, 299-307.
 - **Simons MR, Zurynski Y, Cullis J, Morgan MK, Davidson AS.** *Does evidence-based medicine training improve doctors' knowledge, practice and patient outcomes? A systematic review of the evidence. Medical Teacher* 2019 May 41(5): 532-538, 2019.
 - **Dawes BH, Lloyd RA, Rogers JM, Magnussen JS, Bilston LE, Stoodley MA.** *Cerebellar Tissue Strain in Chiari Malformation with Headache. World Neurosurg* 2019 May 130, 74-81.
 - **Lloyd RA, Stoodley MA, Fletcher DF, Bilston LE.** *The effects of variation in the arterial pulse waveform on perivascular flow. J Biomech* 2019 Jun 11;90:65-70.
 - **Di Ieva A, Tschabitscher M.** *Letter to the Editor Regarding "The Exoscope in Neurosurgery: An Innovative Point of View. A Systematic Review of the Technical, Surgical, and Educational Aspects. World Neurosurgery* 2019 July 127: 652.
 - **Houston JR, Allen PA, Rogers JM, Lien MC, Allen NJ, Hughes ML, Bapura JR, Eppelheimer MS, Loth F, Stoodley MA, Vorster SJ, Luciano MG.** *Type I Chiari malformation, RBANS performance, and brain morphology: Connecting the dots on cognition and macrolevel brain structure. Neuropsychology* 2019 July 33(5):725-738.

- **Li Ching Ng A, Di Ieva A.** *How I do it: 3D exoscopic endoscope-assisted microvascular decompression.* *Acta Neurochirurgica* 2019 July 161(7): 1443-1447.
- **Lo Presti A, Rogers JM, Stoodley MA, Assaad NNA, Simons M, Sen I, Morgan MK.** *Laminar Wall Shear Stress in Brain Arteriovenous Malformations: Systematic Review of Literature.* *World Neurosurg* 2019 Aug 128, 760-767.
- **Van Der Veken J, Mulcahy MJ, Harrington TJ, Assaad NN.** *Kinked perforator due to clipping of parent vessel aneurysm - technical note and lessons learned.* *World Neurosurg* 2019 August 128, 473-476.
- **Andronache I, Marin M, Fischer R, Ahammer H, Radulovic M, Ciobotaru AM, Jelinek HF, Di Ieva A, Pintili RD, Drăghici CC, Herman GV, Nicula AS, Simion AG, Loghin IV, Diaconu DC, Peptenatu D.** *Dynamics of Forest Fragmentation and Connectivity Using Particle and Fractal Analysis.* *Scientific Reports* 2019 August 9(1), 12228.
- **Van Der Veken J, Mulcahy MJ, Harrington TJ, Assaad NN.** *Kinked Perforator Due to Clipping of Parent Vessel Aneurysm: Technical Note and Lessons Learned.* *World Neurosurgery* 2019 Aug 128: 473-476.
- **Bairamian D, Liu S, Eftekhar B.** *Virtual Reality Angiogram vs 3-Dimensional Printed Angiogram as an Educational tool-A Comparative Study.* *Neurosurgery* 2019 August 85(2):E343-E349.
- **Ng HY, Namboodiri D, Learoyd D, Davidson A, Champion B, Preda V.** *Clinical Challenges of a co-secreting TSH/GH pituitary*

adenoma. Endocrinology, Diabetes & Metabolism – Case Reports
2019 Sept.

- **Petrujkić K, Milošević N, Rajković N, Stanisavljević D, Gavrilović S, Dželebdžić D, Ilić R, Di Ieva A, Maksimović R.** *Computational quantitative MR image features – A potential useful tool in differentiating glioblastoma from solitary brain metastasis. Eur J Radiol* 2019 Oct, 119, 108634.
- **Busch KJ, Kiat H, Avolio A, Butlin M, Davidson A.** *Obstructive hydrocephalus due to unruptured brain arteriovenous malformation: Demonstrating transcranial color duplex confirmation of cerebral venous hemodynamic alterations and color duplex ultrasound confirmation of shunt patency. Cureus* 2019 Nov 11(11), e6181
- **Amini-Behbahani F, Bahrami M, Eftekhar B, Minaei B, Minaei, B, Dadmehr M.** (Letter to the Editor). *Medicinal Herbal Recommendation for Irritable Bowel Syndrome in Medieval Persian Medicine. Iran J Public Health.* 48(11):2105-2107.
- **Di Ieva A.** *AI-Augmented multidisciplinary teams: Hype or hope? Lancet* 2019 Nov 394(10211), 1801.
- **McRobb L, McKay MJ, Gauden AJ, Lee VS, Subramanian S, Thomas SG, Wiedmann MK, Moutrie V, Grace M, Zhao Z, Molloy MP, Stoodley MA.** *Radiation-stimulated translocation of CD166 and CRYAB to the endothelial surface provides potential vascular targets on irradiated brain arteriovenous malformations. Int J Mol Sci* 2019 Nov, 20(23).

- **Eftekhar B.** *A simple retractor for anterior cervical discectomy.* *J Neurol Surg A Cent Eur Neurosurg* 2019 Nov, 80(6), 494-497.
- **Davidoff CL, Lo Presti A, Rogers JM, Simons M, Assaad NNA, Stoodley MA, Morgan MK.** *Risk of First Hemorrhage of Brain Arteriovenous Malformations During Pregnancy: A Systematic Review of the Literature.* *Neurosurgery* 2019 Nov 85(5), 806, 814.
- **Gauden AJ, McRobb LS, Lee VS, Subramanian S, Moutrie V, Zhao Z, Stoodley MA.** *Occlusion of animal model arteriovenous malformations using vascular targeting.* *Transl Stroke Res* 2019 Dec
- **Davidoff CL, Lo Presti A, Morgan MK.** *In Reply: Risk of first hemorrhage of brain arteriovenous malformations during pregnancy: A systematic review of the literature.* *Neurosurgery* 2019 Dec 85(6), E1135.
- **Jang K, Rosenfeld JV, Di Ieva A.** *Paulus of Aegina and the historical origins of spine surgery.* *World Neurosurgery* 2019 Dec 133, 291-301.
- **Di Ieva A, Magnussen JS, McIntosh J, Mulcahy MJ, Pardey M, Choi C.** *Magnetic Resonance spectroscopic assessment of isocitrate dehydrogenase status in gliomas: The New Frontiers of Spectrobiopsy in Neurodiagnostics.* *World Neurosurg* 2019, 133, e421-427.
- **Van der Veken J, Stoodley M.** When the fat hits the brain – salvage STA-MCA bypass for an intracranial ICA occlusion due to a fat embolus. *BMJ Neurology Open* 2019.

BRAIN SCHOOL

- **John Magnussen, 28 Feb 2019**
NEUROIMAGING: MRI SEQUENCES AND MULTIMODAL IMAGING
- **Michael Rodriguez, 28 March 2019**
NEUROPATHOLOGY MARKERS AND METHODOLOGIES
- **Mary Simons, 2 May 2019**
SEARCH STRATEGIES
- **Antonio Di Ieva, 23 May 2019**
WHITE MATTER(s): Neuroanatomy of the white matter, tractography and principles of connectomics in neurosurgery
- **Cecilia Gzell, 25 July 2019**
Tenets, methods and applications of radiotherapy & radiosurgery in brain tumours
- **Vincent Oxenham, Heather Francis & Greg Savage, 29 August 2019**
Neuropsychology for neurosurgeons
- **Marcus Stoodley, 10 October 2019**
Bypass Surgery: Indications & Techniques
- **Andrew Davidson, 31 October 2019**
Surgical approaches for skull base tumours

- **Michael Morgan & Antonio Di Ieva, multiple dates (fortnightly or monthly)**
Neuroanatomy for Neurosurgery scholars

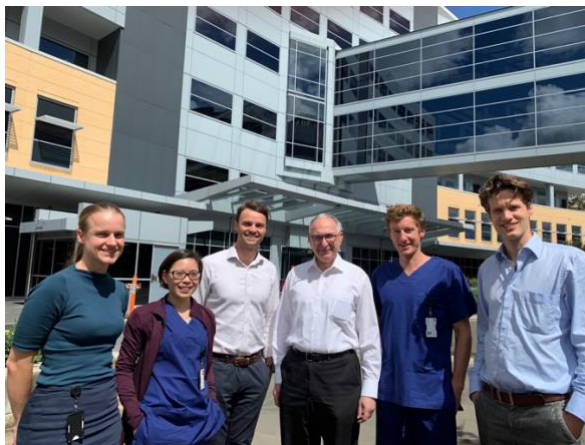
VISITING PROFESSOR PROGRAM

- 21 March 2019

Prof. Jeffrey Rosenfeld,

Monash University, Melbourne

*Bionic vision and the future of the
human brain-computer interface.*



Macquarie Neurosurgery Scholars with Prof. Rosenfeld (from left to right: Dr Renata Ganko, Dr Angela Li Ching Ng, Dr Tim Lukins, Prof. Jeffrey Rosenfeld, Dr. Jorn Van Der Veken, Dr Sebastian Eibach)

- *13 June 2019*

***A/Prof. Kate Drummond,
Royal Melbourne Hospital***

Quality of life in brain tumours. Do we really understand it and what can we do to improve it?



Macquarie Neurosurgery Scholars with Prof. Drummond (from left to right: *Dr Elie Hammam, Dr Tim Lukins, Dr Renata Ganko, Dr. Jorn Van Der Veken, A/Prof. Kate Drummond, Dr Sebastian Eibach*)

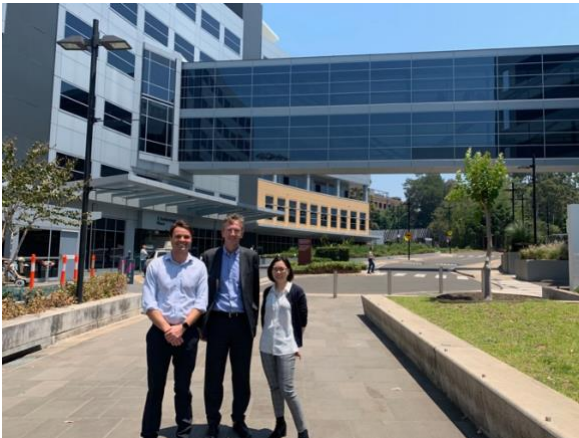
- *31 October 2019*

***A/Prof. Andrew Brodbelt,
Liverpool, UK***

The clinical relevance of brain tumour epidemiology.

- *28 November 2019*

***Prof. Brian Freeman,
University of Adelaide
Pediatric spinal surgery.***



Macquarie Neurosurgery Scholars
with **Prof Freeman** (from left to right: Dr Tim Lukins, Prof. Brian Freeman,
Dr Angela Li Ching Ng)

WORKSHOPS, PRESENTATIONS & INVITED LECTURES

- 1st Australian Conference on Artificial Intelligence in Medicine, Surgery and Healthcare. *Computational modelling and AI in Brain Cancer Research: A neurosurgical perspective*. 9 March 2019, Westmead Conference Centre, Sydney. **Di Ieva A**.
- CEPET (Centre for Elite Performance, Expertise & Training) colloquium. *The AI-Augmented Physician: A Clinical Neuroscience Perspective*. 9 April 2019, Macquarie University. **Di Ieva A**.
- The Evandro de Oliveira Symposium. AANS, San Diego, USA. April 11-12, 2019. *Explaining brain AVMs with laminar wall shear stress*. **Morgan M**.
- John Mitchell Crouch Fellowship Key Note Lecture. 6 May 2019, Annual Congress of the Royal Australasian College of Surgeons, Bangkok, Thailand. **Di Ieva A**.
- AACR meeting – “Bladder Cancer: Transforming the field” Denver, USA, May 2019. *Application of Miltuximab-IRDye800 for near-infrared fluorescence imaging of urothelial carcinoma in vivo*. **Polikarpov D, Campbell D, McRobb L, Zaslavsky A, Zvyagin A, Walsh B, Palapattu G, Gillatt D**
- Syringomyelia Research. Zhengzhou Central Hospital, China. May 2019. **Stoodley MA**.
- International Conference of Radiation Research, Manchester, UK August 2019. *Autophagy role in radiation-induced endothelial surface translocation of mitochondrial protein PDCE2: a novel radiation marker*. (TRAVEL AWARD – Australian Vascular Biology Society : \$4000). **Faqihi F, McRobb L, Stoodley M**.
- 1st Australian Fluorescence-guided resection for brain tumours – Gliolan Course. 16 June, Macquarie University. **Di Ieva A** (Convener and Faculty).

- *2nd Macquarie Brain Anatomy and White Matter Dissection Workshop*. 14-15 June, Macquarie University. **Di Ieva A** (Convener and Faculty)



Macquarie Neurosurgery Brain Anatomy Workshop with participants wearing 3D glasses.

- *Transhumanism: A medical impact example*. 20 June 2019, University of Notre Dame, Sydney. **Di Ieva A**.
- The 34th Annual Meeting of the Neurospinal Society of Japan, Sapporo, Japan, June 2019. *Surgical treatment of syringomyelia*. **Stoodley MA**.
- **CSF Flows at Niagara Falls**, Buffalo, USA, June 2019 (Convener: Prof Stoodley). *Management of persistent or recurrent syringomyelia after Chiari decompression*. **Tanaka K, Stoodley M**.
- **CSF Flows at Niagara Falls**, Buffalo, USA, June 2019. *What drives fluid flow in and around the spinal cord?* **Liu S, Hemley S, Lam M, Bilston L, Stoodley M**.
- **CSF Flows at Niagara Falls**, Buffalo, USA, June 2019. *Spinal cord ultrastructure and the distribution of aquaporin-4 in a rodent model of post-traumatic syringomyelia*. **Berliner J, Hemley S, Lam M. Stoodley M**.
- **The 34th Annual Meeting of the Neurospinal Society of Japan**, Sapporo, Japan, June 2019. *Pathophysiology of syringomyelia: cutting edge*. **Stoodley MA**.
- Australian & New Zealand Association for Health Professional Educators 2019 Conference, Canberra, 2019. *EBM training programs: What if we could measure patient outcomes?* **Simons M, Zurynski Y, Davidson A**.
- **5th International Cerebrospinal Fluid Dynamics Symposium**, Oslo, Norway, July 2019. *Physiological drivers of fluid flow in the spinal subarachnoid space and spinal cord*. **Stoodley MA**.

- Education Event for GPs, Neurosurgery at Macquarie University Hospital. 3/09/2019. **Fuller J, Davidson A, Siu T, Di Ieva A.**
- **Adelaide Spinal Research Symposium XVI**, Adelaide, August 2019. *Spinal cord ultrastructure and the distribution of aquaporin-4 in a rodent model of post-traumatic syringomyelia.* **Berliner J, Hemley S, Lam M, Stoodley M.**
- **Adelaide Spinal Research Symposium XVI**, Adelaide, August 2019. *What drives fluid flow in and around the spinal cord?* **Hemley S, Liu S, Lam M, Bilston L, Stoodley M.**
- **Adelaide Spinal Research Symposium XVI**, Adelaide, August 2019. *Surgical management of persistent or recurrent syringomyelia after Chiari malformation decompression.* **Stoodley M, Tanaka K, Di Ieva A, Rogers J.**
- **2019 Australian Vascular Biology Society Scientific Meeting**, Sydney, September 2019. *Vascular targeting of an atypical surface translocated B-crystallin (CRYAB) for the treatment of irradiated brain arteriovenous malformations.* **McRobb LS, Subramanian S, McKay MJ, Molloy MP, Stoodley MA.**
- Occupational Therapy Australia 28th National Conference and Exhibition 2019, Sydney, 2019. *Measuring quality of life following neurosurgical treatment of brain tumour.* **Tadle A, Johnston B, Davidson A, O'Donnell J.**
- **29th Annual Scientific Meeting of the Stroke Society of Australasia**, Canberra, September 2019. *Vascular targeting for brain AVMs: using radiation to create endothelial surface targets for prothrombotic therapy.* **Stoodley MA.**
- Australian Vascular Biology Society, Sydney, October 2019) *Autophagy role in radiation-induced endothelial surface translocation of mitochondrial protein PDCE2: a novel radiation marker.* **Faqihi F, McRobb L, Stoodley M.**
- Australian Vascular Biology Society, Sydney, October 2019. *Vascular targeting of an atypical surface-translocated aB-crystallin for the treatment of irradiated brain arteriovenous malformations.* **McRobb LS, Subramanian S, McKay MJ, Molloy MP, Stoodley MA.**
- 4th Annual Encourage Symposium, Macquarie University, October 2019. *Consent in spinal surgery – a survey of practice.* **Li Ching Ng A, McRobb L, White S, Cartmill J, Cyna A, Seex K.**

- EnCouRage Symposium, N.S.W, Australia, October 2019. *Spinal cord ultrastructure and the distribution of aquaporin-4 in a rodent model of post-traumatic syringomyelia*. Awarded best presentation by a PhD student. **Berliner JA, Lam MA, Hemley SJ, Najafi E, Bilston LE, Stoodley MA.**
- RACS surgical conference, Melbourne, November 2019. *Consent in spinal surgery*. **Li Ching Ng A, McRobb L, White S, Cartmill J, Cyna A, Seex K.**
- Occupational Therapy Australia 28th National Conference and Exhibition 2019, Sydney, 2019. *Test re-test reliability of touchscreen DriveSafe DriveAware*. **Johnston BJ, O'Donnell JM, Manuguerra M, Davidson AS.**
- First AIMed (Artificial Intelligence in Medicine) event in Australia, Sydney, 13 November 2019. *Artificial Intelligence in Neurosurgery*. **Di Ieva A.**
- Macquarie University MRes (Neurosciences) lecture series. *Clinical Cases and dilemmas – Caring for a patient with glioblastoma*. **Davidson A.**
- Macquarie University MRes (Neurosciences) lecture series. *Brain Tumours, Skull base Surgery and Computational Neurosciences*. **Di Ieva A.**
- MQ Bionetwork Brain Cancer Meeting, Macquarie University. *Challenges in the management of brain cancer*. **Davidson A.**
- MQ Bionetwork Brain Cancer Meeting, Macquarie University. *Computational modelling and artificial intelligence in neuro-oncology*. **Di Ieva A.**
- NSW Regional Health Advisory Group, Sydney. *Traumatic Brain Injury in the ADF*. **Davidson A.**
- Stryker Cranial Access Course, Sydney. **Davidson A** (Convenor)

RESEARCH GRANTS & AWARDS

John Mitchell Crouch Fellowship (Royal Australasian College of Surgeons, RACS, 2019): Computational NeuroSurgery Lab, *Di Ieva A* (\$150,000)

Australian Research Fellowship (ARC) Future Fellowship: In search of relevant things: A novel approach for image analysis. *Di Ieva A* (\$1,015,000)



A Macquarie Neurosurgery gathering to celebrate the ARC Future Fellowship grant.

Sydney Vital Seed Funding 2019: Magnetic keys of a new toolbox for the treatment of brain cancer: A study on 3D engineered healthy and tumour brain organoids. **Gullar A, Sowman P, Davidson A, Nadord A** (\$49,935)

Cure Brain Cancer 2019 Innovation Grant: Improving immunotherapy outcomes in brain cancer. **Rizos H, Shklovskaya E, Wong M, Davidson A** (\$200,000)

Macquarie University Safety Net Scheme: Computational Modelling & Artificial Intelligence in Brain Tumours Neuroimaging: Towards the augmented-diagnostics of the future. *Di Ieva A* (\$20,000)

CEPET (Centre for Elite Performance, Expertise and Training) Start-up research grant: Visual search dynamics and image complexity in radiology. *Nalepka P, Carrigan A, Di Ieva A* (\$4,000)

ARC Centre of Excellence in cognition and its disorders Legacy Support scheme funding: Workshop on Australasian Magnetoencephalography (WAM 2019) – Neurocognitive clinical applications of MEG: present and future. *Sowman P, Crain S, He W, McAlpine D, Di Ieva A, Seymour R, Rapaport H, Zhu* (\$11,698)

2019 NHMRC Grant Project: Advanced computational fluid dynamic (CFD) technology to predict cerebrovascular aneurysm haemorrhage. *Sen I, Morgan M, Mao Y, Di Ieva A, Javadzadegan A* (\$724,101)

Cooperative Research Centres Projects (CRC-P) grant. Artificial Intelligence and Brain Aneurysms detection. Stoodley M, Magnussen J, et al, cooperation between Fujitsu Australia, GE Healthcare, Macquarie University and Macquarie Medical Imaging (\$2,100,000)



CRC-P grant. L-R: Mike Foster, CEO Fujitsu Australia and New Zealand; Professor John Magnussen, Diagnostic and Interventional Radiologist at Macquarie Medical Imaging, Professor of Radiology at Macquarie University; Richard Zwar, Head of Architecture and Consulting, Fujitsu Australia and New Zealand; Professor Patrick McNeil, Deputy Vice-Chancellor Medicine and Health, Macquarie University; Matt Tucker, CEO and President, GE Healthcare Australia, New Zealand and Papua New Guinea; Professor Marcus Stoodley, Head of Neurosciences at Macquarie University Hospital and National Director of Brain Foundation.

Brain Foundation Grant 2019. CSF movement in syringomyelia: Effect of respiration and pathways for fluid flow. **Hemley S, Stoodley M, Bilston L, Lam M, Liu S** (\$29,000)

Brain Foundation Grant 2019. In vitro testing of thrombotic nanodisks for vascular targeting of AVMs. **Zhao Z, Stoodley M, Shi B, McRobb L, Fu L** (\$29,000)

Brain Foundation Grant 2020. Novel agent for the targeting of abnormal blood vessels in the brain to prevent stroke. **McRobb L, Stoodley MA** (\$22,000)

2019 Brain Foundation Research Gift. DNA aptamers targeting endothelial RAS mutants for vascular drug delivery in brain arteriovenous malformations. **McRobb LS, Stoodley MA** (\$22,000)

Adelaide 2019 Spinal Research Symposium Award for the best presentation. **Berliner J**

CEPET (Centre for Elite Performance, Expertise and Training) Macquarie University Research Centre. **Thompson B, Wiggins M, Crane M, Curby K, Downey G, Griffin B, Kallen R, Pearlman K, Reichle E, Rich A, Richardson M, Sutton J, Auton J, Baird A, Bicknell K, Carrigan A, Di Ieva A, Garrido W, Kangas M, Olsen K, Williams M, Yu L.** 2019-2021 (\$150,000)

Macquarie University. Professor Michael Morgan's Higher Doctoral Degree of Doctor of Science (DSc). This degree is to recognise Professor Morgan's extraordinary contribution to the advancement of knowledge and understanding in Neurosurgery. Professor Morgan will receive his degree at the April 2020 Faculty of Medicine and Health Sciences Graduation Ceremony and deliver the Occasional Address.

PhD Completions

Sinduja Subramanian and Andrew Gauden (Supervisor: Stoodley M).



Sinduja Subramanian PhD graduation with a research thesis on vascular targeting of arteriovenous malformations (AVMs).

Nurse Practitioner graduation: Kate Lin (Supervisor: Di Ieva A)



Kate Lin's Nurse Practitioner graduation.