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


• Dawes BH, Lloyd RA, Rogers JM, Magnussen JS, Stilston LE, Stoodley MA. Cerebellar Tissue Strain in Chiari Malformation with Headache. World Neurosurg 2019 May 130, 74-81.


• Ng HY, Namboodiri D, Learoyd D, Davidson A, Champion B, Preda V. Clinical Challenges of a co-secreting TSH/GH pituitary


- Di Ieva A. *AI-Augmented multidisciplinary teams: Hype or hope?* Lancet 2019 Nov 394(10211), 1801.


• 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.

with Prof Freeman (from left to right: Dr Tim Lukins, Prof. Brian Freeman, Dr Angela Li Ching Ng)
WORKSHOPS, PRESENTATIONS & INVITED LECTURES


- 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.**


- Syringomyelia Research. Zhengzhou Central Hospital, China. May 2019. **Stoodley MA.**


- 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.


• 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.


• 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.](image)


**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)


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. 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


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 or arteriovenous malformations (AVMs).

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

Kate Lin’s Nurse Practitioner graduation.