October 2023

PreOperative Performance

Validated Magnetic Resonance Imaging data

Address:
MaRS Discovery District,
South Tower
101 College Street, Toronto,
Ontario
M5G 1L7

Website:
https://preoperativeperformance.com/

Founder:
Fergal Kerins, CEO
E: fkerins@preoperativeperformance.com
L: https://www.linkedin.com/in/fergalkerins/

PreOperative Performance

Founder

Fergal Kerins
Founder & CEO, PreOperative Performance

E: fkerins@preoperativeperformance.com

In Toronto's start-up sector since 2008.

Program Manager @ medical device company
Built and launched a portfolio of surgical training products
Inventor/co-inventor of >20 patents

Director of Operations @ neutraceutical company
Built first product, co-inventor of foundational IP, obtained Health Canada product licence
Company went on to raise $1M in seed-funding

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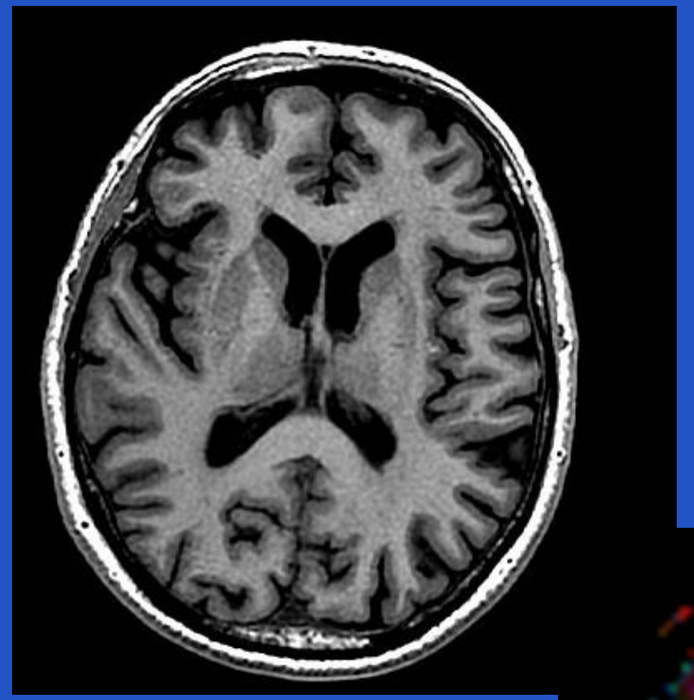
Problem

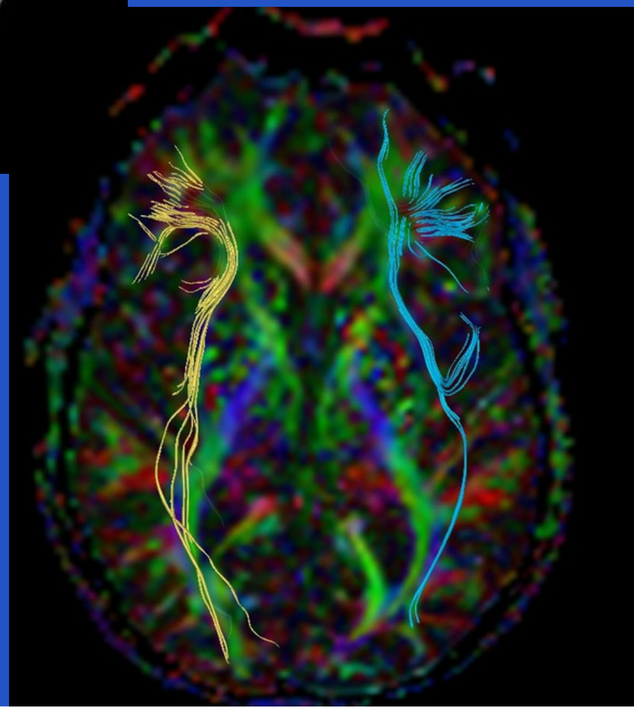
MRI is the gold standard for imaging soft tissues.
No radiation is required,
Contrast media can be used,
but is not always necessary.

Used for diagnosis and treatment planning
But how do we know these images are accurate?

We don’t.

Rates of MRI use increasing in children, adults and older adult populations (>65) of 11% per year (2000 - 2006)





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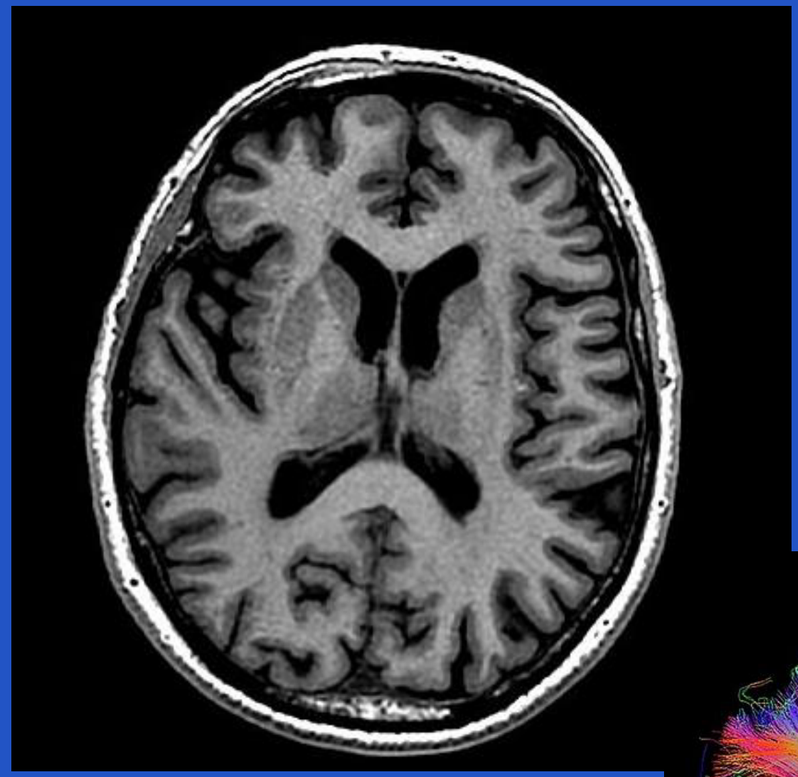
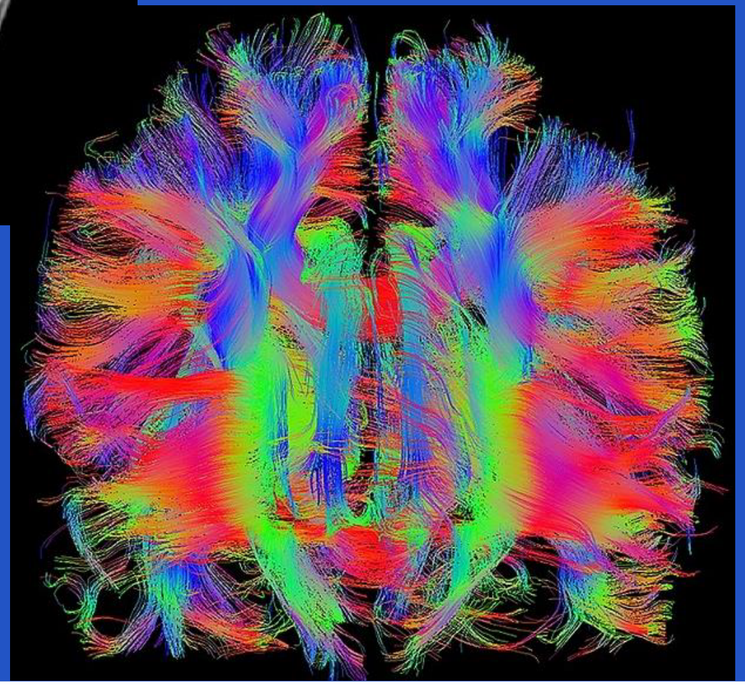
Problem

A diffusion image (DTI) shows the mapping of the nerve fibers of the brain and can be used to plan neurosurgery.

If inaccurate information is used, permanent injury can occur.





Systemic Issue

Variation of MR data quality from system to system limits the ability to follow patient progress, and also limits the ability to perform multi-center research studies into various conditions and the robustness of results of clinical trials.

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Attempts to solve MRI data variance

Review > Neuroimage. 2018 Nov 15;182:39-61. doi: 10.1016/j.neuroimage.2018.06.046. Epub 2018 Jun 18.

Physical and numerical phantoms for the validation of brain microstructural MRI: A cookbook

Els Fieremans [1], Hong-Hsi Lee [2]

Affiliations + expand

PMID: 29920376 PMCID: PMC6175674 DOI: 10.1016/j.neuroimage.2018.06.046

Free PMC article

Abstract

Phantoms, both numerical (software) and physical (hardware), can serve as a gold standard for the validation of MRI methods probing the brain microstructure. This review aims to provide guidelines on how to build, implement, or choose the right phantom for a particular application, along with an overview of the current state-of-the-art of phantoms dedicated to study brain microstructure with MRI. For physical phantoms, we discuss the essential requirements and relevant characteristics of both the (NMR visible) liquid and (NMR invisible) phantom materials that induce relevant microstructural features detectable via MRI, based on diffusion, intra-voxel incoherent motion

A literal cookbook - Use of asparagus and celery to model the brain

Multicenter dataset of multi-shell diffusion MRI in healthy traveling adults with identical settings

Qiqi Tong[1], Hongjian He[1]✉, Ting Gong[1], Chen Li[1], Peipeng Liang[2,3]✉, Tianyi Qian[4], Yi Sun[5], Qiuping Ding[1], Kuncheng Li[3,6] & Jianhui Zhong[1,7]

Multicenter diffusion magnetic resonance imaging (MRI) has drawn great attention recently due to the expanding need for large-scale brain imaging studies, whereas the variability in MRI scanners and data acquisition tends to confound reliable individual-based analysis of diffusion measures. In addition, a growing number of multi-shell diffusion models have been shown with the potential to generate various estimates of physio-pathological information, yet their reliability and reproducibility in multicenter studies remain to be assessed. In this article, we describe a multi-shell diffusion dataset collected from three traveling subjects with identical acquisition settings in ten imaging centers. Both the scanner type and imaging protocol for anatomical and diffusion imaging were well controlled. This dataset is expected to replenish individual reproducible studies via multicenter collaboration by providing an open resource for advanced and novel microstructural and tractography modelling and quantification.

Travelling Subject study - flying multiple individuals to different locations and scanning.
3 people, 10 centers, 12 months elapsed time

PreOperative Performance

Our Solution

A quality control instrument that has been designed to repeatably mimic human tissue response to MR imaging.

With this, it is now possible to assess the performance of any MRI and know the truth.

We can replicate disease parameters and brain structure in modules. MR parameters mimic biology.

Methodology is proprietary, codifiable, repeatable.

The first product on the market to validate DTI data.

PreOperative Performance

Go to Market

- Starts with the researchers
- We go to them, with enabling technology to solve the current problems that exist
- Through this process, we learn more, faster and
- Incorporate the “voice of the customer” into our product

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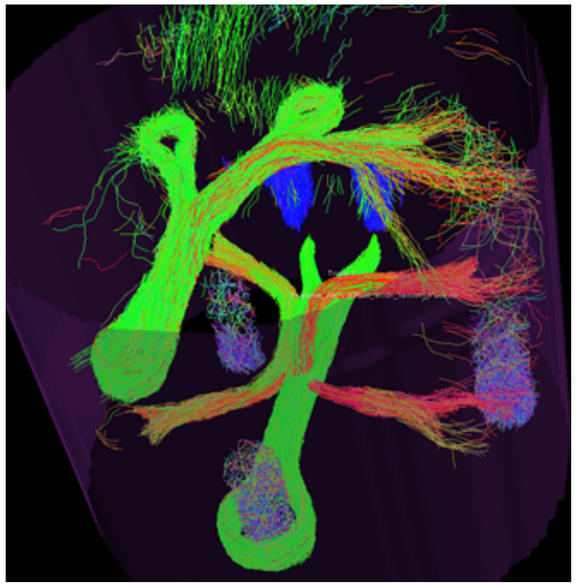
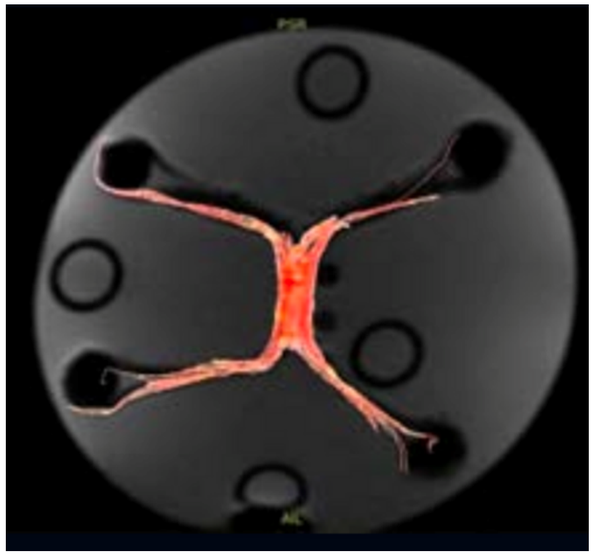
Market Response is positive



"...it is often mentioned at international research and clinical meetings that there is a significant need for some way to perform standardization of MRI diffusion-based scans."

DTI tractography traces from 1.5mm isotropic scans vs 2mm isotropic scans for 90 directional B = 1000 acquisitions in each case.



... [This] work has a specific focus on safer planning for neurological interventions, therapeutic monitoring and expanding the diagnostic capability of MR imaging"

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Competitive Advantage

	Hardware	SFW	Directional Information	Data
PreOperative Performance	✓	✓	✓	✓
Psychology Software Tools	✓	✓	✓	✓
HQ Imaging	✓	✓	✓	✓
Gold Standard Phantoms	✓	✗	✗	✗
Newmatic Medical	✓	✗	✗	✗
Iba	✓	✗	✗	✗
Radia therapy	✗	✓	✗	✗

Only 3 companies providing directional structural information.

Of these three, we have the most versatility in creating structures that mimic human tissue and its response to MRI imaging.

PreOperative Performance

2020

- First IP filing

2021

- BiomedicalZone Support
- First Prototype

2022

- Pre-Seed Raise of $500,000 CAD
- Next gen Product (additional functionality)
- First Evaluation Project

2023

- MaRS Tenancy
- IPON Support
- National Phase IP Filings complete (US, CA, EU, JP, KR)

SOPHIE
Southern Ontario Pharmaceutical & Health Innovation Ecosystem

The Research Institute of St. Joe's Hamilton

McMaster University

- Research Partners - Prof Noseworthy & Norm Konyer
- First conference poster - ESMRMB 2023 (Oct '23)

- RSNA 2023 conference attendance
- Second IP family patent filing

Preoperative Performance
Data harmonization tools and a potential quality standard for diffusion MR Imaging - Anisotropic Diffusion Phantoms
Partnered with the Research Institute at St. Joe's Hamilton
The SOPHIE project promoted the standardization of MR data for neurosurgeries using cutting-edge tools to assess the quality of preoperative image scans thereby enhancing diagnostic capabilities, reducing errors, and improving patient outcomes.
Fergal Kerins
Founder & CEO
PreOperative Performance
The Research Institute of St. Joe's Hamilton
MENTAL HEALTH & ADDICTION
LUNGS & CHEST
Innovation FACTORY
Hamilton's
Catalyst
for Tec
Innova

SOPHIE

Southern Ontario Pharmaceutical
& Health Innovation Ecosystem

Access Surgery
The Research Institute

PreOperative Performance

Team, Advisors, Contractors

Israa Saber B.A.Sc.
Research Scientist

Extensive experience working with biomaterials for medical applications

Engineering
Lithium Design Consulting - Chris Gillespe

Scientific Advisor & Research Collaboration Partner
Prof. Mike Noseworthy McMaster University

Neurology
Dr. Jocelyne Whitehead

Experienced Founder Advisor
Andy Sinclair, Founder OtoSim

SOPHIE Southern Ontario Pharmaceutical & Health Innovation Ecosystem

Intellectual Property Ontario

MaRS

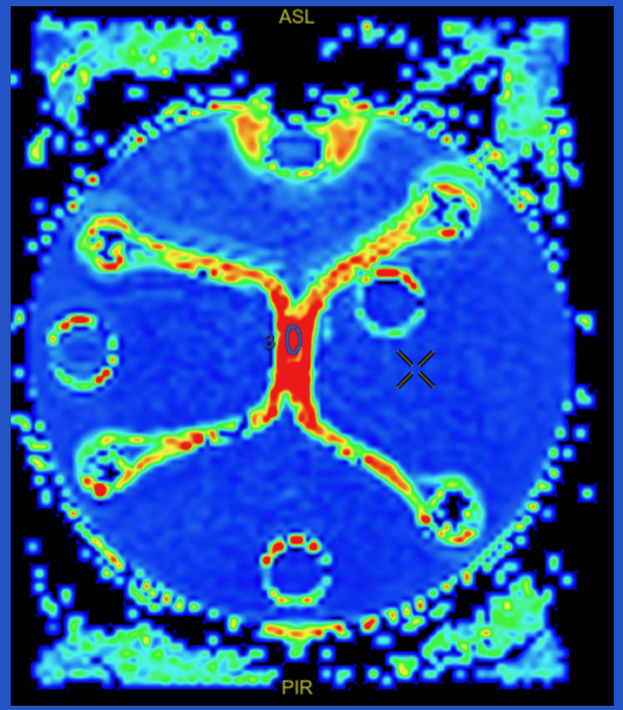
Ontario Bioscience Innovation Organization BIO

PreOperative Performance

Thank You

Fergal Kerins
CEO & Founder

fkerins@preoperativeperformance.com
https://www.linkedin.com/in/fergalkerins/



“When push comes to shove we can afford to lose an arm or a leg,
but I am operating on peoples thoughts and feelings…
and if something goes wrong I can
destroy that persons character… forever.”
Henry Marsh, Neurosurgeon