Glioma MR imaging 2.0

Action meeting

12 & 13 December 2019

Vivaldi hotel

Saint Julians, Malta

GliMR

cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

In this document you will find the detailed program of the Glioma MR imaging 2.0 COST Action meeting. As the largest network event of the first Grant Period, this meeting is intended for the GliMR membership to get to know one another or reconnect with old colleagues. We will discuss current state-of-the-art glioma imaging diagnostics and brainstorm about how to increase the role of advanced imaging biomarkers within clinical research and practice.

Note that additionally this meeting is to contribute to the following deliverables of the Memorandum of Understanding of GliMR:

- A review of advanced MRI biomarkers for glioma. *(Working Group 1)*
- An overview of research studies into glioma within Europe. *(Working Group 3)*
- Design research projects for international collaborations on glioma diagnostics *(Working Group 3)*

This meeting will be concluded with a Management Committee meeting. Amongst other things, this meeting is also to look towards the second year of the COST Action, which will run from the 1st of May 2020 to 30th of April 2021 and will include another large meeting. Please do not hesitate to share your thoughts and ideas about this, including the format and location.

We are looking forward to seeing you in Malta and making this a fruitful and enjoyable meeting.

The organisation committee

Reuben Grech
Matthew Grech-Sollars
Lydiane Hirschler
Vera Keil
Jan Petr
Joana Pinto
Malcolm Vella
Esther Warnert

Contents

Hotel information

The conference will be held in the Golden Tulip Vivaldi hotel (Dragonara Road, St. Julians, Malta, https://vivaldi.goldentulip.com). Note that the meeting itself will take place in the Sonata 2&3 conference room.

NB! Important information about paying for lunch (Thursday and Friday) and Thursday dinner!!

Participants eligible for reimbursement of their costs will be able to claim 20 euro's per lunch/dinner after the meeting has concluded. For the full regulations have a look at the COST Vademecum. Please note that you are therefore asked to pay for this yourself. The following situations will therefore happen:

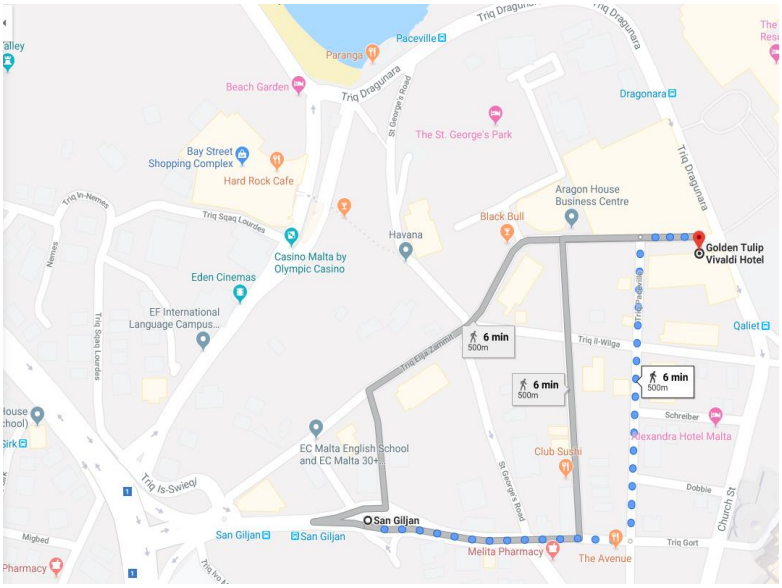
- Your hotel bill from Vivaldi will be the total of your stay and the two lunches during the meeting.
- You will have to pay for the Thursday evening dinner at Nenu The Artisan Baker yourself. This will be 35.50 euros (+ a 10% tip). This includes two drinks (half a bottle of wine, or two beers/soft drinks). You will be able to claim 20 euros back from the COST Action after the meeting.

Local transport

Transport to and from the Vivaldi hotel to the airport can be done via public transport or via a taxi. Note that, according to the COST Vademecum, you can claim 25 euros for local transport for the whole duration of your trip without a receipt. Please keep that in mind when arranging your travel to and from the airport.

There are restrictions on the use of taxis for local transport, which can be found in the COST Vademecum. A single taxi journey from the airport to the Vivaldi Hotel is approximately 20 euros. Sharing taxis will help to keep your local transport costs low - arrange sharing before your arrival following this link.

From the international airport you can also take bus TD2 (leaving every hour, starting from 4.30am) or TD3 (leaving every hour, starting at 04.00am) to the bus stop "San Giljan". From there it is a 6 minute walk to the hotel. A single journey bus ticket costs 1.50 euro and can be bought with cash from the driver.



Walking route from bus stop St. Julians to Vivaldi Hotel

Program: Thursday, 12-12-2019

Morning session

Moderators: Dr. Malcolm Vella & Patricia Clement

09.00h – 09.10h	Opening *Dr. Esther Warnert*
	Diffusion weighted imaging in brain tumours:
09.10h – 09.30h	● The technical perspective *Dr. Enrico De Vita & Dr. Laura Mancini*
09.30h – 09.50h	● The clinical perspective *Dr. Thomas Booth*
	Meet & Greet with the GliMR membership - part I
09.50h – 09.55h	*1. Dr. Patrick Hales*
09.55h – 10.00h	*2. Prof. Alpay Özcan*
10.00h – 10.05h	*3. Daniel Krahulec*
10.05h – 10.10h	*4. Dr. Otto Mølby Henriksen*
10.10h – 10.15h	*5. Prof. Patrìcia Figueiredo*
10.30h – 11.00h	**COFFEE BREAK**

Brunch session

Moderators: Dr. Marco Castellaro & Dr. Elli Paal

	Perfusion MRI in brain tumours:
11.00h – 11.20h	● The technical perspective *Prof. Matthias van Osch*
11.20h – 11.40h	● The clinical perspective *Prof. Yelda Özsunar*
	Meet & Greet with the GliMR membership - part II
11.40h – 11.45h	*6. Dr. Vasileios Katsaros*
11.45h – 11.50h	*7. Prof. Richard Wise*
11.50h – 11.55h	*8. Fatemehsadat Arzanforoosh*
11.55h – 12.00h	9. *Dr. Jan Petr*
12.00h – 13.30h	**LUNCH**

Afternoon session

Moderators: Dr. Ece Ercan & Dr. Enrico De Vita

	MRS in brain tumours:
13.30h – 13.50h	● The technical perspective *Dr. Esin Özturk Isik*
13.50h – 14.10h	● The clinical perspective *Prof. Radim Jančalek*
	Meet & Greet with the GliMR membership - part III
14.10h – 14.15h	*10. Dr. Matthew Grech-Sollars*
14.15h – 14.20h	*11. Yulun Wu*
14.20h – 14.25h	*12. Dr. Esin Özturk Isik*
14.25h – 14.30h	*13. Dr. Enrico De Vita*

14.30h – 15.00h	**COFFEE BREAK**
	Brainstorm session *Led by Dr. Lydiane Hirschler*
15.00h – 16.00h	Novel techniques for glioma characterisation: a review
16.30h	**Bus to Valetta – from Vivaldi hotel**
17.00h-19.00h	**Treasure hunt in Valetta**
19.30h	**Dinner at "Nenu the Artisan Baker"**
23.00h	**Bus to Vivaldi Hotel – from Valetta**

Program: Friday, 13-12-2019

07.30h	Fun run – led by Dr. Jan Petr *Meet at 07.30h in the lobby of the Vivaldi Hotel*
	Morning session *Moderators: Dr. Reuben Grech & Prof. Patrícia Figueiredo*
09.00h – 09.40h	DSC-MRI Perfusion Technology for Gliomas: Consensus, Clinical Trial & Translational Efforts *Prof. Kathleen Schmainda*
09.40h – 10.00h	The association between vascular habitats and patient prognosis, molecular profile and response to treatment *Dr. Juan Garcia-Gomez*
	Meet & Greet with the GliMR membership - part IV
10.00h – 10.05h	14. *Prof. Domenec Puig*
10.05h – 10.10h	15. *Dr. Clement Aquitter*
10.10h – 10.15h	16. *Dr. Paula Croal*
10.15h – 10.20h	17. *Dr. Henk- Jan Mutsaerts*
10.20h – 10.25h	*18. Dr. Ruben Nechifor*
10.25h – 10.30h	*19. Prof. Ioannis 'John' Toliopoulos*
10.30h – 11.00h	**COFFEE BREAK**
	Brunch session *Moderators: Dr. Elies Fuster & Prof. Radim Jančalek*
	Meet & Greet with the GliMR membership - part V
11.00h – 11.05h	20. *Dr. Kim van de Ven*
11.05h – 11.10h	21. *Bárbara Schmitz Abecassis*
11.10h – 11.15h	22. *Dr. Esther Warnert*
11.15h – 11.20h	*23. Prof. Yelda Özsunar*
11.20h – 11.25h	*24. Dr. Michal Bittsansky*
11.25h – 11.30h	*25. Dr. John Healy*
	Brainstorm session *Led by Dr. Jan Petr*
11.30h – 12.30h	Clinical problems in glioma treatment: novel international projects
12.30h – 14.00h	**LUNCH**
	Afternoon session *Led by Dr. Esther Warnert*
14.00h – 15.00h	Management Committee meeting – part I
15.00h – 15.30h	**COFFEE BREAK**
15.30h – 17.00h	Management Committee meeting – part II

Abstracts/Summaries of Meet & Greet Sessions

Thursday, 12 December 2019 – Meet & Greet part I

1. *Dr. Patrick Hales, University College London, United Kingdom*

I am research fellow working at the UCL Great Ormond Street Institute of Child Health. My research is focussed on the development of arterial spin labelling (ASL) and diffusion-weighted MRI techniques to improve our understanding of the biology of paediatric brain tumours (a large proportion of which are gliomas). I work closely with neuro-surgeons at Great Ormond Street Hospital to develop imaging techniques to help plan biopsies and resections of brain tumours. These are used to target the most malignant part of a tumour for biopsy (using ASL/DWI), and to avoid damage to eloquent white matter tracts during surgery (using tractography). I also work with the neuro-radiologists to help implement quantitative reporting of ADC and CBF values in gliomas as part of a patient's radiological diagnosis.

My background is in physics, and I am interested in developing new image acquisition and analysis techniques for clinical use. I am starting to explore the potential of artificial intelligence (AI) for improving the signal-to-noise ratio in clinical MRI data, and aim to assess the utility of AI in predicting the recurrence of gliomas following standard treatment.

2. *Prof. Alpay Özcan, Acibadem Mehmet Ali Aydinlar University, Turkey*

Diffusion MR of Glioma Using Machine Learning

Diffusion MR provides biomarkers for tissue microstructural changes which might potentially distinguish GLM genotypes non-invasively. Focusing on the microstructural changes of the healthy tissue, namely normal appearing white matter, for discovering connections between genotypes and diffuse properties, the outcomes of various machine learning algorithms (MLA) for discriminating between TERT, IDH and 1p/19q deletion subgroups are obtained using various anisotropy indices as features.

While MLAs prove to be successful for single genotype discrimination, in separating combinations of multiple genotypes reduces the performance significantly. Considering cancer heterogeneity as a potential cause of this insufficiency, further features, e.g. inclusion of multimodal data, might provide a solution.

3. *Daniel Krahulec, Philips Healthcare, The Netherlands*

My name is Daniel Krahulec, I have a background in Biomedical engineering (BSc at VSB-TUO, Ostrava, Czechia), and Human neuroscience/neurotechnology (MSc at Aalto University, Espoo, Finland). Nowadays I am working as a doctoral candidate in the TRABIT consortium funded by the European Union's Horizon 2020 research and innovation program. Pursuing a design PhD (not PDEng), I am employed at Philips Healthcare in Best, The Netherlands, where my goal is to develop a clinical research prototype of a software for neuro-fiber tracking in patients with brain neoplasms, especially gliomas.

Diffusion MRI tractography is infrequently utilized in current clinical practice as well as in clinical research software due to a couple of reasons. Data analysis workflow is cumbersome; there is a need for extensive prior knowledge of nerve fiber anatomy for accurate fiber tracking, and numerous file formats and data conversions are involved in processing. Moreover, the widely used DTI-FACT algorithm fails to resolve complex nerve fiber

architectures (e.g. crossing fibers) and fiber bundle displacement/infiltration in tumor vicinity. To optimize clinical preoperative workflow, the aim is to create an automated and robust data analysis application with enhanced informative visualization to facilitate brain tumor surgery planning.

4. *Dr. Otto Mølby Henriksen, Rigshospitalet, Denmark*

At Rigshospitalet, our PET/MR system is located at Dept. of Nuclear medicine used for clinical hybrid brain examinations, i.e. for brain tumors combined 18F-FET PET and conventional MR usually with additional advanced MRI imaging

This general protocol has with project dependent modifications been applied to projects , e.g.

- clinical oncological trials
- pediatric brain tumors pre- and postoperatively
- multimodal prediction of tumor recurrence

and to clinical examinations for

- early response assessment
- progression MR lesions: pseudo progression vs radiation necrosis/pesudoprogression

Our focus is on how hybrid imaging may improve diagnostic accuracy in the post-treatment stage in glioma management by facilitating mulitimodal imaging. In terms of advanced MRI we have focused on initially DSC and currently DCE blood volume imaging, but have also some experience with ASL perfusion, single and multivoxel MRI spectroscopy, and DTI.

Our main interest for participating in GLIMR is exchange of advanced MRI that can be implemented in clinical routine hybrid imaging, and possibly joining multicenter investigations.

5. *Prof. Patrícia Figueiredo, Instituto Superior Técnico, Portugal*

LaSEEB is the Biomedical Engineering Lab at *Instituto Superior Técnico* (IST), the engineering school of the University of Lisbon (https://www.laseeb.org/). We are dedicated to research in biomedical systems and engineering, specializing in biomedical imaging techniques, ranging from cell microscopy to ultrasound and magnetic resonance imaging, as well as electroencephalography. We are particularly interested in developing non-invasive imaging techniques for the study of human brain function, with experience in applications in epilepsy, migraine, small vessel disease, Parkinson's disease, and psychiatric diseases.

At GliMR, LaSEEB is represented by Patrícia Figueiredo, Rita G. Nunes, Joana Pinto and Ana Fouto. We work on the following topics which may be of interest for the GliMR:

- Perfusion imaging by arterial spin labelling (ASL), including quantitative measurement of cerebral blood flow as well as arterial blood volume and arterial transit time based on kinetic modelling of multiple-delay acquisitions;
- Imaging of cerebrovascular reactivity (CVR) using blood oxygen-level dependent (BOLD) fMRI, based on noninvasive respiratory challenges, including breath-holding and paced deep breathing paradigms;
- Imaging of cerebral haemodynamic fluctuations using resting-state BOLD-fMRI;
- Diffusion-weighted imaging (DWI), including multi-shell acquisitions and free water mapping;
- Quantitative MRI techniques, in particular T1, T2 and T2* mapping;
- Susceptibility weighted imaging (SWI), including detection of cerebral microbleeds.

6. *Dr. Vasileios Katsaros, Hellenic Neuro-Oncological Group (HENOG), National and Kapodistrian University of Athens, Greece*

Combining Advanced/Functional MRI methods and Clinical Neuropsychological Evaluation for Patient Tailored Therapy Decision, Treatment and Monitoring of Gliomas

Vasileios K. Katsaros[1], Christos Boskos[1], Agapi-Alexandra Katsarou[1], Maria Pelechrini[1], Evangelia Liouta[1], Evangelia Razi[1], Wojciech Gradkowski[2], Laurent Hermoye[2], Kathleen Schmainda[3], George Stranjalis[1]

[1]Hellenic Neuro-Oncological Group (HENOG), National and Kapodistrian University of Athens, Greece [2]Imagilys, Brussels, Belgium [3]Medical College of Wisconsin, USA

From March 2006 until today, about 1500 patients with gliomas have been evaluated pre-surgically as well as post-treatment.

Our protocol includes neuropsychological tests (frontal executive and visuospatial functions, language, motor, memory, emotion and behavior), structural MRI, SWI, Resting-State and task-based fMRI, diffusion, permeability (DCE-T1) and perfusion (DSC-T2*) MRI, as well as spectroscopy before surgery as well as 1 to 14 months (at least) after surgery, following radio- and/or chemotherapy treatment. The fMRI paradigms are selected according to the neuropsychological evaluation results.

The acquired and post-processed data from structural, functional and advanced MRI are used for differential diagnosis, treatment decision and monitoring follow-up.

In case of biopsy, ablative or gross total excision, the necessary data is transferred to a Neuronavigation system for imaging-guided surgery.

In all cases undergone surgical resection, histopathologic results were available.

In case of Radiotherapy mainly FLAIR and T1 post-Gadolinium images are used for IMRT or IGRT, with strong additive value of Standardized Fractional Tumor Burden results from DSC-T2* Perfusion (last two years) for dose-painting and also for recurrent glioma cases treated with Stereotactic Radiosurgery in order to distinguish relapse from radiation necrosis.

All cases are discussed extensively in neuro-oncology tumor board, in order to decide for the optimal diagnosis and treatment.

Our combined protocol of advanced MR techniques and fMRI with neuropsychological evaluation demonstrates clinical feasibility, high diagnostic accuracy, and allows on an individual base decision and planning of the treatment regimen in patients with gliomas, with resulting better outcome.

7. *Prof. Richard Wise, University of Chieti-Pescara, Italy, in partnership with Cardiff University Brain Research Imaging Centre (CUBRIC), United Kingdom*

Brain tumour research at the Institute for Advanced Biomedical Technologies (ITAB)

Prof. Richard G Wise[a,b,c] & Prof. Massimo Caulo[a,b,]

[a]Department of Neuroscience, Imaging and Clinical Sciences, Università degli Studi G. d'Annunzio Chieti e Pescara, Chieti, Italy. [b]Institute for Advanced Biomedical Technologies (ITAB), Università degli Studi G. d'Annunzio Chieti e Pescara, Chieti, Italy. [c]Cardiff University Brain Research Imaging Centre (CUBRIC), School of Psychology, Cardiff University, UK

The Institute for Advanced Biomedical Technologies (ITAB) has a 15-year history of fMRI applied to presurgical mapping for glioma and has a strong research interest in the characterisation of glioma through the use of conventional and advanced MR sequences (perfusion-weighted, spectroscopy, and diffusion-weighted)[1]. A recent focus has been on the multi-centre standardised assessment of dynamic contrast enhanced and dynamic susceptibility contrast MR images [2]. Advanced sequences are routinely acquired in patients before surgery and after surgery and radiotherapy. ITAB has potentially hundreds of conventional and advanced MR datasets to contribute to the data integration effort of the COST Action.

ITAB has recently been joined by Richard Wise who brings a research programme in imaging brain oxygen metabolismfrom CUBRIC. In the coming years CUBRIC and ITAB will combine efforts in a new UK research council funded project to investigate tissue function in glioma, focussing on oxygen metabolism and characterisation of vascular function. The project will combine contrast-based perfusion measurements with arterial spin-labelling and calibrated fMRI, sensitive to blood oxygenation (BOLD), along with machine learning approaches to infer the physiological state of brain tissue based on biophysical models of the MR signal [3].

References

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[3] Germuska M, Wise RG. Calibrated fMRI for mapping absolute CMRO(2): Practicalities and prospects. Neuroimage. 2019 Feb 15;187:145-153. doi:10.1016/j.neuroimage.2018.03.068.

8. *Fatemehsadat Arzanforoosh, Erasmus MC, The Netherlands*

Cerebral hypoxia occurs in a plethora of brain diseases, including stroke, chronic hypertension and brain tumor. Despite its relevance for patient-specific treatment planning and follow-up, a non-invasive measurement of cerebral oxygenation is currently missing in the clinic. This work provides a step towards a rapid, non-invasive imaging protocol for clinically feasible cerebral oxygenation mapping.

To assess cerebral hypoxia and its cause, a clinical imaging protocol therefore needs to assess CBF, the microvascular bed, and the oxygen that has been extracted out of the vasculature: the oxygen extraction fraction (OEF).

Then to validate the new oxygen delivery framework, we will apply the framework in 20 patients with glioma, who are scheduled to undergo MRI scanning , on a 3T MR scanner, before resection surgery. The framework will be used in addition to the standard clinical imaging protocol to guide minimally 3 biopsies of tumour. From these 3 biopsies ex vivo immunohistochemistry measurements of hypoxia and microvessel density will be obtained and would be compared with our MRI measurements.

9. *Dr. Jan Petr, Helmholtz-Centrum Dresden-Rossendorf, Germany*

Jan Petr works in the department of radiopharmacy in Helmholtz-Zentrum Dresden-Rossendorf. His main focus is processing and analysis of perfusion data from ASL MRI. Our two recent applications are a technical comparison of perfusion measurements by ASL, DSC, and 15O-H20-PET in glioma patients, and a comparison of adverse effects of photon and proton radiochemotherapy in glioblastoma patients by investigating the longitudinal changes in cortical perfusion and volume.

Thursday, 12 December 2019 - Meet & Greet part III

10. Dr. Matthew Grech-Sollars, Imperial College, United Kingdom

Improving brain tumour diagnosis using advanced imaging techniques

My work is focused around improving brain tumour diagnosis using advanced imaging techniques, with a particular interest in assessing brain tumour transformation.

My group is currently evaluating and developing MR Fingerprinting techniques for the purpose of integration into a clinical environment. We have analysed the reproducibility and variability of T1/T2 MRF values in comparison to standard techniques in the ISMRM/NIST standard phantom and in health volunteers. Initial results have shown the technique to be reproducible, reliable and in agreement with literature values. However, a bias was observed between MRF and standard relaxometry measurements. We are currently recruiting brain tumour patients to assess the techniques use and reliability in patients with glioma.

Separately, I am investigating diffusion/perfusion/spectroscopy MRI and choline PET in low grade glioma. In a pilot study we observed Cho/Cr on MRS was able to differentiate WHO grade II glioma from WHO grade III/IV glioma. While choline PET was able to differentiate WHO grade IV glioma from the rest of the tumours. However, we did observe that tracer uptake may be confounded by blood-brain barrier permeability and further investigation is required.

11. Yulun Wu, Erasmus MC, The Netherlands

I am Yulun Wu, PhD candidate from Erasmus MC. I am supervised by Dr. Esther Warnert and Prof. Marion Smits from the Department of Radiology and Nuclear Medicine. The research project will also have close ties with the research team from King's College London. We mainly focus on Chemical Exchange Saturation Transfer (CEST) imaging which is a novel MRI of brain tumor imaging.

Glioma is the most frequent and devastating of primary brain tumors tumor progression which is invisible with conventional MRI. CEST MRI have been highlighted that it can be used to inform on physiological processes within brain tumors including cell proliferation and glutamate metabolism, which makes this technique an excellent candidate for early detection of tumor growth.

The aim of the research project is to non-invasively map cell proliferation and migration in human glioma based on CEST MRI technique. Two main goals to achieve in this project: One objective is to create a clinical workflow for CEST MRI, which includes an optimized CEST MRI sequence and software package for image acquisition, analysis, and planning of targeted biopsies based on the resulting images; the other objective is about development and validation of the clinical use of CEST MRI by mapping the contrast generated in human gliomas with total amide and amine content in targeted biopsies.

12. Dr. Esin Özturk Isik, Boğaziçi University, Turkey

Dr. Esin Ozturk Isik founded Computational Imaging Laboratory at Biomedical Engineering Institute of Boğaziçi University in 2014. The main aim of the current and future projects is to develop novel quantitative metabolic magnetic resonance (MR) imaging methodologies to allow for a better understanding of the underlying biochemistry of brain diseases including gliomas. The technical projects at the Computational Imaging Laboratory focus on developing novel techniques for MR imaging data acquisition, post-processing, and quantitation, as well as machine learning for disease status classification. Our latest work includes IDH and TERTp mutationstatus prediction in gliomas using MR spectroscopyat 3T. The laboratory currently has 11 Ph.D.

and 3 M.Sc. students. Our intent is to translate all the projects developed at our laboratory into the clinics in collaboration with the clinical investigators in order to improve patient health.

13. Dr. Enrico De Vita, King's College London, United Kingdom

I am a roman Physicist, now Reader in Medical Physics in the Biomedical Engineering Department within the School of Biomedical Engineering & Imaging Sciences at King's College London, where I arrived 2 years ago.

I previously worked in solid state NMR in the Chemistry Department at University of Illinois at Chicago. I then moved to University College London for my PhD in 2000, to work on a 4.7T scanner, the highest field MRI scanner in Europe at the time. I then worked 14 years as MR Clinical Scientist in Medical Physics and then Neuroradiology (National Hospital for Neurology and Neurosurgery).

I have extensive experience in developing MRI acquisition and post-processing methods to provide novel imaging biomarkers, using these to establish natural history and measure response to therapy in proof-of-principle investigations of new treatments as well as elucidating underlying disease mechanisms.

I love juggling, climbing and kite flying; I am an aspiring kitesurfer and have an interest in neuro-rehabilitation following brain injury, especially in children.

My current focus is on developing effective and motion-robust methods for MR Spectroscopy in the fetal brain and body. I am currently hiring a postdoc (https://bit.ly/2LOsziC) and a PhD student (https://bit.ly/2NTgnhY) in this area.

I am also currently working on measuring GABA in newborns and looking at its potential relation with risk of autism.

I am keen to develop MRS methodology on the newly installed 7T scanner at KCL and have a long-standing interest in non-invasive MR quantification of cerebral perfusion with Arterial Spin Labelling (ASL).

Finally, I have an additional PhD project in the development of placenta perfusion -with Velocity Selective ASL in collaboration with Leiden and Utrecht (https://www.imagingcdt.com/research/).

Friday, 13 December 2019 – Meet & Greet part IV

14. Prof. Domenec Puig, University Rovira i Virgili, Spain

Intelligent Robotics and Computer Vision Lab

The Intelligent Robotics and Computer Vision Lab (http://deim.urv.cat/~rivi/) at the University Rovira i Virgili (URV) is constituted by faculty from the School of Engineering of the URV in Tarragona (Spain). The Lab is directed by Prof Dr Domenec Puig, and it is dedicated to the field of medical image analysis, computational modelling of prevention in medicine and personalised health care and social care. The expertise of the members of the lab includes the next topics: image processing, pattern recognition, computer vision, medical image analysis, machine learning, perception models, scene analysis, mobile robotics and social robotics.

Our lab is working on personalized medicineto design health plans tailored to each patient to provide better diagnosis, facilitating early intervention, or more efficient treatment and monitoring. Furthermore, imaging can potentially provide valuable information for personalized medicine by offering predictive tools to evaluate health risks, favouring the design of personalised health plans to help patients mitigate risks, prevent diseases and to treat.

We have recently developed projects focused on medical image analysis (e.g., classification of the molecular subtypes of breast cancer, or segmentation of skin cancer lesions). Multimodal images were characterised, focusing especially on the density and the texture properties to discriminate healthy tissues from malignant.

15. *Dr. Clement Aquitter*

I have received a Ph.D. degree in Biomedical Engineering from Burgundy University (Dijon) in December 2018. My doctoral work has focused on computer-aided diagnosis tools based on cardiovascular MRI and involved studying image segmentation algorithms and patient-specific modeling techniques adapted to 4D Flow MRI. During this period, I was awarded a JSPS fellowship and spent 9 months at the Biomedical Engineering lab at Tohoku

University (Sendai, Japan). Since May 2019, I am a postdoctoral researcher at the Grenoble Institute of Neurosciences (INSERM U1216) working on a joint project between our team (PI: Benjamin Lemasson) and the University Cancer Institute of Toulouse (PI: Elizabeth Moyal), funded by the ARC Foundation for cancer research. This project includes a clinical trial for patients with recurrent glioblastoma and aims to investigate the relationship between both imaging and biological markers and the clinical response to the therapy. In this context, my research program focuses on radiomics analysis on multiparametric MRI. My current interests include data management, quality control and harmonization for multicenter studies and the design of radiomics models for treatment outcome prediction.

16. *Dr. Paula Croal, Wellcome Centre for Integrative Neuroimaging, University of Oxford, United Kingdom*

<u>Quantiphyse: Quantification and Visualisation Software for Physiological MRI</u>

Paula Croal[1,2], Martin Craig[2], Michael Chappell[1,2]

[1]Wellcome Centre for Integrative Neuroimaging, University of Oxford, UK. [2]Institute for Biomedical Engineering, University of Oxford, UK.

Overview: Quantiphyse (www.quantiphyse.org) is a data visualisation and analysis tool for quantitative physiological MRI. Via a GUI, Quantiphyse allows you to load imaging data, and perform a range of interactive analyses, before finally turning this into a batch pipeline for future reuse.

Software Specification: Quantiphyse is available as a package for Windows, OS X and Linux via the Oxford University Software Store (free for academic use), or via PyPi.Quantiphyse includes:

- Automated region generating tools, clustering and supervoxel methods
- Loading and manual definition of regions of interest (ROI)
- ROI-based summaries of descriptive statistics.
- Quantitative analysis of physiological MRI
- Arterial Spin Labelling perfusion
- Dynamic Susceptibility Contrast perfusion
- Dynamic Contrast Enhanced perfusion
- Chemical Exchange Saturation Transfer
- Image viewing and timeseries plotting tools

Clinical Application and Future Directions: Developed as part of the Oxford Cancer Imaging Centre, Quantiphyse is currently utilised for preclinical and clinical brain tumour research. Future work will continue to develop and extend analysis tools for quantitative physiological imaging to suit both research and clinical

needs. Particular focus will be paid to providing robust automated analysis tools optimised for tumour application, working towards robust standardised analysis in the glioma imaging community.

17. *Dr. Henk- Jan Mutsaerts, Amsterdam University Medical Centre, The Netherlands*

Explore ASL

ExploreASL is a community-wide effort to create a robust and reproducible image processing tool which allows for standardised processing of T1w, FLAIR and ASL images across centers and scanners. ExploreASL is self-contained, written in MATLAB and based on SPM12, CAT12 and LST LPA. Over 10,000 scans were processed to iteratively refine data curation, image processing, quality control and registration to standard space. Ultimately, this workflow may allow syncing image processing between clinical research, trials and practice.

18. *Dr. Ruben Nechifor, Babes-Bolyai University, Romania*

As we all know, glioma imaging is a powerful tool used in diagnosis, therefore extending its capabilities will bring tremendous benefits for patients. Thus it is my great honor and pleasure to be part of this ACTION.

I have experience in Clinical MRI, field addressed while I was Postdoc at UCLA, and where I was more focused on diffusion and perfusion procedures anddiffusion and perfusion MRIdata analysis on various brain tumors. My actual work is more related with running various fMRI studies, being within the Clinical Psychology and Psychotherapy Department (http://www.clinicalpsychology.ro/en/) and within the International Institute for the Advanced Studies of Psychotherapy and Applied Mental Health (http://psychotherapy.psiedu.ubbcluj.ro/) both from Babes-Bolyai University. More exactly I am interested in running both resting and stress fMRI analysis for various groups, pathologies and psycho-pathologies. As a future work, I want to extend the research activity of fMRI with Clinical MRI, within the Institute for Research, Development and Innovation in Applied Natural Sciences (http://icdisna.institute.ubbcluj.ro/index_en.htmlanother Research Institute from Babes-Bolyai University to which I am affiliated too). Another extension will be towards developing new pulse sequence and novel biomarker, which will bring benefits to the actual glioma imaging procedure.

19. *Prof. Ioannis 'John' Toliopoulos, Konstantin Research Center of Molecular Medicine and Biotechnology, Greece*

Glioblastoma's management by regulating pathways by Specific Diagnostic Markers and Targeted-Natural Therapies

The team of Konstantinion Research Center of Molecular Medicine and Biotechnology

Glioblastoma (GBM) is a lethal disease associated with poor prognosis, short median patient survival (12-15 months), and a very limited response to therapies. Signalling pathways such as RTK/Ras/PI3K, pRB, as well as Ras/MAPK/ERK are associated with GBM pathogenesis. These pathways are involved in the regulation of cell proliferation, survival, differentiation and angiogenesis.

The importance here is the six tyrosine kinase receptors; the epidermal growth factor receptor (EGFR), the vascular endothelial growth factor receptor (VEGFR), the platelet-derived growth factor receptor (PDGFR), the hepatocyte growth factor receptor (HGFR/c-MET), the fibroblast growth factor receptor (FGFR) and the insulin-like growth factor 1 receptor (IGF-1R), which are all involved in the GBM and are the promising ones for targeted therapies.

Also, TGF-b signaling has been shown to facilitate Ras/Raf/MEK/ERK signaling via the increased GTP loading of Ras, and activates the PI3K/AKT/mTOR pathway. Furthermore, specific antibodies such as CD133, CD15, aldehyde dehydrogenase (ALDH), CD36, CD47, and IDO1 and the above pathways can be tested from Konstantinion Research Center by flow cytometry and are important biomarkers activated in GBM, and also can be used for targeted and evaluating immunotherapy.

The targeted therapies for GBM firstly should concern the testing of glycolysis (GLY), where GBM has large sensitivity, as well as the products of GLY. These include: first, dichloro-acecates (DCA), in which there is enough clinical experience by our group. The specific product blocks GLY. At the same time with the above product, GLY is inhibited with many polyphenols mainly the combination of resveratrol, curcumin, and others that can act synergistically. In relation with the GLY products, the Achilles' heel is Glyoxal (toxic product which causes apoptosis in the GBM cells, which is neutralized by neoplasmatic cells with glyoxalase enzyme, which over secreted by them).

Friday, 13 December 2019 – Meet & Greet part IV

20. *Dr. Kim van de Ven, Philips Healthcare, The Netherlands*

MR imaging is one of the most important imaging modalities to non-invasively characterize brain tumors, and MRI is guiding procedures throughout the patients journey, from initial findings to treatment planning and follow-up. MRI is however not suited today to make a final diagnosis, this is always done based on genetic and histopathological analysis of excised tissue. We aim to improve MR imaging along the care continuum, both from an MR imaging perspective, by bringing new techniques such as Amide Proton Transfer imaging and brain tumor segmentation, as well as by optimizing the workflow for the clinicians to come to a fast and confident diagnosis. More research is required to reach this state, and therefore I'm very interested to see the research of the members of the COST GliMR initiative.

21. *Bárbara Schmitz Abecassis & Dr. Ece Ercan, Leiden University Medical Center, The Netherlands*

Cancer Diagnostics 3.0: Assessing the value of 7T MR for Glioma

Project team members: Bárbara Schmitz Abecassis[1], Linda Dirven[2], Jeroen Bresser[1], Ece Ercan[1], Chloé Najac[1], Itamar Ronen[1], Marion Smits[4], Johan A. F. Koekkoek[2,3], Martin J. B. Taphoorn[2,3], Matthias J.P. van Osch[1]

The current project aims to in the upcoming 4 years focus on assessing how valuable, and feasible, 7T MR modalities are for glioma marker development. This investigation will be a product of combining methods development expertise from the LUMC Radiology department, to answer a specific clinical question from the LUMC and The Hague Medical Center (HMC) Neurology departments[2, 3], where we receive the neuro-oncology expertise from.

At the Gorter center we investigate a variety of MR modalities, from methods development all the way to the assessment of potential clinical feasibility to pure clinical applications.

On a wider scale, this project is supported by the Medical Delta Program which aims to develop advanced imaging acquisition and machine learning approaches to improve and sustain diagnostics in cancer care. The current project will focus on image-to-biopsy registration for imaging biomarkers appraisal.

In this way we will collaborate with the Erasmus Medical Center[4](Rotterdam) where the clinical infrastructure is optimized (iGENE project) for an accurate multimodality registration as well as with the Technical University Delft.

22. *Dr. Esther Warnert, Erasmus MC, The Netherlands*

I am an Assistant Professor at the Erasmus MC in Rotterdam (NL). Here I work in close collaboration between the MR Physics group of Associate Prof. Juan-Antonio Hernandez-Tamames and the Applied Physiological Neuroimaging group of Prof. Marion Smits. This pitch is a brief overview of the glioma projects lead by Marion Smits and me.

- GLASS-NL: longitudinal low grade glioma genomics (PI: Prof. Marion Smits, PhD candidates: Karin van Garderen & Wies Vallentgoed.)
- Vascular signature mapping (PI: Prof. Marion Smits, in collaboration with Prof. Matthias van Osch at the LUMC and Assoc. Prof. Juan-Antonio Hernandez-Tamames)
- The Imaging Genomics (iGENE) project, in which we use multi-parametric imaging of non-enhancing glioma to improve understanding of the heterogeneous tumour environment and aim to do radiomics to stratify patients into the three distinct classes based on molecular profile (PI: Prof. Marion Smits, Assistant Prof. Esther Warnert, PhD candidates: Sebastian van der Voort & Fatih Incekara.)
- The "Making the invisible visible project", a collaboration with King's College London (Prof. Gareth Barker, Dr. Tobias Wood, Dr. Thomas Booth) in which we aim to develop and validate CEST-MRI in glioma imaging. (PI: Assistant Prof. Esther Warnert & Prof. Marion Smits, PhD candidate: Yulun Wu.)
- "Food for thought" in which we aim to generate a rapid and non-invasive manner to map oxygenation non-invasively within glioma. (PI: Assistant Prof. Esther Warnert & Prof. Marion Smits, PhD candidate Fatemehsadat Arazanforoosh).

23. *Prof. Yelda Özsunar, Adnan Menderes University, Turkey*

Yelda Özsunar is Professor of Radiology and Dean of Faculty of Nursery at Adnan Menderes University School of Medicine, Aydin, Turkey. She is a European and Turkish board certified neuroradiologist. She has graduated from Gazi University School of Medicine, Ankara and finished her radiology residency at the same university. She worked as researcher at the University of Copenhagen, Oxford, Yale University, Harvard Medical School, MGH Radiology and MR Departments; Martinos Center and Great Ormond Street hospital in London. (see: https://www.healing-symphony.com/about or http://www.yeldaozsunar.com/)

Her clinical research has primarily focused on perfusion imaging of brain tumors. She is preparing a book as an editor for Springer called 'Atlas of Clinical Cases on Brain Tumor Imaging'.Her most recent work about the effect of susceptibility artefacts on ASL versus DSC perfusion imaging has been recently accepted at AJNR. She wants to investigate the effect of chemotherapy on perfusion of normal appearing brain parenchyma in patients with brain tumors. She think multiphase ASL, which is a more effective technique then single phase ASL, has superior accuracy over DSC perfusion and therefore should be utilised more and standardized among vendors and imaging centers. She will share her clinical experience as an invited lecturer in Malta.

24. *Dr. Michal Bitsansky, Comenius University, Slovakia*

25. *Dr. John Healy, University College Dublin, Ireland*

Dr Healy will give a short presentation on an upcoming funding call, CHIST-ERA.

Social program

Informal drinks on Wednesday

If you are already at the hotel on Wednesday evening: we will meet in the lobby of hotel Vivaldi at 7 pm to head out for some food & drinks.

Meeting dinner on Thursday

The conference dinner will happen on Thursday 12 December at Nenu the Artisan Baker, at **19.30h**. Note that this is in the city centre (Valetta). There is a bus that will take us from the hotel to the city centre and back.

16.30h: bus from Vivaldi hotel to Valetta.

23.00h: bus from Valetta to the Vivaldi hotel.

Guide to Malta

Dr. Matthew Grech-Sollars and Dr. Joana Pinto made a nice guide to Malta. Have a flick through this folder for some sightseeing tips during your stay in Malta! You can find this guide here: https://drive.google.com/file/d/1hZnDdoyUvhdi48jlmwuhaIzVAZu_2e3P/view?usp=sharing

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