OP-07 RETINAL AND CORTICAL VASCULAR FUNCTION ACROSS THE MENSTRUAL CYCLE

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Introduction Oestrogen has a protective effect against neurodegenerative conditions, including glaucoma and dementia. Animal models suggest that oestrogen has a vasodilatory effect, which is a possible mechanism for this. However, the full influence of oestrogen on specific cerebrovascular functions is unclear.

Aims This study aims to investigate the influence of hormonal fluctuations across a healthy menstrual cycle on measures of retinal and cortical vascular functioning.

Methods 27 menstruating participants (age mean[SD]=22.94 [3.52] years) completed a testing session during the early-follicular, late-follicular, and mid-luteal phase of their menstrual cycle. Bloods were taken to measure circulating hormones.

Retinal vasculature was assessed using a Swept-Source OCT (TOPCON healthcare), including:

- Choroidal thickness – 6mm^2 OCT scan
- Vessel density, radius, and resistance – 3mm^2 OCT Angiography

Cortical data were acquired on a Siemens MAGNETOM Prisma 3T MRI scanner and include:

- Grey matter Cerebral Blood Flow (CBF) and Arterial Arrival Time (AAT) – MPLD-pCASL scan
- Global Oxygen Extraction Fraction (OEF) – TRUST sequence

Linear models investigated the amount of variance explained by circulating oestradiol.

Results Oestradiol significantly decreased retinal resistance ($\chi^2(1)=6.1218$, $P=0.01335$), an effect which was greatest in the foveal vessels. Other retinal measures were stable across the menstrual cycle. No association was found with OEF, but oestradiol did significantly increase CBF ($\chi^2(1)=17.801$; $P=2.452e\text{-}5$) and AAT ($\chi^2(1)=9.5183$; $P=0.002034$), which was a global effect.

Conclusion Evidence for oestrogen's vasodilatory influence was demonstrated across a menstrual cycle and in multiple vascular beds. This provides information into how oestrogen influences the cerebrovascular system and highlights possible mechanisms by which oestrogen has a protective effect against neurodegenerative conditions.

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OP-08 ANALYSING THE TRANSCRIPTOME OF CHOROIDEREMIA PATIENT-DERIVED IPSC-RPE

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Introduction Choroideremia is an X-linked recessive retinal dystrophy, marked by degeneration of the RPE, photoreceptors and choroid. Choroideremia is caused by loss-of-function variants in the *CHM* gene, with no genotype-phenotype correlation. The *CHM* gene encodes REP1 protein, which is involved in intracellular vesicle trafficking. Disruption to melanosome transport, photoreceptor outer segment digestion and phagolysosomal activation is reported in choroideremia models. The pathogenic mechanism of choroideremia is not yet fully characterised.

Aims There is no current animal model that fully recapitulates the choroideremia retinal phenotype. We aim to use patient-derived iPSC-RPE to identify novel disrupted pathways and therapeutic targets.

Methods We generated iPSC-RPE from a CHM^{S190X} patient-derived fibroblast line (n=3), and two wildtype control lines (n=3). Samples were sent off for paired-end RNAseq. Differential gene expression and enrichment analysis were performed (using threshold cut off for the adjusted p value of < 0.05, log2fold change > 2).

Results Significant disruption was seen in 4149 genes of CHM^{S190X} iPSC-RPE, compared to wildtype lines. Disrupted cytokine, cellular senescence, and oxidative stress pathways were seen in CHM^{S190X} iPSC-RPE, suggesting inflammatory pathomechanisms. Disruption of cell adhesion pathways was also highlighted, potentially causative of lymphocyte migration into the retina, as seen in choroideremia patients. Disruption of several ion transport mechanisms was observed, which could be associated with inflammation.

Conclusion To our knowledge, this is the first study to characterise the choroideremia iPSC-RPE transcriptome using RNA-seq. Disruption to inflammatory pathways were identified, which may draw parallels to underlying mechanisms in AMD.

OP-09 STRUCTURAL CORRELATIONS BETWEEN BRAIN MAGNETIC RESONANCE IMAGE-DERIVED PHENOTYPES AND RETINAL NEUROANATOMY

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Introduction The eye is a well-established model of brain structure and function, yet region-specific structural correlations between the retina and the brain remain underexplored.

Aims To explore and describe the relationships between the retinal layer thicknesses and brain magnetic resonance image (MRI) derived phenotypes in UK Biobank.

Methods Participants with both quality-controlled optical coherence tomography (OCT) and brain magnetic resonance imaging (MRI) were eligible. Retinal sub-layer thicknesses and total macular thicknesses were derived from OCT scans. Brain image-derived phenotypes (IDPs) of 153 cortical and subcortical regions were processed from MRI scans. In this hypothesis-free study, we examined pairwise retinal-brain

associations using multivariable linear regression models. All analyses were corrected for multiple testing and adjusted for confounders.

Results Data from 6,446 participants were included in this study. We identified highly significant associations between volumetric brain MRI measures of subregions in the occipital lobe (intracalcarine cortex), parietal lobe (postcentral gyrus), cerebellum (lobules VI, VIIb, VIIIa, VIIIb and IX) and deep brain structures (thalamus, hippocampus, caudate, putamen, pallidum and accumbens) with the thickness of the innermost retinal sub-layers and total macular thickness (all $P<3.3\times10^{-5}$). We did not observe statistically significant associations between brain IDPs and the thickness of the outer retinal sub-layers.

Conclusion Thinner inner and total retinal thicknesses are associated with smaller volumes of specific brain regions. These associations go beyond anatomically established retina-brain connections. Furthermore, the links between the normal variations in retinal and brain structures broaden our understanding of neurological ageing in general population.

OP-10 BIOINSPIRED INTELLIGENT VISUAL ATTENTION SYSTEM FOR THE HUMANOID ROBOT ICUB EXPLORING EVENT-DRIVEN SENSING AND NEUROMORPHIC HARDWARE

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Introduction Visual applications in robotics must meet strict requirements for power efficiency, low latency, and data processing capacity. Despite the remarkable performance achievements of traditional computer vision methods, they struggle to generalise effectively and often rely on vast datasets, increasing data processing and transfer. The proposed system leverages bioinspired visual attention mechanisms to process only relevant parts of the scene, further exploring event-based sensing and neuromorphic computing via Spiking Neural Networks (SNNs).

Aims This scientific challenge aims to connect bioinspired hardware with biologically plausible algorithms, thereby showcasing the potential of spike-based implementations for online robotics visual applications.

Methods The bioinspired saliency-based visual attention model processes events from event-driven cameras on the humanoid robot iCub, running on SpiNNaker neuromorphic hardware. Intensity, disparity, and motion are the bottom-up feature extraction channels competing for scene representation. These cues feed into a biologically plausible saliency-based proto-object model based on Gestalt perceptual grouping theories to detect only relevant scene parts. The model produces saliency maps with salient areas representing regions potentially containing objects, called 'proto-objects'.

Results The online system accurately generates saliency maps in ~16ms detecting salient proto-objects and disregarding clutter. The system has been qualitatively and quantitatively validated, achieving comparable results to the frame-based implementation, in online simple office scenarios, as well as when compared against the ground truth fixation maps from real human subjects (NUS3D dataset).

Conclusion This project is the first significant step towards more complex real-world robotic applications for vision, where bioinspiration sets the basis for fast, power-efficient online robotic applications and innovative computer vision approaches.

Poster Presentations (P)

P-01 THE DEVELOPMENT OF A GLAUCOMA-SPECIFIC SYMPTOM QUESTIONNAIRE USING THE NOMINAL GROUP TECHNIQUE – A PILOT STUDY

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Introduction Few symptom-specific questionnaires exist within the glaucoma literature. Existing questionnaires have not used participant-led analyses, reducing patient influence and reports from lived experience. They also have not assessed the impact or severity of individual symptoms.

Aims To pilot use of the Nominal Group Technique (NGT), to generate a glaucoma-specific symptom list and facilitate development of a symptom questionnaire.

Methods Participants included one glaucoma (n=6, median [IQR] age: 77 [71, 79.5] and one age-similar control group (n=10, median [IQR] age: 73 [66, 74]. The glaucoma group were asked to identify vision changes attributable to their glaucoma. The controls were asked to identify vision changes since the age of 50. Group discussions achieved a unique symptom list through group consensus via the NGT. Participants then individually ranked their symptoms based on frequency, severity, and activity-limitation. Lists were compared between groups, and common symptoms removed.

Results The final, glaucoma-specific symptom list consisted of 12 unique symptoms. Needing more light for near tasks was the most frequent and severe symptom, with the greatest impact on daily living. The second highest ranked symptom for all measures was sensitivity to bright light/sunlight. Some symptoms were not ranked by any participants, indicating some misunderstanding of task requirements.

Conclusion Indications that the ranking task was not fully understood suggest an important limitation of this methodology. In future, a hand count will determine frequency of symptoms. Participants will also indicate their single most severe and most activity-limiting symptom. Multiple sessions with glaucoma and control participants will inform development of the questionnaire.

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P-02 THE EFFECT OF VARYING STORAGE CONDITIONS ON THE MECHANICAL PROPERTIES OF PORCINE RETINA

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Introduction Accurate characterisation of the physical properties of the retina is essential for understanding the effects of age, disease mechanisms and developing effective surgical interventions. Ex vivo measurements have been used to do