

A window to 2024 and beyond?

BY NIMA GHADIRI

The connection between the eye and systemic diseases has been acknowledged for millennia. Historical records suggest that ancient civilisations had some understanding of the eye's significance beyond its primary function in vision. For instance, in ancient Egypt, the 'Eye of Horus' symbolised royal power, good health, and protection, reflecting a broader significance attributed to the eye beyond its anatomical function. Greek mythology and medicine also recognised the eye's symbolic and medical importance, with detailed medical knowledge supporting the symbolic value of the eye in mythology.

The specific study of the eye's involvement in systemic diseases has evolved significantly over time. With rapid advancements in technology – particularly imaging, artificial intelligence and big data – we are now at a dawn of a new era [1,2], with previously undiscovered links emerging and enabling us to detect diseases at earlier stages and identify risk factors during preclinical stages. These achievements could lead to early intervention and improved health outcomes for patients. Already in 2024, some fascinating insights have been unearthed in the literature:

- Adults who had childhood amblyopia ('lazy eye') are more likely to experience hypertension, obesity, and metabolic syndrome in adulthood, as well as an increased risk of heart attack, using data from 126,000 participants aged 40–69 in the UK Biobank [3].
- A link between outer retinal thickness and gum disease based on data from 67,000 participants aged 40–70 years [4].
- Screening for moyamoya disease (a rare and chronic condition characterised by narrowing of brain arteries leading to stroke and seizures) based on 500 retinal photographs [5].
- We can predict the intimal thickness of carotid arteries from fundus images of patients with type two diabetes mellitus – based on data from 1236 participants [6].

Ambitions for 2024 include greater breadth of biomarkers beyond the many ocular imaging modalities, so that histologic, molecular and other quantifiable characteristics are incorporated within an arsenal of combined ocular biomarkers for systemic disease. An example would be Alzheimer's disease, for which conventional neuro-imaging cannot find early signs.

A combination of both imaging-based oculomics (where reflectance scores in hyperspectral imaging might predict amyloid beta, and there are other changes in retinal and optic nerve architecture and nerve fibre layer thickness which can predict cognitive decline) alongside structural biomarkers, such as tear film constituents (particularly t-tau and Amyloid-beta), and functional biomarkers could revolutionise screening and detect pre-clinical Alzheimer's disease before symptoms emerge [7].

This work is happening all over the world, with the UK at the forefront through the UK Biobank and entities such as the Insight Hub. Avenues for research are manifold as we discover more biomarkers, which can enable us to find and treat conditions faster, potentially preventing or delaying progression of disease.

My hope is that the second half of the 2020s emerges as the era for predictive, preventive and personalised medicine (PPPM) to be prioritised and implemented, combined -omics alongside more seamless digital health integration allowing for tailored treatment strategies based on individual profiles. As a greater range of detectable diseases are unearthed, we hope that more low-cost ways of screening can help bridge gaps in isolated or under-resourced settings around the world.

Of course, these exciting links all need further exploration, appraisal and clinical validation. This year at the Royal College of Ophthalmologists' annual meeting in Belfast, there will be a morning session entitled 'Oculomics: re-linking the eye and the body' chaired by Professors Pearse Keane and Alastair Denniston.

“The eyes are the mirror of the body and mind” – Hippocrates

We wish to invite submissions for this section as this field develops over the coming months, years and decades – and call on all experts and enthusiasts to share intuitions, research and reviews: samuel@pinpoint-scotland.com

References

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[All links last accessed March 2024]

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“The eyes are the windows through which the wind blows in and out of the house of life”

– Eugene Ionesco