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The eye as a window into health impacts of environmental change.

The outermost layer of the eye is highly susceptible to damage from the environment including from climate changes, air-borne allergens and air pollutants. People living in regions affected by bushfires and smoke report very high levels of eye irritation, and this is exacerbated by pre-existing conditions (e.g. allergy, asthma, respiratory conditions (COVID-19)). We have identified biological eye markers that can be used to measure and diagnose the body's and eye's response to environment and climate change, and to test novel approaches to prevention and treatment.

Competitive advantage

- Specific clinical, neuro- and bio-markers to track, characterise and quantify the human eye's response to various environmental challenges - in vivo and in real time
- Capacity to replicate environmental exposure using environmental chambers and goggles
- Specialist practitioners able to deliver complex care including specialty medical devices and interventions

Impact

- Most Australians, and peoples world-wide, are increasingly impacted by environmental changes. Air-borne allergens and air pollution are intensified by longer pollen seasons, more extreme bushfires and fossil fuel emissions.
- 80% of the Australian population was impacted by smoke during the bushfires of 2019-2020. Eye irritation was reported by 50-75% of Australians living in smoke-affected regions.
- This equates to over 10 million Australians who have eye-related effects from the recent bushfires.
- Considerable societal and economic costs are associated with eye irritation including reduced productivity at work and quality of life, and a significant and ongoing Medicare burden.
- Development of prevention protocols and eye care products will mitigate the adverse impact of environmental changes on the eye, ensuring that millions of Australians and those beyond continue to see and feel well without the need for cumbersome protective equipment.
- Improved diagnostics, particularly those that target the key pathophysiological mechanisms will enable more appropriate treatment and monitoring of the impact of treatment.

More Information

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Successful outcomes

- Demonstrated changes in clinical, neurological and biomarkers documented in allergy, contact lens wear, smartphone use, corneal refractive surgery, neurotrophic eye pain, cancer treatment and with age, hormone and metabolic changes
- Developed audit methods to characterise, evaluate, and improve the eye care patients seek and receive
- Capacity development and training of over 150 graduate and honours students in specialised clinical and laboratory techniques
- Established track record of clinical studies (including Phase 1 to Phase 4 trials) including complex trial designs

Capabilities and facilities

- Capacity to replicate environmental exposure using environmental chambers and goggles
- In vivo, real-time observation and tracking of ocular response and biomarkers in human participants (e.g. immune cells, corneal nerves and neurosensory response, tear film stability, eye blinking, inflammation, subjective symptomatology, quality of life indicators)
- State-of-the-art diagnostic imaging and measurement (e.g. in vivo confocal microscopy, blinking dynamics, tear film visualisation, aesthesiometry, meibography, aberrometry)
- Cutting-edge laboratory techniques for onsite analysis of novel and established neuro- and bio-markers (e.g. PCR, multiplex, mass spectrometry, tissue culture, tear film assessment for cytokines, neuropeptides, microorganisms)

Our partners

- Established collaborations with Sydney Children's Hospital Randwick, Menzies Institute for Medical Research, Fire Centre Research Hub, University of Tasmania, Campbelltown Hospital.
- Optometry Association and eye care practitioners Australia-wide
- Patient advocacy groups
- Tear Film and Ocular Surface Society