Research Highlight

Adding Metabolomics to the Toolbox for Studying Retinal Disease

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There is no shortage of studies using 'omic' technologies (genomics, transcriptomics, and proteomics) for studying retinal physiology and pathophysiology. For instance, searching PubMed (http://www.ncbi.nlm.nih.gov/pubmed) for manuscripts using transcriptomics to study glaucoma-relevant biology yielded 71 hits; however, to date, metabolomics has not been widely used to study ocular biology. Metabolomics is a relatively new technology that quantifies the numerous metabolites that make up the metabolome of a given cell or tissue.[1] Like the other 'omics,' it is an important technology that will likely, with time, provide key information about the cell biology underlying ocular disease. A particular strength of metabolomics compared with the other 'omic' technologies is that it can be used as a direct read out of the physiologic state (or health) of a cell or tissue at a given point in time. It can also be useful in identifying biomarkers of disease.[2] In this issue, Agudo-Barriuso and colleagues[3] use metabolomics to quantify changes in metabolites in the retina after mechanical optic nerve injury, a model system for studying axon injury signaling that is relevant to glaucoma. Importantly, they look at two time points after injury allowing for identification of metabolic changes during different stages of injury response. The first was just 24 hours after injury, a time point when retinal cells are responding to injury, but have not yet begun to die. The second was two weeks after injury, a time when the majority of retinal ganglion cells have died. By comparing these time points to each other and to uninjured retinas the group identified several potentially key metabolite changes occurring within the retina during retinal ganglion cell injury response and loss. It should also be noted that the study highlights the unique insight that metabolomics can bring to studying retinal disease. Furthermore, we commend the authors for taking important early steps in bringing metabolomics to ophthalmic research. Going forward, the challenge for us all will be to integrate metabolomic studies with the numerous other 'omic' and cell biologic approaches to truly gain a systems-level understanding of ocular disease.

References

1. Patti GJ, Yanes O, Siuzdak G. Innovation: metabolomics: the apogee of the omics trilogy. *Nat Rev Mol Cell Biol*. 2012;13:263–269.
2. Collino S, Martin FP, Rezzi S. Clinical metabolomics paves the way towards future healthcare strategies. *Br J Clin Pharmacol*. 2013;75:619–629.
3. Agudo-Barriuso M, Lahoz A, Nadal-Nicolás FM, et al. Metabolomic changes in the rat retina after optic nerve crush. *Invest Ophthalmol Vis Sci*. 2013;54:4249–4259.

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