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Research Interests:

1.) Lipids Involved in Signal Transduction Mechanisms in the Eye

2.) Cell signal transduction events during corneal wound healing, particularly how specific growth factors that are released during injury activate kinase to communicate their signals from the cell membrane to the nuclei.

Selected Publications:


Neurotrophins and DHA induce nerve regeneration

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The cornea has the highest nerve density and the highest sensitivity among tissues. Damage of the nerves after trauma, surgery or infection leads to neurotrophic keratitis, a condition characterized by decreased blink reflex and reduction of tear flow that, in turn, produces dry eye and consequently damage to the corneal epithelium. In severe cases, damage could lead to corneal ulceration.

Docosahexaenoic acid (DHA) is the precursor of neuroprotectin D1 (NPD1), a newly-discovered lipid mediator that protects retinal pigment epithelial (RPE) cells and neural cells from oxidative stress. Synthesis of NPD1 in RPE cells is stimulated by several mechanisms (Bazan NG, Adv Exp Med Biol, 2008).

We have found that treatment with nerve growth factor (NGF) or pigment epithelial-derived growth factor (PEDF) in conjunction with DHA enhances nerve regeneration of corneal nerves damaged post surgery. At 2 and 4 weeks post surgery, there was a 2.5 increase in corneal nerve area, and further increase was seen after 8 weeks. Epithelial cell proliferation also was increased after treatment. Neurotrophins or DHA alone do not have the same effect. NPD1 synthesis was four times higher in the PEDF+DHA-treated group compared to control.

This data demonstrates a new mechanism by which neurotrophin-mediated NPD1 synthesis is involved in nerve regeneration. This signaling mechanism may be targeted in neurotrophic keratitis as well as in other diseases where nerve repair is needed. (Supported by NIH-RO1 EY19465).