33. Kathryn Gerber, Calvin College **Biology**

(Co-Authors: Paul Schramm)

"Worldwide meta-analysis of the relationship between allergenic pollen seasons and climate change"

Pollen, as an environmental trigger for diseases such as seasonal allergic rhinitis, allergic airways disease, and asthma, poses a serious public health risk to much of the world's population. Recent studies evaluating pollen levels and public health outcomes suggest that increasing season duration and pollen quantity are correlated with higher allergic illness levels and fewer productive work and school days, disproportionately affecting vulnerable groups such as children, elderly, uninsured, and urban dwellers. Bearing this public health significance in mind, recent research has sought to evaluate the possible correlation between pollen production and increasing temperatures, hypothesizing that climate change is increasing duration and intensity of pollen seasons across the globe. This study seeks to identify the body of published and peer-edited literature which evaluate this connection, and collect data from identified articles to illustrate the observed patterns. The further exploration and understanding of this connection will aid Centers for Disease Control and Prevention's public health program development for pollen-vulnerable populations in the future.

34. Courtney Glupker, Calvin College **Biology**

(Co-Authors: Peter M. Boersma, Mark P. Schotanus, Loren D. Haarsma, John L. Ubels)

"Effects of Ba2+ on ultraviolet B–induced activation of K+ channels and apoptotic signaling pathways in corneal epithelial cells"

Purpose: The goal of this study was elucidate the ability of Ba2+ to block UVB- induced K+ channel activation, as well as investigate possible protective effects of Ba2+ against UVB-induced activation of apoptotic signaling pathways in human corneal limbal epithelial (HCLE) cells. The overall goal of this study, in conjunction with previous studies, was to investigate the effects of UVB-exposure on corneal epithelial cells, and investigate how high K+ in tears may protect the cornea against UVB-induced apoptosis. Methods: HCLE cells were exposed to UVB at doses relevant to ambient outdoor exposure. Patch-clamp recording was used to measure effects of Ba2+ on UVB- induced K+ currents in HCLE cells. Cells were also exposed to UVB followed by incubation with 5 mM Ba2+ for 4-6 hr. Caspase-activity assays and TUNEL assay were used to determine whether Ba2+ inhibits activation of UVB-induced apoptotic pathways. Results: K+ currents in HCLE cells increased with UVB-exposure, and decreased following addition of Ba2+. When UVB-exposed HCLE cells were incubated with Ba2+, caspases-9, -8, and -3 showed significant decreases in activation as compared to control cells not exposed to Ba2+. Following exposure of HCLE cells to UVB in the presence of Ba2+ apoptosis was also inhibited, as evidenced by a decrease in DNA fragmentation and the number of apoptotic cells.Conclusions: Results indicate that exposure of HCLE cells to UVB activates K+ currents, leading to activation of the caspase cascade and apoptosis due to loss of intracellular K+. This UVB-induced activation is inhibited by Ba2+, giving evidence that Ba2+, a known K+ channel blocker, has effects similar to high extracellular K+, protecting the corneal epithelium from UVB-induced apoptosis. This supports our overall hypothesis that the high K+ in tears, which constantly bathe the cornea, is a protective mechanism against UVB-induced apoptosis in the corneal epithelium.

35. Alexandra Kuipers, Calvin College **Biology**

(Co-Authors: Ryan Bebej, PhD)

"Evaluating Change in Hip and Hind Limb Form and Function to Assess Evolution of Swimming Mode in Early Cetaceans"

The fossil record demonstrates that early cetaceans once lived on land. Our research aimed to study their evolution from a locomotion method suited to land to one suited for water.