



Virginia Commonwealth University  
VCU Scholars Compass

---

Biology and Medicine Through Mathematics  
Conference

2022

---

May 18th, 5:00 PM - 7:00 PM

## A spatially dependent model for photoreceptors in a healthy eye

Danielle C. Brager

*National Institute of Standards and Technology, [danielle.brager@nist.gov](mailto:danielle.brager@nist.gov)*


Anthony Kearsley

*National Institute of Standards and Technology*

Daniel Anderson

*George Mason University*

Follow this and additional works at: <https://scholarscompass.vcu.edu/bamm>

 Part of the [Life Sciences Commons](#), [Medicine and Health Sciences Commons](#), and the [Physical Sciences and Mathematics Commons](#)

---

<https://scholarscompass.vcu.edu/bamm/2022/wed/32>

This Event is brought to you for free and open access by the Dept. of Mathematics and Applied Mathematics at VCU Scholars Compass. It has been accepted for inclusion in Biology and Medicine Through Mathematics Conference by an authorized administrator of VCU Scholars Compass. For more information, please contact [libcompass@vcu.edu](mailto:libcompass@vcu.edu).

**Danielle Brager (NIST), Daniel Anderson (George Mason University, NIST), Anthony Kearsley (NIST)**

**Title: A spatially dependent model for photoreceptors in a healthy eye**

**Abstract**

Retinal degenerations include disorders that lead to photoreceptor loss. These light-sensing cells in the retina convert light into signals that are sent to the brain. There are two types of photoreceptors – rods and cones. Rods contribute to night vision while cones contribute to color vision and visual acuity. Rods and cones both have an outer segment (OS) which is the part of the photoreceptors that absorbs light. Photoreceptors undergo shedding and renewal of their OS to prevent the toxic effects of accumulated photooxidative products. An interruption in these processes leads to photoreceptor degeneration and loss. Photoreceptor loss is common to degenerative eye disorders such as retinitis pigmentosa, age-related macular degeneration, and cone-rod dystrophy. Research in this field is focused on developing strategies to delay or prevent the onset of photoreceptor degeneration but, there is currently no cure for diseases linked to photoreceptor degeneration. There exist mathematical models of regions of the retina in retinal development, health, and disease. Most of these models are not spatially dependent. To our knowledge, there is no mathematical model of the physiology of photoreceptors in a healthy eye that incorporates the interplay between the spatial density distribution, OS length, and nutrient source. We have developed a novel mathematical model of these processes. Our results illustrate the beneficial role of mathematical modeling in this research effort.