**F30/F31/F32/F33 Review**

Applicant: David St-Amand

# Overall Impact

Reviewers will provide an overall impact score to reflect their assessment of the likelihood that the fellowship will enhance the candidate’s potential for, and commitment to, a productive independent scientific research career in a health-related field, in consideration of the following scored and additional review criteria. An application does not need to be strong in all categories to be judged likely to have a major impact. *See BIOTRAIN 720 review criteria rubric for guidance in evaluating proposals and writing critiques.*

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| Overall Impact/Merit *Write a paragraph summarizing the factors that informed your Overall Impact score.* |
| The research in this proposal is a computational project seeking to apply established principles of neural coding to elements of retinal physiology. Efficient coding is a hypothesis which has been able to explain many aspects of neural coding, through the lens of what the most efficient way to transmit or process information is for a given circuit. While this has been applied to retinal coding in some ways, this project proposed to extend the application of efficient coding to incorporate chromatic and temporal information. The project is highly innovative, representing a step forward in our understanding of retinal coding, and will require developing novel machine learning methods to complete the proposed research. The significance is clear, as explanations of the reasons for the evolution of the structure of sensory and sensory processing neurons in the retina are lacking. The methods are established within the Pearson lab and have previously been shown to replicate features of retinal physiology. This work will extend these methods to new stimuli and domains. The approach is well founded; however, some elements remain unclear, specifically how the outputs of the model will be analyzed. There was a clear effort to effectively address reviewer comments. I would like to see a greater explanation of how the outputs of the model will determine whether there is a match between the model predictions and observed retinal physiology, as well as how the model will then be analyzed to elucidate the “why” of retinal coding. Overall, this is a very strong project. |

# Review Criteria

Reviewers will consider each of the review criteria below in the determination of the candidate’s qualifications, scientific and technical merit of the proposed research, candidate’s training potential, and institutional environment and commitment to training.

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| 1. Significance |
| **Strengths**   * Use of a known theory in neural coding to address a gap in understanding * Addressing in gap in understanding of why RGCs are organized and the mismatch in ratios of cell types. * Clear that current models are inaccurate   **Weaknesses**   * Does not address whether the integration of sensory AND chromatic information into one model is important, and whether this model could be extended to include that * Would like to see addressed how models uniquely contribute knowledge that experimental work cannot |

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| 2. [Innovation](http://grants.nih.gov/grants/peer/critiques/rpg_D.htm%23rpg_03) |
| **Strengths**   * Advancement of previous methods from the lab to a time domain space, and to incorporate chromatic information * Using neural coding principles to examine the function of the retinal ganglion cells, particularly with the understanding that the inputs are highly correlated * Development of novel machine learning methods to facilitate many input channels into retinal model   **Weaknesses**   * None |

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| 3. Approach |
| **Strengths**   * Use of publicly available datasets * Clear rationale for each aim, which effectively summarizes why the aim is important and relevant * Application of one algorithm to answer multiple questions, which if successful, will assert its robustness in predicting retinal organization   **Weaknesses**   * Inadequate description of how model outputs will be analyzed, and how the conclusion of a match or not with known retinal physiology will be determined. * Too much technical detail on the content of equations, without a robust and understandable explanation of their meaning and relevance |

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| Resubmission |
| Comments (if applicable):   * Addressed lack of alternative outcomes * The link between aim 1 and 2 is much more clear now * Many points are more clearly elaborated on * Greatly improved from first draft |