

Poster presentation

Open Access

## A large-scale realistic model of V1 exhibiting orientation selectivity diversity and laminar dependence

Rodrigo F Oliveira\*<sup>1</sup> and Antonio C Roque<sup>2</sup>

Address: <sup>1</sup>Computational and Experimental Neuroplasticity Laboratory, Krasnow Institute, George Mason University, Rockfish Creek Lane, Fairfax, VA, 22030-4444, USA and <sup>2</sup>Laboratory of Neural Systems, Department of Physics and Mathematics, School of Philosophy, Sciences and Letters of Ribeirão Preto, University of São Paulo, 14040-901 Ribeirão Preto, SP, Brazil

Email: Rodrigo F Oliveira\* - rodrigofreire.oliveira@gmail.com

\* Corresponding author

from Sixteenth Annual Computational Neuroscience Meeting: CNS\*2007  
Toronto, Canada. 7–12 July 2007

Published: 6 July 2007

BMC Neuroscience 2007, 8(Suppl 2):P36 doi:10.1186/1471-2202-8-S2-P36

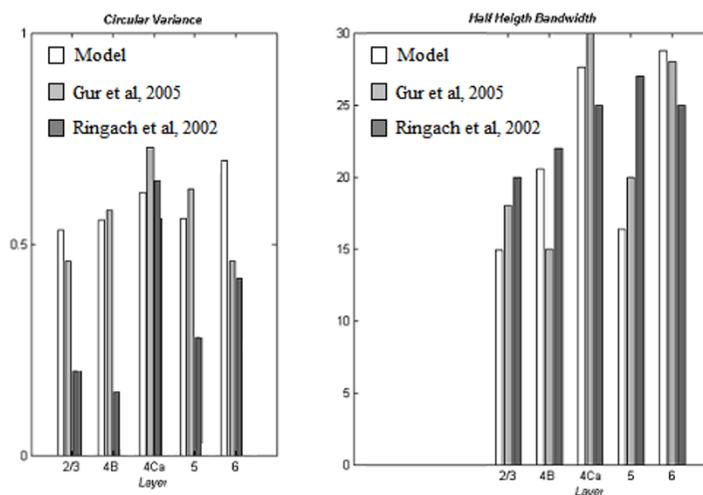
© 2007 Oliveira and Roque; licensee BioMed Central Ltd.

### Background

An important question regarding orientation selectivity (OS) in the primary visual cortex (V1) is to know how OS varies among different V1 neural populations and throughout V1 layers [1,2]. In this work we present a large-scale model highly constrained by physiology and anatomy and use it to address these questions.

### Methods

The model corresponds to 4 mm<sup>2</sup> of cortical area in a 10:1 scale. It is composed of 59,821 cells arranged into six layers (L1, L2/3, L4B, L4C<sub>av</sub>, L5 and L6) representing the M pathway. Six different HH-type neuron models were constructed to simulate six different cell classes: late spiking, non-late spiking, fast spiking, regular spiking, chattering,



**Figure 1**

Comparison of the OS profile shown by the model with experimental results.

and bursting neurons. These neurons were distributed in the six layers in a realistic way with short- and long-range intra-laminar connections as well as inter-laminar connections. Thalamic inputs are delivered to all excitatory cells in layers 4C<sub>α</sub> and 6. Activation of a cortical cell is modeled by a convolution of a sinusoidal drifting grating with a Gabor function. Neural OS profile was determined via circular variance and half-height bandwidth of its tuning curve.

## Results

Neurons in the model show a diversity of OS consistent with experimental data (see Figure 1).

## Conclusion

Results suggest that the diversity in OS observed across cortical layers is at least partially due to heterogeneity in cellular electrophysiology and circuitry properties.

## Acknowledgements

Supported by grants from FAPESP.

## References

1. Ringach D, Shapley R, Hawken MJ: **Orientation selectivity in macaque V1: Diversity and laminar dependence.** *J Neurosci* 2002, **22**:5639-5651.
2. Gur M, Kagan I, Snodderly DM: **Orientation and direction selectivity of neurons in V1 of alert monkeys: Functional relationships and laminar distributions.** *Cereb Cortex* 2005, **15**:1207-1221.

Publish with **BioMed Central** and every scientist can read your work free of charge

*"BioMed Central will be the most significant development for disseminating the results of biomedical research in our lifetime."*

Sir Paul Nurse, Cancer Research UK

Your research papers will be:

- available free of charge to the entire biomedical community
- peer reviewed and published immediately upon acceptance
- cited in PubMed and archived on PubMed Central
- yours — you keep the copyright

Submit your manuscript here:  
[http://www.biomedcentral.com/info/publishing\\_adv.asp](http://www.biomedcentral.com/info/publishing_adv.asp)

