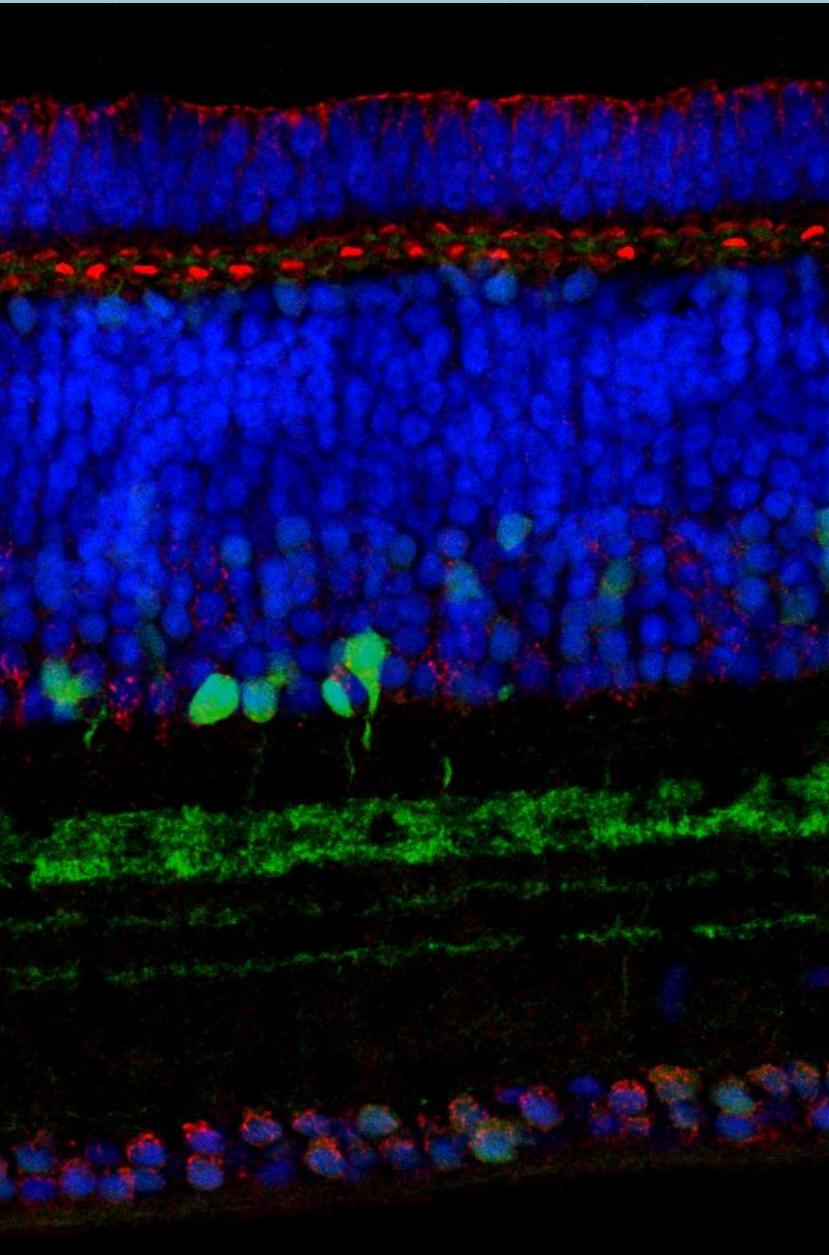


Retinal Processing

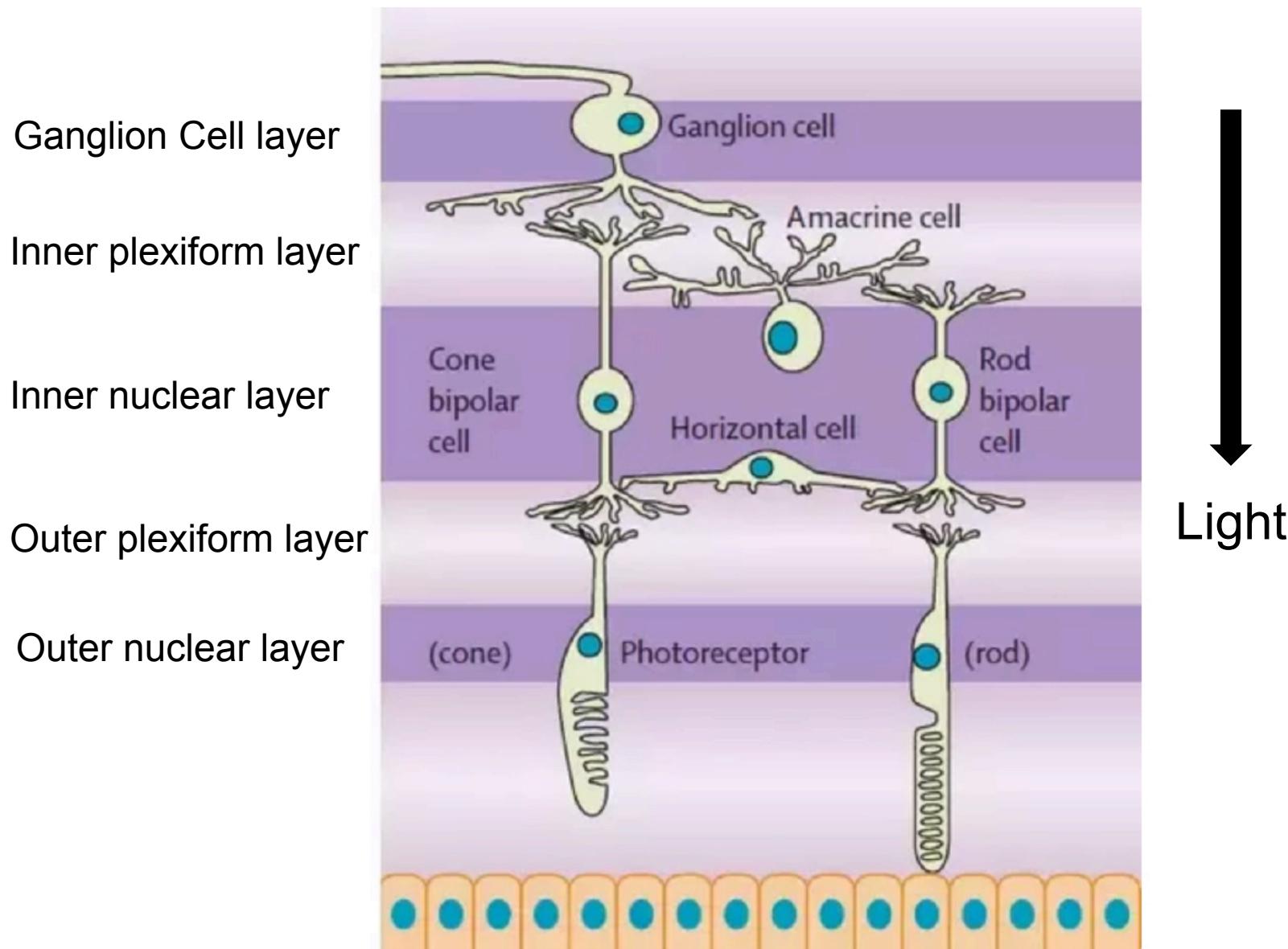


David Keays
Institute of Molecular Pathology
<http://keayslab.org>

Talk Structure

1. Retinal cells and structure
2. Receptive Fields
3. Vertical processing
4. Lateral processing
5. Processing of colour
6. Processing of movement
7. Disease states

Retinal Cells and Structure



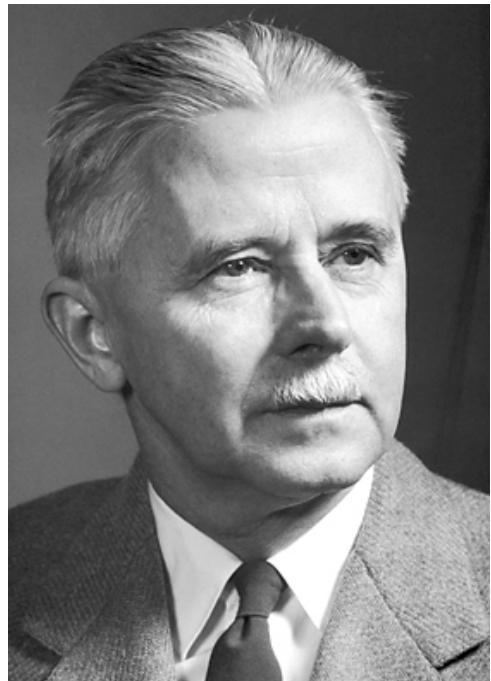
Receptive Fields

THE RECEPTIVE FIELDS OF OPTIC NERVE FIBERS

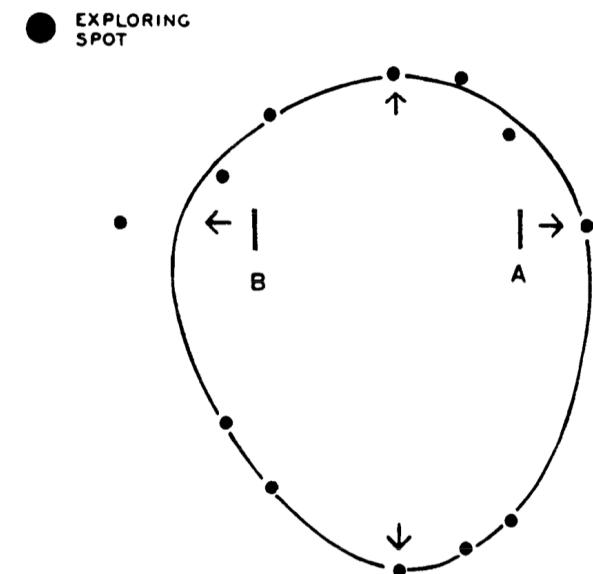
H. K. HARTLINE

*From the Eldridge Reeves Johnson Research Foundation, University of Pennsylvania,
Philadelphia*

Received for publication May 18, 1940



Rana catesbeiana



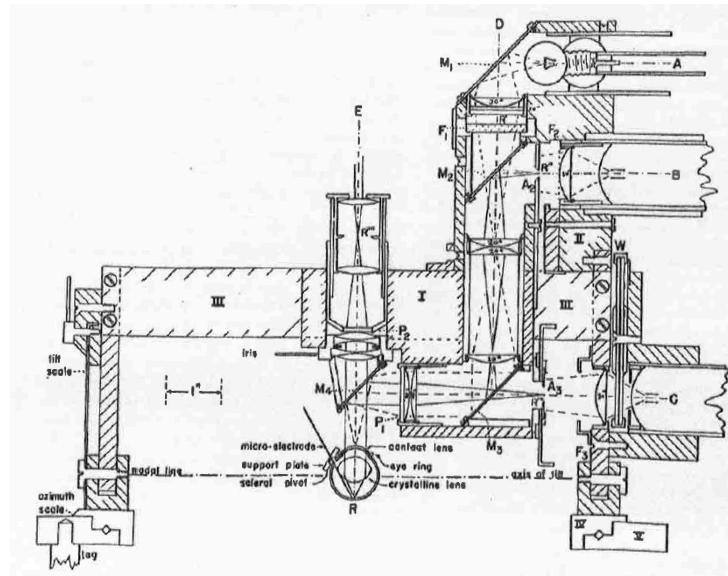
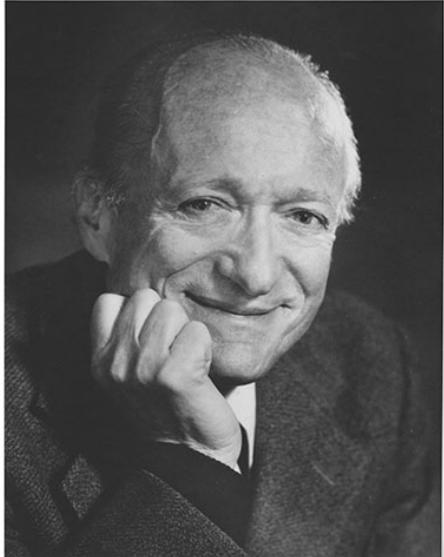
Receptive Fields

DISCHARGE PATTERNS AND FUNCTIONAL ORGANIZATION OF MAMMALIAN RETINA*

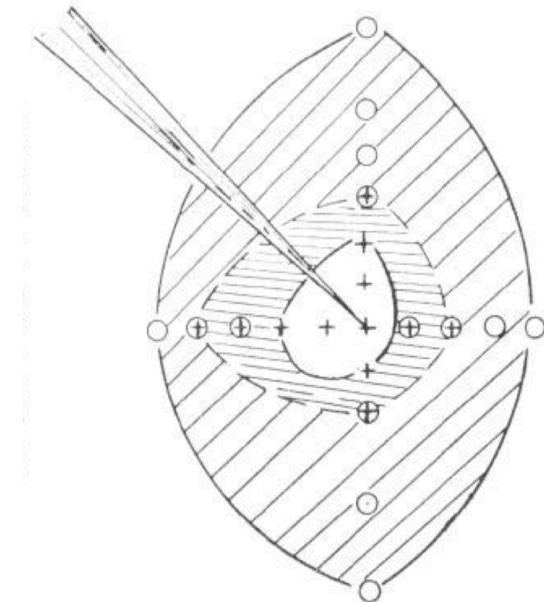
STEPHEN W. KUFFLER

*The Wilmer Institute, Johns Hopkins Hospital and University
Baltimore, Maryland*

(Received for publication December 11, 1951)

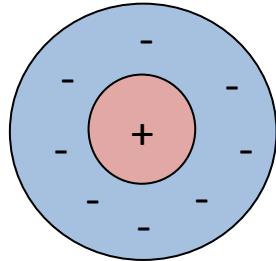


Multibeam Ophthalmoscope

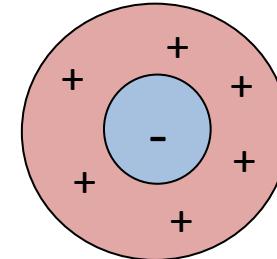


Receptive Fields

On Center
Ganglion Cell

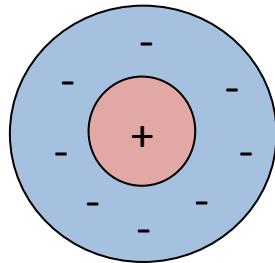


Off Center
Ganglion Cell

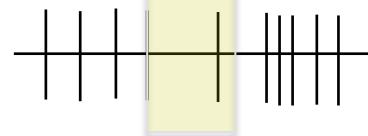
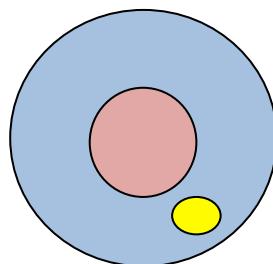
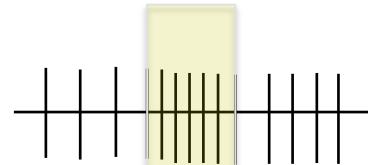
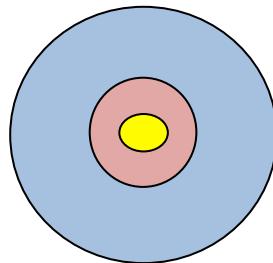
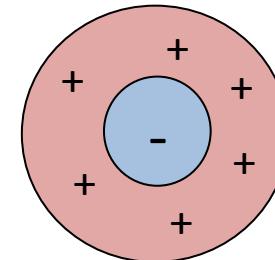


Receptive Fields

On Center
Ganglion Cell

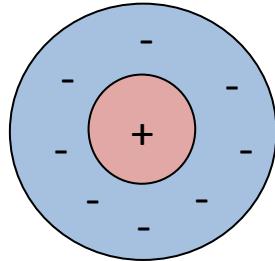


Off Center
Ganglion Cell

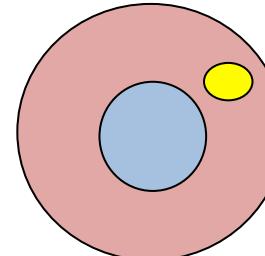
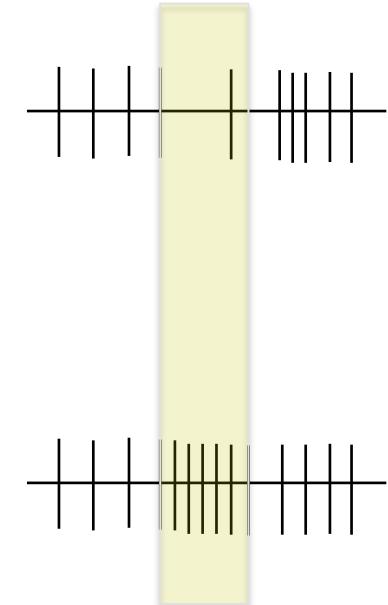
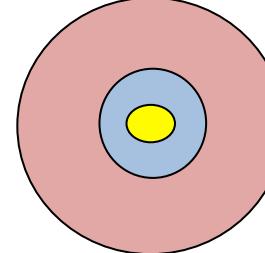
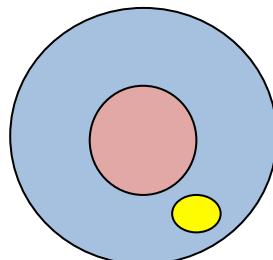
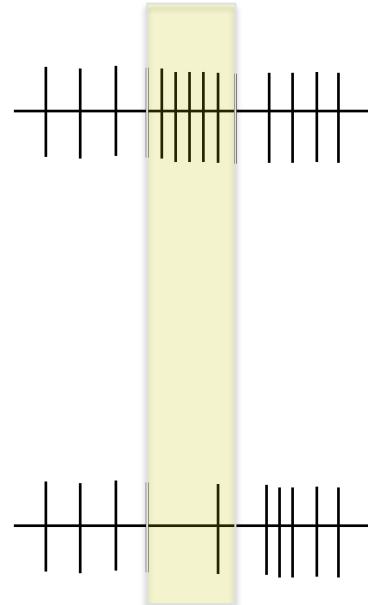
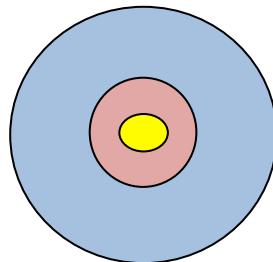
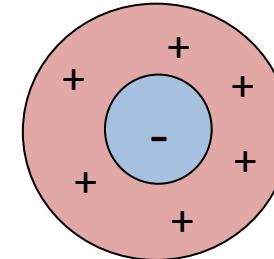


Receptive Fields

On Center
Ganglion Cell

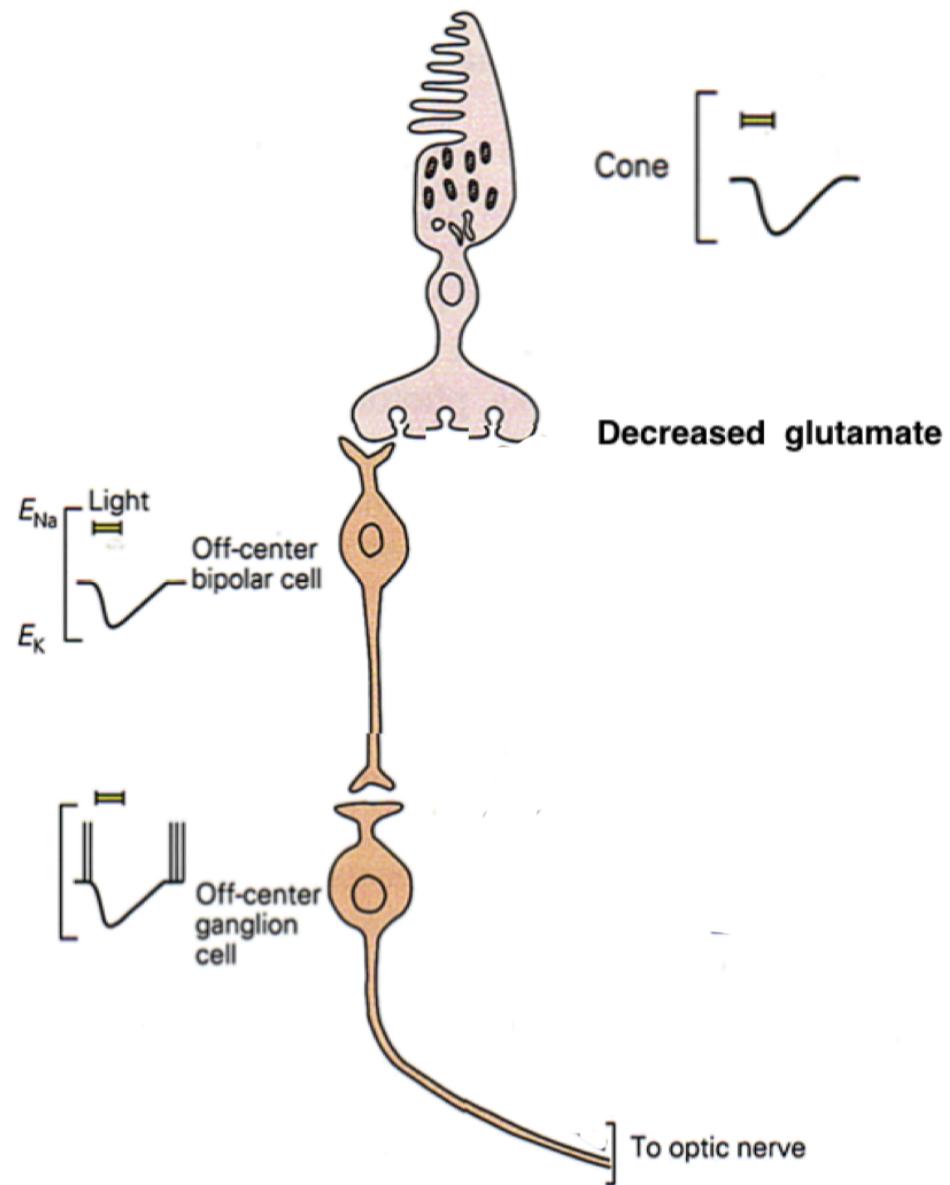


Off Center
Ganglion Cell



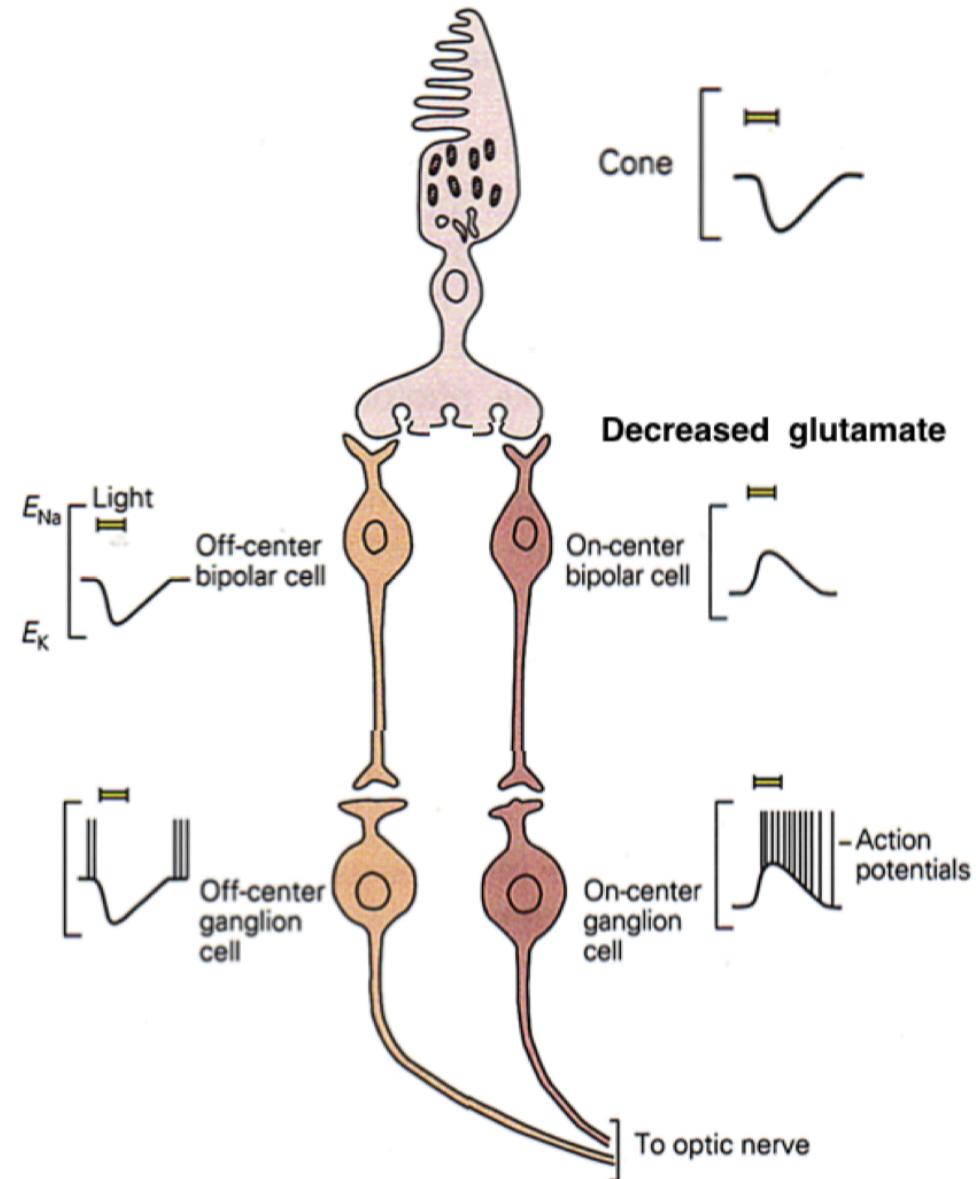
Adapted from *Kandel et al*

Vertical Processing



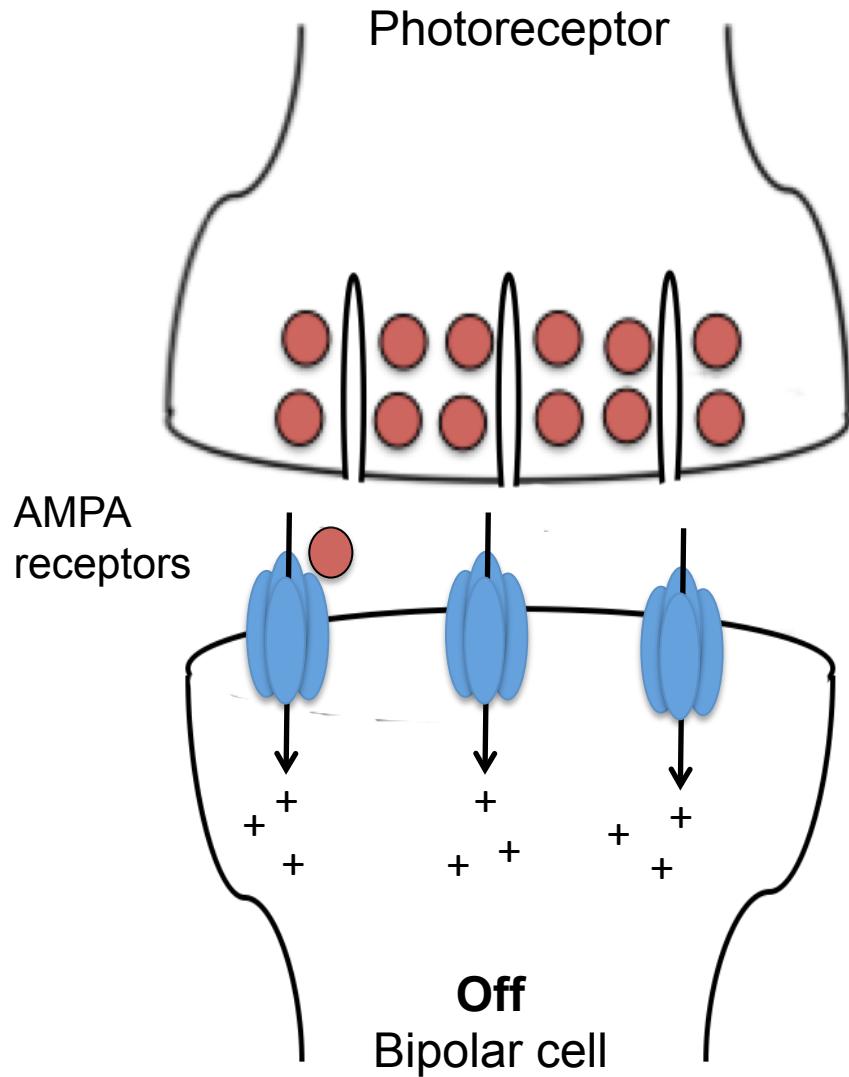
Adapted from *Kandel et al*

Vertical Processing

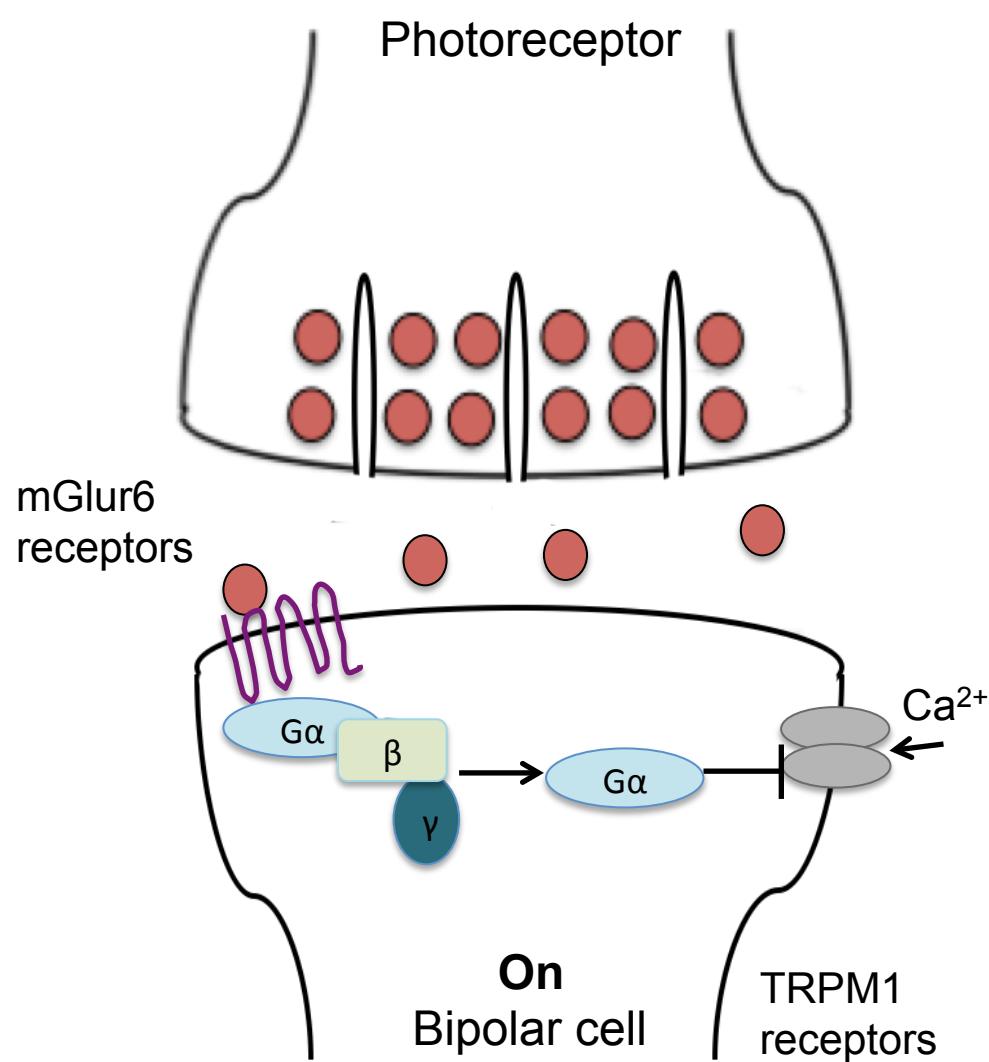
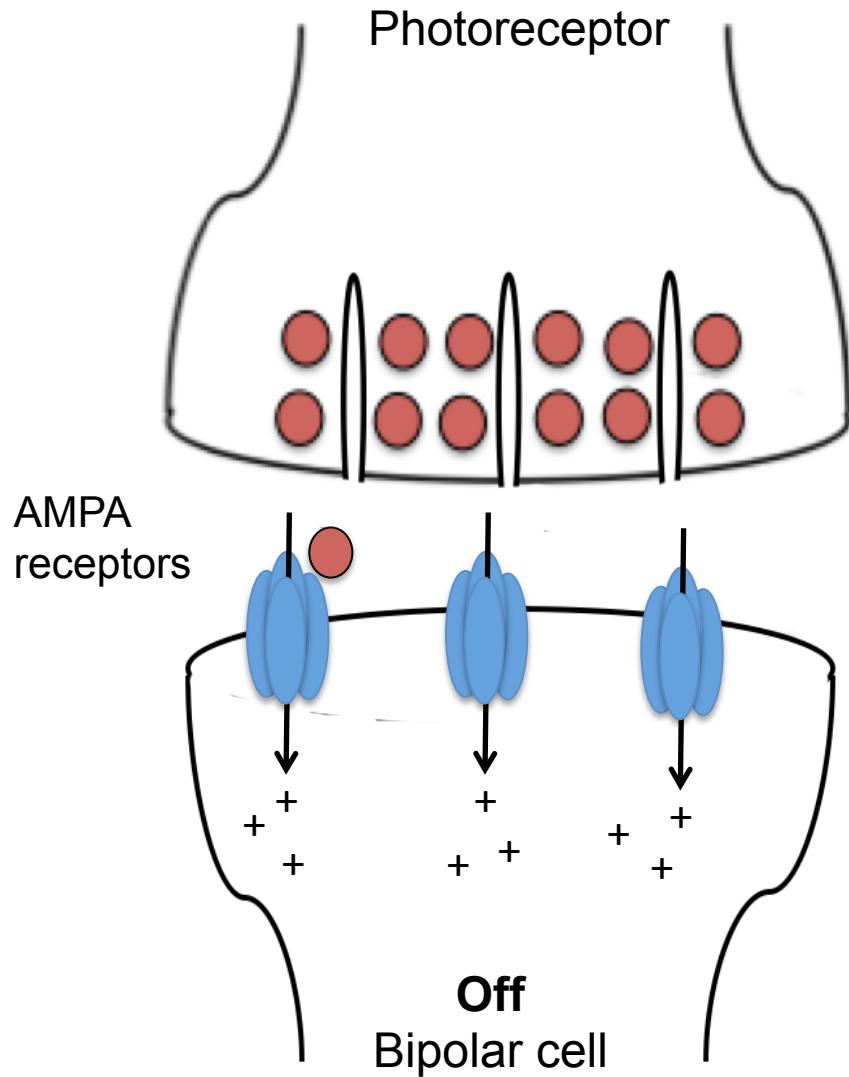


Adapted from *Kandel et al*

On vs Off Bipolar cells

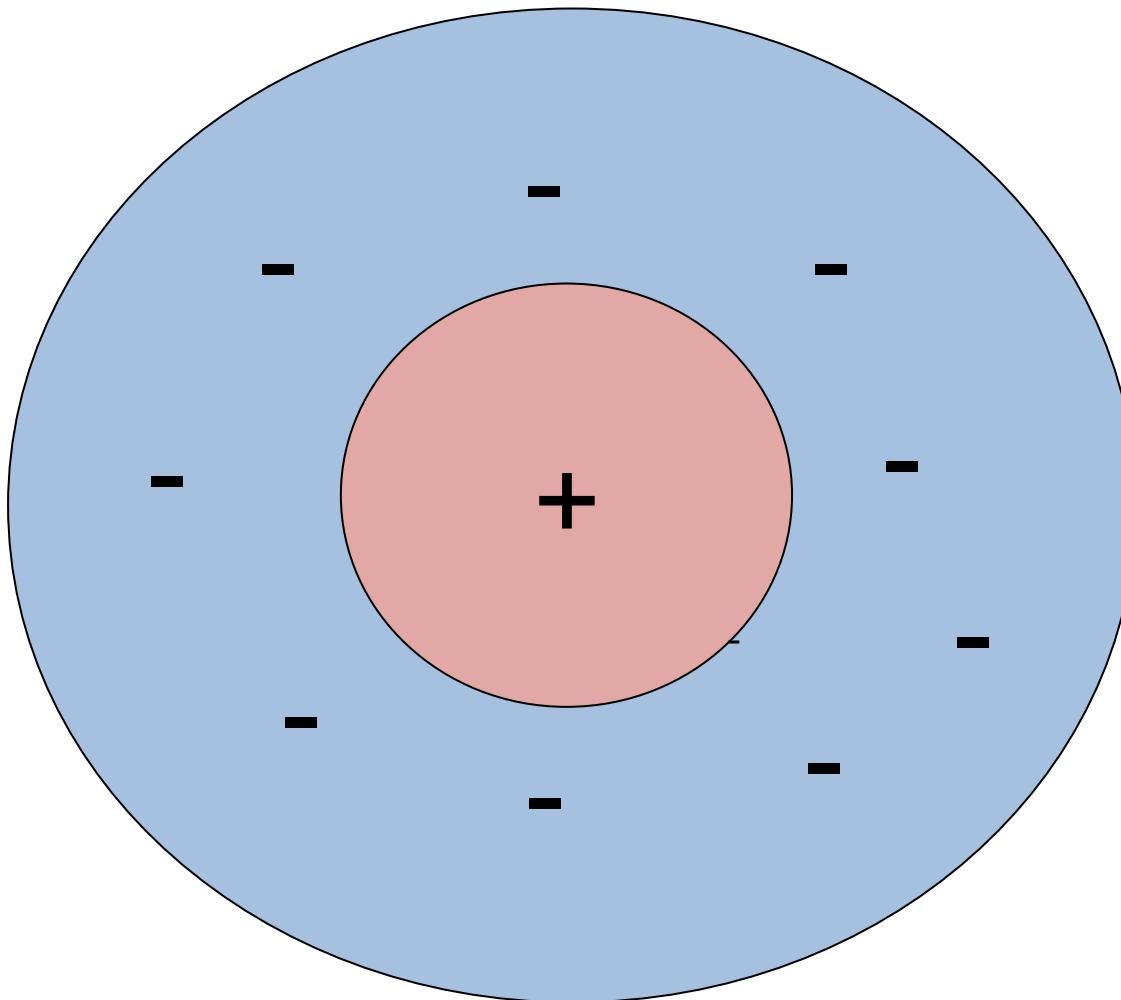


On vs Off Bipolar cells



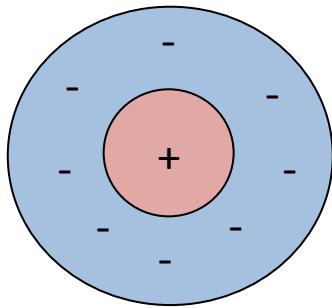
Lateral processing

On Center
Ganglion Cell



Center surround
anatagonism

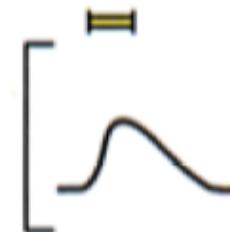
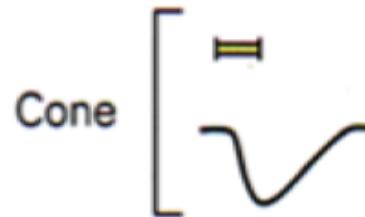
Lateral processing



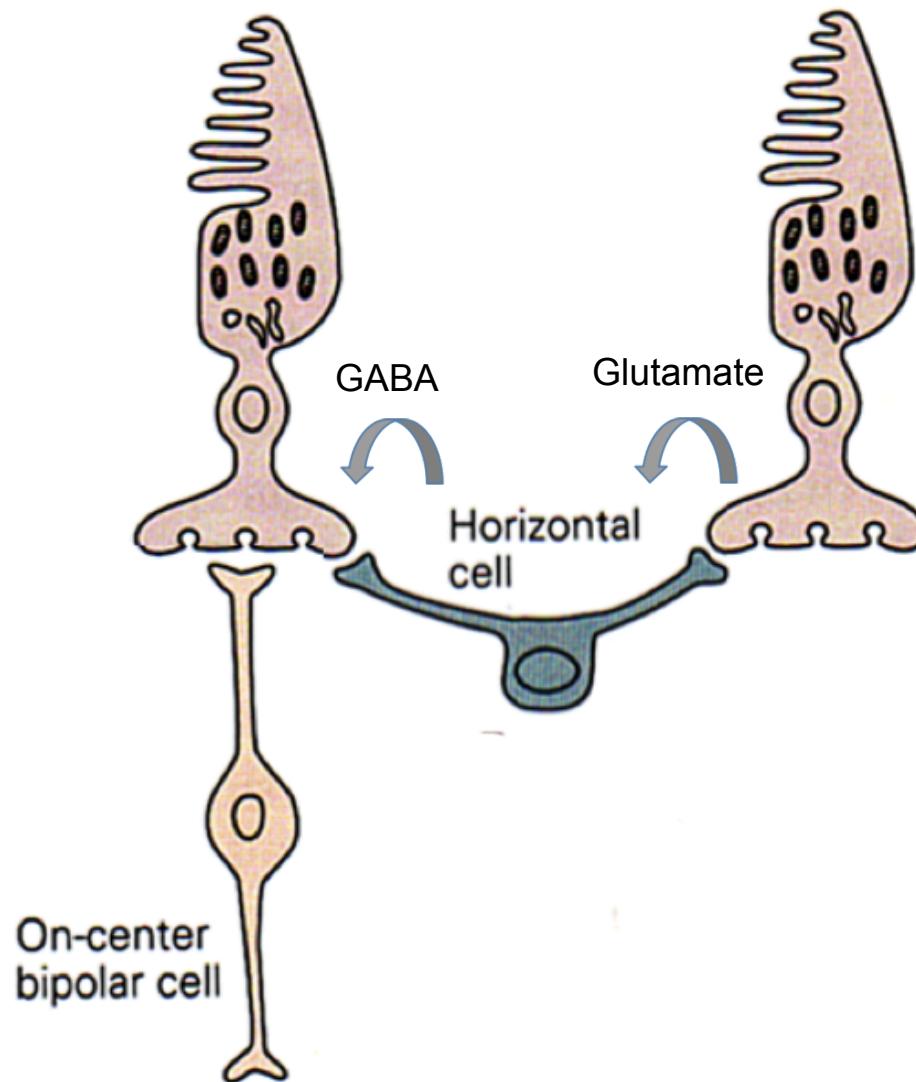
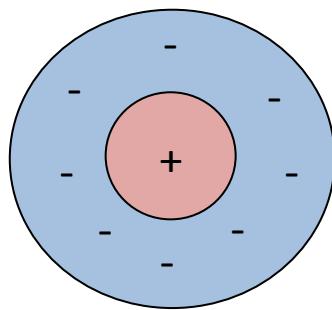
On Center
Ganglion Cell



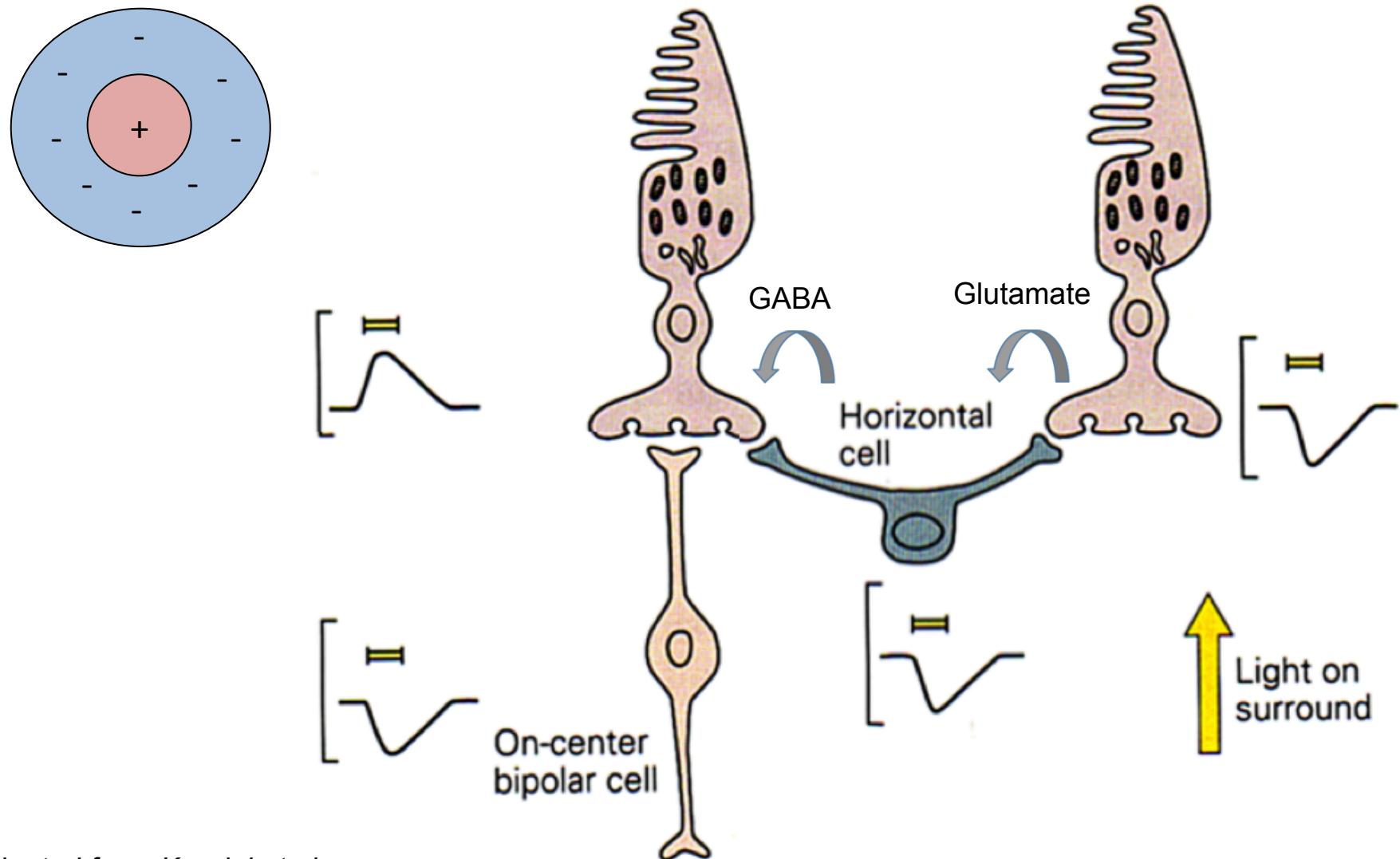
On-center
bipolar cell



Horizontal Cells

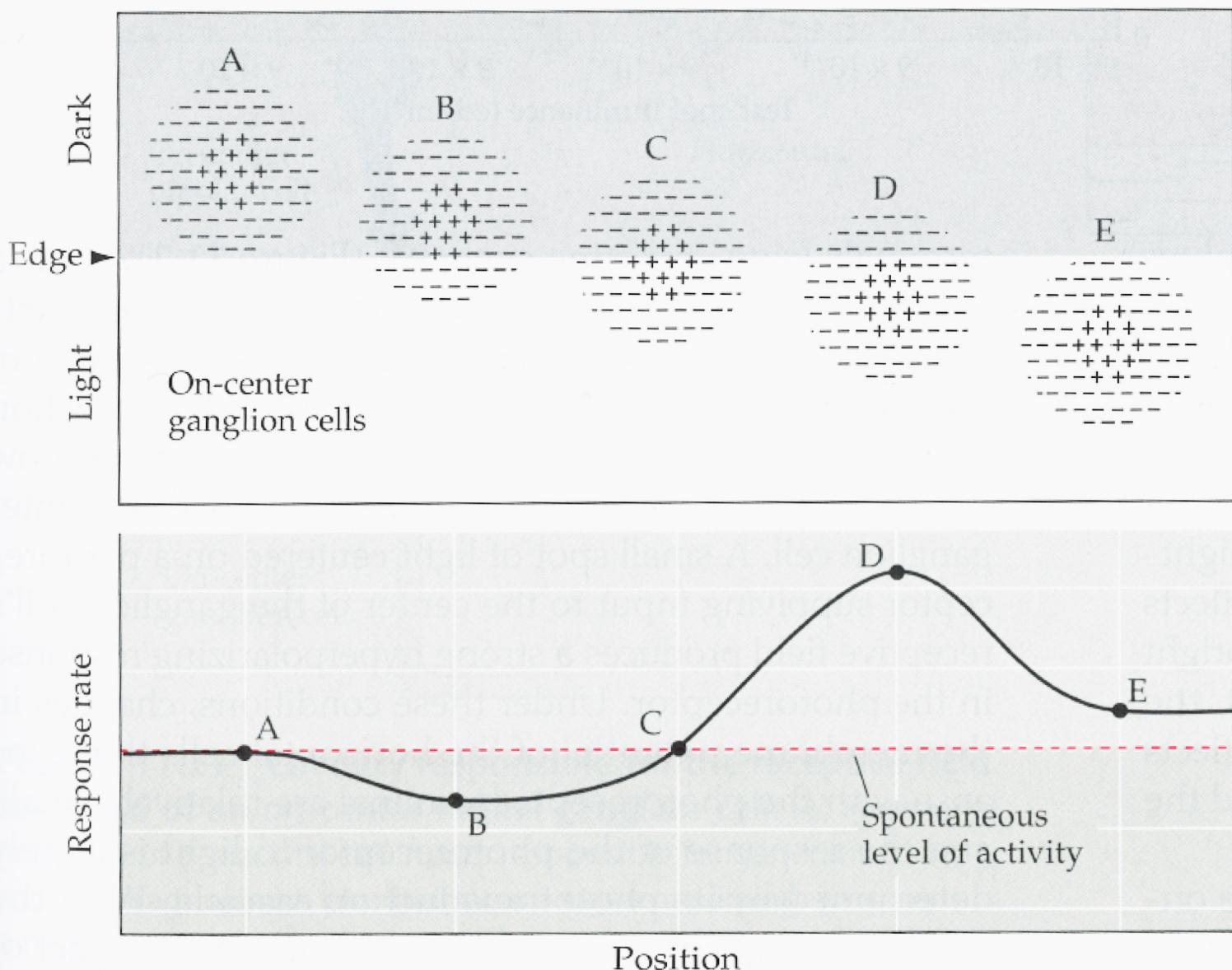


Horizontal Cells



Adapted from *Kandel et al*

Contrast Detection

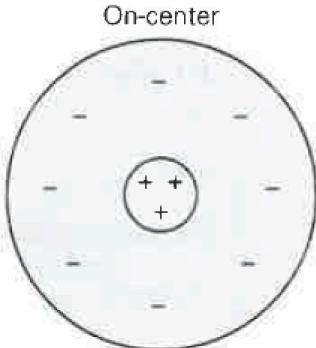


Talk Structure

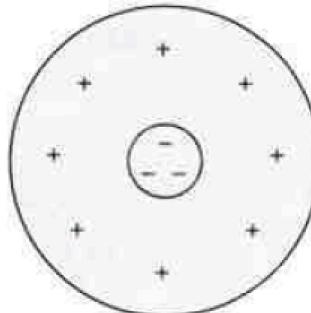
1. Retinal cells and structure
2. Receptive Fields
3. Vertical processing
4. Lateral processing
5. Processing of colour
6. Processing of movement
7. Disease states

Processing of Colour

M cells



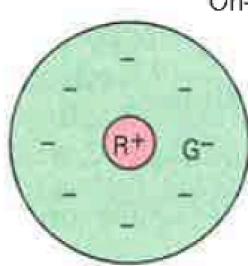
Off-center



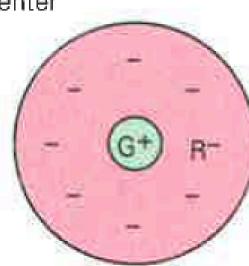
M Cells

- project to magnocellular lateral geniculate nucleus
- no spectral sensitivity

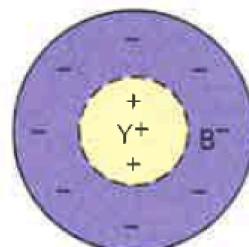
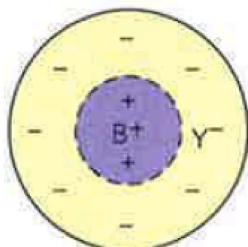
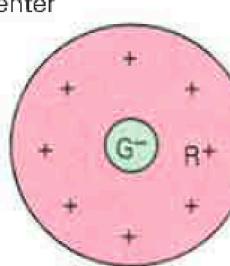
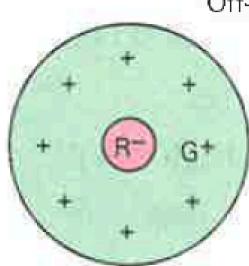
P cells



On-center



Off-center



P Cells

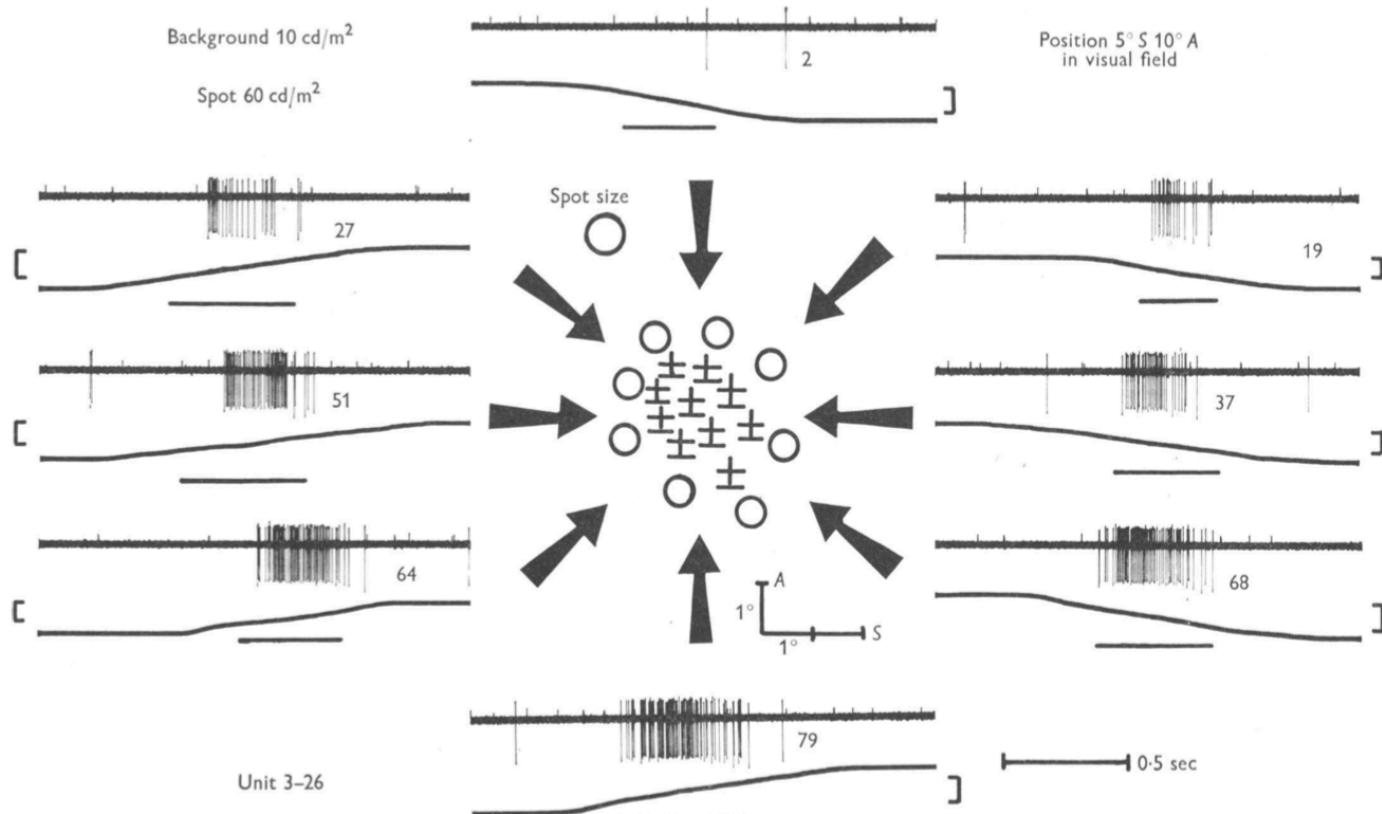
- project to parvocellular lateral geniculate nucleus
- red/green on/off center
- blue/yellow on/off center

Processing of Movement

RETINAL GANGLION CELLS RESPONDING SELECTIVELY TO DIRECTION AND SPEED OF IMAGE MOTION IN THE RABBIT

By H. B. BARLOW, R. M. HILL AND W. R. LEVICK*

- Directionally sensitive units



Processing of Object Movement

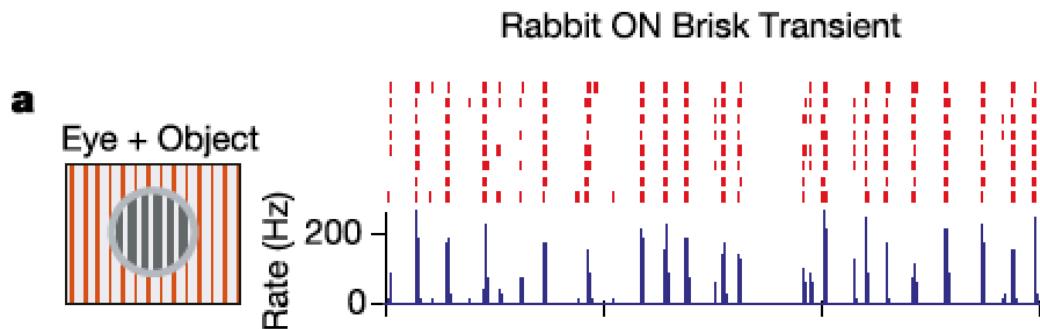
articles

Segregation of object and background motion in the retina

Bence P. Ölveczky^{*†}, Stephen A. Baccus[‡] & Markus Meister[‡]

OMS Cells

- Object motion sensitive ganglion cells
- Role of excitatory amacrine cells



Disease States

REPORT

TRPM1 Is Mutated in Patients with Autosomal-Recessive Complete Congenital Stationary Night Blindness

Isabelle Audo,^{1,2,3,4,5} Susanne Kohl,⁶ Bart P. Leroy,^{7,8} Francis L. Munier,^{9,17} Xavier Guillonneau,^{1,2,3} Saddek Mohand-Saïd,^{1,2,3,4} Kinga Bujakowska,^{1,2,3} Emeline F. Nandrot,^{1,2,3} Birgit Lorenz,¹⁰ Markus Preising,¹⁰ Ulrich Kellner,¹¹ Agnes B. Renner,¹² Antje Bernd,¹³ Aline Antonio,^{1,2,3,4} Veselina Moskova-Doumanova,^{1,2,3} Marie-Elise Lancelot,^{1,2,3} Charlotte M. Poloschek,¹⁴ Isabelle Drumare,¹⁵ Sabine Defoort-Dhellemmes,¹⁵ Bernd Wissinger,⁶ Thierry Léveillard,^{1,2,3} Christian P. Hamel,¹⁶ Daniel F. Schorderet,¹⁷ Elfride De Baere,⁷ Wolfgang Berger,¹⁸ Samuel G. Jacobson,¹⁹ Eberhart Zrenner,¹³ José-Alain Sahel,^{1,2,3,4} Shomi S. Bhattacharya,^{1,2,3,5} and Christina Zeitz^{1,2,3,*}

OPEN  ACCESS Freely available online

PLOS ONE

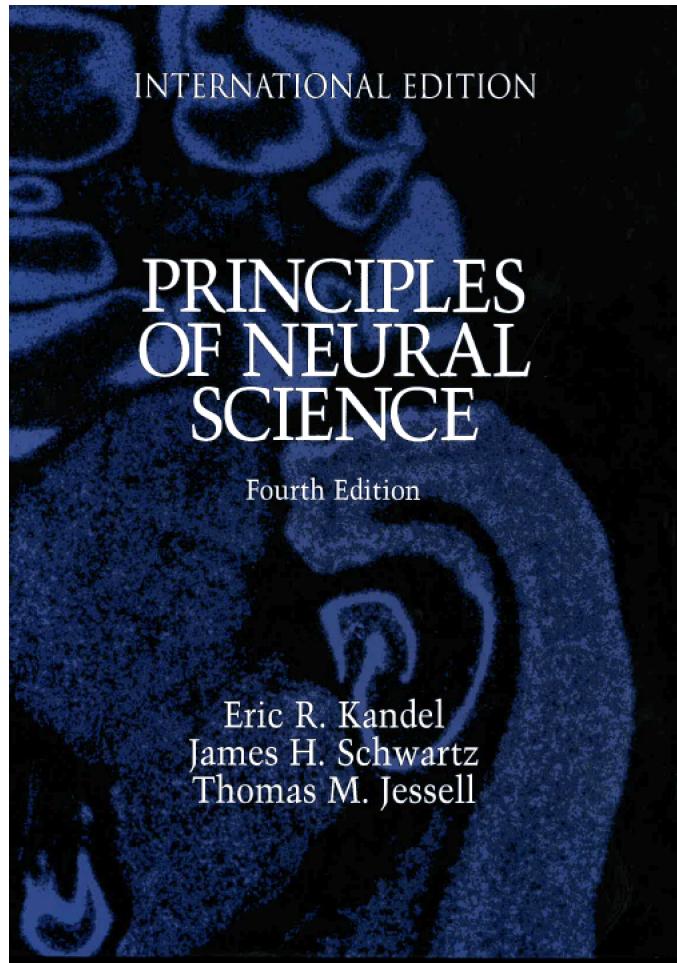
Evidence for a Retroviral Insertion in *TRPM1* as the Cause of Congenital Stationary Night Blindness and Leopard Complex Spotting in the Horse

Rebecca R. Bellone^{1*}, Heather Holl², Vijayasardhi Setaluri³, Sulochana Devi³, Nityanand Maddodi³, Sheila Archer⁴, Lynne Sandmeyer⁵, Arne Ludwig⁶, Daniel Foerster⁶, Melanie Pruvost^{6,7}, Monika Reissmann⁸, Ralf Bortfeldt⁸, David L. Adelson⁹, Sim Lin Lim⁹, Janelle Nelson¹, Bianca Haase¹⁰, Martina Engensteiner¹¹, Tosso Leeb¹¹, George Forsyth¹², Michael J. Mienaltowski¹³, Padmanabhan Mahadevan¹, Michael Hofreiter¹⁴, Johanna L. A. Pajmans¹⁴, Gloria Gonzalez-Fortes¹⁴, Bruce Grahn⁶, Samantha A. Brooks²

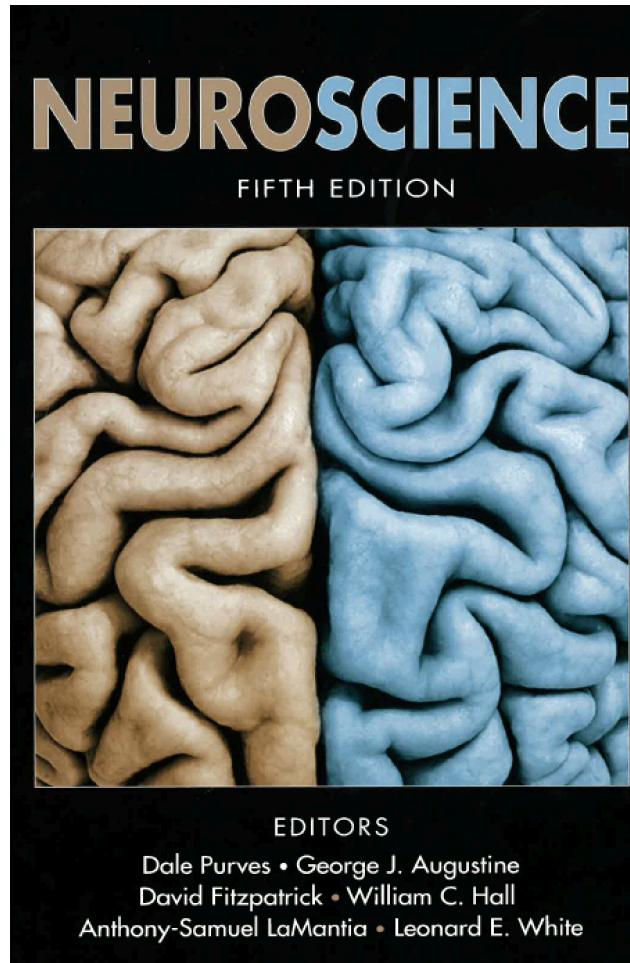


Appaloosa horse

Reading and References



p515-522, 577-582



p249-256

- Spillmann L, *Perception* 2014(43) 1145-1176
- Diamond JS, *Annu Rev Vis Sci* 2017. 1-24.
- Gollisch T, *Neuron*, 2010 (28) 150-164.
- Olveczky et al, *Nature*, 2003, 401-407.
- Audo I, et al. *AJHG*, 2009(85) 720-729.