RETINA CODE: R-16 SEPTEMBER 25/FRIDAY

IS THE FEEDBACK MODEL OF CHROMATIC OPPONENCY IN HORIZONTAL CELLS STILL VALID?

HOTEL/ROOM: LA PALMA/A

CHAIRPERSONS: HELGA KOLB (USA)
SILVANA VALLERGA (ITALY)

NUMBER	TIME	PRESENTATION
1	3:00	Circuitry for Chromatic Processing in Goldfish Horizontal Cells: the Feedback Cascade Model, Seventeen Years Later W.K. Stell (Canada)
2	3:17	Cone-Horizontal Connectivity in Cyprinid Fish: Characterization of Feed-forward and Feed-back M.B.A. Djamgoz, J.E.G. Downing and E.H. Greenstreet (UK)
3	3:34	The Model of Color Opponency in Horizontal Cells A.L. Byzov, I.S. Vergelskaja and V.V. Maximov (Russia)
4	3:51	Spectral Opponency in Cone-driven Carp Horizontal Cells M. Kamermans and H. Spekreijse (The Netherlands)
5	4:08	Horizontal Cells and their Photoreceptor Connections in the Cone-Dominated Retina of the Tree Shrew L. Peichl and B. Muller (Germany)
6	4:25	Color Connectivity of Human Horizontal Cells H. Kolb and P.K. Ahnelt (Austria)
7	4:42	Two Levels of Cone Opponency in Primate Retina P. Gouras (USA)

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CIRCUITRY FOR CHROMATIC PROCESSING IN GOLDFISH HORIZONTAL CELLS: THE FEEDBACK-CASCADE MODEL, SEVENTEEN YEARS LATER.

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The so-called "Stell model" (let's not forget Lightfoot, Wheeler and Leeper) followed from detailed anatomical studies, reasonable assumptions about function, and arguments of simplicity and consistency. The observed selectivities of different CHC types for different sets of cones were consistent with a cascade from monophasic to biphasic to triphasic CHCs. At first we expected the coupling pathway to be feed-forward, but ultimately the type-specific structure of cone-CHC contacts and the apparent absence of HC-HC synapses argued more persuasively for feed-back.

The newer Kamermans/Spekreijse model explains many HC functions not addressed by our model, but one of its key premises - that all CHCs receive from all cone types - is poorly supported. In contrast, the selective pattern of cone-CHC connections in goldfish is well documented, and the feedback-cascade model has survived scrutiny by diverse methods in many teleostean species. What is needed is not to discard this model, but to account for unexplained functions with additional circuit elements or pathways. Cone telodendrons may comprise one such pathway, interplexiform cells perhaps another.

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2 **819**

CONE - HORIZONTAL CONNECTIVITY IN CYPRINID FISH : CHARACTERIZATION OF FEED-FORWARD AND FEED-BACK

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Cone - horizontal cell connectivity has been investigated in the retina of the roach, a common European cyrinid fish, using a variety of intracellular recording, staining and neuro-pharmacological methods, and electron microscopy. Spectral identities of the cone pedicles were determined according to ribbon number. H1, H2 and H3 horizontal cells were identified electrophysiologically and stained with either horseradish peroxidase or biocytin. The connectivity patterns observed were in agreement overall with the 'feed-back model' of spectral opponency in horizontal cells. However, deviations from the model were found. In particular, spectral responses of horizontal cells were highly variable depending on the adaptation state of the retinae. It is proposed that cone - horizontal cell connectivity in cyprinid fish retina is highly ordered but dynamic. Functional consequences and species-dependence of cone-horizontal cell connectivity generally will be discussed.

3 **820**

THE MODEL OF COLOR OPPONENCY IN HORIZONTAL CELLS

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According to circuitry proposed by Stell and Fuortes, R/G C-type horizontal cells (HC) receive direct chemical inputs from green cones and, therefore, respond with hyperpolarization to blue light and their depolarizing response to red light is due to sign-inverting feedback from L-type HCs. The model we developed is based on an electrical feedback mechanism described in detail earlier and involves the nonlinearity of HC nonsynaptic membrane as measured experimentally. The variable parameter in the model is the relative weighting of direct inputs from red and green cones. With appropriately selected parameters the model is able to reproduce phenomena such as opponent responses to blue and red lights in R/G C-cells and mutual enhancement of blue and red responses in L- and R/G C-cells. It is also possible to model the unusual phenomenon, in R/G C-cells of some fishes, of the inversion of the depolarizing red response to a hyperpolarizing response with moderate blue backgrounds.