INTRODUCTION

Traditionally, the neurons in V1 of both cats and monkeys have been divided into two principal classes: simple and complex cells. Simple cells, described as quasilinear spatiotemporal operators, are often assumed to represent the basic functional population of V1 neurons. Complex cells are grossly non-linear, and have been characterized by local energy mechanisms, responding selectively to particular stimulus features while generalizing over position and contrast polarity. However, if simple cell type constitutes only a small portion of alert monkey V1 cells, some other neuronal class should be able to deal, at least partially, with presumed simple cell functions. In this study we explore such a possibility and show that the major cell type in our preparation has complex-like receptive field properties that are intermediate between linear and non-linear cells.

METHODS

Extracellular responses of V1 neurons in alert monkeys were recorded. Activation regions (AR) were mapped with increment and sweeping bars and flashes. The Overlap Index (OI) was calculated as:

$$OI = \frac{0.5(INC + DEC) - dis}{0.5(INC + DEC) + dis}, \quad \text{where } dis = \left| INCcenter - DECcenter \right|$$

Responses to drifting and counterphase gratings of various parameters were analyzed.

RESULTS

The distribution of OI is clearly dichotomous **(Fig. 1)**. Simple cells (OI < 0.3) represent only 16 % of our population, while the majority (82.3 %) of the cells has completely or partially overlapping increment and decrement ARs (OI > 0.5, "duplex") and quite restricted ARs width **(Fig. 2)**.

The responses of "duplex" cells **(Figs. 3, 4)** to drifting gratings often contain a significant component which is modulated at the stimulus temporal frequency, similarly to responses of simple cells **(Fig. 5)**, whereas counterphase gratings in the duplex cells yield predominantly frequency-doubled responses **(Fig. 6)**. In a large portion of "duplex" cells (n=27) frequency doubling occurs also in response to drifting gratings of low spatial frequency **(Fig. 7)**.

The harmonic content of the grating responses depends upon the combination of the grating spatial and temporal frequency and window extent

CONCLUSIONS

- "Duplex" cells are the major cell type in V1 of alert monkey
- The properties of "duplex" cells are incompatible with the general view of the complex cell
- "Duplex" cells responses are shaped by inputs from INC and DEC subunits, by interactions between these subunits, and by inhibitory surrounds