Photopic c-wave in the chicken ERG: sensitivity to sodium azide, epinephrine, sodium iodate, barbiturates, and other general anesthetics

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Abstract. The c-wave recorded in the chicken electroretinogram proved to be a cone-triggered component. The questions arose whether its reactivity to various specific drugs (sodium iodate, sodium azide, epinephrine, or barbiturates) were similar to those described for classic rod-triggered c-waves. We also tested the sensitivity of the chicken c-wave to various general anesthetics. Urethane was found to be the drug that best preserves the c-wave in electrophysiological recordings.

Introduction

The ERG of a number of cone-dominated retinas was reported to be lacking a c-wave (Meservey and Chaffee, 1927; Arden and Tansley, 1955; Crescitelli, 1961; Ikeda, 1965; Meneghini and Hamasaki, 1967; Ogden and Wylie, 1971) and these observations supported a generalized statement that the c-wave was specifically related to the rod system. In the chicken, nevertheless, the recorded c-wave proved to be a cone-mediated component (Wioland and Bonaventure, 1984; 1985), as it was reported previously in the turtle (Matsuura et al., 1978).

The purpose of the present paper was:

(1) to better characterize the cone-mediated c-wave of the chicken by testing its pharmacological sensitivity to various drugs known to act specifically on c-waves in rod-dominant species; and

(2) to understand the reported absence of a c-wave in the ERG of various cone-dominant species, including birds. The use of general anesthetics appeared to provide a tentative explanation for this absence.

Methods

The ERGs were usually recorded on curarized (Flaxedil 10 mg/kg) and artificially ventilated chickens. When testing general anesthetics, the following concentrations were used: sodium pentobarbital (Nembutal 50 mg/kg) ketamine (Ketalar 300 mg/kg) and ethylcarbamate (urethane 1 g/kg). Concentrations higher or lower than the latters by 20% to 50% were also tested in some experiments.
The D.C. ERGs were recorded from the cornea. Monochromatic flashes ($\lambda = 560 \text{ nm}$, duration 3–5 sec) at an intensity of about 2.51 log units above the threshold of the $b$-wave were used as photic stimuli.

**Results**

*Effects of sodium azide and epinephrine*

These drugs produced very similar effects on the chicken ERG. When injected intravenously, Na azide (2 mg/kg) or epinephrine (0.25 mg/kg) induced an increase in the standing potential of the eye of 1–5 mV which started 5–15 sec after the end of the injection and lasted 20–30 sec. But no increase in the voltage of the $c$-wave could be obtained with either drug, even at higher concentrations (azide 10 mg/kg or epinephrine 50 mg/kg). When injected intravenously or intraperitoneally the increase of the standing potential could not be recorded, probably because of its too-slow rise, but the voltage of the $c$-wave underwent a typical cyclic variation (Figure 1) with an almost immediate decrease or even total suppression for a period of several minutes, followed by a period of hypernormal voltage lasting around 10 minutes. The negative $c$-wave that occurs at light offset followed quite similar variations.

*Effects of sodium iodate*

The selective suppression of the $c$-wave described in the ERG of several scotopic mammals (Noell, 1954; Clifton and Makous, 1973; Weidner, 1976;

![Figure 1](image_url). Effects of i.m. injection of sodium azide (2 mg/kg) and of epinephrine (0.25 mg/kg) on the voltage of positive and negative $c$-waves.