

Calcium dependence of light evoked membrane current signal and membrane voltage signal and their changes due to light adaptation in *Limulus* photoreceptor

H. Stieve, J. Klomfaß

Institut für Neurobiologie der KFA, D-5170 Jülich, FR Germany

The intensity dependence of the light response of the *Limulus* ventral nerve photoreceptor was determined both for the membrane voltage signal (receptor potential) and for the membrane current signal (voltage clamp) in alternating measurements.

The stimulus regime used (1) ensures the measurement of intensity dependence of the light response at 2 defined levels of adaptation: α) in a (relatively) light adapted and β) in a fairly dark adapted state. Each experiment consisted of 2 periods; in the first the photoreceptor was superfused by a saline containing 10 mmol/l Ca^{2+} ; in the second period the Ca^{2+} -concentration of the superfusate was either lowered to 250 $\mu\text{mol/l}$ or raised to 40 mmol/l.

Generally the changes of the light evoked membrane current signal are similar to those of the voltage signal. As for the voltage signal (1), light adaptation causes desensitization for the current signal by a shift in the stimulus-response curve to higher stimulus intensities. This shift is larger when the external Ca^{2+} -concentration is raised and smaller when it is lowered.

The changes due to adaptation and to altered external Ca^{2+} -concentration are listed in the table for the sensitivity, as stimulus intensity I_{50} resp. I_c , evoking a criterion response, for the latency period T LAT, time to peak T MAX and half time T 2 of the decay of both light responses (and the amplitude J_{max} of the membrane current signal) evoked by a 10 ms light flash of our maximal intensity I_0 (ca. $4 \cdot 10^{16}$ 540 nm photons $\text{cm}^{-2} \text{s}^{-1}$). The stimulus evokes a response amplitude saturation for the voltage signal but not for the current signal.

Table: a) Membrane Voltage Signal b) Membrane Current Signal

	Ca^{2+}		250 $\mu\text{mol/l}$		10 mmol/l		40 mmol/l	
			β :DA	α :LA	β :DA	α :LA	β :DA	α :LA
a	$\log I_{50}/I_0$		-1,8	-1,3	-2,6	-1,4	-2,1	-1,0
	T LAT /ms		51	42	21	16	15	15
	T MAX /ms		179	120	74	52	72	52
	T 2 /ms		935	475	853	256	387	57
b	$\log I_c/I_0$		-1,3	-1,2	-2,0	-1,2	-1,7	-1,1
	ΔJ_{max} /nA		-725	-240	-821	-322	-463	-79
	T LAT /ms		63	50	32	22	18	26
	T MAX /ms		181	96	75	46	69	46
	T 2 /ms		137	55	90	32	41	31

Mean values of 3 experiments; S.E.: 20 - 30 %

(1) Stieve, H., Bruns, M. (1980) Verh. Dtsch. Zool. Ges., 369
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