Calcium deficiency in Limulus photoreceptors causes a change in the latency distribution of bumps

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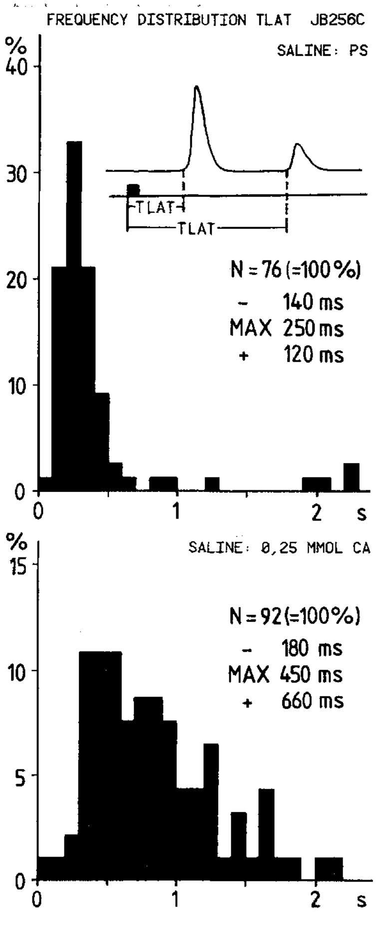
Bumps are fluctuations of membrane conductance, measured as voltage signals across the photoreceptor plasma membrane; they are considered to be elementary excitatory events.

The extracellular Ca^{2+}-concentration was lowered from 10 mmol/l to 250 µmol/l, and the following results were obtained from dark adapted ventral nerve photoreceptors:

1) Receptor potentials (RePs) evoked by light-flashes that saturated the response amplitude: latency of ReP increased to ca. 200 %; half-time of repolarizing phase of the ReP increased to ca. 300 %; saturation amplitude was almost unchanged.

2) Bumps evoked by very dim light flashes: Mean bump latency increased to 200 - 500 % (T LAT in Fig.); Mean bump amplitude was almost unchanged; half-time of the rising phase slightly increased, and that of the falling phase prolonged to ca. 120 %.



3) When normal voltage bumps as in 2) were linearly summed the shape of the response resembles a ReP. Lowered Ca^{2+}-concentration caused the following changes in the summed response: Latency prolonged to ca. 200 %; half-time of the repolarizing phase lengthened to ca. 400 %; unsaturated response amplitude reduced to ca. 35 %.

Interpretation: The shape of an individual bump is not changed appreciably by lowering extracellular Ca^{2+}-concentration but the changes of the shape of the receptor potential are mainly caused by changes in the statistics of the bump latencies. Specifically, the latency distribution is broadened and the mean latency is lengthened.

In RePs evoked by strong light flashes the repolarizing phase is accelerated. This acceleration is weaker when the external calcium concentration is lowered.

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