EVIDENCE FOR TWO POPULATIONS OF CA^{2+} CHANNEL IN VENTRICULAR CELLS OF SQUALUS ACANTHIAS

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In the previous communication (MDIBL Bulletin, 1985) we have characterized the membrane currents in isolated ventricular myocytes of shark heart using the giga-seal technique (Hamill et al., Pfulgers Arch. 391:85, 1981). In these cells we were able to identify a fast TTX-sensitive Na^+ channel, and an inwardly rectifying K^+ channel, in addition to the Ca^{2+} channel. However, the Ca^{2+} channel could not be easily classified as a unitary transport system.

Analysis of inactivation kinetics of Ca^{2+} current yielded a fast (10 ms) and a slower (86 ms) time constant suggesting at least a 2 step process for the inactivation of this current. Examination of the voltage-dependence of Ca^{2+} current yielded an I-V relation not consistent with one population of channels. In TTX (5 uM) containing solutions with holding potentials negative to -80 mV, a TTX insensitive fast inward current could be demonstrated. This current activated from -60 to -50 mV and was blocked by Co^{2+} but not by Cd^{2+}. At more positive holding potentials (-50 to -40 mV), the conventional Ca^{2+} current described earlier in this preparation and well studied in other species could be recorded. Figure 1 illustrates an attempt to separate the two populations of Ca^{2+} channels based upon their time and voltage dependence. Note that while holding at -85 mV, the peak inward current in the presence of TTX and Ba^{2+} has a distinct shoulder at about -30 mV where the conventional Ca^{2+} current is generally activated. The I-V relation measured 40 ms into the clamp step shows activation voltage for the channel more similar to the conventional Ca^{2+} current. The insets show that the current activating between -60 and -30 mV has faster kinetics than the current activated positive to -35 mV.

Our results suggest the existence of two distinct populations of Ca^{2+} channels with different voltage and pharmacological sensitivities in isolated shark ventricular myocytes.

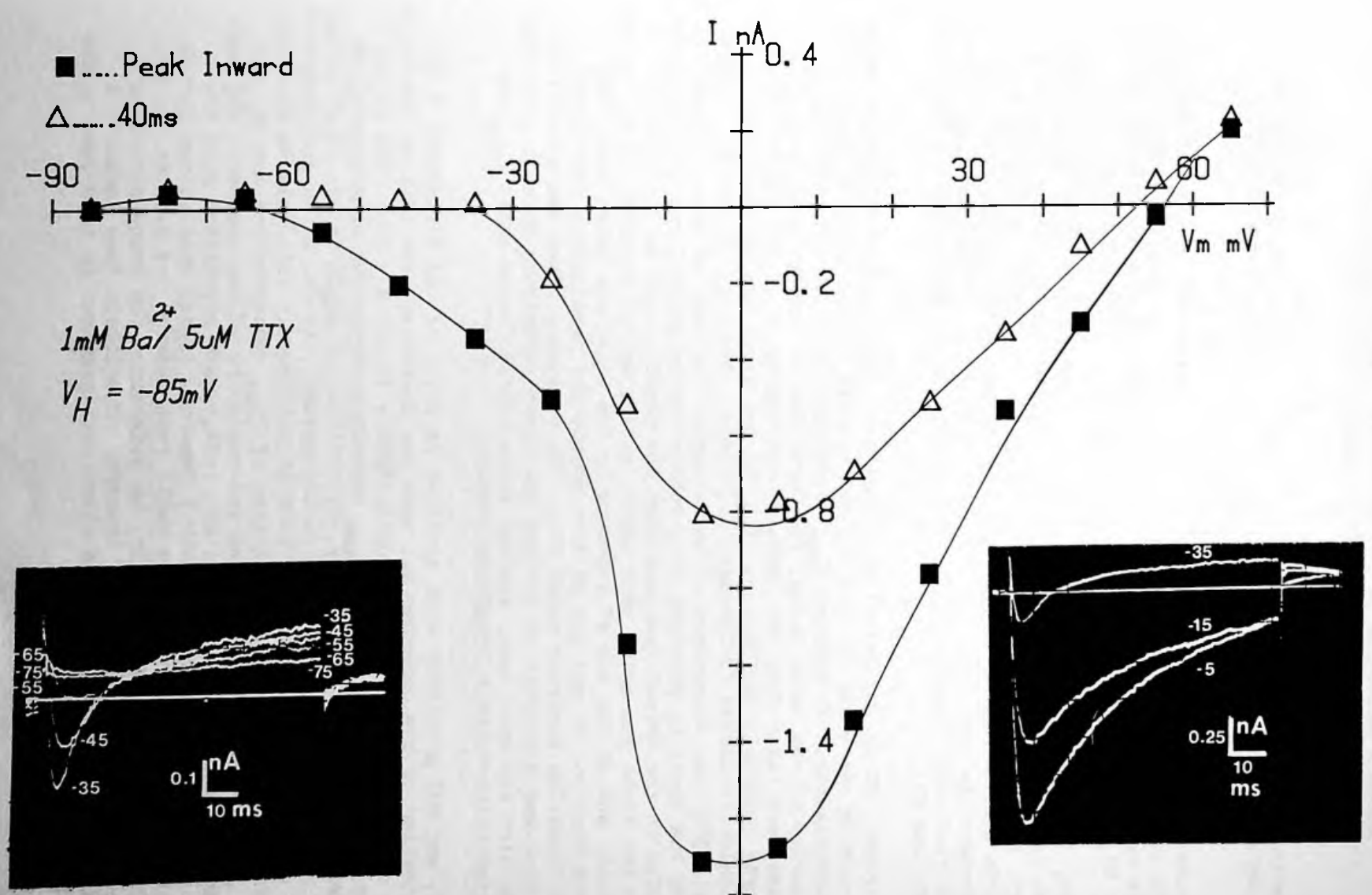
■....Peak Inward
Δ.....40ms
I nA
0.4
-0.2
-0.8
-1.4
-2
-90
-60
-30
30
60
Vm mV
1mM Ba2+/ 5uM TTX
VH = -85mV
-35
-45
-55
-65
-75
65
75
55
-45
-35
0.1 nA
10 ms
-35
-15
-5
0.25 nA
10
ms

FIGURE 1