Automated patch clamp system in ion channel drug discovery

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The most reliable method to estimate the effects of compounds on ion channel activity is to record ionic currents with patch clamp techniques using cells expressing ion channels. Even skilled researchers can evaluate about 10 compounds at most by the classical patch clamp method, so the classical method can not correspond to high-throughput drug discovery. However, automated patch clamp apparatuses with relatively high throughput ability have been developed recently, and made the process of ion channel drug discovery more efficient. At present, we are using three automated patch clamp systems, IonWorks Quattro、IonWorks HT and Q-Patch for discovery and optimization of lead compounds. The order of throughput ability is Quattro>HT>Q-Patch, and 1600、400、and 100 data can be obtained during normal working time in a day, respectively. There are necessarily some failed wells for recording the current in a multi-well plate, and overall success rate for recording is about 97%、80% and 70%, respectively, for Quattro, HT, and Q-Patch, in CHO cells expressing hERG channels. On the other hand, the IC50 values for hERG channel inhibition showed the tendency of better correlation compared with those of manual patch clamp method in order of Q-Patch, HT and Quattro. Issues such as, attainment of high-throughput ability comparable to fluorescence measurement methods, high success rate irrespective of cell types, or improvement of running cost remain to be solved for further development of ion channel drug discovery.