Erwin Neher and Bert Sakmann
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The Patch-Clamp-Apparatus

In all tissues and organs, cells must exchange signals among themselves. This is a prerequisite for coordinated performance of both individual organs and the organism as a whole. Rapid signals, such as between nerves and muscle cells, are mediated by changes of electrical currents at cell membranes. These, in turn, are caused by changes in membrane conductivity for small charged particles of the body fluids (the Na^+, K^+, Ca^{2+}, Cl^--ions) that are found unequally distributed on the inner and outer side of the membrane. The notion of the so-called »ion channels«, the smallest units of conductivity in biological membranes, was first suggested in 1970-72 by the work of Bernard Katz and Ricardo Miledi on the neuromuscular synapse. No proof, however, had been provided for their existence. In 1976, the Patch-Clamp-Apparatus was used to successfully measure for the first time the size and duration of ion currents through single channels in the cell membrane of muscle fibres. The results of these experiments provided the first proof of the existence of ion channels, proteins that span the cell membrane. It was also the first time that scientists succeeded in making time-resolved observations of structural changes in single biological molecules – i.e. the ion channels. This apparatus is now on display at the Deutsches Museum Bonn.

The Patch-Clamp measurement technique is principally an analytical method. It allows observation of »elementary« changes in conductivity in the biological membrane of single molecules. These membranes are the most important locations for interaction of signal substances, such as hormones or transmitter molecules, with their corresponding receptors (signal transduction). Thus, the Patch-Clamp method allows extremely precise measurements of interaction between cells and the body's own signal molecules, as well as artificial substances. A large number of drugs that function via ion channels can therefore be analyzed with regard to both their intended action and unwanted side effects.

The rapid application of the Patch-Clamp method in many physiology laboratories throughout the world has helped to bring about a turn toward cell and molecular physiology in Germany. Before this the emphasis in physiological research had been on tissues and systems analysis.

1991 joint Nobel Prize for Physiology or Medicine

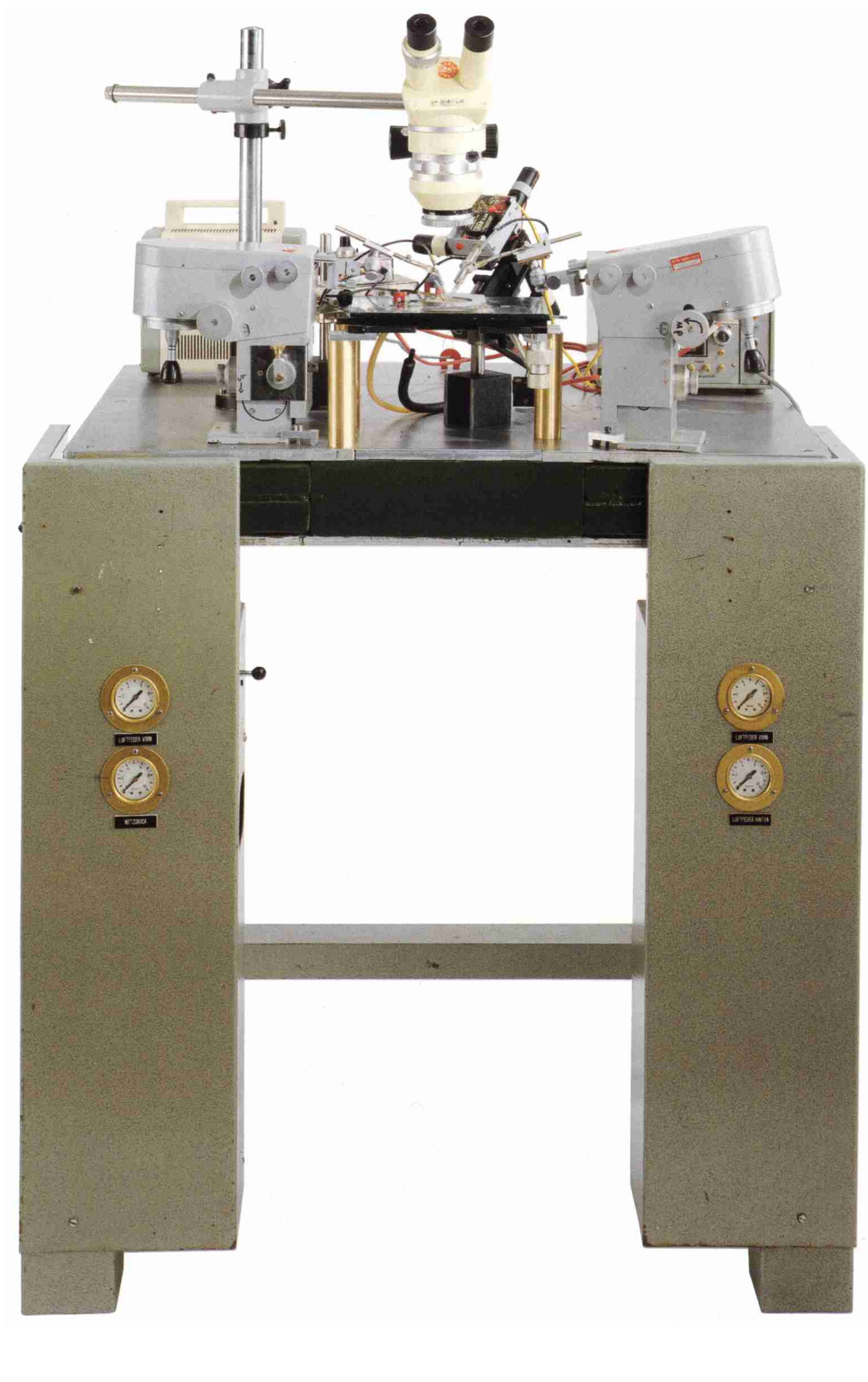
Erwin Neher (born 1944)
Studied physics at the Technical University of Munich and at the University of Wisconsin, Madison/U.S.A.;
1967 Master of Science;
1970 Doctorate under the guidance of Hans-Dieter Lux at the Technical University of Munich;
since 1972 Max-Planck-Institute for biophysical Chemistry, Göttingen (collaboration with Bert Sakmann);
1977-1978 Yale University, New Haven/U.S.A.;
1981 Fellow at the University of Göttingen and Associate Professor;
since 1983 Director at the Max-Planck-Institute for biophysical Chemistry;
since 1987 Honorary Professor at the University of Göttingen.

Bert Sakmann (born 1942)
Studied medicine at the University of Tübingen and at the University of Munich;
1971-1973 Department of Biophysics, University College London, head: Sir Bernard Katz;
1974 Doctorate in medicine awarded by the University of Göttingen;
1974 Research Associate Max-Planck-Institute for biophysical Chemistry, Göttingen (MPI);
1981 Habilitation at the University of Göttingen;
1984 Director of the Department for Cell Physiology at the MPI;
1989 Director of the Department for Cell Physiology at the Max-Planck-Institute for Medical Research, Heidelberg;
since 1990 Professor at the University of Heidelberg.

Max-Planck-Institute for biophysical Chemistry (Karl Friedrich Bonhoeffer Institute), Göttingen.
1972 established by combining the earlier Max-Planck-Institutes for physical Chemistry and Spectroscopy.
This Institute concentrates on research of the dynamics of physical and chemical processes in biological systems.

Patch-Clamp-Apparatus
built in 1974 -1976
Donated by the Max-Planck-Institute for biophysical Chemistry, Göttingen
Inventory number: 1994-184.000
mass: 240 kg

overall height: 1.5 m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