

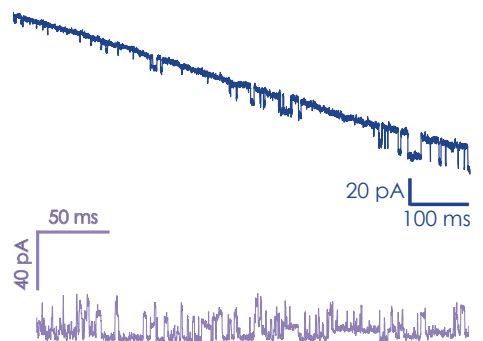
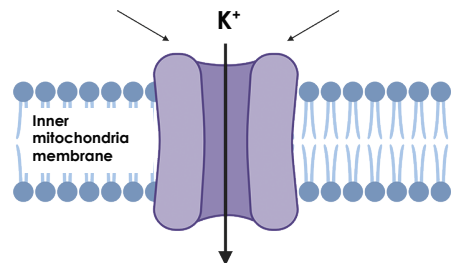
# Mitochondrial Membrane Research

## Investigating Mitochondrial Membrane Channels

The function of the mitochondria is critically dependent on ion homeostasis. Disturbances in ion homeostasis lead to abnormal cell function<sup>1</sup>. Therefore, mitochondrial ion channels, which influence the ionic permeability of the membrane, highlight the relevance of these channels as potential therapeutic targets. From a pharmacological perspective, we can distinguish between two major types of mitochondrial ion channels: mitochondria-specific channels and multiple-location channels.

Among mitochondria-specific channels, we recognize the mitochondrial calcium uniporter (MCU), the inner membrane anion channel (IMAC), the magnesium-transporting Mrs2 and the uncoupling protein (UCP). Most of the other channels can be found in the plasma membrane and possibly elsewhere. These multiple-location channels include the voltage-dependent anion channel (VDAC), calcium-dependent K<sup>+</sup> channels (K<sub>Ca</sub>1.1, K<sub>Ca</sub>3.1, K<sub>Ca</sub>2.1), voltage dependent K<sup>+</sup> channels (K<sub>v</sub>1.3, K<sub>v</sub>1.5), two-pore channel K<sub>2P</sub>9.1, ATP-dependent K<sup>+</sup> channel (K<sub>ATP</sub>; Kir3.4), and the intracellular chloride channels (ClC-4, ClC-5)<sup>2</sup>.

- | Regulatory mechanisms  | Posttranslational regulation   |
|--|--|
| <ul style="list-style-type: none"><li>- Ligands (STP, Ca<sup>2+</sup>, etc.)</li><li>- Membrane potential</li><li>- Potassium channel openers</li><li>- Channel inhibitors</li></ul> | <ul style="list-style-type: none"><li>- ROS action</li><li>- Phosphorylation</li><li>- S-nitrosylation</li><li>- S-sulfhydrylation</li><li>- N-glycosylation</li></ul> |



In blue: Single channel events seen as downward deflections at  $V < -20$  mV recorded from mitoplasts using APC. In lilac: Step to +60 mV with internal K<sup>+</sup> and Cl<sup>-</sup> free external solution. Activity possibly corresponding to mitoBK recorded using APC.

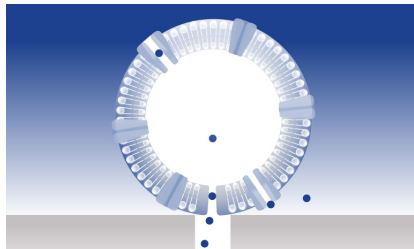


Contact us today

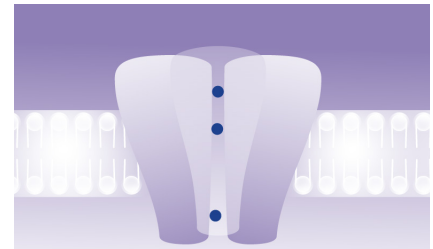
# Mitochondrial Ion Channels

## Recording organelles made easy

### Automated Patch Clamp



### Membrane Biophysics



**Data points per day**

50 - 20,000

150 - 10,000

**Methods**

- Single channels
- Whole cell
- Perforated patch
- Cell attached
- Washout

- Solid Supported Membrane-Based Electrophysiology (SSME)
- Painted bilayers

**Channels/ Targets**

- Mitochondrial ion channels
- Lysosomal ion channels
- Voltage- & ligand-gated ion channels
- Heat/cold & light activated channels
- Mechanosensitive channels

- Mitochondrial ion channels
- Lysosomal ion channels
- Voltage- & ligand-gated ion channels
- Transporters
- Membrane pumps
- Leak channels
- Pores and Nanopores
- Antimicrobial peptides, toxins, and more

**Cell systems/ samples**

- Cell lines
- iPSC-derived cells
- Primary cells
- Organelles

- Organelles
- Purified membranes
- Proteoliposomes
- Purified ion channel proteins
- Purified pore forming constructs

**Features**

- Automation
- Temperature control
- Fast solution exchange
- Other features (instrument-specific)

- Automation
- Temperature control
- Fast solution exchange
- Other features (instrument-specific)

**Parallel recordings**

1 - 384

1 - 96

1. Szabo & Szewczyk (2023) Annu. Rev. Biophys. (52): 229-254
2. Leanza *et al.* (2019) Br. J. Pharmacol. (176): 4258-4283
3. Szabo & Zoratti (2014) Physiol. Rev. 94: 519-608