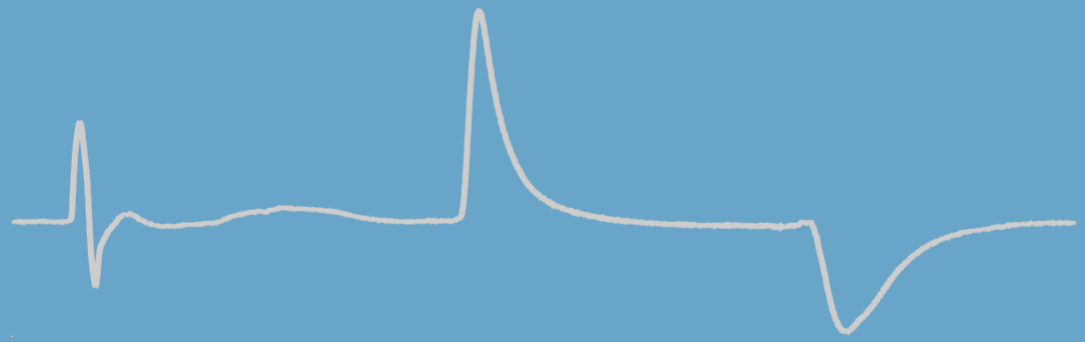
Nanion Technologies



Small Currents – Big Potential.

Electrophysiology for transporters using the "SURFE^{2}R" technology

Dr. Maria Barthmes
Application Scientist & Product Manager SURFE^{2}R Family
Nanion Technologies

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Nanion Technologies introduced

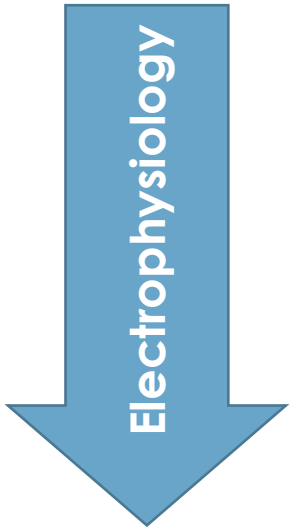
- University spin-off in 2002
- Instrumentation for research, drug screening and safety testing
- One of the leading providers of automated patch clamp systems

- Headquarters located in Munich, Germany
- ~100 employees worldwide
- Offices in USA, Japan, China

Electrophysiology for transporters

Many transporters generate transmembrane currents

- P-Type and F/V-Type ATPases
- Many SLC transporters (coupled transport)



→ No labels
→ Real time measurement
→ High information content
→ High experimental freedom

Patch Clamp/Voltage Clamp → low signal amplitude

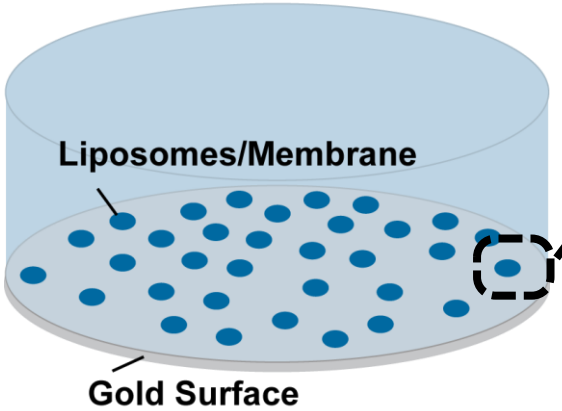
Oocyte TEVC→ low throughput, compound concentrations

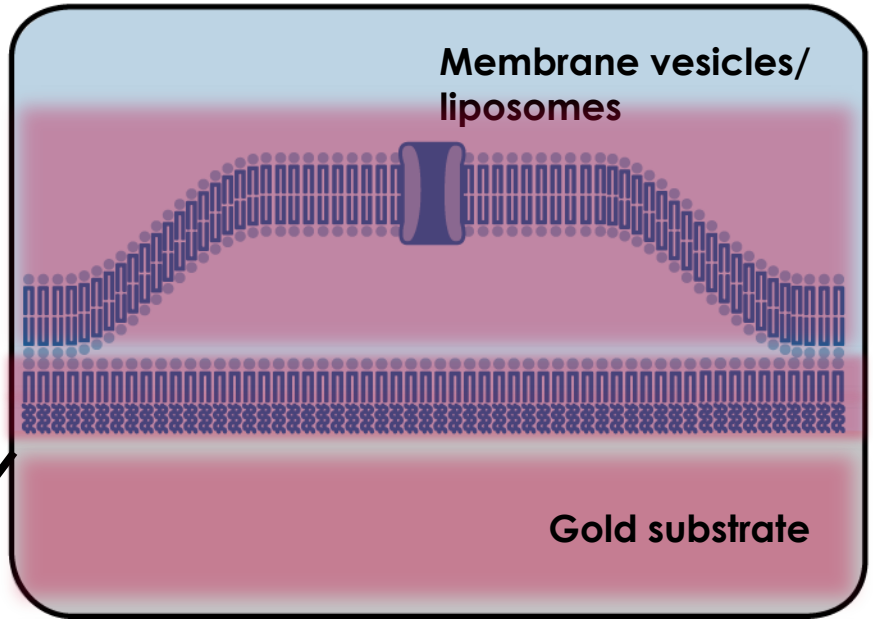
SSM-based Electrophyiology → invented for transporters

Solid supported membrane (SSM)-based electrophysiology

high amount of protein = high signal

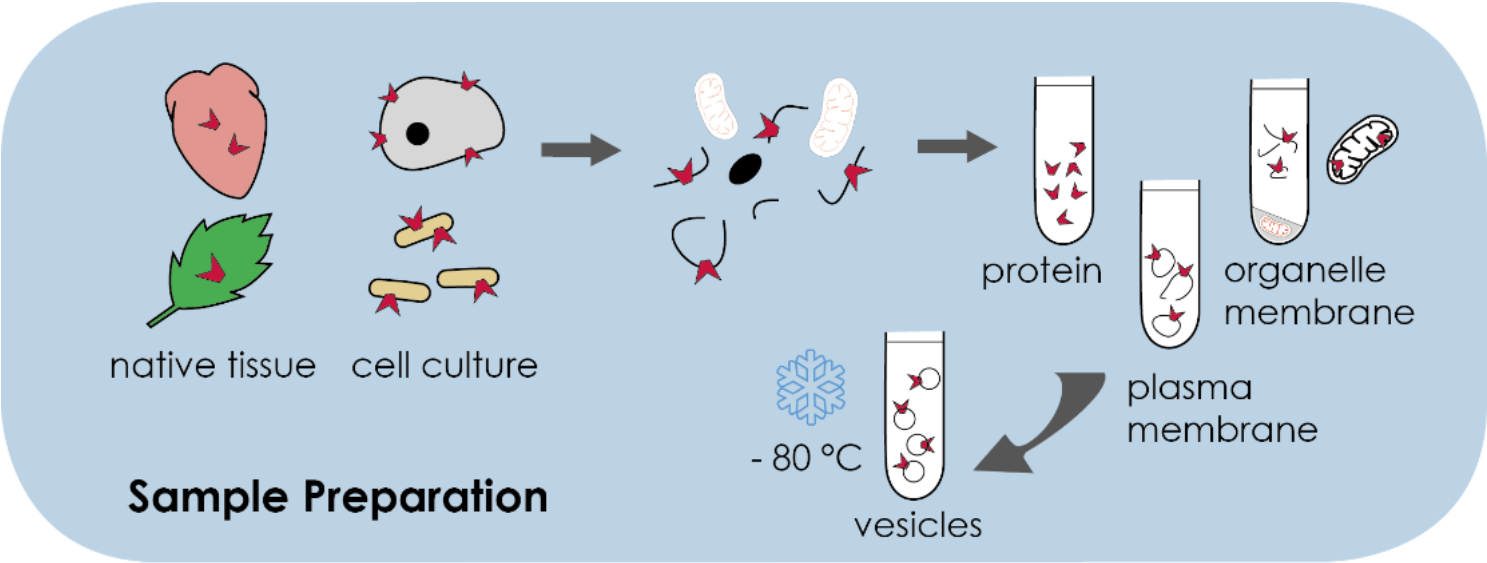
"Sensor"





SSM

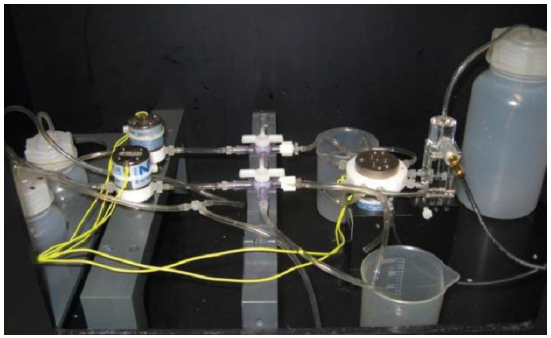
The sample on the SSM

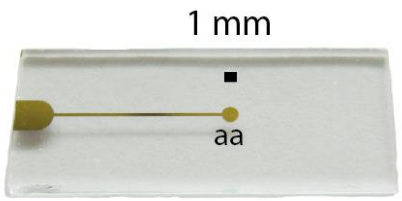


10 µl per 96 well plate ~ 0.1 µg protein/well

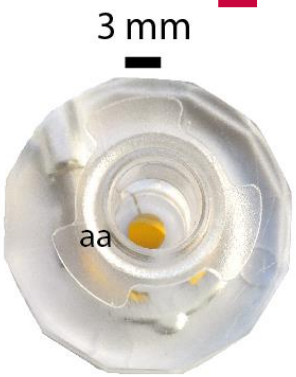
Insertion of the Sensor into a recording device

Custom built

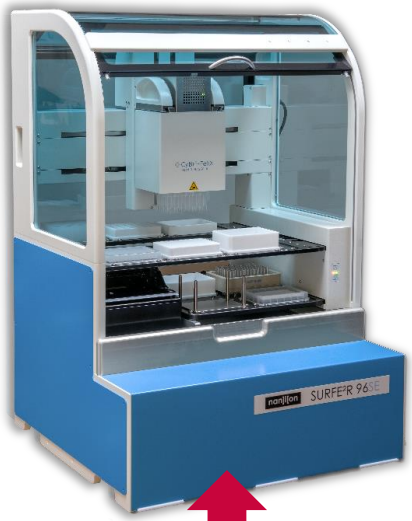




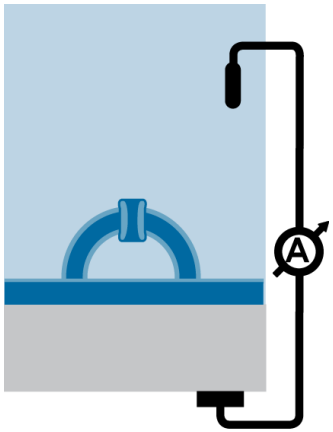
SURFE²R N1



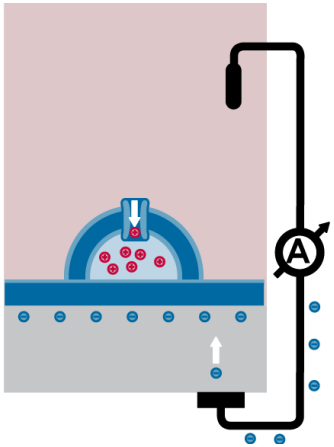
SURFE²R 96SE



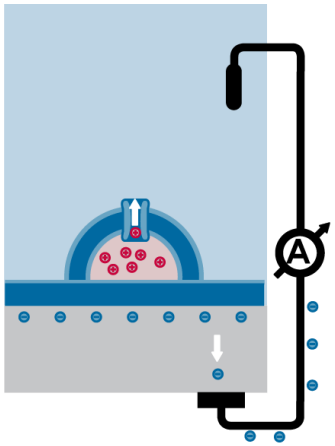
Activation by perfusion of the sensor



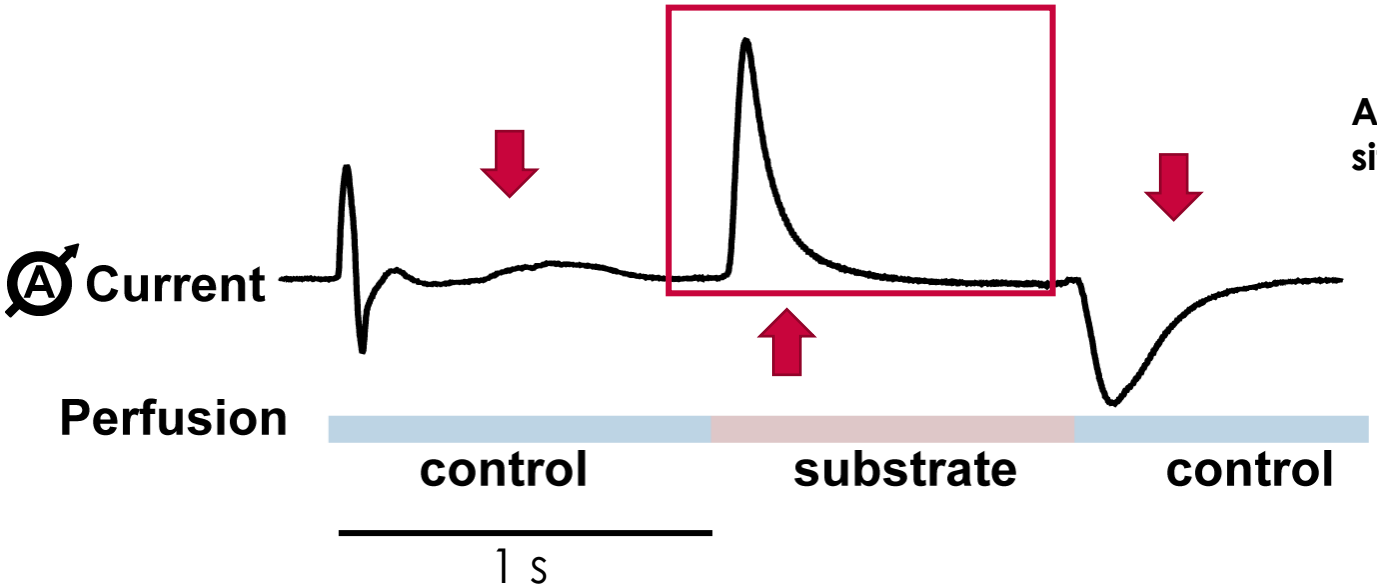
Control phase



Substrate is applied → Transport

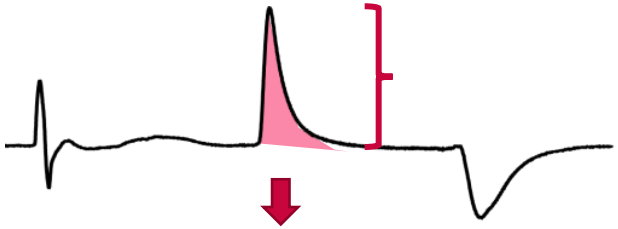


Wash out of substrate

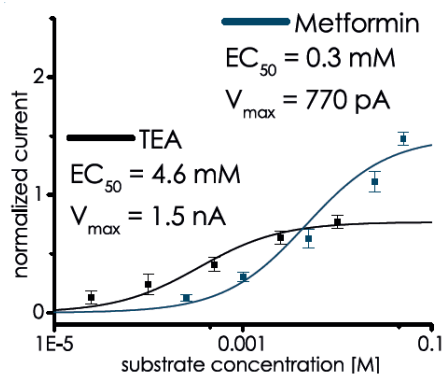


After rinsing: Initial situation is restored

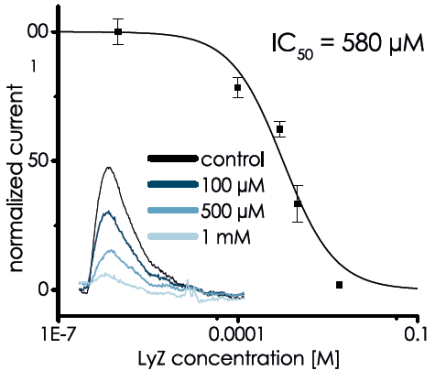
Experimental scope



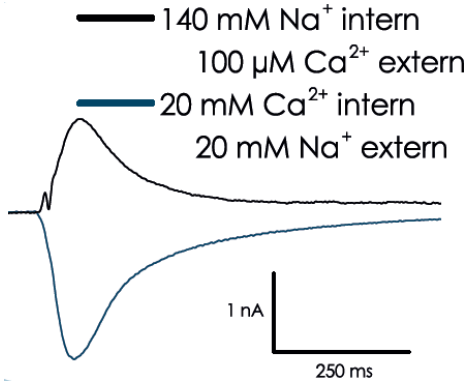
Substrates



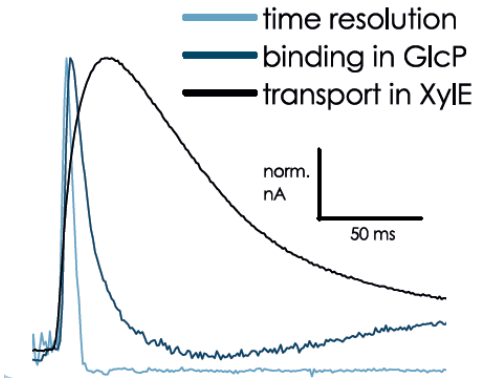
Inhibition



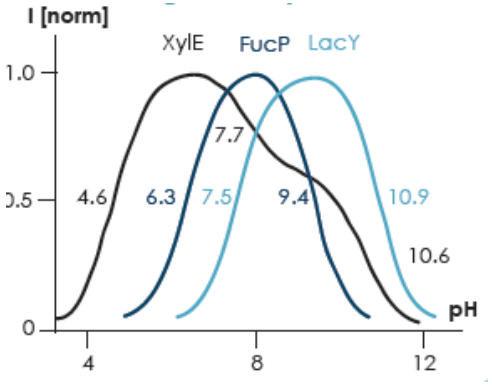
Environment



Mechanisms

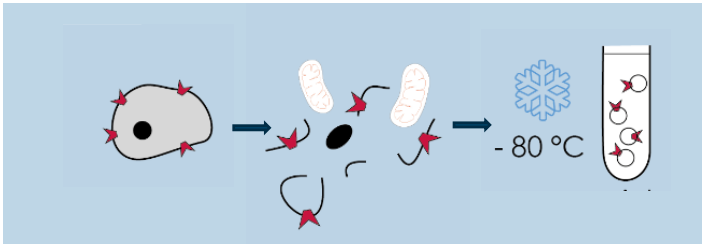


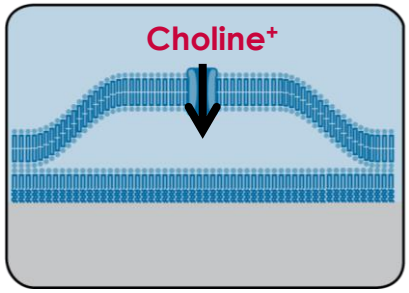
Comparison

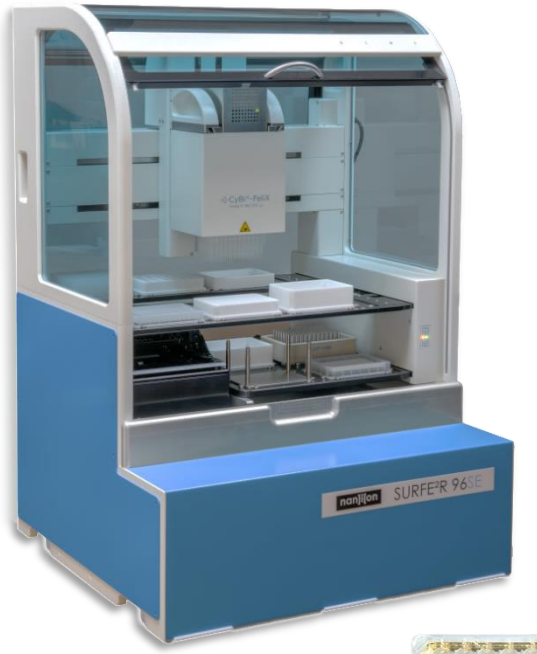


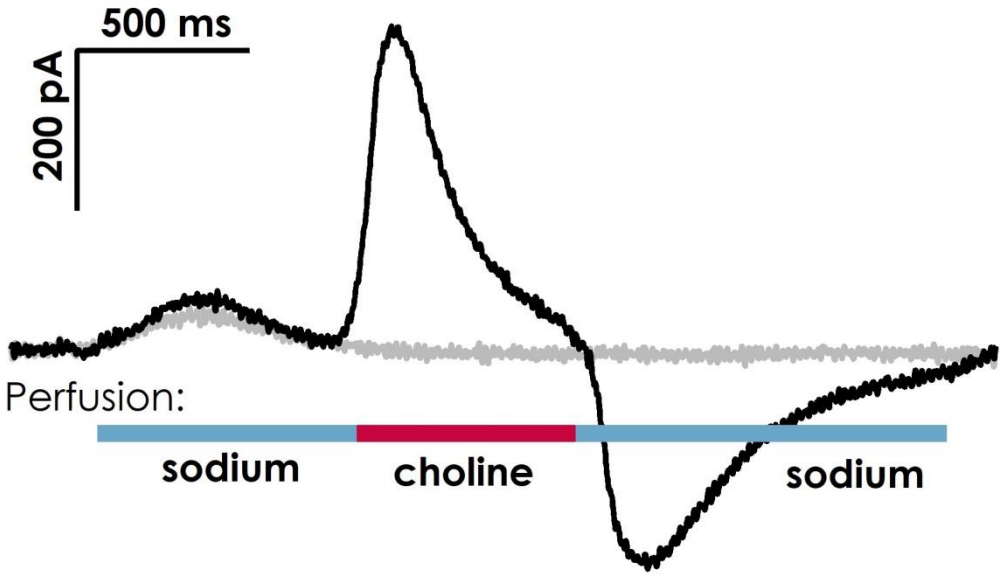
OCT2: Development and validation of an assay

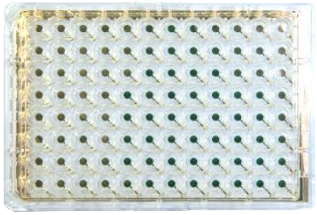
SOLVO® BIOTECHNOLOGY
THE TRANSPORTER COMPANY











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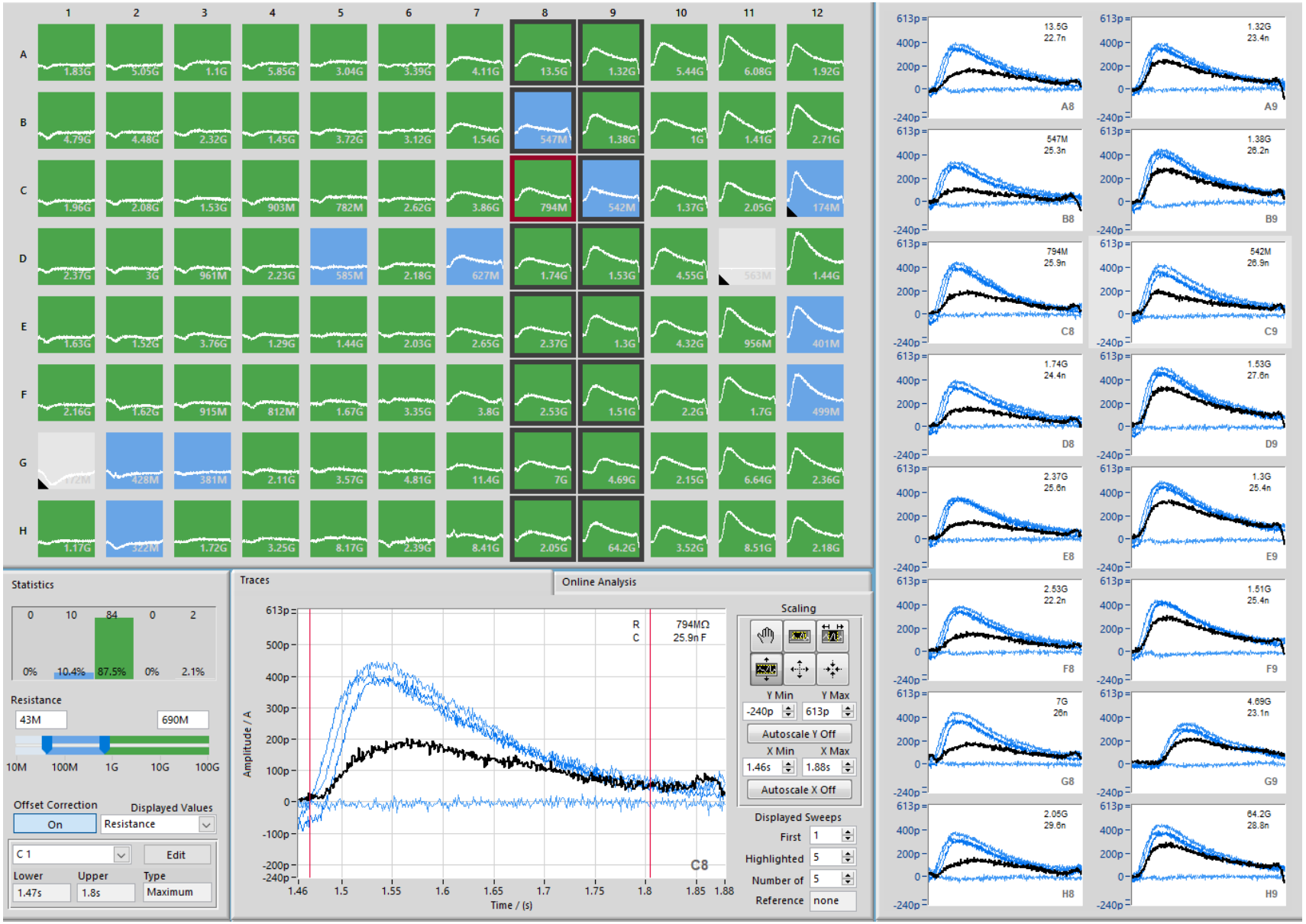
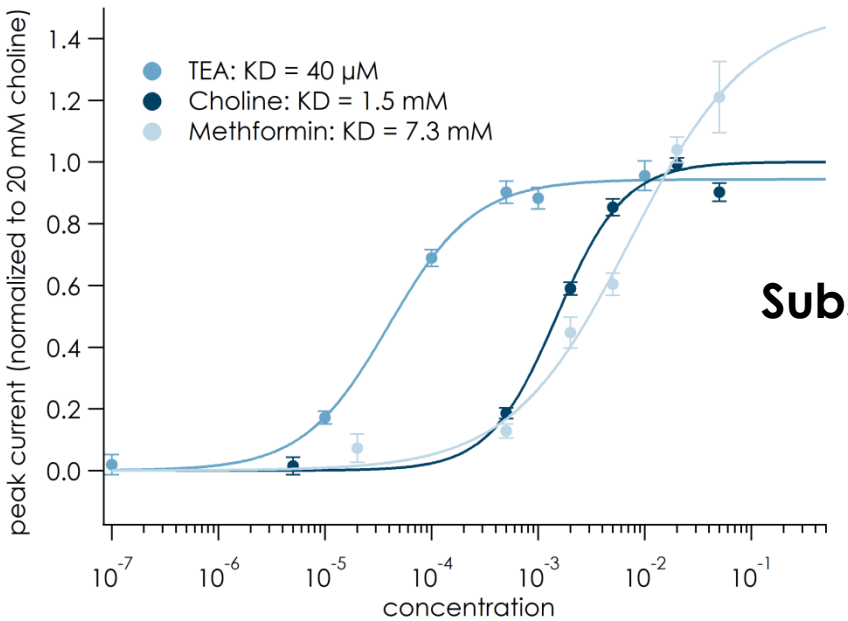
OCT2: Development and validation of an assay

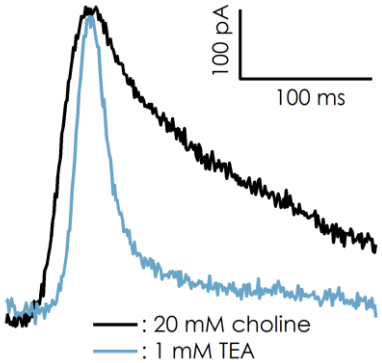
3x Topotecan 20 µM
2x Tropsipin 20 µM
1x Vehicle control
Noise reduction
Baseline



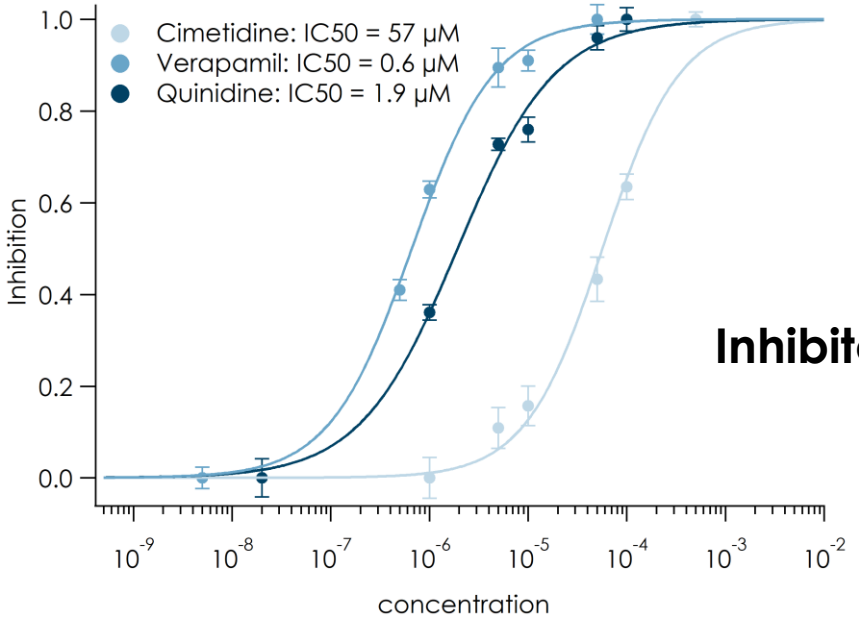
OCT2: Development and validation of an assay



Substrates



	SSM	Published
TEA	40 µM	33-270 µM
Choline	1.5 mM	0.46 mM
Metformin	7.3 mM	0.6 -3.3 mM



Inhibitors

	SSM	Published
Cimetidine	57 µM	8.6-120 µM
Verapamil	0.6 µM	13.4-85 µM
Quinidine	1.9 µM	8-87 µM

Other validated targets on the SURFE²R

Pumps

ATPases
- NaK-ATPase
- HK-ATPase
- SERCA
- V-ATPase
- FoF1-ATPase
- Kdp-ATPase
- CopA
- ATP7A/B
- VrPPase

Redox-driven ion pumps
- Complex I
- respiratory chain complex I/III
- respiratory chain complex II/III
- cyctochrome c-oxidase
- respiratory chain complexes I/III/V

Light-driven ion pumps
- Bacteriorhodopsin (BR)
- Oxyrrhis marina Rhodopsin
- Rhodopsin-2 (KR2)
- Halorhodopsin (HR)
- Acerhodopsin
- Channelrhodopsin (ChR)

Channels and Pores
- Gramicidine
- P2X2
- nAChR
- A/M2
- UCP1 (Slc25a7)
- TRPC5
- TRPA1
- CFTR
- AQP6

Transporters

Inorganic ions
- NhaA
- NhaP
- NhaB
- NCX1 (Slc8a1)
- Clc-7
- EcClc
- NirC
- Amt1-3
- AmtB
- SulP
- NIS (Slc5a5)
- NaPi2b (Slc34a2)
- MntH2

Amino acids
- PEPT1 (Slc15a1)
- YdgR
- YhiP/DtpB
- PutP
- GltP
- EAAC1 (Slc1a1)
- PAT1 (Slc36a1)
- ArcD
- CAT2B (Slc7a2)
- GlyT1/2 (Slc6a9/a5)

Sugars
- SGLT1/2 (Slc5a1/a2)
- MelB
- LacY
- FucP
- XylE
- GlcP

Organic ions
- OCT2 (Slc22a2)
- CNT1 (Slc28a1)
- ANT (Slc25a4)
- AAC
- GAT1 (Slc6a1)
- BetP
- CHT (Slc5a7)
- NupC
- NacT (Slc13a5)

Uniporters
Symporters
Exchangers