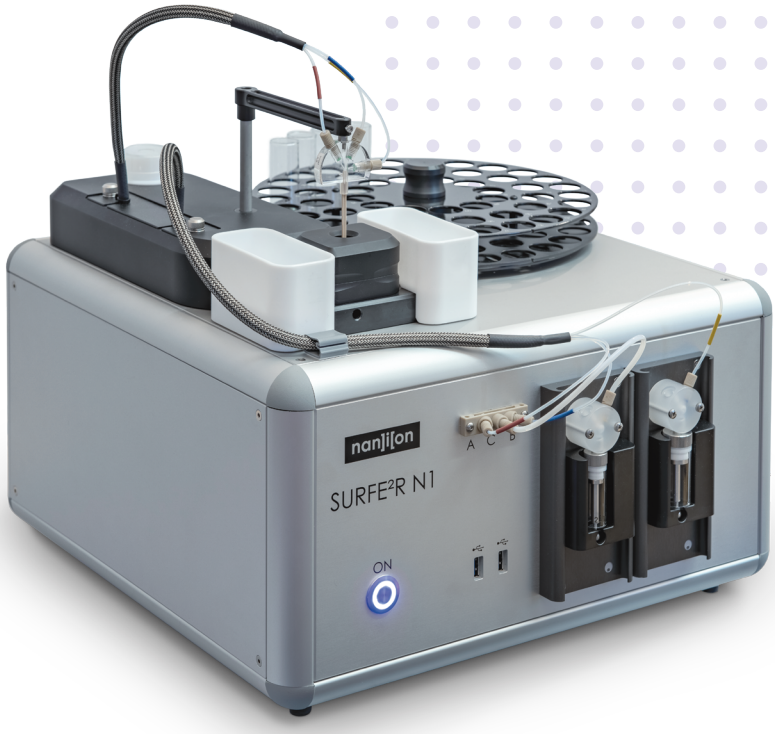
SURFE²R N1

In-depth transporter research



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Unveiling Membrane Transport through SSM-based Electrophysiology

Nanion's SURFE²R (surface electrogenic event reader) instruments allow for functional and direct recordings of electrogenic membrane transport from symporters, exchangers, uniporters and pumps, and from ligand-gated and leak ion channels.

SURFE²R N1 facilitates in-depth functional characterization of electrogenic membrane transport in real-time with high sensitivity and high temporal resolution.

Any membrane can be accessed for recordings, ranging from isolated membrane vesicles from native tissues or cultured cells to transporters reconstituted into proteoliposomes.

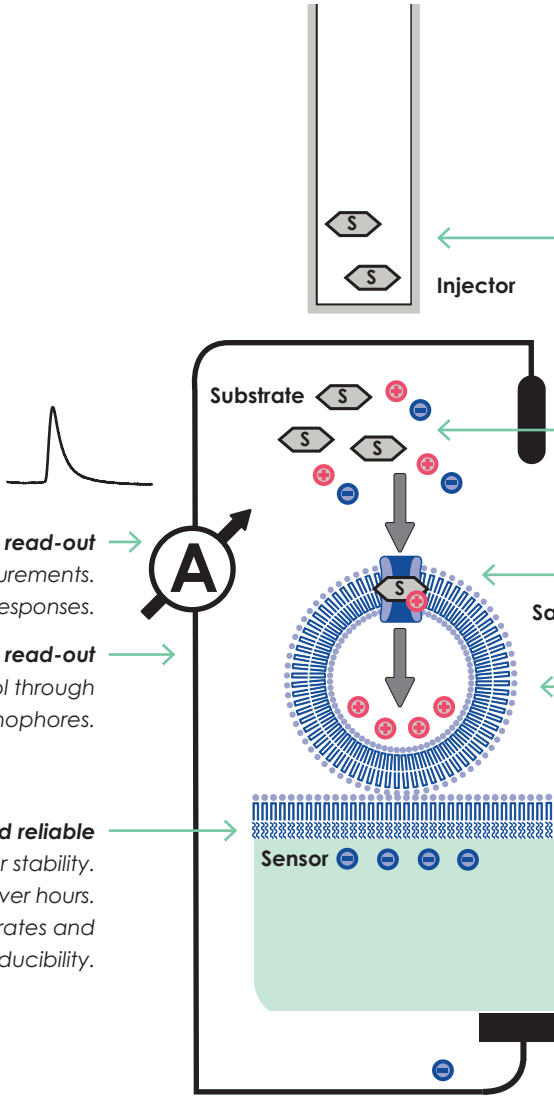
It's easy to use, efficient, and unlocks completely new possibilities in transporter research and screening.

Key features at a glance

1. Functional transporter recordings in real-time
2. No need for labels, radioactivity or fluorescence
3. High sensitivity & temporal resolution
4. Access any membrane with only 0.1–1 µg protein per sensor required
5. Pre-programmable, automated recordings
6. Broad range of validated transporter targets
7. Easy to learn and use — even for students
8. Up to 150 datapoints per day

SURFE²R recording principles

Membrane fragments from cell culture, tissue or liposomes are adsorbed onto a solid supported membrane (SSM) on a gold coated sensor chip. Approximately 0.1–1 µg of membrane is required to cover the 3 mm sensor electrode, corresponding to ca 10^9 transporter molecules. Membrane transport, i.e. charge translocation, is triggered by rapidly perfusing the sensor with a substate or an altered ionic composition resulting in a gradient across the membrane. The resulting electrogenic transport is measured as a transient, capacitive current which decays until a new electrochemical equilibrium has been reached. The size and shape of the current reveal information about numerous biophysical and pharmacological transporter properties like the speed of transport, coupling ratio or substrate affinity.



Automation
Automated measurements using up to 53 solutions.
Up to 150 data points per day (SURFE²R N1).
Up to 10.000 data points per day (SURFE²R 96SE).

Compounds
Substrate and inhibitor assays; for hydrophobic compounds and metal ions, negative controls are essential.

High target range
Symporters, exchangers, ATPases, channels.

Sample flexibility
Native membranes or proteoliposomes.
Low sample consumption <0.1 µg protein per sensor.
High protein density may be required.

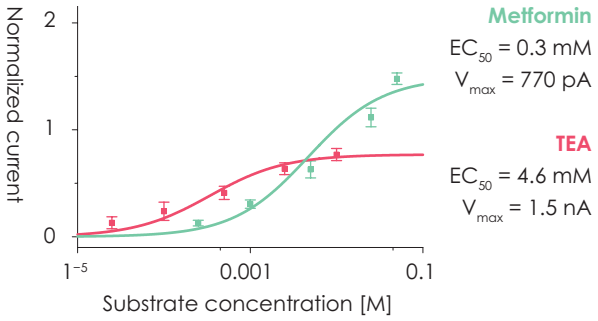
High sensitivity
Huge sensor surface.
Targets down to transport rates of 0.1 s^{-1}. Detects even conformational transitions and binding.

Electric read-out
No labels, direct measurements.
Real-time and immediate responses.

Capacitive read-out
Voltage-control through ionophores.

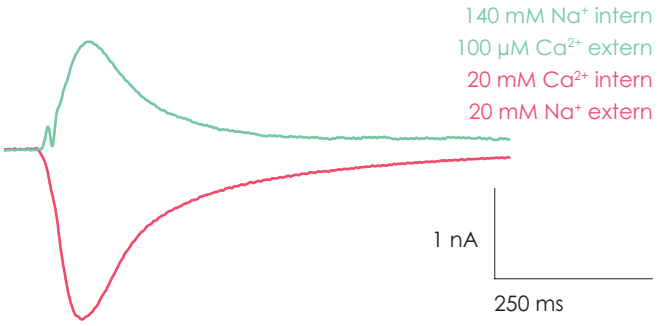
Robust and reliable
High sensor stability.
Multiple measurements over hours.
High success rates and reproducibility.

Explore the possibilities of full experimental freedom



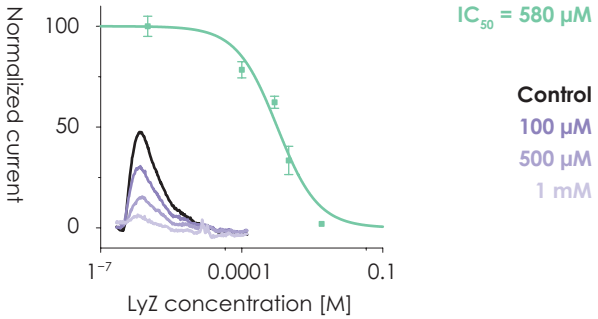
Transport assays

Substrate specificity (V_{max}, EC_{50}).



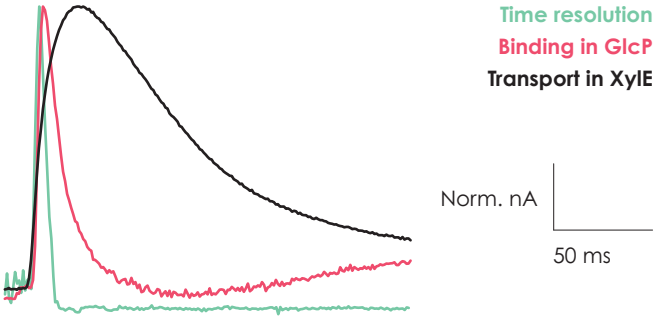
Influx and efflux assays

Symmetry of transport.



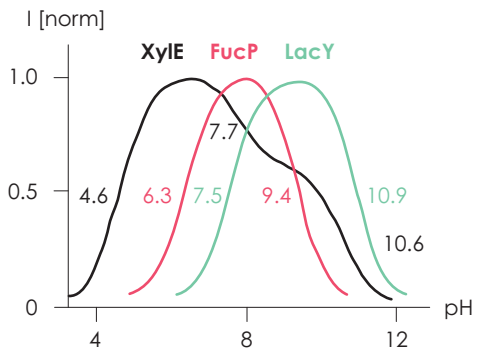
Compound assays

Inhibition and positive modulation.



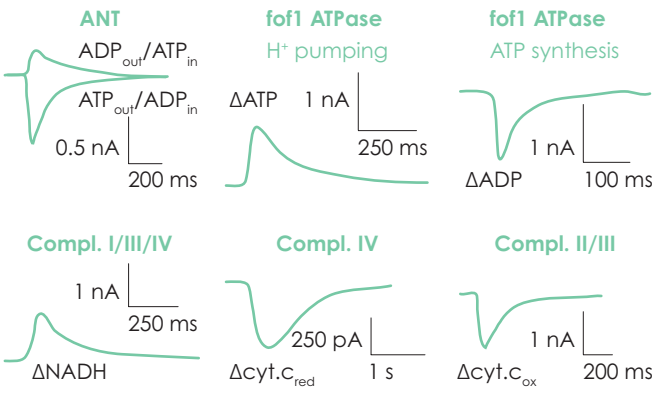
Substrate binding assay

Pre-steady state currents (k^+, k^-).



Comparative assays

Mutants, orthologues, isoforms.



Multiple targets in one experiment

Serial recordings from the same sample and sensor.

Broad range of validated targets

Primary active transporters / Ion pumps

ATPases
NaK-ATPase
HK-ATPase
SERCA (Ca^{2+})
v-ATPase (H^+)
FoF1-ATPase (H^+)
Kdp-ATPase (K^+)
CopA (Cu^{2+})
ATP7A/B (Cu^{2+})
ATP8A2 (Flippase)
VrPPase

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

Light-driven ion pumps
Bacteriorhodopsin (BR)
Rhodopsin OR1
Rhodopsin-2 (KR2)
Halorhodopsin (HR)
Acerhodopsin
Channelrhodopsin 1/2 (ChR)

Channels + Pores

Gramicidine
P2X2
nAChR
A/M2
UCP1 (Slc25a7)
TRPC5
TRPA1
AQP6
KtrAB
TMEM175

Uniporters + Symporters + Exchangers

Inorganic ions
NhaA/B ($2Na^+/1H^+$)
NhaP/NHA2 ($1Na^+/1H^+$)
NCX1/mjNCX ($3Na^+/Ca^{2+}$)
ecClc/Clc-3/5/7/K (Cl^-/H^+)
NirC (NO_2^-/H^+)
afAmt1-3/ksAmt5/ecAmtB (NH_4^+)
NeRh50 (NH_4^+)
SulP/DauA (bicarbonate)
NIS ($2Na^+/I^-$)
NaPi-IIb (Na^+/PO_3^{2-})
MntH2 (Mn(II), Zn(II), Co(II), Cd(II))
YiiP (metals)

Sugars
SGLT1/2 (Na^+/glucose)
MelB (Na^+/melibiose)
LacY (H^+/lactose)
FucP (H^+/fucose)
XylE (H^+/xylose)
GlcP (glucose)
STP10 (H^+/glucose)

Amino acids + peptides
PepT1/PepT_St (di-/tri-peptides)
YdgR/DtpA (tri-peptides)
YhiP/DtpB (di-/tri-peptides)
PutP (Na^+/proline)
GltP (Na^+/glutamate)
GltTK (Na^+/aspartate)
EAAC1 ($3Na^+$/glutamate)
PAT1 (H^+/proline)
ArcD (arginine/ornithine exchange)
CAT-IIB (cationic amino acids)
GlyT1/2/B1 (Na^+/glycine)
B0AT2 (Na^+/neutral amino acids)
Cystin Transporter

Other organic ions
OCT1/2 (organic cations)
OATP1B1 (organic anions)
CNT1 (nucleosides)
ANT (ADP/ATP exchange)
GAT1 (Na^+/GABA)
BetP (betaine)
CHT (choline)
LicB (choline)
NupC (H^+/nucleoside)
PurT (H^+/purine)
NaCT (Na^+/citrate)
SugE/Gdx (guanidinium)
EmrE (small drugs)
MCT13 (monocarboxylates)
PfCRT (cloroquine/CQ)
DgoT (H^+/galactonate)
Malate/lactate exchange
Bicarbonate transport

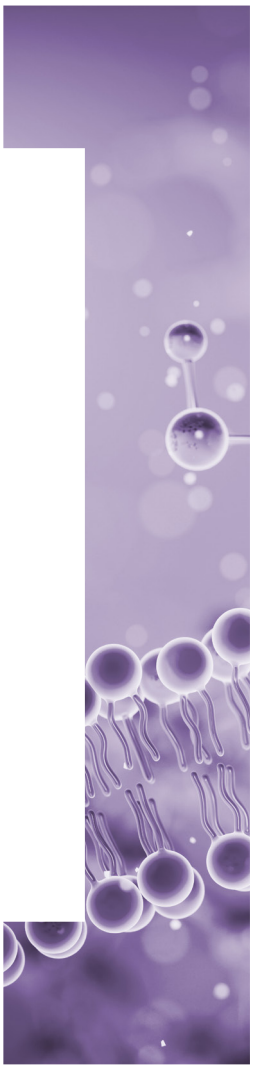
The SURFE²R N1 includes

- **Turn-key, stand-alone system**
- **PC and monitor with integrated recording and analysis software**
- **SURFE²R N1 Sensor 3 mm for optimal signal-to-noise**
- **SURFE²R N1 Sensor 1 mm for high temporal resolution**
- **Integrated computer with Windows and SURFE²R N1 Control software**
- **The SURFE²R Stimulating Optical Lid SOL (optional)**
- **Ph.D. level assay support and highly qualified technical support**
- **1 year warranty with further optional comprehensive service plans available**

Specifications

Data output	**Signal amplitude: 0.1–10 nA, detection limit: 50 pA, noise: 20 pA**
Low noise amplifier	**Gain: 10^8–10^{11} V/A, resolution: −10 V to +10 V (1.2 mV steps), RMS noise: 0.5–22 pA, low pass: 480 Hz, rise time: 0.7 ms**
Measuring electrode	**Re-usable gold coated sensor chip with 1 or 3 mm diameter**
Reference electrode	**Platinum electrode pin in measurement chamber**
Integrated computer	**Win11, SURFE²R N1 Control (data recording and analysis software)**
Fast solution exchange	**200 µl/s, continuous flow: 0.5–6 s, time resolution: 5–30 ms**
Fluidic components	**2 pumps, fast switching valve, tubing cassette, IonJet with Y-fluidic**
Solution handling	**Autosampler with 53 positions, each ~10 ml and 2 teflon reservoirs, each ~70 ml**
Solution consumption	**Volume per measurement/substrate: ~300 µl (inhibitor: 1–2 ml)**

accelerate your research



nanion Europe
info@nanion.de
phone: +49 89 2190 95-0
www.nanion.de

nanion USA
info@nanionteсh.com
phone: 1-888-9-NANION
www.nanionteсh.com

nanion China
andy.di@nanion.cn
phone: +86 10 82 17 6388
www.nanion.cn

nanion Japan
info@nanion.jp
phone: +81 3 6457 8773
www.nanion.jp

To find your nearest Nanion representative, visit our website: www.nanion.de

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