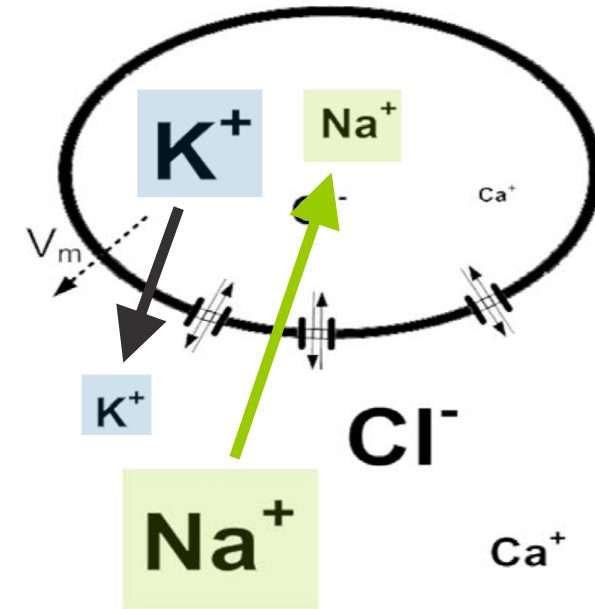


Mini-Gehirne auf Chips

Kilian Imfeld
kilian.imfeld@3brain.com

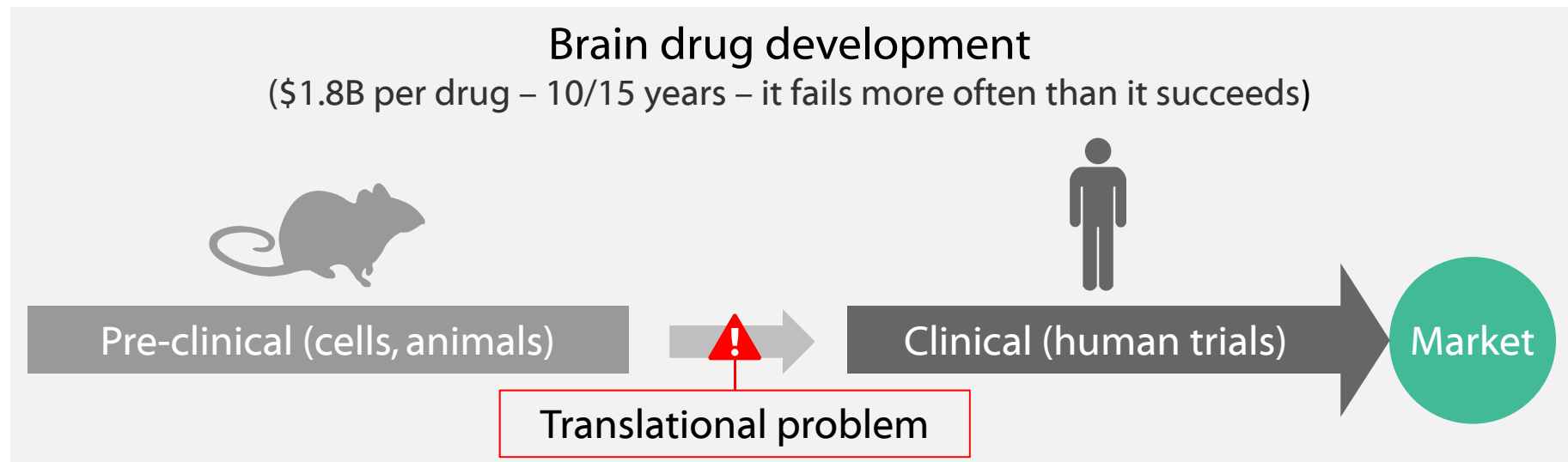
Kontext

- Wie funktioniert das Gehirn ?
- Warum müssen wir das wissen? Verständnis von mentalen Prozessen und Krankheiten
- Neuron als Grundelement elektrische Signale in einem Netzwerk von Zellen
- Werkzeuge zur Forschung



Problem – neuronale Krankheiten

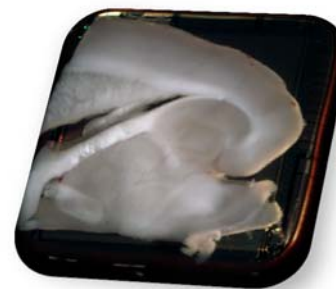
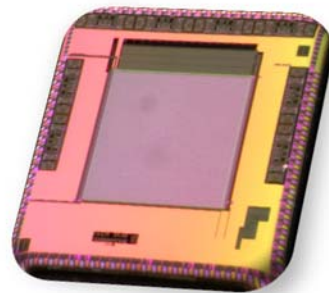
- Alzheimer, Parkinson, Depressionen usw.
- Mehr als 2 Milliarden Menschen betroffen
- Medikamenten-Entwicklung ist ineffizient
 - ✓ Viele Misserfolge in klinischer Phase
 - ✓ Resultate aus Tierversuche können nur ungenügend auf den Menschen übertragen werden



Themen – Werkzeuge und Methoden

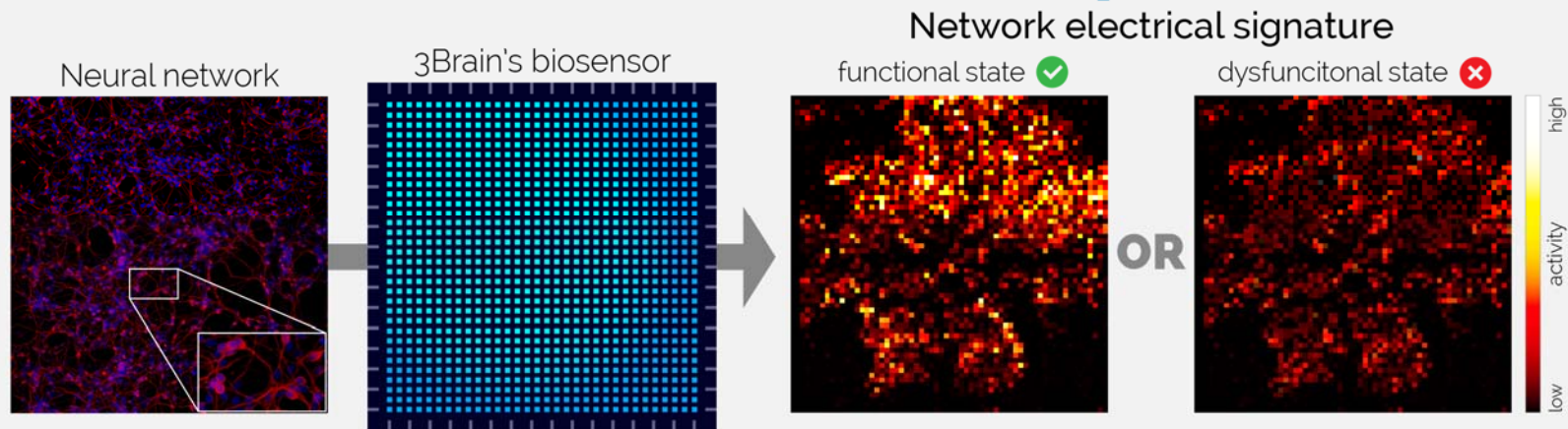
- MRI vs. Mikroskopie = ganze Hirnareale vs. einzelne Zelle
- Was passiert dazwischen? Wie entsteht aus vielen einzelnen Zellen ein “intelligentes” Wesen?
- Es fehlen die Werkzeuge, um neuronale Netze (Subsysteme) sichtbar zu machen

3Brain's hoch-
auflösenden
Elektroden Arrays
(MEA)



Unsere Technologie

Brain-on-chip



Pre-clinical (animals)

3·Brain(human)



Clinical (human trials)

Market



Increase predictability: reject "bad" drugs => save costs to pharma

BioCAM X platform



Neurophysiologische Messung von Netzwerken

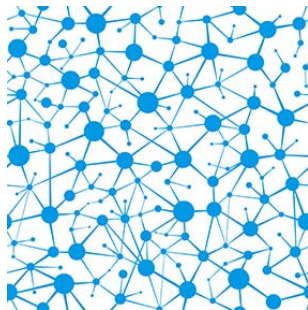
Sample

Current approach

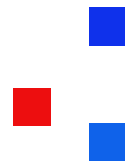
Our approach

neuronal network

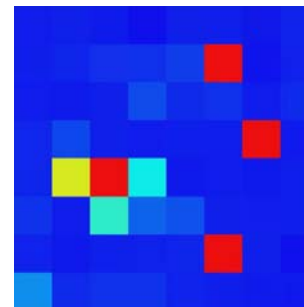
Tens of thousands of cells



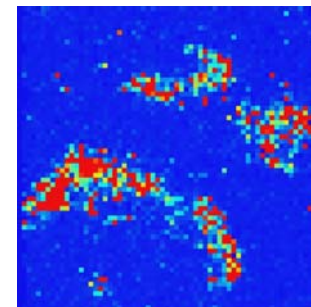
Patch



Low res MEA



Thousands of sensors



analogy

Symphony



1 violin
(and perhaps not good)

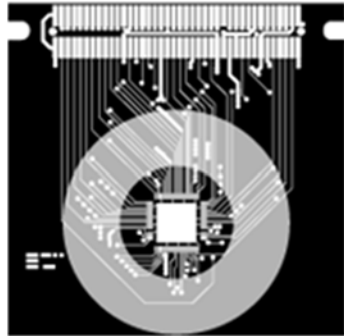


orchestra

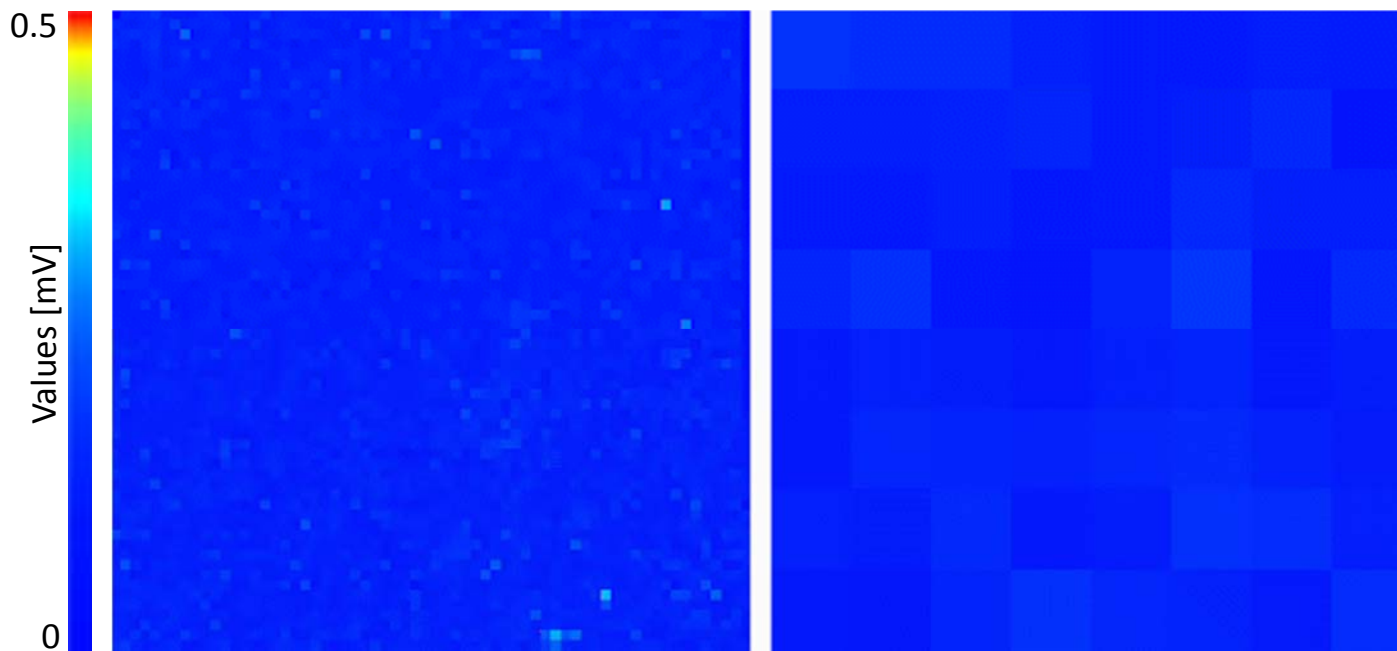
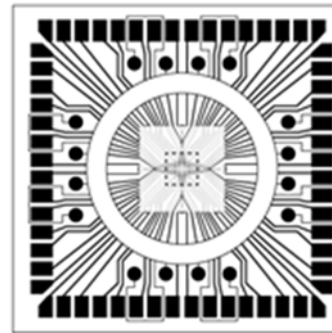


Zellkulturen

APS-MEA
high-resolution: ~ 580 el/mm²
covered area: ~ 7 mm²



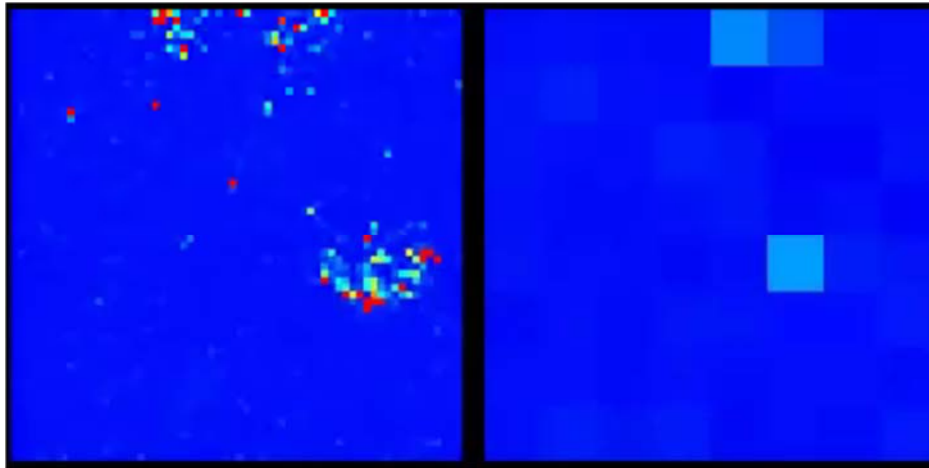
standard MEA
low-resolution ~ 19 el/mm²
covered area: $\sim 2,7$ mm²



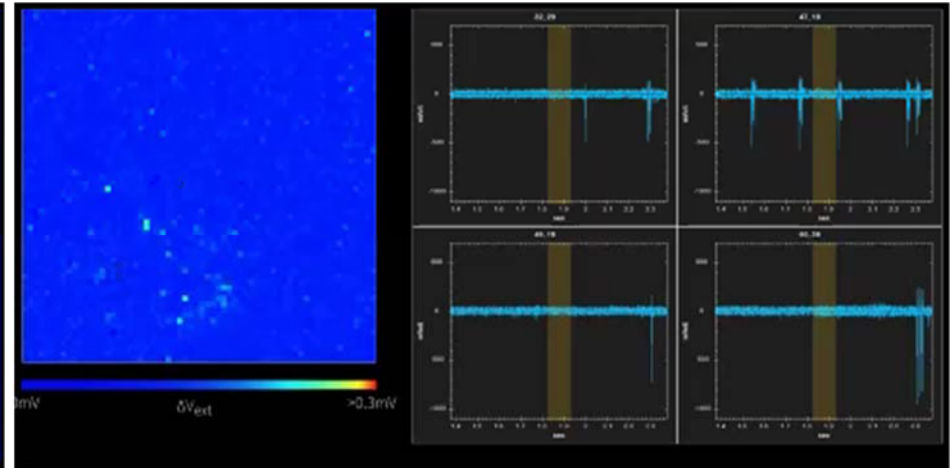
burst event, 100 ms, DIV21, hippocampal culture

Retina

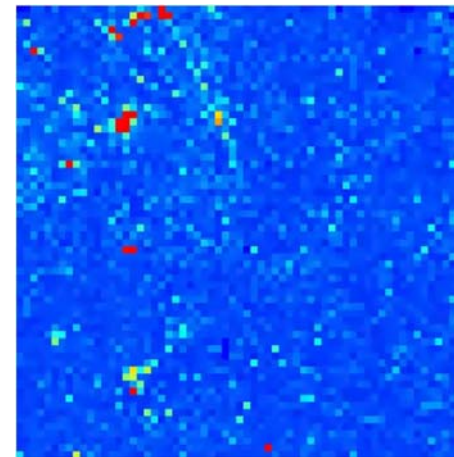
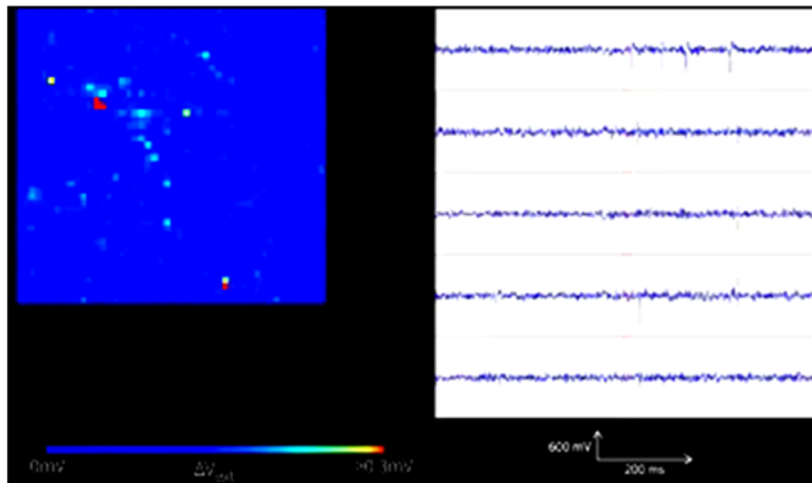
Retinal waves HR vs LR



Light-response without light artefacts

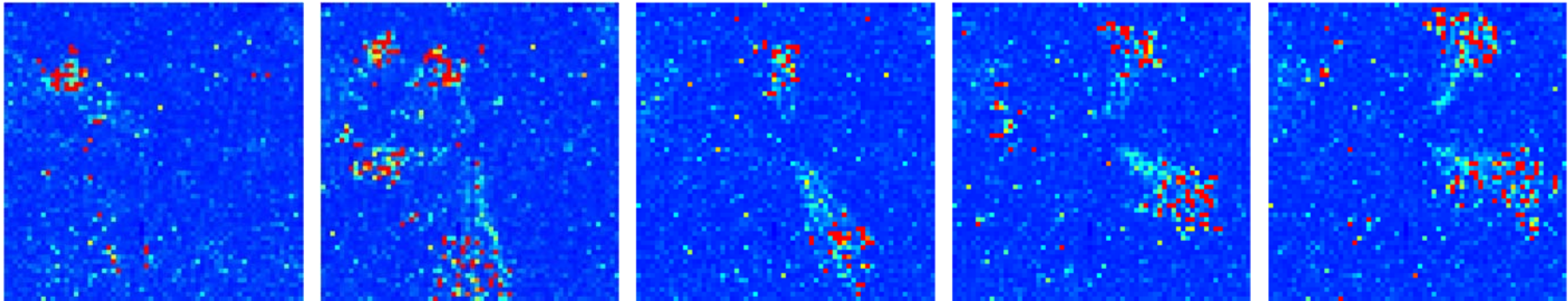


Observe action potential propagations along axonal bundles

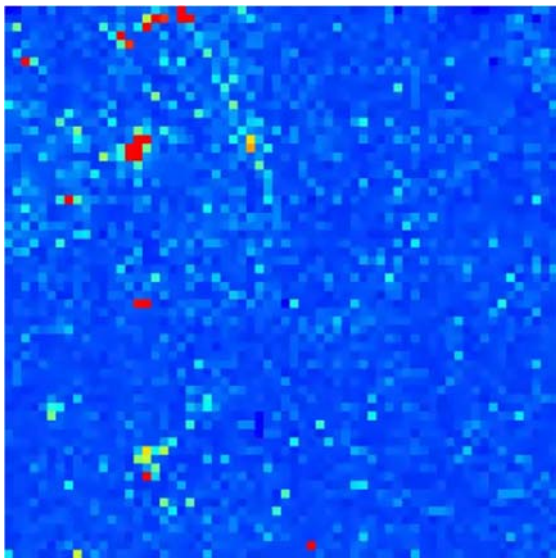


Spontaneous activity in the cone-rod homeobox knockout mouse retina, a model of photoreceptor dystrophy

Auf zu neuen Dimensionen 😊



■ 0μV → ■ 250μV - time span: ~1sec



“The large-scale, high-density capabilities of the 3Brain’s system bring our understanding of brain networks function to a new dimension”

Dr Evelyne Sernagor
Newcastle University