BioCAM DupleX

3 Brain

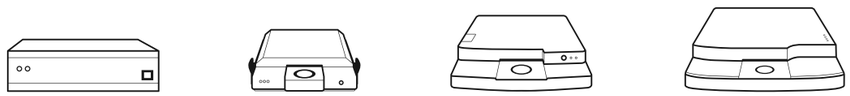
BioCAM DupleX

4096 electrodes for sensing and actuation in 2D and 3D *in vitro* brain models

BioCAM DupleX is the result of more than 15 years of 3Brain's experience in developing microchip embedded high-resolution multielectrode array platform.

The system integrating all the latest technological advances will provide the researcher a simple, fully informative experience in all experimental contexts requiring a bidirectional interaction with *in vitro* brain models.

Sensing and actuating from thousands of cells will be easy and immediate, large dataset will be stored and analyzed in a fast and simple way thanks to BrainWave, the most powerful software to handle electrophysiological data ever developed.



BioCAM Idea
2004

BioCAM 4096
2012

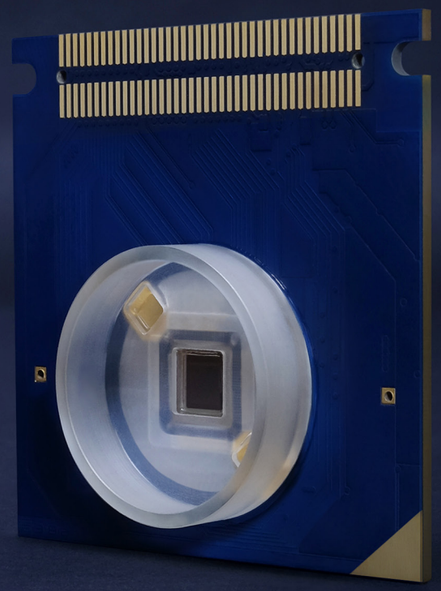
BioCAM X
2015

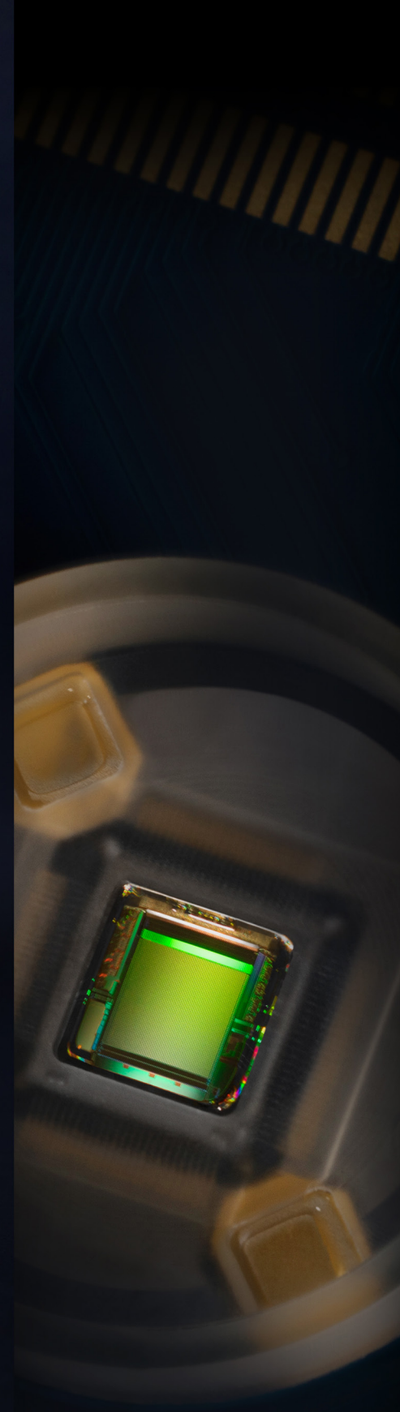
BioCAM DupleX
2019

4096 x 20kHz

BioCAM DupleX is empowered by CorePlate™ 1W 38/60, allowing it to select any of the thousands of recording electrodes to release an electrical stimulation thus combining a high-resolution sensing with a micrometer precise stimulation.

CorePlate™ 1W 38/60 is nowadays the most advanced chip on the market providing simultaneous recording of all the 4096 electrodes with the freedom to stimulate from any of them.

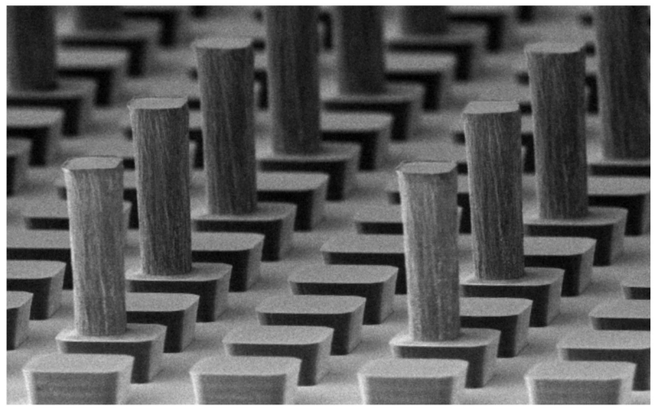


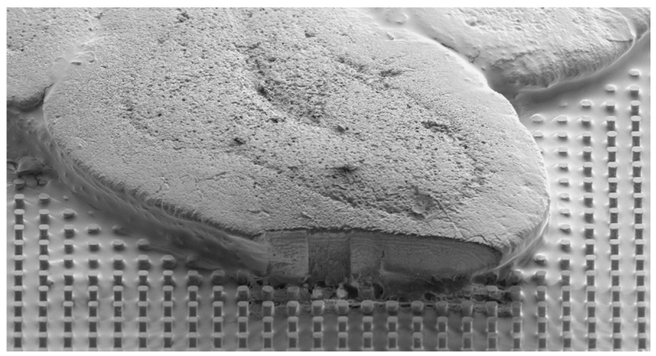


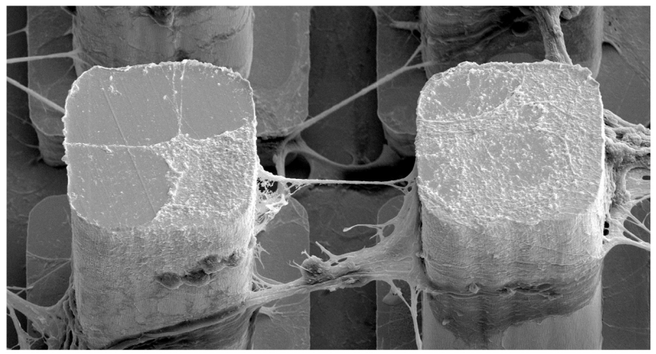
3D Brain tissue: the future of electrophysiology at your fingertips

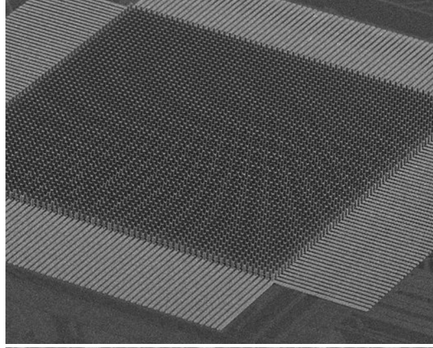
BioCAM DupleX is the first achievement of 3Brain's project in providing electrophysiological tool to finely explore the *in vivo* like activity generated by 3D *in vitro* models such as brain organoids or spheroids.

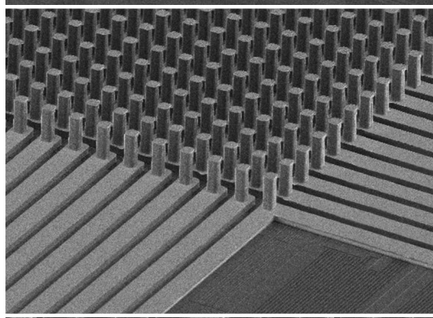
BioCAM DupleX is indeed the unique system able to acquire the signals recorded by the CorePlate™ 1W-3D 38/60/90, providing 4096 penetrating µNeedle electrodes. This revolutionary technology will enable the recording and stimulation from within a tissue, allowing the full exploitation of the use of 3D model in applications such as drug discovery, toxicology, personalized medicine etc…

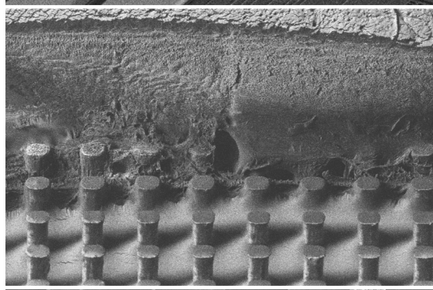


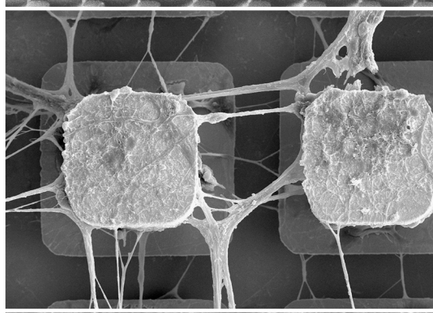


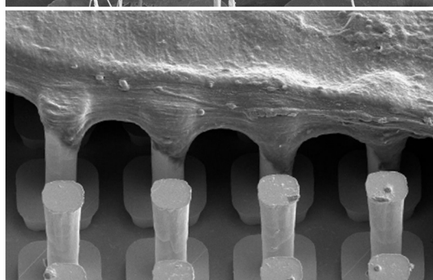








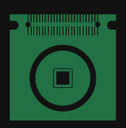




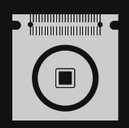
COMPATIBLE WITH ALL MEA CHIP SERIES

CorePlate™ 1W 27/42

GEN 1

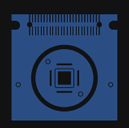


CorePlate™ 1W 27/42L



CorePlate™ 1W 51/81

GEN 2



CorePlate™ 1W 38/60

CorePlate™ 1W-3D 38/60/90

GEN 3

All the power you need

BioCAM DupleX has a completely revised electronic and improved hardware computational power to pre-process your data. Real-time optimized algorithms allow to filter, denoise and compress signals before acquisition, which opens infinite potentiality in exploiting the high content data provided by the BioCAM DupleX.

Compact - Easy - Fully accessorized

Like its predecessor BioCAM X, the BioCAM DupleX is a complete system comprising a stimulus generator, a temperature control and a magnetic plate to attach perfusion holders integrated into a compact aluminum case.

In addition, BioCAM DupleX implements an on chip integrated reference, thus simplifying experimental procedures and providing more freedom in using the system combined with other instrumentations as a microscope or a patch system.

Perfect alignment, perfect experiment

3Brain is always attentive to every detail in designing its products. The locking mechanism of the BioCAM DupleX has been equipped with a motorized system activated by the simple press of a button that will guarantee an always perfect contact alignment with the chip.

A set of LEDs will show the status of the system indicating if it is powered, a chip is locked, or if a recording is running.

One platform for all the chips

BioCAM DupleX is compatible with all of 3Brain's previous 1W chip series,comprising the 1st and 2nd generation (CorePlate™ 1W 27/42, CorePlate™ 1W 27/42L, CorePlate™ 1W 51/81) and the fully bidirectional CorePlate™ 1W 38/60 and CorePlate™ 1W-3D 38/60/90 chips.

HIGHLIGHTS

Unbounded performance

3D electrodes

for 3D *in vitro* models

4096

simultaneous recording electrodes

20 kHz/electrode

or up to 64kHz for electrode subsets

4096

stimulation sites

13 Gbps

Intel®'s Arria® 10 FPGA

2 GB

DDR4

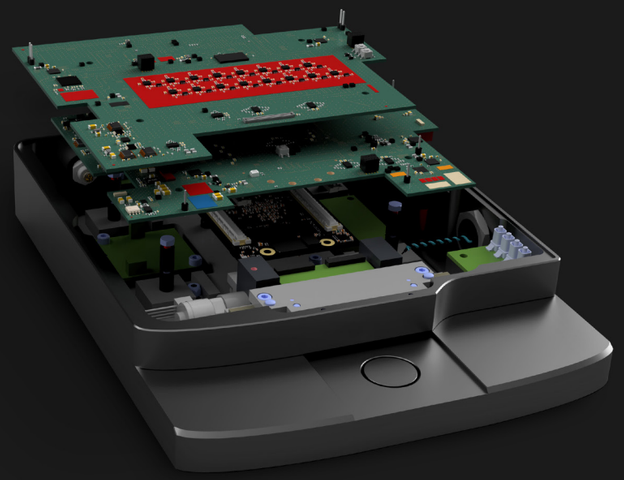
USB-C™

data interface

V.2

anti-spill barrier

UNDER THE CASE



REAL-TIME PROCESSING

Advanced FPGA control to denoise, filter and compress high-density data.

MAGNETIC SURFACES

All the surfaces around the MEA chip are magnetic for easy setup with other equipment, such as perfusion holders.

TEMPERATURE CONTROL

Integrated heating and cooling system.

INTEGRATED STIMULATOR

2 independently programmable stimulator channels (1 voltage and 1 current).

FAST LOCKING SYSTEM

A motorized solution to reliably lock and unlock your microelectrode array (MEA) chips.

ROBUST EXTERNAL CASE

Crafted from aluminum to shield from electromagnetic and mechanical noise.

MAIN CONTROLLER

computational core	Intel®'s Arria® 10 FPGA 13Gbps, 2GB DDR4, and ARM® dual-core Cortex™-A9 1.5 GHz
data resolution	12 bit
number of simultaneous recording channels	4096
sampling frequency (full-array)	20 kHz/electrode
region-of-interest	1 - 4 independent subsets of electrodes (up to 64 kHz sampling frequency)
temperature control	active heating and cooling system
data interface	USB 3.1 Type-C
ground reference	on-chip integrated
HD-MEA compatibility	CorePlate™ 1W 27/42, CorePlate™ 1W 27/42L, CorePlate™ 1W 51/81, CorePlate™ 1W 38/60
3D HD-MEA compatibility	CorePlate™ 1W-3D 38/60/90 (firmware upgrade required)
control software compatibility	BrainWave 4 or higher
inputs	two analog inputs (-3.3 V to 3.3 V) or triggers (LV-TTL)

STIMULATION MODULE

integrated current stimulator	✔
real-time stimulation controller	✔
number of independent channels	3 (2 int. and 1 ext.)
internal (on-chip) stimulation sites	4096 (only with CorePlate™ 1W 38/60)
external stimulation sites	2 (accessible with optional connector box)
maximum amplitude	+/- 1 mA
amplitude resolution	10 µA
time resolution	10 µs

PHYSICAL SPECS

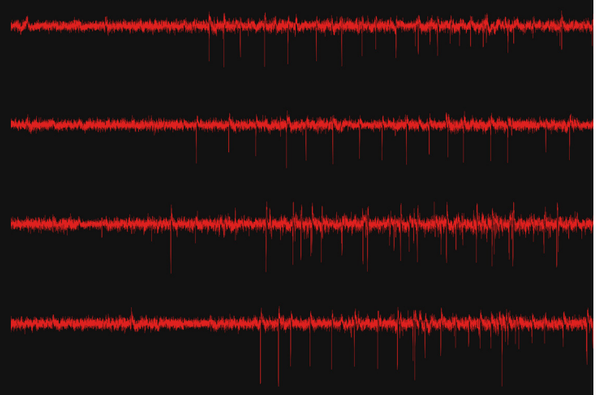
body material	anodized aluminum and stainless steel
locking mechanism	motorized
protection from liquid spill over	anti-spill barrier v. 2
dimensions (W x D x H)	180 x 230 x 42 mm 7.09 x 9.05 x 1.65 in
weight	2 kg / 4.4 lb

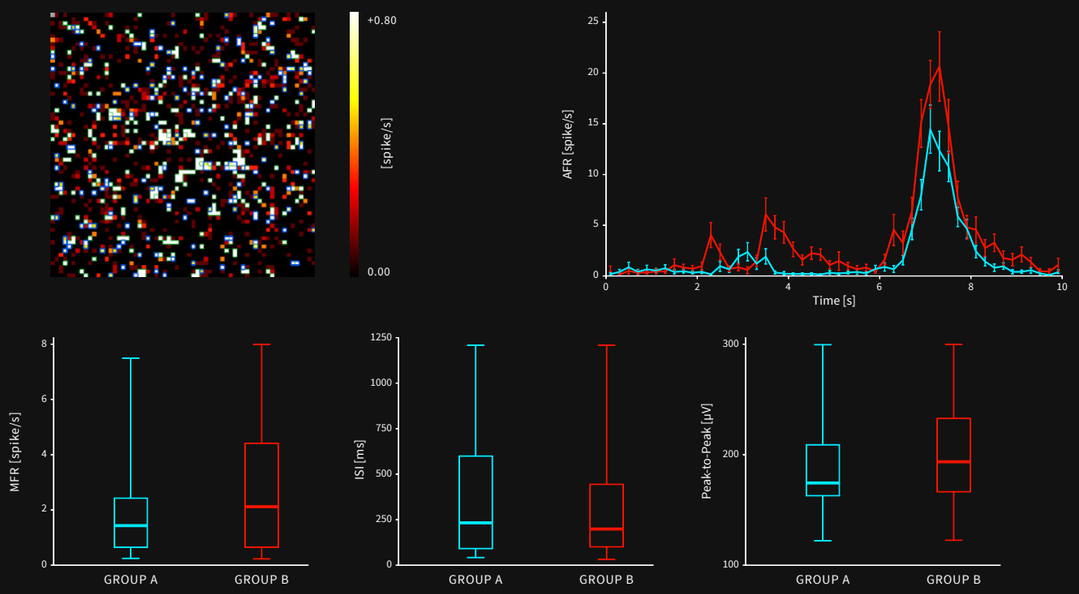
Chip generation	**GEN 1**	**GEN 2**		**GEN 3**
HD-MEA model:	CorePlate™ 1W 27/42	CorePlate™ 1W 27/42L	CorePlate™ 1W 51/81	CorePlate™ 1W 38/60
ELECTRICAL CHARACTERISTICS				
system bandwidth	1 Hz - 20 kHz	1 Hz - 20 kHz	1 Hz - 20 kHz	1 Hz - 20 kHz
noise	11 µV*	11 µV*	11 µV*	11 µV*
maximum input-referred signal amplitude	4 mV	4 mV	4 mV	40 mV
MAIN ARRAY				
mode of operation	recording	recording	recording	recording and stimulation (bidirectional)
# of electrodes	4096	4096	4096	4096
# of simultaneous recording electrodes	4096	4096	4096	4096
# of stimulating electrodes	-	-	-	4096
electrode size	21 µm x 21 µm	21 µm x 21 µm	21 µm x 21 µm	21 µm x 21 µm
electrode pitch	42 µm	42 µm	81 µm	60 µm
active area (area with electrodes)	2.67 mm x 2.67 mm	2.67 mm x 2.67 mm	5.06 mm x 5.06 mm	3.8 mm x 3.8 mm
SECONDARY ARRAY				
secondary Array	No	No	✔	No
mode of operation	-	-	stimulation	-
# of electrodes	-	-	16	-
electrode size	-	-	21 µm x 21 µm	-
electrode pitch	-	-	1.28 mm	-
electrodes area	-	-	3.86 mm x 3.86 mm	-
PHYSICAL SPECS				
flat area (around active area)	~3 mm x 3 mm	~6 mm x 6 mm	~6 mm x 6 mm	~6 mm x 6 mm
reservoir volume	~2.5 mL	~2.5 mL	~2.5 mL	~2.5 mL

** within 100 Hz - 10 kHz*

Human-derived neuronal cultures

Human stem cell-derived neuronal networks represent the future gold-standard in *in-vitro* neuroscience. 3Brain's technology can fully exploit such a model by recording outstanding spiking activity from human-derived neuronal cultures as the example on the right. Furthermore, acquired data can be analyzed in a fast and easy way using the neurocomputational tools integrated in BrainWave as shown in figures below.



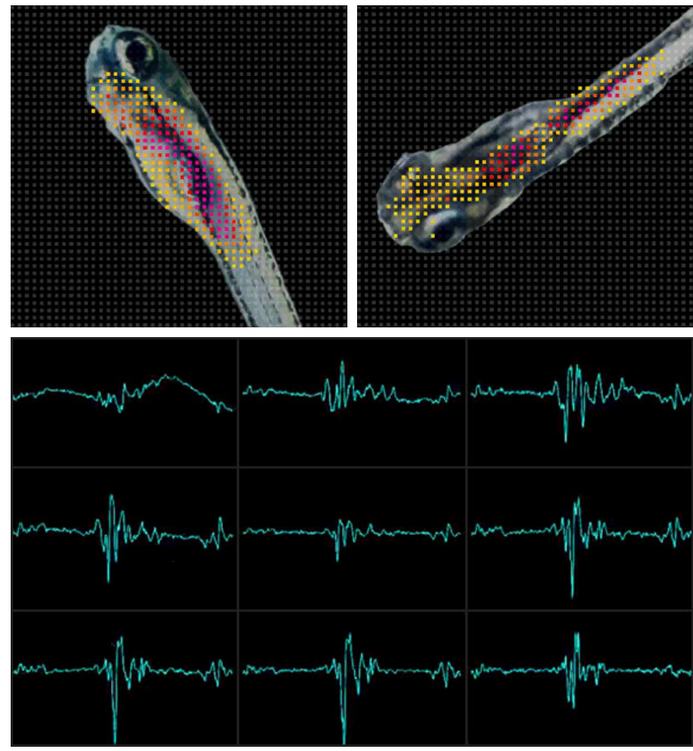


False color map (top left) of the spiking activity recorded from the 64x64 electrode array.
Average Firing Rate (top right) and boxplots (bottom) of the Mean Firing Rate, Inter Spike Interval and Spike Amplitudes computed on two selected distinct groups of neurons.
(Courtesy of Dr Ma'ayan Semo, Institute of Ophthalmology, University College London).

Zebrafish for toxicology and drug discovery

Zebrafish is emerging as a new important tool in studying brain disfunction with an increasing key role in toxicology and drug discovery applications due to its peculiarities as a genetic structure and major organs development similar to humans.

3Brain's HD-MEA can easily record from the entire zebrafish providing a detailed map of the functional activity, thus representing a powerful tool to study this fascinating biological model.



Examples of whole zebrafish electrical activity recording by means of HD-MEAs.
(Courtesy of Dr. Karen Mruk, School of Pharmacy, University of Wyoming).

DESIGNED IN SWITZERLAND

3Brain AG

Huobstrasse 16 - 8808 Pfäffikon SZ - Switzerland

+41 81 322 70 86 - contact@3brain.com - www.3brain.com