

SynFire® Human iPSC-derived induced neurons

Protocol with Axion 48-well MEA plates

Important: Before use, add the whole volume contained in each Supplement to its corresponding Basal Media bottle as follows:

1. Add supplements to basal media right before using. In order to prevent media from expiring prior to the completion of your assay, don't prepare such mix too early in your assay workflow.
2. For the Seeding Media, add whole content of Seeding Supplement into the Seeding Basal Media bottle. Protect the bottle from light.
3. For the Short-Term Media, add whole content of Short-Term Supplement into the Short-Term Basal Media bottle. Protect the bottle from light.
4. For the Long-Term Media, add whole content of Long-Term Supplements into the Long-Term Basal Media bottle. Protect the bottle from light.
5. When warming up media prior to every media change, only heat the amount of media needed for media change for the day. In order to prevent media from expiring prior to the completion of your assay, don't warm up the entire bottle of media at every media change.

Coating of MEA Plates

1. Prepare borate buffer (1L): dissolve 3.1 g of boric acid and 4.75 g of sodium tetraborate in distilled water. Adjust pH to 8.4.
2. Prepare 0.1% polyethyleneimine (PEI) solution: dilute 50% PEI stock solution 1:500 in borate buffer. Sterilize 0.1% PEI solution using a 0.22 µm filter.
3. Add 70 µl of prepared 0.1% PEI solution to each well of a 48-well MEA plate. Add approximately 4-5 ml of sterile water to the surrounding areas outside of the wells to reduce media evaporation. Incubate overnight at 37°C.
4. Aspirate PEI solution and thoroughly rinse each well 4 x with 400 µl of sterile water.
5. Dilute laminin stock (1 mg/ml) to 20 µg/ml in PBS.
6. Add 70 µl of prepared laminin solution to each well of the MEA plate and incubate for at least 1 hour at 37°C.
7. Aspirate laminin and directly plate cells.

Thawing of iN and Astroglial Cells

1. To thaw the cells, put the vial in a 37°C water bath with gentle agitation for ~2 minute. Keep the cap out of water to minimize the risk of contamination.
2. Transfer the cells into a 15 ml conical tube with pre-warmed (37°C) Seeding Media. Repeat steps 1-2 for all cell types.
3. Check cell number and viability.
4. The recommended starting number of cells per well of an Axion 48-well plate is 270K (140K Glutamatergic, 60K GABAergic, and 70K Astroglia). Alternatively, the end-user can adjust the ratio of the different cell types to fit their experimental needs.
5. According to the recommended cell density, pool the adequate volumes (adjusted for 50 wells) of each cell type into a new 15ml conical tube, and centrifuge at 250 x g for 5 minutes at room temperature.
6. Aspirate the supernatant and resuspend the cells in 2.5 ml of **Seeding Media**. This volume corresponds to 50 µl/well (adjusted for 50 wells) for subsequent seeding on PEI/laminin-coated MEA plates.

Plating iN and Astroglial Cells into MEA Plates

1. Add 50 µl of pooled cell mix to each well of a previously coated 48-well MEA plate.
2. Incubate seeded MEA plate in a cell culture incubator at 37°C, 5% CO₂, and 95% humidity.
3. Next day, add 250 µl of **Short-Term Media** to each well.

Maintaining Human Neural Co-cultures

1. Perform half-medium changes with **Short-Term Media** every other day.
2. At day 7 after seeding, switch medium gradually to **Long-Term Media** by aspirating 150 µl of old medium and adding 150 µl of new medium.
3. Perform half-medium changes with **Long-Term Media** once every 3 days.

Data Acquisition

Spontaneous synchronized neuronal network activity can be measured starting at 3-4 weeks after seeding. Functional neural co-cultures can be maintained for assessment of neuronal activity for up to 8 weeks. Data acquisition for compound screening usually includes measurements of neuronal activity prior to compound application (baseline) and measurements after compound application (dose). Recordings of neuronal activity using the Axion BioSystems MEA platform is performed on the Maestro unit controlled by the AxIS Software according to the manufacturer's protocols.