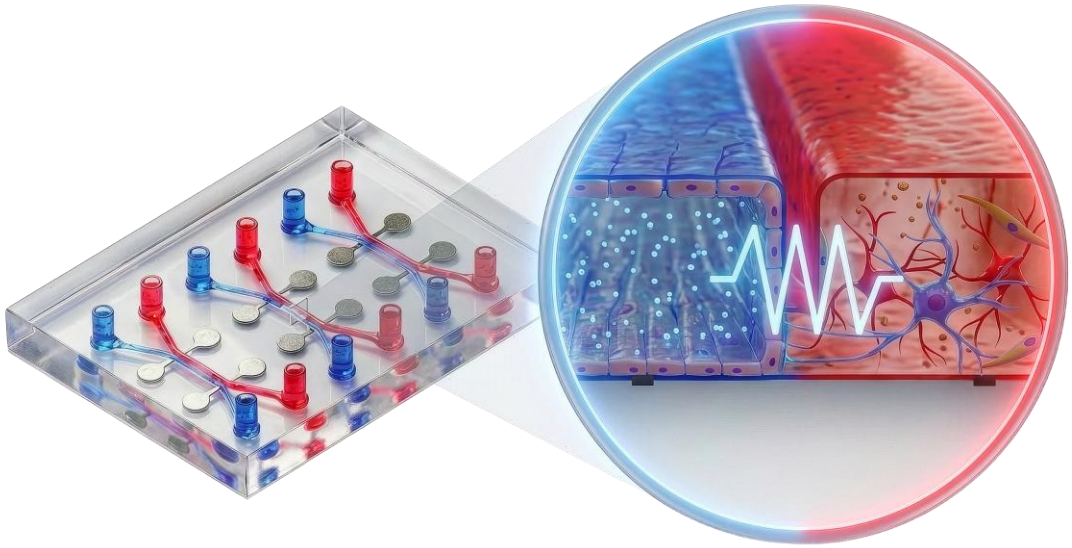
TECHNICAL MANUAL

SYNVIVO

REALISTIC.
DYNAMIC.

Organ-on-Chip Models



SynTEER™ Multiplexed Organ-on-Chip Model

TEER Embedded Electrodes CONFIGURATION

For Chips and Starter Kits:
Catalog #s: 402016, 105016-STE8

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INTRODUCTION

Introduction

The SynVivo SynTEER™ chip recreates tight junctions of the in vivo blood brain barrier (BBB) by mimicking a histological slice of brain tissue cells in communication with endothelial cells. Electrical resistance measurements provide a non-invasive method for real-time monitoring of tight junctions. Tight junction formation between cells (e.g., blood brain barrier) can be evaluated by measuring changes in electrical resistance in the intercellular space between cells. The SynVivo Cell Impedance Analyzer, used in conjunction with the SynTEER chip, measures electrical impedance (resistance, denoted by "Z").

TEER Workflow

Figure 1 shows a schematic of the SynTEER embedded electrodes chip required for capturing TEER (Z) measurement across the cell barrier. The SynTEER chip consists of 3 model units, each with a vascular channel (blue) and tissue channel (red) separated by a porous barrier. Electrodes running through the channels are connected to the Cell Impedance Analyzer through circular contact pads (gray).

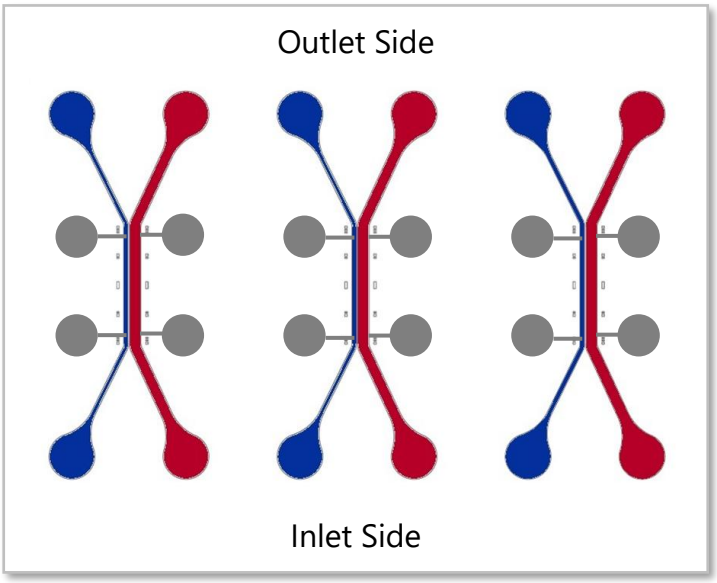

Fig. 1 SynTEER Embedded Electrodes Chip Schematic

TEER Workflow

There are six basic steps in the SynTEER workflow for functionalizing channels with cells under flow conditions and measuring TEER:

1. Coat channels with the desired extracellular matrix.
2. Prime channels with serum-free basal media to remove all trapped air bubbles.
3. Measure the baseline TEER (blank) before adding cells into the channels.
4. Seed cells into the appropriate channels.
5. Establish flow over the endothelial cells in the vascular channel.
6. Perform the desired assay and measure TEER.

For functionalization of a primary human blood brain barrier model in SynTEER, please see SynBBB 3Plex-Configuration Technical Manual.

Measuring TEER

The SynVivo TEER system consists of a probe and a meter (Figure 2). The probe has a cradle for holding the SynBBB TEER chip and a lever arm for engaging the electrical connection with the contact pins. The cradle can be placed in a left, middle, or right position to correspond to the three BBB units on each 3PLEX SynBBB TEER chip. It is recommended for most cells to keep the side switch to the middle position (1000 Hz frequency).

Fig. 2 Analyzer and Probe Set-up

Protocol for Measuring TEER:

1. Mount the SynTEER chip onto the probe cradle.
2. Position the cradle against the probe in the right-most position (the probe will be aligned with the left-most model unit on the chip).
3. Move the lever arm in the downward position so that the contact pins engage with the circular contact pads on the chip.
4. Press the button on the front of the meter to acquire the measurement.
5. Record the **Z** measurement in kOhms.
6. Lift the lever arm and re-position the cradle to the center position.
7. Repeat steps 3 through 5 to record TEER for the center model unit.
8. Lift the lever arm and re-position the cradle to the left-most position (the probe will be aligned with the right-most model unit on the chip).
9. Repeat steps 3 through 5 to record TEER for the center model unit.

Calculating TEER

Much like the Transwell format, the “blank” TEER measurement must be subtracted from the acquired value of the vascularized channel to achieve the TEER of the cell barrier. Use this formula to calculate TEER from the cell model:

$$TEER_{Barrier} = TEER_{Measured} - TEER_{Blank}$$

All measurements are expressed in kOhm units.

Troubleshooting

All measurements should be in the range of 15 to 100 kOhms. If the measurement is >>100 kOhms, there may be an issue with the connection between the probe and chip. Be sure that the chip is fully perfused with cell media, and the contact pins are engaged with the contact pads of the chip.