



Human Engineered Muscle Tissue (EMT)

Scalable, patient-specific 3D *in vitro* platform for target discovery and drug screening

Patient-derived, hiPSC-engineered skeletal muscle tissues (EMTs) give a scalable, on-demand supply of disease-relevant human muscle. With automated functional readouts and isogenic controls, they bridge the gap between animal models and clinical research.

Scalability

24 EMTs analysed in 90 seconds.

Translational predictability

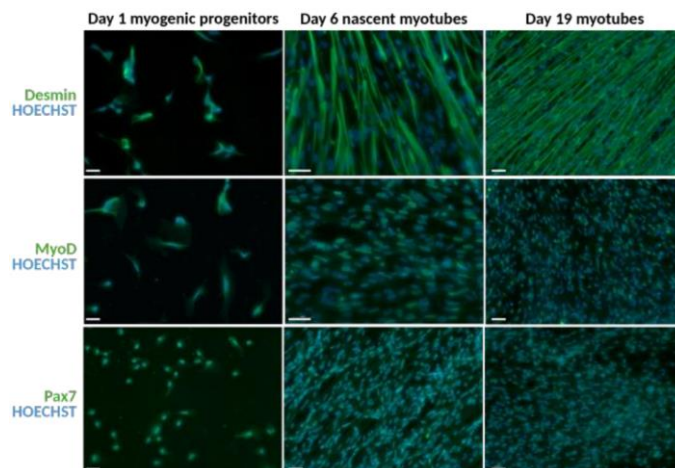
Reproducible human tissue architecture.

Sterile closed-loop analytics

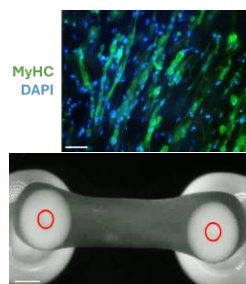
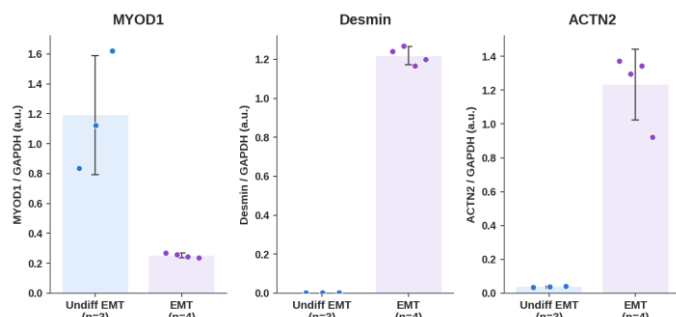
Automated, GLP-compliant data collection.

Platform architecture & tissue engineering

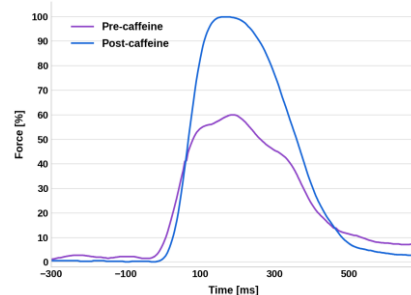
- **hiPSC source lines.** EMTs are built from healthy control, patient-derived or CRISPR-edited isogenic hiPSC lines using transgene-free directed differentiation.
- **Myogenic progenitors.** hiPSC-derived myogenic progenitors are PAX7⁺ and MYOD1⁺ (left panel) before they are cast into 3D tissues.
- **3D structural scaffold.** In fibrin/Matrigel between elastic pillars, progenitors differentiate into aligned, multinucleated, cross-striated myotubes (below left and middle).
- **Biomimetic maturation.** Chronic electrical pacing and adjustable mechanical loading. Hormonal cues can be added to the medium: T3 drives the switch to adult myosin isoforms, IGF-1 drives myotube growth.



IF of hiPSC-derived myogenic progenitors (day 1) and differentiated myotubes (days 6 and 19) in 2D; desmin, MyoD or Pax7 with Hoechst, scale bar 50 µm.



Western blot quantification of MYOD1, desmin and ACTN2 normalised to GAPDH in undifferentiated vs. differentiated EMTs (left). EMT: IF for MyHC/DAPI (scale bar 50 µm) and brightfield (scale bar 1 mm; middle). DiNAQUBE™ functional readout of an EMT: average of 10 twitches pre- and post-caffeine treatment (20 V, 0.5 Hz, transgene-free hiPSC-derived single-lineage EMT; right).



Comparative scientific evaluation: EMT platform vs. traditional models

Feature / metric	<i>In vivo</i> rodent models	Primary human muscle biopsies	EMT platform
Fiber-type biology	Most limb fibers express fast type 2B myosin (MyHC-2B, encoded by <i>Myh4</i>), which human limb muscle does not express at the protein level.	Variable; depends on anatomical site and patient history.	Human MyHC isoform repertoire; fiber-type programme can be steered by pacing, loading and hormonal cues.
Translational relevance	Disease course often differs from patients: <i>mdx</i> mice lack dystrophin yet never lose ambulation and live close to a normal lifespan.	Direct patient representation.	Human disease background with customisable genotypes; hiPSC-derived motor neurons can be co-cast to model neuromuscular junction disease.
Therapeutic compatibility	Species differences limit AAV tropism, promoter activity and sequence matching.	High variability across clinical samples.	Directly compatible with human-specific therapeutics, AAV vectors and nucleic acids.
Viability & longevity	Chronic dosing possible <i>in vivo</i> , but direct force assays are largely terminal; isolated muscle stays viable <i>ex vivo</i> only for hours.	Ischaemia-sensitive; observation window of ~30 min to hours.	Weeks of stable culture; chronic dosing with repeated force readouts on the same tissue.
Sample availability & baseline controls	Abundant inbred strains.	Scarce and donor-dependent; confounded by age, comorbidities and medication.	Scalable, on-demand supply from banked hiPSC lines; clean, genetically matched isogenic controls.
Genetic manipulation	Variable efficiency depending on model.	Low transduction efficiency; no clonal selection.	Efficient genome editing and transgene insertion.

Workflow integration

01 Phenotype induction

Disease-specific or target-perturbed hiPSC-derived EMTs.

02 Functional assays

Repeated DiNAQUBE™ contractility readouts, such as twitch force pre/post caffeine at set pacing rates.

03 Multi-omics integration

DiNALYTIQS™ links force data with RT-qPCR, sequencing, mass spectrometry, Western blot and ELISA.

04 Validation & hit selection

Rank by phenotype rescue; re-validate in independent donor lines or run contractility safety assays.