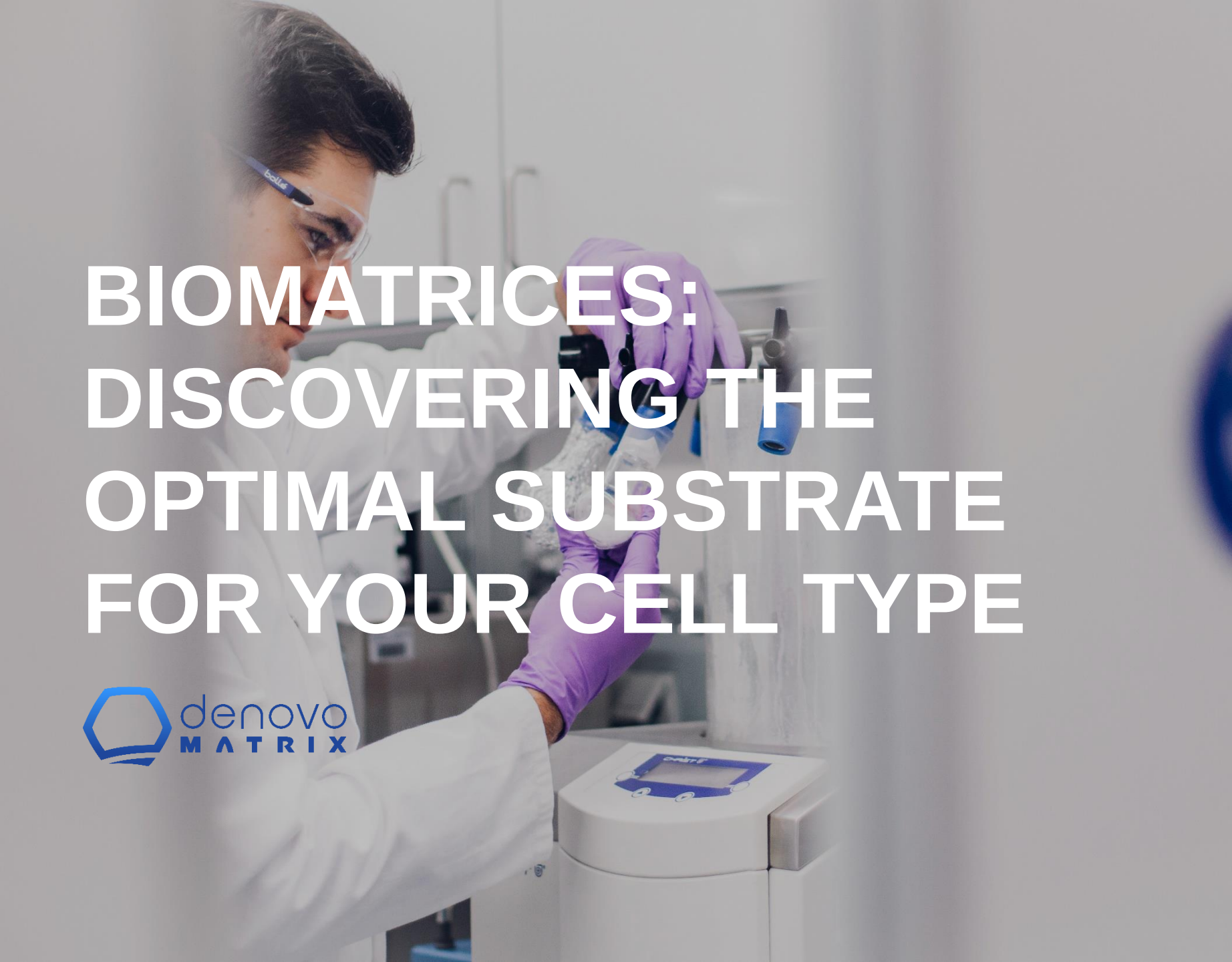


BIOMATRICES: DISCOVERING THE OPTIMAL SUBSTRATE FOR YOUR CELL TYPE

denovo MATRIX

INTRODUCTION

Cell culture is changing – and changing rapidly.

The movement of Goodbye Flat Biology/3D cell culture. Organ-on-chip and even human-on-chip technologies. Specialized serum-free medias and ECM-mimetic substrates. Through these developments Life Science researchers are offered several of benefits for their cell culture practices. All promise multiple advantages such as more biological relevance, robust use, and lower costs. But which are worth your time, and which should be viewed with caution?

One of the most important, and currently least developed technology in standard cell culture today are ECM-mimetic substrates. Many new product offerings are on the market – like synthetic and semisynthetic hydrogels – as well as many established ones - like Matrigel and collagen. Researchers are left with the challenging task and considerable cost of testing and finding an optimal solution.

This special report will provide an overview of current technologies for addressing the issue of recreating an in vivo-like ECM, and present important features to consider for various applications.

Table of Contents

CURRENT CHALLENGES

There is clearly a mismatch between what one research group is producing and what another can validate. Studies indicate US $10 billion is spent each year due to biological reagents and reference materials resulting in preclinical research that is not reproducible[1] . A root cause for this reproducibility issue can be that cells aren't being cultured in conditions which are reproducible, AND which are similar to those found in the human body[2]. Every Life Science researcher will know that reproducibility is easy in tissue culture plastic – but few cells of interest grow in such conditions. Various surface coatings have been developed to recapitulate ECM signals for in vitro cell culture[3], however research in this area has stagnated. ''…the most disappointing aspect of iPSC development is the matrix for cell growth. The technology that we use right now is what we used in 2003…" said Paul Burridge, PhD, assistant professor, Northwestern University in 2017[4]. Additionally, which is right for your particular application? Few researchers have the time or the funds to test multiple substrates. ''You can purchase more materials and hire more team members, but you can never buy back lost time'' says Jennifer Miller, laboratory manager at Chromocell[5].

> “…the most disappointing aspect of iPSC development is the matrix for cell growth. The technology that we use right now is what we used in 2003…”

***Paul Burridge, PhD**, assistant professor, Department of Pharmacology, Center for Pharmacogenomics, Northwestern University*

INSIDE LOOK INTO THE STERNECKERT LAB

Dr. Jared Sterneckert’s group uses induced pluripotent stem cells to generate disease models for neurodegenerative diseases, such as amyotrophic lateral sclerosis (ALS) and Parkinson’s disease (PD). His group currently uses matrigel for culturing their iPSCs, and has faced a number of challenges so far. Consistency in batch to batch performance can be an issue - ‘’We only use pre-approved/certified Matrigel’’ says PhD student Lara Marrone, ‘’we’ve experienced losing our cultures when switching to a new stock, which is particularly upsetting when long-term experiments are affected’’.

The group has a healthy portion of their budget spent on Matrigel alone. ‘’Matrigel used to cost 400 € for a bottle, and recently due to demand prices have gone up to 460 €’’ says Dr. Sterneckert. However, cell culture maintainance wasn’t the only issue. When exploring cell differentiation into mature lineages, it was clear that certain differentiation rounds worked better than others “we don’t know which ECM components are essential, so perhaps we are missing something in the media, or something in the substrate to get successful differentiation..” claims Dr. Sterneckert.

CELL CULTURE SUBSTRATES ON THE MARKET

Here is a list of all currently available extracellular matrix substrate products as of 2018. Products are categorized according to important characteristics such as containing adhesion ligands, degradability, or compatibility with microscopy. Suitability for specific types of cell culture have also been evaluated, and are shown in green.

	Fibronectin	Vitronectin	Osteopontin	Collagen (I,IV,etc)	Gelatin	Laminin	Biolamina, recombinant Laminin	3D MATRIX, puramatrix	biogelx, biogelx powder	ESI-BIO, Hystem	Trevigen, cultrex	East River BioSolutions, TissueSpec	ectica, 3DProSeed	Corning, matrigel	Corning, Synthemax	Corning, Synthemax II	Corning, Osteo-assay	Corning, Ultra-low attachment	BRTI Life Sciences, Cell-Mate3D	Pepgel, PGmatrix	Novamatrix, Novatach	Orla, OrlaExplorer-ECM	Cellendes, 3D-Life	Amsbio, mimetix	Amsbio, iMatrix	Amsbio, MAPTrix	Amsbio, Alvetex	Noviocell, PIC hydrogel	Organogenix, NanoCulture Plate	primorigen biosciences, StemAdhere	The well bioscience, Vitrogel 3D	Thermofisher, Algimatrix	Thermofisher, CELLstart	Thermofisher, Geltrex	Lonza, RAFT	Global Cell Solutions, GEM	InSphero, GravityPLUS	denovoMATRIX, screenMATRIX
Ease of use (protocol free)	▪	▪	▪	▪		▪	▪	▪	▪			▪			▪	▪	▪	▪		▪				▪	▪	▪			▪	▪		▪	▪	▪			▪
Adhesion Ligand	▪	▪	▪	▪	▪	▪	▪			▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪			▪	▪	▪	▪	▪	▪	▪		▪
Oligosaccharide							▪			▪	▪	▪		▪	▪				▪		▪								▪		▪	▪				▪
Degradable				▪	▪			▪	▪	▪	▪	▪		▪	▪				▪	▪	▪		▪				▪			▪	▪		▪			
Cell recovery/Trypsination	▪	▪	▪	▪	▪	▪	▪					▪			▪		▪					▪			▪				▪	▪		▪	▪			▪
Chemical reaction free	▪	▪	▪	▪	▪	▪	▪	▪	▪		▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪		▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Growth Factor storage/release										▪	▪	▪		▪																	▪	▪					▪
Chemically defined							▪	▪	▪	▪			▪		▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪		▪	▪	▪				▪
Microscopy compatible	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪		▪	▪	▪				▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Suitable for Stem cell culture		▪					▪			▪					▪				▪						▪	▪			▪			▪					▪
Suitable for Cancer cell culture	▪	▪		▪	▪	▪	▪				▪	▪	▪	▪	▪			▪	▪		▪	▪	▪	▪	▪	▪		▪		▪		▪	▪	▪	▪	▪	▪
Suitable for Primary cell culture	▪	▪				▪	▪			▪					▪		▪					▪	▪		▪	▪			▪	▪			▪			▪		▪
Suitable for screening							▪					▪										▪				▪											▪
ECM protein																																					
peptide nanofiber hydrogel																																					
peptide nanofiber hydrogel																																					
hyaluronate, collagen, Polyethylene glycol																																					
EHS tumor extract																																					
Tissue specific extracts																																					
polymer																																					
EHS tumor extract																																					
vitronectin derived peptide																																					
Plastic microbeads coated with synthemax																																					
crystalline calcium phosphate																																					
hydrophilic uncharged polymer surface																																					
Hyaluronate -Chitosan hydrogel																																					
Peptide hydrogel																																					
RGD coupled alginate																																					
32 recombinant ECM proteins																																					
Dextran PVA - PEG hydrogels																																					
PLLA electrospun fibres																																					
E8 Fragment from laminin																																					
recombinant chimeric ECM proteins																																					
Porous Polystyrene sheet																																					
thermoreversible polyisocyanopeptide hydrogel																																					
low adhesion patterned plates																																					
recombinant protein, human origin																																					
polysaccharide hydrogel, non-covalent crosslink																																					
alginate gels																																					
Human plasma extract																																					
EHS tumor extract																																					
Collagen, RAFT (Real Architecture For 3D Tissue)																																					
Alginate microcarrier ferromagnetic beads																																					
hanging drop ECM-free																																					
Glycosaminoglycan PEG-Peptide biomatrix																																					

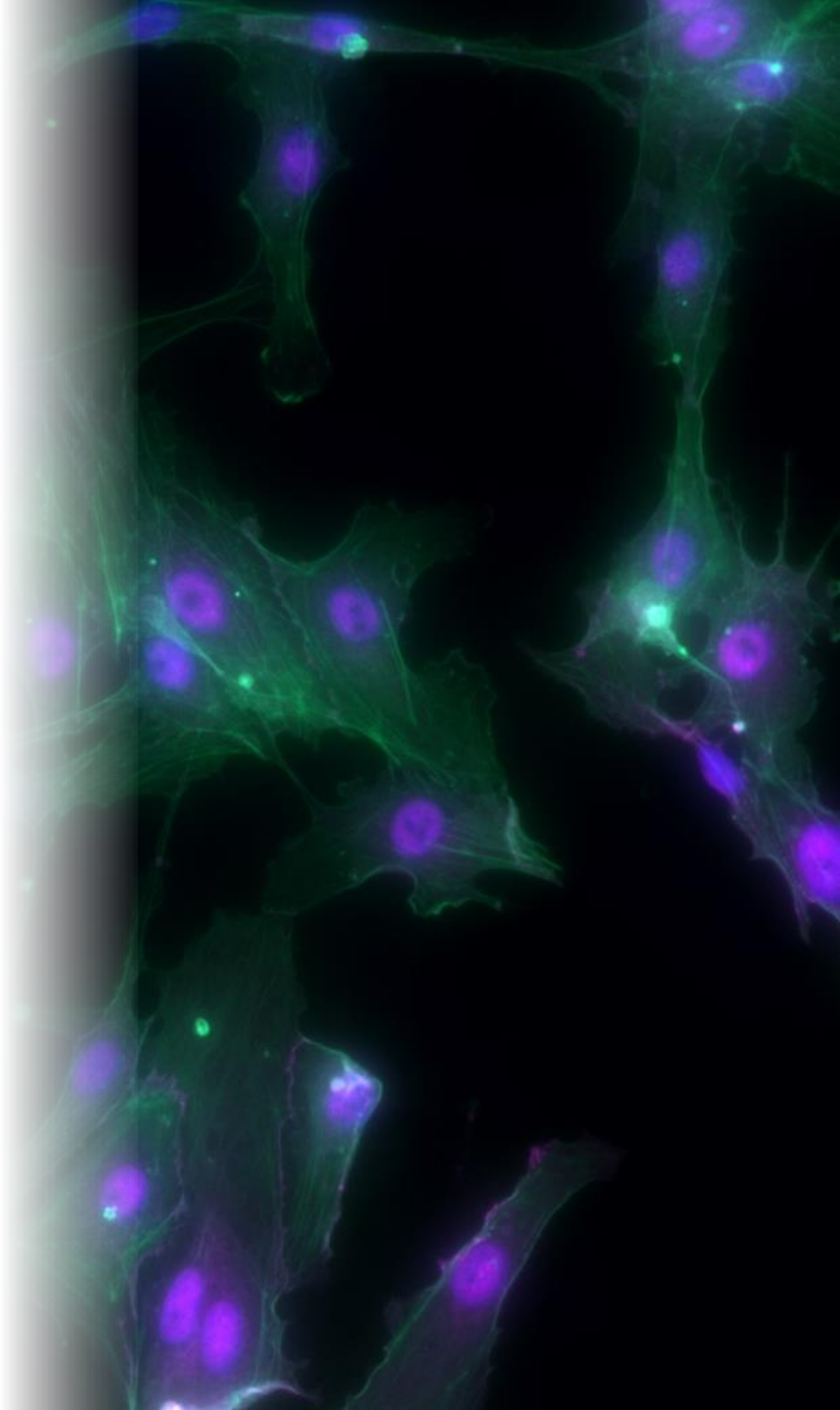
denovoMATRIX is a young, dynamic spin-off of the TU Dresden, with an innovative take on creating ECM substrates for cell culture.

denovoMATRIX believes that biologically relevant, yet completely chemically defined extracellular mimetics/substrates are the future of cell culture practices. Their very first product is a screening tool to enable testing of a large variety of ECM factors for isolating, maintaining or differentiating cells.

The **screenMATRIX** is a easy to use 96-well plate containing different microenvironments in each well, allowing users to rapidly discover optimal growth conditions for their cells.

So get in touch with us on our website, try out denovoMATRIX for your cell application and join us in

enabling human biology *in vitro*



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