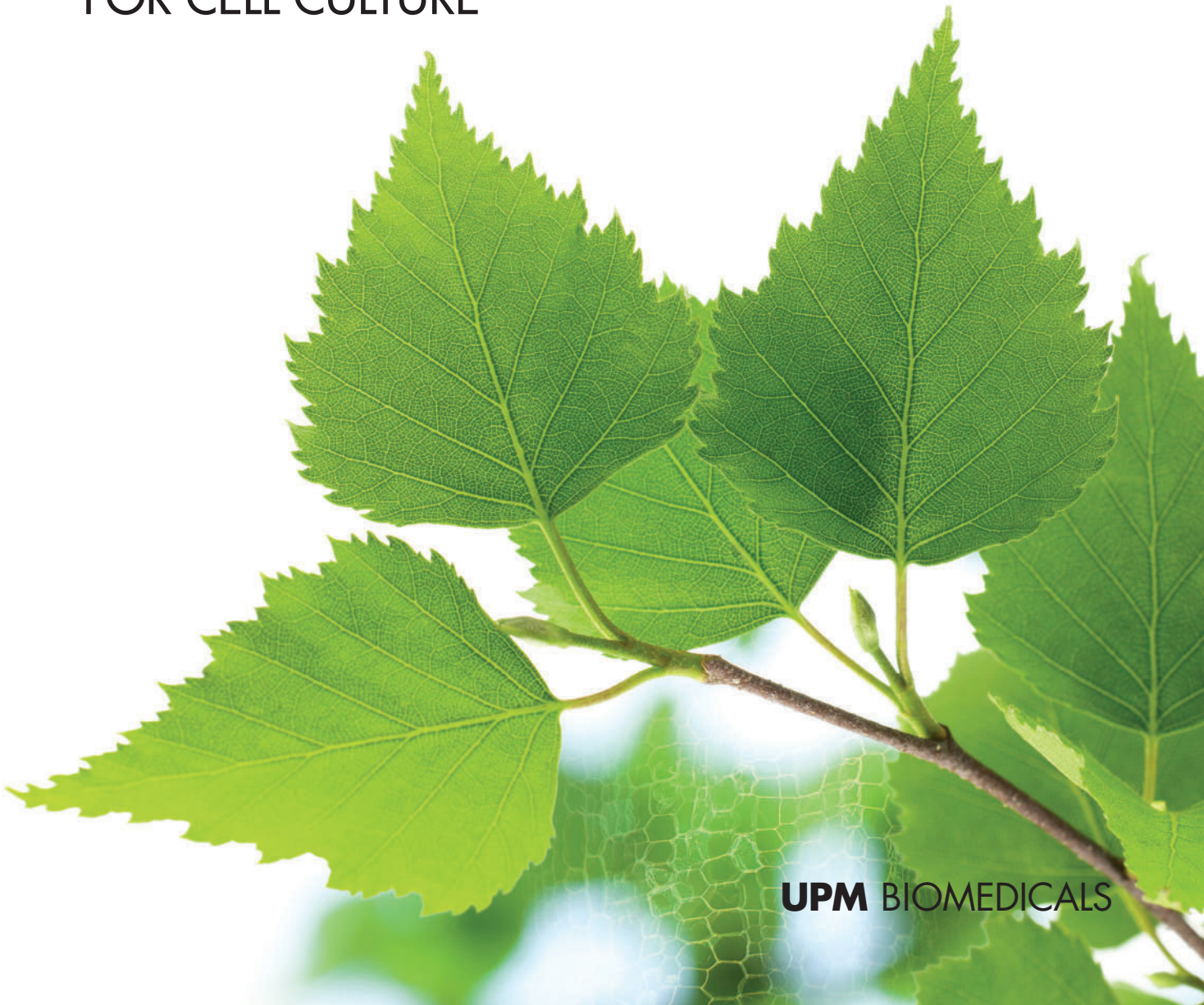


GrowDex[®]

THE NATURAL CHOICE
FOR CELL CULTURE



GrowDex[®]

Nature's solution – a bio-friendly hydrogel extracted from birch and sourced from sustainable and responsibly managed forests. GrowDex[®] is a ready to use hydrogel that mimics the extracellular matrix (ECM), supporting cell growth and differentiation with consistent results. The versatility of GrowDex has seen it used in numerous applications ranging from: 3D cell culture and organ-on-a-chip models, through to drug release studies and 3D printing. GrowDex is ideal for these and other applications due to its unique properties:



ANIMAL FREE

Xeno-free with no detectable endotoxins, GrowDex is pH neutral and supplied in a user friendly syringe for convenience and ease of use.



ROOM TEMPERATURE STABLE

Stored, shipped and used at room temperature, this stable hydrogel eliminates the need for temperature control, costly transportation and is ideal for use in liquid handling system for the automation of any cell-based assay.



READY TO USE

GrowDex truly is a ready-to-use hydrogel. No cross-linking, no gelation, no sonication or any other steps required prior to use. Just mix with your media and cells, dispense and incubate.



REPRODUCIBLE LOTS

Raw material supply, production procedures and quality control checks, to ensure that GrowDex is manufactured reproducibly to the highest standards.



BIOCOMPATIBLE

The biocompatible nanofibrillar network allows easy diffusion of small molecules such as nutrients and oxygen supporting the culture of various cell types.



TUNABLE VISCOSITY

The viscosity "stiffness" of GrowDex can be tuned by dilution with media. As different cell types thrive in different micro-environments, determining the optimum conditions for your cells is imperative. Being ready to use, dilution curves with GrowDex are quick and easy to prepare.



MICROSCOPE & IMAGING COMPATIBLE

GrowDex is not auto-fluorescent, is compatible with microscope and cell imaging systems and can be used for brightfield, phase contrast or fluorescence image capture.



ONE-STEP CELL RECOVERY

GrowDase enzyme allows easy recovery of cells, spheroids or other sample from GrowDex without disrupting or destroying the structure.

VISIT WWW.GROWDEX.COM
FOR MORE INFORMATION,
VIEW THE LATEST PUBLICATIONS
AND TO DOWNLOAD OUR
APPLICATION NOTES.



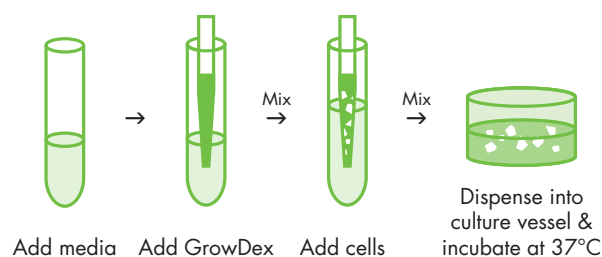
Culture your cells with confidence

Being a completely xeno-free hydrogel, GrowDex enables you to have complete control over the culture environment for you cells. This flexibility has enabled GrowDex to be used in a wide variety of assays culturing cells from many different sources, such as primary hepatocytes for *in vitro* drug screening or patient derived cells in a personalized medicine study. Other examples include:

- 3D organoid formation
- Hepatocyte toxicity, induction and metabolism
- Stem cell proliferation and differentiation, ES, iPS & MSCs
- Tumor cell migration and invasion
- Neurite outgrowth and network formation
- Patient specific cells and biopsies
- Human corneal cells
- Lung adenocarcinoma
- Osteoblast and chondrocyte
- Melanoma
- Co-culture of various cell types
- Regenerative medicine and tissue engineering

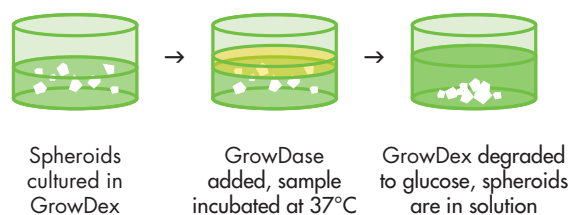
Mix & use

Ready to use GrowDex makes cell culture simple.
Just mix media, cells and GrowDex together and dispense.
What could be easier!



Harvest your cells

Recovering your cells or organoids post culture is a one step process. Add our GrowDase™ enzyme to your culture and incubate at 37°C. The enzyme digests the GrowDex leaving your cells in solution for re-plating or downstream processing



Ordering information

Visit our webshop at www.growdex.com or contact us at growdex.sales@upm.com.

CATALOGUE CODE	DESCRIPTION
100 103 005	GrowDex® 5 ml syringe
100 103 010	GrowDex® 10 ml syringe
100 103 305	Multi-pack GrowDex® 3 x 5 ml syringe
100 103 905	GrowDex® 5 ml syringe + GrowDase™ 2.5 ml Combo pack
900 102 002	GrowDase™ 2.5 ml, 10 mg/ml

Not just for cell culture

GrowDex is not limited to 2D and 3D plate-based assays, but it has been used successfully in a number of other areas. Here are a few examples to give you an insight:

Organ-on-a-Chip Models

The thixotropic nature of GrowDex allows the hydrogel to be dispensed into the channels of a microfluidic device. GrowDex is able to retain its structure once in place making it ideal for use with organ-on-a-chip models.

Drug Delivery Vehicle

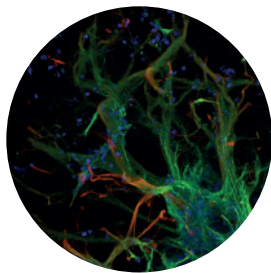
The biocompatible hydrogel can be mixed with test drug for use in drug release studies.

Cell Barrier

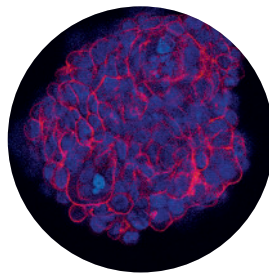
GrowDex at high concentration can be used to form a barrier preventing cell migration but allowing nutrient, drug or metabolite diffusion.

3D Printing

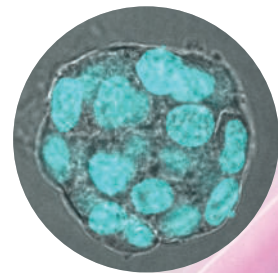
The interest in 3D printing, especially in regenerative medicine, has called for a reliable raw material with reproducible batch quality. GrowDex has both the physical qualities and supply credentials to support this rapidly growing area.



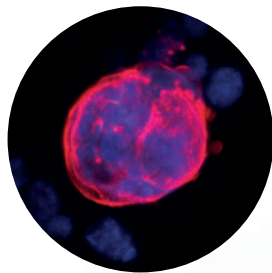
Human embryonic stem cell (hESC) derived neuronal cells
Biomeditech, Finland



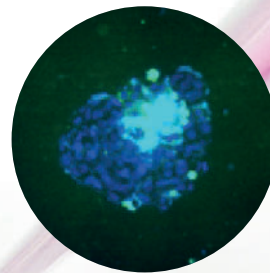
HCE-T Human corneal epithelial cells
Experimentica, Finland



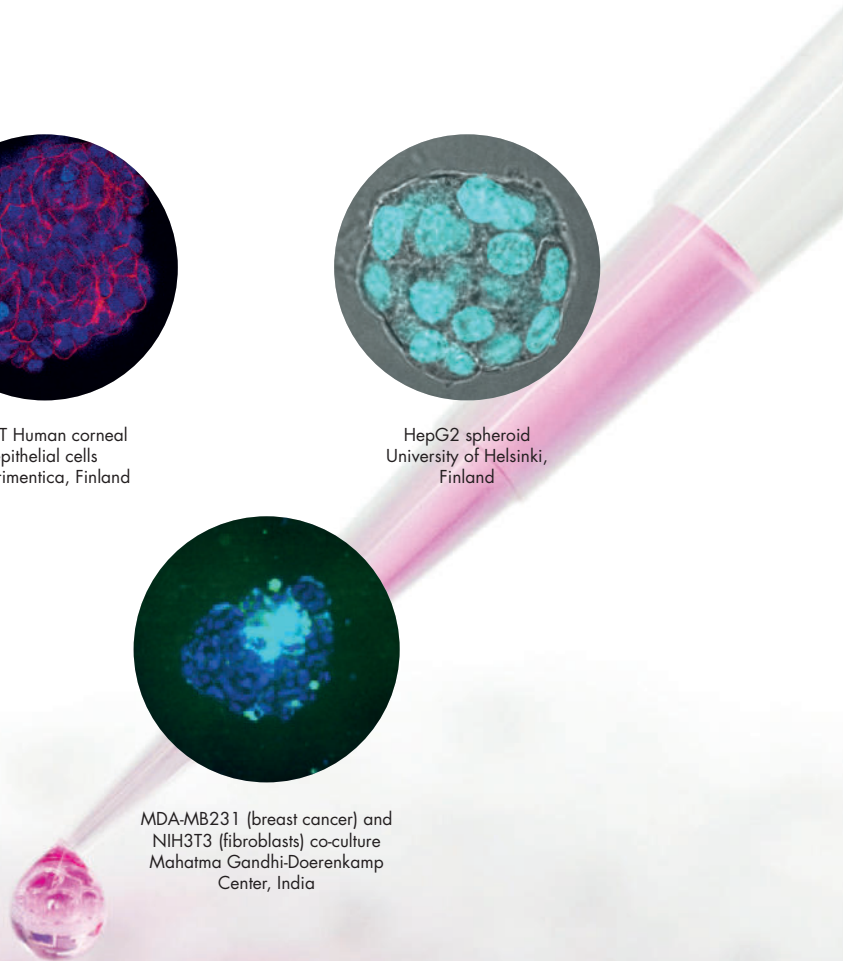
HepG2 spheroid
University of Helsinki, Finland



Co-culture human primary hepatocytes and Kupffer cells
Admescope, Finland



MDA-MB231 (breast cancer) and NIH3T3 (fibroblasts) co-culture
Mahatma Gandhi-Doerenkamp Center, India



Innovation with care
Automation-friendly
Tumor cells
fast set up
Transparent
Primary cell
Biofore
Natural
Recover cells
Innovative
Animal free
Sustainable
3D cell studies
Responsible
Eco-friendly
Renewable
Hydrogel
Dilute and use
Reproducible
Biocompatible
Advanced
Room-temperature
Sterile
Tunable
Ready-to-use
Natural
Simple protocols
Regenerative medicine

Recommended Procedure For Binding Biotinylated Proteins to GrowDex®-A

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GrowDex®-A is avidin-conjugated nanofibrillar cellulose hydrogel suitable for use in a variety of 3D cell culture applications. Avidin is able to bind to biotin with high affinity and specificity and this phenomenon has been exploited in many technologies e.g. ELISA assays. GrowDex-A can be customised by binding different biotinylated molecules e.g. proteins or peptides, to create a cell specific matrix for 3D cell-based assays (Fig. 1).

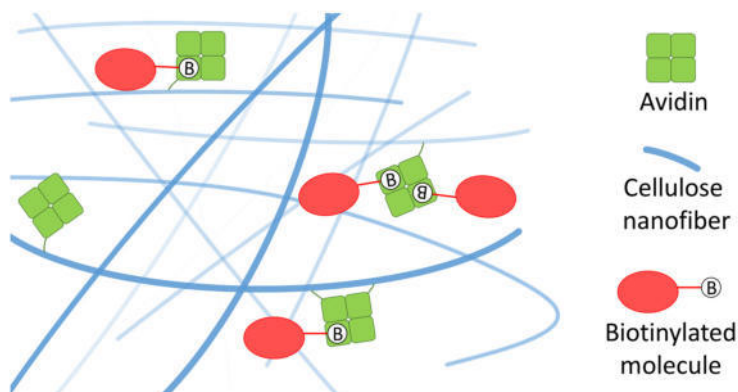


Figure 1. Illustration of binding biotinylated molecules to GrowDex-A hydrogel

PROTOCOL FOR BINDING BIOTINYLATED COMPOUNDS TO GROWDEX-A

- A. Calculate the volume of stock GrowDex-A required for your experiment. NOTE: The total volume of other components (biotinylated compound, cell culture media, cell suspension) is calculated as: Final volume (ml) – volume of stock GrowDex-A (ml).

$$\text{Volume of stock GrowDex - A (ml)} = \frac{\text{Final volume (ml)} \times \text{working concentration of GrowDex - A (\%)}}{\text{Concentration of stock GrowDex - A (\%)}}$$

- B. Before opening the GrowDex-A syringe cap, move the plunger slightly back and forth to release it before dispensing.
- C. Dispense GrowDex-A directly from the syringe provided or pipette the required amount into the test tube. Graduations on the syringe indicate the volume dispensed or alternatively GrowDex-A may be weighed.
- D. Calculate the volume of biotinylated compound needed (ml). We recommend that the biotinylated compound is added in a volume of at least 50 µl per 1 ml of GrowDex-A hydrogel, to be able to mix the reaction efficiently. If the volume of biotinylated compound to be added is very small, for example PBS can be used for diluting it.

$$\text{Volume of biotinylated compound (ml)} = \frac{\text{Final conc. of biotinylated compound (mg/ml)} \times \text{Final volume (ml)}}{\text{Initial conc. of biotinylated compound (mg/ml)}}$$

- E. Mix the biotinylated compound with Growdex-A carefully by pipetting up and down to disperse throughout the gel and incubate at room temperature for 1 h.

PROTOCOL FOR DILUTION AND CELL CULTURE

The Growdex-A-biotinylated compound mixture will be at a slightly lower concentration than the original 1% stock due to dilution with the biotinylated compound used in step 5. This should be taken into consideration when preparing the working stock.

NOTE: We recommend using culture media without biotin. If you have different media that contain biotin, we recommend selecting the media which contains the least amount of biotin.

A. Calculate the volume of cell culture media required:

$$\begin{aligned} & \text{Volume of culture media (ml)} \\ &= \text{Final volume of the assay (ml)} - \text{Volume of stock GrowDex} - A \\ & \quad - \text{Volume of biotinylated compound (ml)} - \text{Volume of cell suspension (ml)} \end{aligned}$$

- B. Add the culture media to the test tube with the GrowDex-A-biotinylated compound mixture and mix by first swirling the pipette tip along the wall of the tube and then by pipetting up and down for a minimum of 90 seconds, a wide bore pipette tip or one that has been cut can help with the initial mixing. Continue mixing until a homogeneous solution is achieved by visual inspection. Increase the speed of pipetting towards the end of mixing and make sure the hydrogel flows smoothly through the pipette tip.
- C. The cells can be either seeded on top or embedded in GrowDex-A-biotinylated compound mixture, see Fig. 2.

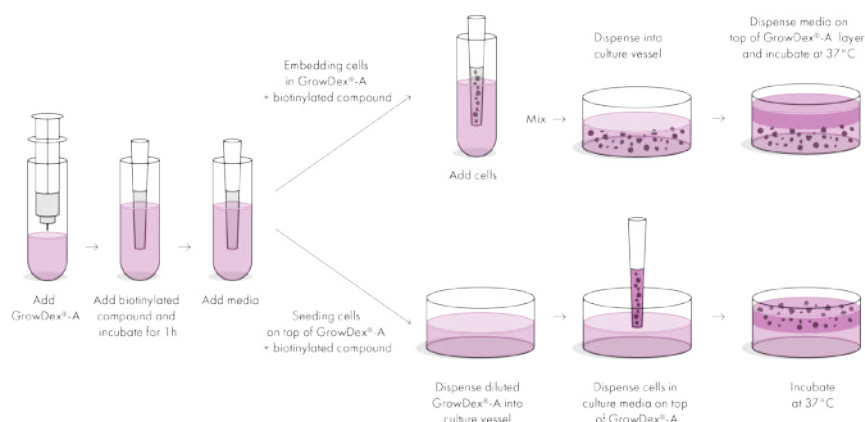


Figure 2. Binding, diluting, mixing, and plating of GrowDex-A-biotinylated compound mixture.

EXAMPLE FOR BINDING, DILUTION AND EMBEDDED CELL CULTURE WITH GROWDEX-A

- Stock GrowDex-A concentration 1.0%
- GrowDex-A working concentration 0.5%
- Final volume 1 ml
- Biotinylated compound stock concentration 1 mg/ml
- Required concentration of biotinylated compound 50 µg/ml
- Cell suspension volume 100 µl

NOTE: For example, for 96 well plates, we recommend using 100 µl of hydrogel per well. We recommend preparing some extra volume since some hydrogel might be lost when pipetting.

- A. Calculate the needed stock amount of GrowDex-A:
 Volume of stock GrowDex-A (1.0%) = $1 \text{ ml} * 0.5\% / 1.0\% = 0.5 \text{ ml}$
 The total volume of other components (biotinylated compound, PBS/cell culture media, cell suspension) is calculated as: $1.0 \text{ ml} - 0.5 \text{ ml} = 0.5 \text{ ml}$.
- B. Calculate the amount of biotinylated compound needed (ml) as:
 Amount of biotinylated compound (ml) = $0,05 \text{ mg/ml} * 1 \text{ ml} / 1 \text{ mg/ml} = 0.05 \text{ ml}$
 When the biotinylated compound stock concentration is 1 mg/ml, the volume of biotinylated compound needed is $0.05 \text{ ml} = 50 \mu\text{l}$.
- C. When the volume of cell suspension needed for the experiment is taken into consideration, the volume of culture media to be added to the functionalized gel can be calculated by following equation:
 Volume of culture media (ml) = $1.0 \text{ ml} - 0.5 \text{ ml} - 0.05 \text{ ml} - 0.1 \text{ ml} = 0.35 \text{ ml}$
- D. Add 500 μl of stock GrowDex-A into a test tube.
- E. Add 50 μl of biotinylated compound and mix by gently pipetting up and down until homogenous mixture is obtained. Incubate at room temperature for one hour.
- F. Add 350 μl of cell culture media and mix until homogenous suspension is achieved.
- G. Add 100 μl of cell suspension and mix gently.
- H. Transfer 100 μl of sample per well on 96 well plate.
- I. Add 100 μl of culture medium carefully on top not to disturb the GrowDex-A layer.
- J. Incubate at 37°C.

DILUTION TABLE

Table 1. Volumes of stock GrowDex-A, biotinylated compound, culture media, and cell suspension required for the preparation of 1 ml of GrowDex-A-biotinylated compound mixture for a variety of final working concentrations.

FINAL GROWDEX-A CONCENTRATION	TOTAL VOLUME	VOLUME OF GROWDEX-A STOCK SOLUTION (1.0%)	BIOTINYLATED COMPOUND VOLUME	CULTURE MEDIA	CELL SUSPENSION
0.7%	1ml	700 μl	50 μl	150 μl	100 μl
0.6%	1ml	600 μl	50 μl	250 μl	100 μl
0.5%	1ml	500 μl	50 μl	350 μl	100 μl
0.4%	1ml	400 μl	50 μl	450 μl	100 μl
0.3%	1ml	300 μl	50 μl	550 μl	100 μl
0.2%	1ml	200 μl	50 μl	650 μl	100 μl
0.1%	1ml	100 μl	50 μl	750 μl	100 μl