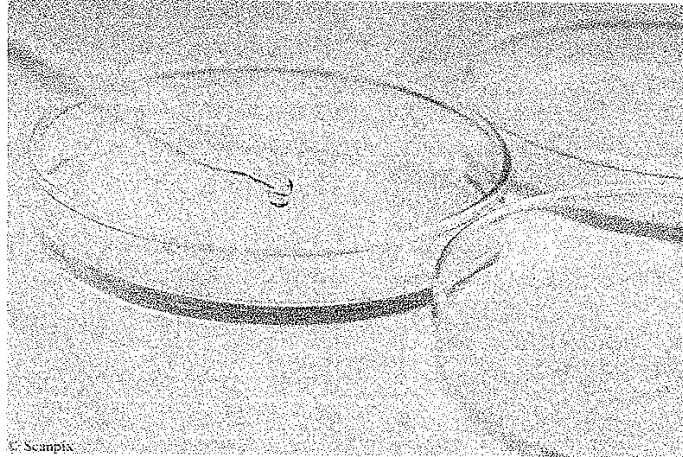


## 6. Alternativer



### **6.1. Et par indledende bemærkninger**

Frygten for overførsel af smittestoffer via føtalt kalveserum har altid været til stede, og siden 1960'erne har man arbejdet på at finde alternativer til FBS.<sup>95</sup> I de senere år har ikke mindst frygten for kogalskab fået forskere og sundhedsmyndigheder til at overveje, hvordan man bedst kan mindske eller undgå anvendelsen af kvægprodukter i udviklingen af eksempelvis lægemidler.

Der findes forskellige alternative produkter og metoder, men den absolut bedste løsning er at erstatte FBS med definerede, syntetiske næringsmediesupplementer. Derved undgår man de ulemper, som organisk materiale pr. definition indebærer, og samtidig er man sikker på, at man anvender et produkt, der ikke baserer sig på dyrs lidelser.

Ud over syntetiske næringsmediesupplementer findes der tre andre 'alternativer' til FBS, som Forsøgsdyrenes Værn imidlertid ikke umiddelbart kan anbefale:

Mange forskere ville kunne mindske deres forbrug af serum, uden at dette ville få negativ indflydelse på cellevæksten.<sup>96</sup> Denne mulighed er i overensstemmelse med de 3 R'er, men er langt fra optimal for forskerne, idet en reduktion jo ikke ændrer ved det faktum, at føtalt kalveserum er udefineret og indeholder bakterier, vira og andre skadelige stoffer. Forskerne kan anvende andre typer animalsk serum end føtalt kalveserum, men disse har, i lighed med FBS, nogle væsentlige etiske og videnskabelige ulemper. I vore øjne er det intet fremskridt, at man i stedet for kalvefostre anvender andre dyr til fremstillingen af næringsmediesupplementer. Føtalt heste- og svineserum fremstilles, så vidt vides, på samme måde som FBS og kan derfor ikke anbefales, og animalsk serum stammer pr. definition fra levende organismer – med de problemer dette indebærer for forskningen. Forskerne kan endvidere anvende næringsmedier, hvor FBS er erstattet af plantedele. Produktionen af disse næringsmediesupplementer giver som udgangspunkt ikke anledning til dyreetiske betænkeligheder. Imidlertid påpeger S. J. Froud fra Lonza Biologics, at brugen af planter kan indebære nogle af de samme videnskabelige problemer som FBS, idet planter jo er levende organismer, hvilket giver anledning til variation fra produkt til produkt.<sup>97</sup>

Såfremt man ønsker et etisk og videnskabeligt forsvarligt alternativ til føtalt kalveserum, er udviklingen og anvendelsen af definerede, syntetiske, ikke-animalske næringsmediesupplementer altså den eneste reelle mulighed.

95 Even *et al.*, *op. cit.*: s.106, Statens Serum Institut, *Serumfri Polio vaccine* <http://www.ssi.dk/sw14842.asp>  
*Dansk automationsfirma står bag verdensnyhed i: Automatik* (28. januar 2003): s. 4.

96 Jochems 1997: s. 5 og 8 og Jochems *et al.*: s. 12.

97 S.J. Froud *op cit.*: s. 162.

## **6.2. Syntetiske næringsmediesupplementer: mere pålidelige**

Når man anvender et næringsmediesupplement, der er fremstillet kunstigt i et laboratorium, ved man med sikkerhed, hvad produktet indeholder. Det betyder, at man undgår den usikkerhed, som organisk materiale uundgåeligt repræsenterer i en forskningsproces. Kunstigt fremstillede stoffer er ensartede – i modsætning til de animalske, som forskerne er nødt til at teste grundigt p.g.a. den betydelige variation mellem de enkelte produkter. Sundhedsmyndighederne stiller stadigt stigende krav til sådanne tests (bl.a. på grund af frygten for kogalskab), og ved at gå over til syntetiske, ikke-animalske alternativer undgår man de bakterier og vira, der forekommer naturligt i eksempelvis føtalt kalveserum. Syntetiske næringsmediesupplementer kan anvendes i vacciner og lægemidler til både dyr og mennesker uden risiko for overførsel af sygdomme som BSE, Mund- og Klovesyge og BVD.

## **6.3. Syntetiske næringsmediesupplementer: billigere**

Syntetiske næringsmediesupplementer er på lang sigt ikke blot mere sikre og mere effektive end FBS, de er også billigere. Anvendelsen af føtalt kalveserum er nemlig en dyr fornøjelse: 1 liter føtalt kalveserum koster mellem 2000 og 6800 DKK,<sup>98</sup> og udbrud af sygdomme som BSE eller mund- og klovesyge i lande med en stor FBS-produktion kan presse prisen på serum yderligere i vejret.<sup>99</sup> Produktets ukendte sammensætning spiller også en stor rolle, for selvom FBS er et supplement og kun udgør ca. 5-15 % af det samlede næringsmedium, der anvendes, så anslås det, at føtalt kalveserum *prismæssigt* udgør mellem 55 og 70 % af et givent næringsmedium. Det skyldes blandt andet de mange omstændelige tests, som skal foretages inden produktet kan anvendes.<sup>100</sup> Visse forskere anslår, at man opnår en besparelse på hele 80 % når man går over til serumfri alternativer.<sup>101</sup>

## **6.4. Eksisterende ikke-animalske alternativer**

Der er allerede adskillige syntetiske næringsmediesupplementer på markedet, og mange nye er under udvikling. Det kan undre, at FBS overhovedet bliver brugt i så stort et omfang, som det rent faktisk er tilfældet, og at den videnskabelige verden ikke i højere grad retter blikket mod de eksisterende alternativer. Nogle af de forskere, der arbejder med alternativer, påpeger, at den fortsatte anvendelse af animalsk serum skyldes uvidenhed og træghed i forskerverdenen.<sup>102</sup> Udfordringen ligger derfor i at få gjort forskere opmærksom på de etiske og videnskabelige ulemper, som fremstillingen og anvendelsen af FBS indebærer, og på de alternativer, der allerede findes.

I de senere år er det blevet betydeligt lettere for forskere at finde frem til de alternativer, der er anvendelige i netop *deres* forskning. Dels findes der internationale databaser over serumfri næringsmediesupplementer, og dels tilbyder en lang række producenter teknisk assistance og vejledning om alternative produkter.

Desværre er ikke alle alternativer til FBS anbefalelsesværdige ud fra et dyreetisk synspunkt, og Forsøgsdyrenes Værn har derfor, på baggrund af forskellige databaser, udarbejdet en liste med over 80

98 Priser indhentet i oktober 2007 fra:

Statens Serum Instituts *Produktkatalog og prisliste 2007*, hjemmesiden *USA Scientific: Precise Solutions for Research*. <http://www.usascientific.com/index.asp?PageAction=VIEWCATS&Category=792> og hjemmesiden *BioCompare: The Buyer's Guide for Life Scientists*. [http://www.biocompare.com/matrix/7844/Fetal-Bovine-Serum-\(ES-Cell\).html](http://www.biocompare.com/matrix/7844/Fetal-Bovine-Serum-(ES-Cell).html)

99 Blair Fujimoto, *Fetal Bovine Serum – Supply vs. Demand?* i: *Art to Science: A Publication on Advancement in Tissue and Cell Culture Technology*. 21/1 (Utah: Hyclone, 2002): s. 1.

100 Even *et al.*, *op cit.*, s. 105 og Newman, *op cit.*: s. 941.

101 Even *et al.* *op cit.*: s. 105-6.

102 Even *et al.* *op cit.*: s. 106.

alternativer til animalsk serum, der udelukkende består af ikke-animalske komponenter. Denne liste findes bagest i rapporten.

Et ofte anvendt argument imod brugen af alternativerne til FSB er, at de kun kan anvendes til bestemte typer celler, og at fordelene ved FBS netop ligger i, at produktet er så bredspektret. Som det fremgår af vor liste, er mange alternative produkter imidlertid anvendelige til flere forskellige celletyper. Desuden kommer der stadig flere syntetiske næringsmediesupplementer på markedet, og mange af de rutineopgaver, der udføres på laboratorier rundt om i verden, er baseret på relativt få cellelinier, hvortil der i disse år udvikles alternativer.<sup>103</sup>

For at kunne anvende et serumfrit næringsmediesupplement skal forskeren vænne den enkelte cellekultur fra føtalt kalveserum og til det nye vækstmedium, hvilket kan tage tid. Mange firmaer forhandler dog cellelinier, der allerede er tilvænnet et serumfrit miljø, og nogle tilbyder også at afvænne specifikke cellelinier for deres kunder (se vor liste over alternativer). Forskerne har alt at vinde, for når først cellerne er blevet vænnet til det serumfrie miljø, opnås langt mere pålidelige resultater.<sup>104</sup>

## 7. Konklusion

Forsøgsdyrenes Værn har i denne rapport gjort rede for de dyreetiske og videnskabelige problematikker ved både fremstillingen og anvendelsen af føtalt kalveserum. Vi har påpeget, at størstedelen af kalvefostrene ikke blot er levende, men også ved bevidsthed under udvindelsesproceduren, som er meget lidelsesfuld. Vi har ligeledes gjort opmærksom på, at det vil være meget vanskeligt at sikre en effektiv bedøvelse af fostrene under tapningen. Vi har gennemgået de mange videnskabelige ulemper ved føtalt kalveserum og gjort opmærksom på, at man i EU-sammenhæng arbejder på at inkludere fostre i dyreforsøgslovgivningen i en anerkendelse af, at en eventuel tvivl om den grad af smerte, et dyrefoster kan føle, bør komme dyret til gode. Vi har sidst, men ikke mindst, påpeget, at der er mange alternativer til animalsk serum på markedet, og at sundhedsmyndigheder og forskere anbefaler, at man indstiller brugen af føtalt kalveserum og i stedet anvender syntetiske næringsmediesupplementer.

Forskere er ifølge både dansk og EU-lovgivning forpligtet til at anvende alternativer til dyreforsøg.<sup>105</sup> Den gængse udvinding af føtalt kalveserum hører imidlertid ikke ind under *Lov om Dyreforsøg*, idet de fleste fostre stammer fra kvier, der indgår i den almindelige kvægproduktion, hvor fostre jo vurderes som slagteriaffald. Forsøgsdyrenes Værn mener imidlertid, at forskerne har et moralsk ansvar – ikke blot over for de dyr, som rent fysisk indgår i deres forsøg – men også over for de dyr, som har lidt under fremstillingen af de råvarer, der benyttes i forskningen. Det personlige moralske ansvar bør få forskere til at tage initiativer til at stoppe anvendelsen af FBS, også selv om loven endnu ikke påbyder det.

En afvikling af brugen af føtalt kalveserum til fordel for serumfrie alternativer vil ikke alene spare mange dyr for lidelse, men vil også bevirke, at forskere opnår mere pålidelige og videnskabelige resultater. På kort sigt vil en afvikling af brugen af føtalt kalveserum medføre, at nogle forskere bliver nødt til at revurdere deres forsøgsstrategier. På dyreforsøgsområdet pålægger lovgivningen imidlertid allerede forskerne at tilrettelægge deres forskning på en måde, der sikrer, at der anvendes så få dyr som muligt.<sup>106</sup> Målet om at minimere eller eliminere den *indirekte* brug af dyr i forskningen, f.eks. i form af føtalt kalveserum, bør tages ligeså alvorligt.

103 Franz P. Gruber *et al.*, *op cit.*

104 Newman *op cit.*: s. 942.

105 Rådets direktiv af 24. november 1986 om indbyrdes tilnærmelses af medlemsstaternes love og administrative bestemmelser om beskyttelse af dyr, der anvendes til forsøg og andre videnskabelige formål (86/609/EOEF). EF-Tidende nr. L 358 af 18/12/1986 s. 0001 – 0028.

106 Justitsministeriet, *Lov om dyreforsøg* af 1993, § 6, stk. 1 og 2.

## 8. anbefalinger

På baggrund af rapportens konklusioner fremkommer Forsøgsdyrenes Værn med følgende anbefalinger:

1. Dyreværnsloven, Lov om Dyreforsøg og den danske slagteribekendtgørelse skal udvides til at omfatte fostre fra 1/3 inde i fostertilstanden. Ved slagtning af drægtige dyr skal det sikres, at fostrene aflives hurtigt og humant. Det skal om nødvendigt præciseres, at det ikke er tilladt at udtage blod eller andet væv fra levende fostre (uanset dyreart).

2. EU's dyreforsøgslovgivning og slagterilovgivning (Rådsdirektiver 86/609/EØF og 93/103/EF) skal udvides til at omfatte fostre fra 1/3 inde i fostertilstanden. Ved slagtning af drægtige dyr skal det sikres, at fostrene aflives hurtigt og humant. Det skal om nødvendigt præciseres, at det ikke er tilladt at udtage blod eller andet væv fra levende fostre (uanset dyreart).

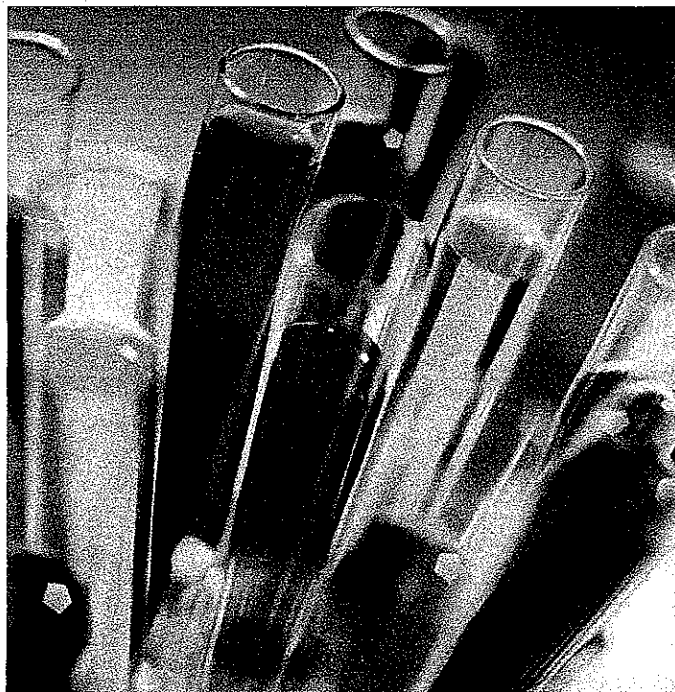
3. Import af serum udvundet fra levende fostre (uanset dyreart) skal forbydes både i Danmark og i EU.

4. Alle offentlige forskningsinstitutioner (universiteter, hospitaler og sektorforskningsinstitutter) skal udarbejde en strategi for udfasning af brugen af føtalt kalveserum til fordel for syntetiske næringsmedier.

5. Statslige forskningsråd og andre offentlige instanser, der støtter dansk forskning, skal i forbindelse med behandling af ansøgninger om midler bede om oplysninger om, hvilke næringsmedier der påtænkes anvendt, og kræve, at ansøger gør rede for, hvorfor en påtænkt brug af føtalt kalveserum eller andre animalske næringsmedier ikke kan erstattes af syntetiske næringsmedier.

6. EU-Kommissionen skal fremme erstatningen af føtalt kalveserum med syntetiske alternativer ved bl.a. at a) oprette og løbende opdatere en central database over syntetiske alternativer til føtalt kalveserum – evt. i tilknytning til ECVAM, b) give økonomisk støtte til udviklingen af syntetiske alternativer til føtalt kalveserum, og c) stille krav om, at der så vidt muligt anvendes syntetiske næringsmedier i EU-støttede forskningsprojekter.

7. Den danske regering og EU-Kommissionen skal arbejde for, at internationale retningslinjer for in vitro testning af lægemidler, kemikalier og andre stoffer så vidt muligt baserer sig på celle-linjer, som lever på definerede syntetiske næringsmedier.



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## 10. Oversigt over eksisterende alternativer til føtalt kalveserum

Numrene i denne oversigt refererer til produktnumrene, anført i oversigtens første kolonne.

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Multipurpose media (Supporting a wide range of different cell types)	3, 9, 11, 12, 21, 22, 23, 51, 55, 61, 64, 67, 87, 88
3T3 (mouse embryo fibroblast)	21, 22, 23
A549	11
BHK	11, 21, 22, 23
BHK-21 (Syrian hamster kidney fibroblast-like)	36, 37, 56
CD34+	86
Chick cells	15, 16, 62
CHO (Chinese Hamster ovary)	7, 8, 9, 10, 11, 22, 24, 33, 34, 39, 41, 44, 47, 48, 54, 55, 63, 66, 68, 71, 72, 73, 81
CHO-DG44	13
CHO-DUKXB11	13
CHO K1 (Chinese hamster ovary)	13, 22, 23, 41
Cornea	78
COS-7 (SV40 transformed monkey kidney)	36, 37
DG44 clones	41
DXB11	41
Endothelium	32, 60
Fibroblast	15, 16, 21, 22, 23, 60, 62
FOX-NY	7, 8, 21
HEK (transformed human embryonic kidney)	11, 14, 25, 28, 29, 31, 32, 38, 46, 49, 77, 83, 84
HeLa (human cervix carcinoma)	23, 46, 31, 36, 42, 53,
Hep-2	21, 22, 23, 37
HepG2	11
Hep3B2	22, 23
Human cells	2, 4, 5, 6, 26, 35, 42, 45, 46, 49, 50, 54, 78, 83
Hybridoma	1, 2, 3, 7, 8, 17, 18, 21, 22, 23, 35, 42, 45, 46, 50, 54, 60, 65, 75
JEG3	22, 23
Keratinocytes	4, 54
L-929	11
MDBK	21, 23, 36, 27, 85
MDCK (Madin-Darby Canine Kidney)	11, 23, 27, 36, 37, 53, 54, 57, 85
Mouse cells	1, 2, 50, 54, 19, 35, 45
MRC-5 cells	23, 59
Myeloma	3, 7, 8, 21, 22, 23, 42, 46, 78,
NS-1 (mouse myeloma)	7, 8, 22, 23, 54
NSO	27, 79
P3X63Ag8	21, 22, 23
P3X63Ag9	7

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PC12	22, 23
PerC6 (human, embryo retinoblast)	30, 31, 38, 43, 52, 76, 84
Rat cells	35
Retinoblast	82
Schneider S2	70
Sf21 (Spodoptera fugiperda)	70, 74
Sf9	70, 74
Sp2/0	7, 21, 80
SZ95 (human sebaceous gland cell)	5
Trichoplusia	69
U937 (human histiocytic lymphoma)	21, 22, 23
Vero (African Green Monkey Kidney)	11, 23, 27, 37, 53, 58

**Firmaer, der tilbyder særlige services -  
bl.a. udvikling af serumfri medier eller tilvænnning af celler**

**Atlanta Biologicals:**

[http://www.securewebexchange.com/atlantabio.com/pi\\_specialty\\_media.asp](http://www.securewebexchange.com/atlantabio.com/pi_specialty_media.asp)

**Biochrom:**

<http://biochrom.de/index.php/en/Company/Services?PHPSESSID=8d869cc3782a6b458f7c546b6ef7077b>

**Cell Culture Technologies:**

<http://www.cellculture.com/custom.html>

**CSS Cell Culture Service:**

<http://www.cellcultureservice.de/>

**HyClone:**

<http://www.hyclone.com/media/customization.htm>

**Invitrogen:**

<http://www.invitrogen.com/content.cfm?pageid=10627>

**Irvine Scientific:**

<http://www.irvinesci.com/sub.cfm?sec=2&loc=60>

**Lonza:**

<http://www.lonzabioscience.com/Content/Bioscience/CustomMedia.asp>

**PAN-Biotech:**

<http://www.pan-biotech.com/content.php?lang=en>

**ATLANTA BIOLOGICALS** [www.atlantabio.com](http://www.atlantabio.com)

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	PRODUCT	COMPOSITION	APPLICATION	CELLS
1	MaxiCell™/Hybridoma-PF	Chemically defined, serumfree medium. No proteins, peptides or animal-derived constituents. Fortified with key amino acids.	Formulated for optimal growth of hybridoma cell lines and monoclonal antibody production.	Murine hybridoma Human-mouse heterohybridomas.
2	MaxiCell™/Hybridoma-PFplus	Chemically defined, serumfree medium. No proteins, peptides or animal-derived constituents. Fortified with key amino acids.	Formulated for use with more demanding high-density cell cultures. Suitable for cell culture bioreactors.	Murine hybridoma Human-mouse heterohybridomas.

**AUTOGENBIOCLEAR** [www.autogen-bioclear.com](http://www.autogen-bioclear.com)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
3	HybridoMed DIF 1000	Serum free medium with glutamine	General application	hybridoma, myeloma, spleen cells & other sensitive cells
4	MCDB 153	Complete serum free medium	General application	Human keratinocytes
5	Sebomed	Complete (Basal) Medium	General application	Human Sebaceous gland cells, SZ95 cells
6	TNB 100 Medium	Serum free medium defined medium, should contain complex lipid suppliment	General application	Neuronal cells, Human cytotoxic T cells

**BD BIOSCIENCES / BECTON, DICKINSON & COMPANY** [www.bdbiosciences.com](http://www.bdbiosciences.com)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
7	BD Cell™ MAb Media, Quantum Yield	Chemically defined, serum-free, non-animal component basal medium. Requires supplementation. Contains L-Glutamine and phenol red. Without pluronic acid or other surfactants.	Supports a wide variety of myeloma fusion partners and hybridomas. Designed to enhance monoclonal antibody production.	Various myeloma fusion partners and hybridomas including Sp2/0, NS-1, P3X63Ag9, and FOX-NY, as well as secreting cell lines such as CHO.
8	BD Cell™ MAB Media	Serum-free, animal component-free complete medium, HEPES based. Contains L-Glutamine and is supplemented with 0.3% select soytone. Without phenol red, pluronic acid or other surfactants, or attachment factors.	Supports a wide variety of myeloma fusion partners and hybridomas. Designed to enhance monoclonal antibody production.	Various myeloma fusion partners and hybridomas including Sp2/0, NS-1, P3X63Ag9, and FOX-NY, as well as secreting cell lines such as CHO.

**BioConcept** [www.bioconcept.ch](http://www.bioconcept.ch) [www](http://www)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
9	MAM-PF 2	Mammalian Artificial Medium - Protein and Animal Component free. Chemically defined media. Formulated without L-glutamine to avoid problems associated with L-glutamine degradation, including ammonia accumulation. Available with a minimal amount of Phenol red (10-02F25) to facilitate downstream processing steps, or without Phenolred (10-02F24).	Protein-free, defined medium for the high cell density cultivation of a variety of cell lines as CHO (Chinese Hamster Ovary) cells or BHK (Baby Hamster Kidney) cells and the high level expression of recombinant proteins.	Variety of cell lines as CHO (Chinese Hamster Ovary) cells or BHK (Baby Hamster Kidney) cells.

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10	SFC-60 CHO Express	Animal derived component free.	Optimized for CHO cells.	CHO cells.

### CCS Cell Culture Service [www.cellcultureservice.de](http://www.cellcultureservice.de)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
11	SynQ Serum Substitute	Protein free, serum replacement		Various cell lines including CHO, BHK, Vero, HepG2, MDCK, HEK, L-929, A549.
12	Media development/optimization:	Multi purpose formulation Animal derived component free	Various cell lines	Various cell lines

### CELL CULTURE TECHNOLOGIES [www.cellculture.com](http://www.cellculture.com)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
13	ChoMaster	Contain exclusively small molecules characterized by their CAS- and EINECS registry numbers. Free of proteins, peptides, and complex additives such as hydrolysates and yeast extracts. Free of animal-derived components.	The media are used for the routine maintenance and the long-term cryopreservation of cells.	Used for long-term preservation, gene transfection, routine maintenance and mass cultivation of Chinese Hamster Ovary (CHO) cells, particularly CHO-K1, CHO-DUKXB11 and CHO-DG44 Cells.
14	Hektor G	Contain exclusively small molecules characterized by their CAS- and EINECS registry numbers. The media are free of proteins, peptides, and complex additives such as hydrolysates and yeast extracts. Free of animal-derived components.	Used for routine maintenance and long-term cryopreservation of cells. Derived from the InVirus medium and were developed for the in vitro cultivation of human cell lines such as the HEK 293 and HEK 293EBNA. The authenticated and certified serum-free 293-Hektor deposited at the European collection of Animal Cell Cultures can be routinely cultivated and banked with the Hektor G Medium.	Human cell lines such as the HEK 293 and HEK 293EBNA
15	InVirus™ VP-6, art IVP6	Protein free, serum free medium	General purpose	Chicken embryo lines, production of fibroblasts
16	InVirus™, art ITV	Protein free, serum free medium	General purpose	Chicken embryo lines, maintenance of fibroblasts
17	TurboDoma TP-6, art. TPP-6	Protein free, serum free medium	General purpose	Production of hybridoma
18	TurboDoma art. THP	Protein free, serum free medium	General purpose	Maintenance of hybridoma

### CHEMICON International [www.chemicon.com](http://www.chemicon.com)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
19	ESGRO Complete™ Clonal Grade Medium	Complete serum free feeder free medium	Contains BM4 and LIF, allowing growth of clonal cells without FBS.	Murine ES cells



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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
21	FetalClone I	FBS Alternative: IgG levels comparable to those found in FBS	Reduced cost, unlimited supply and readily available. No adaption is required and suggested concentrations are the same as with FBS. Optimized for the growth of hybridomas.	Hybridomas, Sp2/0-Ag Myeloma, Sp 2/0-Ag Hybridoma, P3 Myeloma, P3 Hybridoma, NS - 1 Myeloma, NS-1 Hybridoma, BHK, 3 T3, P3x63 AG 8, 653 Myeloma, P3 63 AG, 653 Hybridoma, HeLa, MDBK, FOX-NY Myeloma, FOX-NY Hybridoma, Hep-2, U-937
22	FetalClone II	FBS Alternative	Reduced cost, unlimited supply and readily available. No adaptation is required and suggested concentrations are the same as FBS,	CHO cells and derivatives. Sp2/0-Ag Myeloma, Sp 2/0-Ag Hybridoma, FOX-NY Hybridoma, Hep-2, CHO-K1, COS, NS-1 Myeloma, NS-1 Hybridoma, BHK, HEP3B2, PC-12, P3X 63AG 8,653 Myeloma, P3x63 AG 8,653 Hybridoma, DG44/CHO-K1, 3T3, U-937, JEG3
23	FetalClone III	FBS Alternative	Most widely applicable FBS alternative designated to include fibroblasts	Sp2/0-Ag Myeloma, Sp2/0-Ag hybridoma, FOX-NY Myeloma, FOX-NY hybridoma, CHO-K1, W1-38, L2929, COS, NS-1 Myeloma, NS-1 hybridoma, MDBK, MDCK, PC-12, Hep-2, DG44/CHO-K1, Vero, P3x63 AG 8,653 Myeloma, P3X63AG 8,653 hybridoma, HeLa, NY1 Lu, BHK, HEP3B2, MRC-5, P3 Myeloma, P3 Hybridoma, 3T3, U937, JEG 3, C3H 10T1/2CRFK
24	HyQ® CDM4 CHO	Serum free, contains Pluronic ®F68 and L Glutamine. Does not contain phenol red. Available without L-Glutamine to support the GS gene expression system	For therapeutic recombinant protein expression in CHO cells, increases process yields.	Variety of CHO cell clones
25	CDM4 PERMAb	HyClone CDM4PERMAb is a chemically-defined medium containing no animal derived components	Developed to increase process yields in the production of human antibodies and recombinant proteins using PER.C6® technology. Successfully tested in a variety of applications, including fed-batch bioreactors.	PER.C6
26	HyQ SFM4 HEK293™	Protein free, animal derived component free		HEK-293 cells
27	HyQ SFM4 MegaVir™	PF/ADCF	Viral production,	MDBK cells, MDCK cells, Vero cells

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28	HyQ CDM4 NS0	Chemically-defined medium containing no animal derived components. Requires no cholesterol or GS supplementation, as it has sufficient amounts to support NS0 cell culture already in the formulation. Tested in a variety of culture systems, including T-flasks, shaker flasks and bioreactors using batch and fed-batch strategies. Contains Pluronic® F68, and does not contain L-glutamine and phenol red.	This regulatory-friendly medium is developed through Metabolic Pathway Design™ to increase process yields in the manufacture of monoclonal antibodies (MAbs) using a variety of NS0 cell clones.	Therapeutic MAb production in NS0 Cells
29	CDM4 HEK 293	HyClone CDM4HEK293 is a chemically-defined, animal derived component free and protein-free cell culture medium.	Support the growth of HEK 293 cultures, and promote adenovirus and recombinant protein production. This regulatory-friendly medium was developed to support high cell density and specific cell productivity in suspension cultures.	HEK 293 cultures
30	SFM4 Transfx 293	Serum-free, animal derived component free medium.	Support the growth of HEK 293 cultures and promote transfection using lipofection or similar methods. This regulatory-friendly medium was developed to support high transfection efficiency, productivity and cell density in suspension cultures.	HEK 293 cultures

**INVITROGEN CORPORATION/GIBCO™** [www.invitrogen.com](http://www.invitrogen.com)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
31	293-SFM II	Serum-free medium, without any components of human or animal origin. Very low protein (10µg/l) concentration.	Supports adaptation of 293 adherent-dependent cells to large-scale, high-density suspension culture. Expansion of transfected 293 cells. Supports suspension culture of HeLa cells, and PerC6 cells. Not adherent cultures.	Human embryonic kidney (HEK) 293 cells HeLa S3 cells PerC6 cells
32	CD 293	Chemically defined, proteinfree medium. Devoid of any animal-origin components, undefined lysates or hydrolysates.	For adaptation and high-density suspension culture of 293 cells. Not recommended for adherent culture. For propagation of adeno, retro and other viruses, production of recombinant proteins and utilization in drug screening.	HEK 293 cells (including 293-F and 293-H) HeLa S3 cells
33	CD CHO	Chemically defined, proteinfree and entirely free of animal-derived components Requires supplementation with L-glutamine	For growth and production of recombinant proteins in suspension culture.	CHO cells, including CHO-S
34	CD CHO AGT™:	Chemically defined/protein free/ animal component derived free		CHO cells

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35	CD Hybridoma	Chemically defined, proteinfree and free of animal components. No undefined hydrolysates or lysates. Without L-glutamine or Phenol red. Contains surfactant and inorganic iron carrier	For hybridoma growth and monoclonal antibody production	Mouse, human and rat hybridomas
36	OPTIPRO SFM	Serum-free, low protein (7.5µg/l) medium, and without components of animal or human origin.	Sustains growth of a broad range of cell lines, for virus expression.	MDCK, MDBK, BHK-21, COS-7, HeLa cell lines
37	VP-SFM	Ultra low protein, serum-free, and free of animal-origin components. Trace proteins are human recombinant EFG and insulin. Transferrin is replaced by iron-chelate, and albumin replaced by di- and tripeptides from plants Lglutamine can be added if required.	Suitable for growing viruses, production of recombinant proteins and monoclonal antibodies.	VERO cells, COS-7, MDCK, BHK21, Hep2 cell lines
38	Adenovirus Expression Medium	Animal-origin free cell culture medium without components directly derived from human or animal sources.	AEM is performance tested for cell growth with PER C6@ cells and has been qualified to produce adeno-virus and influenza viruses. AEM is recommended for the growth of PER.C6@ cells in suspension and for the production of viruses and viral vectors in these cells. It also supports HEK 293 cell growth. Glutamine or GlutaMAX™-I supplementation is required.	PER.C6@ cells. HEK 293 cell growth.

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UK suppliers: Metachem Diagnostics Ltd at [www.metachem.co.uk](http://www.metachem.co.uk)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
39	IS-CHO-V™	Serum-free medium, Contains no components derived from human or other mammalian sources. Without L-Glutamine, hypoxanthine or thymidine. Technical data sheets available	Optimised to promote longterm, high-density growth of CHO cells and expression of recombinant proteins. For use with dihydrofolate reductase and other selection systems.	CHO cell lines
40	IS-CHO-V-GS™	Serum-free medium, Contains no components derived from human, bovine, or other mammalian sources. With hypoxanthine and thymidine, Without L-Glutamine. Technical data sheets available on request.	Optimised to promote long-term, high-density growth of CHO cells and expression of recombinant proteins. For use with Glutamine Synthetase selection system.	CHO cell lines
41	IS-CHO-CD	Chemically defined, serumfree medium. Components all of non-animal origin, Without L-Glutamine or hypoxanthine. Technical data sheets available on request.	For production of recombinant proteins using CHO cells in suspension or stationary cultures .	CHO cells CHO K1, DXB 11 and DG44 clones.
42	IS-293-V	Modified version of IS-293 without transferrin. Requires supplementation with non-protein iron chelate for optimum performance, and Pluronic F-68 for suspension cultures. Technical data sheets available on request.	Optimised for long-term, highdensity culture of 293 cells, used for production or adenovirus or recombinant protein expression. Also for growth of other cells.	293 human embryonic kidney cells HeLa cells Myelomas Hybridomas Human breast cancer cells

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43	IS ProVec CD	Chemically defined, serumfree medium formulated with only non-animal origin components. Technical data sheets available on request.	Optimised for high-density suspension cultures of PER. C6 cells used in production of biopharmaceuticals.	PER.C6 cells
44	IS-CHO™	Serum free medium and protein free medium.		CHO cells
45	IS-MAB-V	Serum-free medium with no components derived from human, bovine or other mammalian sources. Without L-Glutamine. Requires addition of iron chelate. Technical data available of request.	Developed for growth of hybridoma for manufacture of monoclonal antibodies.	Human and murine hybridomas
46	IS-293	Serum free and protein free medium.		Hybridoma cells, myeloma cells, human embryonic 293, HeLa cells

**Lonza** [www.lonza.com](http://www.lonza.com)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
47	PowerCHO	Chemically defined, non-animal origin, protein-free CHO media.	Delivers high levels of cell proliferation, protein production, and high cell viability. Contains HEPES and Pluronic® F-68, but does not contain L-glutamine, phenol red, hypoxanthine, and thymidine.	CHO
48	ProCHO Series	Three chemically defined serum-free media without hypoxanthine or thymidine. With phenol red and 0.1% Pluronic F-68. Only one protein: recombinant human insulin.	Optimized to support large scale, high density bioprocessing suspension cultures of CHO cells.	CHO suspension cultures
49	Pro293s-CDM & Pro293a-CDM	Serum-free, low protein, and chemically defined media. Without L-Glutamine or phenol red, and with 0.1% Pluronic F68. Contains only one protein: rh insulin. Without hypoxanthine and thymidine.	Supports high-density cultures of 293 cells for use in research gene therapy, and production of proteins and vaccines. Pro293s-CDM for suspension cultures, and Pro293aCDM for adherent cultures.	293 transformed human embryonic kidney (HEK) cells
50	ProDoma™ Hybridoma Media	Protein free, contains rh insulin, without L-Glutamine or phenol red, with 0.1% Pluronic acid. Also contains HEPES and NaHCO <sub>3</sub> as a buffering system.	Significantly simplifies downstream process, convenient for small or large scale cultures.	Supports murine, rat, chimeric and human hybridoma cell lines.
51	ProFreeze™ NOA Freezing Medium (2X)	Serum and protein free, requires the addition of DMSO at time of use.	Specifically formulated for cryopreserving cells that have been propagated in serum free media. Maintains high cell viability upon recovery from frozen storage.	Cells that have been propagated in serum free media.

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52	ProPer™ 1	Serum Free, without L-Glutamine or phenol red, with 0.1% Pluronic acid.	For culturing Per.C6 cells used for adenoviral-based gene therapy, production of vaccines, cytokines, antibodies, and other therapeutic proteins.	Per.C6 cells.
53	ProVero™ 1	Protein free medium containing rh insulin and L-Glutamine. May benefit from 5 ng/ml EGF supplementation.	Optimised to support adherent cultures of Vero and MDCK used to support virus production.	Vero African Green Monkey kidney cells (Vero) and Madin-Darby Canine Kidney cells (MDCK)
54	UltraDOMA-PF™	Serum-free and protein-free medium. Contains L-glutamine	Supports the growth of murine, human and chimeric hybridomas for monoclonal antibody production. Designed for lab or industrial scale use.	Murine hybridomas NS-1 derived myelomas SP-2 derived myelomas Rat hybridoma Some transfected CHO cell lines Human lymphoid origin cells Murine lymphoid origin cells

**MEDIATECH INC** [www.cellgro.com](http://www.cellgro.com)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
55	Cellgro FREE™	Serum and protein-free medium, without hormones or growth factors.	Designed for growth of mammalian cell lines. Both adherent and suspension culture. CHO K-1 require minimum adaptation into cellgro-FREE	Mammalian cells, CHO.

**MP BIOMEDICALS** [www.mpbio.com](http://www.mpbio.com)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
56	MP-BHK	Serum-free, animal component-free medium with very low protein.	Developed for culture of BHK cells.	BHK
57	MP-MDCK	Serum-free, animal component-free medium with very low protein.	Developed for culture of MDCK cells.	MDCK
58	MP-VERO	Serum-free, animal component-free medium with very low protein.	Specially developed for culture of Vero cells.	Vero
59	MP-MRC-5	Serum-free, completely animal component-free and contains very little protein.	Developed specifically for microcarrier culture of MRC-5 cells in production systems. It achieves growth rates superior to standard serum-supplemented media. Adaptation from serum-supplemented media is not necessary.	MRC-5

**Novozymes GroPep Limited** [biopharmaceuticals.novozymes.com](http://biopharmaceuticals.novozymes.com)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
60	Long® EGF	Animal component free medium	Recombinant analogue of human epidermal growth factor (EGF)	Variety of fibroblast and endothelial cells
61	Long®R3 IGF-I	Animal component free insulin alternative	Recombinant growth analogue of human insulin-like growth factor	Mammalian cells
62	Long®TGF - alpha	Animal component free medium	Recombinant analogue of human transforming growth facrot-alpha (TGF-a)	Chicken, virus production, fibroblasts

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
63	CHO Express	Ready to use media, completely animal component free	General purpose for growth and optimum efficiency	CHO cells
64	Custom Media Formulation	Serum free/chemically defined/animal derived protein free	Various cells	Various cells
65	Hybridoma Express™	Chemically defined/animal derived component free	Hybridoma cells	Hybridoma cells

**PAN BIOTECH** [www.pan-biotech.com](http://www.pan-biotech.com)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
66	PANSERIN 604S	Serumfree medium without animal or human components. Basal medium completed with exclusively recombinant proteins. Does not contain any undefined lysates or planthydrolysates.	Especially suitable for the production of proteins which are applied in sensitive fields. It excels by a quick cell growth without long adaption phases.	CHO-cells in suspension culture
67	PANEXIN H	Serum substitute without animal components.	Chemically defined serum substitute for the cultivation of adherent and nonadherent cells under serumfree conditions. The sterile solution ready for use is added in an end concentration of 2 % to 8 % (dependant on the cells) to the culture medium. It supports the growth of many cell types in an optimal way.	Various cells

**SIGMA-ALDRICH Co.** [www.sigmaaldrich.com](http://www.sigmaaldrich.com)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
68	EX-CELL™ 325 PF CHO	Protein-free, serum-free medium. Contains HEPES, sodium bicarbonate, Pluronic F-68, glucose. Plant derived hydrolysate. Without L-Glutamine, hypoxanthine, and thymidine.	For growth of CHO cells and expression of recombinant products. Appropriate for use with DHFR or GS selection systems.	CHO cells
69	EX-CELL™ 405	Protein-free and serum-free medium. Hydrolysate source yeast. Without hypoxanthine and thymidine.	Optimised for the nutrient and environmental needs of Trichoplusia ni (High Five™ cells). Can be used for expressing recombinant products using the BEV system. Can be used in both suspension and adherent culture systems.	Trichoplusia ni (High Five™ cells)
70	EX-CELL™ 420	Protein-free and serum-free medium. Contains L-Glutamine, Pluronic-F68, and Glucose. Hydrolysate source yeast. Without hypoxanthine and thymidine.	Optimised for growth of Sf9 and Sf21 cells. Can be used in both suspension and adherent culture systems.	Spodoptera frugiperda Sf9 and Sf21 c Schneider S2 (Drosophila) cells

71	EX-CELL ACF CHO Medium	Proprietary formulation containing inorganic salts, HEPES and sodium bicarbonate buffers, essential and non-essential amino acids, vitamins, recombinant human insulin, plant hydrolysates, other organic compounds, trace elements, and surfactants. Does not contain antibiotics, antimycotics, L-glutamine, or transferrin. Contains no animal-derived proteins or other components.	Medium formulated to optimize cell growth and protein expression in Chinese hamster ovary (CHO) cells.	Chinese hamster ovary (CHO) cells.
72	EX-CELL® CD CHO-2 Medium	Animal-component free, with sodium bicarbonate, without L-glutamine, without phenol red., sterile-filtered, cell culture tested. Proprietary formulation containing inorganic salts, HEPES and sodium bicarbonate buffers, essential and non-essential amino acids, vitamins, recombinant human insulin, other organic compounds, trace elements, and surfactants. Does not contain antibiotics, antimycotics, L-glutamine, transferrin, hydrolysates, or other undefined nutrients or supplements. Contains no components synthesized from animal-derived materials.	Complete chemically-defined medium formulated to optimize cell growth and protein expression in Chinese hamster ovary (CHO) cells.	Chinese hamster ovary (CHO) cells
73	EX-CELL® CD CHO-3 Medium	Chemically Defined, Animal-component free, liquid, cell culture tested, sterile-filtered. Proprietary formulation containing inorganic salts, HEPES and sodium bicarbonate buffers, essential and non-essential amino acids, vitamins, recombinant human insulin, other organic compounds, trace elements, and surfactants. Does not contain antibiotics, antimycotics, L-glutamine, transferrin, hydrolysates, or other undefined nutrients or supplements. Contains no components synthesized from animal-derived materials.	Complete, chemically-defined medium formulated to optimize cell growth and protein expression in Chinese hamster ovary (CHO) cells.	Chinese hamster ovary (CHO) cells
74	EX-CELL® TiterHigh™	Animal-component free, protein-free, liquid, sterile-filtered, insect cell culture tested. This formulation includes inorganic salts, sodium bicarbonate, essential and non-essential amino acids, vitamins, yeast extract, a proprietary lipid formulation, trace elements, and other organic compounds. Glutamine is supplied in the form of an alanine-glutamine dipeptide. It does not contain phenol red, antibiotics, antimycotics, transferrin, and products of animal origin.	Supports fast cell growth rates and high cell densities, while maintaining high cell viability and high recombinant protein production using the Baculovirus Expression Vector System (BEVS).	Designed specifically for the Sf21 and Sf9 ( <i>Spodoptera frugiperda</i> ) insect cell lines.

75	X-CELL® CD Hybridoma Medium	Chemically Defined liquid, with sodium bicarbonate, without L-glutamine, Animal-component free, hybridoma tested.	This medium offers the advantages of reduced raw material costs and uniform lot-to-lot product consistency. In addition, it reduces the risk of contamination by adventitious agents associated with animal-derived materials, making it of particular interest for biopharmaceutical applications. Cells can be successfully transferred from serum-supplemented cultures to these medium with little or no adaptation. Developed to meet the needs of biotechnology manufacturing, this medium supports rapid initial cell growth and high levels of antibody expression. It also supports high cell densities at high viability for extended periods without the use of animal-derived proteins.	Hybridoma cells
76	EX-CELL™ VPRO	Serum-free medium, free of animal protein. With Pluronic F-68 and glucose, hypoxanthine and thymidine.	Developed for long-term growth of human embryo retinoblast cells (PER.C6™ and related cell lines) for production of adenovirus. Cells can be grown as suspension cultures either in shaker flasks or roller bottles.	PER.C6™ and related cell lines
77	EX-CELL™ 293	Serum-free medium, free of animal protein. With Pluronic F-68 and glucose, hypoxanthine and thymidine.	For long-term growth of HEK 293 and related cells for adenovirus production in suspension culture.	HEK 293 cells
78	EX-CELL™ 610-HSF	Low protein, serum-free, chemically defined medium.	Supports a wide range of cells including lymphoid and epithelial cells and B cell hybridomas of murine, rat and human origin. Designed for production of antibodies.	Lymphoid and epithelial cells and B cell hybridomas of murine, rat and human origin
79	EX-CELL NSO	Animal component free and serum free medium, without glutamine, with and without sodium bicarbonate		NSO cells
80	EX-CELL Sp2/O	Animal component free and serum free medium without glutamine.	Chemically defined for monoclonal antibody production	Sp2/O cells
81	CHO DHFR Medium	Animal derived component free, serum free		CHO cells
82	Gene Therapy Medium-1	Low protein, serum-free, animal component-free medium. Contains small amounts of recombinant human insulin and polypeptides from plant origin. Also contains Pluronic F-68. Does not contain antibiotics. Requires supplementation with L-Glutamine.	For production of adenovirus in cells of retinoblastoma origin. Supports high-density suspension cultures. Designed to meet current regulatory guidelines for component used in preparation of in vivo biotherapeutic agents.	Retinoblastoma-like cells



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83	Gene Therapy medium-2	Very low protein, serum-free, animal component-free medium. Contains small amounts of recombinant human insulin and polypeptides from plant origin. Also contains Pluronic F-68. Requires supplementation with L-Glutamine. Does not contain antibiotics. Addition of antibiotics is recommended.	For production of adenovirus in HEK-293 cells. Supports high-density suspension cultures. Designed to meet current regulatory guidelines for component used in preparation of in vivo biotherapeutic agents.	HEK-293 cells
84	Gene Therapy Medium 3	Serum free/animal derived component free	Gene therapy, adenovirus production, virus production	PerC6 cells For the growth of HEK-293 and propagation of adenoviruses
85	MDCK custom formulations	Completely animal component free custom formulations are available on request.	Vaccine production	MDCK cells
86	Stemline™ Hematopoietic Stem Cell Expansion Medium	Serum-free medium, with no animal components. Human serum albumin is the only human origin material. Requires supplementation with desired cytokines and /or antibiotics.	For expansion of total nucleated cells (TNC), committed progenitors and primitive (GM-CFC), high proliferative potential progenitors (HPP-CFC)	CD34+ hematopoietic stem cells derived from bone marrow, cord blood, or mobilized peripheral blood.
87	SyntheChol™ Supplement	Chemically defined/animal derived component free		Various cells

**Tissue Therapies** [www.tissuetherapies.com](http://www.tissuetherapies.com)

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	PRODUCT	COMPOSITION	APPLICATIONS	CELLS
88	VitroGro®	The VitroGro® platform provides an animal product free alternative to Foetal Bovine Serum (FBS) or serum-derived factors.	Defined, synthetic, animal product free platform technology applicable in medical, pharmaceutical and research markets in areas as diverse as Wound Healing, Industrial Cell Culture, Systems for Cell Protein Production (eg. Vaccines), Live Cell Screening Systems, Cosmeceuticals, Tissue Regeneration, Cell-Based Therapies. Can be used as a defined component of tissue culture to simultaneously deliver multiple recombinant growth factors in a way that is highly biologically efficient. Depending on cell type, VitroGro® can potentially deliver to the cell surface any growth factors that form a macromolecular complex with vitronectin and/or growth factor binding proteins.	Various cell types