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Canadian Intellectual Property Office

CA 2910877 C 2021/08/03

(11)(21) 2 910 877

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 2014/04/29
(87) Date publication PCT/PCT Publication Date: 2014/11/06
(45) Date de délivrance/Issue Date: 2021/08/03
(85) Entrée phase nationale/National Entry: 2015/10/29
(86) N° demande PCT/PCT Application No.: GB 2014/000165
(87) N° publication PCT/PCT Publication No.: 2014/177826
(30) Priorités/Priorities: 2013/05/03 (GB1308017.1); 2013/11/18 (GB1320339.3)

(51) Cl.Int./Int.Cl. *C12N 15/85* (2006.01), *C07K 16/06* (2006.01), *C07K 16/30* (2006.01)

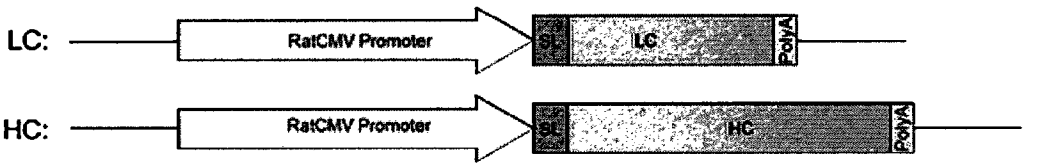
(72) Inventeurs/Inventors:
SAUNDERS, FAY LOUISE, GB;
DODDS, ANNA LOUISE, GB;
BAYARD, ADELINE MARIE GERALDINE, GB;
KARA, BHUPENDRA VALLABH, GB

(73) Propriétaire/Owner:
FUJIFILM DIOSYNTH BIOTECHNOLOGIES UK LIMITED, GB

(74) Agent: SMART & BIGGAR LLP

(54) Titre : PROCEDE D'EXPRESSION
(54) Title: EXPRESSION PROCESS

Structure of Expression Cassettes



(57) Abrégé/Abstract:
A process for the production of a target polypeptide is provided. The process comprises expression of an expression vector for expressing a target polypeptide in a host cell, preferably a mammalian cell, the expression vector comprising an expression cassette comprising a polynucleotide encoding a recombinant polypeptide operably linked to a fibronectin secretion leader sequence; and recovering the target polypeptide.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 November 2014 (06.11.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/177826 A1

(51) International Patent Classification:
C12N 15/85 (2006.01) *C07K 16/30* (2006.01)
C07K 16/06 (2006.01)

(21) International Application Number:
PCT/GB2014/000165

(22) International Filing Date:
29 April 2014 (29.04.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1308017.1 3 May 2013 (03.05.2013) GB
1320339.3 18 November 2013 (18.11.2013) GB

(71) Applicant: **FUJIFILM DIOSYNTH BIOTECHNOLOGIES UK LIMITED** [GB/GB]; Belasis Avenue, Billingham TS23 1LH (GB).

(72) Inventors: **SAUNDERS, Fay Louise**; Belasis Avenue, Billingham TS23 1LH (GB). **DODDS, Anna Louise**; Belasis Avenue, Billingham TS23 1LH (GB). **BAYARD, Adeline Marie Geraldine**; Belasis Avenue, Billingham TS23 1LH (GB). **KARA, Bhupendra Vallabh**; Belasis Avenue, Billingham TS23 1LH (GB).

(74) Agent: **REVELL, Christopher**; FUJIFILM Diosynth Biotechnologies UK Limited, Hexagon Tower, Blackley, Manchester M9 8ES (GB).

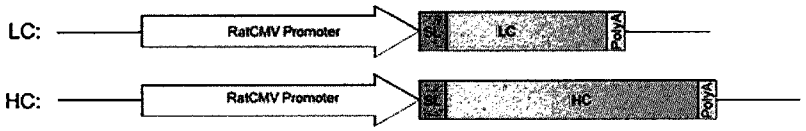
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*

(54) Title: EXPRESSION PROCESS

Figure 1 Structure of Expression Cassettes



(57) Abstract: A process for the production of a target polypeptide is provided. The process comprises expression of an expression vector for expressing a target polypeptide in a host cell, preferably a mammalian cell, the expression vector comprising an expression cassette comprising a polynucleotide encoding a recombinant polypeptide operably linked to a fibronectin secretion leader sequence; and recovering the target polypeptide.

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EXPRESSION PROCESS

The present invention concerns a process for the expression of recombinant polypeptides, and in particular the secretion of recombinant polypeptides.

It is of significant benefit in recombinant polypeptide production if the polypeptide of interest can be exported from the cell in which it is expressed. Expression systems are therefore advantageously designed to enable such export, or secretion. Secretion of the recombinant polypeptide from the host cell commonly involves use of signal peptides, which are found on the majority of eukaryotic and prokaryotic proteins that are destined for export from the cytoplasm. Secretion leaders employed in such expression systems are typically native to the expression host, for example, the PhoA, MalB and OmpA signal peptides of *Escherichia coli* have been used extensively to secrete polypeptides to the periplasm of that organism.

US7,071,172 describes the use of fibronectin secretion leaders in AAV-based delivery vectors for use in gene therapy.

According to a first aspect of the present invention, there is provided a process for the production of a target polypeptide which comprises:

a) expressing an expression vector for expressing a target polypeptide in a host cell, the expression vector comprising an expression cassette comprising a polynucleotide encoding a recombinant polypeptide operably linked to a fibronectin secretion leader sequence or a functional equivalent thereof; and

b) recovering the target polypeptide.

Fibronectin secretion leaders that can be employed in the present invention include mammalian and reptilian fibronectin secretion leaders. Examples of reptilian fibronectin secretion leaders include *Xenopus laevis* fibronectin secretion leaders. Examples of mammalian fibronectin secretion leaders include human, rat, murine, bovine, porcine, canine, feline and Chinese hamster fibronectin secretion leaders, and functional equivalents thereof, such as human fibronectin secretion leader having the sequence MLRGPGPGLLLLAVQCLGTAVPSTGA (SEQ ID No. 1). In certain embodiments, the Chinese hamster fibronectin secretion leader having the amino acid sequence MLRGPGPGLLLAVLCLGTAVRCTEA (SEQ ID No. 2) and functional equivalents thereof is preferred.

A functional equivalent to a secretion leader is one that shares 70% or greater identity with an amino acid sequence, preferably 75% or greater identity, more preferably 80% or greater identity and most preferably 90% or greater identity, such as 95% identity or more, and which retains the ability to secrete the recombinant polypeptide. In some embodiments, the functionally equivalent secretion leader differs by a single amino acid, by any of addition, deletion or replacement.

In many embodiments, polynucleotide sequences which are operably linked are contiguous and, in the case of a secretion leader, contiguous and in the same reading frame.

In an embodiment, there is provided a process for the production of a target polypeptide which comprises: (a) expressing an expression vector for expressing a target polypeptide in a CHO cell, the expression vector comprising an expression cassette comprising a polynucleotide encoding a recombinant polypeptide operably linked to a fibronectin secretion leader sequence; and (b) recovering the target polypeptide.

In an embodiment, there is provided a process for the production of a target polypeptide which comprises: (a) transfection or transformation of a CHO cell with an expression vector for expressing a target polypeptide in the CHO cell, the expression vector comprising an expression cassette comprising a polynucleotide encoding the target polypeptide operably linked to a fibronectin secretion leader sequence; (b) culturing the CHO cell under conditions which allow proliferation of the CHO cell and expression and secretion of the target polypeptide from the CHO cell; and (c) recovering the target polypeptide.

In an embodiment, there is provided a Chinese hamster ovary cell transfected with an expression vector comprising an expression cassette comprising a polynucleotide encoding the target polypeptide operably linked to a fibronectin secretion leader sequence.

Preferably, the linkage between the polynucleotide encoding the fibronectin secretion leader sequence and the polynucleotide encoding the target polypeptide is such that the secretion leader is attached to the N-terminal of the recombinant polypeptide. In certain embodiments, the recombinant polypeptide comprises an N-terminal tag, the linkage between the secretion leader sequence and the polynucleotide encoding the recombinant polypeptide being such that the secretion leader is attached to the tag, preferably to the N-terminus of the tag.

The polynucleotide encoding the fibronectin secretion leader sequence is preferably attached at the 5' end of the polynucleotide encoding the target polypeptide and preferably has the sequence ATGCTGAGAGGCCCTGGACCTGGACTGCTGCTGCTGGCTGTGCAGT GTCTGGGAACCGCCGTGCCTTCTACCGGCGCC (SEQ ID No. 3) or ATGCTCAGGGGTCC GGGACCCGGGCTGCTGCTGGCCGTCCTGTGCCTGGGGACAGCGGTGCGCTGTACCGA AGCC (SEQ ID No. 4).

The vectors of the present invention comprise a promoter operably linked to the expression cassette for the secretion leader and recombinant polypeptides.

Date Reçue/Date Received 2020-08-06

Promoters which may be employed in the vectors according to the present invention are selected according to the host cell in which the expression cassette is to be expressed.

Promoters that can be employed in prokaryotic host cells include phage polymerase-promoters, such as single T7 promoter regions, including those disclosed by Studier and Moffat, J. Mol. Biol. 189:113-130 (1986), especially a T7 gene 10 promoter region and host polymerase promoters, especially E coli polymerase promoters, such as T7A1, T7A2, T7A3, λρL., λpR, lac, lacUV5, trp, tac, trc, phoA and rrnB.

When a T7 RNA-polymerase dependent promoter region is employed, it will be recognised that a source of T7 RNA polymerase is required, which is provided by methods known in the art, and commonly by inserting a λDE3 prophage expressing the required phage polymerase into the host strain to create lysogenic host strains. The T7 RNA polymerase can also be delivered to the cell by infection with a specialised λ transducing phage that carries the gene for the T7 RNA polymerase.

Promoters that can be employed in yeast host cell include gal promoters and AOX promoters, such as AOX1 and AOX2, GAP (glyceraldehyde 3-phosphate dehydrogenase), FLP (formaldehyde dehydrogenase) and GAL1 and GAL10.

Promoters that can be employed in mammalian host cells may be endogenous or exogenous to the host cells. Suitable promoters include viral promoters such as CMV, SV40 promoter, and RSR-LTR. Promoters from housekeeping genes such as hEF1a and murine phosphoglycerate kinase (mPGK) may also be utilised. In some embodiments, preferred promoters are human CMV and rat CMV. The promoters may be the same or different if more than one polypeptide is being expressed (eg MAb HC and LC polypeptides). The promoter may be employed in combination with an enhancer

sequence, such as the major immediate early enhancer of a cytomegalovirus, especially human cytomegalovirus.

The expression vector may be integrated into the host cell genome or comprised within an extrachromosomal element such as a plasmid.

The expression vector typically also comprises a selectable marker appropriate to the host cell in which the vector is to be expressed. Selectable markers for use in prokaryotic host cells include antibiotic resistance markers, such as tetracycline or kanamycin resistance markers. Selectable markers for use in yeast hosts include antibiotic resistance markers, such as Zeocin, puromycin, neocin and hygromycin resistance. Selectable markers for mammalian cells, and especially for Chinese hamster ovary cells include glutamine synthetase and dihydrofolate reductase marker systems.

The vectors employed comprise features conventional in the art appropriate for expression in the appropriate host cell. Prokaryotic expression vectors typically comprise an origin of replication, restriction enzyme sites, a transcription terminator, and a plasmid stability locus, such as a cer stability sequence. Yeast expression vectors typically comprise promoter, transcription terminator, selection marker, and if replicating, an origin of replication. Mammalian expression vectors typically comprise a polyadenylation sequence, such as human betaglobin polyA sequence, bovine growth hormone polyA sequence and SV40 early or late poly A sequences.

The expression vector of the present invention can be employed to express recombinant polypeptides, especially proteins in host cells. Prokaryote and especially eukaryote host cells can be employed. Examples of prokaryotic cells include bacterial cells, for example gram-negative bacterial cells, including *E. coli*, *Salmonella typhimurium*, *Serratia marsescens*, *Pseudomonas putida* and *Pseudomonas aeruginosa*, and gram-positive bacterial cells including *Bacillus subtilis*. Preferred prokaryote host cells are bacteria, particularly enterobacteriacae, preferably *E coli*, and especially B or K12 strains thereof.

Examples of eukaryote host cells which can be employed include yeast, mammalian and insect cells. Yeast host cells include in particular *Saccharomyces cerevisiae*, *Pichia pastoris* and *Hansenula polymorpha.*

Preferred host cells are mammalian cells, such as baby hamster kidney cells, human embryonic kidney cell lines, for example HEK 293 cells, human retina-derived cell lines, for example PER.C6 cells, and murine lymphoid cell lines, for example NS0 and SP2 cells. and most preferably Chinese hamster ovary cells, and in particular CHOK1, DG44, DUXKB11 and CHO pro3- cells.

The expression vector of the present invention is commonly employed in the form of a plasmid. The plasmids may be autonomously replicating plasmids or integrative plasmids.

In certain highly preferred embodiments of the present invention, the fibronectin secretion leader is selected to correspond to the host cell employed. For example, human fibronectin is employed in human-derived cells, rat fibronectin is employed in rat cells, and particularly Chinese hamster fibronectin is employed in Chinese hamster ovary cells.

Polypeptides which can be expressed by the process of the present invention include therapeutic proteins and peptides, including cytokines, growth factors, antibodies, antibody fragments, immunoglobulin like polypeptides, enzyme, vaccines, peptide hormones, chemokines, receptors, receptor fragments, kinases, phosphatases, isomerases, hydrolyases, transcription factors and fusion polypeptides.

Antibodies which can be expressed include monoclonal antibodies, polyclonal antibodies and antibody fragments having biological activity, including multivalent and/or multispecific forms of any of the foregoing.

Naturally occurring antibodies typically comprise four polypeptide chains, two identical heavy (H) chains and two identical light (L) chains inter-connected by disulfide bonds. Each heavy chain comprises a variable region (V_H) and a constant region (C_H), the C_H region comprising in its native form three domains, C_H1, C_H2 and C_H3. Each light chain comprises a variable region (V_L) and a constant region comprising one domain, C_L.

The V_H and V_L regions can be further subdivided into regions of hypervariability, termed complementarity determining regions (CDR), interspersed with regions that are more conserved, termed framework regions (FR). Each V_H and V_L is composed of three CDRs and four FRs, arranged from amino-terminus to carboxy-terminus in the following order: FR1, CDR1, FR2, CDR2, FR3, CDR3, FR4.

Antibody fragments which can be expressed comprise a portion of an intact antibody, said portion having a desired biological activity. Antibody fragments generally include at least one antigen binding site. Examples of antibody fragments include: (i) Fab fragments having V_L, C_L, V_H and C_H1 domains; (ii) Fab derivatives, such as a Fab' fragment having one or more cysteine residues at the C-terminus of the C_H1 domain, that can form bivalent fragments by disulfide bridging between two Fab derivatives; (iii) Fd fragment having V_H and C_H1 domains; (iv) Fd derivatives, such as Fd derivatives having one or more cysteine residues at the C-terminus of the C_H1 domain; (v) Fv fragments having the V_L and V_H domains of a single arm of an antibody; (vi) single chain antibody molecules such as single chain Fv (scFv) antibodies in which the V_L and V_H domains are covalently linked; (vii) V_H or V_L domain polypeptide without constant region domains linked to another variable domain (a V_H or V_L domain polypeptide) that is with or without constant region domains, (e.g., V_H-V_H, V_H-V_L, or V_L-V_L) (viii) domain antibody fragments, such as fragments consisting of a V_H domain, or a V_L domain, and antigen-binding fragments of either V_H or V_L domains, such as isolated CDR regions; (ix) so-called "diabodies" comprising two antigen binding sites, for example a heavy chain variable domain (V_H) connected to a light chain variable domain (V_L), in the same polypeptide chain; and (x) so-

called linear antibodies comprising a pair of tandem Fd segments which, together with complementary light chain polypeptides, form a pair of antigen binding regions.

Preferred antibody fragments that can be prepared are mammalian single variable domain antibodies, being an antibody fragment comprising a folded polypeptide domain which comprises sequences characteristic of immunoglobulin variable domains and which specifically binds an antigen (i.e., dissociation constant of 500 nM or less, such as 400 nM or less, preferably 250 nM or less, and most preferably 100 nM or less), and which binds antigen as a single variable domain; that is, without any complementary variable domain. Single variable domain antibodies include complete antibody variable domains as well as modified variable domains, for example in which one or more loops have been replaced by sequences which are not characteristic of antibody variable domains or antibody variable domains which have been truncated or comprise N- or C-terminal extensions, as well as folded fragments of variable domains. Preferred single variable domains which can be prepared are selected from the group of V_H and V_L, including V_{kappa} and V_{lambda}. Most preferably the single variable domains are human or camelid domains, including humanised camelid domains.

Where the target polypeptide comprises two or more chains to be secreted, particularly where the target polypeptide is an antibody or a fragment antibody comprising two or more chains, at least one, and preferably each, of the chains is attached to a fibronectin secretion leader, and polynucleotides encoding such polypeptides are designed accordingly. The fibronectin secretion leaders employed may be the same or different. The polynucleotides encoding the two or more chains may be comprised within the same expression cassette, but are preferably comprised in different expression cassettes. Where different expression cassettes are employed, the expression cassettes may be located on different vectors, but are preferably on the same vector. Promoters employed may be the same or different.

The expression system is expressed by methods well known in the art for the cells employed. Preferred expression methods include culturing the host cells in growth medium, and then recovering the expressed polypeptide. The term "growth medium" refers to a nutrient medium used for growing the host cells. In many embodiments, a nutrient solution is employed. Suitable growth media for given host cells and methods of recovering polypeptides are well known in the art.

In many embodiments, the polypeptide recovery comprises one or more of filtration, centrifugation, diafiltration, ion-exchange chromatography, affinity chromatography, such as Protein A affinity chromatography, Hydrophobic Interaction Chromatography (HIC), Gel Filtration and HPLC.

According to a preferred aspect of the present invention there is provided a process for the production of a target polypeptide which comprises:

(a) transfection or transformation of a host cell with an expression vector for expressing a target polypeptide in a host cell, the expression vector comprising an

expression cassette comprising a polynucleotide encoding the target polypeptide operably linked to a fibronectin secretion leader sequence or a functional equivalent thereof;

(b) culturing the host cell under conditions which allow proliferation of the host cell and expression and secretion of the target polypeptide from the host cell

(c) and recovering the target polypeptide.

According to a further aspect of the present invention, there is provided a Chinese hamster ovary cell, preferably a CHOK1, DG44, DUXKB11 or CHO pro3- cell, transfected with an expression vector comprising an expression cassette comprising a polynucleotide encoding the target polypeptide operably linked to a fibronectin secretion leader sequence or a functional equivalent thereof.

The target polypeptide encoded in the further aspect of the present invention is preferably comprises a monoclonal antibody. An expression cassette comprising polynucleotides encoding both heavy and light chains of a monoclonal antibody, preferably each operably linked to a fibronectin secretion leader, may be employed. In some embodiments, separate expression cassettes comprising heavy and light chains are employed, which may be located on separate vectors, but are often located on the same vector. The fibronectin secretion leaders employed may be the same or different, but are preferably the same.

In many preferred embodiments, the expression cassette comprises a housekeeping gene promoter, especially an hEF1a promoter operably linked to the polynucleotide encoding the target polypeptide, and when two or more expression cassettes are employed, each expression cassette comprises a housekeeping gene promoter, preferably the same promoter, and most preferably an hEF1a promoter.

The, or each, expression cassette for the target polypeptide preferably comprises a bovine growth hormone polyA sequence.

The expression vector preferably comprises a selection marker, most preferably a dihydrofolate reductase marker system. In certain instances, the dihydrofolate reductase marker system comprises an expression cassette further comprising a murine phosphoglycerate kinase promoter.

A DNA construct comprising an expression cassette comprising a promoter effective in a mammalian cell and a polynucleotide encoding a target polypeptide operably linked to a fibronectin secretion leader sequence forms another aspect of the present invention.

The DNA constructs preferably comprise separate expression cassettes for heavy and light chains of a monoclonal antibody. Most preferably, each expression cassette comprises the same promoter, especially a housekeeping gene promoter, most especially an hEF1a promoter. Particularly preferably, each expression cassette further comprises a bovine growth hormone polyA sequence. The DNA constructs often advantageously comprise a selection marker, most preferably a dihydrofolate reductase marker system.

In certain instances, the dihydrofolate reductase marker system comprises an expression cassette further comprising a murine phosphoglycerate kinase promoter.

The present invention is illustrated without limitation by the following examples.

Example 1

For each secretion leader (SL) being assessed, two single gene vectors were constructed which contained either the hγ1 FL heavy chain (HC) of an anti-MUC-1 MAb or the lambda light chain (LC) of an anti-MUC-1 MAb. Each expression cassette consisted of a rat CMV promoter, functionally linked to a polynucleotide sequence encoding the secretion leader which was linked in frame to a polynucleotide sequence encoding the HC or LC mature polypeptide and a human betaglobin polyA sequence. The structure of the expression cassettes is illustrated in Figure 1.

Secretion leaders employed were as follows:

Secretion leader A: human collagen, sequence MLSFVDTRTLLLLAVTLCLATCQS (SEQ ID No. 5)

Secretion leader B: human fibronectin, sequence MLRGPGPGLLLLAVQCLGTAVPSTGA (SEQ ID No. 1)

Secretion leader C: Chinese hamster fibronectin, sequence MLRGPGPGLLLAVLCLGTAVRCTEA (SEQ ID No. 2)

Secretion leader D: Chinese hamster albumin, sequence MKWVTFLLLLFVSDSAFS (SEQ ID No. 6)

CHO DG44 host cells were counted and seeded onto wells of a 6 well plate at 1.2×10^6 cells/well in MEM-α medium supplemented with 10% serum, 2mM Glutamine and 0.45% glucose, and incubated overnight at 36.5°C, 7.5% CO_2.

For each transfection 4µg of the HC and LC single gene vectors (2µg) were mixed together and diluted in 250µL serum free MEM-α medium (Life Technologies). A mock transection (PBS only) was also included. For each transfection 12.5µL Lipofectamine 2000 (Life Technologies) was diluted in 250µL serum free MEM- α medium and mixed. The mixture was incubated at room temperature (15-25°C) for 5 minutes. The diluted DNA and Lipofectamine 2000™ reagent were combined, mixed and incubated for 20

minutes at room temperature. A further 500µL MEM-α medium was added to each transfection mix, growth medium was removed from the well and the complex was then added to a well of the 6-well plate containing the cells. After 5 hours the medium was removed and fresh growth medium was added. Cells were incubated for 5 days at 36.5°C, 7.5% CO_2. Supernatant was harvested and clarified by centrifugation. Antibody titre was determined using an Octet (Forte Bio) protein A assay.

The results are given in Table 1 below.

Table 1

Secretion leader used	Mean antibody titre (mg/l)
A	2.91
B	7.79
C	8.85
D	1.89

The antibody produced is recovered from the supernatant by Protein A capture, elution at low pH and purified by cation exchange chromatography followed by anion exchange chromatography. Eluent from the anion exchange chromatography is subject to viral nanofiltration, followed by buffer exchange and concentration.

Example 2

Vector construction

Double gene vectors were constructed which contained a hEF1a promoter driving expression of both the hγ1 FL heavy chain of an anti-MUC-1 MAb and the human lambda light chain of an anti-MUC-1 MAb.

Further double gene vectors were constructed where the hEF1α promoter was exchanged for either a hCMV-MIE promoter or rat CMV promoter.

Each expression cassette within the double gene vectors consisted of the promoter functionally linked to a polynucleotide sequence encoding the CHO fibronectin signal peptide of Example 1, which was linked in frame to a polynucleotide sequence encoding the HC or LC mature polypeptide. Correct mRNA processing was ensured by the presence of a bovine growth hormone poly A sequence.

To allow selection of stable cell lines the vectors also contained a copy of the mouse dyhydrofolate reductase (dhfr) gene under control of the murine phosphoglycerate (mPGK) promoter and the hygromycin resistance gene under the control of the thymidine kinase (TK) promoter.

Routine subculture of CHO DG44 cells:

CHO DG44 cells were routinely cultured in suspension shaker flasks in EX-CELL ACF CHO medium (Sigma) supplemented with 8 mM L-glutamine and 1 x HT supplement (Life Technologies). Cells were seeded at a concentration of 2 x 10^5 cells/ml, and cells were split every 3 days. Flasks were cultured at 37°C, 7.5% CO_2 in an orbital shaking incubator at 140 rpm.

Transfections for generation of stable cell lines

Cells used for transfections were grown in cell suspension culture, as detailed above. Cells from growing cultures were centrifuged and re-suspended to a concentration of $2x10^7$ cells/mL. A 0.1 mL volume of the cell suspension and 4 µg of linearised plasmid DNA were added to an electroporation cuvette. The cuvette was then placed in the Amaxa nucleofector (Lonza) and nucleofected. Following transfection, the cells were added to 20ml pre-warmed EX-CELL ACF CHO medium (Sigma) supplemented with 8mM Glutamine and 1 x HT supplement in a T75 flask. Transfected cells were incubated at 37°C, 7.5% CO_2. Following the removal of hypoxanthine and thymidine (HT) (48hrs post transfection) from the medium and addition of 400µg/ml Hygromycin B (Invitrogen) and 25nM MTX (144hrs post transfection) cells were plated out into 96 well plates at 5000 cells/well (2.5 x 10^4/mL). The plates were incubated at 37°C in an atmosphere of 7.5% CO_2 in air. The plates were monitored for colony growth up to approximately three weeks after transfection. Supernatant from up to 100 wells containing cell growth were harvested and analysed for the Antibody using an Octet (Forte Bio) protein A assay. The top 24 expressing colonies were expanded into 24 well plates and cultured for 10 days. Supernatant was then assayed for the Antibody using an Octet (Forte Bio) protein A assay. The results are given in Table 2 below.

Table 2

	hEF1α		hCMV-MIE		Rat CMV	
	96 wp	24 wp	96 wp	24 wp	96 wp	24 wp
Max Exp Level (µg/mL)	7.3	18.0	6.1	3.2	6.1	nd
Mean Exp Level (µg/mL)	3.3	4.2	0.7	1.3	0.6	nd

Example 3

Purification of Antibody from CHO supernatant

Supernatant from recombinant CHO DG44 cell lines generated using the hEF1α promoter double gene vector described in Example 2 was purified using protein A resin. 350mL of clarified harvest was loaded onto a pre-packed column containing MabSelect SuRe resin (GE Healthcare). Resin was washed first with 20mM Sodium Phosphate, 1M NaCl (pH7.0) and then with 20mM Sodium Phosphate (pH7.0). Antibody was then eluted with 100mM Acetic acid. Recovered product was quantified using an Octet (Forte Bio) protein A assay and is shown in Table 3.

Table 3

	Volume (mL)	Concentration (mg/mL)
Clarified Harvest	350	1.3
Eluted Antibody	50.55	7.7

CLAIMS:

1. A process for the production of a target polypeptide which comprises:

(a) expressing an expression vector for expressing a target polypeptide in a CHO cell, the expression vector comprising an expression cassette comprising a polynucleotide encoding a recombinant polypeptide operably linked to a fibronectin secretion leader sequence; and

(b) recovering the target polypeptide.

2. A process for the production of a target polypeptide which comprises:

(a) transfection or transformation of a CHO cell with an expression vector for expressing a target polypeptide in the CHO cell, the expression vector comprising an expression cassette comprising a polynucleotide encoding the target polypeptide operably linked to a fibronectin secretion leader sequence;

(b) culturing the CHO cell under conditions which allow proliferation of the CHO cell and expression and secretion of the target polypeptide from the CHO cell; and

(c) recovering the target polypeptide.

3. A process according to claim 1 or 2, wherein the fibronectin secretion leader is Chinese hamster fibronectin secretion leader.

4. A process according to any one of claims 1-3, wherein the CHO cell is CHOK1, DG44, DUXKB11 or CHO pro3- cell.

5. A process according to claim 4, wherein the CHO cell is a DG44 cell.

6. A process according to claim 4 or 5, wherein the expression cassette comprises an hEF1a promoter.

7. A process according to any one of claims 4 to 6, wherein the expression cassette comprises a polyA sequence.

8. A process according to claim 7, wherein the poly A sequence is selected from human betaglobin polyA, bovine growth hormone polyA SV40 early or late poly A sequences.

9. A process according to any one of claims 1-8, wherein the fibronectin secretion leader has the sequence MLRGPGPGLLLAVLCLGTAVRCTEA.

10. A process according to any one of claims 1-9, wherein two expression cassettes are employed, one expression cassette comprising a polynucleotide encoding a light chain of a monoclonal antibody, and a second expression cassette comprising a polynucleotide encoding a heavy chain of a monoclonal antibody.

11. A process according to claim 10, wherein the two expression cassettes comprise the same promoter, secretion leader and polyA sequence.

12. A process according to claim 11, wherein the promoter is an hEF1a promoter, the fibronectin secretion leader is Chinese hamster fibronectin secretion leader and the polyA sequence is bovine betaglobin polyA sequence.

13. A Chinese hamster ovary cell transfected with an expression vector comprising an expression cassette comprising a polynucleotide encoding the target polypeptide operably linked to a fibronectin secretion leader sequence.

14. A Chinese hamster ovary cell according to claim 13, wherein the target polypeptide comprises a monoclonal antibody.

15. A Chinese hamster ovary cell according to claim 14, wherein separate expression cassettes comprising heavy and light chains are employed.

16. A Chinese hamster ovary cell according to claim 15, wherein the expression cassettes are located on the same vector.

17. A Chinese hamster ovary cell according to any one of claims 13 to 16, wherein each expression cassette comprises a housekeeping gene promoter operably linked to the polynucleotide encoding the target polypeptide.

18. A Chinese hamster ovary cell according to any one of claims 13 to 17, wherein each expression cassette comprises a bovine growth hormone polyA sequence.

19. A Chinese hamster ovary cell according to any one of claims 13 to 18 which further comprises a dihydrofolate reductase marker system.

20. A Chinese hamster ovary cell according to claim 19, wherein the dihydrofolate reductase marker system comprises a murine phosphoglycerate kinase promoter.

21. A Chinese hamster ovary cell according to any one of claims 13 to 20, wherein the fibronectin secretion leader is CHO fibronectin.

22. A Chinese hamster ovary cell according to any one of claims 13 to 21, wherein the fibronectin secretion leader has the sequence MLRGPGPGLLLAVLCLGTAVRCTEA.

23. A process for the production of a polypeptide which comprises culturing a Chinese hamster ovary cell according to any one of claims 13 to 22.

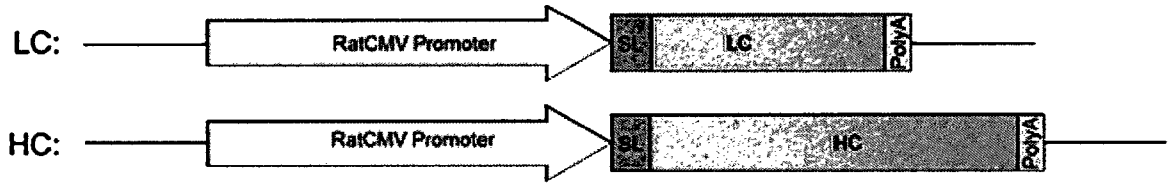
24. A DNA construct comprising an expression cassette comprising a housekeeping promoter and a polynucleotide encoding a target polypeptide operably linked to a fibronectin secretion leader sequence.

25. A DNA construct according to claim 24, wherein the promoter is an hEF1a promoter, and the expression cassette further comprises a bovine growth hormone poly A sequence.

26. A Chinese hamster ovary cell according to claim 13, wherein the Chinese hamster ovary cell is a CHOK1, DG44, DUXKB11 or CHO pro3- cell.

27. A Chinese hamster ovary cell according to claim 17, wherein the housekeeping gene promoter is an hEF1a promoter.

Figure 1 Structure of Expression Cassettes



Structure of Expression Cassettes