番号	用途・機能・特徴	研究・開発メーカー	ベクター	プロモーター	ターミネーター	マーカー
762	RNAi	Promega	psiCHECK-1 (Accession No. AY535006)	・T7 ・SV40		Ampicillin
763	RNAi	Promega	psiCHECK-2 (Accession No. AY535007)	・T7 ・SV40 ・HSV-TK		Ampicillin
764	クローニング	Promega	pGEM-T	・T7 ・SP6		Ampicillin
765	クローニング	Promega	pGEM-T Easy	・T7 ・SP6		Ampicillin
766	大腸菌発現	Promega	PinPoint Xa-1 (Accession No. U47626)	・T7 ・SP6 ・Tac		Ampicillin
767	クローニング	STRATGENE	Lambda gt11	lac		Ampicillin
768	クローニング	STRATGENE	Lambda ZAPII	・T3 ・T7 ・lac		Ampicillin
769	クローニング	STRATGENE	pBluescript SK(+/-)	・T3 ・T7 ・lac		Ampicillin
770	・クローニング ・大腸菌発現 ・哺乳類細胞発現	STRATGENE	Lambda ZAP-CMV	・T3 ・T7 ・CMV		・Kanamycin ・Neomycin
771	クローニング	STRATGENE	pBC SK(+/-)	lac		Chloramphenicol
772	クローニング	STRATGENE	pBC KS(+/-)	lac		Chloramphenicol
773	クローニング	STRATGENE	pCMV-Script	CMV		・Kanamycin ・Neomycin
774	・クローニング ・大腸菌発現 ・哺乳類細胞発現	STRATGENE	Zap Express	・T3 ・T7 ・lac ・CMV		・Kanamycin ・Neomycin
775	Bacillus megaterium 発現	Mo Bi Tec	pWH1520	xylA		・Ampicillin ・Tetracycline
776	Bacillus megaterium 発現	Mo Bi Tec	pMM1522	xylA		・Ampicillin ・Tetracycline
777	Bacillus megaterium 発現	Mo Bi Tec	pMM1525	xylA		・Ampicillin ・Tetracycline
778	Bacillus megaterium 発現	Mo Bi Tec	pHIS1522	xylA		・Ampicillin ・Tetracycline
779	Bacillus megaterium 発現	Mo Bi Tec	pHIS1525	xylA		・Ampicillin ・Tetracycline
780	Bacillus megaterium 発現	Mo Bi Tec	pSTREP1525	xylA		・Ampicillin ・Tetracycline
781	Bacillus megaterium 発現	Mo Bi Tec	pSTREPHIS1525	xylA		・Ampicillin ・Tetracycline
782	Bacillus megaterium 発現	Mo Bi Tec	pC-HIS1622	xylA		・Ampicillin ・Tetracycline
783	Bacillus megaterium 発現	Mo Bi Tec	pC-STREP1622	xylA		・Ampicillin ・Tetracycline
784	Bacillus megaterium 発現	Mo Bi Tec	pN-HIS-TEV1622	xylA		・Ampicillin ・Tetracycline
785	Bacillus megaterium 発現	Mo Bi Tec	pN-STREP-TEV1622	xylA		・Ampicillin ・Tetracycline
786	Bacillus megaterium 発現	Mo Bi Tec	pN-STREP-Xa1622	xylA		・Ampicillin ・Tetracycline
787	Bacillus megaterium 発現	Mo Bi Tec	pSTOP1622	xylA		・Ampicillin ・Tetracycline
788	Bacillus megaterium 発現	Mo Bi Tec	pRBBm15	xylA		・Ampicillin ・Tetracycline
789	Bacillus megaterium 発現	Mo Bi Tec	pRBBm13	xylA		・Ampicillin ・Tetracycline
790	Bacillus megaterium 発現	Mo Bi Tec	pRBBm16	xylA		・Ampicillin ・Tetracycline
791	Bacillus subtilis発現	Mo Bi Tec	pHT01	groE		・Ampicillin ・Chloramphenicol
792	Bacillus subtilis発現	Mo Bi Tec	pHT43	groE		・Ampicillin ・Chloramphenicol
793	Bacillus subtilis発現	Mo Bi Tec	pHT08	groE		・Ampicillin ・Chloramphenicol
794	Bacillus subtilis発現	Mo Bi Tec	pHT09	groE		・Ampicillin ・Chloramphenicol
795	Bacillus subtilis発現	Mo Bi Tec	pHT10	groE		・Ampicillin ・Chloramphenicol
796	Lactococcus lactis発現	Mo Bi Tec	pNZ8148	Nisin A		Chloramphenicol
797	Lactococcus lactis発現	Mo Bi Tec	pNZ8150	Nisin A		Chloramphenicol

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798	Lactococcus lactis発現	Mo Bi Tec	pNZ8008	Nisin A		Chloramphenicol
799	Bacillus subtilis発現	Mo Bi Tec	pBacTag-FLAG	spac	Tryptophan operon	・Ampicillin ・Erythromycin
800	Bacillus subtilis発現	Mo Bi Tec	pBacTag-cMyc	spac	Tryptophan operon	・Ampicillin ・Erythromycin
801	Bacillus subtilis発現	Mo Bi Tec	pBacTag-HA	spac	Tryptophan operon	・Ampicillin ・Erythromycin
802	Bacillus subtilis発現	Mo Bi Tec	pBacTag-GFP+	spac	Tryptophan operon	・Ampicillin ・Erythromycin
803	Bacillus subtilis発現	Mo Bi Tec	pBacTag-CFP	spac	Tryptophan operon	・Ampicillin ・Erythromycin
804	Bacillus subtilis発現	Mo Bi Tec	pBacTag-YFP	spac	Tryptophan operon	・Ampicillin ・Erythromycin
805	Pichia pastoris発現	Mo Bi Tec	pPICHOLI(1-3)	・T7 ・Alcohol dehydrogenase	Alcohol dehydrogenase Terminator	Zeocin
806	Pichia pastoris発現	Mo Bi Tec	pPICHOLI-C	・T7 ・CUP-1	Alcohol dehydrogenase Terminator	Zeocin
807	Pichia pastoris発現	Mo Bi Tec	pPICHOLI-HA	・T7 ・Alcohol dehydrogenase	Alcohol dehydrogenase Terminator	Zeocin
808	cell label	Mo Bi Tec	pCDNA-3-mito-EosFPwt	・T7 ・CMV		・Ampicillin ・Neomycin
809	cell label	Mo Bi Tec	pCDNA-3-Flag1-EosFPwt	・T7 ・CMV		・Ampicillin ・Neomycin
810	cell label	Mo Bi Tec	pCDNA-3-Flag1-td-EosFP	・T7 ・CMV		・Ampicillin ・Neomycin
811	Broad host range	Mo Bi Tec	pBBR122			・Kanamycin ・Chloramphenicol
812	Broad host range	Mo Bi Tec	pBHR1			・Kanamycin ・Chloramphenicol
813	大腸菌発現	Mo Bi Tec	pHKperi1	lac	bacteriophage fd	Chloramphenicol
814	大腸菌発現	Mo Bi Tec	pHKperi2	lac	bacteriophage fd	Chloramphenicol
815	大腸菌発現	Mo Bi Tec	pHKcyto1	lac	bacteriophage fd	Chloramphenicol
816	大腸菌発現	Mo Bi Tec	pHKcyto2	lac	bacteriophage fd	Chloramphenicol
817	大腸菌発現	Mo Bi Tec	pAX4(a-c)(+,-)	lac		Ampicillin
818	大腸菌発現	Mo Bi Tec	pAX5(+,-)	lac		Ampicillin
819	大腸菌発現	Mo Bi Tec	pJL3	E. coli lipoprotein		Chloramphenicol
820	大腸菌発現	Mo Bi Tec	pSW1			Tetracyclin
821	大腸菌発現	Mo Bi Tec	pPEPTIDE	T7	T7	Ampicillin
822	promoter cloning	Mo Bi Tec	pBBR RESO			・Kanamycin ・Chloramphenicol
823	酵母発現	Mo Bi Tec	pORF-CLONE	CUP1		Ampicillin
824	クローニング	Mo Bi Tec	Exontrap	SV40		Ampicillin
825	クローニング	Mo Bi Tec	p3T	lacI		Ampicillin
826	クローニング	Mo Bi Tec	pCorrect Clone	lambda		Ampicillin
827	クローニング	Mo Bi Tec	pMEX(5-8)	Tac	rrnB	Ampicillin
828	クローニング	Mo Bi Tec	pEG-His1			Ampicillin
829	クローニング	Mo Bi Tec	pMCS5	T7		Ampicillin
830	Y2H	Mo Bi Tec	pBT3-N	CYC1	CYC1	Kanamycin
831	Y2H	Mo Bi Tec	pBT3-C	CYC1	CYC1	Kanamycin
832	Y2H	Mo Bi Tec	pBT3-SUC	CYC1	CYC1	Kanamycin
833	Y2H	Mo Bi Tec	pBT3-STE	CYC1	CYC1	Kanamycin
834	Y2H	Mo Bi Tec	pPR3-N	CYC1	CYC1	Ampicillin
835	Y2H	Mo Bi Tec	pPR3-C	ADH1	CYC1	Ampicillin
836	Y2H	Mo Bi Tec	pPR3-SUC	ADH1	CYC1	Ampicillin
837	Y2H	Mo Bi Tec	pPR3-STE	ADH1	CYC1	Ampicillin
838	Y2H	Mo Bi Tec	pCCw-Alg5	CYC1	CYC1	Kanamycin
839	Y2H	Mo Bi Tec	pAI-Alg5	ADH1	CYC1	Ampicillin
840	Y2H	Mo Bi Tec	pDL2-Alg5	ADH1	CYC1	Ampicillin
841	one-Hybrid	Mo Bi Tec	pGNG2		ADH1	Ampicillin
842	one-Hybrid	Mo Bi Tec	pJG4-5	GAL1	ADH	Ampicillin
843	Y2H	Mo Bi Tec	pGNG1	GAL1,10	ADH	Ampicillin
844	Y2H	Mo Bi Tec	pEG202	ADH1	ADH	Ampicillin

番号	区分	導入遺伝子	宿主乳酸菌	機能・特徴	研究・開発国	文献	遺伝子組換え法	ベクター	プロモーター	ターミネーター	マーカー	備考
1	アレルギー治療剤	IgEエピトープ構造を模したペプチドCε 4nin、α-IdscFv2をコードする遺伝子	Lactobacillus johnsonii NCC 2754	Lactobacillus delbrueckii subsp. bulgaricus由来prtBアンカーペプチドにより菌体表層に固定化発現、マウスの皮下および鼻腔内へ投与し、IgE特異的IgGを産生	スイス・Institute of Immunology 他	Scheppler et al. (2005) Intranasal immunisation using recombinant Lactobacillus johnsonii as a new strategy to prevent allergic disease. Vaccine. 23:1126-34.	形質転換	pMD112			chloramphenicol resistance (cat)	
2	自己免疫疾患治療剤	myelin basic protein (MBP) 遺伝子	Lactobacillus casei ATCC 393	菌体内に蓄積または菌体表層固定発現（β-glucronidase融合タンパク質も含む）、ラットの鼻腔または胃内投与、自己免疫性脳脊髄炎に対する免疫寛容の誘導	オランダ・TNO	Maassen et al. (2003) Reduced experimental autoimmune encephalomyelitis after intranasal and oral administration of recombinant lactobacillus expressing myelin antigens. Vaccine. 21:4685-4693	形質転換	pLP402、pLP403	α-amylase, Pamy (Lactobacillus amylovorus)	cbh (Lactobacillus plantarum conjugated bile acid hydrolase)	erythromycin resistance	pLP400シリーズの文献 Pouwels et al. (2001) Methods in Enzymol. 336:369-389
3	ワクチン	Human Papilloma virus (HPV) 16L-L1抗原遺伝子	Lactobacillus casei CECT 5275	菌体内発現、マウスの皮下へ投与し、HPV 16L-L1特異的IgGの産生	ブラジル・Instituto de Quimica, Universidade de Sao Paulo 他	Aires et al. (2006) Production of human papillomavirus type 16 L1 virus-like particles by recombinant Lactobacillus casei cells. Appl. Env.	形質転換	pIAlac			erythromycin resistance	pIAlacの文献 Gosalbes et al. (2001) Lait 81:29-35
4	ワクチン	重症急性呼吸器症候群 (SARS) ウィルス抗原遺伝子	Lactobacillus casei BLS-S8	Bacillus subtilis由来pgsAアンカーペプチドによる菌体表層発現、マウスへ経口および経鼻投与、擬似SARSウィルスに対する中和抗体の産生	韓国・Bioleaders corporation 他	Lee et al. (2006) Mucosal immunization with surface-displayed severe acute respiratory syndrome coronavirus spike protein on Lactobacillus casei induces neutralizing antibodies in mice. J.	形質転換	pHAT			erythromycin resistance	
5	ワクチン	Helicobacter pylori urease B (UreB) 遺伝子	Lactobacillus plantarum NCIMB 8826	菌体内発現、マウスの胃内へ投与、特異的抗体産生と部分的感染防御効果	スイス・Centre Hospitalier Universitaire Vaudois 他	Corthesy et al. (2005) Oral immunization of mice with lactic acid bacteria producing Helicobacter pylori urease B subunit partially protects against challenge with Helicobacter felis. J. Infect. Dis. 192：1441-	形質転換	pMEC142	lactose dehydorogenase, P_{ldh} (Lactobacillus plantarum)		erythromycin resistance	
6	ワクチン	Transmissible gastroenteritis coronavirus (TGEV) glycoprotein SのN-末端配列遺伝子	Lactobacillus casei Shirota	菌体外分泌、マウスへ経口投与、特異的抗体産生と腸管へのウィルス接着阻害効果	シンガポール・National University of Singapore	Ho et al. (2005) Intragastric administration of Lactobacillus casei expressing transmissible gastroentritis coronavirus spike glycoprotein induced specific antibody production. Vaccine	形質転換	pLP500	lactose dehydorogenase, Pldh (Lactobacillus casei)	cbh (Lactobacillus plantarum conjugated bile acid hydrolase)	erythromycin resistance	pLP500シリーズの文献 Pouwels et al. (2001) Methods in Enzymol. 336:369-389
7	ワクチン	Erysipelothrix rhusiopathiae由来抗原 (SpaA) 遺伝子	Lactococcus lactis subsp. lactis IL1403	菌体外分泌（一部表層固定）、マウスへ鼻腔内、胃内、または腹腔内投与、特異的抗体産生および感染防御効果	日本・帯広畜産大学 他	Cheun et al. (2004) Protective immunity of SpaA-antigen producing Lactococcus lactis against Erysipelothrix rhusiopathiae infection. J. Appl. Microbiol. 96:1347-1353	形質転換	pSECE1			erythromycin resistance	
8	ワクチン	Streptococcus pyogenes M proteinのconserved C-repeat region (CRR) 遺伝子	Lactococcus lactis LM2301	マウスへ鼻腔内および皮下投与、特異的抗体産生と感染防御効果	アメリカ・Oregon State University他	Mannam et al. (2004) Mucosal vaccine made from live, recombinant Lactococcus lactis protects mice against pharyngeal infection with Streptococcus pyogenes. Infect. Immun. 72:3444-3450	形質転換	pPI6pip			erythromycin resistance	
9	ワクチン	Salmonella enterica serovar Enteritidisの鞭毛抗原 (FliC) 遺伝子	Lactobacillus casei ATCC 393	菌体表層発現、マウスへの胃内投与、抗体非依存的な感染防御効果	日本・国立医薬品食品衛生研究所 他	Kajikawa et al. (2007) Intragastric immunization with recombinant Lactobacillus casei expressing flagellar antigen confers antibody-independent protective immunity against Salmonella enterica serovar	形質転換	pLP401	α-amylase, P_{amy} (Lactobacillus amylovorus)	cbh (Lactobacillus plantarum conjugated bile acid hydrolase)	erythromycin resistance	
10	ワクチン	Human immunodeficiency virus (HIV) 抗原遺伝子	Lactococcus lactis subsp. lactis IL1403	菌体表層発現、コレラトキシン使用、マウスへ経口投与、特異的抗体産生、細胞性免疫誘導、および感染防御効果	日本・横浜市立大学 他	Xin et al. (2003) Immunogenicity and protective efficacy of orally administrated recombinant Lactococcus lactis expressing surface-bound HIV Env.	形質転換	pSGANC332	erythromycin resistance gene promoter			
11	ワクチン	破傷風毒素fragment C (TTFC) 遺伝子	Lactobacillus plantarum NCIMB 8826および Lactococcus lactis MG1363	菌体内発現、マウスへ胃内投与、破傷風毒素中和抗体の産生	フランス・パスツール研究所 他	Grangette et al. (2002) Protection against tetanus toxin after intragastric administration of two recombinant lactic acid bacteria: impact of strain viability and in vivo persistence.	形質転換	pMEC127	lactose dehydorogenase, P_{ldh} (Lactobacillus plantarum)		erythromycin resistance	
12	ワクチン	破傷風毒素 ミニトープ遺伝子	Lactobacillus johnsonii NCC 2754	菌体表層発現、マウス胃内への投与、特異的抗体産生	スイス・Institute of Immunology and Allergology 他	Scheppler et al. (2002) Recombinant Lactobacillus johnsonii as a mucosal vaccine delivery vehicle.	形質転換	pMD112			chloramphenicol resistance (cat)	
13	ワクチン	ウシ Rotavirus nonstructural protein 4 (NSP4) 抗原遺伝子	Lactococcus lactis NZ9000	菌体内発現または菌体外分泌、菌体ライセート+アラムアジュバントをウサギの筋肉内へ投与、特異的抗体産生	フランス・INRA	Enouf et al. (2001) Bovine rotavirus nonstructural protein 4 produced by Lactococcus lactis is antigenic and immunogenic. Appl. Env. Microviol. 67:1423-1428	形質転換	pSEC、pCYT	nisin-inducible promoter, P_{nisA}		chloramphenicol resistance (cat)	
14	ワクチン	破傷風毒素fragment C (TTFC) 遺伝子	Lactobacillus plantarum 256 および Lactobacillus casei ATCC 393	菌体内発現または菌体表層固定、マウスの胃内または鼻腔内投与、特異的抗体およびT細胞誘導	オランダ・TNO	Shaw et al. (2000) Engineering the microflora to vaccinate the mucosa: serum immunoglobulin G responses and activated draining cervical lymph nodes following mucosal appication of tetanus toxin fragment C-expressing lactobacilli.	形質転換	pLP503、pLP401	lactose dehydorogenase, Pldh (Lactobacillus casei), α-amylase, P_{amy} (Lactobacillus amylovorus)	cbh (Lactobacillus plantarum conjugated bile acid hydrolase)	erythromycin resistance	
15	ワクチン	炭疽菌抗原遺伝子pag	Lactobacillus casei ATCC 393	菌体内発現、マウスの胃内または鼻腔内投与、特異的抗体産生	オランダ・TNO 他	Zegers et al. (1999) Expression of the protective antigen of Bacillus anthracis by Lactobacillus casei: towards the development of an oral vaccine against anthrax. J. Appl. Microbiol. 87:309-	形質転換	pLP503	lactose dehydorogenase, P_{ldh} (Lactobacillus casei)	cbh (Lactobacillus plantarum conjugated bile acid hydrolase)	erythromycin resistance	
16	ワクチン	コレラ毒素Bサブユニット遺伝子	Lactobacillus paracasei LbTGS1.4, Lactobacillus plantarum NCIMB 8826	菌体内発現または菌体外分泌	フランス・Transgene S.A. 他	Slos et al. (1998) Production of cholera toxin B subunit in Lactobacillus. FEMS Microbiol. Lett. 169:29-36	形質転換	pTG292	P25	TIT2 double vertical hairpins	chloramphenicol resistance (cat)	

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17	ワクチン	マウス インターロイキン-2 (IL-2), IL-6, TTFC遺伝子	*Lactococcus lactis*	IL-2 (またはIL-6) 分泌およびTTFC菌体内発現, マウスへ鼻腔内投与, TTFC特異的抗体産生	ベルギー・Ghent大学 他	Steidler et al. (1998) Mucosal delivery of murine interleukin-2 (IL-2) and IL-6 by recombinant strains of *Lactococcus lactis* coexpressing antigen and cytokine. Infect. Immun. 66:3183-3189	形質転換	pTREX1			erythromycin resistance	pTREX1の文献 Wells et al. NATO ASI Ser. H 98:37-63
18	抗ウィルス(HIV)剤	Cyanovirin遺伝子	*Lactococcus lactis* MG1363 および *Lactobacillus plantarum* NCIMB 8826	分泌または細胞内発現, in vitroで抗ウィルス活性を確認	オーストリア・Vienna医科大学 他	Pusch et al. (2005) Bioengineering lactic acid bacteria to secrete the HIV-1 virucide cyanovirin. J Acquir Immune Defic Syndr.	形質転換	pTSV1, pTSV2	LPS2 (bacteriophage)		erythromycin resistance	
19	抗ウィルス(HIV)剤	Cyanovirin-N遺伝子	*Lactobacillus jensenii* 1153	分泌, *L. jensenii*のマウス膣内定着とcyanovirin発現を確認	アメリカ・Osel, Inc. 他	Liu et al. (2006) Engineered vaginal *Lactobacillus* strain for mucosal delivery of the human immunodeficiency virus inhibitor cyanovirin-N. Anticrobial Agents and Chemotherapy 50 : 3250-	形質転換	pOSEL175	P_{23} (*Lactococcus lactis*), P_{tuf} (self), P_{rpsU} (self)		erythromycin resistance	
20	抗炎症剤	ヒトインターロイキン10 (IL-10) 遺伝子	*Lactococcus lactis* MG1363	分泌, IL-10遺伝子をホストthyA遺伝子と置換することで, 生物学的封じ込めに優れる	ベルギー・Ghent大学	Steidler et al. (2003) Biological containment of genetically modified *Lactococcus lactis* for intestinal delivery of human interleukin 10. Nat. Biotech. 21:785-789	相同組換え (double crossover)	pORI19, pVE6007 (推定, 組換え中間体のみ保持)	P_{thyA} (self)		erythromycin resistance (組換え中間体菌株のみ保持)	pORI19, pVE6007の文献 Law et al. (1995) J. Bacteriol. 177:7011-7018
21	抗炎症剤	マウスインターロイキン10 (IL-10) 遺伝子	*Lactococcus lactis* MG1364	分泌, マウスへの胃内投与, 炎症性腸疾患モデルにおいて症状改善	ベルギー・Ghent大学 他	Steidler et al. (2000) Treatment of murine colitis by *Lactococcus lactis* secreting interleukin-10. Science 289:1352-1355	形質転換	pTREX1			erythromycin resistance	組換え体構築の文献 Schotte et al. (2000) Enz. Microb Technol. 27:761-765
22	HIV感染阻害剤	ヒトCD4細胞外ドメイン (2D CD4) 遺伝子	*Lactobacillus jensenii*	分泌, in vitroでHIV-1の感染阻害を確認	アメリカ・Osel, Inc. 他	Chang et al. (2003) Inhibition of HIV infectivity by a natural human isolate of *Lactobacillus jensenii* engineered to express functional two-domain CD4. Proc. Natl. Acad. Sci. USA 100:11672-11677	形質転換	pOSEL144	P_{23} (*Lactococcus lactis*)		erythromycin resistance	
23	*S. mutans* 定着阻害剤	*S. mutans*接着因子認識抗体のFv領域遺伝子	*Lactobacillus casei* ATCC 393	細胞表層発現, ラット口腔内で*S. mutans*の定着阻害	スウェーデン・Karolinska Institutet at Huddinge Hospital 他	Kruger et al. (2002) *In situ* delivery of passive immunity by lactobacilli producing single-chain antibodies. Nat. Biotechnol. 20:702-706	形質転換	pLP402	α-amylase, Pamy (Lactobacillus amylovorus)	*cbh* (*Lactobacillus plantarum* conjugated bile acid hydrolase)	erythromycin resistance	
24	ワクチン	タイプ16ヒトpapillomaウィルス (HPV-16) E7タンパク質抗原遺伝子	*Lactococcus lactis* NZ9000	細胞表層発現, マウスへの鼻腔内投与, 抗原特異的Th1型サイトカイン産生	フランス・INRA 他	Bermudez-Humaran et al. (2004) An inducible surface presentation system improves cellular immunity against human papillomavirus type 16 E7 antigen in mice after nasal administration with recombinant lactococci. J. Med.	形質転換	pCWA	nisin-inducible promoter, P_{nisA}		chloramphenicol resistance (*cat*)	
25	免疫アジュバント	インターロイキン12遺伝子	*Lactococcus lactis* NZ9000	分泌, マウスへの鼻腔内投与, 抗原特異的Th1型サイトカイン産生の増強	フランス・INRA 他	Bermudez-Humaran et al. (2003) Intranasal immunization with recombinant *Lactococcus lactis* secreting murine interleukin-12 enhances antigen-specific Th1 cytokine production. Infect. Immun. 71:1887-1896	形質転換	pSEC	nisin-inducible promoter, P_{nisA}		chloramphenicol resistance (*cat*)	
26	non-GMOsタンパク質表層固定システム		*Lactococcus lactis* NZ9001	アンカー融合組換えタンパク質の産生, gram-positive enhancer,matrix (GEM)粒子に結合させる	オランダ・BiOMaDe Technology 他	Bosma et al. (2006) Novel surface display system for proteins on non-genetically modified gram-positive bacteria. Appl. Env. Microbiol.	形質転換	pPA3	nisin-inducible promoter, P_{nisA}		chloramphenicol resistance (*cat*)	
27		green fluorescent protein (GFP) 遺伝子	Lactobacillus		ブラジル・Universidade Federal de Minas Gerais 他	Mota et al. (2006) Genetic transformation of novel isolates of chicken Lactobacillus bearing probiotic features for expression of heterologous proteins: a tool to develop live oral	相同組換え (single crossover)	pLBS-GFP-EmR				
28		ヒトパピローマウィルス type-16 E7抗原	*Lactobacillus plantarum* NCIMB 8826, *Lactococcus lactis* NZ9000		フランス・INRA 他	Cortes-Perez et al. (2005) Cell-surface display of E7 antigen form human papillomavirus type-16 in Lactococcus lactis and in Lactobacillus plantarum using a new cell-wall anchor from lactobacilli. J. Drug Target. 13:89-98	形質転換	pSEC, pCWA, pILCWA	nisA		erythromycin resistance, or chloramphenicol resistance	
29		*Streptococcus pneumoniae* antigen, PsaA and PspA	*Lactobacillus casei* CECT 5275		ブラジル・Instituto Butantan 他	Oliveira et al. (2003) Expression of *Streptococcus pneumoniae* antigens, PsaA (pneumococcal surface antigen A) and PspA (pneumococcal surface protein A) by *Lactobacillus casei*. FEMS Microbiol Lett. 227:25-31	形質転換	pIA	lac		erythromycin resistance	
30			*Lactobacillus reuteri* 100-23C		ドイツ・University of Hohenheim 他	Walter et al. (2003) Identification of Lactobacillus reuteri genes specifically induced in the mouse gastrointestinal tract. Appl Environ Microbiol. 69:2044-51	形質転換	pJW100, pJW200	ldh		chloramphenicol resistance	
31			*Lactococcus lactis* NZ9000		フィンランド・University of Helsinki	Avall-Jääskeläinen et al. (2003) Surface display of the receptor-binding region of the Lactobacillus brevis S-layer protein in Lactococcus lactis provides nonadhesive lactococci with the ability to adhere to intestinal epithelial	形質転換	pKTH 5056	nisA		chloramphenicol resistance	
32		FliC	Lactococcus lactis		韓国・Kyung Hee University	Kim et al. (2008) Display of heterologous proteins on the surface of Lactococcus lactis using the H and W domain of PrtB from Lactobacillus delbrueckii subsp. bulgaricus as an anchoring matrix. J Appl		pACL1			rythromycin resistance gene (ery)	

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33		classical swine fever virus (CSFV) T cell epitope E290 peptide	Lactobacillus casei		中国・Northeast Agricultural University	Xu et al. (2007) The oral immune efficacy of recombinant lactobacillus casei expressing CSFV E290 peptide and it elicited specific CTL response. Sheng Wu Gong Cheng Xue		pPG-VP2				
34		GFP	Leuconostoc mesenteroides		韓国・Kyung Hee University	Lee et al. (2007) Development of a monitoring vector for Leuconostoc mesenteroides using the green fluorescent protein gene. J Microbiol Biotechnol.		pCW5	p32			
35					インド・National Dairy Research Institute	Sudhanani et al. (2008) Characterisation of pSMA23, a 3.5kbp plasmid of Lactobacillus casei, and application for heterologous expression in Lactobacillus. Plasmid. 59:11-9.		pSMA23, pL142, pL157				
36		GFP			中国・Nanjing Agricultural University	Yu et al. (2007) Use of green fluorescent protein to monitor Lactobacillus in the gastro-intestinal tract of chicken. FEMS Microbiol Lett. 275:207-		pLEM415				
37		GFP	Lactobacillus reuteri		台湾・National Chung-Hsing University	Mice protected by oral immunization with Lactobacillus reuteri secreting fusion protein of Escherichia coli enterotoxin subunit protein. FEMS Immunol Med Microbiol. 50:354-		pNIES				
38			Lactobacillus casei		日本・岡山大学	An et al. (2007) Expression of citrate permease gene of plasmid pCM1 isolated from Lactococcus lactis subsp. lactis biovar diacetylactis N1A1 N-7 in Lactobacillus casei L-49-4. Appl Microbiol Biotechnol. 74:609-16.		pJLECit			rythromycin resistance gene (ery)	
39			L. mesenteroides SY1 (another Kimchi isolate), Leuconostoc ssp., and Lactobacillus brevis		韓国・Gyeongsang National University	Characterization of pFMBL1, a small cryptic plasmid isolated from Leuconostoc mesenteroides SY2. Plasmid. 57:314-23.		pSJ33E				
40		foot-and-mouth disease virus (FMDV) VP1 protein			中国・China Agricultural University	Li et al. (2007) Immune responses generated by Lactobacillus as a carrier in DNA immunization against foot-and-mouth disease virus. Vaccine. 25:902-		pRc/CMV2				
41					アメリカ・University of Wisconsin-Madison	Sridhar et al. (2006) Construction and evaluation of food-grade vectors for Lactococcus lactis using aspartate aminotransferase and alpha-galactosidase as selectable markers. J Appl Microbiol. 101:161-71.		pSUW611, pSUW711			lactococcal aspartate aminotransferase gene (aspC), Bifidobacterium longumalpha-galactosidase	
42					台湾・National Chung-Hsing University	Wu et al. (2006) Construction and characterization of nisin-controlled expression vectors for use in Lactobacillus reuteri. Biosci Biotechnol Biochem.		pNICE				
43					中国・Jilin Agricultural University	Wang et al. (2005) Expression of recombinant Vp6 gene of porcine rotavirus A with non-antibiotic Lactobacillus vector in Escherichia coli. Wei Sheng Wu Xue Bao.		pW425t				
44					ノルウェー・Norwegian Food Research Institute	Sørvig et al. (2005) High-level, inducible gene expression in Lactobacillus sakei and Lactobacillus plantarum using versatile expression vectors. Microbiology. 151:2439-		pSIP				
45					韓国・Korea University	Kim et al. (2005) Optimization of technical conditions for the transformation of Lactobacillus acidophilus strains by electroporation. J Appl Microbiol. 99:167-74.		pNZ123, pKU				
46					ノルウェー・Agricultural University of Norway	Sørvig et al. (2005) Plasmid p256 from Lactobacillus plantarum represents a new type of replicon in lactic acid bacteria, and contains a toxin-antitoxin-like plasmid maintenance system. Microbiology. 151:421-31.		p256				
47		S-layer protein SgsE from Geobacillus stearothermophilus NRS 2004/3a	Lactococcus lactis		オーストリア・University of Natural Resources and Applied Life Sciences	Novotny et al. (2005) Gene cloning, functional expression and secretion of the S-layer protein SgsE from Geobacillus stearothermophilus NRS 2004/3a in Lactococcus lactis. FEMS Microbiol Lett. 242:27-35.		pNZ124				
48			Lactococcus lactis		マレーシア・Universiti Putra Malaysia	Raha et al. (2005) Cell surface display system for Lactococcus lactis: a novel development for oral vaccine. Appl Microbiol Biotechnol. -		pSVac				
49			Lactobacillus paracasei NFBC 338, Lactococcus lactis		アイルランド・Teagasc, Biotechnology Centre	Desmond et al. (2004) Improved stress tolerance of GroESL-overproducing Lactococcus lactis and probiotic Lactobacillus paracasei NFBC 338. Appl Environ Microbiol.		pGRO1, pGRO2				

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50					中国・Fudan University	Yao et al. (2004) Inoculation of Lactobacillus expressing hCG beta in the vagina induces an anti-hCG beta antibody response in murine vaginal mucosa. J Reprod Immunol. 63:111-		pIlac				
51					フランス・Université de Bourgogne	Gury et al. (2004) Randon transposon mutagenesis of Lactobacillus plantarum by using the pGh9:IS S1 vector to clone genes involved in the regulation of phenolic acid metabolism. Arch		pGh9				
52					アメリカ・Utah State University	Broadbent et al. (2004) Overexpression of Lactobacillus casei D-hydroxyisocaproic acid dehydrogenase in cheddar cheese. Appl Environ Microbiol. 70:4814-20.		pTRKH2				
53					アメリカ・North Carolina State University	Bruno-Bárcena et al. (2004) Expression of a heterologous manganese superoxide dismutase gene in intestinal lactobacilli provides protection against hydrogen peroxide toxicity. Appl Environ		pTRK563				
54					ロシア・All-Russia State Institute of the Physiology	Tarakanov et al. (2004) Expression vector pLF22 for the lactic acid bacteria. Mikrobiologiia. 73:211-		pLF22				
55		folate gene cluster, consisting of six genes (folA, folB, folKE, folP, ylgG, and folC)	L. gasseri strain ATCC 33323		オランダ・WCFS	Wegkamp et al. (2004) Transformation of folate-consuming Lactobacillus gasseri into a folate producer. Appl Environ Microbiol. 70:3146-8.	形質転換	pNZ7019	pepN		chloramphenicol acetyltransferase (cat)	
56			L. plantarum WCFS1		オランダ・WCFS	Bron et al. (2004) Selection and characterization of conditionally active promoters in Lactobacillus plantarum, using alanine racemase as a promoter probe. Appl Environ Microbiol.		pNZ7120, pNZ7121			rythromycin resistance gene (ery)	
57			Lactobacillus sakei, Lactobacillus plantarum		ノルウェー・Norwegian Food Research Institute	Sørvig et al. (2003) Construction of vectors for inducible gene expression in Lactobacillus sakei and L. plantarum. FEMS Microbiol Lett. 229:119-						
58					ノルウェー・Norwegian Food Research Institute	Axelsson et al. (2003) Development of an inducible gene expression system for Lactobacillus sakei. Lett Appl Microbiol.		pKRV3				
59					スペイン・Instituto de Agroquímica y Tecnología de los Alimentos	Pérez-Arellano et al. (2003) Optimization of the green fluorescent protein (GFP) expression from a lactose-inducible promoter in Lactobacillus casei. FEMS Microbiol Lett.						
60					ドイツ・Universität Kaiserslautern	Neu et al. (2003) New thermosensitive delivery vector and its use to enable nisin-controlled gene expression in Lactobacillus gasseri. Appl Environ Microbiol. 69:1377-82.		pTN1				
61					フィンランド・University of Helsinki	Takala et al. (2003) Food-grade host/vector expression system for Lactobacillus casei based on complementation of plasmid-associated phospho-beta-galactosidase gene lacG. Appl Microbiol		pLEB600				
62					ノルウェー・Agricultural University of Norway	Rawlinson et al. (2002) LasX, a transcriptional regulator of the lactocin S biosynthetic genes in Lactobacillus sakei L45, acts both as an activator and a repressor. Biochimie. 84:559-67. Review.		pCIM1				
63					ドイツ・Universität Kaiserslautern	Henrich et al. (2002) Food-grade delivery system for controlled gene expression in Lactococcus lactis. Appl Environ Microbiol.		pLNG1363, pUK500				
64					フィンランド・University of Helsinki	Takala et al. (2002) A food-grade cloning vector for lactic acid bacteria based on the nisin immunity gene nisI. Appl Microbiol Biotechnol. 59:467-71.		pLEB 590				
65					アメリカ・University of Illinois at Chicago	Pavlova et al. (2002) Characterization of a cryptic plasmid from Lactobacillus fermentum KC5b and its use for constructing a stable Lactobacillus cloning vector. Plasmid. 47:182-92.		pSP1				
66					イギリス・Rural Development for Northern Ireland	Thompson et al. (2001) DNA cloning in Lactobacillus helveticus by the exconjugation of recombinant mob-containing plasmid constructs from strains of transformable lactic acid bacteria. Plasmid.						
67		gusA (β-glucronidase)			オランダ・TNO	Pouwels et al. (2001) Lactobacilli as vehicles for targeting antigens to mucosal tissues by surface exposition of foreign antigens. Methods Enzymol.	形質転換	pLP401-pLP403, pLP501-pLP503, pLP601, pLP602, pLP701-pLP704, pLP803	amy, ldh, xylA,	cbh	ery, cat	

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68					フィンランド・Food Research Institute, Agricultural Research Centre of Finland	Luoma et al. (2001) Expression of six peptidases from Lactobacillus helveticus in Lactococcus lactis. Appl Environ Microbiol. 67:1232-8.	形質転換	pKTH2172, pKTH2171, pKTH2150, pKTH2170	pepN, pepX, pepC, pepD, pepR, nisA		ery, cat	
69		GFP			フランス・INRA	Gory et al. (2001) Use of green fluorescent protein to monitor Lactobacillus sakei in fermented meat products. FEMS Microbiol Lett.	相同組換え (double crossover)	pldhL::gfp				
70					スペイン・Instituto de Agroquímica y Tecnología de Alimentos	Gosalbes et al. (2000) Integrative food-grade expression system based on the lactose regulon of Lactobacillus casei. Appl Environ Microbiol. 66:4822-8.	形質転換	pIlac				
71					スペイン・Universidad de Oviedo	Martín et al. (2000) Generation of food-grade recombinant lactic acid bacterium strains by site-specific recombination. Appl Environ Microbiol.	部位特異的組換え	pEM76, pEM68			(ery), 最終組換え体には残らない	
[illegible]					ロシア・Institute of Genetics and Selection of Industrial Microorganisms	Shevelev et al. (2000) Expression of bacillar glutamyl endopeptidase genes in Bacillus subtilis by a new mobilizable single-replicon vector pLF.	形質転換	pLF9, pLF14				
73					韓国・Seoul National University	Cho et al. (2000) Expression of Clostridium thermocellum endoglucanase gene in Lactobacillus gasseri and Lactobacillus johnsonii and characterization of the genetically modified probiotic lactobacilli.	形質転換	pSD1, pSD2				
74					アメリカ・North Carolina State University	Walker and Klaenhammer. (2000) An explosive antisense RNA strategy for inhibition of a lactococcal bacteriophage. Appl Environ Microbiol.		pTRK593				
75					アメリカ・Agricultural Research Service, Eastern Regional Research Center	Coderre et al. (1999) Cloning and expression of the pediocin operon in Streptococcus thermophilus and other lactic fermentation bacteria. Curr Microbiol. 39:295-301.		pPC418				
76					アメリカ・North Carolina State University	Walker et al. (1999) The groESL chaperone operon of Lactobacillus johnsonii. Appl Environ Microbiol. 65:3033-41.		pTRKH2				
77					イギリス・Department of Agriculture for Northern Ireland	Thompson et al. (1999) Potential of conjugal transfer as a strategy for the introduction of recombinant genetic material into strains of lactobacillus helveticus. Appl Environ Microbiol. 65:1910-4.		pSA3, pVA797			ery, cat	
78					イタリア・Istituto di Microbiologia	Callegari et al. (1998) The S-layer gene of Lactobacillus helveticus CNRZ 892: cloning, sequence and heterologous expression. Microbiology. 144:719-		pMC01				
79					ベルギー・Université catholique de Louvain	Hols et al. (1997) Efficient secretion of the model antigen M6-gp41E in Lactobacillus plantarum NCIMB 8826. Microbiology. 143:2733-		pTG2281, pTG3237				
80		endo-1, 3-1, 4-β-glucanase (*bglM*)			ニュージーランド・University of Otago	Heng et al. (1997) Cloning and expression of an endo-1, 3-1, 4-beta-glucanase gene from Bacillus macerans in Lactobacillus reuteri. Appl Environ Microbiol.	形質転換	pNCKH111	bgl		ery	
81					アメリカ・University of Nebraska	Gold et al. (1996) Cloning and expression of the Zymomonas mobilis "production of ethanol" genes in Lactobacillus casei. Curr Microbiol. 33:256-60.		pMGE36e, pRSG02				
82					アメリカ・University of Wisconsin-Madison	Yüksel et al. (1996) DNA sequence analysis, expression, distribution, and physiological role of the Xaa-prolyldipeptidyl aminopeptidase gene from Lactobacillus helveticus CNRZ32. Appl Microbiol		pGK12, pIL253				
83					オランダ・TNO	Pouwels et al. (1996) The potential of Lactobacillus as a carrier for oral immunization: development and preliminary characterization of vector systems for						
84					ドイツ・Institut für Lebensmitteltechnologie	Obst et al. (1995) Two genes encoding the beta-galactosidase of Lactobacillus sake. Microbiology. 141:3059-						
85					スロバキア・Comenius University	Grones and Turna. (1995) Transformation of microorganisms with the plasmid vector with the replicon from pAC1 from Acetobacter pasteurianus. Biochem Biophys Res Commun.		pACK5, pACT72				
86					ドイツ・Institut für Lebensmitteltechnologie	Hemme et al. (1994) Expression of Lactobacillus casei ATCC 393 beta-galactosidase encoded by plasmid pLZ15 in Lactococcus lactis CNRZ 1123. Lett Appl Microbiol. 19:345-8.		pLZ15				

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87		chitinase gene from Serratia marcescens	Lactococcus lactis and Lactobacillus plantarum		ノルウェー・Agricultural University of Norway	Brurberg et al. (1994) Expression of a chitinase gene from Serratia marcescens in Lactococcus lactis and Lactobacillus plantarum. Appl Microbiol		pMG36e, pGKV259, pIL253	p32, p59			
88		beta-glucuronidase gene (gusA)			オランダ・Netherlands Institute for Dairy Research (NIZO)	Platteeuw et al. (1994) Use of the Escherichia coli beta-glucuronidase (gusA) gene as a reporter gene for analyzing promoters in lactic acid bacteria. Appl Environ Microbiol. 60:587-93. Erratum in: Appl Environ Microbiol		pNZ272	lacA, usp45, a promoter from bacteriophage phi SK11G			
89		manganese superoxide dismutase	Lactococcus lactis and Lactobacillus gasseri		アメリカ・North Carolina State University	Roy et al. (1993) Cloning and expression of the manganese superoxide dismutase gene of Escherichia coli in Lactococcus lactis and Lactobacillus gasseri. Mol Gen Genet.		pMG36e				
90		conjugated bile acid hydrolase	Lactobacillus plantarum 80		ベルギー・University of Ghent	Christiaens et al. (1992) Cloning and expression of a conjugated bile acid hydrolase gene from Lactobacillus plantarum by using a direct plate assay. Appl Environ		pCBH1				
91		katA	Lactobacillus casei		ドイツ・Universität Hohenheim	Knauf et al. (1992) Cloning, sequence, and phenotypic expression of katA, which encodes the catalase of Lactobacillus sake LTH677. Appl Environ		pGKV210				
92		lysostaphin	Lactobacillus casei 102S		西ドイツ・Universität Hohenheim	Gaier et al. (1992) Cloning and expression of the lysostaphin gene in Bacillus subtilis and Lactobacillus casei. Lett Appl Microbiol.						
93		beta-galactosidase	L. helveticus SBT2195		日本・雪印乳業	Hashiba et al. (1992) Establishment of a host-vector system in Lactobacillus helveticus with beta-galactosidase activity as a selection marker. Biosci Biotechnol Biochem.		pBG10				
94		beta-glucanase	Lactobacillus helveticus strain CNRZ450		イギリス・Department of Agriculture for Northern Ireland	Thompson and Collins (1991) Molecular cloning in Lactobacillus helveticus by plasmid pSA3::pVA797 co-integrate formation and conjugal transfer. Appl Microbiol Biotechnol.		pSA3, pVA797				
95					アメリカ・North Carolina State University	Muriana and Klaenhammer (1991) Cloning, phenotypic expression, and DNA sequence of the gene for lactacin F, an antimicrobial peptide produced by Lactobacillus spp. J Bacteriol. 173:1779-88.		pTRK160, pTRK162				
96					フィンランド・Genesit Oy	Sibakov et al. (1991) Secretion of TEM beta-lactamase with signal sequences isolated from the chromosome of Lactococcus lactis subsp. lactis. Appl Environ Microbiol.		pVS2				
97		alpha-amylase			イギリス・Cranfield Institute of Technology	Jones and Warner (1990) Cloning and expression of alpha-amylase from Bacillus amyloliquefaciens in a stable plasmid vector in Lactobacillus plantarum. Lett Appl Microbiol.						
98		lipase	Lactobacillus curvatus Lc2-c		西ドイツ・Hohenheim University	Vogel et al. (1990) Expression of the lipase gene from Staphylococcus hyicus in Lactobacillus curvatus Lc2-c. FEMS Microbiol Lett. 57:289-		pLipPS1				
99			Lactobacillus plantarum CCM 1904		フランス・Université Louis-Pasteur	Bringel et al. (1989) Characterization, cloning, curing, and distribution in lactic acid bacteria of pLP1, a plasmid from Lactobacillus plantarum CCM 1904 and its use in shuttle vector construction. Plasmid.		pLP1				
100			Leuconostoc paramesenteroides		オランダ・Netherlands Institute for Dairy Research (NIZO)	David et al. (1989) Plasmid transformation by electroporation of Leuconostoc paramesenteroides and its use in molecular cloning. Appl Environ Microbiol. 55:1483-9.		pNZ12				
101						Fons et al. (1997) Isolation and characterization of a plasmid from Lactobacillus fermentum conferring erythromycin resistance. Plasmid		pLEM415, pLEM3				
102						Klein et al. (1995) Molecular tools for the genetic modification of dairy lactobacilli. Syst. Appl. Microbiol. 18:493-503		pJK650, pWS58				
103						patent		pX, pBUL1				
104						De Vos et al. (1987) Gene cloning and expression in lactic streptococci. FEMS		pNZ12, pSH71				
105						Maguin et al. 1992 New thermosensitive plasmid for gram-positive bacteria. J. Bacteriol. 174:5633-5638		pG⁺host4, pVE6002				
106						Le Chatelier et al. (1993) Biochemical and genetic analysis of the unidirectional theta replication of the S. agalactiae plasmid pIP501. Plasmid 29:50-56		pGB305Δ, pIP501				

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107						Tannock et al. (1994) Molecular characterization of a plasmid-borne (pGT633) erythromycin resistance determinant (ermGT) from *Lactobacillus reuteri*, 100-63. Plasmid 31:60-71		pGT633				
108						Klein et al. (1993) Characterization and sequence analysis of a small cryptic plasmid from Lactobacillus curvatus LTH683 and its use for construction of new Lactobacillus cloning vectors. Plasmid		pCUI882, pLC2				
109						Horinouchi et al. (1982) Nucleotide sequence and functional map of pE194, a plasmid that specifies inducible resistance to macrolide, lincosamide, and streptogranin type B antibiotics. J. Bacteriol. 150:804-814		pE194				
110						Horinouchi et al. (1982) Nucleotide sequence and functional map of pC194, a plasmid that specifies inducible chloramphenicol resistance. J.		pC194				
111						Zink et al. (1991) Transformation of Lactobacillus delbrueckii ssp. Lactis by electroporation and cloning of origins of replication by use of a positive selection vector. FEMS Microbiol. Lett. 78:207-212		pJK300, pWS97 pAZ20, pNCDO151				
112						Perez-Casal et al. (1993) An M protein with a single C repeat prevents phagocytosis of Streptococcus pyogenes: use of a temperature-sensitive shuttle vector to deliver homologous sequences to the chromosome of S. pyogenes. Mol.		pJRS233				
113						Kok et al., 1984; Leenhouts et al., 1991		pWV01				
114						de Vos et al., 1987		pSH71				
115						Xu et al., 1990		pD125				
116						Chang et al., 1995		pCL2.1				
117						Pillidge et al., 1996		pWC1				
118						Sanchez et al., 2003		pBM02				
119						Hayes et al., 1990, 1991		pCI305				
120						Jahns et al., 1991		pSL2				
121						von Wright et al., 1990; von Wright and Raty, 1993		pVS40			nisin resistance	
122						Horng et al., 1991		pSK11L				
123						Kiewiet et al., 1993		pWV02				
124						Lucey et al., 1993		pCI528				
125						Frere et al., 1993		pUCL22				
126						Pedersen et al., 1994		pCT1138				
127						Seegers et al., 1994		pWV04				
128						Seegers et al., 1994		pWV05				
129						Seegers et al., 1994		pIL7				
130						Gravesen et al., 1995		pJW563				
131						Liu et al., 1996, 1997		pND302			cadmium resistance	
132						Liu et al., 1997		FG2 plasmid				
133						van Kranenburg and deVos, 1998		pNZ4000				
134						Duan et al., 1999		pND324				
135						Seegers et al., 2000		pCIS3				
136						Kearney et al., 2000		pCI2000				
137						Jewel and Thompson-Collins, 1989		pcaT				
138						Vujcic and Topisirovic, 1993		pA1				
139						Bouia et al., 1989		pLP1				
140						Leer et al., 1992		p8014-2				
141						Skaugen et al., 1989		pC30il				
142						Bates and Gilbert, 1989		pLB4				
143						Daming et al., 2003		pLP2000				
144						Daming et al., 2003		pLP9000				
145						Eguchi et al., 2000		pLKL				
146						Eguchi et al., 2000		pLKS				
147						Danielsen, 2002		pMD5057				
148						Iwata et al., 1986		pLY2				
149						Iwata et al., 1986		pLY4				
150						Fons et al., 1997		pLEM3				
151						Aleshin et al., 1999		pLF1311				
152						Pavlova et al., 2002		pKC5b				
153						Posno et al., 1991		p353-1				
154						Leer et al., 1992		p353-2				
155						Axelsson et al., 1988		pLUL631				
156						Rinckel and Savage, 1990		pLAR33				
157						Tannock et al., 1994		pGT633				
158						Heng et al., 1999		pGT232				
159						Lin et al., 1999		pTE15				
160						Lin et al., 1999		pTE80				
161						Lin et al., 1996, 2001		pTC82				
162						Josson et al., 1989, 1990		pLAB1000				
163						Josson et al., 1989		pLAB2000				
164						Vogel et al., 1991; Klein et al., 1993		pLC2				
165						Zink et al., 1991		pWS97				
166						Chagnaud et al., 1992		pLB10				
167						Azcarate-Peril and Raya, 2002		pLBB1				
168						Bourniquel et al., 2002		pJBL2				
169						Bourniquel et al., 2002		pN42				
170						Damiani et al., 1987		p1				
171						Damiani et al., 1987		p3				
172						Luchansky et al., 1988		pPM4				
173						Kanatani et al., 1992, 1995		pLA103				
174						Kanatani et al., 1995		pLA105				
175						Sano et al., 1997		pLA106				
176						Takiguchi et al., 1989		pLJ1				

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177						Yamamoto and Takano, 1996		pCP53				
178						Fortina et al., 1993; Thompson et al., 1999		pLH1				
179						Fortina et al., 1993		pLH2				
180						Fortina et al., 1993		pLH3				
181						Pridmore et al., 1994		pLH4				
182						Unpublished; GenBank accession noZ50862		pSAK1				
183						Alpert et al., 2003		pRV500				
184						Chassy and Flickinger, 1987		pLZ15				
185						Whitehead et al., 2001		p121BS				
186			*B. subtilis*			Kok et al., 1984		pGK1			Chloramphenicol resistance	Shuttle No
187			*L. lactis, B. subtilis, E. coli, L. acidophilus, L. brevis, L. casei, L. delbrueckii, L. fermentum, L. helveticus, L. pentosus, L. plantarum, L. reuteri*			Kok et al., 1984; Posno et al., 1991; Zink et al., 1991; de los Reyes-Gavilan et al., 1990; Badii et al., 1989; Luchansky et al., 1989		pGK12			Chloramphenicol and Erythromycin resistance	Shuttle Yes
188			*L. acidophilus*			Luchansky et al., 1988		pGKV1			Chloramphenicol and Erythromycin resistance	Shuttle Yes
189			*B. subtilis*			van der Vossen et al., 1985		pGKV10			Chloramphenicol resistance	Shuttle Yes
190			*L. lactis, B. subtilis*			van der Vossen et al., 1985		pGKV110			Chloramphenicol and Erythromycin resistance	Shuttle Yes
191			*L. lactis, B. subtilis*			van der Vossen et al., 1985		pGKV11			Chloramphenicol and Erythromycin resistance	Shuttle Yes
192			*L. lactis, B. subtilis, E. coli, L. plantarum*			van der Vossen et al., 1985; Josson et al., 1989		pGKV2			Chloramphenicol and Erythromycin resistance	Shuttle Yes
193			*L. acidophilus, L. plantarum, L. casei*			van der Vossen et al., 1994; Pouwels and Leer, 1993; Gaier et al., 1992		pGKV21			Chloramphenicol and Erythromycin resistance	Shuttle Yes
194			*L. lactis, B. subtilis, L. casei, L. johnsonii, L. reuteri*			van der Vossen et al., 1987; Gaier et al., 1992; Fremaux et al., 1993; Djordjevic et al., 1994		pGKV210			Chloramphenicol and Erythromycin resistance	Shuttle Yes
195			*L. plantarum*			Badii et al., 1989		pGKV13			Chloramphenicol and Erythromycin resistance	Shuttle Yes
196			*L. lactis, B. subtilis*			Kok et al., 1985		pGKV500			Erythromycin resistance	Shuttle No
197			*L. lactis*			van Belkum et al., 1989		pMG24			Kanamycin resistance	Shuttle No
198			*L. lactis*			van de Guchte et al., 1989		pMG36			Kanamycin resistance	Shuttle No
199			*L. lactis, L. gasseri*			van de Guchte et al., 1989; Roy et al., 1993		pMG36e			Erythromycin resistance	Shuttle No
200			*L. acidophilus, L. gasseri, L. helveticus*			Roya and Klaenhammer, 1992		pTRK170			Chloramphenicol resistance	Shuttle Yes
201			*L. plantarum*			Hols et al., 1994		pGIP212			Chloramphenicol, Kanamycin, and Spectinomycin	Shuttle Yes
202			*L. casei*			Perez-Arellano et al., 2001		pLAV1			Erythromycin and Chloramphenicol resistance, lacZ	Shuttle Yes
203			*L. casei*			Perez-Arellano et al., 2001		pLAV6			Chloramphenicol resistance	Shuttle Yes
204			*L. casei*			Perez-Arellano et al., 2001		pLAV7			Erythromycin resistance	Shuttle Yes
205			*L. casei*			Perez-Arellano et al., 2001		pLAV9			Chloramphenicol resistance	Shuttle Yes
206			*B. subtilis, L. lactis, E. coli*			de Vos et al., 1986		pNZ11			Chloramphenicol and Kanamycin resistance	Shuttle No
207			*B. subtilis, L. lactis, E. coli, L. casei, L. curvatus, L. plantarum, L. sakei*			de Vos et al., 1986, 1987; Olukoya et al., 1993; Vogel et al., 1992; Gaier et al., 1990; Bringel and Hubert, 1990; Bringel and Hubert, 1990; Gaier et al., 1990		pNZ12			Chloramphenicol and Kanamycin resistance	Shuttle No
208			*B. subtilis, S. aureus, E. coli, L. lactis*			de Vos et al., 1987		pNZ121			Chloramphenicol and Kanamycin resistance	
209			*L. lactis*			de Vos et al., 1986		pNZ122			Chloramphenicol and Kanamycin resistance	Shuttle No
210			*L. lactis, L. acidophilus, L. casei, L. plantarum*			de Vos et al., 1986; Kim et al., 1994; Platteeuw et al., 1994		pNZ123			Chloramphenicol resistance	
211			*L. casei, L. plantarum*			Platteeuw et al., 1994		pNZ124			Chloramphenicol resistance	Shuttle Yes
212						de Vos, 1987		pNZ17				Shuttle Yes

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213			*L. casei*			Solaiman et al., 1992		pNZ18			Chloramphenicol and Kanamycin resistance	Shuttle Yes
214			*L. casei*			Solaiman et al., 1992; Somkuti et al., 1992		pNZ19			Chloramphenicol and Kanamycin resistance	Shuttle Yes
215			*L. lactis, B. subtilis, E. coli*			deVos et al., 1989		pNZ220			Kanamycin resistance	Shuttle No
216			*L. casei, L. plantarum*			Platteeuw et al., 1994		pNZ272			Chloramphenicol resistance	Shuttle Yes
217			*B. subtilis, L. lactis, E. coli*			Gasson and Anderson, 1985		pCK1			Chloramphenicol and Kanamycin resistance	Shuttle Yes
218			*B. subtilis, L. lactis, E. coli*			Gasson and Anderson, 1985		pCK17			Chloramphenicol and Kanamycin resistance	Shuttle Yes
219			*B. subtilis, L. lactis, E. coli*			Gasson and Anderson, 1985		pCK21			Chloramphenicol and Kanamycin resistance	Shuttle Yes
220			*L. lactis*			Wells et al., 1993		pMIG1			Chloramphenicol and Kanamycin resistance	Shuttle Yes
221			*L. lactis*			Wells et al., 1993		pMIG2			Chloramphenicol resistance	Shuttle Yes
222			*L. lactis*			Wells et al., 1993		pMIG2H			Chloramphenicol resistance	Shuttle Yes
223			*L. lactis*			Wells et al., 1993		pMIG3			Chloramphenicol resistance	Shuttle Yes
224			*L. lactis, L. plantarum, L. reuteri, L. sakei*			von Wright et al., 1987; Aukrust and Bloom, 1992; Ahrne et al., 1992; Axelsson et al.,		pVS2			Chloramphenicol and Erythromycin resistance	Shuttle No
225			*L. sakei*			Axelsson and Holck, 1995		pVSB1			Chloramphenicol resistance, lac	Shuttle Yes
226			*L. lactis*			von Wright and Raty, 1993		pRW1			Erhthromycin, Tetracyclin, and Ampicillin resistance	Shuttle Yes
227			*L. casei*			Solaiman et al., 1992		pBN183			Ampicillin, Chloramphenicol, and Kanamycin resistance	Shuttle Yes
228			*L. casei*			Solaiman et al., 1992		pBN183A			Ampicillin, Chloramphenicol, and Kanamycin resistance	Shuttle Yes
229			*L. casei*			Solaiman et al., 1992		pDBN183			Ampicillin, Chloramphenicol, and Kanamycin resistance	Shuttle Yes
230			*L. plantarum*			Hols et al., 1994		pGIP331			Chloramphenicol, Kanamycin, and Spectinomycin	Shuttle Yes
231			*L. lactis*			Xu et al., 1990, 1991		pFX1			Chloramphenicol resistance	Shuttle Yes
232			*L. lactis*			Xu et al., 1990, 1991		pFX3			Chloramphenicol resistance	Shuttle Yes
233			*L. lactis, L. garviae, S. thermophilus, E. faecalis, S. aureus*			Pillidge et al., 1996		pCP12			Chloramphenicol resistance	Shuttle No
234			*L. lactis, L. casei, L. plantarum, B. subtilis*			Sanchez and Mayo, 2003		p21-22			Ampicillin and Erythromycin	Shuttle Yes
235			*L. lactis, L. casei, L. plantarum, B. subtilis*			Sanchez and Mayo, 2003		p22-25			Ampicillin and Erythromycin	Shuttle Yes
236			*L. lactis, L. casei, L. plantarum, B. subtilis*			Sanchez and Mayo, 2003		p22-26			Ampicillin and Erythromycin	Shuttle Yes
237			*L. lactis*			Hayes et al., 1990		pCI3340			Chloramphenicol resistance	Shuttle Yes
238			*L. lactis*			Hayes et al., 1990		pCI374			Chloramphenicol resistance	Shuttle Yes
239			*L. lactis*			von Wright et al., 1990		pVS40			nisin resistance	Shuttle No
240			*L. lactis*			Horng et al., 1991		pKMP1			Chloramphenicol and Erythromycin resistance	Shuttle No
241			*L. lactis*			Lucey et al., 1993		pCI534			Chloramphenicol resistance	Shuttle No
242			*L. lactis, P. acidilactici*			Kiewiet et al., 1993		pLR300			Erythromycin resistance	Shuttle No
243			*L. lactis*			Liu et al., 1996		pND302			cadmium resistance	Shuttle No
244			*L. lactis*			Liu et al., 1996		pND304			Tetracyclin and Ampicillin resistance	Shuttle Yes
245			*L. lactis*			Liu et al., 1996		pND624			Ampicillin, nisin, and cadmium	Shuttle No
246			*L. lactis*			Liu et al., 1996		pND625			nisin and cadmium resistance	Shuttle No
247			*L. lactis*			Duan et al., 1999		pND421			Ampicillin, Erythromycin, and nisin resistance	Shuttle No

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248			*C. divergens, C. piscicola, L. casei, L. plantarum*			Ahn et al., 1992		pcaT			Chloramphenicol resistance	
249			*E. coli, L. delbrueckii, L. plantarum*			Vujcic and Topisirovic, 1993		pA1			Chloramphenicol resistance	Shuttle No
250			*B. subtilis, L. plantarum*			Bringel et al., 1989		pULP8			Ampicillin and Erythromycin resistance	Shuttle Yes
251			*B. subtilis, L. plantarum*			Bringel et al., 1989		pULP9			Ampicillin and Erythromycin resistance	Shuttle Yes
252			*L. acidophilus, L. brevis, L. casei, L. fermentum, L. helveticus, L. pentosus, L. plantarum*			Posno et al., 1991; Leer et al., 1992; de los Reyes-Gavilan et al., 1990; Badii et al., 1989, Duckworth et al., 1993		pLP825			Ampicillin and Chloramphenicol resistance	Shuttle Yes
253			*L. casei, L. pentosus, L. plantarum*			Leer et al., 1992; Duckworth et al., 1993		pLP82H			Ampicillin and Chloramphenicol resistance	Shuttle Yes
254			*L. casei, L. pentosus, L. plantarum*			Leer et al., 1992		pLPC37			Chloramphenicol resistance	Shuttle No
255			*B. subtilis, L. acidophilus, L. fermentum, L. helveticus, L. plantarum, L. reuteri, L. lactis*			Cocconcelli et al., 1991		pPSC1			Chloramphenicol resistance	Shuttle Yes
256			*B. subtilis, L. acidophilus, L. fermentum, L. helveticus, L. reuteri, L. lactis*			Cocconcelli et al., 1991		pPSC10			Erythromycin resistance	Shuttle Yes
257			*B. subtilis, L. acidophilus, L. fermentum, L. helveticus, L. reuteri, L. lactis*			Cocconcelli et al., 1991		pPSC11			Chloramphenicol resistance	Shuttle Yes
258			*B. subtilis, L. acidophilus, L. fermentum, L. helveticus, L. reuteri, L. lactis*			Cocconcelli et al., 1991; Vescovo et al., 1991		pPSC20			Chloramphenicol and Erythromycin resistance	Shuttle Yes
259			*B. subtilis, L. acidophilus, L. fermentum, L. helveticus, L. reuteri, L. lactis*			Cocconcelli et al., 1991		pPSC22			Chloramphenicol and Erythromycin resistance	Shuttle Yes
260			*L. plantarum, L. sake*			Holck et al., 1992		pLPV106			Ampicillin and Erythromycin resistance	Shuttle Yes
261			*L. sake*			Axelsson and Holck, 1995		pLPVIII			Erythromycin resistance, lac	Shuttle Yes
262			*L. fermentum*			Iwata et al., 1986		pLY2			Tetracyclin resistance	
263			*L. fermentum*			Iwata et al., 1986		pLY4			Erythromycin resistance	
264			*L. fermentum*			Fons et al., 1997		pLEM5			Erythromycin resistance	Shuttle No
265			*L. fermentum*			Fons et al., 1997		pLEM7			Erythromycin resistance	Shuttle No
266			*L. brevis, L. buchneri, L. lactis, E. faecalis, E. facium, B. subtilis, B. thuringiensis subsp. galleriae, subsp. kurstaki, subsp. finitimus, B. amyloliquefaciens, B. flavum, E. coli*			Aleshin et al., 1999		pLFVM2			Chloramphenicol resistance	Shuttle Yes
267			*L. fermentum, L. jensenii, L. spp., L. gasseri, L. crispatus, L. johnsonii, L. salivarius, S. mutans, S. gordonii, S. sanguis*			Pavlova et al., 2002		pSP1			Erythromycin resistance	Shuttle Yes
268			*L. plantarum*			Pouwels and Leer, 1993		pLPE23M			Erythromycin resistance	Shuttle No
269			*L. plantarum*			Pouwels and Leer, 1993		pLPE24M			Erythromycin resistance	Shuttle No

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270			*L. casei, L. pentosus, L. plantarum*			Posno et al., 1991		pLPE317			Erythromycin resistance	Shuttle No
271			*L. casei, L. pentosus, L. plantarum*			Posno et al., 1991		pLPE323			Erythromycin resistance	Shuttle No
272			*L. casei, L. pentosus, L. plantarum*			Leer et al., 1992		pLPE350			Chloramphenicol resistance	Shuttle No
273			*L. acidophilus, L. casei, L. pentosus, L. plantarum*			Posno et al., 1991		pLP3537			Ampicillin and Erythromycin resistance	Shuttle Yes
274			*L. casei, L. pentosus, L. plantarum*			Posno et al., 1991		pLP3537-xyl			Ampicillin and Erythromycin resistance, xyl	Shuttle Yes
275			*B. subtilis, E. faecalis, L. delbrueckii, L. fermentum, L. reuteri, L. gasseri, L. salivarius, S. aureus, S. sanguis*			Tannock et al., 1994		pGT633			Erythromycin resistance	
276			*L. reuteri*			Ahn et al., 1992		pLUL631			Erythromycin resistance	
277			*L. reuteri*			Ahn et al., 1992		pLUL200			Chloramphenicol resistance	Shuttle Yes
278			*L. reuteri*			Ahn et al., 1992		pLUL201			Chloramphenicol and Erythromycin resistance	Shuttle Yes
279			*L. reuteri*			Ahn et al., 1992		pLUL202			Chloramphenicol resistance	Shuttle No
280			*L. reuteri*			Ahn et al., 1992		pLUL634			Erythromycin resistance	Shuttle No
281			*L. reuteri*			Heng et al., 1999		pNCKH104			Erythromycin resistance	Shuttle Yes
282			*L. reuteri*			Heng et al., 1999		pNCHK103			Erythromycin resistance	Shuttle Yes
283			*L. reuteri, L. fermentum*			Lin et al., 1999		pTE15-RO			Ampicillin and Erythromycin resistance	Shuttle Yes
284			*L. reuteri*			Lin et al., 1999		pTE80-RO			Ampicillin and Erythromycin resistance	Shuttle Yes
285			*L. reuteri*			Lin et al., 2001		pTC82-RO			Erythromycin resistance	Shuttle No
286			*L. plantarum*			Scheirlinck et al., 1989		pERM3.2			Ampicillin and Erythromycin resistance	Shuttle Yes
287			*B. subtilis, E. faecalis, L. casei, L. plantarum*			Josson et al., 1989		pLAB1102			Ampicillin and Chloramphenicol resistance	Shuttle Yes
288			*B. subtilis, E. faecalis, L. casei, L. plantarum*			Josson et al., 1989		pLAB1301			Ampicillin and Erythromycin resistance	Shuttle Yes
289			*B. subtilis, E. faecalis, L. plantarum*			Josson et al., 1990		pLAB1304			Ampicillin and Erythromycin resistance	Shuttle Yes
290			*B. subtilis, E. faecalis, L. plantarum*			Josson et al., 1990		pLAB1321			Ampicillin and Erythromycin resistance	Shuttle Yes
291			*B. subtilis, L. casei, L. lactis*			Klein et al., 1993		pJK352			Ampicillin and Chloramphenicol resistance	Shuttle Yes
292			*B. subtilis, L. casei, L. lactis*			Klein et al., 1993		pJK352d			Chloramphenicol resistance	Shuttle No
293			*B. subtilis, L. casei, L. lactis*			Klein et al., 1993		pJK353			Ampicillin and Chloramphenicol resistance	Shuttle Yes
294			*B. subtilis, L. casei, L. lactis*			Klein et al., 1993		pJK354			Ampicillin and Chloramphenicol resistance	Shuttle Yes
295			*B. subtilis, L. casei, L. lactis*			Klein et al., 1993		pJK355			Chloramphenicol resistance	Shuttle No
296			*B. subtilis, L. casei, L. lactis*			Klein et al., 1993		pJK356			Chloramphenicol resistance	Shuttle No
297			*L. delbrueckii*			Zink et al., 1991		pJK300			Ampicillin and Chloramphenicol resistance	Shuttle Yes
298			*Lactobacillus spp. 89*			Chagnaud et al., 1992		pLE16			Chloramphenicol and Tetracyclin resistance	Shuttle Yes
299			*L. lactis, L. johnsonii*			Azcarate-Peril and Raya, 2002		pSS1			Chloramphenicol, Erythromycin, and Tetracyclin resistance	Shuttle No
300			*L. lactis*			Bourniquel et al., 2002		pN42+pJDC9			Erythromycin resistance	Shuttle Yes
301			*L. helveticus*			Hashiba et al., 1990		pLHR			Ampicillin and Erythromycin resistance	Shuttle Yes
302			*L. helveticus*			Hashiba et al., 1992		pBG10			B-gal	Shuttle Yes
303			*L. helveticus, L. casei*			Yamamoto and Takano, 1996		pCP53d			Tetracyclin resistance	Shuttle No
304			*L. acidophilus*			Damiani et al., 1987		pPV751			Tetracyclin resistance	Shuttle Yes
305			*L. acidophilus*			Damiani et al., 1987		pPV754			Tetracyclin resistance	Shuttle Yes
306			*L. acidophilus*			Luchansky et al., 1988		pTRK13			Chloramphenicol resistance	Shuttle Yes

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307			*L. acidophilus*			Muriana and Klaenhammer, 1991		pTRK159			Chloramphenicol, Erythromycin, and Tetracyclin resistance	Shuttle Yes
308			*L. acidophilus, L. casei*			Kanatani et al., 1992		pULA105E			Ampicillin and Erythromycin resistance	Shuttle Yes
309			*L. acidophilus, L. casei, E. coli*			Sano et al., 1997		pLA106PVem			Erythromycin resistance	Shuttle No
310			*L. sakei, L. plantarum, L. curvatus, L. casei*			Alpert et al., 2003		pRV566			Ampicillin and Erythromycin resistance	Shuttle Yes
311			*L. casei, L. lactis*			Chassy and Flickinger, 1987; Hemo et al., 1994		pLZ15			lac	Shuttle Yes
312			*L. delbrueckii*			Zink et al., 1991		pAZ20			Ampicillin and Chloramphenicol resistance	Shuttle Yes
313						Mercenier et al., 1989		pTG219			Erythromycin resistance	Shuttle Yes
314			*S. thermophilus*			Solaiman and Somkuti, 1993		pMEU5a			Ampicillin and Erythromycin resistance	Shuttle Yes
315			*S. thermophilus*			Solaiman and Somkuti, 1993		pMEU5b			Ampicillin and Erythromycin resistance	Shuttle Yes
316			*S. thermophilus*			Solaiman and Somkuti, 1993		pMEU6a			Ampicillin and Erythromycin resistance	Shuttle Yes
317			*S. thermophilus*			Solaiman and Somkuti, 1993		pMEU6b			Ampicillin and Erythromycin resistance	Shuttle Yes
318			*S. thermophilus*			Solaiman and Somkuti, 1993		pMEU9			Ampicillin, Chloramphenicol, and Erythromycin resistance	Shuttle Yes
319			*S. thermophilus*			Solaiman and Somkuti, 1993		pMEU10			Ampicillin, Chloramphenicol, and Erythromycin resistance	Shuttle Yes
320			*S. thermophilus*			Solaiman and Somkuti, 1995		pEU5xML2201 a/b			Ampicillin and Erythromycin resistance	Shuttle Yes
321			*S. thermophilus*			Solaiman and Somkuti, 1995		pEU5aML2201 a			Ampicillin and Erythromycin resistance	Shuttle Yes
322			*S. thermophilus*			Solaiman and Somkuti, 1995		pEU5aCH2201 a/b			Ampicillin and Erythromycin resistance	Shuttle Yes
323			*S. thermophilus*			Somkuti et al., 1995		pER82			Chloramphenicol and Erythromycin resistance	Shuttle No
324			*S. thermophilus*			Somkuti et al., 1995		pER82Pb			Chloramphenicol and Erythromycin resistance	Shuttle No
325			*S. thermophilus*			Solaiman and Somkuti, 1996		pER82pPbID			Ampicillin, Chloramphenicol, and Erythromycin resistance	Shuttle No
326			*S. thermophilus*			Solaiman and Somkuti, 1996		pEU5aID2201			Ampicillin and Erythromycin resistance	Shuttle No
327			*S. thermophilus*			Somkuti and Steinberg, 1999		pG341Pa			Ampicillin and Erythromycin resistance	Shuttle Yes
328			*S. thermophilus*			Somkuti and Steinberg, 1999		pG341Pb			Ampicillin and Erythromycin resistance	Shuttle Yes
329			*E. coli, S. thermophilus, L. lactis, E. faecalis*			Coderre and Somkuti, 1999		pPC418			Ampicillin and Erythromycin resistance	Shuttle Yes
330			*S. thermophilus, S. salivarius, L. lactis, E. coli*			Turgeon and Moineau, 2001		pSMQ172cat			Chloramphenicol resistance	Shuttle No
331			*S. thermophilus, L. lactis*			Su et al., 2002		pND913			Ampicillin and Erythromycin resistance	Shuttle Yes
332			*S. thermophilus*			Su et al., 2002		pND914			Ampicillin and Erythromycin resistance	Shuttle Yes
333			*S. thermophilus*			Su et al., 2002		pND915			Ampicillin and Erythromycin resistance	Shuttle Yes
334			*S. thermophilus*			El Demerdash et al., 2003		pHRM1			shsp	Shuttle No
335			*L. cremoris, L. mesenteroides subsp. mesenteroides, subsp. dextranicum, L. sakei*			Biet et al., 1999		pFBYC018E			Ampicillin and Erythromycin resistance	Shuttle Yes
336			*L. cremoris, L. mesenteroides subsp. mesenteroides, subsp. dextranicum, L. sakei*			Biet et al., 1999		pFBYC18E			Erythromycin resistance	Shuttle No

番号	区分	導入遺伝子	宿主乳酸菌	機能・特徴	研究・開発国	文献	遺伝子組換え法	ベクター	プロモーター	ターミネーター	マーカー	備考
337			*L. cremoris, L. mesenteroides subsp. mesenteroides, subsp. dextranicum, P. acidilactici, L. sakei*			Biet et al., 2002		pFBYC050E			Ampicillin and Erythromycin resistance	Shuttle Yes
338			*L. cremoris, L. mesenteroides subsp. mesenteroides, subsp. dextranicum, P. acidilactici, L. sakei*			Biet et al., 2002		pFBYC50E			Erythromycin resistance	Shuttle No
339			*L. mesenteroides subsp. mesenteroides, L. paramesenteroides, L. lactis subsp. lactis, S. thermophilus, B. subtilis, L. casei*			Coffey et al., 1994		pCI431			Chloramphenicol resistance	Shuttle No
340			*P. acidilactici, L. mesenteroides subsp. mesenteroides, L. plantarum, E. faecalis*			Benachour et al., 1995		pUCB813			Erythromycin resistance	Shuttle No
341			*P. acidilactici, L. mesenteroides subsp. mesenteroides, L. plantarum, E. faecalis*			Benachour et al., 1995		pUCB825			Erythromycin resistance	Shuttle No
342			*E. coli*			Matteuzzi et al., 1990		pMR3			Ampicillin and Chloramphenicol resistance	Shuttle Yes
343			*E. coli, B. animalis*			Argnani et al., 1996		pDG7			Ampicillin and Chloramphenicol resistance	Shuttle Yes
344			*B. longum, E. coli*			Missich et al., 1994		pRM2			Spectinomycin and Ampicillin resistance	Shuttle Yes
345			*E. coli*			Rossi et al., 1996		pDH7			Ampicillin and Chloramphenicol resistance	Shuttle Yes
346			*B. animalis, E. coli*			Rossi et al., 1996		pKG7			Ampicillin and Chloramphenicol resistance	Shuttle Yes
347			*B. animalis*			Rossi et al., 1996		pNC7			Ampicillin and Chloramphenicol resistance	Shuttle No
348			*B. animalis, E. coli*			Rossi et al., 1996		pDGE7			Ampicillin, Chloramphenicol, and Erythromycin resistance	Shuttle Yes
349			*B. animalis, B. bifidum, B. infantis, B. longum, B. magnum*			Rossi et al., 1998		pLF5			Ampicillin and Chloramphenicol resistance	Shuttle Yes
350			*B. animalis, B. bifidum, B. infantis, B. longum, B. magnum*			Rossi et al., 1998		pCLJ15			Ampicillin and Erythromycin resistance	Shuttle Yes
351			*B. animalis, B. bifidum, B. infantis, B. longum, B. magnum*			Rossi et al., 1998		pSPEC1			Spectinomycin and Ampicillin resistance	Shuttle Yes
352			*B. animalis, B. bifidum, B. infantis, B. longum, B. magnum*			Rossi et al., 1998		pTRE3			Chloramphenicol resistance	Shuttle No
353			*B. longum*			Matsumura et al., 1997		pBLES100			Spectinomycin resistance	Shuttle Yes
354			*B. animalis*			Park et al., 1999		pBKJ50F/R			Ampicillin and Chloramphenicol resistance	Shuttle Yes
355			*B. animalis, B. infantis*			Park et al., 2000		pBKJ36F/R			Ampicillin and Chloramphenicol resistance	Shuttle Yes
356			*B. longum*			Park et al., 2003		pBES2			Ampicillin and Chloramphenicol resistance	Shuttle Yes
357			*B. animalis*			Gonzalez Vara et al., 2003		pLAV			Chloramphenicol resistance	Shuttle Yes

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1			・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pWH1520	xylA		・Ampicillin ・Tetracycline				
2			・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pMM1522	xylA		・Ampicillin ・Tetracycline				
3			・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pMM1525	xylA		・Ampicillin ・Tetracycline				pMM1522+signal sequence
4			・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pHIS1522	xylA		・Ampicillin ・Tetracycline		His		
5			・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pHIS1525	xylA		・Ampicillin ・Tetracycline		His		pHIS1522+signal sequence
6			・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pSTREP1525	xylA		・Ampicillin ・Tetracycline	STREP			pHIS1522+signal sequence
7			・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pSTREPHIS1525	xylA		・Ampicillin ・Tetracycline	STREP	His		
8			・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pC-HIS1622	xylA		・Ampicillin ・Tetracycline		His		
9			・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pC-STREP1622	xylA		・Ampicillin ・Tetracycline		STREP		
10			・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pN-HIS-TEV1622	xylA		・Ampicillin ・Tetracycline	His			
11			・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pN-STREP-TEV1622	xylA		・Ampicillin ・Tetracycline	STREP			
12			・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pN-STREP-Xa1622	xylA		・Ampicillin ・Tetracycline	STREP			
13			・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pSTOP1622	xylA		・Ampicillin ・Tetracycline				
14		levansucrase (Lactobacillus reuteri)	・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pRBBm15	xylA		・Ampicillin ・Tetracycline		His		
15		levansucrase (Lactobacillus reuteri)	・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pRBBm13	xylA		・Ampicillin ・Tetracycline	STREP			
16		levansucrase (Lactobacillus reuteri)	・E. coli ・Bacillus megaterium	Bacillus megaterium発現	Mo Bi Tec			pRBBm16	xylA		・Ampicillin ・Tetracycline	STREP	His		
17			・E. coli ・Bacillus subtilis	Bacillus subtilis発現	Mo Bi Tec			pHT01	groE		・Ampicillin ・Chloramphenicol				
18			・E. coli ・Bacillus subtilis	Bacillus subtilis発現	Mo Bi Tec			pHT43	groE		・Ampicillin ・Chloramphenicol				
19			・E. coli ・Bacillus subtilis	Bacillus subtilis発現	Mo Bi Tec			pHT08	groE		・Ampicillin ・Chloramphenicol	His			
20			・E. coli ・Bacillus subtilis	Bacillus subtilis発現	Mo Bi Tec			pHT09	groE		・Ampicillin ・Chloramphenicol	STREP			
21			・E. coli ・Bacillus subtilis	Bacillus subtilis発現	Mo Bi Tec			pHT10	groE		・Ampicillin ・Chloramphenicol		cMyc		
22			・E. coli ・Bacillus subtilis	Bacillus subtilis発現	Mo Bi Tec			pBacTag-FLAG	spac	Tryptophan operon Terminator	・Ampicillin ・Erythromycin		FLAG		
23			・E. coli ・Bacillus subtilis	Bacillus subtilis発現	Mo Bi Tec			pBacTag-cMyc	spac	Tryptophan operon Terminator	・Ampicillin ・Erythromycin		cMyc		
24			・E. coli ・Bacillus subtilis	Bacillus subtilis発現	Mo Bi Tec			pBacTag-HA	spac	Tryptophan operon Terminator	・Ampicillin ・Erythromycin		HA		
25			・E. coli ・Bacillus subtilis	Bacillus subtilis発現	Mo Bi Tec			pBacTag-GFP+	spac	Tryptophan operon Terminator	・Ampicillin ・Erythromycin		GFP+		
26			・E. coli ・Bacillus subtilis	Bacillus subtilis発現	Mo Bi Tec			pBacTag-CFP	spac	Tryptophan operon Terminator	・Ampicillin ・Erythromycin		CFP		
27			・E. coli ・Bacillus subtilis	Bacillus subtilis発現	Mo Bi Tec			pBacTag-YFP	spac	Tryptophan operon Terminator	・Ampicillin ・Erythromycin		YFP		

添付資料3 枯草菌用ベクターリスト

番号	区分	導入遺伝子	宿主	生産物・機能・特徴	研究・開発国	文献	遺伝子組換え法	ベクター名	プロモーター	ターミネーター	マーカー	タグ N末端	タグ C末端	その他	備考
28	食用ワクチン	white spot syndrome virus (WSSV) envelope protein "VP28"	Bacillus subtilis	・B. subtilisはVP28を分泌 ・経口投与したザリガニにWSSVに対する防御効果を誘導	中・浙江大学	Fu LL et. al. (2008) Oral vaccination with envelope protein VP28 against white spot syndrome virus in Procambarus clarkii using Bacillus subtilis as delivery vehicles. Lett Appl Microbiol. 46(5):581-6	electoroporation	pGS-H1	sigma43 promorter from B. subtilis 168		Kanamycin				
29		a-amylase gene	Bacillus subtilis QB1130	培養液中にa-amylaseを産生	中・中山大学	李文清ら (1994) 分泌载体pUS186的构建及地衣杆菌a-淀粉酶基因在枯草杆菌中的表达和分泌 Acta Genetica Sinica. 21:330-336		pUSA186	sigma43 promorter from B. subtilis 168		Kanamycin				
30		thioredoxin from Aliciclobacillus acidocaldarius (Alitrx)	Bacillus subtilis DB428	B. subtilisはAlitrxを培養液中に活性を有するAlitrxを産生し、 Alitrxはinsulinを還元活性を有する	伊・Instituteof protein biochemistry	Anna DF et. Al. (2003) High-level expression of Aliciclobacillus acidocaldarius thioredoxin in Pichia pastoris and Bacillus subtilis. Protein Expr Purif. 30:179-184.		pBE3	aprE (B. subtilis subtilisin E promoter)		Kanamycin				B. subtilis subtilisin E signal peptideにより分泌
31		single chain variable fragment (scFv)	Bacillus brevis HPD-31	B. brevisはscFvを分泌	日・日本大学	Shiroza T et. al. (2001) Construction of a chimeric shuttle plasmid via a heterodimer system: secretion of an scFv protein from Bacillus brevis cells capable of inhibiting hemagglutination. Biosci Biotechnol Biochem. 65(2):389-95.	electoroporation	pYS08	a-amylase promorter (from Bacillus subtilis NA64)		Erythromycin				
32		single chain variable fragment (scFv)	Bacillus brevis HPD-31	B. brevisは生物活性を有するscFvを分泌	日・日本大学	Shiroza T et. al. (2003) Production of a single-chain variable fraction capable of inhibiting the Streptococcus mutans glucosyltransferase in Bacillus brevis: construction of a chimeric shuttle plasmid secreting its gene product. Biochim Biophys Acta.	electoroporation	pYS18	a-amylase promorter (from Bacillus subtilis NA64)		Erythromycin				
33		Glutamin合成制御タンパク GltC(gltC)	Bucillus subtilis SMY	B. subtilisはGltCを発現	米・タフツ大学	Picossi S et. Al. (2007) Molecular mechanism of the regulation of Bacillus subtilis gltAB expression by GltC.	electoroporation	pSP12	gltC promorter		Neomycin		6xHis		相同組換えにより染色体上へ導入される
34		Glutamin合成制御タンパク GltC(gltC)	Bucillus subtilis SMY	B. subtilisはGltCを発現	米・タフツ大学	Picossi S et. Al. (2007) Molecular mechanism of the regulation of Bacillus subtilis gltAB expression by GltC.	electoroporation	pSP16	gltC promorter		Neomycin	6xHis			相同組換えにより染色体上へ導入される
35		Bacillus pumilus B26由来 lipaseB26 (Lip)	Bacillus subtilis DB104	B. subtilisはlipase B26を分泌	韓・Korea Research Institute of Bioscience and Biotechnology	Kim HK et. Al. (2002) Expression and characterization of Ca(2+)-independent lipase from Bacillus pumilus B26. Biochim Biophys Acta. 11;1583(2):205-12.	electoroporation	pMB26	lip promoter		・Ampicillin ・Kanamycin				
36		bgaB	Bacillus subtilis 1A747	B-galactosidase	中・Northwest A&F University	Li W et. Al. (2007) Characterization of two temperature-inducible promoters newly isolated from B. subtilis. Biochem Biophys Res Commun. 358(4):1148-53.	electoroporation	pSI2427	temperature inducible promorter P2		・Chloramphenicol ・Spectinomycin				

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37		bgaB	Bacillus subtilis 1A747	B-galactosidase	中・Northwest A&F University	Li W et. Al. (2007) Characterization of two temperature-inducible promoters newly isolated from B. subtilis. Biochem Biophys Res Commun. 358(4):1148-53.	electoroporation	pSI7427	temperature inducible promorter P7		・Chloramphenicol ・Spectinomycin				
38		cystatin S and SA	Bacillus subtilis Marburg 168	B. subtilisは培養液中にcystatin SあるいはSAを産生	日・Biological science laboratories of Kao corporation	Extracellular production of human cystain S and systatin SA by Bacillus subtilis. Protein Expr Purif. 49:203-210.		pHSP-US	alkaline endoglucanase promoter (from Bacillus sp. KSM-S237)		・Ampicillin ・Tetracycline				
39		・grpE ・dnaK ・dnaJ ・bgaB	Bacillus subtilis 1012	B. subtilisはいずれのタンパク質も発現		Kim L et. al. (1996) A xylose-inducible Bacillus subtilis integration vector and its application. Gene. 181(1-2):71-6.		pX	xylA (from B. megaterium)		Chloramphenicol				染色体上のamyE部位にplasmidは組み込まれる
40		gfp (jellyfish Aequorea victoria)	Bacillus subtilis YB886	B. subtilisは温度依存的にGFPを発現し、蛍光を発する	西・Universidad Autónoma	Serrano-Heras G et. al. (2005) A new plasmid vector for regulated gene expression in Bacillus subtilis. Plasmid. 54(3):278-82.	electoroporation	pPR54	λ-phage promoter (temperature inducible)	rrnB (from E. coli)	Bleomycin				
41		bgaB	Bacillus subtilis IHA01	B-galactosidase	独・university of bayreuth	Hartl B et. Al. (2001) Development of a new integration site within the Bacillus subtilis chromosome and construction of compatible expression cassettes. J Bacteriol. 183(8):2696-9.	electoroporation	pAX01	xylA promorter	t0 (lambda phage)	Erythromycin				染色体上のlacA部位にplasmidは組み込まれる
42		bgaB	Bacillus subtilis IHA01	B-galactosidase	独・university of bayreuth	Hartl B et. Al. (2001) Development of a new integration site within the Bacillus subtilis chromosome and construction of compatible expression cassettes. J Bacteriol. 183(8):2696-9.	electoroporation	pAX01	lac promorter	t0 (lambda phage)	Erythromycin				染色体上のlacA部位にplasmidは組み込まれる
42		・bgaB (B-galactosidase from Bacillus stearothermophilus) ・vgb (Vitreoscilla haemoglobin) ・bioA (diaminopelargonic acid aminotransferase)	Bacillus subtilis	maltose存在下で、B. subtilisは導入したタンパク質を菌体内に産生	中・Zhejiang university	Ming-Ming Y et. al. (2006) Construction and characterization of a novel maltose inducible expression vector in Bacillus subtilis. Biotechnol Lett.	electoroporation	・pLJ-7 ・pGJ203 ・pDCA	glv (from B. subtilis maltose utilization operon)		Chloramphenicol				
43		bgaB	Bacillus subtilis 1A747	B-galactosidase	中・Northwest A&F University	Zhang AL et. al. (2007) Assay and characterization of a strong promoter element from B. subtilis. Biochem Biophys Res Commun. 354(1):90-5.	electoroporation	pSI3423	yxiE		・Chloramphenicol ・Spectinomycin				
44		bgaB	Bacillus subtilis 1A747	B-galactosidase	中・Northwest A&F University	Zhang AL et. al. (2007) Assay and characterization of a strong promoter element from B. subtilis. Biochem Biophys Res Commun. 354(1):90-5.	electoroporation	pYG123	yxiE		Chloramphenicol				
45		pga (Bacillus megaterium penicillin G acylase)	Bacillus subtilis WB600	B. subtilisは培養液中に活性を有するpenicillin G acylaseを産生	中・Chinise academy of sciences	Yang S et. Al. (2001) Expression and purification of extracellular penicillin G acylase in Bacillus subtilis/ Protein Expr Purif. 21:60-	protoplast method	pEES102	P43		Neomycin				
46		bgaB or htpG	Bacillus subtilis 1012	・B-galactosidase ・Heat shock protein	独・University of Bayreuth	Nguyen HD et. al. (2005) Construction of plasmid-based expression vectors for Bacillus subtilis exhibiting full structural stability.		pHCMC02	lepA (weak constitutive promoter)	trpA	・Ampicillin ・Chloramphenicol				

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47		bgaB or lacZ	・Bacillus subtilis 1012 ・Bacillus subtilis IS58	・B-galactosidase	独・University of Bayreuth	Nguyen HD et. al. (2005) Construction of plasmid-based expression vectors for Bacillus subtilis exhibiting full structural stability.		pHCMC03	gsiB (B. subtilis glucose starvation inducible promoter)	trpA	・Ampicillin ・Chloramphenicol				
48		bgaB or htpG	Bacillus subtilis 1012	・B-galactosidase ・Heat shock protein	独・University of Bayreuth	Nguyen HD et. al. (2005) Construction of plasmid-based expression vectors for Bacillus subtilis exhibiting full structural stability.		pHCMC04	xylA (xylose indicible promoter)	trpA	・Ampicillin ・Chloramphenicol				
49		bgaB or htpG	Bacillus subtilis 1012	・B-galactosidase ・Heat shock protein	独・University of Bayreuth	Nguyen HD et. al. (2005) Construction of plasmid-based expression vectors for Bacillus subtilis exhibiting full structural stability.		pHCMC05	spac (IPTG inducible promoter)	trpA	・Ampicillin ・Chloramphenicol				
50		Glutamyl endopeptidase gene (gseBL from Bacillus licheniformis) B-6839)	Bacillus subtilis AJ73	B. subtilisは培養液中にGseBLを産生	露・Institute of Genetics and Selection of Industrial Microorganisms	Shevelev AB et. al. (2000) Expression of bacillar glutamyl endopeptidase genes in Bacillus subtilis by a new mobilizable single-replicon vector pLF. Plasmid. 43(3):190-9.		pLF9	・cryIAa (endotoxin gene from B. thuringiensis ssp kurstaki) ・Kanamycin		Chloramphenicol				
51		・Glutamyl endopeptidase gene (gseBL from Bacillus licheniformis) B-6839) ・Glutamyl endopeptidase gene (gseBI from Bacillus intermedius)	Bacillus subtilis AJ73	・B. subtilisは培養液中にGseBLを産生 ・B. subtilisは培養液中にGseBIを産生	露・Institute of Genetics and Selection of Industrial Microorganisms	Shevelev AB et. al. (2000) Expression of bacillar glutamyl endopeptidase genes in Bacillus subtilis by a new mobilizable single-replicon vector pLF. Plasmid. 43(3):190-9.		pLF14	Kanamycin		Chloramphenicol				
52		Bacillus thuringiensis subsp. Morrisoni PG-14由来 cry11Aa	Bacillus brevis	B. brevisはCry11Aaを発現し、Aedes aegyptiとCulex pipiensに対し殺虫活性をもつ	韓・Seoul national university	Roh JY et. al. (2010) Expression of Bacillus thuringiensis mosquitocidal toxin in an antimicrobial Bacillus brevis strain. Journal of Asia-Pacific Entomology. 13:61-64	electoroporation	pPro11A	cry1Ac		Erythromycin				
53		・xynA (xylanase from Bacillus subtilis 168) ・bgls (glucanase from Bacillus subtilis 168)	Bacillus subtilis 1A304	B. subtilisは培養液中に酵素活性を有するxylanaseあるいはglucanaseを産生	中・University of Hong Kong	Chan AY et. Al. (2002) A dual protein expression system in Bacillus subtilis. Protein Expr Purif. 26:337-342.		pSGt	φ105 (thermal induction)	a-amylase (from B. licheniformis)	・Chloramphenicol ・Ampicillin				vectorは宿主の染色体上に組み込まれる
54		・birA (Bacillus subtilis biotin biosynthetic enzym) ・prsA (Bacillus subtilis extraccytoplasmic molecular chaperone) ・sak (staphylokinase)	Bacillus subtilis WB600	B. subtilisはそれぞれBirA、PrsAを菌体内に、SAKを培養液中に産生する	加・University of calgary	Wu SC et. al. (1999) Development of improved pUB110-based vectors for expression and secretion studies in Bacillus subtilis. J Biotechnol. 72:185-195.		pUB18P43BIRA pUB18P43PRSA pUB18P43SAKT	P43 (B. subtilis constitutive promoter)	pUB18P43SAKTのみT1T2 (from E. coli rrnB operon)	Kanamycin				
55		・birA (Bacillus subtilis biotin biosynthetic enzym) ・prsA (Bacillus subtilis extraccytoplasmic molecular chaperone)	Bacillus subtilis WB600	B. subtilisはそれぞれBirA、PrsAを菌体内に、SAKを培養液中に産生する	加・University of calgary	Wu SC et. al. (1999) Development of improved pUB110-based vectors for expression and secretion studies in Bacillus subtilis. J Biotechnol. 72:185-195.		pE18P43BIRA pE18P43PRSA pE18P43SAK	P43 (B. subtilis constitutive promoter)		・Erythromycin ・Lincomycin				
56		sak (staphylokinase)	Bacillus subtilis WB600	B. subtilisはSAKを培養液中に産生する	加・University of calgary	Wu SC et. al. (1999) Development of improved pUB110-based vectors for expression and secretion studies in Bacillus subtilis. J Biotechnol. 72:185-195.		pUB19P43	P43 (B. subtilis constitutive promoter)		Kanamycin				

番号	区分	導入遺伝子	宿主	生産物・機能・特徴	研究・開発国	文献	遺伝子組換え法	ベクター名	プロモーター	ターミネーター	マーカー	タグ N末端	タグ C末端	その他	備考
57		cryIC (σ-endotoxin from Bacillus thuringiensi subsp. Aizawai 7-29)	・Bacillus thuringiensis 407-OA ・Bacillus thuringiensis Kto	CryICはいずれの宿主でも発現するが、Spodoptera littoralisへの殺虫活性は407-OA株が高い	仏・institute pasteur	Sanchis V et. al. (1996) Construction of new insecticidal Bacillus thuringiensis recombinant strains by using the sporulation non-dependent expression system of cryIIIA and site specific recombination vector J Biotechnol. 48:81-96	electoroporation	pHTBS-F3-IC	cryIIIA		・Erythromycin ・Ampicillin ・Tetracycline				
58		cccA (Bacillus stearothermophilus PS3 cytochrome c-551)	Bacillus subtilis 1012	B. subtilisはcytochromeを膜画分に産生し、NADH oxidase活性をもつ	日・Kyusyu Institute of Technology	Kai K et. al. (1997) Over-expression and post-translational modification of thermophilic Bacillus cytochrome c-551 in Bacillus subtilis. J Ferment Bioeng. 84:190-194.	electoroporation	pHYc551	B. stearothermophilus neutral protease gene		・Tetracycline ・Ampicillin				
59		celE (from Clostridium thermocellum)	Bacillus subtilis 168	B. subtilisは培養液中に活性を持つcarboxymethylcellulaseを産生する	日・Mie university	Aminov RI et. Al. (1995) Expression of a celE gene from Clostridium thermocellum in Bacillus. J Ferment Bioeng. 79:530-537	electoroporation	pUB102	celE promoter		・Kanamycin ・Neomycin				
60		celE (from Clostridium thermocellum)	Bacillus subtilis 168	B. subtilisは培養液中に活性を持つcarboxymethylcellulaseを芽胞表面に産生する	日・Mie university	Aminov RI et. al. (1995) Expression of a celE gene from Clostridium thermocellum in Bacillus. J Ferment Bioeng. 79:530-537	electoroporation	pHE9102	celE promoter		・Erythromycin ・ Chloramphenicol				
61		aprBi (serine proteinase from Bacillus intermedius)	Bacillus subtilis AJ73	B. sublitisは培養液中に活性を持つserine proteinaseを産生する	露・Kazan state university	Sharipova M et. al. (2008) The expression of the serine proteinase gene of Bacillus intermedius in Bacillus subtilis. Microbiol Res. 163:39-50.	protoplast method	pCS9	aprBi	aprBi	Erythromycin				
62		bTub1 (β-tubulin from Plasmodium falciparum)	Bacillus brevis 47-5Q	B. brevisは培養液中にβ-tubulinを産生	瑞・Biozentrum	Bell A et. Al. (1995) Expression and secretion of malarial parasite β-tubulin in Bacillus brevis. Biochimie. 77:256-261	Tris-polyethylen glycol method	pGB202	MWP (B. brevis midle wall protein promoter)		Erythromycin				
63		ami (Amidase from Rhodococcus erythropolis)	Bacillus subtilis	全ての組換え体がAmidaseを産生するが、amyEプロモーターを用いたものが産生量、活性が共に最も高い		Yue Y et. Al. (2009) Cloning of amidase gene from Rhodococcus erythropolis and expression by distinct promoters in Bacillus subtilis. J Mol Catal B Enzym.		pGj103	・sacB ・amyE ・p43 ・degQ ・aprE		Chloramphenicol				
64		kojP (kojibiose phosphorylase:KP) treP (trehalose phosphorylase:TP) from Thermoanaerobacter brockii ATCC35047	Bacillus subtilis	B. subtillisはKPあるいはTPを産生。組換えKPとTPを用いてトレハロースからセラギノースの合成に成功	日・Hayashibara biochemical laboratories	Takuo Y et. al. (2005) Hyper expression of kojibiose phosphorylase gene and trehalose phophorylase gene from Thermoanaerobacter brockii ATCC35047 in Bacillus subtilis and selaginose synthesis utilizing two phosphorylases.	protoplast method	・pUBAPKP ・pUBAPTP	BamP (a-amylase gene from Bacillus amyloliquefaciens)		Kanamycin				
65		・bgaB (B-galactosidase) ・htpG (heat shock protein) ・pbpE (penicillin binding protein Pbp4)	Bacillus subtilis 1012	B subtilisはIPTGの添加により、菌体内に各タンパク質を産生	独・university of bayreuth	Phan TT et. al. (2006) Novel plasmid-based expression vectors for intra- and extracellular production of recombinant proteins in Bacillus subtilis. Protein Expr Purif. 46(2):189-95.		pNDH33	groE		・Ampicillin ・ Chloramphenicol				