

Antimicrobial	Group	Gene/Codon no.	Primer name	Internal number	Sequence	Temperature (°C)	Reference	
Beta-lactams	TEM	All	TEM front P1	Primer 757	5'-GCGGAACCCCTATTGG-3'	55	Olesen, L., H. Hasman, and F. M. Aarestrup. 2004. Prevalence of beta-lactamases among ampicillin-resistant <i>Escherichia coli</i> and <i>Salmonella</i> isolated from food animals in Denmark. <i>Microb. Drug Resist.</i> 10:334-340. Moodley, A. and Guardabassi, L. Transmission of IncN Plasmids Carrying blaCTX-M-1 between Commensal <i>Escherichia coli</i> in Pigs and Farm Workers. <i>Antimicrobial Agents and Chemotherapy.</i> 2009. 53:1709-1711.	
			TEM-C-R-ny	Primer 686	5'-ACC AAT GCT TAA TCA GTG AG-3'			
	CTX	M-All		ctx M U1	Primer 1354	5'-ATGTGCAGYACCAGTAARGTKATGGC-3'	60	Hasman, H., D. Mevius, K. Veldman, I. Olesen and F. M. Aarestrup. 2006. Beta-lactamases among Extended spectrum Beta-lactamase resistant (ESBL) <i>Salmonella</i> from poultry, poultry products and human patients in The Netherlands. <i>J. Antimicrob. Chemother.</i> 56:115-121.
				CTX-M-U-2new	Primer 1580	5'-TGGGTRAARTARGTSACCAGAAAYSAGCGG-3'		
		CTX-M1		ctx-M-15 front P1	Primer 1537	5'-CCATGGTTAAAAATCACTGCG-3'	60	Moodley, A. and Guardabassi, L. Transmission of IncN Plasmids Carrying blaCTX-M-1 between Commensal <i>Escherichia coli</i> in Pigs and Farm Workers. <i>Antimicrobial Agents and Chemotherapy.</i> 2009. 53:1709-1711.
				CTX-M-U-2new	Primer 1580	5'-TGGGTRAARTARGTSACCAGAAAYSAGCGG-3'		
		CTX-M2		ctx-M2-group-forward	Primer 1000	5'-ATGATGACTCAGAGCATTGCG-3'	60	Hendriksen R. S., Mikoleit M., Kornschober C., Rickert R.L., Duyne S.V., Kjelsø C., Hasman H., Cormican M., Mevius D., Threlfall J., Angulo F. J., Aarestrup F. M. 2009. Emergence of Multidrug-Resistant <i>Salmonella</i> Concord Infections in Europe and the United States in Children Adopted From Ethiopia, 2003-2007. <i>Pediatr Infect Dis J.</i> 28:814-818.
				ctx-M2-group-reverse	Primer 1001	5'-GAAACCGTGGGTACGATTT-3'		
		CTX-M9		ctx-M-9 P1	Primer 1096	5'-GTGACAAAGAGAGTGCAACGG-3'	60	Park YJ, Lee S, Kim YR, Oh EJ, Woo GJ, Lee K. Occurrence of extended-spectrum (beta)-lactamases and plasmid-mediated AmpC (beta)-lactamases among Korean isolates of <i>Proteus mirabilis</i> . <i>J Antimicrob Chemother.</i> 2006. 57:156-8.
				ctx-M-9 P2	Primer 1097	5'-ATGATTCTCGCCGCTGAAGCC-3'		
	SHV	All		SHV OS5	Primer 1545	5'-TTATCTCCCTGTTAGCCACC-3'	60	Arlet G, Rouveau M, Philippon A. Substitution of alanine for aspartate at position 179 in the SHV-6 extended-spectrum beta-lactamase. <i>FEMS Microbiol Lett.</i> 1997. 152:163-7.
				SHV OS6	Primer 1546	5'-GATTTGCTGATTTTCGCTCGG-3'		
	CMY	CMY-1		gruppe CMY-2	Primer 1617	5'-ATGCAACAACGACAATCC-3'	55	Pai H, Lyu S, Lee JH, Kim J, Kwon Y, Kim JW, Choe KW. Survey of extended-spectrum beta-lactamases in clinical isolates of <i>Escherichia coli</i> and <i>Klebsiella pneumoniae</i> : prevalence of TEM-52 in Korea. <i>Clin Microbiol.</i> 1999 37:1758-63.
				FOX group P2	Primer 1584	5'-TTGGCCAGCATGACGATG-3'		
		CMY-2		cmy-group2-F	Primer 1006	5'-GCACCTTAGCCACTATACGGCAG-3'	60	D'Andrea MM, Nucleo E, Luzzaro F, Giani T, Migliavacca R, Vailati F, Kroumova V, Pagani L, Rossolini GM. Antimicrob Agents Chemother. CMY-16, a novel acquired AmpC-type beta-lactamase of the CMY/LAT lineage in multifocal monophyletic isolates of <i>Proteus mirabilis</i> from northern Italy. 2006 50:618-24.
				cmy-group2-R	Primer 1007	5'-GCTTTTCAAGAATGCGCCAGG-3'		
	Chloramphenicol	cmlA		CmlA 1F, U12338 3860=>3879	Primer 114	5'-TAC TCG GAT CCA TGC TGG CC-3'	65	DTU Food* - in-house
				CmlA 2B, U12338 4437=>4418	Primer 115	5'-TCC TCG AAG AGC GCC ATT GG-3'		
				catA1	Primer 94	5'-CGC CTG ATG AAT GCT CAT CCG-3'		
	Florphenicol	floR		Flor-1	Primer 348	5'-ATGGCAGGCGATATTCATTA-3'	55	Farmer, J. J., III (1999). Enterobacteriaceae: Introduction and Identification. In <i>Manual of Clinical Microbiology</i> , 7th edn (Murray, P. R., Baron, E. J. & Tenover, M. A. Eds), pp. 442-58. ASM Press, Washington, DC, USA.
Flor-2				Primer 349	5'-AAACGGGTTGTCACGATCAT-3'			
Gentamicin	aac(3)-IV		AME 14ACC(3) IV B	Primer 152	5'-AGTTGACCCAGGGCTGTCGC-3'	63	Bräu B, Pilz U, Piepersberg W. (1984). Genes for gentamicin-(3)-N-acetyltransferases III and IV: I. Nucleotide sequence of the AAC(3)-IV gene and possible involvement of an IS140 element in its expression. <i>Molecular and general genetics</i> 193:179-87	
			AME 13ACC(3) IV F	Primer 153	5'-GTG TGC TGC TGG TCC ACA GC-3'			
	ant(2'')-I		AME 3, ANT (2'')-I-1	Primer 81	5'-GGG CGC GTC ATG GAG GAG TT-3'	67	Cameron, F.H., Groot Obbink, DJ., and Hall, R.M. 1986. Nucleotide sequence of the AAD(2'') aminoglycoside adenylyltransferase determined aadB. Evolution relationship of this with those surrounding addA in R538-1 and dhfrII in R388. <i>Nucleic Acids. Res.</i> 14:8625-8635.	
			AME 4, ANT (2'')-I-2	Primer 82	5'-TAT CGC GAC CTG AAA GCG GC-3'			
	aac(3)-II		AME7, AAC(3)-II X51534 381->400	Primer 87	5'-TGA AAC GCT GAC GGA GCC TC-3'	54	Vlieghehart, J.S., Ketelaar van Gaalen, P.A., and van de Klundert, J.A. 1989 Nucleotide sequence of the aacC2 gene, a gentamicin resistance determinant involved in a hospital epidemic of multiresistant members of the family Enterobacteriaceae. <i>Antimicrob. Agents Chemother.</i> 33:1153-1159.	
			AME8, AAC(3)-II X51534 750->731	Primer 88	5'-GTC GAA CAG GTA GCA CTG AG-3'			
Neomycin	aph(3'')-III		AME 19 APH (3'') I-F	Primer 171	5'-AACGTCTTGCTCAGGCGCG-3'	52	Oka, A., Sugisaki, H., and Takanami, M. 1981. Nucleotide sequence of the kanamycin resistance transposon Tn905. <i>J. Mol. Biol.</i> 147:217-226.	
			AME 20 APH(3'') I-B	Primer 172	5'-GGCAAGATCCTGGTATCGGTCTGGC-3'			
	aph(3'')-II		AME 21 Aph 3' -II-F	Primer 186	5'-GCT ATT CGG CTA TGA CTG GGC-3'	63	Aarestrup, F.M. et al. <i>J. Antim Chem</i> (2003) 52, 715-718. Antimicrobial susceptibility and occurrence of resistance genes among <i>Salmonella enterica</i> serovar Weltevreden from different countries	
			AME 22 APH (3'')-II B	Primer 187	5'-CCA CCA TGA TAT TCG GCA AGC-3'			
	aph(3'')-I		P2, APH(3'')-III	Primer 203	5'-GCCGATGTGGATTGCGAAAA-3'	68	Melano et al. <i>J Antim Chem</i> (2003) 52, 36-42. Multiple antibiotic-resistance mechanisms including a novel combination of extended-spectrum beta-lactamases in a <i>Klebsiella pneumoniae</i> clinical strain isolated in Argentina.	
Quinolones	gyrA Salmonella		P1-APH(3'')-III new	Primer 1428	5'-GCTTGATCCCAAGTCA-3'	60	Wiuif C, Madsen M, Baggesen DL, Aarestrup FM. Quinolone resistance among <i>Salmonella enterica</i> from cattle, broilers, and swine in Denmark. <i>Microb Drug Resist.</i> 2000 Spring;6(1):11-7.	
			gyrA, P2 bio	Primer 184	5'-TACCGTCATAGTTATCCACGA-3'			
	parC Salmonella		gyrA, P3	Primer 185	5'-GTACTTTACGCCATGAACCT-3'	59	Wiuif C, Madsen M, Baggesen DL, Aarestrup FM. Quinolone resistance among <i>Salmonella enterica</i> from cattle, broilers, and swine in Denmark. <i>Microb Drug Resist.</i> 2000 Spring;6(1):11-7.	
			ParC STPARC1	Primer 305	5'-CTATGCGATGTCAGAGCTGG-3'			
	gyrA E. Coli		ParC STPARC2	Primer 306	5'-TAACAGCAGCTCGCGTATT-3'	55	Everett MJ, Jin YF, Ricci V, Piddock LJ. Contributions of individual mechanisms to fluoroquinolone resistance in 36 <i>Escherichia coli</i> strains isolated from humans and animals. <i>Antimicrob Agents Chemother.</i> 1996 Oct;40(10):2380-6.	
			E.coliGyrAF (166 355)	Primer 1662	5'-ACGTACTAGGCAATGACTGG-3'			
			EcoliGyrAR	Primer 1663	5'-AGAAGTCGCCGTGCATAGAAC-3'			

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	parC E. Coli		E.coliParCF 2	Primer 1684	5'-TGTATGCGATGTCTGAACTG-3'	57	Cavaco LM, Frimodt-Møller N, Hasman H, Guardabassi L, Nielsen L, Aarestrup FM. Prevalence of quinolone resistance mechanisms and associations to minimum inhibitory concentrations in quinolone-resistant <i>Escherichia coli</i> isolated from humans and swine in Denmark. <i>Microb Drug Resist.</i> 2008 Jun;14(2):163-9.	
			E.coliParCR	Primer 1667	5'-CTCAATAGCAGCTCGGAATA-3'			
		qnrA		QnrA fw	Primer 1685	5'-GGATGCCAGTTTCGAGGA-3'	59	Cavaco LM, Frimodt-Møller N, Hasman H, Guardabassi L, Nielsen L, Aarestrup FM. Prevalence of quinolone resistance mechanisms and associations to minimum inhibitory concentrations in quinolone-resistant <i>Escherichia coli</i> isolated from humans and animals. <i>Antimicrob Agents Chemother.</i> 1996 Oct;40(10):2380-6.
				QnrA rw	Primer 1686	5'-TGCCAGGCACAGATCTTG-3'		
		qnrB		qnrB (1-6)F	Primer 1831	5'-GGMATHGAAATTCGCCACTG-3'	57	Cattoir V, Weill FX, Poirer L, Fabre L, Soussy CJ, Nordmann P. Prevalence of qnr genes in <i>Salmonella</i> in France. <i>J Antimicrob Chemother.</i> 2007 Apr;59(4):751-4.
				qnrB (1-6)R	Primer 1832	5'-TTTGCYGYCCGACATCGAA-3'		
		qnrC		qnrC fw	Primer 2196	5' GGGTTGTACATTTATGAAATC 3'	55	Wang M, Guo Q, Xu X, Wang X, Ye X, Wu S, Hooper DC, Wang M. New plasmid-mediated quinolone resistance gene, qnrC, found in a clinical isolate of <i>Proteus mirabilis</i> . <i>Antimicrob Agents Chemother.</i> 2009 May;53(5):1892-7.
				qnrC rev	Primer 2197	5' TCCACTTTACGAGGTTCT 3'		
		qnrD		qnr C fw	Primer 2013	5' CGAGATCAATTTACGGGGAATA 3'	50	Cavaco LM, Hasman H, Xia S, Aarestrup FM. qnrD, a novel gene conferring transferable quinolone resistance in <i>Salmonella enterica</i> serovar Kentucky and Bovismorbificans strains of human origin. <i>Antimicrob Agents Chemother.</i> 2009 Feb;53(2):603-8.
				qnrC rev	Primer 2014	5'AACAAGCTGAAGCGCCTG 3'		
		qnrS		qnrS (1-2)F	Primer 1829	5'-TCGACGTGCTAACTTGC-3'	57	Cavaco LM, Frimodt-Møller N, Hasman H, Guardabassi L, Nielsen L, Aarestrup FM. Prevalence of quinolone resistance mechanisms and associations to minimum inhibitory concentrations in quinolone-resistant <i>Escherichia coli</i> isolated from humans and swine in Denmark. <i>Microb Drug Resist.</i> 2008 Jun;14(2):163-9.
				qnrS (1-2)R	Primer 1830	5'-GATCTAAACCGTCGAGTTCCG-3'		
Streptomycin	-	strA	Strep-res, strA, plasm-ref1010,787-769, primer-2	Primer 67	5'-CCA ATC GCA GAT AGA AGG C-3'	55	Scholz, P., V. Haring, B. Wittmann-Liebold, K. Ashmann, M. Bagdasarian, and E. Scherzinger. 1989. Complete nucleotide sequence and gene organization of the broad- host-range plasmid RSF1010. <i>Gene</i> 75:271-288.	
			Strep-res, strA, plasm-ref1010,240-259, primer-1	Primer 68	5'-CTT GGT GAT AAC GGC AAT TC-3'			
	-	strB	Strep-res, strB, plasm-ref1010, 623-604, primer-2	Primer 65	5'-GGA TCG TAG AAC ATA TTG GC-3'	56	Scholz, P., V. Haring, B. Wittmann-Liebold, K. Ashmann, M. Bagdasarian, and E. Scherzinger. 1989. Complete nucleotide sequence and gene organization of the broad- host-range plasmid RSF1010. <i>Gene</i> 75:271-288.	
			Strep-res, strB, plasm-ref1010, 115-134, primer-1	Primer 66	5'-ATC GTC AAG GGA TTG AAA CC-3'			
	-	aadA2	aadA forward	Primer 521	5'-ATT TGC TGG TTA CGG TGA CC-3'	56	DTU Food* - in-house	
			aadA backward	Primer 522	5'-CTT CAA GTA TGA CGG GCT GA-3'			
	-	aadE	aadE p4	Primer 428	5'-TCA AAA CCC CTA TTA AAG CC-3'	60	DTU Food* - in-house	
			aadE p3	Primer 429	5'ATG GAA TTA TTC CCA CCT GA-3'			
Sulfamethoxazole	-	sul1	Sul 1 forward	Primer 519	5'-TGA GAT CAG ACG TAT TGC GC-3'	58	DTU Food* - in-house	
			Sul 1 backward	Primer 520	5'-TTG AAG GTT CGA CAG CAC GT-3'			
	-	sul2	Sul 2-f	Primer 591	5'-GCG CTC AAG GCA GAT GGC ATT-3'	70	Antimicrobial susceptibility and occurrence of resistance genes among <i>Salmonella enterica</i> serovar Weltevreden from different countries Frank M. Aarestrup, Monton Lertworapreecha, Mary C. Evans, Aroon Bangtrakulnonth, Thongchai Chalermchaikit, Rene Sjogren Henriksen1 and Henrik Caspar Wegener. <i>Journal of Antimicrobial Chemotherapy</i> Volume52, Issue4 Pp. 715-718	
			Sul 2-b	Primer 592	5'-GCG TTT GAT ACC GGC ACC CGT-3'			
	-	sul3	sul3(F)	Primer 1356	5'-GAGCAAGATTTTTGGAATCG-3'	53	Perreten, V. & Boerlin, P. (2003). A new sulphonamide resistance gene (sul3) in <i>Escherichia coli</i> is widespread in the pig population of Switzerland. <i>Antimicrobial Agents and Chemotherapy</i> 47, 1169-72.	
			sul3(B)	Primer 1357	5'-CATCTGCAGCTAACTAGGCGTTTGA-3'			
Tetracycline	-	tetA	TetA primer1	Primer 173	5'-GTAATCTGAGCACTGTCCG-3'	57	Waters, S. H. P., P. Rogowsky, and J. Grinstead. 1983. The tetracycline resistance determinants of RP1 and Tn721: nucleotide sequence analysis. <i>Nucleic Acids Res.</i> 11:6089-6105.	
			TetA primer2	Primer 175	5'-CTGCCTGGACAACATTGCTT-3'			
	-	tetB	TetB-Tn10=, 39->58	Primer 90	5'-CTC AGT ATT CCA AGC CTT TG-3'	52	Sengeløv, G., Y. Agersø, B. Halling-Sørensen, and Baloda. 2003. Bacterial antibiotic resistance levels in Danish farmland as a result of treatment with pig manure slurry. <i>Environ. Int.</i> 28:587-595	
			TetB-Tn10=, 454->434	Primer 91	5'-ACT CCC CTG AGC TTG AGG GG-3'			
	-	tetC	TetC,595->576	Primer 92	5'-GGT TGA AGG CTC TCA AGG GC-3'	62	Sengeløv, G., Y. Agersø, B. Halling-Sørensen, and Baloda. 2003. Bacterial antibiotic resistance levels in Danish farmland as a result of treatment with pig manure slurry. <i>Environ. Int.</i> 28:587-595	
			TetC,90->110	Primer 93	5'-CCT CTT GCG GGA TAT CGT CC-3'			
	-	tetD	Tet D2 (894-874)	Primer 575	5'-CAT CCA TCC GGA AGT GAT AGC-3'	57	Miranda, C. D., C. Kehrenberg, C. Ulep, S. Schwarz, and M. C. Roberts. 2003. Diversity of tetracycline resistance genes in bacteria from Chilean salmon farms. <i>Antimicrob. Agents Chemother.</i> 47:883-888	
			Tet D1 (459-478)	Primer 576	5'-GGA TAT CTC ACC GCA TCT GC-3'			
	-	tetE	<tet(E)2-1 sekvens	Primer 1318	5'-TGATGATGGCACTGGTCA-3'	57	Agersø, Y & Sandvang, D. Class I Integrons and Tetracycline Resistance Genes in <i>Alcaligenes</i> , <i>Arthrobacter</i> , and <i>Pseudomonas</i> spp. Isolated from Pigsties and Manured Soil. <i>Applied and Environmental Microbiology</i> , December 2005, p. 7941-7947, Vol. 71, No. 12	
			<tet(E)2-2 sekvens	Primer 1319	5'-GCTGGCTGTTGCCATTA-3'			
-	tetG	TetA(G)-1	Primer 229	5'-GCAGCGAAAGCGTATTTGCG-3'	62	Agersø, Y & Sandvang, D. Class I Integrons and Tetracycline Resistance Genes in <i>Alcaligenes</i> , <i>Arthrobacter</i> , and <i>Pseudomonas</i> spp. Isolated from Pigsties and Manured Soil. <i>Applied and Environmental Microbiology</i> , December 2005, p. 7941-7947, Vol. 71, No. 12		
		TetA(G)- 2	Primer 230	5'-TCCGAAAGCTGTCCAAGCAT-3'				

*DTU Food: Technical University of Denmark, National Food Institute (EU Reference Laboratory for Antimicrobial Resistance)