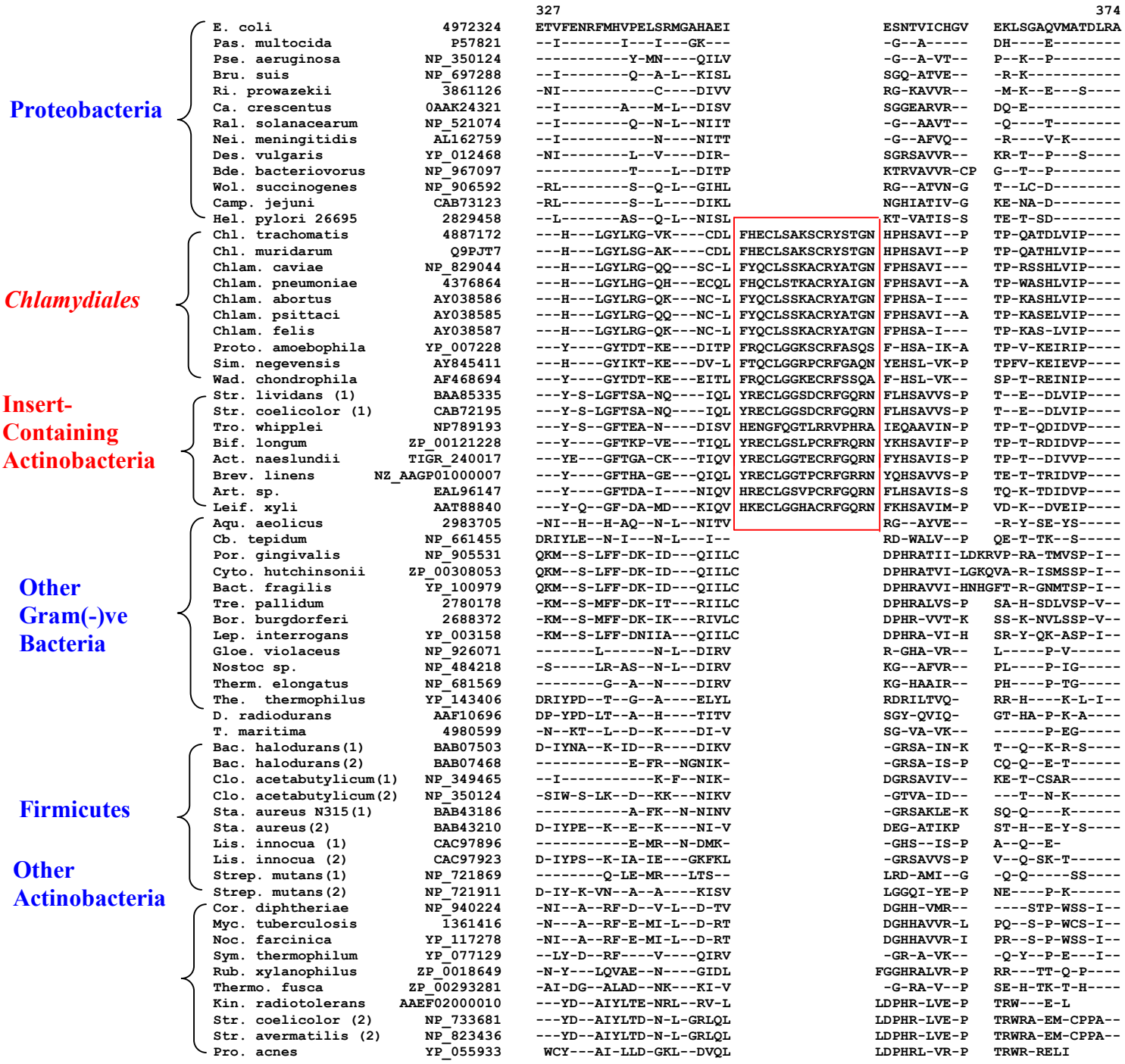
Laterally Transferred Genes between Chlamydiales and Actinobacteria (MurA)

E. Griffiths and R.S. Gupta (2006) J Mol Evol. 63(2):283-296.



		327			374
E. coli	4972324	ETVFENRFMHVPELSRMGAHAEI		ESNTVICHGV	EKLSGAQVMATDLRA
Pas. multocida	P57821	--I-------I---I---GK---		-G--A-----	DH----E--------
Pse. aeruginosa	NP_350124	----------Y-MN----QILV		-G--A-VT--	P--K--P--------
Bru. suis	NP_697288	--I--------Q--A-L--KISL		SGQ-ATVE--	-R-K----------
Ri. prowazekii	3861126	-NI----------C----DIVV		RG-KAVVR--	-M-K--E---S----
Ca. crescentus	0AAK24321	--I-------A---M-L--DISV		SGGEARVR--	DQ-E----------
Ral. solanacearum	NP_521074	--I--------Q--N-L--NIIT		-G--AAVT--	-Q----T--------
Nei. meningitidis	AL162759	--I----------N----NITT		-G--AFVQ--	-R----V-K------
Des. vulgaris	YP_012468	-NI---------L--V----DIR-		SGRSAVVR--	KR-T--P---S----
Bde. bacteriovorus	NP_967097	----------T----L--DITP		KTRVAVVR-CP	G--T--P--------
Wol. succinogenes	NP_906592	-RL--------S--Q-L--GIHL		RG--ATVN-G	T--LC-D--------
Camp. jejuni	CAB73123	-RL--------S--L----DIKL		NGHIATIV-G	KE-NA-D--------
Hel. pylori 26695	2829458	--L--------AS--Q-L--NISL		KT-VATIS-S	TE-T-SD--------
Chl. trachomatis	4887172	---H---LGYLKG-VK----CDL	FHECLSAKSCRYSTGN	HPHSAVI--P	TP-QATDLVIP----
Chl. muridarum	Q9PJT7	---H---LGYLSG-AK----CDL	FHECLSAKSCRYSTGN	HPHSAVI--P	TP-QATHLVIP----
Chlam. caviae	NP_829044	---H---LGYLRG-QQ---SC-L	FYQCLSSKACRYATGN	FPHSAVI---	TP-RSSHLVIP----
Chlam. pneumoniae	4376864	---H---LGYLHG-QH---ECQL	FHQCLSTKACRYAIGN	FPHSAVI--A	TP-WASHLVIP----
Chlam. abortus	AY038586	---H---LGYLRG-QK---NC-L	FYQCLSSKACRYATGN	FPHSA-I---	TP-KASHLVIP----
Chlam. psittaci	AY038585	---H---LGYLRG-QQ---NC-L	FYQCLSSKACRYATGN	FPHSAVI--A	TP-KASELVIP----
Chlam. felis	AY038587	---H---LGYLRG-QK---NC-L	FYQCLSSKACRYATGN	FPHSA-I---	TP-KAS-LVIP----
Proto. amoebophila	YP_007228	---Y----GYTDT-KE---DITP	FRQCLGGKSCRFASQS	F-HSA-IK-A	TP-V-KEIRIP----
Sim. negevensis	AY845411	---H----GYIKT-KE---DV-L	FTQCLGGRPCRFGAQN	YEHSL-VK-P	TPFV-KEIEVP----
Wad. chondrophila	AF468694	---Y----GYTDT-KE---EITL	FRQCLGGKECRFSSQA	F-HSL-VK--	SP-T-REINIP----
Str. lividans (1)	BAA85335	---Y-S-LGFTSA-NQ----IQL	YRECLGGSDCRFGQRN	FLHSAVVS-P	T--E--DLVIP----
Str. coelicolor (1)	CAB72195	---Y-S-LGFTSA-NQ----IQL	YRECLGGSDCRFGQRN	FLHSAVVS-P	T--E--DLVIP----
Tro. whipplei	NP789193	---Y-S--GFTEA-N----DISV	HENGFQGTLRRVPHRA	IEQAAVIN-P	TP-T-QDIDVP----
Bif. longum	ZP_00121228	---Y----GFTKP-VE---TIQL	YRECLGSLPCRFRQRN	YKHSAVIF-P	TP-T-RDIDVP----
Act. naeslundii	TIGR_240017	---YE---GFTGA-CK---TIQV	YRECLGGTECRFGQRN	FYHSAVIS-P	TP-T--DIVVP----
Brev. linens	NZ_AAGP01000007	---Y----GFTHA-GE---QIQL	YRECLGGTPCRFGRRN	YQHSAVVS-P	TE-T-TRIDVP----
Art. sp.	EAL96147	---Y----GFTDA-I----NIQV	HRECLGSVPCRFGQRN	FLHSAVIS-S	TQ-K-TDIDVP----
Leif. xyli	AAT88840	---Y-Q--GF-DA-MD---KIQV	HKECLGGHACRFGQRN	FKHSAVIM-P	VD-K--DVEIP----
Aqu. aeolicus	2983705	-NI--H--H-AQ--N-L--NITV		RG--AYVE--	-R-Y-SE-YS-----
Cb. tepidum	NP_661455	DRIYLE--N-I---N-L---I--		RD-WALV--P	QE-T-TK--S-----
Por. gingivalis	NP_905531	QKM--S-LFF-DK-ID---QIILC		DPHRATII-LDKRVP-RA-TMVSP-I--	
Cyto. hutchinsonii	ZP_00308053	QKM--S-LFF-DK-ID---QIILC		DPHRATVI-LGKQVA-R-ISMSSP-I--	
Bact. fragilis	YP_100979	QKM--S-LFF-DK-ID---QIILC		DPHRAVVI-HNHGFT-R-GNMTSP-I--	
Tre. pallidum	2780178	-KM--S-MFF-DK-IT---RIILC		DPHRALVS-P	SA-H-SDLVSP-V--
Bor. burgdorferi	2688372	-KM--S-MFF-DK-IK---RIVLC		DPHR-VVT-K	SS-K-NVLSSP-V--
Lep. interrogans	YP_003158	-KM--S-LFF-DNIIA---QIILC		DPHRA-VI-H	SR-Y-QK-ASP-I--
Gloe. violaceus	NP_926071	-------L------N-L--DIRV		R-GHA-VR--	L-----P-V------
Nostoc sp.	NP_484218	-S-----LR-AS--N-L--DIRV		KG--AFVR--	PL----P-IG-----
Therm. elongatus	NP_681569	--------G--A--N----DIRV		KG-HAAIR--	PH----P-TG-----
The. thermophilus	YP_143406	DRIYPD--T--G--A----ELYL		RDRILTVQ-	RR-H----K-L-I--
D. radiodurans	AAF10696	DP-YPD-LT--A--H----TITV		SGY-QVIQ-	GT-HA-P-K-A----
T. maritima	4980599	-N--KT--L--D--K----DI-V		SG-VA-VK--	------P-EG-----
Bac. halodurans(1)	BAB07503	D-IYNA--K-ID--R----DIKV		-GRSA-IN-K	T--Q--K-R-S----
Bac. halodurans(2)	BAB07468	----------E-FR--NGNIK-		-GRSA-IS-P	CQ-Q--E-T------
Clo. acetabutylicum(1)	NP_349465	--I----------K-F--NIK-		DGRSAVIV--	KE-T-CSAR------
Clo. acetabutylicum(2)	NP_350124	-SIW-S-LK--D--KK---NIKV		-GTVA-ID--	---T--N-K------
Sta. aureus N315(1)	BAB43186	----------A-FK--N-NINV		-GRSAKLE-K	SQ-Q----K------
Sta. aureus(2)	BAB43210	D-IYPE--K--E--K----NI-V		DEG-ATIKP	ST-H--E-Y-S----
Lis. innocua (1)	CAC97896	----------E-MR--N-DMK-		-GHS--IS-P	A--Q--E-
Lis. innocua (2)	CAC97923	D-IYPS--K-IA-IE---GKFKL		-GRSAVVS-P	V--Q-SK-T------
Strep. mutans(1)	NP_721869	--------Q-LE-MR---LTS--		LRD-AMI--G	-Q-Q-----SS----
Strep. mutans(2)	NP_721911	D-IY-K-VN--A--A----KISV		LGGQI-YE-P	NE----P-K------
Cor. diphtheriae	NP_940224	-NI--A--RF-D--V-L--D-TV		DGHH-VMR--	----STP-WSS-I--
Myc. tuberculosis	1361416	-N---A--RF-E-MI-L--D-RT		DGHHAVVR-L	PQ--S-P-WCS-I--
Noc. farcinica	YP_117278	-NI--A--RF-E-MI-L--D-RT		DGHHAVVR-I	PR--S-P-WSS-I--
Sym. thermophilum	YP_077129	--LY-D--RF----V----QIRV		-GR-A-VK--	-Q-Y--P-E---I--
Rub. xylanophilus	ZP_0018649	-N-Y---LQVAE--N----GIDL		FGGHRALVR-P	RR---TT-Q-P----
Thermo. fusca	ZP_00293281	-AI-DG--ALAD--NK---KI-V		-G-RA-V--P	SE-H-TK-T-H----
Kin. radiotolerans	AAEF02000010	---YD--AIYLTE-NRL--RV-L		LDPHR-LVE-P	TRW---E-L
Str. coelicolor (2)	NP_733681	---YD--AIYLTD-N-L-GRLQL		LDPHR-LVE-P	TRWRA-EM-CPPA--
Str. avermatilis (2)	NP_823436	---YD--AIYLTD-N-L-GRLQL		LDPHR-LVE-P	TRWRA-EM-CPPA--
Pro. acnes	YP_055933	WCY---AI-LLD-GKL--DVQL		LDPHRL-VR-P	TRWR-RELI

Figure 5. Partial sequence alignment of MurA proteins from different species showing a 16aa conserved insert that is commonly shared by various *Chlamydiales* and a subset of Actinobacteria. Additional abbreviations in species names are: *Act., Actinomyces; Art., Arthrobacter; Therm., Thermosynechococcus.*