

# Diverse sensory repertoire of paralogous chemoreceptors Tlp2, Tlp3 and Tlp4 in

## *Campylobacter jejuni*

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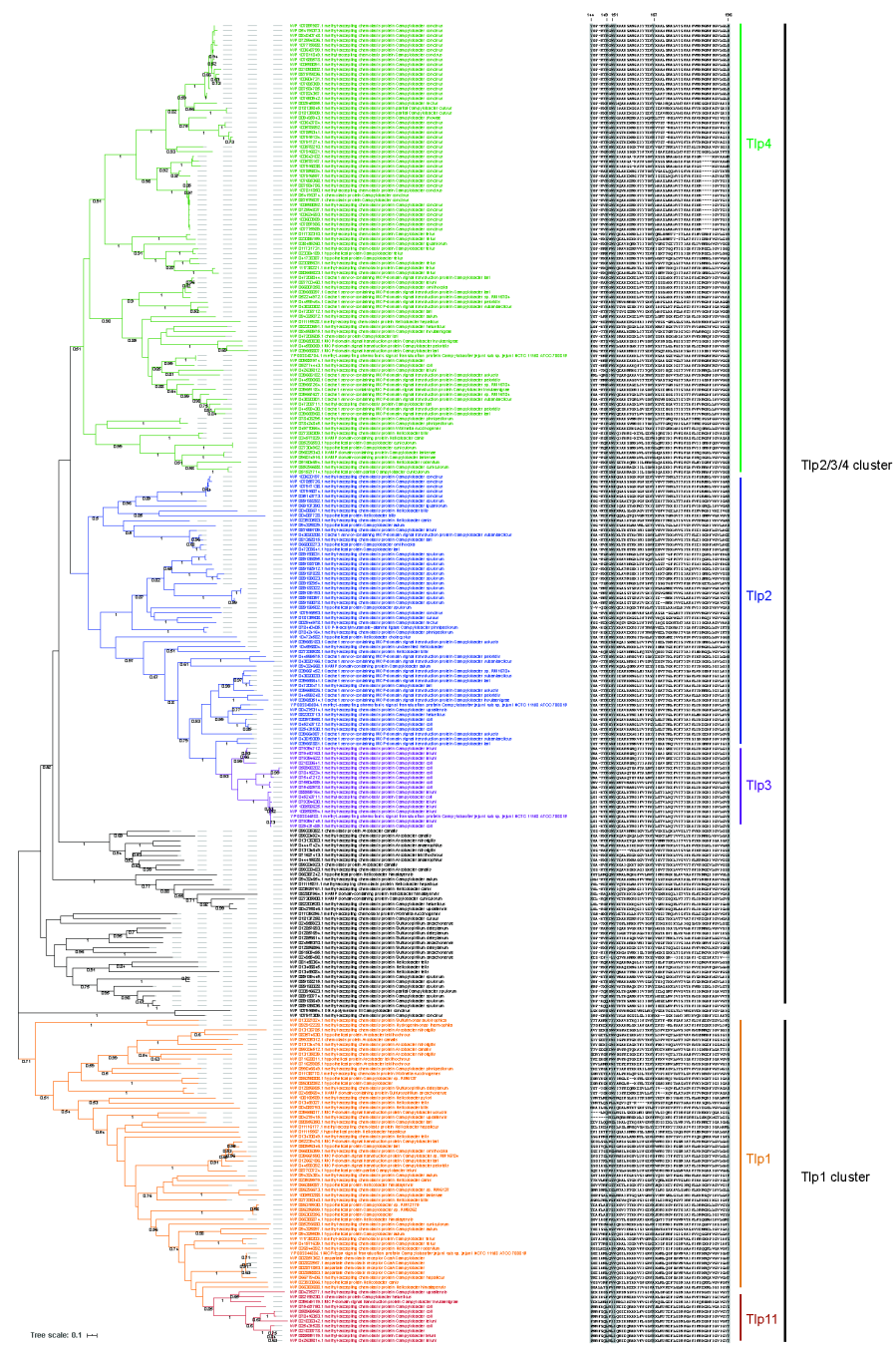
## SUPPORTING INFORMATION

**Figure S1.** Protein sequence alignment showing 30% identity and signalling domain completely identical across Tlp2, Tlp3 and Tlp4.

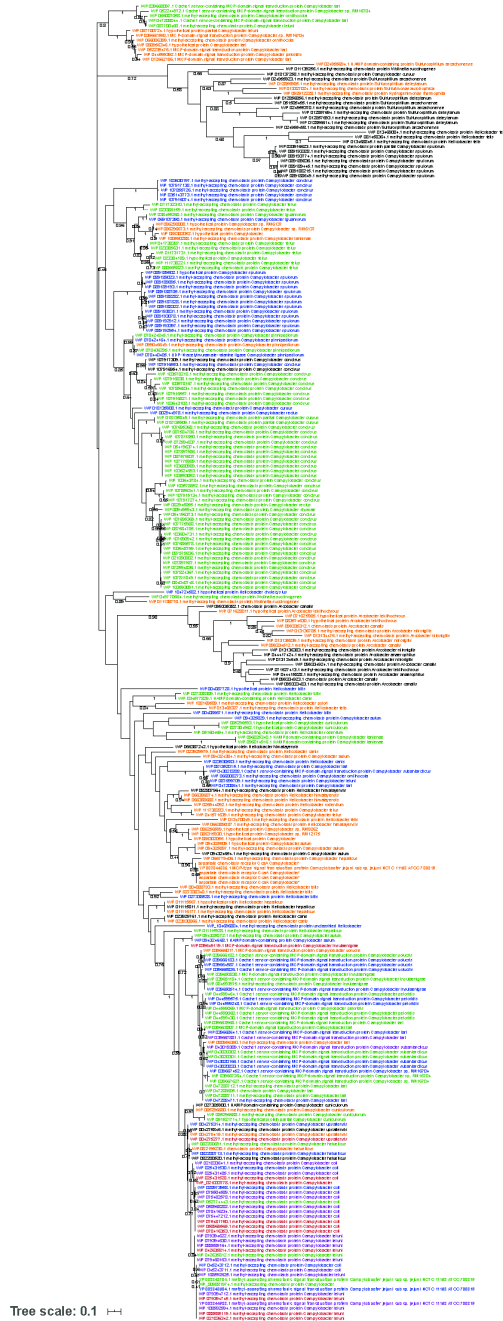




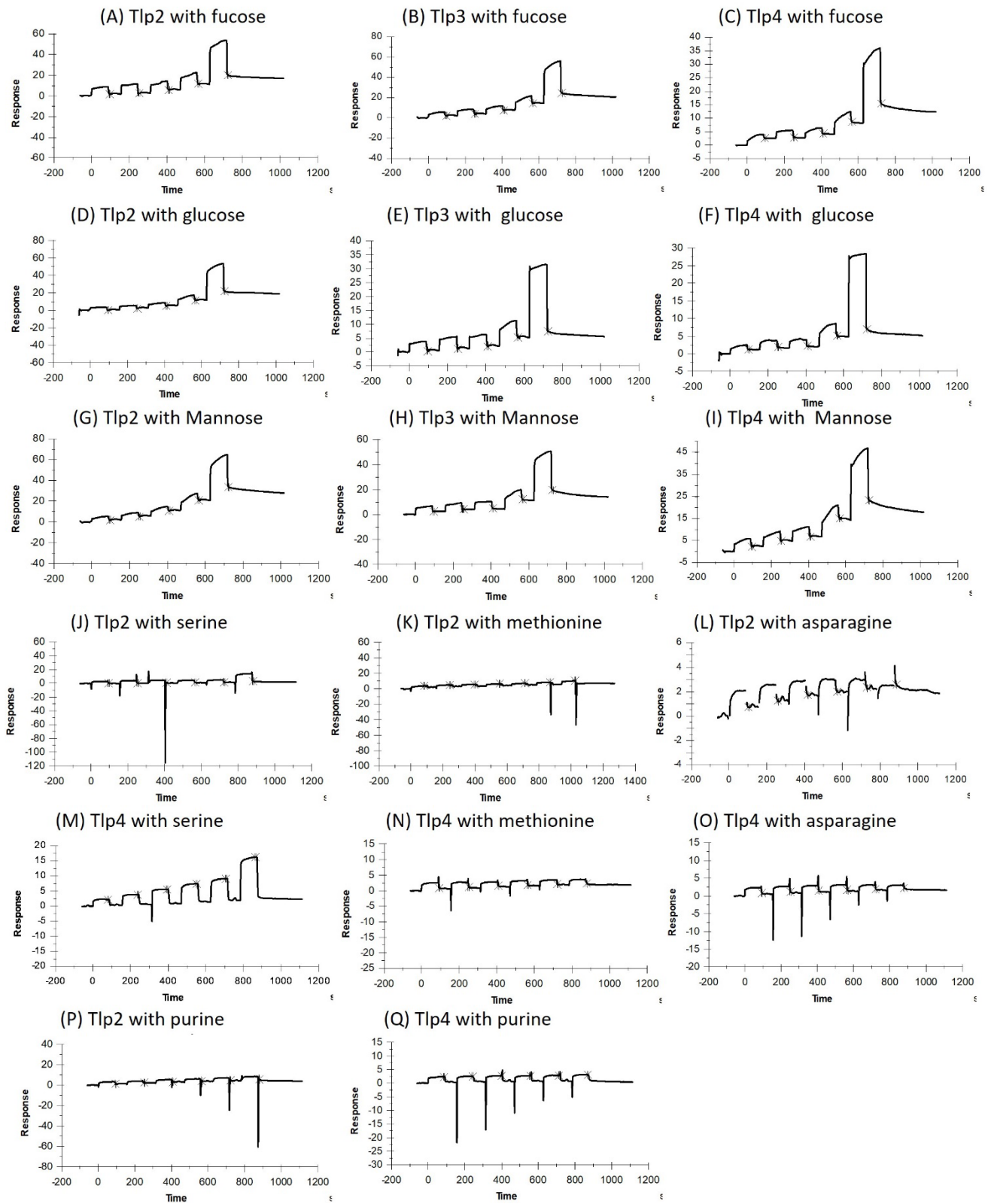
**Figure S3.** Relationship between dCache\_1 domains from *Campylobacterota* chemoreceptors. *C. jejuni* 11168-O chemoreceptors are shown in bold. Clades containing Tlp2, Tlp3 and Tlp4 colored in blue, purple and green, respectively. Tlp1-like clade is shown in orange. Conserved amino acid recognition motif is highlighted in grey. Amino acid numeration is based on the Tlp3 protein sequence. Bootstrap support values greater than 50% are shown. This figure is also available as a scalable pdf.



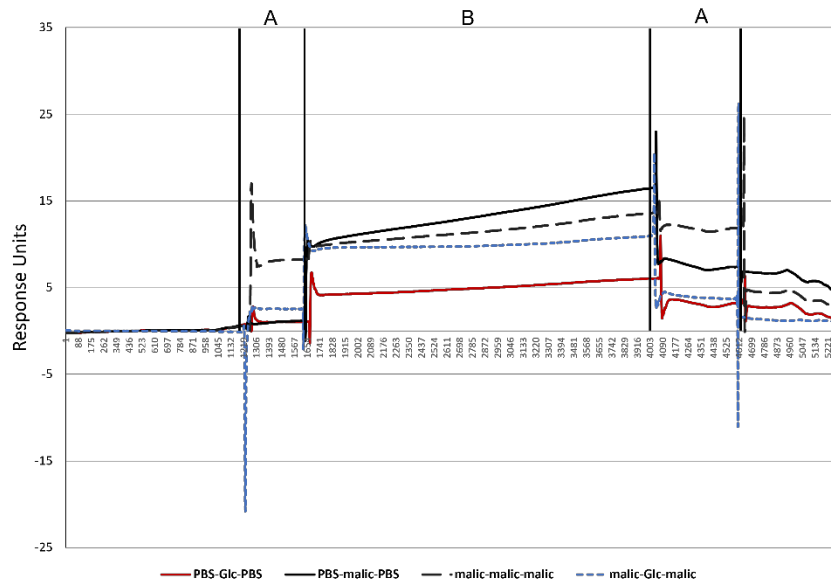
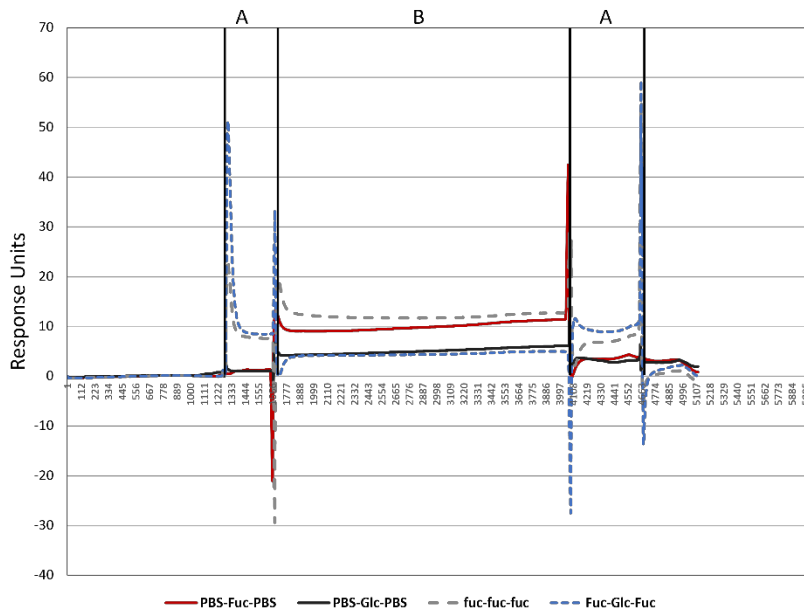
**Figure S4.** Phylogenetic tree of MCP signal domains from dCache\_1 containing chemoreceptors. *C. jejuni* 11168-O chemoreceptors are shown in bold. Sequences are coloured according to clustering of the respective sensing domain on dCache\_1 domain phylogenetic tree (Figure S3). Bootstrap percentage values greater than 40 are shown. This figure is also available as a scalable pdf.



**Figure S5.** Surface Plasmon Resonance (SPR) sensograms for Tlp3<sup>peri</sup>, Tlp2<sup>peri</sup> and Tlp4<sup>peri</sup>. Single cycle SPR plots are shown as concentration dependent interactions between proteins and monosaccharides as illustrated.

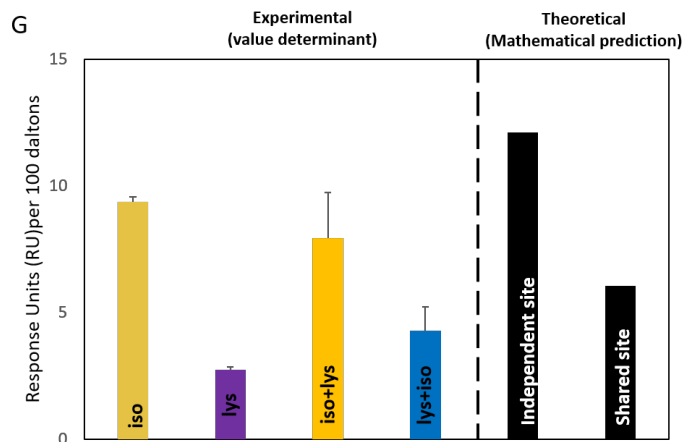
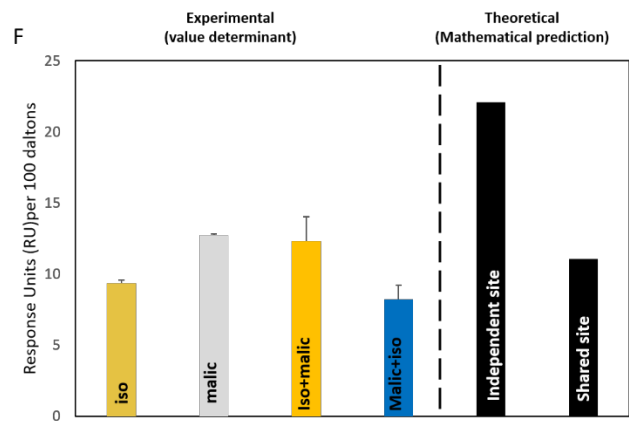
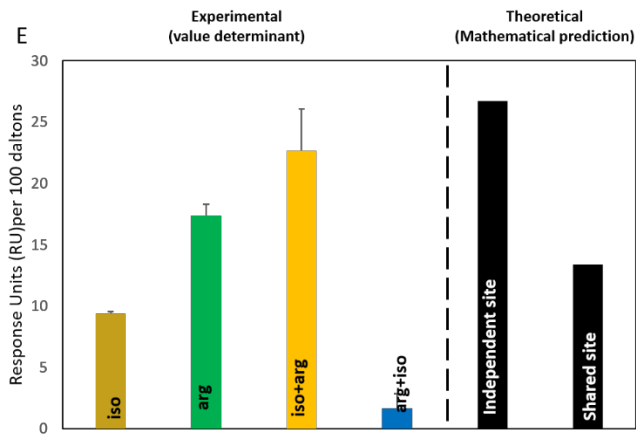
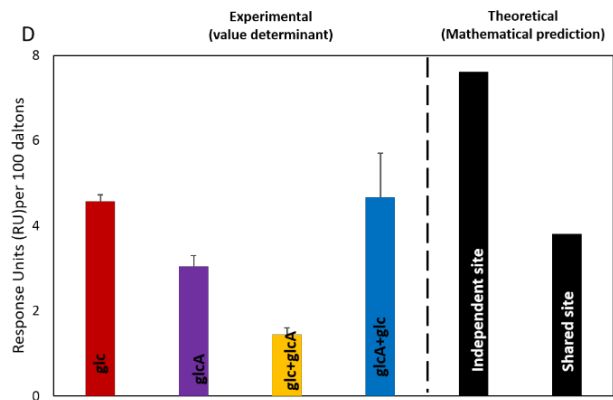
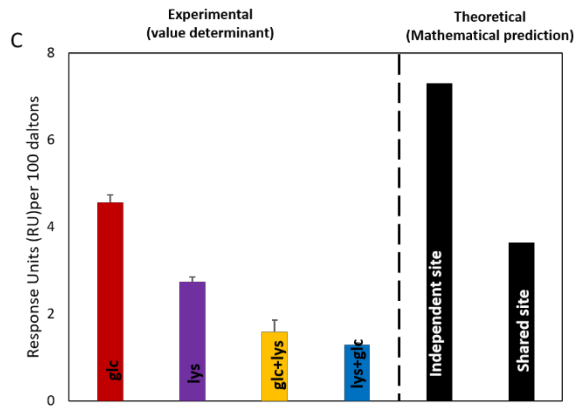
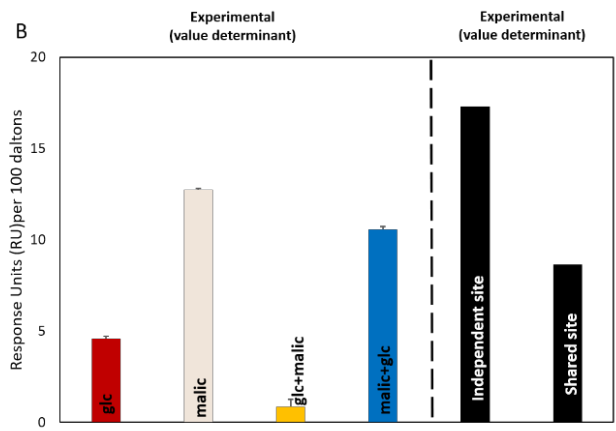
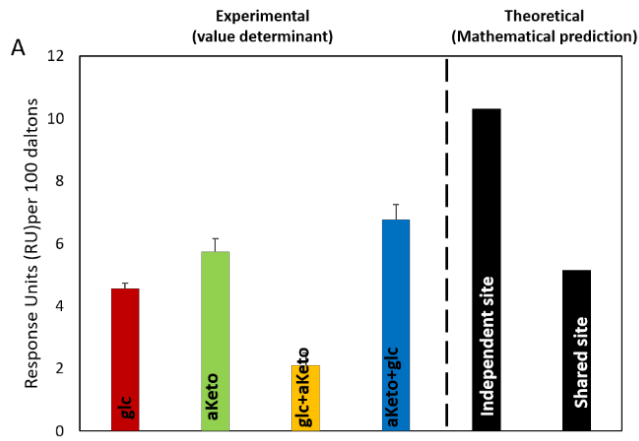


**Figure S6.** Competition between glucose and fucose /glucose and malic acid binding to Tlp3. **A)** Injections are indicated as injection-A (PBS or glucose at 300  $\mu$ M for 30 seconds) and injection-B (glucose at 300  $\mu$ M or fucose at 300  $\mu$ M for 60 seconds). Final responses units (RU) of injections are recorded (indicated by dashed vertical line and label), with the response of glucose equalling  $5.07\text{RU} \pm 0.81$  at 15 seconds after injection-B and fucose equalling  $9.86\text{RU} \pm 1.14$  at 15 seconds after injection-B. The response 15 seconds after injection-B when glucose and fucose were competed was  $4.4\text{RU} \pm 0.46$ . As this value sits below 5 RU, it indicates direct competition for the same site where glucose replacing and blocking the bound fucose during the 60 second injection-B. **B)** Injections are indicated as injection-A (PBS or glucose at 500  $\mu$ M for 30 seconds) and injection-B (glucose at 300  $\mu$ M or malic acid at 200  $\mu$ M for 60 seconds). Final responses units (RU) of injections are recorded (indicated by dashed vertical line and label), with the response of glucose equalling  $5.07\text{RU} \pm 0.81$  at 15 seconds after injection-B and malic acid equalling  $13.5\text{RU} \pm 2.4$  at 15 seconds after injection-B. The response 15 seconds after injection-B when glucose and malic acid were competed was  $10.04\text{RU} \pm 0.66$ . As this value sits between 5.07-13.5 RU, it indicates direct competition for the same site with glucose replacing some of the bound malic acid during the 60 second injection-B.

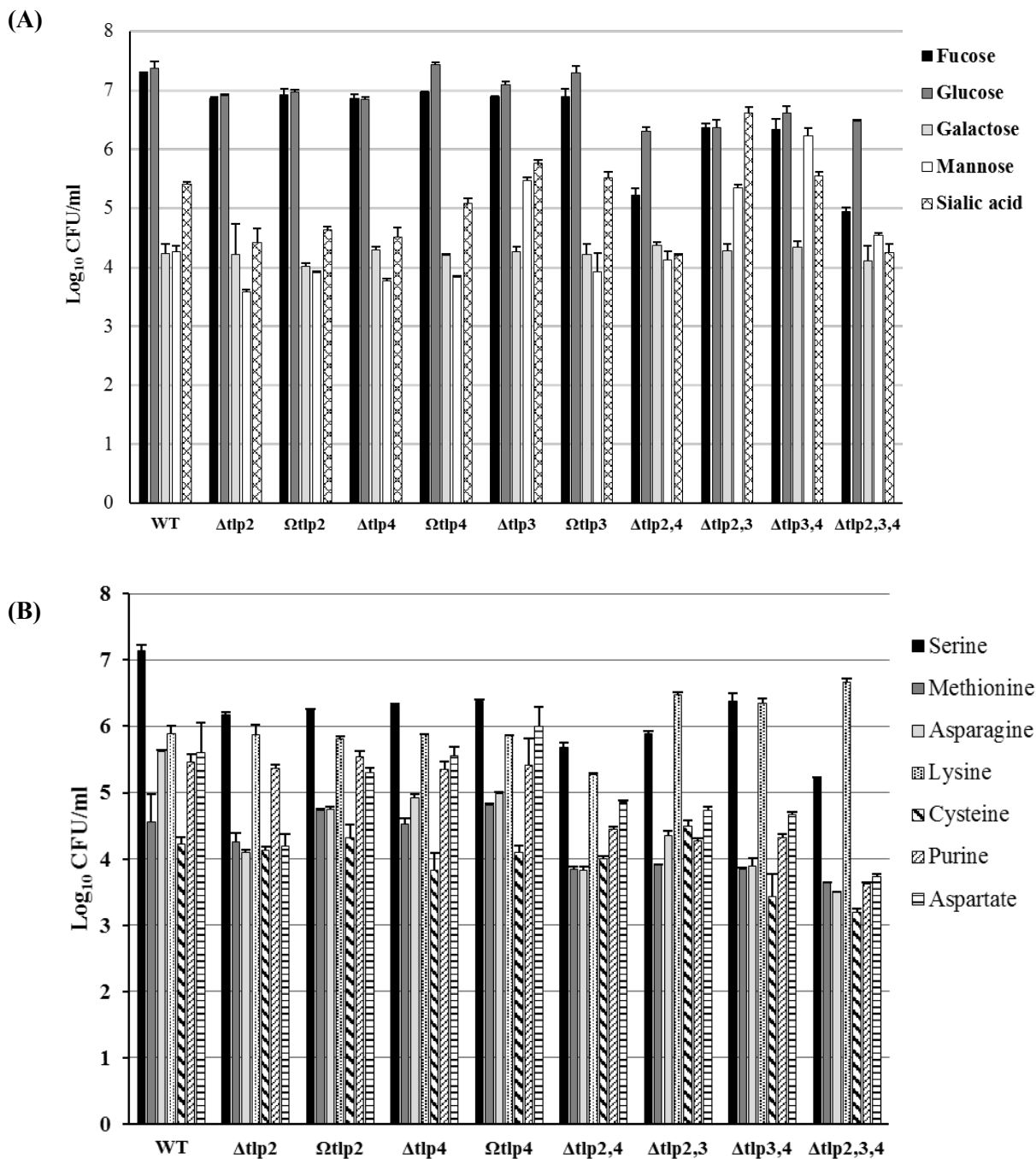




**Figure S7.** SPR ligand competition analysis for Tlp3. SPR competition analysis of binding of glucose (glc),  $\alpha$ -ketoglutarate (aketo), malic acid (malic), lysine (lys), glucosamine (glcA), arginine (arg), and isoleucine (iso) to WT Tlp3<sup>LBD</sup>. The experimental RU value is actual response unit (RU) values for the following: A) (glc) is responses to glucose only, (aketo) is responses to  $\alpha$ -ketoglutarate only, and (glc+aketo) is glucose responses following saturation with  $\alpha$ -ketoglutarate and (aketo+glc) is  $\alpha$ -ketoglutarate following saturation with glucose. B) (glc) is responses to glucose only, (malic) is responses to malic acid only, and (glc+malic) is glucose responses following saturation with malic acid and (malic+glc) is malic acid following saturation with glucose. C) (glc) is responses to glucose only, (lys) is responses to lysine only, and (glc +lys) is glucose responses following saturation with lysine and (lys+glc) is lysine following saturation with glucose. D) (glc) responds to glucose only, (glcA) is response to glucosamine only, (glc+glcA) glucose response following saturation with glucosamine and (glcA+glc) glucosamine following saturation with glucose. E) (iso) is responses to isoleucine only, (arg) is responses to arginine only, and (iso+arg) is isoleucine responses following saturation with arginine and (arg+iso) is arginine following saturation with isoleucine. F) (iso) is responses to isoleucine only, (malic) is responses to malic acid only, and (iso+ malic) is isoleucine responses following saturation with malic acid and (malic +Iso) is malic acid following saturation with isoleucine. G) (iso) is responses to isoleucine only, (lys) is responses to lysine only, and (iso+lys) is isoleucine responses following saturation with lysine and (lys+iso) is lysine following saturation with isoleucine. The theoretical value is responses unites (RU) values based on mathematical theory. The binding status of the ligands to protein are classified as: Independent site (additive/accumulative effect); ligands binding to different binding sites, Shared site; ligands binding/sharing same binding site, Preferential Shared site; ligands binding/sharing same binding site but the protein binds to one ligand better than the other when in equilibrium. All response data was normalized 100 Da molecular weight for each analyte allowing direct comparison of responses.

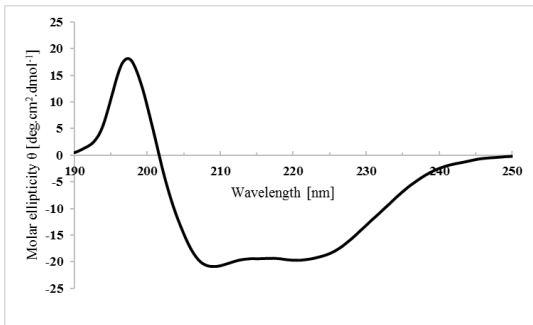


**Figure S8.** Modified hard plug agar assay (tHAP) chemotaxis assay quantitation. Viable counts of *C. jejuni* are shown on a log scale. The agarose plugs contained the following ligands: (A) fucose, glucose, galactose, mannose and sialic acid; (B) serine, methionine, asparagine, lysine, cysteine, purine and aspartate. *C. jejuni* 81116 *flaA*<sup>-</sup>/*flab*<sup>-</sup> isogenic mutant was used as a non-motile, non-chemotactic control; and agar plugs containing no added ligand were used as a negative control. Standard errors are shown as bars above the mean of three replicates.

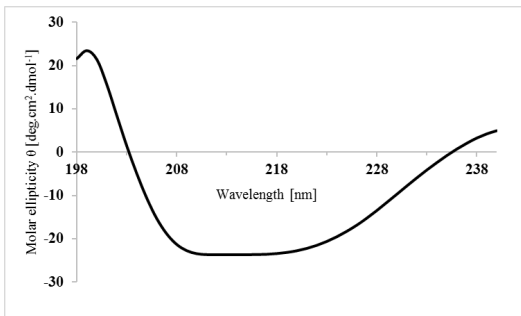


**Figure S9.** Circular dichroism spectrometry analyses of periplasmic domains of **(A)** Tlp2, **(B)** Tlp3 and **(C)** Tlp4. Molar ellipticity  $[\theta]$  is calculated using the formula:  $(\theta \times 100 \times M)/(C \times l \times n)$ . Purified Tlp2, Tlp3 and Tlp4 were confirmed as folded proteins consisting of  $\alpha$ -helix structures.

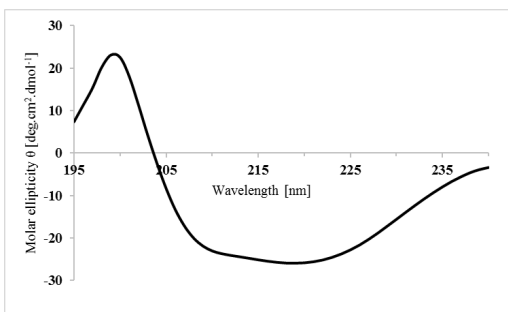
**(A) Tlp2**



**(B) Tlp3**



**(C) Tlp4**



**Videos S1.** Molecular dynamics simulations between two molecules, a monosaccharide (glucose) and an amino acid (arginine).

**Videos S2.** Molecular dynamics simulations between two molecules, an amino acid (arginine) and a monosaccharide (glucose).

**Table S1.** The presence of dCache\_1 domain containing chemoreceptors in different *Campylobacterota* representatives.

Phylum	Class	Order	Family	Genus	GTDB Species name	Representative genome	NCBI name	MiST ID	NCBI ID
<b>p_Campylobacterota</b>									
c_Campylobacteria									
o_Campylobacteriales									
f_Arcobacteraceae									
			Aliarcobacter	<i>Arcobacter butzleri</i>	GCF_001010585.1	<i>Arcobacter butzleri</i> L348			F7 system, 36H
			Arcobacter	<i>Arcobacter nitrofigilis</i>	GCF_00009245.1	<i>Arcobacter nitrofigilis</i> DSM 7299	<a href="#">GCF_000092245.1-ARNIT_RS12945</a>	WP_013136383.1	F7 system, <b>36H</b>
							<a href="#">GCF_000092245.1-ARNIT_RS10155</a>	WP_013135839.1	
							<a href="#">GCF_000092245.1-ARNIT_RS04225</a>	WP_013134649.1	
							<a href="#">GCF_000092245.1-ARNIT_RS15045</a>	WP_013136785.1	
							<a href="#">GCF_000092245.1-ARNIT_RS03330</a>	WP_013134476.1	
			Halarcobacter	<i>Halarcobacter anaerophilus</i>	GCF_000935065.1	<i>Arcobacter anaerophilus</i>	<a href="#">GCF_000935065.1-TN41_RS08535</a>	WP_044417424.1	F7 system, <b>36H</b>
							<a href="#">GCF_000935065.1-TN41_RS03965</a>	WP_044415828.1	
			Malaciobacter	<i>Malaciobacter canalis</i>	GCF_002723485.1	<i>Arcobacter canalis</i>	<a href="#">GCF_002723485.1-CPG37_RS07870</a>	WP_099334512.1	F7 system, F9 system, 34H, <b>36H</b> , 40H, 44H
							<a href="#">GCF_002723485.1-CPG37_RS13415</a>	WP_099335382.1	
							<a href="#">GCF_002723485.1-CPG37_RS01535</a>	WP_099333483.1	
							<a href="#">GCF_002723485.1-CPG37_RS10520</a>	WP_099334924.1	
							<a href="#">GCF_002723485.1-CPG37_RS10515</a>	WP_099334923.1	
							<a href="#">GCF_002723485.1-CPG37_RS12925</a>	WP_099335312.1	
			Poseidonibacter	<i>Poseidonibacter lekithochrous</i>	GCF_001878855.1	<i>Arcobacter lekithochrous</i>	<a href="#">GCF_001878855.1-BRO21_RS12110</a>	WP_071627413.1	F7 system, F8 system, 34H, <b>36H</b>
							<a href="#">GCF_001878855.1-BRO21_RS15155</a>	WP_071628011.1	
							<a href="#">GCF_001878855.1-BRO21_RS08205</a>	WP_083574630.1	
							<a href="#">GCF_001878855.1-BRO21_RS05035</a>	WP_071625985.1	

f_Campylobacteraceae						
Campylobacter						
<i>Campylobacter fetus</i>	GCF_900475935.1	<i>Campylobacter fetus</i>	<a href="#">GCF_900475935.1-DQN38_RS08290</a>	WP_011732310.1	F3 system; 24H, <b>28H</b> , 40H, 44H	
			<a href="#">GCF_900475935.1-DQN38_RS06385</a>	WP_041738387.1		
			<a href="#">GCF_900475935.1-DQN38_RS06380</a>	WP_111738221.1		
			<a href="#">GCF_900475935.1-DQN38_RS00960</a>	WP_011731731.1		
<i>Campylobacter iguaniorum</i>	GCF_000736415.1	<i>Campylobacter iguaniorum</i>	<a href="#">GCF_000736415.1-CIG1485E_RS09305</a>	WP_038455260.1	F3 system; <b>28H</b> , 40H	
			<a href="#">GCF_000736415.1-CIG1485E_RS09275</a>	WP_069107390.1		
<i>Campylobacter lanienae</i>	GCF_002139415.1	<i>Campylobacter lanienae</i>	<a href="#">GCF_002139415.1-CCB79_RS06750</a>	WP_096025340.1	F3 system; <b>28H</b> , 40H, 44H	
<i>Campylobacter sp002139855</i>	GCF_002139855.1	<i>Campylobacter sp. RM6137</i>	<a href="#">GCF_002139855.1-CSUIS_RS06325</a>	WP_086298008.1	F3 system; <b>28H</b> , 40H	
			<a href="#">GCF_002139855.1-CSUIS_RS00300</a>	WP_086296673.1		
<i>Campylobacter sp002139875</i>	GCF_002139875.1	<i>Campylobacter sp. RM12175</i>	<a href="#">GCF_002139875.1-CVIC12175_RS06330</a>	WP_086315930.1	F3 system; <b>28H</b> , 40H, 44H	
	GCF_002139175.1	<i>Campylobacter sp. RM9262</i>	<a href="#">GCF_002139175.1-CVIC9262_RS00905</a>	WP_086256599.1	F3 system; <b>28H</b> , 40H, 44H	
<i>Campylobacter sp002139915</i>	GCF_002139915.1	<i>Campylobacter sp. NCTC 13003</i>	<a href="#">GCF_002139915.1-CIGN_RS01655</a>	WP_086302052.1	F3 system; <b>28H</b> , 40H	
			<a href="#">GCF_002139915.1-CIGN_RS01725</a>	WP_086302056.1		
Campylobacter_A						
<i>Campylobacter_A concisus</i>	GCF_001298465.1	<i>Campylobacter concisus</i>	<a href="#">GCF_001298465.1-CCON33237_RS03260</a>	WP_054196374.1	F3 system, <b>28H</b> , 40H	
			<a href="#">GCF_001298465.1-CCON33237_RS03255</a>	WP_054196373.1		
<i>Campylobacter_A concisus_N</i>	GCF_002914005.1	<i>Campylobacter concisus</i>	<a href="#">GCF_002914005.1-CYP54_RS07185</a>	WP_103600989.1	F3 system, <b>28H</b> , 40H	
			<a href="#">GCF_002914005.1-CYP54_RS07180</a>	WP_103604731.1		
<i>Campylobacter_A concisus_U</i>	GCF_003048575.1	<i>Campylobacter concisus</i>	<a href="#">GCF_003048575.1-CVS84_RS01985</a>	WP_107690942.1	F3 system, <b>28H</b> , 40H	

<i>Campylobacter_A pinnipediorum</i>	GCF_002021925.1	<i>Campylobacter pinnipediorum subsp. Pinnipediorum</i>	<a href="#">GCF_002021925.1-CPIN17260_RS08940</a>	WP_078406295.1	F3 system, <b>28H</b> , 40H
			<a href="#">GCF_002021925.1-CPIN17260_RS00765</a>	WP_099046649.1	
			<a href="#">GCF_002021925.1-CPIN17260_RS00760</a>	WP_078440405.1	
<i>Campylobacter_A rectus</i>	GCF_000174175.1	<i>Campylobacter rectus RM3267</i>	<a href="#">GCF_000174175.1-CAMRE0001_RS08300</a>	WP_002944978.1	F3 system, <b>28H</b> , 40H
			<a href="#">GCF_000174175.1-CAMRE0001_RS11105</a>	WP_002945855.1	
<i>Campylobacter_A showae_A</i>	GCF_000313615.1	<i>Campylobacter showae CSUNSWC D</i>	<a href="#">GCF_000313615.1-CSUNSWCD_RS08695</a>	WP_009495943.1	F3 system, <b>28H</b> , 40H
Campylobacter B					
<i>Campylobacter_B sputorum</i>	GCF_002220755.1	<i>Campylobacter sputorum bv. paraureolyticus</i>	<a href="#">GCF_002220755.1-CSPARA_RS08305</a>	WP_089189895.1	F3 system, <b>28H</b> , <b>40H</b> , 44H
			<a href="#">GCF_002220755.1-CSPARA_RS05480</a>	WP_089189193.1	
			<a href="#">GCF_002220755.1-CSPARA_RS01695</a>	WP_089189023.1	
			<a href="#">GCF_002220755.1-CSPARA_RS05130</a>	WP_089189502.1	
			<a href="#">GCF_002220755.1-CSPARA_RS07910</a>	WP_089189836.1	40H
			<a href="#">GCF_002220755.1-CSPARA_RS04765</a>	WP_089189445.1	40H
Campylobacter D					
<i>Campylobacter_D avium</i>	GCF_002238335.1	<i>Campylobacter avium LMG 24591</i>	<a href="#">GCF_002238335.1-CAV_RS08355</a>	WP_094324384.1	F3 system, <b>28H</b> , 40H, 44H
			<a href="#">GCF_002238335.1-CAV_RS07060</a>	WP_094325829.1	
			<a href="#">GCF_002238335.1-CAV_RS01035</a>	WP_094324668.1	
			<a href="#">GCF_002238335.1-CAV_RS00955</a>	WP_094324654.1	
			<a href="#">GCF_002238335.1-CAV_RS07455</a>	WP_094325897.1	
			<a href="#">GCF_002238335.1-CAV_RS00870</a>	WP_094325509.1	



	GCF_002245 935.1	<i>Campylobacter avium</i>	<a href="#">GCF_002245935.1-CAV8706_RS07895</a>	WP_094325 829.1	F3 system, <b>28H</b> , 40H, 44H
			<a href="#">GCF_002245935.1-CAV8706_RS01820</a>	WP_094324 654.1	
			<a href="#">GCF_002245935.1-CAV8706_RS04075</a>	WP_094325 072.1	
			<a href="#">GCF_002245935.1-CAV8706_RS01900</a>	WP_094324 668.1	
			<a href="#">GCF_002245935.1-CAV8706_RS00375</a>	WP_094324 384.1	
			<a href="#">GCF_002245935.1-CAV8706_RS01735</a>	WP_094325 509.1	
			<a href="#">GCF_002245935.1-CAV8706_RS08285</a>	WP_094325 897.1	
<i>Campylobacter_D cunicolorum</i>	GCF_002104 335.1	RS <i>Campylobacter cunicolorum</i> DSM 23162 = LMG 24588	<a href="#">GCF_002104335.1-CCUN_RS08200</a>	WP_085296 680.1	F3 system, <b>28H</b> , 40H
			<a href="#">GCF_002104335.1-CCUN_RS06815</a>	WP_027305 900.1	
			<a href="#">GCF_002104335.1-CCUN_RS09175</a>	WP_085296 688.1	
			<a href="#">GCF_002104335.1-CCUN_RS00300</a>	WP_085296 593.1	
	GCF_000621 005.1	<i>Campylobacter cunicolorum</i> DSM 23162 = LMG 24588	<a href="#">GCF_000621005.1-Q330_RS0106010</a>	WP_027305 900.1	F3 system, <b>28H</b> , 40H
			<a href="#">GCF_000621005.1-Q330_RS0105540</a>	WP_051521 714.1	
			<a href="#">GCF_000621005.1-Q330_RS0100570</a>	WP_027304 962.1	
<i>Campylobacter_D helveticus</i>	GCF_002080 395.1	<i>Campylobacter helveticus</i> ATCC 51209	<a href="#">GCF_002080395.1-CHELV3228_RS00050</a>	WP_082200 713.1	F3 system, <b>28H</b> , 40H, 44H
			<a href="#">GCF_002080395.1-CHELV3228_RS09175</a>	WP_082200 691.1	
			<a href="#">GCF_002080395.1-CHELV3228_RS01550</a>	WP_082199 230.1	
			<a href="#">GCF_002080395.1-CHELV3228_RS08180</a>	WP_082200 520.1	

<i>Campylobacter_D upsaliensis</i>	GCF_000167395.1	<i>Campylobacter upsaliensis</i> RM3195	<a href="#">GCF_000167395.1-CUP_RS03190</a>	WP_004275314.1	F3 system, <b>28H</b> , 40H, 44H
			<a href="#">GCF_000167395.1-CUP_RS03010</a>	WP_004275277.1	
			<a href="#">GCF_000167395.1-CUP_RS03665</a>	WP_004275415.1	
			<a href="#">GCF_000167395.1-CUP_RS05805</a>	WP_004275846.1	
<i>Campylobacter_D sp002738235</i>	GCF_002738235.1	<i>Campylobacter sp. 73/13</i>			F3 system, 40H, 44H
<i>Campylobacter_D hepaticus</i>	GCF_001687475.1	<i>Campylobacter hepaticus</i>	<a href="#">GCF_001687475.1-A2J15_RS07055</a>	WP_066779406.1	F3 system, <b>28H</b> , 40H
<i>Campylobacter_D jejuni_B</i>	GCF_002179165.1	<i>Campylobacter jejuni W1</i>			F3 system, 28H, 40H, 44H
<i>Campylobacter_D coli</i>	GCF_000465235.1	<i>Campylobacter coli</i> CVM N29710	<a href="#">GCF_000465235.1-G157_RS01370</a>	WP_002822567.1	F3 system, <b>28H</b> , 40H
			<a href="#">GCF_000465235.1-G157_RS01095</a>	WP_021033641.1	
			<a href="#">GCF_000465235.1-G157_RS07430</a>	WP_021033778.1	
	GCF_000465235.1	<i>Campylobacter coli</i> CVM N29710	<a href="#">GCF_000465235.1-G157_RS01370</a>	WP_002822567.1	F3 system, <b>28H</b> , 40H
			<a href="#">GCF_000465235.1-G157_RS01095</a>	WP_021033641.1	
			<a href="#">GCF_000465235.1-G157_RS07430</a>	WP_021033778.1	
	GCF_000583795.1	<i>Campylobacter coli</i> RM5611	<a href="#">GCF_000583795.1-YSU_RS08010</a>	WP_025431530.1	F3 system, <b>28H</b> , 40H
			<a href="#">GCF_000583795.1-YSU_RS01055</a>	WP_025431485.1	
			<a href="#">GCF_000583795.1-YSU_RS07490</a>	WP_025431528.1	
	GCF_000954195.1	<i>Campylobacter coli</i>	<a href="#">GCF_000954195.1-VC76_RS07390</a>	WP_002822567.1	F3 system, <b>28H</b> , 40H
			<a href="#">GCF_000954195.1-VC76_RS07950</a>	WP_045243712.1	
			<a href="#">GCF_000954195.1-VC76_RS07680</a>	WP_045243711.1	
			<a href="#">GCF_000954195.1-VC76_RS01340</a>	WP_021033778.1	

<i>Campylobacter</i> <i>D coli</i> <i>A</i>	GCF_000470 055.1	<i>Campylobacter</i> <i>coli</i> 76339	<a href="#">GCF_000470055.1- BN865_RS01275</a>	WP_020973 958.1	F3 system, <b>28H</b> , 40H
	GCF_001498 475.1	<i>Campylobacter</i> <i>coli</i>	<a href="#">GCF_001498475.1- AV450_RS02685</a>	WP_075504 589.1	F3 system, <b>28H</b> , 40H
	GCF_001494 895.1	<i>Campylobacter</i> <i>coli</i>	<a href="#">GCF_001494895.1- AV288_RS04180</a>	WP_075482 578.1	F3 system, <b>28H</b> , 40H
<i>Campylobacter</i> <i>D coli</i> <i>B</i>	GCF_001492 295.1	<i>Campylobacter</i> <i>coli</i>	<a href="#">GCF_001492295.1- AV154_RS00980</a> <a href="#">GCF_001492295.1- AV154_RS08260</a>	WP_058968 202.1 WP_058969 565.1	F3 system, <b>28H</b> , 40H
	GCF_002019 865.1	<i>Campylobacter</i> <i>coli</i>	<a href="#">GCF_002019865.1- BOQ00_RS06585</a> <a href="#">GCF_002019865.1- BOQ00_RS08225</a>	WP_078416 234.1 WP_078416 353.1	F3 system, <b>28H</b> , 40H
	GCF_002020 015.1	<i>Campylobacter</i> <i>coli</i> <i>VA8</i>	<a href="#">GCF_002020015.1- BOP99_RS05705</a> <a href="#">GCF_002020015.1- BOP99_RS05315</a> <a href="#">GCF_002020015.1- BOP99_RS00005</a>	WP_075447 212.1 WP_052774 443.1 WP_075481 750.1	F3 system, <b>28H</b> , 40H
<i>Campylobacter</i> <i>D jejuni</i>	<b>GCF_000009 085.1</b>	<i>Campylobacter</i> <i>jejuni</i> <i>subsp.</i> <i>jejuni</i> <i>NCTC</i> <i>11168</i> = <i>ATCC</i> <i>700819</i>	<a href="#">GCF_000009085.1-Cj1506c</a>	<b>YP_0023448 85.1</b>	F3 system, <b>28H</b> , 40H
			<a href="#">GCF_000009085.1-Cj0144</a>	<b>YP_0023436 04.1</b>	
			<a href="#">GCF_000009085.1-Cj1564</a>	<b>YP_0023449 33.1</b>	
			<a href="#">GCF_000009085.1-Cj0262c</a>	<b>YP_0023437 04.1</b>	
	GCF_000835 285.1	<i>Campylobacter</i> <i>jejuni</i> <i>subsp.</i> <i>jejuni</i>	<a href="#">GCF_000835285.1- PJ17_RS07875</a> <a href="#">GCF_000835285.1- PJ17_RS00730</a> <a href="#">GCF_000835285.1- PJ17_RS08150</a> <a href="#">GCF_000835285.1- PJ17_RS01290</a> <a href="#">GCF_000835285.1- PJ17_RS01300</a>	WP_002858 883.1 WP_079394 622.1 WP_079394 630.1 WP_042635 812.1 WP_042635 814.1	F3 system, <b>28H</b> , 40H
	GCF_002209 045.1	<i>Campylobacter</i> <i>jejuni</i> <i>subsp.</i> <i>jejuni</i>	<a href="#">GCF_002209045.1- A6J93_RS07640</a> <a href="#">GCF_002209045.1- A6J93_RS00985</a>	WP_002871 853.1 WP_079460 163.1	F3 system, <b>28H</b> , 40H

			<a href="#">GCF_002209045.1-A6J93_RS07895</a>	WP_088585 164.1	
			<a href="#">GCF_002209045.1-A6J93_RS01525</a>	WP_088585 119.1	
	GCF_003060 745.1	<i>Campylobacter jejuni</i>	<a href="#">GCF_003060745.1-CJ12660_RS07665</a>	WP_002851 362.1	F3 system, <b>28H</b> , 40H
			<a href="#">GCF_003060745.1-CJ12660_RS07910</a>	WP_108592 625.1	
			<a href="#">GCF_003060745.1-CJ12660_RS00720</a>	WP_108592 594.1	
			<a href="#">GCF_003060745.1-CJ12660_RS01265</a>	WP_021036 342.1	
	GCF_000835 345.1	<i>Campylobacter jejuni</i> <i>subsp. jejuni</i>	<a href="#">GCF_000835345.1-PJ19_RS08250</a>	WP_002851 362.1	F3 system, <b>28H</b> , 40H
			<a href="#">GCF_000835345.1-PJ19_RS00730</a>	WP_079394 712.1	
			<a href="#">GCF_000835345.1-PJ19_RS08495</a>	WP_079394 745.1	
			<a href="#">GCF_000835345.1-PJ19_RS01250</a>	WP_009881 974.1	
<i>Campylobacter_D insulaenigrae</i>	GCF_000816 185.1	<i>Campylobacter insulaenigrae</i> <i>NCTC 12927</i>	<a href="#">GCF_000816185.1-CINS_RS06385</a>	WP_039650 838.1	F3 system, <b>28H</b> , 40H, 44H
			<a href="#">GCF_000816185.1-CINS_RS07375</a>	WP_039651 184.1	
			<a href="#">GCF_000816185.1-CINS_RS00645</a>	WP_084593 975.1	
			<a href="#">GCF_000816185.1-CINS_RS05400</a>	WP_039650 514.1	
			<a href="#">GCF_000816185.1-CINS_RS01075</a>	WP_039649 119.1	
<i>Campylobacter_D volucris</i>	GCF_000816 345.1	<i>Campylobacter volucris</i> <i>LMG 24379</i>	<a href="#">GCF_000816345.1-CVOL_RS07670</a>	WP_039666 183.1	F3 system, <b>28H</b> , 40H, 44H
			<a href="#">GCF_000816345.1-CVOL_RS07665</a>	WP_039666 182.1	
			<a href="#">GCF_000816345.1-CVOL_RS06585</a>	WP_039666 017.1	
			<a href="#">GCF_000816345.1-CVOL_RS05505</a>	WP_039665 826.1	
			<a href="#">GCF_000816345.1-CVOL_RS00675</a>	WP_039664 987.1	
<i>Campylobacter_D peloridis</i>	GCF_000816 785.1	<i>Campylobacter peloridis</i> <i>LMG 23910</i>	<a href="#">GCF_000816785.1-CPEL_RS08275</a>	WP_044599 430.1	F3 system, <b>28H</b> , 40H
			<a href="#">GCF_000816785.1-CPEL_RS07205</a>	WP_044599 248.1	

			<a href="#">GCF_000816785.1-CPEL_RS06215</a>	WP_044599 069.1	
			<a href="#">GCF_000816785.1-CPEL_RS06210</a>	WP_044599 575.1	
			<a href="#">GCF_000816785.1-CPEL_RS06205</a>	WP_044599 068.1	
			<a href="#">GCF_000816785.1-CPEL_RS00725</a>	WP_044599 464.1	
			<a href="#">GCF_000816785.1-CPEL_RS08030</a>	WP_044599 392.1	
<i>Campylobacter_D</i> <i>sp000816245</i>	GCF_000816 245.1	<i>Campylobacter</i> <i>sp.</i> <i>RM16704</i>	<a href="#">GCF_000816245.1-CAQ16704_RS07750</a>	WP_039667 627.1	F3 system, <b>28H</b> , 40H, 44H
			<a href="#">GCF_000816245.1-CAQ16704_RS06675</a>	WP_039667 452.1	
			<a href="#">GCF_000816245.1-CAQ16704_RS05595</a>	WP_039667 264.1	
			<a href="#">GCF_000816245.1-CAQ16704_RS02125</a>	WP_052244 972.1	
			<a href="#">GCF_000816245.1-CAQ16704_RS07495</a>	WP_039667 590.1	
<i>Campylobacter_D</i> <i>subantarcticus</i>	GCF_000816 305.1	<i>Campylobacter</i> <i>subantarcticus</i> <i>LMG</i> <i>24377</i>	<a href="#">GCF_000816305.1-CSUB8523_RS09320</a>	WP_043020 302.1	F3 system, <b>28H</b> , 40H
			<a href="#">GCF_000816305.1-CSUB8523_RS09315</a>	WP_043020 301.1	
			<a href="#">GCF_000816305.1-CSUB8523_RS08420</a>	WP_043020 208.1	
			<a href="#">GCF_000816305.1-CSUB8523_RS08075</a>	WP_043020 166.1	
			<a href="#">GCF_000816305.1-CSUB8523_RS07005</a>	WP_043020 033.1	
			<a href="#">GCF_000816305.1-CSUB8523_RS00730</a>	WP_043019 309.1	
<i>Campylobacter_D</i> <i>ornithocola</i>	GCF_001705 345.1	<i>Campylobacter</i> <i>ornithocola</i> <i>WBE38</i>	<a href="#">GCF_001705345.1-A7X81_RS05805</a>	WP_066008 273.1	F3 system, <b>28H</b> , 40H, 44H
			<a href="#">GCF_001705345.1-A7X81_RS02290</a>	WP_066007 058.1	
			<a href="#">GCF_001705345.1-A7X81_RS00225</a>	WP_066006 399.1	
<i>Campylobacter_D</i> <i>lari</i>	GCF_900111 465.1	<i>Campylobacter</i> <i>lari</i> <i>subsp. Lari</i> <i>ATCC</i> <i>35221</i>	<a href="#">GCF_900111465.1-BMY58_RS03220</a>	WP_081352 015.1	F3 system, <b>28H</b> , 40H, 44H
			<a href="#">GCF_900111465.1-BMY58_RS06285</a>	WP_012662 186.1	

	<i>Campylobacter</i> <i>D lari_B</i>	GCF_000816 225.1	<i>Campylobacter</i> <i>lari</i> <i>subsp.</i> <i>concheus</i> LMG 11760	<a href="#">GCF_000816225.1- CONCH_RS07460</a>	WP_039668 968.1	F3 system, <b>28H</b> , 40H, 44H	
				<a href="#">GCF_000816225.1- CONCH_RS06405</a>	WP_039668 807.1		
				<a href="#">GCF_000816225.1- CONCH_RS00695</a>	WP_039667 881.1		
				<a href="#">GCF_000816225.1- CONCH_RS05400</a>	WP_039668 641.1		
				<a href="#">GCF_000816225.1- CONCH_RS02065</a>	WP_039668 097.1		
				<a href="#">GCF_000816225.1- CONCH_RS07215</a>	WP_052239 476.1		
	<i>Campylobacter</i> <i>D lari_C</i>	GCF_001017 575.1	<i>Campylobacter</i> <i>lari</i>	<a href="#">GCF_001017575.1- CD56_RS06815</a>	WP_047208 605.1	F3 system, <b>28H</b> , 40H, 44H	
				<a href="#">GCF_001017575.1- CD56_RS05810</a>	WP_047208 471.1		
				<a href="#">GCF_001017575.1- CD56_RS07085</a>	WP_047208 641.1		
				<a href="#">GCF_001017575.1- CD56_RS07865</a>	WP_047208 712.1		
				<a href="#">GCF_001017575.1- CD56_RS07860</a>	WP_047208 711.1		
				<a href="#">GCF_001017575.1- CD56_RS02030</a>	WP_047208 044.1		
				<a href="#">GCF_001017575.1- CD56_RS08150</a>	WP_080956 350.1		
				<a href="#">GCF_001017575.1- CD56_RS07615</a>	WP_080956 346.1		
	<i>Campylobacter</i> <i>D jejuni_C</i>	GCF_002179 635.1	<i>Campylobacter</i> <i>jejuni S4</i>	<a href="#">GCF_002179635.1- CAS13_RS02695</a>	WP_087699 709.1	F3 system, <b>28H</b> , 40H, 44H	
				<a href="#">GCF_002179635.1- CAS13_RS06905</a>	WP_087700 724.1		
				<a href="#">GCF_002179635.1- CAS13_RS05225</a>	WP_087700 460.1		
f_Helicobacteraceae							
	Helicobacter	<i>Helicobacter</i> <i>pylori</i>	GCF_900478 295.1	<i>Helicobacter</i> <i>pylori</i> NCTC 11637 = CCUG 17874 = ATCC 43504	<a href="#">GCF_900478295.1- DQL14_RS01445</a>	WP_108169 589.1	F3 system, <b>28H</b> , 40H
	Helicobacter A	<i>Helicobacter</i> <i>A bilis</i>	GCF_000686 565.1	<i>Helicobacter</i> <i>bilis</i> ATCC 51630	<a href="#">GCF_000686565.1- T368_RS13380</a>	WP_004087 959.1	F3 system, <b>28H</b> , 40H, 44H

				<a href="#">GCF_000686565.1-T368_RS0105195</a>	WP_027338 340.1	
				<a href="#">GCF_000686565.1-T368_RS0103980</a>	WP_027338 309.1	
				<a href="#">GCF_000686565.1-T368_RS0112100</a>	WP_027338 528.1	
				<a href="#">GCF_000686565.1-T368_RS0111695</a>	WP_004086 671.1	
				<a href="#">GCF_000686565.1-T368_RS0101325</a>	WP_004088 793.1	
				<a href="#">GCF_000686565.1-T368_RS0104865</a>	WP_004087 728.1	
Helicobacter_ B	<i>Helicobacter_ B canis</i>	GCF_000507 865.1	<i>Helicobacter_ r canis</i> NCTC 12740	<a href="#">GCF_000507865.1-HMPREF2087_RS09205</a>	WP_034577 829.1	F3 system, <b>28H</b> , 40H, 44H
				<a href="#">GCF_000507865.1-HMPREF2087_RS07780</a>	WP_023930 583.1	
				<a href="#">GCF_000507865.1-HMPREF2087_RS04115</a>	WP_023929 761.1	
				<a href="#">GCF_000507865.1-HMPREF2087_RS09050</a>	WP_023930 866.1	
				<a href="#">GCF_000507865.1-HMPREF2087_RS05180</a>	WP_023929 979.1	
Helicobacter_ C	<i>Helicobacter_ C hepaticus</i>	GCF_000007 905.1	<i>Helicobacter_ r hepaticus</i> ATCC 51449	<a href="#">GCF_000007905.1-HH_RS05325</a>	WP_011115 928.1	F3 system, <b>28H</b> , 40H, 44H
				<a href="#">GCF_000007905.1-HH_RS04770</a>	WP_011115 811.1	
				<a href="#">GCF_000007905.1-HH_RS06465</a>	WP_011116 177.1	
				<a href="#">GCF_000007905.1-HH_RS03595</a>	WP_011115 567.1	
Helicobacter_ D	<i>Helicobacter_ D rodentium</i>	GCF_000687 535.1	<i>Helicobacter_ r rodentium</i> ATCC 700285	<a href="#">GCF_000687535.1-BS85_RS10280</a>	WP_051604 694.1	F3 system, <b>28H</b> , 40H, 44H
				<a href="#">GCF_000687535.1-BS85_RS0106525</a>	WP_026944 092.1	
Helicobacter_ E	<i>Helicobacter_ E felis</i>	GCF_000200 595.1	<i>Helicobacter_ r felis</i> ATCC 49179	<a href="#">GCF_000200595.1-HFELIS_RS04385</a>	WP_013469 327.1	F3 system, 24H, <b>28H</b> , <b>40H</b> , 44H
				<a href="#">GCF_000200595.1-HFELIS_RS07975</a>	WP_013470 049.1	
				<a href="#">GCF_000200595.1-HFELIS_RS02830</a>	WP_081458 364.1	40H
				<a href="#">GCF_000200595.1-HFELIS_RS03120</a>	WP_013469 084.1	40H
				<a href="#">GCF_000200595.1-HFELIS_RS01885</a>	WP_013468 845.1	40H

Helicobacter_ F	<i>Helicobacter_ F himalayensis</i>	GCF_001602 095.1	<i>Helicobacte r himalayensi s</i>	<a href="#">GCF_001602095.1- A3217_RS04305</a>	WP_082807 964.1	F3 system, <b>28H</b> , 40H, 44H
				<a href="#">GCF_001602095.1- A3217_RS01860</a>	WP_066387 242.1	
				<a href="#">GCF_001602095.1- A3217_RS06775</a>	WP_066389 087.1	
				<a href="#">GCF_001602095.1- A3217_RS00950</a>	WP_066386 874.1	
				<a href="#">GCF_001602095.1- A3217_RS05205</a>	WP_066388 688.1	
Helicobacter_ G	<i>Helicobacter_ G cholecystus</i>	GCF_900198 475.1	<i>Helicobacte r cholecystus</i>	<a href="#">GCF_900198475.1- C6H20_RS03470</a>	WP_104724 582.1	F3 system, 24H, <b>28H</b>
Helicobacter_ H	<i>Helicobacter_ H sp900199585</i>	GCF_900199 585.1	<i>Helicobacte r sp. 'house sparrow 1'</i>	<a href="#">GCF_900199585.1- C6H31_RS00220</a>	WP_104696 804.1	F3 system, 24H, <b>28H</b> , 44H
Helicobacter_ I	<i>Helicobacter_ I sp002272925</i>	GCF_002272 925.1	<i>Helicobacte r sp. 13S00401-1</i>			F3 system, 24H, 28H, 44H
Helicobacter_ J	<i>Helicobacter_ J sp002272795</i>	GCF_002272 795.1	<i>Helicobacte r sp. 13S00482-2</i>			F3 system, 24H, 40H, no 28H
Wolinella	<i>Wolinella succinogenes</i>	GCF_000196 135.1	<i>Wolinella succinogene s DSM 1740</i>	<a href="#">GCF_000196135.1- WS_RS06375</a>	WP_049770 664.1	F3 system, <b>28H</b> , 36H, <b>40H</b> , 44H
				<a href="#">GCF_000196135.1- WS_RS04140</a>	WP_011138 770.1	
				<a href="#">GCF_000196135.1- WS_RS06705</a>	WP_011139 256.1	40H
f_Hydrogenimonadaceae						
Hydrogenimo nas	<i>Hydrogenimo nas thermophila</i>	GCF_900115 615.1	<i>Hydrogenim onas thermophila</i>	<a href="#">GCF_900115615.1- BM227_RS06280</a>	WP_092912 228.1	F3, F7, and F8 systems, 28H, 34H, 36H, <b>40H</b> , 44H
f_Nitratiruptoraceae						
Nitratiruptor	<i>Nitratiruptor tergarcus</i>	GCF_900176 045.1	<i>Nitratirupto r tergarcus DSM 16512</i>			F14, 40H, 44H
f_Sulfurimonadaceae						
Sulfuricurvum	<i>Sulfuricurvum kuijense</i>	GCF_000183 725.1	<i>Sulfuricurvu m kuijense DSM 16994</i>			F3, F7, and F8 systems, 28H, 34H, 36H, <b>40H</b> , 44H
Sulfurimonas	<i>Sulfurimonas autotrophica</i>	GCF_000147 355.1	<i>Sulfurimona s autotrophic a DSM 16294</i>	<a href="#">GCF_000147355.1- SAUT_RS06215</a>	WP_013327 024.1	F3 and F8 systems, 34H, <b>40H</b>



f_Sulfurospirillaceae							
	Sulfurospirillum	<i>Sulfurospirillum deleyianum</i>	GCF_000024885.1	<i>Sulfurospirillum deleyianum</i> DSM 6946	<a href="#">GCF_000024885.1-SDEL_RS09760</a>	WP_012857693.1	F3 and F7 systems, 36H, <b>40H</b> , 44H
					<a href="#">GCF_000024885.1-SDEL_RS06120</a>	WP_012856985.1	
					<a href="#">GCF_000024885.1-SDEL_RS04195</a>	WP_012856614.1	
					<a href="#">GCF_000024885.1-SDEL_RS09765</a>	WP_012857694.1	
					<a href="#">GCF_000024885.1-SDEL_RS05480</a>	WP_012856856.1	
	Sulfurospirillum_A	<i>Sulfurospirillum_A arcachonense</i>	GCF_000597725.1	<i>Sulfurospirillum arcachonense</i> DSM 9755	<a href="#">GCF_000597725.1-K354_RS0113080</a>	WP_051505455.1	F3 and F7 systems, 24H, 28H, <b>36H</b> , <b>40H</b> , 44H
					<a href="#">GCF_000597725.1-K354_RS0110060</a>	WP_024955370.1	40H
					<a href="#">GCF_000597725.1-K354_RS0111745</a>	WP_024955694.1	36H
					<a href="#">GCF_000597725.1-K354_RS14850</a>	WP_024955923.1	40H
					<a href="#">GCF_000597725.1-K354_RS14235</a>	WP_024955498.1	40H
f_Sulfurovaceae							
	Nitratifractor	<i>Nitratifractor salsuginis</i>	GCF_000186245.1	<i>Nitratifractor salsuginis</i> DSM 16511			no chemotaxis
	Sulfurovum	<i>Sulfurovum lithotrophicum</i>	GCF_000987835.1	<i>Sulfurovum lithotrophicum</i>			no chemotaxis
o_Nautiliales							
f_Nautilliaceae							
	Caminibacter	<i>Caminibacter mediatlanticus</i>	GCF_000170735.1	<i>Caminibacter mediatlanticus</i> TB-2			F3 system, 28H, 40H, 44H
	Lebetimonas	<i>Lebetimonas natsushimae</i>	GCF_002335445.1	<i>Lebetimonas natsushimae</i>			F3 system, 40H, 44H
	Nautilia	<i>Nautilia profundicola</i>	GCF_000021725.1	<i>Nautilia profundicola</i> AmH			F3 system, 28H, 40H, 44H
c_Desulfurelli							
a							
o_Desulfurellales							
f_Desulfurellaceae							

	Desulfurella	<i>Desulfurella acetivorans</i>	GCF_000517 565.1	<i>Desulfurella acetivorans A63</i>	F1 system, 40H, 44H
	Desulfurella	<i>Desulfurella amilsii</i>	GCF_002119 425.1	<i>Desulfurella amilsii</i>	F1 system, 40H, 44H
f_Hippeaceae					
	Hippea	<i>Hippea maritima</i>	GCF_000194 135.1	<i>Hippea maritima DSM 10411</i>	F3 system, 24H, 40H, 44H
	Hippea_A	<i>Hippea jasoniae</i>	GCF_000744 435.1	<i>Hippea_A jasoniae</i>	F3 system, 40H, 44H

**Table S2.** The presence of *tlp2*, *tlp3* and *tlp4* genes in *Campylobacter\_D* species with complete and draft genomes.

GTDB Species	Assembly ID	Strain	Tlp2	Tlp3 paralog 1 YNxxxRxW Y x Y x D	Tlp3/CcmL	Tlp3 paralog 2	Tlp4
<i>Campylobacter_D jejuni</i>	GCF_00150 7125.1	Campylobacter jejuni CJ677CC024					
	GCF_00150 6885.1	Campylobacter jejuni CJ677CC040					
	GCF_00150 6205.1	Campylobacter jejuni CJ677CC002					
	GCF_00150 6345.1	Campylobacter jejuni CJ677CC036					
	GCF_00150 6465.1	Campylobacter jejuni CJ677CC530					
	GCF_00150 6665.1	Campylobacter jejuni CJ677CC528					
	GCF_00150 7145.1	Campylobacter jejuni CJ677CC064					
	GCF_00150 7065.1	Campylobacter jejuni CJ677CC094			WP_05911 9483.1		
	GCF_00150 6485.1	Campylobacter jejuni CJ677CC532					
	GCF_00150 6705.1	Campylobacter jejuni CJ677CC520					

GCF\_00150  
7045.1 Campylobacter jejuni CJ677CC522  
GCF\_00150  
6225.1 Campylobacter jejuni CJ677CC534  
GCF\_00150  
6445.1 Campylobacter jejuni CJ677CC092  
GCF\_00150  
6685.1 Campylobacter jejuni CJ677CC538  
GCF\_00150  
6385.1 Campylobacter jejuni CJ677CC016  
GCF\_00150  
6425.1 Campylobacter jejuni CJ677CC535  
GCF\_00150  
6505.1 Campylobacter jejuni CJ677CC529  
GCF\_00150  
6525.1 Campylobacter jejuni CJ677CC531  
GCF\_00150  
6565.1 Campylobacter jejuni CJ677CC059  
GCF\_00150  
6625.1 Campylobacter jejuni CJ677CC537  
GCF\_00150  
6745.1 Campylobacter jejuni CJ677CC039  
GCF\_00150  
6825.1 Campylobacter jejuni CJ677CC078  
GCF\_00150  
6905.1 Campylobacter jejuni CJ677CC061  
GCF\_00150  
6965.1 Campylobacter jejuni CJ677CC047  
GCF\_00150  
6985.1 Campylobacter jejuni CJ677CC058  
GCF\_00150  
7085.1 Campylobacter jejuni CJ677CC008  
GCF\_00150  
6185.1 Campylobacter jejuni CJ677CC519  
GCF\_00150  
6545.1 Campylobacter jejuni CJ677CC062  
GCF\_00150  
6805.1 Campylobacter jejuni CJ677CC527  
GCF\_00150  
7005.1 Campylobacter jejuni CJ677CC013

WP\_05911  
6327.1  
WP\_07975  
6629.1

WP\_07975  
6887.1

GCF\_00150  
7025.1 Campylobacter jejuni CJ677CC100  
GCF\_00150  
7185.1 Campylobacter jejuni CJ677CC026  
GCF\_00150  
6305.1 Campylobacter jejuni CJ677CC526  
GCF\_00150  
6365.1 Campylobacter jejuni CJ677CC524  
GCF\_00150  
7165.1 Campylobacter jejuni CJ677CC525  
GCF\_00150  
6245.1 Campylobacter jejuni CJ677CC536  
GCF\_00150  
6285.1 Campylobacter jejuni CJ677CC521  
GCF\_00150  
6845.1 Campylobacter jejuni CJ677CC523  
GCF\_00150  
6725.1 Campylobacter jejuni CJ677CC014  
GCF\_00150  
7225.1 Campylobacter jejuni CJ677CC086  
GCF\_00150  
6945.1 Campylobacter jejuni CJ677CC533  
GCF\_00150  
7245.1 Campylobacter jejuni CJ677CC095  
GCF\_00150  
7265.1 Campylobacter jejuni CJ677CC012  
GCF\_00150  
6585.1 Campylobacter jejuni CJ677CC032  
GCF\_00150  
7105.1 Campylobacter jejuni CJ677CC541  
GCF\_00150  
6265.1 Campylobacter jejuni CJ677CC073  
GCF\_00150  
6405.1 Campylobacter jejuni CJ677CC041  
GCF\_00150  
6605.1 Campylobacter jejuni CJ677CC033  
GCF\_00150  
6645.1 Campylobacter jejuni CJ677CC542  
GCF\_00150  
6765.1 Campylobacter jejuni CJ677CC085

WP\_07975  
6629.1

WP\_05911  
9230.1

GCF_00150 6785.1	Campylobacter jejuni CJ677CC052			
GCF_00150 6865.1	Campylobacter jejuni CJ677CC540			
GCF_00150 6925.1	Campylobacter jejuni CJ677CC539			
GCF_00150 7205.1	Campylobacter jejuni CJ677CC034			
GCF_00336 8245.1	Campylobacter jejuni CJ066CC508			
GCF_00093 4305.1	Campylobacter jejuni subsp. Jejuni 35925			WP_044305740.1
GCF_00202 4325.1	Campylobacter jejuni NCTC12662		WP_07900 5337.1	WP_044305740.1
GCF_00202 8305.1	Campylobacter jejuni subsp. Jejuni ATCC 35925	WP_07939 9331.1	WP_07900 5337.1	WP_044305740.1
GCF_00306 0765.1	Campylobacter jejuni NCTC 12661		WP_07900 5337.1	WP_044305740.1
GCF_00195 1255.1	Campylobacter jejuni HF5-5-1	WP_03840 2013.1	WP_07588 8393.1	WP_075888364.1
GCF_00195 1275.1	Campylobacter jejuni HF5-7-1	WP_03840 2013.1	WP_07588 8393.1	WP_075888364.1
GCF_00223 4455.1	Campylobacter jejuni RM1246-ERRC	WP_09395 8665.1	WP_07946 7350.1	WP_087694997.1
GCF_00049 3495.1	Campylobacter jejuni 4031		WP_07927 9415.1	
GCF_00336 8065.1	Campylobacter jejuni CJ515CC45			
GCF_00336 8125.1	Campylobacter jejuni CJ513CC45			
GCF_00336 8085.1	Campylobacter jejuni CJ031CC45			
GCF_00001 7905.1	Campylobacter jejuni subsp. jejuni 81116	WP_01200 6626.1	WP_07925 4164.1	WP_012006635.1
GCF_00220 9065.1	Campylobacter jejuni subsp. Jejuni FDAARGOS_266	WP_01200 6626.1	WP_07925 4164.1	WP_088592094.1
GCF_00336 8045.1	Campylobacter jejuni CJ067CC45			
GCF_00073 7085.1	Campylobacter jejuni subsp. Jejuni MTVDSCj20	WP_03840 2013.1	WP_07588 8393.1	WP_014516918.1

GCF_00014 8705.1	Campylobacter jejuni subsp. jejuni M1		WP_07588 8393.1	WP_014516918.1
GCF_00141 2295.1	Campylobacter jejuni CJM1cam		WP_07588 8393.1	WP_014516918.1
GCF_00336 8105.1	Campylobacter jejuni CJ017CCUA			
GCF_00145 7695.1	Campylobacter jejuni NCTC11351	WP_05820 7847.1	WP_07975 4350.1	
GCF_00220 9005.1	Campylobacter jejuni subsp. Jejuni FDAARGOS_262	WP_05820 7847.1	WP_07975 4350.1	
GCF_00129 9565.1	Campylobacter jejuni subsp. Jejuni RM3197	WP_00285 4643.1	WP_07925 4326.1	WP_002854722.1
GCF_00129 9595.1	Campylobacter jejuni subsp. Jejuni RM3196	WP_00285 4643.1	WP_07925 4326.1	WP_002854722.1
GCF_00001 5525.1	Campylobacter jejuni subsp. jejuni 81-176	WP_00988 1803.1		WP_009881974.1
GCF_00222 4385.1	Campylobacter jejuni 81-176_G1_B0	WP_00988 1803.1		WP_009881974.1
GCF_00168 6905.1	Campylobacter jejuni subsp. Jejuni RM1285		WP_01089 1944.1	WP_065453843.1
GCF_00176 7215.1	Campylobacter jejuni subsp. jejuni str. RM3420	WP_07036 3962.1	WP_07946 1914.1	WP_002851876.1
GCF_00221 4785.1	Campylobacter jejuni FORC_046	WP_05279 1709.1		WP_002851876.1
GCF_00171 7625.1	Campylobacter jejuni subsp. Jejuni 14980A		WP_07946 0008.1	WP_07985 1618.1
GCF_00336 8205.1	Campylobacter jejuni CJ090CC1332			
GCF_00336 8225.1	Campylobacter jejuni CJ018CCUA		WP_11576 6720.1	
GCF_00336 8185.1	Campylobacter jejuni CJ071CC464			
GCF_00186 5435.1	Campylobacter jejuni IF1100			
GCF_00083 5285.1	Campylobacter jejuni subsp. Jejuni 00-1597		WP_07939 4622.1	WP_07939 4630.1
GCF_00186 5595.1	Campylobacter jejuni subsp. jejuni M129	WP_01451 7177.1	WP_07946 0163.1	WP_07986 5828.1
GCF_00186 5395.1	Campylobacter jejuni FJ3124		WP_07946 0008.1	

GCF_00336 8145.1	Campylobacter jejuni CJ088CC52				
GCF_00017 1795.2	Campylobacter jejuni CG8421		WP_07934 3735.1		
GCF_00018 4205.1	Campylobacter jejuni subsp. jejuni S3	WP_01451 7177.1	WP_07925 4342.1	WP_07925 4358.1	WP_014517176.1
GCF_00001 1865.1	Campylobacter jejuni RM1221	WP_01104 9652.1		WP_07925 4358.1	WP_011049651.1
GCF_00258 7225.1	Campylobacter jejuni FDAARGOS_421	WP_01104 9652.1		WP_07925 4358.1	WP_011049651.1
GCF_00336 8165.1	Campylobacter jejuni CJ074CC443			WP_11576 9683.1	
GCF_00156 3565.1	Campylobacter jejuni RM3194	WP_05281 6913.1	WP_07946 0008.1	WP_01089 1944.1	WP_061099736.1
GCF_00172 1965.1	Campylobacter jejuni subsp. Jejuni MTVDSCj13		WP_07985 4565.1	WP_07985 4575.1	
GCF_00172 1985.1	Campylobacter jejuni subsp. Jejuni MTVDSCj16		WP_07985 4703.1	WP_07985 4727.1	
GCF_00303 0185.1	Campylobacter jejuni CFSAN054107		WP_10713 1175.1	WP_10713 1164.1	
GCF_00186 5415.1	Campylobacter jejuni TS1218		WP_07131 1218.1		
GCF_00187 0085.1	Campylobacter jejuni YQ2210				
GCF_00187 0105.1	Campylobacter jejuni ZP3204				
GCF_00043 0385.1	Campylobacter jejuni 32488			WP_07926 9902.1	WP_07926 9906.1
GCF_00240 7125.1	Campylobacter jejuni CFSAN032806	WP_09677 7911.1		WP_09677 7910.1	WP_009881974.1
GCF_00077 2225.1	Campylobacter jejuni subsp. jejuni F38011	WP_00988 1803.1		WP_01089 1944.1	WP_041160003.1
GCF_00220 9045.1	Campylobacter jejuni subsp. Jejuni FDAARGOS_265		WP_07946 0163.1	WP_08858 5164.1	
GCF_00158 7015.1	Campylobacter jejuni OD267			WP_06157 7918.1	
GCF_00158 7035.1	Campylobacter jejuni WP2202				WP_061563569.1
GCF_00030 2555.5	Campylobacter jejuni subsp. jejuni PT14		WP_07976 8733.1	WP_07976 8734.1	WP_015016423.1

GCF_00172 1945.1	Campylobacter jejuni subsp. Jejuni MTVDSCj07	WP_06935 8644.1	WP_01089 1944.1	WP_015016423.1
GCF_00131 4285.1	Campylobacter jejuni RM1285		WP_01089 1944.1	
GCF_00306 0785.1	Campylobacter jejuni NCTC 12664		WP_10861 4575.1	WP_108614536.1
GCF_00195 1235.1	Campylobacter jejuni HF5-4A-4	WP_07591 2927.1	WP_07591 2974.1	WP_075912928.1
GCF_00258 7105.1	Campylobacter jejuni FDAARGOS_422	WP_00285 1724.1	WP_01089 1944.1	WP_002851876.1
<b>GCF_00000 9085.1</b>	<b>Campylobacter jejuni subsp. jejuni NCTC 11168 = ATCC 700819</b>	<b>YP_002343 604.1</b>	<b>YP_002344 933.1</b>	<b>YP_002343704.1</b>
GCF_00030 4375.1	Campylobacter jejuni subsp. jejuni NCTC 11168-BN148	WP_00988 1803.1	WP_01089 1944.1	WP_009881974.1
GCF_00083 0775.1	Campylobacter jejuni subsp. jejuni NCTC 11168-K12E5	WP_04133 7137.1	WP_07939 4646.1	WP_041337140.1
GCF_00083 0805.1	Campylobacter jejuni subsp. jejuni NCTC 11168-Kf1	WP_04133 7137.1	WP_07939 4646.1	WP_041337140.1
GCF_00083 0825.1	Campylobacter jejuni subsp. jejuni NCTC 11168-mcK12E5	WP_00988 1803.1	WP_01089 1944.1	WP_009881974.1
GCF_00083 0845.1	Campylobacter jejuni subsp. jejuni NCTC 11168-mfK12E5	WP_00988 1803.1	WP_01089 1944.1	WP_009881974.1
GCF_00083 0865.1	Campylobacter jejuni subsp. jejuni NCTC 11168-GSv	WP_00988 1803.1	WP_01089 1944.1	WP_009881974.1
GCF_00220 9025.1	Campylobacter jejuni subsp. Jejuni FDAARGOS_263	WP_00988 1803.1		WP_009881974.1
GCF_00222 4325.1	Campylobacter jejuni 11168H/lacY	WP_00988 1803.1	WP_01089 1944.1	WP_009881974.1
GCF_00223 8375.1	Campylobacter jejuni 11168H/araE	WP_00988 1803.1	WP_01089 1944.1	WP_009881974.1
GCF_90047 5265.1	Campylobacter jejuni subsp. jejuni	WP_00988 1803.1	WP_01089 1944.1	WP_009881974.1
GCF_00306 0745.1	Campylobacter jejuni NCTC 12660		WP_10859 2625.1	WP_10859 2594.1
GCF_00195 1295.1	Campylobacter jejuni NS4-1-1		WP_07222 3305.1	WP_07586 7322.1
GCF_00195 1315.1	Campylobacter jejuni NS4-5-1		WP_07222 3305.1	WP_07586 7322.1
GCF_00195 1335.1	Campylobacter jejuni NS4-9-1		WP_07222 3305.1	WP_07586 7322.1



	GCF_00002 5425.1	Campylobacter jejuni subsp. jejuni IA3902		WP_01451 6860.1	WP_07925 4169.1	
	GCF_00083 5345.1	Campylobacter jejuni subsp. Jejuni 01-1512	WP_07939 4712.1	WP_07939 4745.1		WP_009881974.1
	GCF_00083 5365.1	Campylobacter jejuni subsp. Jejuni 00-0949	WP_07939 4712.1	WP_07939 4721.1		
	GCF_00306 0725.1	Campylobacter jejuni 12567				
	GCF_00210 1355.1	Campylobacter jejuni YH002		WP_01451 6860.1	WP_07925 4169.1	
	GCF_00083 5305.1	Campylobacter jejuni subsp. Jejuni 00-6200		WP_01451 6860.1	WP_07939 4740.1	
	GCF_00046 6075.2	Campylobacter jejuni subsp. jejuni 00-2544		WP_07937 6548.1	WP_07937 6546.1	
	GCF_00046 6065.2	Campylobacter jejuni subsp. jejuni 00-2538		WP_07937 6548.1	WP_07937 6546.1	
	GCF_00046 6105.2	Campylobacter jejuni subsp. jejuni 00-2426		WP_07937 6548.1	WP_07937 6546.1	
	GCF_00046 8915.2	Campylobacter jejuni subsp. jejuni 00-2425		WP_07937 6548.1	WP_07937 6546.1	
<i>Campylobacter_D cuniculorum</i>	GCF_00210 4335.1	Campylobacter cuniculorum DSM 23162 = LMG 24588				
	GCF_00062 1005.1	Campylobacter cuniculorum DSM 23162 = LMG 24588				
<i>Campylobacter_D helveticus</i>	GCF_00208 0395.1	Campylobacter helveticus	WP_08220 0713.1			WP_082200691.1, WP_082200520.1
	GCF_90017 6295.1	Campylobacter helveticus				
<i>Campylobacter_D upsaliensis</i>	GCF_00062 0965.1	Campylobacter upsaliensis DSM 5365				
	GCF_00016 7395.1	Campylobacter upsaliensis RM3195	WP_00427 5314.1			
	GCF_00018 5345.1	Campylobacter upsaliensis JV21				
<i>Campylobacter_D sp002738235</i>	GCF_00273 8235.1	Campylobacter sp. 73/13				

<i>Campylobacter_D hepaticus</i>	GCF_00273 8305.1	Campylobacter sp. 251/13		
	GCF_00168 7475.1	Campylobacter hepaticus		
<i>Campylobacter_D coli</i>	GCF_00025 4135.1	Campylobacter coli LMG 9860		
	GCF_00202 4185.1	Campylobacter coli aerotolerant OR12		WP_09904 6908.1
	GCF_00046 5235.1	Campylobacter coli CVM N29710		WP_02103 3641.1
	GCF_00049 4775.1	Campylobacter coli 15-537360	WP_02336 2248.1	WP_02336 2235.1
	GCF_00058 3755.1	Campylobacter coli RM1875		
	GCF_00058 3795.1	Campylobacter coli RM5611	WP_02543 1530.1	WP_02543 1485.1
	GCF_00095 4195.1	Campylobacter coli FB1	WP_04524 3712.1	WP_04524 3711.1
	GCF_00141 7635.1	Campylobacter coli HC2-48		
	GCF_00148 3845.1	Campylobacter coli OR12		WP_05891 4555.1
	GCF_00163 9125.1	Campylobacter coli YH501		WP_06365 1861.1
	GCF_00171 7605.1	Campylobacter coli 14983A		WP_05799 2610.1
	GCF_00186 5495.1	Campylobacter coli BP3183		WP_07130 4885.1
	GCF_00186 5515.1	Campylobacter coli WA333		
	GCF_00186 5555.1	Campylobacter coli BG2108		
	GCF_00193 6355.1	Campylobacter coli YH502		WP_07539 5263.1
	GCF_00240 7145.1	Campylobacter coli CFSAN032805		WP_09678 8361.1
	GCF_00284 3985.1	Campylobacter coli YH503		WP_10134 8801.1

	GCF_00303 0205.1	Campylobacter coli CFSAN054106	WP_10712 8010.1	WP_10712 8017.1	
	GCF_00141 7615.1	Campylobacter coli CO2-160	WP_06047 3514.1		
	GCF_00141 7655.1	Campylobacter coli CF2-75			
<i>Campylobacter_D coli_A</i>	GCF_00047 0055.1	Campylobacter coli 76339	WP_02097 3958.1		
	GCF_00047 0055.1	Campylobacter coli	WP_02097 3958.1		
	GCF_00148 8335.1	Campylobacter coli			
	GCF_00201 9885.1	Campylobacter coli VA7		WP_07839 7504.1	
	GCF_00149 5535.1	Campylobacter coli			
	GCF_00149 8475.1	Campylobacter coli		WP_07550 4589.1	
	GCF_00149 4895.1	Campylobacter coli		WP_07548 2578.1	
<i>Campylobacter_D coli_B</i>	GCF_00149 2295.1	Campylobacter coli		WP_05896 8202.1	
	GCF_00201 9985.1	Campylobacter coli VA46		WP_07544 7212.1	
	GCF_00202 0085.1	Campylobacter coli VA37			
	GCF_00201 9865.1	Campylobacter coli VA6		WP_07841 6234.1	
	GCF_00202 0015.1	Campylobacter coli VA8		WP_07544 7212.1	WP_052774443.1
	GCF_00149 1515.1	Campylobacter coli		WP_07543 8466.1	
	GCF_00149 0995.1	Campylobacter coli			
	GCF_00149 7615.1	Campylobacter coli		WP_07545 7517.1	

**Table S3:** Glycan structures recognized by (A) T1p2<sup>LBD</sup>, (B) T1p3<sup>LBD</sup> and (C) T1p4<sup>LBD</sup>. Blood group A antigens - A (typeX), Blood group B antigens -B (typeX), Blood group H antigens -H (typeX), Lewis<sup>a</sup> (Le<sup>a</sup>), Lewis<sup>b</sup> (Le<sup>b</sup>), Lewis<sup>c</sup> (Le<sup>c</sup>), Lewis<sup>x</sup> (Le<sup>x</sup>), Lewis<sup>y</sup> (Le<sup>y</sup>), Ganglioside asialo GM1(Asialo-GM1), Thomsen-Friedenreich (TF) antigens, and Thomsen nouvelle (Tn) antigens. GM1(Asialo-GM1), Thomsen-Friedenreich (TF) antigens, P antigens P<sub>1</sub>, P<sub>2</sub>, P<sup>k</sup>, and P and Thomsen nouvelle (Tn) antigens.

### (A) T1p2

Glycan No	Structure	Common name
240	(Glc $\alpha$ 1-4)3 $\beta$ -sp4	TRISACCHARIDES
390	(Glc $\alpha$ 1-4)4 $\beta$ -sp4	TRISACCHARIDES
241	(Glc $\alpha$ 1-6)3 $\beta$ -sp4	TRISACCHARIDES
492	(Glc $\alpha$ 1-6)5 $\beta$ -sp4	PENTA-NONA SACCHARIDES
502	(Glc $\alpha$ 1-6)6 $\beta$ -sp4	PENTA-NONA SACCHARIDES
165	GlcA $\beta$ 1-3Gal $\beta$ -sp3	DISACCHARIDES
164	GlcA $\beta$ 1-3GlcNAc $\beta$ -sp3	DISACCHARIDES
166	GlcA $\beta$ 1-6Gal $\beta$ -sp3	DISACCHARIDES
392	Fuca1-2(GalNAc $\alpha$ 1-3)Gal $\beta$ 1-3GalNAc $\alpha$ -sp3	A (type 3)
366	Fuca1-2(GalNAc $\alpha$ 1-3)Gal $\beta$ 1-3GlcNAc $\beta$ -sp3	A (type 1)
368	Fuca1-2(GalNAc $\alpha$ 1-3)Gal $\beta$ 1-4GlcNAc $\beta$ -sp3	A (type 2)
363	Fuca1-2(Gal $\alpha$ 1-3)Gal $\beta$ 1-3GalNAc $\beta$ -sp3	B (type 4)
359	Fuca1-2(Gal $\alpha$ 1-3)Gal $\beta$ 1-3GlcNAc $\beta$ -sp3	B (type 1)
360	Fuca1-2(Gal $\alpha$ 1-3)Gal $\beta$ 1-4GlcNAc $\beta$ -sp3	B (type 2)
371	Fuca1-2Gal $\beta$ 1-3(Fuca1-4)GlcNAc $\beta$ -sp3	Le <sup>b</sup>
480	Fuca1-2Gal $\beta$ 1-3GlcNAc $\beta$ 1-3Gal $\beta$ 1-4GlcNAc $\beta$ -sp2	H (type1) penta
19L	Fuca1-2Gal $\beta$ 1-4(Fuca1-3)GlcNAc $\beta$ 1-3Gal	Le <sup>y</sup> pentaose
216	Fuca1-2Gal $\beta$ 1-4GlcNAc $\beta$ -sp3	H (type 2)
219	Fuca1-2Gal $\beta$ 1-4Glc $\beta$ -sp4	H (type 6)
71	Fuca1-2Gal $\beta$ -sp3	H <sub>di</sub>
483	Fuca1-3(Fuca1-2 (Gal $\alpha$ 1-3)Gal $\beta$ 1-4)GlcNAc $\beta$ -sp3	Ble <sup>y</sup>
497	Fuca1-3(Fuca1-2Gal $\beta$ 1-4)GlcNAc $\beta$ 1-3Gal $\beta$ 1-4Glc $\beta$ -sp4	Le <sup>y</sup> -Lac
372	Fuca1-3(Fuca1-2Gal $\beta$ 1-4)GlcNAc $\beta$ -sp3	Le <sup>y</sup>
364	Fuca1-3(Gal $\alpha$ 1-3Gal $\beta$ 1-4)GlcNAc $\beta$ -sp3	$\alpha$ Gal-Le <sup>x</sup>
234	Fuca1-3(Gal $\beta$ 1-4)GlcNAc $\beta$ -sp3	Le <sup>x</sup>
429	Fuca1-3(Neu5Ac $\alpha$ 2-3(6-O-Su)Gal $\beta$ 1-4)GlcNAc $\beta$ -sp3	TETRASACCHARIDES
428	Fuca1-3(Neu5Ac $\alpha$ 2-3Gal $\beta$ 1-4)6-O-Su-GlcNAc $\beta$ -sp3	TETRASACCHARIDES
423	Fuca1-3(Neu5Ac $\alpha$ 2-3Gal $\beta$ 1-4)GlcNAc $\beta$ -sp3	Sia-Le <sup>x</sup>
18E	GalNAc $\alpha$ 1-3(Fuca1-2)Gal $\beta$ 1-4(Fuca1-3)Glc	Blood group A pentasaccharide
9A	Gal $\alpha$ 1-3(Fuca1-2)Gal $\beta$ 1-4(Fuca1-3)Glc	Blood Group B pentasaccharide
233	Gal $\beta$ 1-3(Fuca1-4)GlcNAc $\beta$ -sp3	Le <sup>a</sup>

8C	Gal $\beta$ 1-3GlcNAc $\beta$ 1-3Gal $\beta$ 1-4(Fuca1-3)GlcNAc $\beta$ 1-3Gal $\beta$ 1-4Glc	Fucosylated glycans
19J	Gal $\beta$ 1-4(Fuca1-3)GlcNAc $\beta$ 1-3Gal	Le <sup>x</sup> tetraose
8E	Gal $\beta$ 1-4(Fuca1-3)GlcNAc $\beta$ 1-6(Fuca1-2Gal $\beta$ 1-3GlcNAc $\beta$ 1-3)Gal $\beta$ 1-4Glc	Fucosylated glycans
289	Gal $\alpha$ 1-3(Neu5Ac $\alpha$ 2-6)GalNAc $\alpha$ -sp3	6-Sia-TF
2A	Gal $\alpha$ 1-3Gal $\beta$ 1-4Gal $\alpha$ 1-3Gal	Terminal galactose
373	Gal $\alpha$ 1-3Gal $\beta$ 1-4GlcNAc $\beta$ 1-3Gal $\beta$ -sp3	Galili 4
220	Gal $\alpha$ 1-3Gal $\beta$ 1-4Glc $\beta$ -sp2	TRISACCHARIDES
375	Gal $\alpha$ 1-4GlcNAc $\beta$ 1-3Gal $\beta$ 1-4GlcNAc $\beta$ -sp3	TETRASACCHARIDES
228	Gal $\beta$ 1-2Gal $\alpha$ 1-4GlcNAc $\beta$ -sp4	TRISACCHARIDES
145	Gal $\beta$ 1-3(6-O-Su)GlcNAc $\beta$ -sp3	6-O-Su-Le <sup>c</sup>
388	Gal $\beta$ 1-3(Gal $\beta$ 1-4GlcNAc $\beta$ 1-6)GalNAc $\alpha$ -sp3	TETRASACCHARIDES
382	Gal $\beta$ 1-3GalNAc $\beta$ 1-4Gal $\beta$ 1-4Glc $\beta$ -sp3	Asialo-GM1
229	Gal $\beta$ 1-3Gal $\beta$ 1-4GlcNAc $\beta$ -sp4	TRISACCHARIDES
377	Gal $\beta$ 1-3GlcNAc $\beta$ 1-3Gal $\beta$ 1-3GlcNAc $\beta$ -sp2	TETRASACCHARIDES
379	Gal $\beta$ 1-3GlcNAc $\beta$ 1-3Gal $\beta$ 1-4GlcNAc $\beta$ -sp3	TETRASACCHARIDES
376	Gal $\beta$ 1-3GlcNAc $\beta$ 1-3Gal $\beta$ 1-4Glc $\beta$ -sp4	TETRASACCHARIDES
381	Gal $\beta$ 1-3GlcNAc $\beta$ 1-6Gal $\beta$ 1-4GlcNAc $\beta$ -sp2	TETRASACCHARIDES
18M	Gal $\beta$ 1-4Gal	Terminal galactose
264	Gal $\beta$ 1-4Gal $\beta$ 1-4GlcNAc-sp3	TRISACCHARIDES
94	Gal $\beta$ 1-4Gal $\beta$ -sp4	TRISACCHARIDES
488	Gal $\beta$ 1-4GlcNAc $\beta$ 1-3(Gal $\beta$ 1-4GlcNAc $\beta$ 1-6)GalNAc $\alpha$ -sp3	LN2-3,6-Tn
499	Gal $\beta$ 1-4GlcNAc $\beta$ 1-3(Gal $\beta$ 1-4GlcNAc $\beta$ 1-6)Gal $\beta$ 1-4GlcNAc-sp2	PENTA-NONA SACCHARIDES
489	Gal $\beta$ 1-4GlcNAc $\beta$ 1-3(GlcNAc $\beta$ 1-6)Gal $\beta$ 1-4GlcNAc-sp2	PENTA-NONA SACCHARIDES
383	Gal $\beta$ 1-4GlcNAc $\beta$ 1-3Gal $\beta$ 1-4Glc $\beta$ -sp2	TETRASACCHARIDES
97	Gal $\beta$ 1-4GlcNAc $\beta$ -sp3	DISACCHARIDES
119	Man $\alpha$ 1-2Man $\beta$ -sp4	DISACCHARIDES
495	Man $\alpha$ 1-3(Man $\alpha$ 1-3(Man $\alpha$ 1-6)Man $\alpha$ 1-6)Man $\beta$ -sp4	PENTA-NONA SACCHARIDES
258	Man $\alpha$ 1-3(Man $\alpha$ 1-6)Man $\beta$ -sp4	TRISACCHARIDES
120	Man $\alpha$ 1-3Man $\beta$ -sp4	DISACCHARIDES
121	Man $\alpha$ 1-4Man $\beta$ -sp4	DISACCHARIDES
5F	Man $\alpha$ 1-6Man	Mannosyl containing glycans
122	Man $\alpha$ 1-6Man $\beta$ -sp4	DISACCHARIDES
123	Man $\beta$ 1-4GlcNAc $\beta$ -sp4	DISACCHARIDES
19F	Neu5Ac $\alpha$ 2-6Gal $\beta$ 1-4GlcNAc $\beta$ 1-2Man $\alpha$ 1-3(Neu5Ac $\alpha$ 2-6Gal $\beta$ 1-4GlcNAc $\beta$ 1-2Man $\alpha$ 1-6)Man $\beta$ 1-4GlcNAc $\beta$ 1-4(Fuca1-6)GlcNAc	Complex type X-glycan

## (B) T1p3

Glycan	Structure	Common name
12P	$\Delta$ UA-GalNAc-4S,6S	Glycosaminoglycans - high and low molecular weight
18I	GlcA	D-Glucuronic acid
12F	Neocarradecaos-41, 3, 5, 7, 9-penta-O-sulphate (Na <sup>+</sup> )	Glycosaminoglycans - high and low molecular weight

12J	$\Delta$ UA-2S-GlcNAc	Glycosaminoglycans - high and low molecular weight
13A	$\Delta$ UA-2S-GalNAc-4S	Glycosaminoglycans - high and low molecular weight
13M	(GlcA/IdoA $\beta$ 1-3( $\pm$ 6S)GalNAc $\beta$ 1-4) <sub>n</sub> (n<250)	Glycosaminoglycans - high and low molecular weight
14E	HA 30000	Glycosaminoglycans - high and low molecular weight
13M	HA 107000	Glycosaminoglycans - high and low molecular weight
1N	Gal $\alpha$ 1-3Gal ( $\alpha$ 1-3 Galactobiose)	Terminal galactose
2B	Gal $\beta$ 1-6Gal (beta1-6galactobiose)	Terminal galactose
5G	Man $\alpha$ 1-6(Man $\alpha$ 1-3)Man( $\alpha$ 1-3, $\alpha$ 1-6-Mannobiose)	Mannosyl containing glycans
10E	Neu5Ac $\alpha$ 2-3Gal $\beta$ 1-3(Neu5Ac $\alpha$ 2-6)GalNAc	Sialylated glycans
8B	SO <sub>3</sub> -3Gal $\beta$ 1-4(Fuca1-3)GlcNAc	Fucosylated glycans
19M	Gal $\beta$ 1-3(Fuca1-4)GlcNAc $\beta$ 1-3Gal	Le <sup>a</sup> tetraose
19N	Fuca1-2Gal $\beta$ 1-3(Fuca1-4)GlcNAc	Le <sup>b</sup> tetraose
2C	GalNAc $\beta$	Terminal galactose
20	Rha $\alpha$	MONOSACCHARIDES
19	ManNAc $\beta$	MONOSACCHARIDES
78	Gal $\alpha$ 1-3GalNAc $\alpha$ -sp3	DISACCHARIDES
168	GlcNAc $\beta$ 1--[HOOC(CH <sub>3</sub> )CH]-3-O-GlcNAc $\beta$ -L-alanyl-D-i-glutaminy-L-lysine	DISACCHARIDES
177	Gal $\beta$ 1-4(6-O-Su)GlcNAc $\beta$	DISACCHARIDES
123	Man $\beta$ 1-4GlcNAc $\beta$	DISACCHARIDES
206	Neu5Gc $\alpha$ 2-3Gal	DISACCHARIDES
232	Gal $\beta$ 1-4GlcNAc $\beta$ 1-6GalNAc $\alpha$	TRISACCHARIDES
240	(Glc $\alpha$ 1-4) <sub>3</sub> $\beta$	TRISACCHARIDES
293	Neu5Ac $\alpha$ 2-3Gal $\beta$ 1-4Glc $\beta$	TRISACCHARIDES
331	Neu5Gc $\alpha$ 2-3Gal $\beta$ 1-3GlcNAc $\beta$	3`Sia-Le <sup>c</sup> (Gc)
359	Fuca1-2(Gal $\alpha$ 1-3)Gal $\beta$ 1-3GlcNAc $\beta$	B (type 1)
389	GalNAc $\beta$ 1-3Gal $\alpha$ 1-4Gal $\beta$ 1-4Glc $\beta$	P antigen
495	Man $\alpha$ 1-3(Man $\alpha$ 1-3(Man $\alpha$ 1-6)Man $\alpha$ 1-6)Man $\beta$	PENTA-NONA SACCHARIDES
534	Neu5Ac $\alpha$ 2-3Gal $\beta$ 1-4GlcNAc $\beta$ 1-3Gal $\beta$ 1-4GlcNAc $\beta$	PENTA-NONA SACCHARIDES

### (C) Tlp4

Glycan	Structure	Common name
240	(Glc $\alpha$ 1-4) <sub>3</sub> $\beta$ -sp4	TRISACCHARIDES
241	(Glc $\alpha$ 1-6) <sub>3</sub> $\beta$ -sp4	TRISACCHARIDES
45	GlcA $\beta$ -sp3	MONOSACCHARIDES
19P	Glc $\alpha$ 1-4Glc $\alpha$ 1-4Glc $\alpha$ 1-4Glc	Terminal Glucose structures
110	Glc $\alpha$ 1-4Glc $\beta$ -sp3	DISACCHARIDES
7	Glc $\alpha$ -sp3	MONOSACCHARIDES
112	Glc $\beta$ 1-6Glc $\beta$ -sp4	DISACCHARIDES
9	Glc $\beta$ -sp3	MONOSACCHARIDES
287	3-O-Su-Gal $\beta$ 1-3(Fuca1-4)GlcNAc $\beta$ -sp3	Su-Le <sup>a</sup>
8J	Fuca1-2Gal $\beta$ 1-4(Fuca1-3)GlcNAc $\beta$ 1-3(Fuca1-2)Gal $\beta$ 1-4Glc	Fucosylated glycans

366	Fuca1-2(GalNAca1-3)Galβ1-3GlcNAcβ-sp3	A (type 1)
368	Fuca1-2(GalNAca1-3)Galβ1-4GlcNAcβ-sp3	A (type 2)
363	Fuca1-2(Galα1-3)Galβ1-3GalNAcβ-sp3	B (type 4)
359	Fuca1-2(Galα1-3)Galβ1-3GlcNAcβ-sp3	B (type 1)
226	Fuca1-2(Galα1-3)Galβ-sp3	B <sub>tri</sub>
371	Fuca1-2Galβ1-3(Fuca1-4)GlcNAcβ-sp3	Le <sup>b</sup>
217	Fuca1-2Galβ1-3GalNAca-sp3	H (type 3)
219	Fuca1-2Galβ1-4Glcβ-sp4	H (type 6)
288	Fuca1-3(3-O-Su-Galβ1-4)GlcNAcβ-sp3	Su-Le <sup>x</sup>
372	Fuca1-3(Fuca1-2Galβ1-4)GlcNAcβ-sp3	Le <sup>y</sup>
364	Fuca1-3(Galα1-3Galβ1-4)GlcNAcβ-sp3	αGal-Le <sup>x</sup>
234	Fuca1-3(Galβ1-4)GlcNAcβ-sp3	Le <sup>x</sup>
72	Fuca1-3GlcNAcβ-sp3	DISACCHARIDES
1	Fuca-sp3	MONOSACCHARIDES
7M	Galβ1-3(Fuca1-2)Gal	Blood Group B Trisaccharide
7J	Galβ1-3(Fuca1-4)GlcNAc	Le <sup>a</sup>
7E	Galβ1-3(Fuca1-4)GlcNAcβ1-3Galβ1-4(Fuca1-3)Glc	Fucosylated glycans
233	Galβ1-3(Fuca1-4)GlcNAcβ-sp3	Le <sup>a</sup>
8C	Galβ1-3GlcNAcβ1-3Galβ1-4(Fuca1-3)GlcNAcβ1-3Galβ1-4Glc	Fucosylated glycans
7H	Galβ1-4(Fuca1-3)Glc	Fucosylated glycans
7I	Galβ1-4(Fuca1-3)GlcNAc	Le <sup>x</sup>
8F	Galβ1-4(Fuca1-3)GlcNAcβ1-6(Fuca1-2Galβ1-3(Fuca1-4)GlcNAcβ1-3)Galβ1-4Glc	Fucosylated glycans
8D	Galβ1-4(Fuca1-3)GlcNAcβ1-6(Galβ1-3GlcNAcβ1-3)Galβ1-4Glc	Fucosylated glycans
19A	Galβ1-4GlcNAcβ1-2Manα1-3(Galβ1-4GlcNAcβ1-2Manα1-6Man)β1-4GlcNAcβ1-4(Fuca1-6)GlcNAc	Complex type N-glycans
8G	Galβ1-4GlcNAcβ1-3Galβ1-4(Fuca1-3)Glc	Fucosylated glycans
8E	Galβ1-4(Fuca1-3)GlcNAcβ1-6(Fuca1-2Galβ1-3GlcNAcβ1-3)Galβ1-4Glc	Fucosylated glycans
75	Galα1-2Galβ-sp3	DISACCHARIDES
289	Galα1-3(Neu5Aca2-6)GalNAca-sp3	TRISACCHARIDES
78	Galα1-3GalNAca-sp3	DISACCHARIDES
77	Galα1-3GalNAcβ-sp3	DISACCHARIDES
2E	Galα1-4Galβ1-4GlcNAc	P1 antigen
224	Galα1-4Galβ1-4Glcβ-sp3	P <sup>k</sup> antigen
375	Galα1-4GlcNAcβ1-3Galβ1-4GlcNAcβ-sp3	TETRASACCHARIDES
81	Galα1-4GlcNAcβ-sp3	DISACCHARIDES
83	Galα1-6Glcβ-sp4	DISACCHARIDES
2	Galα-sp3	MONOSACCHARIDES
84	Galβ1-2Galβ-sp3	DISACCHARIDES
254	Galβ1-3(GlcNAcβ1-6)GalNAca-sp3	TRISACCHARIDES
1E	Galβ1-3GalNAc	Terminal galactose
89	Galβ1-3GalNAca-sp3	DISACCHARIDES
88	Galβ1-3GalNAcβ-sp3	DISACCHARIDES
229	Galβ1-3Galβ1-4GlcNAcβ-sp4	TRISACCHARIDES
87	Galβ1-3Galβ-sp3	DISACCHARIDES
85	Galβ1-3GlcNAcβ-sp3	DISACCHARIDES

1A	Gal $\beta$ 1-3GlcNAc	Terminal galactose
378	Gal $\beta$ 1-3GlcNAc $\alpha$ 1-3Gal $\beta$ 1-4GlcNAc $\beta$ -sp3	TETRASACCHARIDES
377	Gal $\beta$ 1-3GlcNAc $\beta$ 1-3Gal $\beta$ 1-3GlcNAc $\beta$ -sp2	TETRASACCHARIDES
2G	Gal $\beta$ 1-3GlcNAc $\beta$ 1-3Gal $\beta$ 1-4GlcNAc $\beta$ 1-6(Gal $\beta$ 1-3GlcNAc $\beta$ 1-3)Gal $\beta$ 1-4Glc	Terminal galactose
1C	Gal $\beta$ 1-4Gal	Terminal galactose
264	Gal $\beta$ 1-4Gal $\beta$ 1-4GlcNAc-sp3	TRISACCHARIDES
19B	Gal $\beta$ 1-4GlcNAc $\beta$ 1-2(Gal $\beta$ 1-4GlcNAc $\beta$ 1-4)Man $\alpha$ 1-3(Gal $\beta$ 1-4GlcNAc $\beta$ 1-2(Gal $\beta$ 1-4GlcNAc $\beta$ 1-6)Man $\alpha$ 1-6Man) $\beta$ 1-4GlcNAc $\beta$ 1-4GlcNAc	Complex type N-glycans
231	Gal $\beta$ 1-4GlcNAc $\beta$ 1-3GalNAc $\alpha$ -sp3	LN3-Tn
232	Gal $\beta$ 1-4GlcNAc $\beta$ 1-6GalNAc $\alpha$ -sp3	LN6-Tn
93	Gal $\beta$ 1-4Glc $\beta$ -sp4	Terminal galactose
2B	Gal $\beta$ 1-6Gal	Terminal galactose
1D	Gal $\beta$ 1-6GlcNAc	Terminal galactose
3	Gal $\beta$ -sp3	MONOSACCHARIDES
119	Man $\alpha$ 1-2Man $\beta$ -sp4	DISACCHARIDES
120	Man $\alpha$ 1-3Man $\beta$ -sp4	DISACCHARIDES
20	Rha $\alpha$ -sp3	MONOSACCHARIDES



**Table S4.** Tlp3 docking analysis.

Kd [uM]	Arg	Asp	Fu	Gal	GlcN	Glu	Iso	Lys	Mal	Man	Pur	Sia	Thia
Cluster A (ASN 116)	143	469	109	110	98	93	145	248	376	69	399	19	11
Cluster B (ARG 69)	-	851	-	-	-	-	548	574	472	-	515	-	-
Cluster C (ASN 212)	-	-	-	-	-	-	-	-	663	-	552	-	76
Cluster D (PHE 216)	-	731	326	196	161	143	-	-	468	152	567	27	-
Cluster E (GLN 174)	-	-	-	-	250	232	-	-	-	146	608	72	34
Binding energy [kcal/mol]	Arg	Asp	Fu	Gal	GlcN	Glu	Iso	Lys	Mal	Man	Pur	Sia	Thia
Cluster A (ASN 116)	5.25	4.54	5.41	5.40	5.47	5.49	5.24	4.92	4.67	5.67	4.64	6.47	6.75
Cluster B (ARG 69)	-	4.19	-	-	-	-	4.45	4.42	4.54	-	4.49	-	-
Cluster C (ASN 212)	-	4.12	-	-	-	-	-	-	4.34	-	4.44	-	5.62
Cluster D (PHE 216)	-	4.28	4.76	5.06	5.17	5.24	-	-	4.54	5.21	4.43	6.23	-
Cluster E (GLN 174)	-	-	-	-	4.91	4.96	-	-	-	5.23	4.39	5.65	6.10
#conformers	Arg	Asp	Fu	Gal	GlcN	Glu	Iso	Lys	Mal	Man	Pur	Sia	Thia
Cluster A (ASN 116)	1000	530	780	685	550	650	950	950	350	800	400	750	650
Cluster B (ARG 69)	-	55	-	-	-	-	50	50	250	-	200	-	-
Cluster C (ASN 212)	-	-	-	-	-	-	-	-	50	-	150	-	50
Cluster D (PHE 216)	-	315	120	315	400	300	-	-	250	150	150	200	-
Cluster E (GLN 174)	-	-	-	-	50	50	-	-	-	50	50	50	300

**Table S5:** Summary of chemotactic responses of  $\Delta tlp3$ ,  $\Delta tlp2$ ,  $\Delta tlp4$ ,  $\Delta tlp2,4$ ,  $\Delta tlp2,3$ ,  $\Delta tlp3,4$  and  $\Delta tlp2,3,4$  strains illustrated as log-changes compared to the wild type. Green indicates ligands identified as chemoattractants (down), red indicates ligands identified as chemorepellents (UP) and yellow indicates ligands that showed no significant difference compared with wild-type strain ( $P < 0.05$ ).

Ligands	$\Delta tlp3$ *	$\Delta tlp2$	$\Delta tlp4$	$\Delta tlp2,4$	$\Delta tlp2,3$	$\Delta tlp3,4$	$\Delta tlp2,3,4$
	Depletion assay*	Depletion assay	Depletion assay	Depletion assay	Depletion assay	Depletion assay	Depletion assay
Serine		2.0 down	1.5 down	2.7 down	2.2 down	1.5 down	3.1 down
Methionine		1.8 down	1.4 down	1.9 down	1.9 down	2.2 down	2.0 down
Asparagine		1.7 down	2.4 down	2.7 down	1.7 down	2.3 down	3.5 down
Cysteine		1	1.4 down	1.4 down	1	1.3 down	1.9 down
Lysine	1.6 UP	1.4 UP	1.8 down	1.1 down	1.8 UP	1	1.5 UP
Purine	1.2 down	1.2 down	1.1 down	1.4 down	1.4 down	1.3 down	2.6 down
Aspartate	1.9 down	1.7 down	1.1 down	1.7 down	2.3 down	1.8 down	2.9 down
Isoleucine	2.7 down						
Malic acid	2.0 down						
Fumaric acid	2.2 down						
Arginine	1.3 UP						
Glucosamine	2.1 UP						
Thiamine	1.2 UP						
Succinic acid	1.2 UP						
Glucose	1.2 down	1.6 down	1.4 down	1.7 down	1.4 down	1.2 down	2.4 down
Fucose	1.4 down	1.7 down	1.4 down	2.4 down	2.1 down	2.0 down	3.4 down
Galactose	1	1	1	1.1 down	1.1 down	1.1 down	1.4 down
Mannose	1.4 UP	1.2 down	1.0 down	1.4 down	1.2 UP	1.3 UP	1.2 UP
Sialic acid	1.2 UP	1.4 down	1.2 down	1.3 down	1.1 UP	1	1.1 down

**Table S6.** Microbial strains and plasmids

Strain/plasmid	Description	Reference/source
Bacterial strains/ plasmids		
<i>C. jejuni</i> 11168-O	Wild type (human isolated strain) originally strain 5636/77	[1])
<i>C. jejuni</i> 81116 $\Delta$ <i>flaA</i> / <i>flab</i> <sup>-</sup>	Isogenic mutant of <i>flaA/flaB</i>	J.M. Ketley
<i>C. jejuni</i> 11168-O $\Delta$ <i>tlp3</i> :: <i>aphA3</i>	Isogenic mutant of <i>tlp3</i>	[2]
<i>C. jejuni</i> 11168-O $\Delta$ <i>tlp2</i> :: <i>Er</i> <sup>R</sup>	Isogenic mutant of <i>tlp2</i>	This study
<i>C. jejuni</i> 11168-O $\Delta$ <i>tlp4</i> :: <i>Cm</i> <sup>R</sup>	Isogenic mutant of <i>tlp4</i>	This study
<i>C. jejuni</i> 11168-O $\Delta$ <i>tlp2</i> :: <i>Er</i> <sup>R</sup> $\Delta$ <i>tlp4</i> :: <i>Cm</i> <sup>R</sup>	Isogenic mutant of <i>tlp2</i> and <i>tlp4</i>	This study
<i>C. jejuni</i> 11168-O $\Delta$ <i>tlp2</i> :: <i>Er</i> <sup>R</sup> $\Delta$ <i>tlp3</i> :: <i>Km</i> <sup>R</sup>	Isogenic mutant of <i>tlp2</i> and <i>tlp3</i>	This study
<i>C. jejuni</i> 11168-O $\Delta$ <i>tlp3</i> :: <i>Km</i> <sup>R</sup> $\Delta$ <i>tlp4</i> :: <i>Cm</i> <sup>R</sup>	Isogenic mutant of <i>tlp3</i> and <i>tlp4</i>	This study
<i>C. jejuni</i> 11168-O $\Delta$ <i>tlp2</i> :: <i>Er</i> <sup>R</sup> $\Delta$ <i>tlp3</i> :: <i>Km</i> <sup>R</sup> $\Delta$ <i>tlp4</i> :: <i>Cm</i> <sup>R</sup>	Isogenic mutant of <i>tlp2</i> , <i>tlp3</i> and <i>tlp4</i>	This study
<i>C. jejuni</i> 11168-O $\Delta$ <i>tlp2</i> :: <i>Er</i> <sup>R</sup> $\Omega$ <i>tlp2</i> :: <i>Km</i>	Complemented <i>tlp2</i> <sup>-/+</sup> mutant in <i>C. jejuni</i> 11168-O $\Delta$ <i>tlp2</i> :: <i>Er</i> <sup>R</sup>	This study
<i>C. jejuni</i> 11168-O $\Delta$ <i>tlp4</i> :: <i>Cm</i> <sup>R</sup> $\Omega$ <i>tlp4</i> :: <i>Km</i>	Complemented <i>tlp4</i> <sup>-/+</sup> mutant in <i>C. jejuni</i> 11168-O $\Delta$ <i>tlp4</i> :: <i>Cm</i> <sup>R</sup>	This study
<i>C. jejuni</i> 11168-O $\Delta$ <i>tlp3</i> :: <i>aphA3</i> $\Omega$ <i>tlp3</i> :: <i>cat</i>	Complemented <i>tlp3</i> <sup>-/+</sup> mutant in <i>C. jejuni</i> 11168-O $\Delta$ <i>tlp3</i> :: <i>Km</i>	[2,3]
<i>E. coli</i> BL21(DE3)	F <sup>-</sup> <i>ompT hsdS<sub>B</sub></i> (r <sub>B</sub> <sup>-</sup> m <sub>B</sub> <sup>-</sup> ) <i>gal dcm</i> (DE3)	Novagen
<i>E. coli</i> DH5 $\alpha$	F <sup>-</sup> , $\phi$ 80 <i>dlacZ</i> $\Delta$ M15, $\Delta$ ( <i>lacZYA-argF</i> )U169, <i>deoR</i> , <i>recA1</i> , <i>endA1</i> , <i>hsdR17</i> (rK <sup>-</sup> , mK <sup>+</sup> ), <i>phoA</i> , <i>supE44</i> , $\lambda$ <sup>-</sup> , <i>thi-1</i> , <i>gyrA96</i> , <i>relA1</i>	[3]
pGEM-T Easy	Cloning vector	Promega
pET-19b	His-tag expression vector	Novagen
pGU0504	<i>tlp2</i> <sup>peri</sup> cloned into pGEM-T Easy	This study
pGU0706	<i>tlp4</i> <sup>peri</sup> cloned into pGEM-T Easy	This study
pGU0505	<i>tlp2</i> <sup>peri</sup> cloned into pET-19b	This study
pGU0707	<i>tlp4</i> <sup>peri</sup> cloned into pET-19b	This study
pGU0816	<i>tlp3</i> <sup>peri</sup> cloned into pET-19b	[2]
pGU0817	Tlp3 <sup>LB</sup> DK149A	This study
pGU0818	Tlp3 <sup>LB</sup> DW151A	This study
pGU0819	Tlp3 <sup>LB</sup> DD169A	This study
pGU0820	Tlp3 <sup>LB</sup> DT170A	This study
pGU0821	Tlp3 <sup>LB</sup> DD196A	This study
pGU0510	$\Delta$ <i>tlp2</i> :: <i>Er</i> <sup>R</sup> cloned into pGEM-T Easy	This study

pGU0720	$\Delta tlp4::Cm^R$ cloned into pGEM-T Easy	This study
pGU0817	$\Delta tlp3::Km^R$ cloned into pGEM-T Easy	[2]
pK46 $tlp2$	pK46: $tlp2^{peri}$	This study
pK46 $tlp4$	pK46: $tlp4^{peri}$	This study
pK46	<i>C. jejuni</i> cj0046 pseudogene integration vector; $Km^R$	[2,4]

**Table S7.** Primers used in this study.

Primer name	Sequence 5'-3'	Restriction Site	Reference
Tlp2 <sup>LBD</sup> Forward	<u>CATATGCAAGCAATTTTTTCATGAAGTTGTGA</u>	NdeI	This study
Tlp2 <sup>LBD</sup> Reverse	<u>CTCGAGTTATAAACTGGAGCTTCTATTTGTT</u>	XhoI	This study
Tlp2 Forward	<u>CATATGAAAAGCGTAAAATTG</u>	NdeI	This study
Tlp2 Reverse	<u>CTCGAGTTAAAACCTCTTCTTCTTAACATC</u>	XhoI	This study
Tlp2_invMUT Forward	<u>AGATCTCTGCAGCAGCTTTAGAAGAG</u>	BglIII	This study
Tlp2_invMUT Reverse	<u>AGATCTGCCGCAAGAATATCTACAGC</u>	BglIII	This study
Tlp4 <sup>LBD</sup> Forward	<u>CTCGAGGATTCGAGAAACAATACATATGAATT</u>	XhoI	This study
Tlp4 <sup>LBD</sup> Reverse	<u>CTCGAGTTGTTTCATTAAAATAGAATTAACAGC</u>	XhoI	This study
Tlp4 Forward	<u>GGTACCCAATCAATAAATTCAGG</u>	KpnI	This study
Tlp4 Reverse	<u>CTCGAGTTAAAACCTCTTCTTCTTAACATC</u>	XhoI	This study
Tlp4_invMUT Forward	<u>AGATCTCACCAAGGCGTAGATTATGC</u>	BglIII	This study
Tlp4_invMUT Reverse	<u>AGATCTTTCCAACCCATAGCGTAAGC</u>	BglIII	This study
Tlp2Com Forward	<u>ACTCGTCTCATGAAAAGCGTAAAATTG</u>	BsmBI	This study
Tlp2Com Reverse	<u>GTCCGCTCTTAAAACCTCTTCTTCTTAAC</u>	BsmBI	This study
Tlp3 Forward	<u>ATGCTAAAATAACAAAGATTAATAAG</u>	-	This study
Tlp3 Reverse	<u>AAACCTCTTCTTCTTAACATC</u>	-	This study
Tlp4Com Forward	<u>ACTCGTCTCATGCAATCAATAAATTCAGG</u>	BsmBI	This study
Tlp4Com Reverse	<u>GTCCGCTCTTAAAACCTCTTCTTCTTAACATC</u>	BsmBI	This study
cj0046 Forward	<u>CTCTCTCCGCTAGAAATTAATCC</u>	-	This study
Ery_ Forward (ErmCBgIII-F)	<u>AGATCTATGAACGAGAAAAATATAAAACACAG</u>	BglIII	This study
Ery Reverse (ErmCBgIII-R)	<u>AGATCTTTACTTATTAATAATTTATAGCTA</u>	BglIII	This study
Chlr_ Forward	<u>AGATCTATGATGCAATTCACAAAGATT</u>	BglIII	This study
Chlr_ Reverse	<u>AGATCTTTATTTATTCAGCAAGTCTTG</u>	BglIII	This study
Kan_ Forward	<u>AATGGCTAAAATGAGAATATC</u>	-	This study
Kan_ Reverse	<u>AAACAATTCATCCAGTAAAAT</u>	-	This study
pC46 Cat Forward	<u>ATGATGCAATTCACAAAGATT</u>	-	[2]
pC46 Cat Reverse	<u>TTATTTATTCAGCAAGTCTTG</u>	-	[2]
pK46 Kan Forward	<u>AATGGCTAAAATGAGAATATC</u>	-	[2]
pK46 Kan Reverse	<u>AAACAATTCATCCAGTAAAAT</u>	-	[2]

**Table S8** - Supplementary glycan microarray document based on MIRAGE guidelines. DOI:

10.1093/glycob/cww118.

Classification	Guidelines
<b>1. Sample: Glycan Binding Sample</b>	
Description of Sample	<p><u>Sample names:</u> Tlp2,3,and 4 proteins</p> <p><u>Origin:</u> <i>Helicobacter pylori</i> SS1; produced as a recombinant His -tagged protein in <i>E. coli</i>.</p> <p><u>Method of preparation:</u> The preparation of Tlp2,3, and 4 is explained in the Materials and Methods section: Expression and purification of the periplasmic domain of Tlp2,3, and 4.</p>
Sample modifications	Sample is a His Tagged protein containing only the periplasmic receptor domain of the full length Tlp2,3, and 4 transmembrane protein.
Assay protocol	<p><i>Please see Materials and Methods: Tlps 2/3/4 bind to a range of ligands, including glycans and amino acids</i></p> <p>Proteins were complexed with mouse anti-his antibody, with secondary and tertiary AlexaFluor555 antibodies (rabbit anti-mouse, goat anti-rabbit) at a molar ratio of 4:2:1. The protein/antibody complex was incubated on ice for 10 mins prior to placing on the array. Arrays were performed with 1 µg of complexed protein incubated on the array for 20 min. Arrays were then washed 3 times in Array PBS (PBS + 2mM MgCl<sub>2</sub> + 2mM CaCl<sub>2</sub>) then dried by centrifugation for 3 min at 300 x g. Scanning was performed using an Innopsys InnoScan 1100AL and analyzed using Mapix (Innopsys). Yes/no binding was determined by six positive replicate spots in three replicate experiments. Positive binding was determined by spots being significantly greater than negative control spots by two-tailed <i>t</i> test.</p>
<b>2.1 Glycan Library</b>	
Glycan description for defined glycans	Glycans in this study are listed in Table S2 and is a published library in doi: 10.1371/journal.pntd.0004120.
Glycan description for undefined glycans	N/A.
Glycan modifications	<p>Glycans were prepared in one of two ways for printing:</p> <p>1. Glycans (with IDs in number/letter format; e.g. 1A, 4C, 7K) were sourced commercially from Dextra Laboratories, Elicityl and Carbosynth and were made into glycoamines using the protocol published in Day et al 2009 (doi: 10.1371/journal.pone.0004927).</p>

	2. Glycans (with IDs in number only format) were obtained from Prof Nicolai Bovin and were modified with spacers as per DOI: 10.1073/pnas.0407902101. The library of these glycans was first published in DOI: 10.1016/j.molimm.2009.06.010
<b>2.2 Small molecule Library</b>	
Sample description for defined compounds	Compounds printed in the amino acid/small molecule array for this study are listed in Table 1 and Table S5.
<b>3. Printing Surface; e.g., Microarray Slide</b>	
Description of surface	Epoxy activated glass microarray slides.
Manufacturer	ArrayIt SuperEpoxy 3 (SME3).
Custom preparation of surface	N/A.
Non-covalent Immobilisation	N/A.
<b>4. Arrayer (Printer)</b>	
Description of Arrayer	<b>Glycan array:</b> SpotBot® Extreme Protein Microarray Spotter (ArrayIt, California, USA). <b>Small molecule array:</b> ArrayJet Argus Marathon non-contact printer.
Dispensing mechanism	<b>Glycan array:</b> Contact printing using 946NS6 pins with a 6 pin in a 3 columns x 2 rows configuration. <b>Small molecule array:</b> Non-contact jet printing
Glycan and small molecule deposition	<b>Glycan array:</b> Approximately 1.8 nl per spot is printed according to manufactures guidelines. Glycan were at 500 µM in 50:50 DMF:DMSO. <b>Small molecule array:</b> Approximately 320 nl per spot is printed according to manufactures guidelines. Samples were at 1000 µM in PBS with 2% glycerol
Printing conditions	<b>Glycan array:</b> Array were printed with dehumidification at a maximum humidity of 60% relative humidity (Standard laboratory starting humidity of 75-90%) at 22°C. Glycans were left to react with the slide for at least 8 hours after the print was completed. <b>Small molecule array:</b> Array were printed with dehumidification at a maximum humidity of 60% relative humidity (Standard laboratory starting humidity of 75-90%) at 22°C. Samples were left to react with the slide for at least 15 hours after the print was completed.
<b>5.1 Glycan array with “Map”</b>	

Array layout	The array consists of a single array of glycans split between 6 pins (3 columns x 2 rows) with 4500µm row and column spacing. Each pin printed a 20 columns x 16 rows with 200µm spot spacing (centre to centre) with a minimum spot size of 100µm. Each sample is printed in quadruplicate with each of the 6 print areas including at least three negative control samples (print solution only) and two positive control samples consisting of one sample of fluoroscienamine and one sample of a mixture of rabbit anti-mouse antibody labeled with Alexa 555 and Alexa 647. Positive controls provide proof of successful immobilization of the amine reagents and provides for orientation for analysis. The antibodies also can provide controls for secondary antibodies used in experiments (if applicable).
Glycan identification and quality control	Arrays are quality controlled by a range of measures. 1. Each printed array is post print scanned to confirm deposition of the glycans on the array surface prior to neutralization of the remaining slide surface. 2. Post neutralized slides are scanned again to monitor for remaining autofluorescence. 3. Slides are assayed with fluorescently labeled lectins: WGA-Texas Red (EY Laboratories) and ConA-FITC (EY Laboratories).
<b>5.2 Small molecule array with “Map”</b>	
Array layout	The array consists of triplicate sub-arrays of amino acids and small molecules (24 rows x 10 columns) with 400µm spot spacing (centre to centre) with a minimum spot size of 100µm. Each sample is printed six times, with each of the 3 sub-arrays including at least six negative control samples (print solution only) and a positive control samples consisting of one a mixture of rabbit anti-mouse antibody labeled with Alexa 555 and Alexa 647. Positive controls provide proof of successful immobilization of the amine reagents and provides for orientation for analysis.
Sample identification and quality control	Arrays are quality controlled by a range of measures. 1. Each printed array is post print scanned to confirm deposition of the samples on the array surface prior to neutralization of the remaining slide surface. 2. Post neutralized slides are scanned again to monitor for remaining autofluorescence.
<b>6. Detector and Data Processing</b>	
Scanning hardware	Inopsys InnoScan 1100AL (Lasers: 488 nM, 532 nM with two filter sets for analysis at 532 and 595 nM), 635 nM) scanner.
Scanner settings	Scanning resolution: 10µM Laser channel: 532nM operating 595nM excitation / 625nM emission filter set. PMT: 20% gain Scan powers: Low laser power.
Image analysis software	Innopsys MAPIX.
Data processing	Data was exported as a CSV file and exported to Microsoft Excel.
<b>7. Glycan Microarray Data Presentation</b>	
Data presentation	Glycan array: Data is presented as yes/no binding in Table 1. The full list of glycans is shown in Table S5.
<b>8. Interpretation and Conclusion from Microarray Data</b>	

Data interpretation	<p><b>Glycan arrays:</b> We only use glycan arrays as a yes/no binding tool. Due to this we look only at binding that is unambiguously above background vs lack of binding above background. Average background + 3x standard deviation of the background of 20 sets of 4 spots of DMF:DMSO only spots is applied to determine if binding observed is significantly above background. Only spots with values equal to or greater than this value were considered as binding from data of any tested slide. These values are slide dependent.</p> <p><b>Small molecule arrays:</b> We only use amino acid arrays as a yes/no binding tool. Due to this we look only at binding that is unambiguously above background vs lack of binding above background. Average background + 3x standard deviation of the background of 6 spots of PBS + 2% glycerol only spots is applied to determine if binding observed is significantly above background. Only spots with values equal to or greater than this value were considered as binding from data of any tested slide. These values are slide dependent.</p>
Conclusions	Tlp2, Tlp3 and Tlp4 are a paralogue family of dCache_1 chemoreceptors which capable of responding to carbohydrates including complex glycans as well as to organic and amino acids

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