

Supplementary material ‘**Comparative genomics and genome biology of invasive**

Campylobacter jejuni’

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Legends

Figure S1. Phylogenomic overview of 106 *C. jejuni* strains, including 55 *C. jejuni* strains belonging to the ST677CC lineage described in this study. Strains belonging to ST21CC (15 strains) are shaded green with reference strain 11168 bold-faced. Strains belonging to ST45CC (three strains) and ST283CC (strain 81116 only) are shaded red with reference strain 4031 bold-faced. The ST677CC strains (63 strains) are shaded blue and two strains (faecal strains 524 and 542) representing the two major STs (ST-677 and ST-794) belonging to this lineage are bold-faced. Due to the homogeneity in large parts of ST677CC, the majority of labels were removed to enhance clarity of the figure.

Five strains (255, 414, 1336, 30318 and K1) did not belong to any lineage and are black and bold-faced. The remaining strains belonged to ten different lineages, which are shaded as follows: ST22CC, orange (strains BJ-CJD101 and HB93-13); ST42CC, light green (strain 81-176); ST52CC, pink (strains 10186, 20176 and CG8421); ST353CC (strain R14) and ST354CC (strains RM1221 and S3), purple; ST362CC, teal (strains 260.94, HN-CJD07035, ICDCJ07001 and ICDCJ07002); ST403CC (strain ATCC33560) and ST460CC (strain

10227), light red; ST464CC, light green (strain Cj5) and ST574CC, yellow (strains 30286, CG8486 and Cj3).

Figure S2. Core genome analysis of 63 *C. jejuni* ST677CC strains. Number 1 represents the ST-794 strains; number 2 represents the ST-677 strains and includes one strain (OXC8290) typed as ST-6514, shaded purple. The Harvest suite tool Parsnp (<http://harvest.readthedocs.org/en/latest/content/parsnp.html>, last accessed on 22/04/2015) was used for core genome determination.

Figure S3. HS4 capsule locus of 55 *C. jejuni* strains belonging to the ST677CC lineage. (a) HS4 groups A-C. (b) HS4 group D.

Figure S4. Similarity of *C. jejuni* ST-794 Type III restriction modification system and *Mycoplasma* Type III RM. Number one (red arrow) represents the restriction subunit (2019 bp; 673 aa); number two (green arrow) represents the methylation subunit (1611 bp; 537 aa).

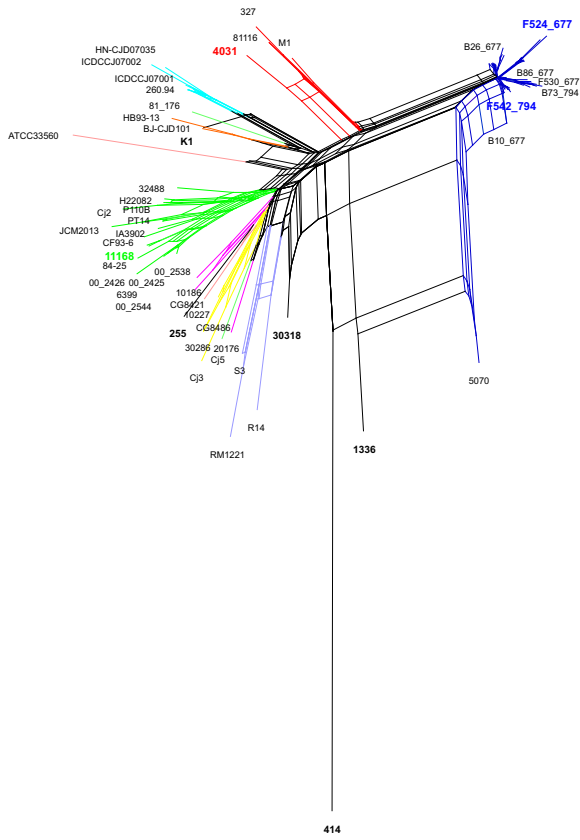
Figure S5. Artemis view of CJIE5 in ST-677 blood isolate 40. ORFs marked in yellow are considered to belong to CJIE5. The ORF marked in red represents a DNA/RNA non-specific endonuclease. Interproscan of the ORF marked in green found an adenine-specific DNA methylase signature, a Type III res subunit, and a DEAD-like helicase superfamily C-terminal domain.

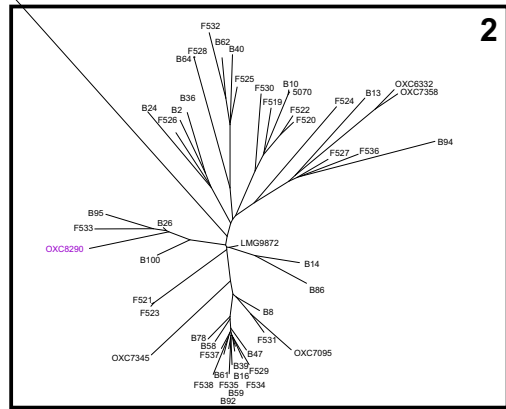
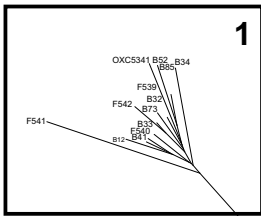
Table S1. List of species included in our ϵ -proteobacterial database for orthology querying.

Table S2. BlastP results of the ST-794 Type III res subunit against the Concise Microbial

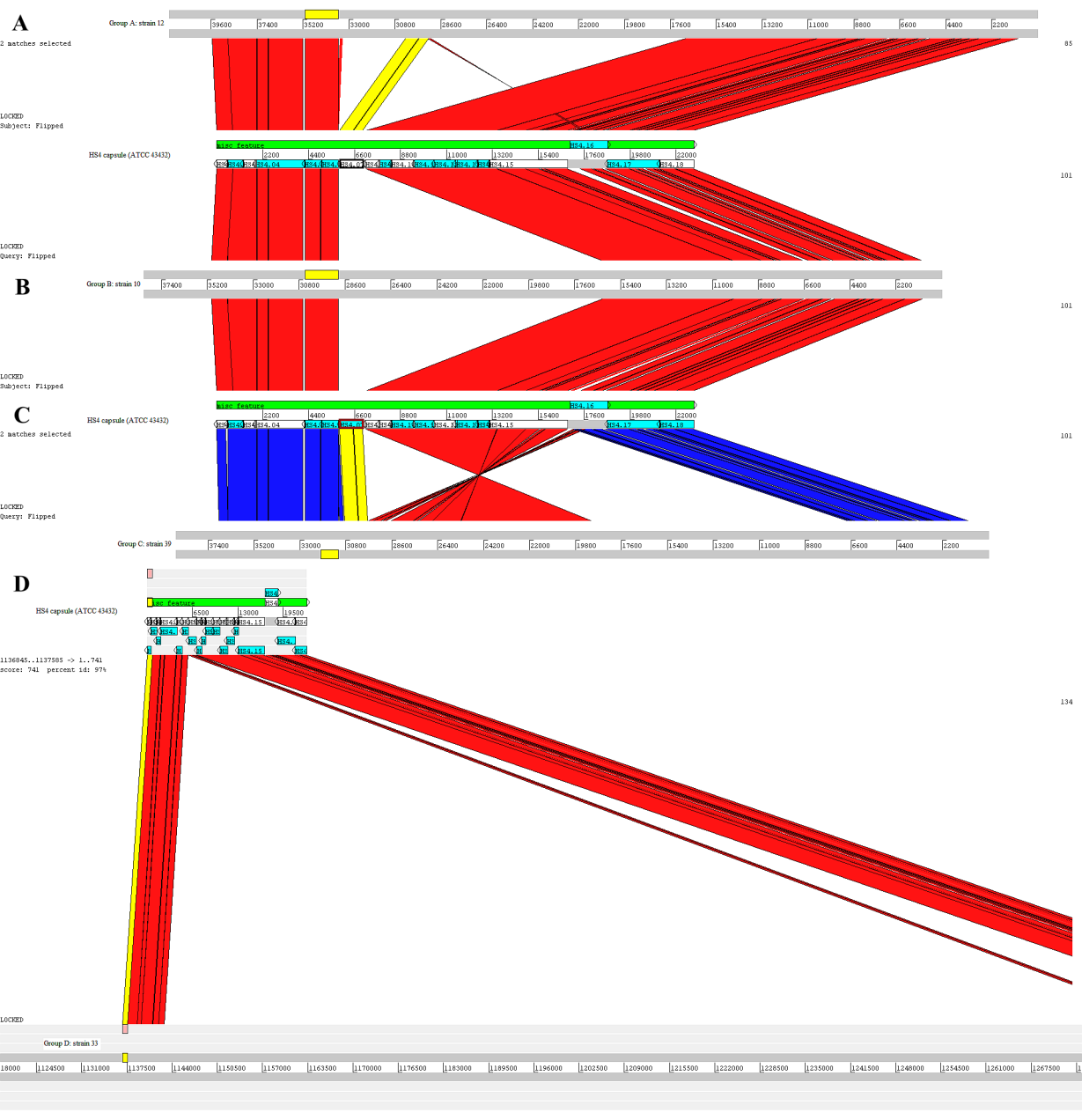
Protein Database

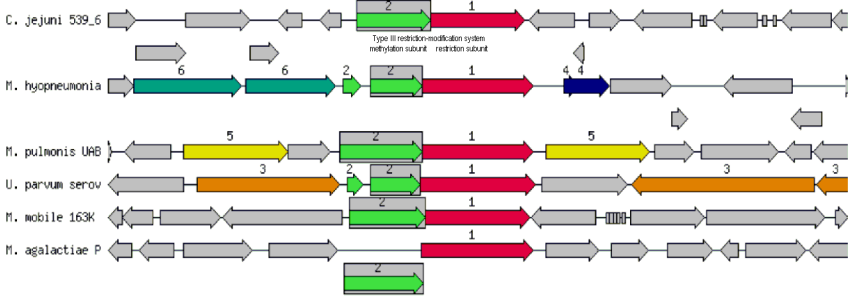
Table S3. Accession numbers of the whole genome sequences of 55 *C. jejuni* strains isolated from human blood (n=31; strains 2-100) and faeces (n=24; strains 519-542).

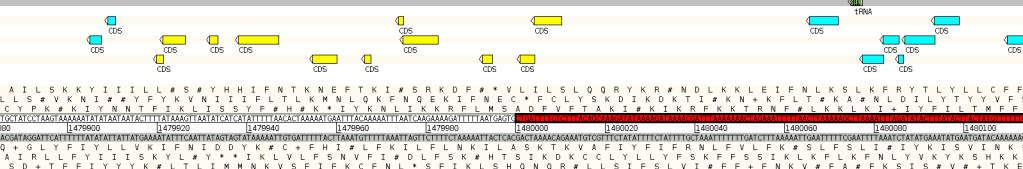
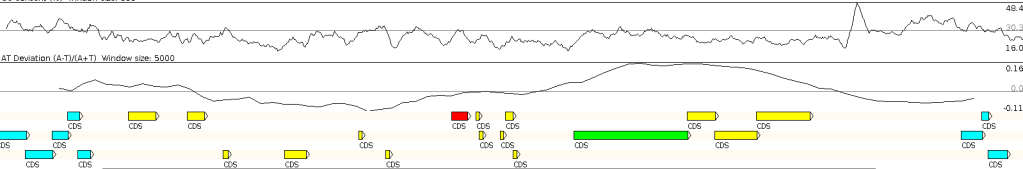




0.002







A I L S K K Y I I I L L # S # Y H H I F N T L K N E F T K I # S R K D F # * V L I L S L Q Q R Y K R # N D L K K L E I F N L K S L K F R Y T L Y L L C F F
 L L S # V K N I # # Y F L K V N I I I F L T L K M N L Q K F N Q E K I F N E C # F C L Y S K D I K D K T I # K N + K F L T # K A # N L D I L Y T Y V F F
 C Y P K # K I Y N T N T F I K L I S S Y F # H # K * I Y K N L I K R F L M S A D F V F T A K I # K I K R F K K T R N F # L K K L K I + I Y F I L T M F F
 T G T A C T C A A G T A A A A A T A T A T A A T A A C T T T T A A A G T A A T A T C A T C A T A T T T T A A C A C T A A A A A T G A T T T A C A A A A T T T A A T C A A G A A A G A T T T T A T G A G T G
 A C C A T A G G A T C A T T T T A T A T A T T A T T A G A A A T T C A A T T A T A G A T A T A A A A T T G T G A T T T A C T A A A T G T T T T C A A A A T T A C T C A G C A C T A A A C A G A A A T G T G T T C T A T A T T T C T A T T T G C T A A A T T T T T G A T C T T A A A A A T G A A T T T T C G A A T T T A A A T C T A T A G A A A T A G A T A C A A A A A A
 A + G L Y F I Y L L V K I F N I D D Y K # C + F H I # L F K I L F L N K I L A S K T K V A F I Y F I F R N L F V L F K # S L F S L I # I Y K I S V N K
 Q I R L L F Y I I I S K Y L # Y * I K L V L F S N V F I # D L F S K # H T S I K D K C C L Y L L F S K F F S S I K L F L K I I Y V Y K Y S H K K
 S D + T F F I Y Y Y K # L T L I M M N K V S F I F K C F N L # S F I K L S H Q N Q R # L L S I F S L V I # F F + F N K V # F A # F K S I S # V # + T K F

misc feature	1480300	1512500	
CDS	1480181	1480486	c FIG00638667: hypothetical protein
CDS	1481056	1482186	Integrase
CDS	1482232	1482504	c hypothetical protein
CDS	1482504	1483427	c hypothetical protein
CDS	1483543	1484235	c hypothetical protein
CDS	1484475	1484795	c hypothetical protein
CDS	1485042	1485236	IncF plasmid conjugative transfer protein TraG
CDS	1485684	1487369	c hypothetical protein
CDS	1487629	1488524	c hypothetical protein
CDS	1488832	1489039	c FIG00471674: hypothetical protein
CDS	1490765	1490690	c hypothetical protein
CDS	1491010	1491252	c hypothetical protein
CDS	1491918	1492046	c hypothetical protein
CDS	1492442	1492633	c conserved hypothetical protein
CDS	1492626	1494083	c conserved hypothetical protein
CDS	1494689	1495338	DNA/RNA non-specific endonuclease
CDS	1495711	1495833	c hypothetical protein
CDS	1495859	1495872	c hypothetical protein
CDS	1495978	1496391	c FIG00469006: hypothetical protein

Table S1. List of species included in our ϵ -proteobacterial database for orthology querying.

Species	Strain	<i>crp</i>†	<i>crp</i> locus tag/Accession
<i>Campylobacter coli</i>	RM2228*	1, 2	1) CCO0558 2) CCO0137
<i>Campylobacter coli</i>	BIGS0002*	1, 2	
<i>Campylobacter coli</i>	BIGS0015*	1, 2	
<i>Campylobacter coli</i>	BIGS0019*	1, 2	
<i>Campylobacter coli</i>	BIGS0023*	1, 2	
<i>Campylobacter coli</i>	BIGS0024*	1, 2	
<i>Campylobacter coli</i>	BIGS0025*	1	
<i>Campylobacter coli</i>	BIGS0001**	1, 2	
<i>Campylobacter coli</i>	BIGS0010**	1, 2	
<i>Campylobacter coli</i>	BIGS0011**	1, 2	
<i>Campylobacter coli</i>	BIGS0012**	1	
<i>Campylobacter coli</i>	BIGS0003***	1,2	
<i>Campylobacter coli</i>	BIGS0008***	1, 2	
<i>Campylobacter coli</i>	76339††***	1, 2	1) BN865_16100c 2) BN865_04590c
<i>Campylobacter jejuni</i> subsp. <i>doylei</i>	269.97	1	JJD26997_1473
<i>Campylobacter jejuni</i> subsp. <i>doylei</i>	ATCC 49349	1	T374_RS0103500
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	NCTC 11168	1	Cj0466 (<i>nssR</i>)
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	81-176	1	CJJ81176_0491
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	81116	1	C8J_0439
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	RM1221	1	CJE0516
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	ATCC 33560	1	cje135_01931
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	00-2425	1	N135_00514
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	00-2426	1	N564_00448
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	00-2538	1	N565_00499
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	00-2544	1	N755_00497
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	10186	1	N194_06230
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	10227	1	L084_05505
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	1336	1	C1336_000070034
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	20176	1	N195_09090
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	255	1	L034_06335
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	260.94	1, 2	1) CJJ26094_0773 2) CJJ26094_0107
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	30286	1	N196_02170
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	30318	1	N212_08750
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	32488	1	M635_06665
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	327	1	CSU_1663
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	4031	1	BN867_04360
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	414	1	C414_000090034
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	6399	1	WP_002851096
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	84-25	1	CJJ8425_0490
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	BJ-CJD101	1	J431_1419

<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	CF93-6	1	CJJCF936_0492
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	CG8421	1	Cj8421_0467
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	CG8486	1	Cj8486_0457
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	Cj2	1	N215_03885
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	Cj3	1	N216_06955
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	Cj5	1	N213_08600
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	g113	1	K696_RS0102290
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	H22082	1	CJJH22082_RS0104305
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	HB93-13	1	CJJHB9313_0476
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	HN-CJD07035	1, 2	1) J432_1615 2) J432_1025
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	IA3902	1	CJSA_0436
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	ICDCCJ07001	1, 2	1) ICDCCJ07001_426 2) ICDCCJ07001_78
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	ICDCCJ07002	1, 2	1) H840_1673 2) H840_1029
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	JCM2013	1	JCM2013_RS00825
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	K1	1, 2	1) N217_06470 2) N217_08280
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	LMG 9872	1, 2	1) Cje89_033337 2) Cje89_02922
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	M1	1	CJM1_0448
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	OXC5341	1, 2	
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	OXC6332	1, 2	
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	OXC7095	1, 2	
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	OXC7345	1, 2	
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	OXC7358	1, 2	
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	OXC8290	1, 2	
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	P110B	1	CJJP110B_RS0104305
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	PT14	1	A911_02275
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	R14	1	H730_02910
<i>Campylobacter jejuni</i> subsp. <i>jejuni</i>	S3	1	CJS3_0458
<i>Campylobacter fetus</i> subsp. <i>fetus</i>	82-40	2, 3	2) CFF8240_0798 3) CFF8240_0428
<i>Campylobacter fetus</i> subsp. <i>testudinum</i>	03-427	2, 3	2) CFT03427_0437; CFT03427_1019 3) CFT03427_0790
<i>Campylobacter fetus</i> subsp. <i>venerealis</i>	cfvi03/293	2, 3	2) CFVI03293_0425 3) CFVI03293_0951
<i>Campylobacter fetus</i> subsp. <i>venerealis</i>	NCTC 10354	2, 3	2) CFV354_0489 3) CFV354_0872
<i>Campylobacter lari</i>	RM2100	1, 2	1) Cla_0689 2) Cla_1155
<i>Campylobacter concisus</i>	13826	3	CCC13826_1550
<i>Campylobacter concisus</i>	ATCC 51561	3	ATCC51561_651

<i>Campylobacter concisus</i>	ATCC 51562	2, 3	2) ATCC51562_1399 3) ATCC51562_365
<i>Campylobacter concisus</i>	UNSWCD	3	UNSWCD_209
<i>Campylobacter curvus</i>	525.92	3	CCV52592_0436
<i>Campylobacter curvus</i>	DSM6644	2, 3	2) C514_RS0107125 3) C514_RS0105485
<i>Campylobacter upsaliensis</i>	DSM5365	2	Q327_RS0102540
<i>Campylobacter upsaliensis</i>	JV21	2	HMPREF9400_0311
<i>Campylobacter upsaliensis</i>	RM3195	2	CUP0987
<i>Arcobacter butzleri</i>	ED1	3	ABED_0342; ABED_1940
<i>Arcobacter butzleri</i>	JV22	3	HMPREF9401_0465; HMPREF9401_1276
<i>Arcobacter butzleri</i>	RM4018	3	Abu_0367
<i>Helicobacter pylori</i>	26695	-	
<i>Helicobacter pylori</i>	HPAG1	-	
<i>Helicobacter pylori</i>	J99	-	
<i>Helicobacter pylori</i>	PeCan18	-	
<i>Helicobacter acinonychis</i>	Sheeba	-	
<i>Helicobacter bilis</i>	ATCC 43879	1, 2	1) HRAG_01781 2) HRAG_00942
<i>Helicobacter bilis</i>	ATCC 51630	1	T368_RS0107190
<i>Helicobacter bizzozeronii</i>	CIII1	-	
<i>Helicobacter canadensis</i>	MIT98-5491	1, 2, 3	1) HCMG_01580 2) HCMG_01531 3) HCMG_00288
<i>Helicobacter cetorum</i>	00-7128	-	
<i>Helicobacter cetorum</i>	MIT99-5656	-	
<i>Helicobacter cinaedi</i>	ATCC BAA-847	1, 2, 3	1) HCBAA847_1282 2) HCBAA847_2282 3) HCBAA847_0807
<i>Helicobacter cinaedi</i>	CCUG18818	1, 2, 3	1) HCCG_01607 2) HCCG_00684 3) HCCG_01135
<i>Helicobacter cinaedi</i>	PAGU611	1, 2, 3	1) HCN_0709 2) HCN_2022 3) HCN_1161
<i>Helicobacter hepaticus</i>	ATCC 51449	1, 2, 3	1) HH0166 2) HH1150 3) HH0012
<i>Helicobacter mustelae</i>	12198	-	
<i>Helicobacter pullorum</i>	MIT98-5489	1, 2	1) HPMG_00981 2) HPMG_01899
<i>Helicobacter winghamensis</i>	ATCC BAA-430	1, 2	1) HWAG_00610 2) HWAG_00492
<i>Sulfurimonas denitrificans</i>	DSM1251	3	Suden_1312/_1296/_1512

Wolinella succinogenes

DSM1740

1, 3

1) WS1193

3) WS0913 (*dnr*)/WS1181

*Clade 1 *C. coli* (Sheppard *et al.* 2008, 2013)

**Clade 2 *C. coli* (Sheppard *et al.* 2008, 2013)

***Clade 3 *C. coli* (Sheppard *et al.* 2008, 2013)

†*crp*: 1) *Cj0466*-like; 2) ST677CC-like; 3) Other; -) absent

††Skarp-de Haan *et al.* 2014

****Strain belonging to the Oxfordshire sentinel surveillance scheme for human campylobacteriosis in Oxfordshire, UK. Deposited in the PubMLST database at pubmlst.org/campylobacter

Table S2. BlastP results of the ST-794 Type III res subunit against the Concise Microbial Protein Database

Organism	Accession	Length (aa)	Locus tag	E-value	Score
<i>C. jejuni</i> strain 539	CP010457	672	RC45_08390	-	-
<i>Helicobacter acinonychis</i> str. Sheeba	YP_664513	673	Hac_0712	0	633.26
<i>Mycoplasma conjunctivae</i> HRC/581	YP_002960738	819	MCJ_002240	2.77785e-30	129.835
<i>Mycoplasma agalactiae</i> PG2	YP_001256295	807	MAG_1520	2.16259e-20	100.737
<i>Aggregatibacter aphrophilus</i> NJ8700	YP_003007037	762	NT05HA_0537	5.02033e-12	74.4441
<i>Parabacteroides distasonis</i> ATCC 8503	YP_001303488	781	BDI_2135	7.606e-12	74.0935
<i>Streptobacillus moniliformis</i> DSM 12112	YP_003306730	751	Smon_1418	5.92191e-11	71.2889
<i>Herminiimonas arsenicoxydans</i>	YP_001099019	840	HEAR0698	1.51159e-06	57.2659
<i>Eubacterium rectale</i> ATCC 33656	YP_002937217	887	EUBREC_1323	0.000273293	50.2544
<i>Bradyrhizobium</i> sp. ORS 278	YP_001203507	824	BRADO1376	0.000763836	48.8521
<i>Bacillus cereus</i> B4264	YP_002365706	892	BCB4264_A0973	0.00134965	48.151
<i>Xanthomonas campestris</i> pv. <i>campestris</i> str. B100	YP_001902467	882	xccb100_1061	0.00564767	46.0475

Table S3. Accession numbers of the whole genome sequences of 55 *C. jejuni* strains isolated from human blood (n=31; strains 2-100) and faeces (n=24; strains 519-542).

Strain	Accession
2	CP010472
8	CP010465
10	CP010478
12	CP010487
13	CP010461
14	CP010502
16	CP010481
24	CP010467
26	CP010470
32	CP010496
33	CP010497
34	CP010484
36	CP010479
39	CP010503
40	CP010510
41	CP010482
47	CP010459
52	CP010505
58	CP010460
59	CP010494
61	CP010511
62	CP010493
64	CP010468
73	CP010475
78	CP010507
85	CP010504
86	CP010485
92	CP010488
94	CP010464

95	CP010486
100	CP010462
519	CP010471
520	CP010501
521	CP010476
522	CP010463
523	CP010508
524	CP010480
525	CP010469
526	CP010477
527	CP010506
528	CP010500
529	CP010491
530	CP010489
531	CP010492
532	CP010490
533	CP010458
534	CP010473
535	CP010483
536	CP010474
537	CP010498
538	CP010495
539	CP010457
540	CP010509
541	CP010466
542	CP010499
