

**Source Data
Supplementary Table 1**

The number of reads in the denoise process

sample-id	input	primer-removed	percentage of input primer-removed	filtered	percentage of input passed filter	denoised	non-chimeric	percentage of input non-chimeric
#q2:types	numeric	numeric	numeric	numeric	numeric	numeric	numeric	numeric
ct_01	37522	33293	88.73	27184	72.45	26186	26164	69.73
ct_02	33914	29980	88.4	24962	73.6	24200	24112	71.1
ct_03	35926	31820	88.57	26328	73.28	25748	25736	71.64
ct_04	38215	33790	88.42	27285	71.4	26255	26221	68.61
ct_05	36770	32693	88.91	26774	72.81	25812	25778	70.11
ct_06	41543	37021	89.11	30239	72.79	28866	28756	69.22
ct_07	38541	34168	88.65	27836	72.22	26813	26775	69.47
ct_08	67445	59452	88.15	45031	66.77	39575	38602	57.23
ct_09	34066	30453	89.39	22787	66.89	19709	19609	57.56
ct_10	32402	28941	89.32	22813	70.41	21400	21358	65.92
ct_11	39857	35678	89.52	28059	70.4	26116	26057	65.38
ct_12	40667	36169	88.94	28845	70.93	27268	27128	66.71
ct_13	36456	32526	89.22	25252	69.27	23339	23321	63.97
ct_14	40395	36256	89.75	29940	74.12	28911	28911	71.57
ct_15	43830	39114	89.24	32029	73.08	31047	31045	70.83
ct_16	36519	31960	87.52	26769	73.3	26416	26310	72.04
ct_17	44820	40308	89.93	32172	71.78	29668	29420	65.64
ct_18	38911	34759	89.33	27056	69.53	24272	24242	62.3
ct_19	41452	36694	88.52	30531	73.65	29972	29595	71.4
ct_20	49250	44161	89.67	36761	74.64	35582	35238	71.55
ct_21	43898	38982	88.8	31849	72.55	30757	30602	69.71
ct_22	32507	29120	89.58	23715	72.95	22783	22722	69.9
ct_23	32560	28573	87.75	21923	67.33	21002	20920	64.25
ct_24	42348	36955	87.27	29166	68.87	28279	28223	66.65
ct_25	28865	25427	88.09	18882	65.41	16783	16750	58.03
ct_26	36562	31852	87.12	25226	69	24568	24450	66.87
ct_27	35590	31030	87.19	24446	68.69	23845	23843	66.99
ct_28	41060	36020	87.73	26696	65.02	24454	24151	58.82
ct_29	35631	31260	87.73	24381	68.43	23581	23551	66.1
ct_30	33667	29489	87.59	23273	69.13	22755	22643	67.26
ct_31	50220	44140	87.89	35583	70.85	34900	34892	69.48
ct_32	50058	43883	87.66	35036	69.99	34313	34006	67.93
ct_33	50304	44021	87.51	33150	65.9	31082	29810	59.26
ct_34	43463	37609	86.53	28315	65.15	27110	26868	61.82
ct_35	40169	35299	87.88	27453	68.34	26458	26296	65.46
ct_36	38872	34240	88.08	26182	67.35	24922	24918	64.1
ct_37	43707	38513	88.12	28328	64.81	22186	21697	49.64
ct_38	46058	40681	88.33	31461	68.31	26740	25666	55.73
ct_39	46100	40902	88.72	31136	67.54	25666	23950	51.95
ct_40	37105	32858	88.55	23849	64.27	18752	18009	48.54
hp_01	35162	31379	89.24	25108	71.41	23627	23573	67.04
hp_02	37854	33936	89.65	28372	74.95	27391	27345	72.24
hp_03	45044	40001	88.8	33736	74.9	33284	33218	73.75

hp_04	42065	37712	89.65	31473	74.82	30397	30319	72.08
hp_05	39873	35624	89.34	30242	75.85	29793	29758	74.63
hp_06	46861	41642	88.86	34928	74.54	34566	34557	73.74
hp_07	57517	51192	89	42983	74.73	42663	41414	72
hp_08	32761	29309	89.46	24446	74.62	23865	23854	72.81
hp_09	39428	35285	89.49	29593	75.06	29067	28916	73.34
hp_10	35538	32055	90.2	26181	73.67	25098	25089	70.6
hp_11	39058	34949	89.48	29124	74.57	28367	28361	72.61
hp_12	33137	29744	89.76	22924	69.18	21148	20869	62.98
hp_13	53945	47914	88.82	37005	68.6	34703	33336	61.8
hp_14	32396	29047	89.66	24615	75.98	24308	24263	74.9
hp_15	26708	23869	89.37	20039	75.03	19585	19571	73.28
hp_16	40069	35746	89.21	29625	73.93	28802	28500	71.13
hp_17	34594	30940	89.44	25784	74.53	24995	24972	72.19
hp_18	34466	31114	90.27	25516	74.03	24684	24617	71.42
hp_19	42658	38302	89.79	32089	75.22	31379	31076	72.85
hp_20	74166	66332	89.44	56242	75.83	54193	54183	73.06
hp_21	57656	51203	88.81	40629	70.47	37917	37857	65.66
hp_22	41747	36539	87.52	30186	72.31	29404	29334	70.27
hp_23	49356	43203	87.53	35050	71.01	33769	33298	67.46
hp_24	42299	37544	88.76	29399	69.5	26829	26788	63.33
hp_25	47592	42022	88.3	33404	70.19	31254	30875	64.87
hp_26	34089	30285	88.84	23759	69.7	21564	21479	63.01
hp_27	46811	41409	88.46	33284	71.1	31949	31720	67.76
hp_28	50239	44497	88.57	34181	68.04	30345	30114	59.94
hp_29	33203	29562	89.03	23648	71.22	22034	21947	66.1
hp_30	44007	39196	89.07	32160	73.08	31130	31041	70.54
hp_31	43362	38698	89.24	31211	71.98	29916	29836	68.81
hp_32	36534	32713	89.54	25643	70.19	23651	23552	64.47
hp_33	41449	37051	89.39	29281	70.64	27115	27113	65.41
hp_34	61653	54890	89.03	45003	72.99	43774	43257	70.16
hp_35	54245	48508	89.42	39165	72.2	37207	37201	68.58
hp_36	38873	34544	88.86	26678	68.63	24010	23551	60.58
hp_37	38979	34703	89.03	28174	72.28	27230	27203	69.79
hp_38	48176	42637	88.5	33594	69.73	31193	30992	64.33
hp_39	36411	32425	89.05	25496	70.02	23493	23119	63.49
hp_40	43795	38864	88.74	31742	72.48	30766	30694	70.09
hp_41	38025	33994	89.4	28277	74.36	27342	24903	65.49
hp_42	39380	35507	90.17	29863	75.83	28038	27444	69.69
hp_43	31704	28620	90.27	24622	77.66	24178	23924	75.46
hp_44	28268	25820	91.34	22020	77.9	21608	21358	75.56
hp_45	27466	24732	90.05	20886	76.04	20194	19876	72.37
hp_46	40935	37001	90.39	30898	75.48	29330	29041	70.94
hp_47	47360	41306	87.22	32102	67.78	31499	31489	66.49
hp_48	38971	34018	87.29	26557	68.15	25855	25804	66.21
hp_49	40906	36067	88.17	26545	64.89	23399	23126	56.53
hp_50	65950	57606	87.35	45273	68.65	44436	44153	66.95
hp_51	61204	53382	87.22	42118	68.82	41110	40975	66.95
hp_52	33976	30484	89.72	25426	74.84	24748	24748	72.84
ta_01	42518	37588	88.4	28094	66.08	25535	25318	59.55
ta_02	33496	29447	87.91	24427	72.93	24037	24005	71.67

ta_03	30245	26791	88.58	21791	72.05	20898	20878	69.03
ta_04	34115	30325	88.89	24080	70.58	23056	22991	67.39
ta_05	34709	30627	88.24	25387	73.14	24800	24800	71.45
ta_06	36388	32252	88.63	26634	73.19	25993	25932	71.27
ta_07	32465	28732	88.5	23770	73.22	23339	22750	70.08
ta_08	33684	29828	88.55	24391	72.41	23645	23643	70.19
ta_09	40647	36211	89.09	30097	74.04	29557	29545	72.69
ta_10	36422	32487	89.2	26909	73.88	26286	26145	71.78
ta_11	43881	39036	88.96	32096	73.14	31122	31037	70.73
ta_12	55995	49865	89.05	40682	72.65	39198	38946	69.55
ta_13	36463	32484	89.09	26825	73.57	25805	25775	70.69
ta_14	40711	36311	89.19	29864	73.36	29087	29045	71.34
ta_15	35306	31377	88.87	25885	73.32	24869	24634	69.77
ta_16	53095	47080	88.67	36254	68.28	34206	33060	62.27
ta_17	35233	31369	89.03	25828	73.31	25144	25144	71.36
ta_18	49404	43654	88.36	35412	71.68	33745	32795	66.38
ta_19	64415	56450	87.63	44983	69.83	43707	42928	66.64
ta_20	43053	38161	88.64	31755	73.76	31164	30758	71.44
ta_21	56589	50257	88.81	41806	73.88	40942	40687	71.9
ta_22	60847	54037	88.81	45239	74.35	44662	44130	72.53
ta_23	70549	62803	89.02	51044	72.35	49018	48395	68.6
ta_24	52154	46668	89.48	36014	69.05	34477	33959	65.11
ta_25	61503	54626	88.82	44955	73.09	44004	43681	71.02
ta_26	50887	45135	88.7	37622	73.93	36925	36752	72.22
ta_27	54905	48959	89.17	41189	75.02	40573	40363	73.51
ta_28	73796	65020	88.11	54916	74.42	54402	54259	73.53
ta_29	60707	53799	88.62	45320	74.65	44892	44726	73.68
ta_30	62204	55038	88.48	46391	74.58	46001	45909	73.8
ta_31	55680	49415	88.75	40585	72.89	40029	39519	70.98
ta_32	52491	46867	89.29	37531	71.5	36351	36031	68.64
ta_33	49791	44319	89.01	36936	74.18	36401	36178	72.66
ta_34	45159	40261	89.15	33929	75.13	33343	33171	73.45
ta_35	44634	39882	89.35	32188	72.12	31394	31162	69.82
ta_36	54525	48555	89.05	39866	73.12	39196	38434	70.49
ta_37	55261	49149	88.94	40697	73.65	40092	39769	71.97
ta_38	56888	50590	88.93	42430	74.59	42015	41618	73.16
ta_39	48910	43588	89.12	35360	72.3	34659	34405	70.34
ta_40	48137	42952	89.23	35795	74.36	35322	35181	73.09
ta_41	33094	29848	90.19	24958	75.42	24199	24191	73.1
ta_42	37828	33825	89.42	27994	74	26549	26485	70.01
ta_43	29225	26415	90.38	22492	76.96	22103	22061	75.49
ta_44	41615	37562	90.26	30996	74.48	29933	29857	71.75
ta_45	39277	35261	89.78	29499	75.11	28017	27890	71.01
ta_46	34333	31031	90.38	26341	76.72	25707	25687	74.82
ta_47	34689	31263	90.12	26694	76.95	26278	26221	75.59
ta_48	29793	26921	90.36	22653	76.03	21971	21917	73.56
ta_49	33058	29709	89.87	24023	72.67	22491	22414	67.8
ta_50	31483	28134	89.36	22185	70.47	20354	20338	64.6
ta_51	34917	30928	88.58	25296	72.45	24357	23673	67.8
ta_52	31700	28322	89.34	22822	71.99	21458	21408	67.53
ta_53	40584	36467	89.86	29628	73	28368	28269	69.66

ta_54	56419	50816	90.07	40700	72.14	36376	36021	63.85
ta_55	45268	40402	89.25	32310	71.37	29803	29654	65.51
ta_56	25297	22690	89.69	19276	76.2	18898	18830	74.44
ta_57	38726	34792	89.84	27242	70.35	23783	23423	60.48
ta_58	42481	38038	89.54	29727	69.98	24779	24261	57.11
ta_59	33866	30422	89.83	25181	74.35	24322	24273	71.67
ta_60	50783	45340	89.28	35682	70.26	31545	30756	60.56

Source Data
Supplementary Table 2

LDA score of (A) the CT and the HP, as well as (B) the CT and the TA groups. The log2foldchange score of (C) the CT and the HP, (D) the CT and the TA group, and € the taxonomy annotation of genus *Fusobacterium* and *Escherichia*.

(A)

feature	enrich_group	ef_lda	pvalue	padj
s__Phocaecicola_A_858004 vulgatus	Normal	3.9742383	0.033489	0.033489005
s__Parabacteroides_B_862066 distasonis	Normal	3.3883189	0.0244958	0.02449578
s__Clostridium_T_disporicum_203972	Normal	3.3385758	0.0060173	0.006017263
s__CAG-353 sp900066885	Normal	3.2848303	0.0352358	0.035235766
s__Romboutsia_B_ilealis	Normal	3.2644467	0.0296141	0.029614108
s__Coprobacillus_cateniformis	Normal	2.6855521	0.014989	0.014988996
s__Blautia_A_141780 hansenii	hyperplastic_polyr	3.5187323	0.0183487	0.018348695
s__Ruminococcus_C_58660 sp000433635	hyperplastic_polyr	3.4176724	0.02409	0.024089998
s__UBA9414 sp003458885	hyperplastic_polyr	2.7483696	0.0359386	0.035938602
s__Veillonella_A_atypica	hyperplastic_polyr	2.5036904	0.0231883	0.023188311

(B)

feature	enrich_group	ef_lda	pvalue	padj
s__Mediterraneibacter_A_155507 lactaris	Normal	3.659995381	0.038110281	0.038110281
s__Clostridium_T chartatabidum	Normal	3.439644354	0.019262175	0.019262175
s__Romboutsia_B ilealis	Normal	3.411670759	0.01154859	0.01154859
s__CAG-177 sp003538135	Normal	2.970017481	0.027966768	0.027966768
s__CAG-273 sp003507395	Normal	2.869422579	0.047709331	0.047709331
s__Eubacterium_F sp003491505	Normal	2.688013236	0.0417682	0.0417682
s__Angelakisella massiliensis	Normal	2.675380235	0.031254517	0.031254517
s__CAG-1427 sp000435475	Normal	2.630680706	0.02464145	0.02464145
s__Mitsuokella jalaludinii	Normal	2.495371572	0.009883808	0.009883808
s__Bifidobacterium dentium	Normal	2.207486703	0.02709596	0.02709596
s__Pseudobutyricococcus sp003477405	Normal	2.204306149	0.011479409	0.011479409
s__Clostridium saccharogumia	Normal	2.185911276	0.0262721	0.0262721
s__Blautia_A_141781 caecimuris	tubular_adenom	3.539706806	0.009623695	0.009623695
s__Clostridium_Q_135822 fessum	tubular_adenom	3.179187253	0.018037018	0.018037018
s__Bacteroides_H fragilis	tubular_adenom	2.785563528	0.027760781	0.027760781
s__Schaedlerella glycyrrhizinilytica_A	tubular_adenom	2.776165718	0.02526578	0.02526578
s__Clostridium_Q_134516 symbiosum	tubular_adenom	2.178131817	0.035357896	0.035357896
s__Veillonella_A atypica	tubular_adenom	2.159582824	0.018264485	0.018264485
s__Bacteroides_H nordii	tubular_adenom	2.104284905	0.042472682	0.042472682

(C)

baseMean	log2FoldChange	lfcSE	stat	pvalue	padj
4.050646135	-2.530566161	0.458479165	-5.519479082	3.40006063578327e-08	2.36870890959568e-06
3.911996958	-1.451379087	0.420162448	-3.45432842	0.000551665	0.006782236
40.37487791	1.726690028	0.434863301	3.97065014	7.16767696630508e-05	0.001416298
10.46215843	-4.013544339	0.537771236	-7.463293065	8.43863648910906e-14	3.52735005244759e-11
3.193158726	-2.13745626	0.445799009	-4.794663552	1.62948076668396e-06	5.67602467061581e-05
3.990186685	1.582074964	0.438979188	3.603986265	0.000313374	0.004516903
1.88981589	1.142045134	0.328637693	3.475088703	0.000510684	0.006573843
4.334324903	-2.643973298	0.463634423	-5.702711374	1.17916550581712e-08	9.85782362863115e-07
6.618808391	-1.611978607	0.475212964	-3.392118334	0.000693545	0.008282907
1.942571248	-1.249996465	0.375730107	-3.326846693	0.000878347	0.009661815
112.6579625	-2.288627823	0.684286241	-3.344547478	0.000824169	0.009310885
2.058630376	1.147289613	0.312181552	3.675071783	0.000237783	0.003822812
3.219705075	1.503088384	0.356794958	4.212751189	2.52278913358316e-05	0.00064187
1.99025746	1.250541688	0.290689448	4.301985151	1.6927465806997e-05	0.000471712
4.866030118	1.602214561	0.448762472	3.570295333	0.000356579	0.004968334
4.479464345	1.456758778	0.410373347	3.549837698	0.000385469	0.005197611
4.977882303	3.194303419	0.441326809	7.237954631	4.55501748366447e-13	9.51998654085873e-11
3.723925669	-2.022156795	0.419383695	-4.821734414	1.42315347928243e-06	5.40798322127325e-05
3.402645417	-2.126449592	0.425738619	-4.994730328	5.89180369238762e-07	2.46277394341803e-05
4.817969181	-2.378771461	0.411114763	-5.786149451	7.20181458216688e-09	7.52589623836439e-07
3.767629251	-2.415512612	0.457605942	-5.278586642	1.30184107485367e-07	6.75248472992823e-06
7.30147929	-2.091652145	0.508642845	-4.1122217	3.91869714077114e-05	0.000910009
3.939222323	-2.530943226	0.475457432	-5.323175235	1.01971426204487e-07	6.08915087906793e-06
2.796380657	-1.590276137	0.412333617	-3.85677052	0.000114895	0.001921043
3.238896346	1.369602421	0.379306641	3.610805275	0.000305248	0.004516903
3.59246499	1.700612851	0.426184526	3.990320501	6.5984070248418e-05	0.001379067
3.270201179	2.476391231	0.414402722	5.975808311	2.28952089311894e-09	3.19006577774573e-07
2.822737193	-1.965032083	0.43115157	-4.557636389	5.17324963991357e-06	0.000154458
5.271590497	2.215256087	0.421287022	5.258306031	1.45388427199412e-07	6.75248472992823e-06
4.822751132	-1.818874185	0.459160623	-3.961302635	7.45419826160826e-05	0.001416298
25.85784782	-2.25826751	0.580770189	-3.888401216	0.000100907	0.001786842
18.28256639	-2.58832838	0.542552519	-4.770650379	1.83632032683384e-06	5.90447612781959e-05
3.918446111	1.385335731	0.378403772	3.660998738	0.000251234	0.003889474
2.941597854	1.101059096	0.317238613	3.470760029	0.000518988	0.006573843
2.686170711	1.518061102	0.374292887	4.055810713	4.99607082084573e-05	0.001099136
47.14425971	-2.441015539	0.580498979	-4.205029858	2.61047692670248e-05	0.00064187
231.6963667	-2.178539994	0.56084709	-3.884374249	0.000102594	0.001786842
49.52385811	-1.98780407	0.587599869	-3.382921225	0.000717192	0.008327396

Genus	Species
Sutterella	Sutterella stercoricanis
Fusobacterium_A	Fusobacterium_A varium
Bacteroides_H	Bacteroides_H ovatus
Prevotella	Prevotella sp002251365
Prevotella	Prevotella pectinovora
Paraprevotella	Paraprevotella xylaniphila
Butyricimonas	Butyricimonas faecalis
Parabacteroides_B_862066	Parabacteroides_B_862066 sp002159645
Scatocola	Scatocola faecipullorum
HGM16780	HGM16780 sp900538765
Bifidobacterium_388775	Bifidobacterium catenulatum
Streptococcus	Streptococcus infantis
Leuconostoc_B	Leuconostoc_B lactis
Gemella	Gemella sanguinis
Faecalibacillus	Faecalibacillus faecis
Coprobacillus	Coprobacillus cateniformis
Catenibacterium	Catenibacterium mitsuokai
Longicatena	Longicatena caecimuris
Onthocola_B	Onthocola_B sp000437355
Veillonella_A	Veillonella_A atypica
Dialister	Dialister sp900543165
Dialister	Dialister succinatiphilus
Megasphaera_A_38685	Megasphaera_A_38685 massiliensis
Mitsuokella	Mitsuokella jalaludinii
Vescimonas	Vescimonas fastidiosa
Ruminococcus_E	Ruminococcus_E sp900314705
CAG-353	CAG-353 sp900066885
Peptacetobacter	Peptacetobacter hiranonis
Clostridium_T	Clostridium_T disporicum_203972
Clostridium_T	Clostridium_T chartatabidum
Coprococcus_A_121497	Coprococcus_A_121497 sp000154245
Butyribacter	Butyribacter sp001916135
Enterocloster	Enterocloster sp000155435
Mediterraneibacter_A_155507	Mediterraneibacter_A_155507 massiliensis
Lachnoclostridium_B	Lachnoclostridium_B sp000765215
Faecalimonas	Faecalimonas umbilicata
Ruminococcus_B	Mediterraneibacter gnavus
Blautia_A_141780	Blautia_A_141780 hansenii

(D)

baseMean	log2FoldChange	lfcSE	stat	pvalue	padj
1.685380175	-1.262752637	0.300511305	-4.202013754	2.64551056406864e-05	0.000858909
4.220907195	2.1818576	0.443100573	4.924068556	8.47631188766713e-07	5.15995486161737e-05
8.67216645	1.983591528	0.466498407	4.252086391	2.11788124220203e-05	0.00073672
3.882098915	1.426494172	0.424170949	3.363017141	0.000770956	0.009880407
40.44766593	2.211904685	0.539245567	4.101850475	4.09859111297938e-05	0.001050534
1.586116029	-1.128030696	0.304794771	-3.700951599	0.000214792	0.003607032
2.128222953	1.385043872	0.379859077	3.646204485	0.000266142	0.004181008
1.732414678	-1.330436806	0.318068074	-4.182868115	2.8785439538793e-05	0.000876157
1.645454068	-1.211177997	0.311924268	-3.882923271	0.000103208	0.002010495
5.474569775	-2.30223136	0.405623133	-5.675789114	1.38050766710497e-08	2.24102411293373e-06
4.657279701	-1.711533851	0.432561314	-3.956742772	7.59786681193766e-05	0.001681891
49.63817934	1.471698272	0.419602992	3.507358857	0.000452578	0.00648252
56.44424283	4.678968961	0.550518481	8.499204154	1.90894915342454e-17	9.2965823771775e-15
3.402728707	1.42014931	0.404222631	3.513285005	0.000442602	0.00648252
4.325857657	-1.927930733	0.42670295	-4.51820343	6.23665500532815e-06	0.000251766
2.457814303	1.246685466	0.364598798	3.419335093	0.000627744	0.008491977
3.162868528	1.615854072	0.358891377	4.502348557	6.72066418728268e-06	0.000251766
4.126895177	2.507793901	0.464831482	5.395060352	6.85005238979356e-08	6.67195102765893e-06
2.090471119	-1.364910514	0.341790373	-3.993414155	6.51286649292574e-05	0.001539105
2.422355848	1.408064279	0.372042055	3.784691171	0.0001539	0.002775892
2.894462218	-1.674659952	0.363402504	-4.608278522	4.06016550136841e-06	0.00019773
3.064346212	-2.482214214	0.390047079	-6.363883611	1.96715227119361e-10	4.79001578035643e-08
1.939078826	-1.586643402	0.346705277	-4.576346278	4.73167102305175e-06	0.000209484
2.781249855	-1.465154874	0.355559357	-4.120704022	3.77716412856251e-05	0.001021933
2.666899864	1.397754171	0.358714279	3.896566858	9.756588281633e-05	0.001979774
2.390562773	-1.301103506	0.336783702	-3.863320871	0.000111856	0.002095148
3.737659429	2.391622298	0.452683381	5.283212056	1.26938313457085e-07	1.03031597756e-05
1.539307428	-1.038794813	0.299745579	-3.465588437	0.000529072	0.007361666
2.270255705	1.133030971	0.335643312	3.375699534	0.000736283	0.009691074
2.638699428	-2.048325131	0.368107353	-5.564477629	2.62938856470116e-08	3.20128057752366e-06
3.383290377	-1.21602027	0.333318069	-3.64822787	0.000264055	0.004181008
30.61673914	2.107909882	0.563384882	3.74150949	0.000182918	0.003181471
2.145869029	-1.31293351	0.329143091	-3.988944461	6.63679565787068e-05	0.001539105
2.40783305	-1.797092294	0.348822168	-5.151886719	2.57878797986031e-07	1.7940996374171e-05
19.5013554	1.620671724	0.414616002	3.90884992	9.27365502122959e-05	0.001963596
237.1579665	2.175971893	0.523799607	4.154206809	3.26417854742839e-05	0.000935091
26.95229807	2.562270162	0.550151439	4.657390637	3.20242442024917e-06	0.000173287
82.55707952	1.95822228	0.542715063	3.608195925	0.000308334	0.004692452

Family	Genus	Species
Burkholderiaceae_A_595427	Parasutterella	Parasutterella gallistercoris
Burkholderiaceae_A_595427	Sutterella	Sutterella parvirubra
Enterobacteriaceae_A	Enterobacter_B_713587	Enterobacter_B_713587 cloacae_713536
Fusobacteriaceae_993521	Fusobacterium_A	Fusobacterium_A varium
Bacteroidaceae	Bacteroides_H	Bacteroides_H eggerthii
Bacteroidaceae	UBA6382	UBA6382 sp002439755
Bacteroidaceae	Prevotella	Prevotella hominis
Marinifilaceae	Butyricimonas	Butyricimonas faecalis
CAG-312	QALA01	QALA01 sp003343565
Eggerthellaceae	CAG-1427	CAG-1427 sp000435475
Bifidobacteriaceae	Bifidobacterium_388775	Bifidobacterium catenulatum
Streptococcaceae	Streptococcus	Streptococcus parasanguinis
Streptococcaceae	Streptococcus	Streptococcus gallolyticus
Enterococcaceae	Enterococcus_B	Enterococcus_B hirae
Coprobacillaceae	Faecalibacillus	Faecalibacillus faecis
Erysipelotrichaceae	Longicatena	Longicatena caecimuris
Veillonellaceae	Veillonella_A	Veillonella_A atypica
Dialisteraceae	Dialister	Dialister sp900543165
Dialisteraceae	Dialister	Dialister invisus
Megasphaeraceae	Caecibacter	Caecibacter sp003467125
Oscillospiraceae_88309	Vescimonas	Vescimonas fastidiosa
Ruminococcaceae	CAG-353	CAG-353 sp900066885
CAG-508	CAG-273	CAG-273 sp003507395
CAG-138	PeH17	PeH17 sp000435055
Anaerovoracaceae	Emergencia	Emergencia timonensis
Peptostreptococcaceae_256921	GCA-900066495	GCA-900066495 sp900066495
Peptostreptococcaceae_256921	Peptacetobacter	Peptacetobacter hiranonis
Clostridiaceae_222000	Clostridium_T	Clostridium_T celatum
Lachnospiraceae	Frisingicoccus	Frisingicoccus caecimuris
Lachnospiraceae	Coprococcus_A_121497	Coprococcus_A_121497 sp000154245
Lachnospiraceae	Eisenbergiella	Eisenbergiella tayi
Lachnospiraceae	Oliverpabstia	Oliverpabstia faecicola
Lachnospiraceae	CAG-45	CAG-45 sp000438375
Lachnospiraceae	Lachnoclostridium_B	Lachnoclostridium_B sp000765215
Lachnospiraceae	Schaedlerella	Schaedlerella glycyrrhizinilytica_A
Lachnospiraceae	Ruminococcus_B	Mediterraneibacter gnavus
Lachnospiraceae	Blautia_A_141780	Blautia_A_141780 hansenii
Lachnospiraceae	Blautia_A_141781	Blautia_A_141781 caecimuris

(E)

Feature ID	Taxon	phylum	class
74ed65b420c642f941fd2cbf68a7c9f6	d__Bacteria	p__Fusobacteriota	c__Fusobacteriia
da16590a9ac0dad894826626dc33f63	d__Bacteria	p__Fusobacteriota	c__Fusobacteriia
b81dbc33bc1d4b8781d70d301cf62b06	d__Bacteria	p__Fusobacteriota	c__Fusobacteriia
0654574c283cf12cde20f5e333499afb	d__Bacteria	p__Fusobacteriota	c__Fusobacteriia
f0f5bc2b7c4102cd9d55098827ce2efa	d__Bacteria	p__Fusobacteriota	c__Fusobacteriia
4e1597894a0ebc50d1f7a7d55acb51d	d__Bacteria	p__Fusobacteriota	c__Fusobacteriia
3f176c74a2287a93a2518c5297e267a1	d__Bacteria	p__Fusobacteriota	c__Fusobacteriia
8eff0d6490e27e9d2e0687d608dc9b37	d__Bacteria	p__Fusobacteriota	c__Fusobacteriia
e90c40d2cdb3041d2bfb062ebccb4849	d__Bacteria	p__Fusobacteriota	c__Fusobacteriia
da554080b86f1b94a06a273086d4f47a	d__Bacteria	p__Fusobacteriota	c__Fusobacteriia
cf6260a036cf2814145a4c06fab03fd8	d__Bacteria	p__Fusobacteriota	c__Fusobacteriia
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79b465f27aff65ee3e8d0208ae58854e	d__Bacteria	p__Fusobacteriota	c__Fusobacteriia
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b737ed3ff80e477096817096df84ee00	d__Bacteria	p__Fusobacteriota	c__Fusobacteriia
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09e872b7d47a6f4f5c0632add8236d12	d__Bacteria	p__Proteobacteria	c__Gammaproteobacteria
381327707b3baf5a525423948d70a49c	d__Bacteria	p__Proteobacteria	c__Gammaproteobacteria

s__Fusobacterium_A mortiferum
s__Fusobacterium_A mortiferum
s__Fusobacterium_A mortiferum
s__Fusobacterium_A mortiferum
s__Fusobacterium_A necrogenes
s__Fusobacterium_C periodonticum_D
s__Fusobacterium_A necrogenes
s__Fusobacterium_A varium
s__Fusobacterium_A mortiferum
s__Fusobacterium_C gastrois
s__Fusobacterium_A ulcerans
s__Fusobacterium_A mortiferum
s__Escherichia marmotae
s__Escherichia marmotae
s__Escherichia marmotae
s__Escherichia marmotae
s__Escherichia marmotae
s__Escherichia marmotae

Source Data
Supplementary Table 3

**The summation of relative abundance
of superpathway of sulfur oxidation (*Acidianus ambivalens*)
(A) EC:1.8.99.2 and (B) EC:1.8.5.2**

(A)

annotation	taxon_rel_abun
s__Blautia_A_141781 wexlerae	244.3401023
s__Blautia_A_141781 luti	167.8601978
s__Agathobacter rectalis	160.8695236
s__Blautia_A_141781 massiliensis	152.4448224
s__Anaerostipes hadrus	138.6657714
s__Agathobacter faecis	96.80075824
s__Blautia_A_141781 faecis	62.76133496
s__Blautia_A_141781 obeum	60.84303853
s__Megasphaera_A_38685 indica	9.097036765
s__Bilophila wadsworthia	5.186217077
s__Bacteroides_H cellulosilyticus	3.705278845
s__Desulfovibrio_R_446353 piger_A	2.3941366
s__Mitsuokella multacida	1.754338922
s__Blautia_A_141781 sp900066505	0.75182913
s__Mailhella massiliensis	0.203460354
s__Desulfovibrio_R_446353 fairfieldensis	0.142902391
s__Desulfovibrio_R_446353 faecigallinarum	0.054312279

(B)

annotation	taxon_rel_abun
s__Parabacteroides_B_862066 distasonis	30.333899
s__Bacteroides_H thetaiotaomicron	7.795259439
s__Bacteroides_H finegoldii	4.788367745
s__Bacteroides_H cellulosilyticus	3.705278845
s__Bacteroides_H fragilis	2.767674843
s__Bacteroides_H xylanisolvens	2.345520351
s__Bacteroides_H zhangwenhongii	0.959739787
s__Parabacteroides_B_862066 chongii	0.267069294
s__Parabacteroides_B_862066 goldsteinii	0.258649517
s__Weissella_A_338544 confusa	0.227787738
s__Staphylococcus condimenti	0.157356805
s__Weissella_A_338544 cibaria	0.079950327
s__Merdousia sp000438015	0.071298779
s__Bacteroides_H faecis	0.057203559
s__QALA01 sp003343565	0.056381366
s__Bacteroides_H luhongzhouii	0.045246538
s__Leuconostoc_B lactis	0.033393982
s__Staphylococcus aureus_317625	0.027954747
s__Brochothrix thermosphacta	0.025900004
s__Parabacteroides_B_862066 gordonii	0.022854683
s__Staphylococcus capitis	0.009232621
s__Bacteroides_H caecimuris	0.008548674

Source Data
Supplementary Table 4

The summation of relative abundance

of mevalonate pathway I (eukaryotes and bacteria)

(A) EC:2.3.3.10, (B) EC:2.7.1.36, (C) EC:2.7.4.2, (D) EC:4.1.1.33, and (E) EC:5.3.3.2

(A)

annotation	taxon_rel_abun
s__Streptococcus gallolyticus	24.4292107
s__Streptococcus parasanguinis	18.39452155
s__Ligilactobacillus ruminis	16.92305569
s__Streptococcus vestibularis	16.35753039
s__Streptococcus infantarius	2.826519258
s__Enterococcus_H_360604 faecalis	2.65325009
s__Streptococcus thermophilus	2.570271295
s__Enterococcus_B hirae	1.518209534
s__Weissella_A_338544 confusa	1.253378584
s__Lactocaseibacillus paracasei	1.116981664
s__Weissella_A_338544 cibaria	1.06231882
s__Lactobacillus johnsonii	0.952011529
s__Streptococcus ilei	0.694007604
s__Lactococcus_A_343473 petauri	0.675069437
s__Streptococcus anginosus	0.602359025
s__Granulicatella adiacens	0.593989315
s__Streptococcus mutans	0.516506509
s__Enterococcus_D gallinarum	0.449500355
s__Limosilactobacillus mucosae	0.417344747
s__Streptococcus agalactiae	0.374998902
s__Leuconostoc_B lactis	0.30451414
s__Enterococcus_F saccharolyticus	0.251503587
s__Limosilactobacillus fermentum	0.22973228
s__Streptococcus constellatus	0.175286507
s__Ligilactobacillus salivarius	0.13639813
s__Lactobacillus acidophilus	0.114349448
s__Weissella_A_338544 viridescens	0.106226358
s__Streptococcus sobrinus	0.090645937
s__Enterococcus_G bulliens	0.090065874
s__Streptococcus oralis_E_350763	0.071978671
s__Streptococcus australis	0.067129053
s__Lactococcus_A_346120 taiwanensis	0.065299172
s__Streptococcus sanguinis_H	0.065260904
s__Streptococcus gordonii	0.05225157
s__Gemella sanguinis	0.051514333
s__Enterococcus_B xinjiangensis	0.049928188
s__Streptococcus rubneri	0.039560161
s__Gemella morbillorum	0.037213549
s__Streptococcus infantis	0.035436967
s__Streptococcus oralis_E_351036	0.027648189
s__Lactobacillus delbrueckii	0.024143013
s__Carnobacterium_A_320617 divergens	0.020314447
s__Streptococcus intermedius	0.017236283
s__Leuconostoc_B inhae	0.017222464

s__Streptococcus cristatus_B_354001	0.015558388
s__Weissella_A_338544 minor	0.012404516
s__Enterococcus_A gilvus	0.002901401
s__Enterococcus_B pernyi	0.002108768

(B)

annotation	taxon_rel_abun
s__Streptococcus gallolyticus	24.4292107
s__Streptococcus parasanguinis	18.39452155
s__Ligilactobacillus ruminis	16.92305569
s__Streptococcus vestibularis	16.35753039
s__Streptococcus infantarius	2.826519258
s__Enterococcus_H_360604 faecalis	2.65325009
s__Streptococcus thermophilus	2.570271295
s__Enterococcus_B hirae	1.518209534
s__Weissella_A_338544 confusa	1.253378584
s__Lacticaseibacillus paracasei	1.116981664
s__Weissella_A_338544 cibaria	1.06231882
s__Lactobacillus johnsonii	0.952011529
s__Streptococcus ilei	0.694007604
s__Lactococcus_A_343473 petauri	0.675069437
s__Streptococcus anginosus	0.602359025
s__Granulicatella adiacens	0.593989315
s__Streptococcus mutans	0.516506509
s__Enterococcus_D gallinarum	0.449500355
s__Limosilactobacillus mucosae	0.417344747
s__Streptococcus agalactiae	0.374998902
s__Leuconostoc_B lactis	0.30451414
s__Enterococcus_F saccharolyticus	0.251503587
s__Limosilactobacillus fermentum	0.22973228
s__Streptococcus constellatus	0.175286507
s__Ligilactobacillus salivarius	0.13639813
s__Lactobacillus acidophilus	0.114349448
s__Lactobacillus crispatus	0.114349448
s__Weissella_A_338544 viridescens	0.106226358
s__Streptococcus sobrinus	0.090645937
s__Enterococcus_G bulliens	0.090065874
s__Streptococcus oralis_E_350763	0.071978671
s__Streptococcus australis	0.067129053
s__Lactococcus_A_346120 taiwanensis	0.065299172
s__Streptococcus sanguinis_H	0.065260904
s__Streptococcus gordonii	0.05225157
s__Gemella sanguinis	0.051514333
s__Enterococcus_B xinjiangensis	0.049928188
s__Streptococcus rubneri	0.039560161
s__Gemella morbillorum	0.037213549
s__Streptococcus infantis	0.035436967
s__Streptococcus oralis_E_351036	0.027648189
s__Lactobacillus delbrueckii	0.024143013
s__Carnobacterium_A_320617 divergens	0.020314447
s__Streptococcus intermedius	0.017236283
s__Leuconostoc_B inhae	0.017222464
s__Streptococcus cristatus_B_354001	0.015558388
s__Weissella_A_338544 minor	0.012404516
s__Enterococcus_A gilvus	0.002901401

s_Enterococcus_B pernyi

0.002108768

(C)

annotation	taxon_rel_abun
s__Streptococcus gallolyticus	24.4292107
s__Streptococcus parasanguinis	18.39452155
s__Ligilactobacillus ruminis	16.92305569
s__Streptococcus vestibularis	16.35753039
s__Streptococcus infantarius	2.826519258
s__Enterococcus_H_360604 faecalis	2.65325009
s__Streptococcus thermophilus	2.570271295
s__Enterococcus_B hirae	1.518209534
s__Weissella_A_338544 confusa	1.253378584
s__Lacticaseibacillus paracasei	1.116981664
s__Weissella_A_338544 cibaria	1.06231882
s__Lactobacillus johnsonii	0.952011529
s__Streptococcus ilei	0.694007604
s__Lactococcus_A_343473 petauri	0.675069437
s__Streptococcus anginosus	0.602359025
s__Granulicatella adiacens	0.593989315
s__Streptococcus mutans	0.516506509
s__Enterococcus_D gallinarum	0.449500355
s__Limosilactobacillus mucosae	0.417344747
s__Streptococcus agalactiae	0.374998902
s__Leuconostoc_B lactis	0.30451414
s__Enterococcus_F saccharolyticus	0.251503587
s__Limosilactobacillus fermentum	0.22973228
s__Streptococcus constellatus	0.175286507
s__Ligilactobacillus salivarius	0.13639813
s__Lactobacillus acidophilus	0.114349448
s__Lactobacillus crispatus	0.114349448
s__Weissella_A_338544 viridescens	0.106226358
s__Streptococcus sobrinus	0.090645937
s__Enterococcus_G bulliens	0.090065874
s__Streptococcus oralis_E_350763	0.071978671
s__Streptococcus australis	0.067129053
s__Lactococcus_A_346120 taiwanensis	0.065299172
s__Streptococcus sanguinis_H	0.065260904
s__Streptococcus gordonii	0.05225157
s__Gemella sanguinis	0.051514333
s__Enterococcus_B xinjiangensis	0.049928188
s__Streptococcus rubneri	0.039560161
s__Gemella morbillorum	0.037213549
s__Streptococcus infantis	0.035436967
s__Streptococcus oralis_E_351036	0.027648189
s__Lactobacillus delbrueckii	0.024143013
s__Carnobacterium_A_320617 divergens	0.020314447
s__Streptococcus intermedius	0.017236283
s__Leuconostoc_B inhae	0.017222464
s__Streptococcus cristatus_B_354001	0.015558388
s__Weissella_A_338544 minor	0.012404516
s__Enterococcus_A gilvus	0.002901401

s_Enterococcus_B pernyi

0.002108768

(D)

annotation	taxon_rel_abun
s__Streptococcus parasanguinis	18.39452155
s__Ligilactobacillus ruminis	12.7219533
s__Streptococcus gallolyticus	4.281049006
s__Enterococcus_H_360604 faecalis	2.65325009
s__Enterococcus_B hirae	1.518209534
s__Weissella_A_338544 confusa	1.230019182
s__Lacticaseibacillus paracasei	1.116981664
s__Weissella_A_338544 cibaria	1.06231882
s__Lactobacillus johnsonii	0.952011529
s__Streptococcus ilei	0.694007604
s__Lactococcus_A_343473 petauri	0.675069437
s__Streptococcus anginosus	0.602359025
s__Granulicatella adiacens	0.593989315
s__Streptococcus mutans	0.516506509
s__Enterococcus_D gallinarum	0.449500355
s__Limosilactobacillus mucosae	0.417344747
s__Streptococcus agalactiae	0.374998902
s__Leuconostoc_B lactis	0.30451414
s__Enterococcus_F saccharolyticus	0.251503587
s__Limosilactobacillus fermentum	0.22973228
s__Streptococcus infantarius	0.214067326
s__Streptococcus constellatus	0.175286507
s__Ligilactobacillus salivarius	0.13639813
s__Lactobacillus acidophilus	0.114349448
s__Lactobacillus crispatus	0.114349448
s__Weissella_A_338544 viridescens	0.106226358
s__Streptococcus sobrinus	0.090645937
s__Enterococcus_G bulliens	0.090065874
s__Streptococcus oralis_E_350763	0.071978671
s__Streptococcus australis	0.067129053
s__Lactococcus_A_346120 taiwanensis	0.065299172
s__Streptococcus sanguinis_H	0.065260904
s__Streptococcus thermophilus	0.063291954
s__Streptococcus gordonii	0.05225157
s__Gemella sanguinis	0.051514333
s__Enterococcus_B xinjiangensis	0.049928188
s__Streptococcus rubneri	0.039560161
s__Gemella morbillorum	0.037213549
s__Streptococcus infantis	0.035436967
s__Streptococcus oralis_E_351036	0.027648189
s__Lactobacillus delbrueckii	0.024143013
s__Carnobacterium_A_320617 divergens	0.020314447
s__Streptococcus intermedius	0.017236283
s__Leuconostoc_B inhae	0.017222464
s__Streptococcus cristatus_B_354001	0.015558388
s__Streptococcus vestibularis	0.012621322
s__Weissella_A_338544 minor	0.012404516
s__Enterococcus_A gilvus	0.002901401

s_Enterococcus_B pernyi

0.002108768

(E)

annotation	taxon_rel_abun
s__Phascolarctobacterium_A faecium	61.63556368
s__Clostridium_T saudiense	37.62781643
s__Streptococcus gallolyticus	24.4292107
s__Streptococcus parasanguinis	18.39452155
s__Phascolarctobacterium_A succinatutens	17.85532666
s__Ligilactobacillus ruminis	16.92305569
s__Streptococcus vestibularis	16.35753039
s__Acidaminococcus intestini	3.720736601
s__Streptococcus infantarius	2.826519258
s__Enterococcus_H_360604 faecalis	2.65325009
s__Streptococcus thermophilus	2.570271295
s__Desulfovibrio_R_446353 piger_A	2.238714751
s__Phascolarctobacterium_A wakonense	1.934174394
s__Pseudocitrobacter faecalis	1.529525465
s__Enterococcus_B hirae	1.518209534
s__Enterobacter_B_713587 cloacae_713536	1.47455709
s__Weissella_A_338544 confusa	1.253378584
s__Lacticaseibacillus paracasei	1.116981664
s__Weissella_A_338544 cibaria	1.06231882
s__Blautia_A_141780 sp001304935	0.971160988
s__Lactobacillus johnsonii	0.952011529
s__Acidaminococcus fermentans	0.797255683
s__Kluyvera georgiana	0.740633017
s__Dielma fastidiosa	0.736993477
s__Streptococcus ilei	0.694007604
s__Lactococcus_A_343473 petauri	0.675069437
s__Enterocloster lavalensis	0.668674024
s__Streptococcus anginosus	0.602359025
s__Granulicatella adiacens	0.593989315
s__Mailhella massiliensis	0.569748951
s__CAG-302 sp000431795	0.541735306
s__Streptococcus mutans	0.516506509
s__Enterococcus_D gallinarum	0.449500355
s__Limosilactobacillus mucosae	0.417344747
s__Streptococcus agalactiae	0.374998902
s__Leuconostoc_B lactis	0.30451414
s__Escherichia marmotae	0.277375906
s__Enterococcus_F saccharolyticus	0.251503587
s__Limosilactobacillus fermentum	0.22973228
s__Streptococcus constellatus	0.175286507
s__OLB9 sp001567255	0.167666016
s__Ligilactobacillus salivarius	0.13639813
s__Parvimonas micra	0.135383479
s__Klebsiella aerogenes_724207	0.125553637
s__Morganella morganii_731151	0.121886684
s__Lactobacillus acidophilus	0.114349448
s__Lactobacillus crispatus	0.114349448
s__Enterobacter_B_682701 huaxiensis	0.110958772

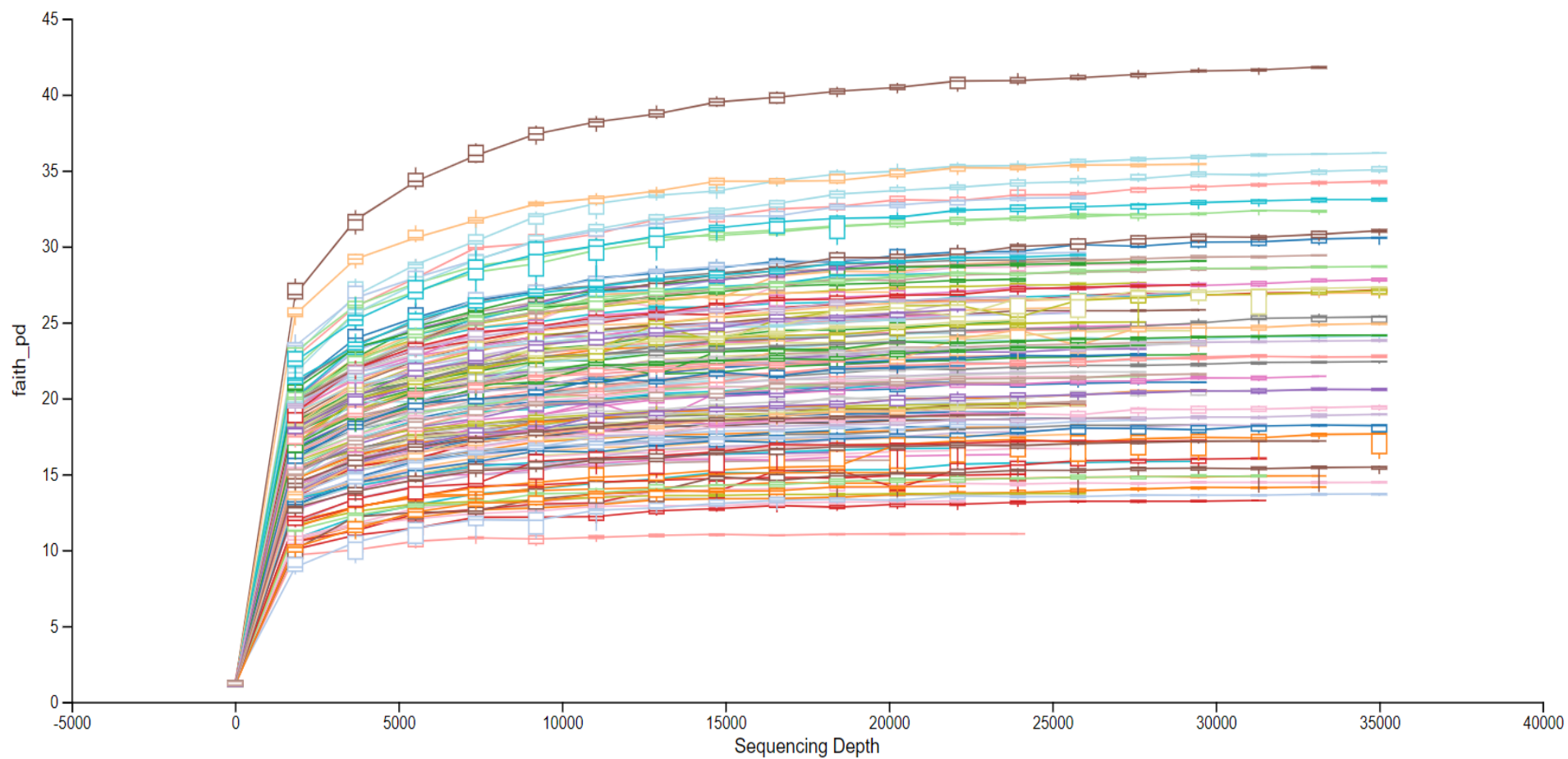
s_Weissella_A_338544 viridescens	0.106226358
s_Macroccoccus_B caseolyticus	0.096878985
s_Streptococcus sobrinus	0.090645937
s_Enterococcus_G bulliens	0.090065874
s_Muricomes oroticus	0.08202708
s_Streptococcus oralis_E_350763	0.071978671
s_Streptococcus australis	0.067129053
s_Lactococcus_A_346120 taiwanensis	0.065299172
s_Streptococcus sanguinis_H	0.065260904
s_Streptococcus gordonii	0.05225157
s_Gemella sanguinis	0.051514333
s_Enterococcus_B xinjiangensis	0.049928188
s_Desulfovibrio_R_446353 fairfieldensis	0.042592742
s_Streptococcus rubneri	0.039560161
s_Klebsiella spallanzanii	0.038963645
s_Gemella morbillorum	0.037213549
s_Streptococcus infantis	0.035436967
s_Citrobacter_A_711567 youngae_711564	0.033283879
s_Morganella morganii_731147	0.030471671
s_Kluyvera sichuanensis	0.030383347
s_Klebsiella michiganensis	0.029222734
s_Streptococcus oralis_E_351036	0.027648189
s_Proteus mirabilis	0.025833696
s_Lactobacillus delbrueckii	0.024143013
s_Citrobacter_A_692098 farmeri	0.023260042
s_Carnobacterium_A_320617 divergens	0.020314447
s_Clostridium_T baratii	0.019506676
s_Onthocola_B sp000437355	0.019481822
s_Citrobacter_A_692098 werkmanii	0.017723096
s_Franconibacter helveticus	0.017388734
s_Streptococcus intermedius	0.017236283
s_Leuconostoc_B inhae	0.017222464
s_Clostridium_T sardiniense	0.016467736
s_Streptococcus cristatus_B_354001	0.015558388
s_Pseudocitrobacter vendiensis	0.015191673
s_Klebsiella ornithinolytica	0.01421933
s_Klebsiella huaxiensis	0.012481455
s_Weissella_A_338544 minor	0.012404516
s_Desulfovibrio_R_446353 desulfuricans_A_446139	0.009246614
s_Finegoldia magna_H	0.009097948
s_Klebsiella oxytoca	0.004027848
s_Enterobacter_B_683299 mori_683152	0.002945595
s_Enterococcus_A gilvus	0.002901401
s_Enterococcus_B pernyi	0.002108768
s_Alloprevotella sp004555055	0.001726728

Supplementary Figure S1 The sequences information shows (A) the sequence length statistics and (B) the alpha diversity curve of all samples.

(A) Sequence Count Min Length Max Length Mean Length Range Standard Deviation

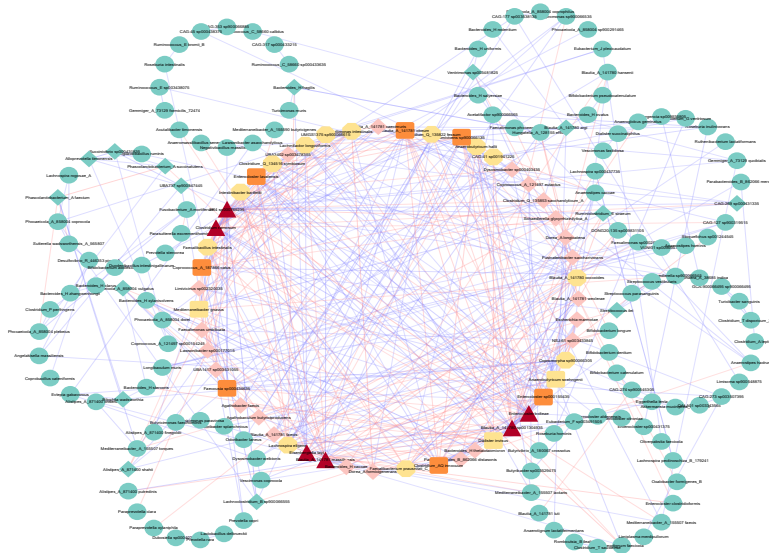
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(B)

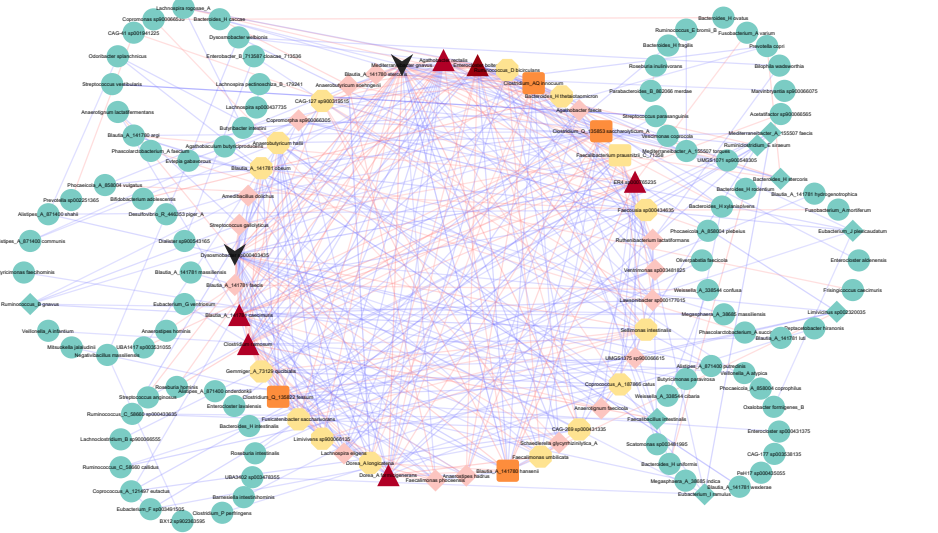


Supplementary Figure S2 The co-occurrence networks of (A) the CT, (B) the HP, and (C) the TA group.

(A)



(B)



(C)

