

**Table S3.** Taxonomic classification<sup>1</sup> of all amplicon sequence variants (ASV)<sup>2</sup>.

Taxonomic Lineage							ASV Count <sup>3</sup>
Kingdom	Phylum	Class	Order	Family	Genus	Species	
Archaea	Euryarchaeota	Methanobacteria	Methanobacteriales	Methanobacteriaceae	Methanobrevibacter	-----	5
	Halobacterota	Methanomicrobia	Methanomicrobiales	Methanocorpusculaceae	Methanobrevibacter	uncultured archeon	6
	Thermoplasmatota	Thermoplasmata	Methanomassiliicoccales	Methanomethylophilaceae	uncultured	-----	1
Bacteria	-----	-----	-----	-----	-----	-----	5
	Actinobacteriota	Coriobacteriia	Coriobacteriales	Coriobacteriales Incertae Sedis	Phoenicibacter	uncultured bacterium	4
					uncultured	Uncultured bacterium	1
				Eggerthellaceae	-----	-----	2
					Denitrobacterium	D. detoxificans	1
					Parvibacter	uncultured bacterium	1
					uncultured	uncultured bacterium	3
				uncultured	uncultured	uncultured bacterium	1
Bacteria	Armatimonadota	-----	-----	-----	-----	-----	1
		uncultured	uncultured	uncultured	-----	-----	1
					uncultured	uncultured bacterium	4
Bacteria	Bacteroidetes	Bacteroidia	-----	-----	-----	-----	4
			Bacteroidales	-----	-----	-----	9
				Bacteroidales BS11 gut group	Bacteroidales BS11 gut group	-----	1
						uncultured bacterium	4
				Bacteroidales RF16 group	Bacteroidales RF16 group	-----	1
						uncultured bacterium	12
				Bacteroidales UCG-001	Bacteroidales UCG-001	-----	4
						uncultured bacterium	5
						uncultured rumen	4
				Bacteroidetes BD2-2	Bacteroidetes BD2-2	uncultured rumen	1

<i>CAP-aah99b04</i>	<i>CAP-aah99b04</i>	<i>uncultured bacterium</i>	1
<i>Dysgonomonadaceae</i>	<i>Uncultured</i>	<i>uncultured bacterium</i>	1
<i>F082</i>	<i>F082</i>	-----	2
		<i>Bacteriodales bacterium</i>	1
		<i>uncultured bacterium</i>	32
<i>gir-aah93h0</i>	<i>gir-aah93h0</i>	<i>uncultured bacterium</i>	1
<i>M2PB4-65 termite group</i>	<i>M2PB4-65 termite group</i>	<i>uncultured bacterium</i>	4
<i>Marinifilaceae</i>	<i>uncultured</i>	<i>uncultured bacterium</i>	2
<i>Muribaculaceae</i>	<i>Muribaculaceae</i>	-----	1
		<i>uncultured bacterium</i>	3
<i>p-251-o5</i>	<i>p-251-o5</i>	<i>uncultured bacterium</i>	28
<i>Paludibacteraceae</i>	<i>uncultured</i>	<i>uncultured bacterium</i>	9
<i>Prevotellaceae</i>	-----	-----	1
	<i>Alloprevotella</i>	-----	7
		<i>uncultured bacterium</i>	4
	<i>Prevotella</i>	-----	10
		<i>uncultured</i>	1
		<i>Prevotellaceae</i>	
	<i>Prevotellaceae</i>	<i>unidentified rumen</i>	1
	<i>Ga6A1 group</i>		
	<i>Prevotellaceae UCG-001</i>	<i>uncultured bacterium</i>	7
		<i>uncultured</i>	2
		<i>Prevotellaceae</i>	
		<i>wallaby gut</i>	6
	<i>Prevotellaceae UCG-003</i>	-----	3
	<i>Prevotellaceae UCG-004</i>	<i>uncultured bacterium</i>	12
<i>Rikenellaceae</i>	-----	-----	1
	<i>Alistipes</i>	<i>uncultured bacterium</i>	1
	<i>dgA-11 gut group</i>	<i>uncultured bacterium</i>	2
	<i>hoa5-07d05 gut group</i>	<i>uncultured bacterium</i>	7
	<i>Mucinivorans</i>	<i>uncultured bacterium</i>	1

					<i>Rikenellaceae RC9 gut group</i>	-----	19
						<i>uncultured bacterium</i>	79
						<i>uncultured</i>	2
						<i>Bacteriodales</i>	
						<i>uncultured beta</i>	6
						<i>uncultured Rikenella</i>	1
						<i>wallaby gut</i>	2
					<i>SP3-e08</i>	<i>uncultured bacterium</i>	15
				<i>uncultured</i>	<i>uncultured</i>	<i>uncultured bacterium</i>	2
<i>Bacteria</i>	<i>Chloroflexi</i>	<i>Anaerolineae</i>	<i>Anaerolineales</i>	<i>Anaerolineaceae</i>	<i>Flexilinea</i>	<i>uncultured bacterium</i>	2
<i>Bacteria</i>	<i>Cyanobacteria</i>	<i>Vampirivibrionia</i>	<i>Gastranaerophilales</i>	<i>Gastranaerophilales</i>	<i>Gastranaerophilales</i>	-----	1
					<i>Gastranaerophilales</i>	<i>uncultured bacterium</i>	1
<i>Bacteria</i>	<i>Desulfobacterota</i>	<i>Desulfovibrionia</i>	<i>Desulfovibrionales</i>	<i>Desulfovibrionaceae</i>	<i>Desulfovibrio</i>	-----	3
					<i>Mailhella</i>	-----	1
						<i>uncultured bacterium</i>	1
<i>Bacteria</i>	<i>Elusimicrobiota</i>	<i>Endomicrobia</i>	<i>Endomicrobales</i>	<i>Endomicrobiaceae</i>	<i>Endomicrobium</i>	<i>uncultured bacterium</i>	1
<i>Bacteria</i>	<i>Fibrobacterota</i>	<i>Fibrobacteria</i>	<i>Fibrobacterales</i>	<i>Fibrobacteraceae</i>	<i>Fibrobacter</i>	-----	1
						<i>Fibrobacter sp</i>	3
<i>Bacteria</i>	<i>Firmicutes</i>	-----	-----	-----	-----	-----	2
		<i>Bacilli</i>	<i>Bacillales</i>	<i>Bacillaceae</i>	<i>Bacillus</i>	-----	1
			<i>Erysipelotrichales</i>	<i>Erysipelatoclostridiaceae</i>	-----	-----	2
					<i>Candidatus Stoquefichus</i>	<i>Candidatus Stoquefichus</i>	1
					<i>Erysipelatoclostridium</i>	<i>uncultured bacterium</i>	2
					<i>UCG-004</i>	-----	2
						<i>uncultured bacterium</i>	7
					<i>uncultured</i>	<i>Uncultured</i>	1
					<i>[Anaerorhabdus] furcosa group</i>	<i>Erysipelotrichaceae</i>	
					<i>Catenisphaera</i>	<i>uncultured rumen</i>	1
					<i>uncultured</i>	<i>uncultured bacterium</i>	4
						<i>uncultured bacterium</i>	3

<i>Clostridia</i>	<i>Izemoplasmales</i>	<i>Izemoplasmales</i>	<i>Izemoplasmales</i>	-----	1
				uncultured bacterium	3
	<i>Lactobacillales</i>	<i>Lactobacillaceae</i>	<i>Lactobacillus</i>	-----	1
				<i>L. equigenerosi</i>	1
				uncultured methanogenic	2
			<i>Streptococcus</i>	-----	1
	<i>Paenibacillales</i>	<i>Paenibacillaceae</i>	<i>Paenibacillus</i>	-----	1
				<i>P. turicensis</i>	1
	<i>RF39</i>	<i>RF39</i>	<i>RF39</i>	-----	12
				uncultured bacterium	1
				uncultured prokaryote	1
	-----	-----	-----	-----	15
	<i>Caldicoprobacterales</i>	<i>Caldicoprobacteraceae</i>	<i>Caldicoprobacter</i>	uncultured bacterium	1
	<i>Christensenellales</i>	<i>Christensenellaceae</i>	<i>Christensenellaceae</i>	-----	78
			<i>R-7 group</i>	-----	1
				<i>Christensenella</i> sp.	2
				gut metagenome	1
				human gut	1
				uncultured bacterium	5
				uncultured <i>Clostridia</i>	2
				uncultured prokaryote	2
				uncultured rumen	12
				unidentified rumen	3
	<i>Clostridia</i>	<i>Hungateiclostridiaceae</i>	<i>Ruminiclostridium</i>	unculture rumen	2
			<i>Saccharofermentans</i>	-----	5
			<i>Saccharofermentans</i>	<i>Clostridiales</i> bacterium	1
				<i>Ruminococcaceae</i>	1
				bacterium	
				uncultured bacterium	4
			uncultured	uncultured bacterium	1
	<i>Clostridia</i> UCG-014	<i>Clostridia</i> UCG-014	<i>Clostridia</i> UCG-014	-----	12
				uncultured bacterium	4

<i>Clostridia vadinBB60 group</i>	<i>Clostridia vadinBB60 group</i>	<i>Clostridia vadinBB60 group</i>	-----	2
			<i>Clostridiales bacterium</i>	1
			<i>metagenome</i>	1
			<i>uncultured bacterium</i>	5
<i>Clostridiales</i>	<i>Clostridiaceae</i>	<i>Clostridium sensu stricto 1</i>	-----	4
			<i>Clostridium butyricum</i>	2
		<i>Sarcina</i>	<i>uncultured bacterium</i>	1
<i>Eubacteriales</i>	<i>Anaerofustaceae</i>	<i>Anaerofustis</i>	<i>uncultured bacterium</i>	1
	<i>Eubacteriaceae</i>	<i>Eubacterium</i>	-----	3
			<i>uncultured bacterium</i>	3
<i>Lachnospirales</i>	-----	-----	-----	3
	<i>Defluviitaleaceae</i>	<i>Defluviitaleaceae UCG-011</i>	<i>uncultured bacterium</i>	2
	<i>Lachnospiraceae</i>	-----	-----	74
		<i>[Eubacterium] hallii group</i>	<i>uncultured bacterium</i>	8
		<i>Acetitomaculum</i>	<i>uncultured bacterium</i>	3
		<i>Agathobacter</i>	<i>uncultured rumen</i>	1
		<i>Blautia</i>	-----	6
		<i>Cellulosilyticum</i>	<i>uncultured bacterium</i>	3
			<i>uncultured Clostridia</i>	1
		<i>Coproccoccus</i>	-----	2
			<i>uncultured rumen</i>	1
		<i>FD2005</i>	<i>uncultured bacterium</i>	1
		<i>Frisingicoccus</i>	<i>uncultured bacterium</i>	1
		<i>Johnsonella</i>	<i>Uncultured Lachnospiraceae</i>	1
		<i>Lachnoclostridium</i>	-----	2
			<i>uncultured bacterium</i>	1
		<i>Lachnospiraceae AC2044 group</i>	-----	3
			<i>uncultured bacterium</i>	7
			<i>uncultured rumen</i>	3

<i>Lachnospiraceae</i>	<i>uncultured bacterium</i>	1
<i>FCS020 group</i>		
<i>Lachnospiraceae</i>	<i>uncultured</i>	3
<i>ND3007 group</i>	<i>Lachnospiraceae</i>	
	<i>uncultured rumen</i>	2
<i>Lachnospiraceae</i>	-----	2
<i>NK4A136 group</i>		
	<i>uncultured rumen</i>	2
<i>Lachnospiraceae</i>	<i>uncultured bacterium</i>	2
<i>NK4B4 group</i>		
<i>Lachnospiraceae</i>	-----	1
<i>UCG-002</i>		
<i>Lachnospiraceae</i>	<i>uncultured rumen</i>	1
<i>UCG-006</i>		
<i>Lachnospiraceae</i>	<i>uncultured</i>	1
<i>UCG-008</i>	<i>Lachnospiraceae</i>	
	<i>uncultured rumen</i>	1
<i>Lachnospiraceae</i>	<i>uncultured bacterium</i>	9
<i>UCG-009</i>		
<i>Lachnospiraceae</i>	<i>uncultured bacterium</i>	1
<i>UCG-010</i>		
	<i>uncultured rumen</i>	1
<i>Lachnospiraceae</i>	-----	4
<i>XPB1014 group</i>		
	<i>uncultured bacterium</i>	9
<i>Marvinbryantia</i>	-----	5
	<i>uncultured bacterium</i>	5
	<i>uncultured</i>	1
	<i>Lachnospiraceae</i>	
	<i>uncultured rumen</i>	1
<i>Oribacterium</i>	<i>uncultured bacterium</i>	4
<i>Probable genus 10</i>	<i>uncultured bacterium</i>	1
<i>Pseudobutyrvibrio</i>	-----	1
<i>Roseburia</i>	-----	2
<i>Syntrophococcus</i>	<i>uncultured bacterium</i>	1
	<i>uncultured rumen</i>	2
<i>uncultured</i>	-----	1

<i>Monoglobales</i>	<i>Monoglobaceae</i>	<i>Monoglobus</i>	-----	1
			uncultured bacterium	7
			uncultured	1
			Clostridiaceae	
			uncultured rumen	1
<i>Oscillospirales</i>	-----	-----	-----	10
	[Eubacterium] coprostanoligenes group	[Eubacterium] coprostanoligenes group	-----	21
			uncultured bacterium	15
			uncultured rumen	5
			uncultured	2
			Ruminococcaceae	
	Butyricoccaceae	UCG-009	uncultured bacterium	3
	Ethanoligenenaceae	Incertae Sedis	uncultured bacterium	1
	Oscillospiraceae	-----	-----	20
		Colidextribacter	-----	1
			uncultured rumen	2
		NK4A214 group	-----	25
			uncultured bacterium	5
			uncultured rumen	10
			uncultured	1
			Ruminococcaceae	
		Papillibacter	uncultured bacterium	2
			uncultured	2
			Clostridiaceae	
			uncultured Clostridiales	1
		UCG-002	-----	13
			uncultured bacterium	4
		UCG-005	-----	9
			Metagenome	1
			uncultured bacterium	2
			uncultured organism	2
			uncultured rumen	7

	UCG-007	uncultured rumen	2
	uncultured	-----	2
	uncultured	uncultured	1
	V9D2013 group	-----	1
		uncultured bacterium	1
Ruminococcaceae	-----	-----	4
	Candidatus	-----	1
	Soleaferrea		
		Uncultured	1
		Acetanaerobacterium	
		uncultured bacterium	2
	Caproiciproducens	-----	3
	Fournierella	Uncultured Firmicutes	1
	Pygmaibacter	uncultured bacterium	3
	Ruminococcus	-----	10
		Bacterium YRD2003	1
		R. flavefaciens	3
		Ruminococcus sp.	1
		uncultured	1
		Clostridiaceae	
	Subdoligranulum	uncultured	1
		Ruminococcaceae	
	uncultured	-----	7
		uncultured bacterium	7
		uncultured Clostridiales	1
		uncultured rumen	2
UCG-010	UCG-010	-----	53
		uncultured bacterium	32
		uncultured Clostridia	1
		uncultured organism	1
		uncultured	2
		Ruminococcaceae	
		Unidentified	1
UCG-011	UCG-011	uncultured rumen	2



			<i>Peptococcales</i>	<i>Peptococcaceae</i>	-----	-----	1
					<i>uncultured</i>	-----	2
						<i>uncultured bacterium</i>	1
						<i>unidentified</i>	1
				<i>Anaerovoracaceae</i>	-----	-----	6
					<i>[Eubacterium]</i> <i>brachy group</i>	<i>Uncultured bacterium</i>	1
					<i>[Eubacterium]</i> <i>nodatum group</i>	-----	1
					<i>Anaerovorax</i>	-----	3
						<i>uncultured bacterium</i>	1
						<i>uncultured rumen</i>	6
					<i>Family XIII AD3011</i> <i>group</i>	-----	1
						<i>uncultured bacterium</i>	7
					<i>Family XIII UCG-001</i>	<i>uncultured bacterium</i>	1
						<i>uncultured rumen</i>	2
					<i>Mogibacterium</i>	-----	1
						<i>uncultured bacterium</i>	1
					<i>uncultured</i>	<i>uncultured bacterium</i>	1
			<i>Peptostreptococcales</i> <i>-Tissierellales</i>	-----	-----	-----	1
		<i>Negativicutes</i>	<i>Acidaminococcales</i>	<i>Acidaminococcaceae</i>	<i>Phascolarctobacterium</i>	-----	6
						<i>uncultured bacterium</i>	4
			<i>Veillonellales-</i> <i>Selenomonadales</i>	<i>Selenomonadaceae</i>	-----	-----	1
					<i>Anaerovibrio</i>	<i>uncultured bacterium</i>	1
					<i>Quinella</i>	-----	1
					<i>Schwartzia</i>	-----	1
				<i>Veillonellaceae</i>	<i>Veillonella</i>	<i>V. caviae</i>	1
		<i>Syntrophomonadia</i>	<i>Syntrophomonadales</i>	<i>Syntrophomonadaceae</i>	-----	-----	1
		<i>uncultured</i>	<i>uncultured</i>	<i>uncultured</i>	<i>uncultured</i>	<i>iron-reducing bacterium</i>	1
<i>Bacteria</i>	<i>Planctomycetota</i>	<i>Planctomycetes</i>	<i>Pirellulales</i>	<i>Pirellulaceae</i>	<i>p-1088-a5 gut group</i>	<i>uncultured bacterium</i>	5

		<i>vadinHA49</i>	<i>vadinHA49</i>	<i>vadinHA49</i>	<i>vadinHA49</i>	-----	1
						<i>uncultured bacterium</i>	1
<i>Bacteria</i>	<i>Proteobacteria</i>	<i>Alphaproteobacteria</i>	<i>Rhodospirillales</i>	-----	-----	-----	1
				<i>uncultured</i>	<i>uncultured</i>	-----	2
						<i>gut metagenome</i>	1
						<i>Uncultured rumen</i>	4
		<i>Gammaproteobacteria</i>	<i>Burkholderiales</i>	-----	-----	-----	1
				<i>T34</i>	<i>T34</i>	<i>uncultured bacterium</i>	1
<i>Bacteria</i>	<i>Spirochaetota</i>	<i>MVP-15</i>	<i>MVP-15</i>	<i>MVP-15</i>	<i>MVP-15</i>	-----	2
						<i>uncultured bacterium</i>	1
		<i>Spirochaetia</i>	<i>Spirochaetales</i>	<i>Spirochaetaceae</i>	<i>Sediminspirochaeta</i>	-----	2
					<i>Sphaerochaeta</i>	-----	1
						<i>uncultured bacterium</i>	3
						<i>uncultured rumen</i>	7
					<i>Treponema</i>	-----	5
						<i>T. ruminis</i>	1
						<i>uncultured bacterium</i>	24
<i>Bacteria</i>	<i>Synergistota</i>	<i>Synergistia</i>	<i>Synergistales</i>	<i>Synergistaceae</i>	-----	-----	1
					<i>Cloacibacillus</i>	<i>uncultured bacterium</i>	1
					<i>uncultured</i>	<i>uncultured bacterium</i>	1
<i>Bacteria</i>	<i>Verrucomicrobiota</i>	<i>Kiritimatiellae</i>	<i>WCHB1-41</i>	<i>WCHB1-41</i>	<i>WCHB1-41</i>	-----	6
						<i>uncultured bacterium</i>	21
		<i>Lentisphaeria</i>	<i>Victivallales</i>	<i>vadinBE97</i>	<i>vadinBE97</i>	-----	1
		<i>Verrucomicrobiae</i>	<i>LD1-PB3</i>	<i>LD1-PB3</i>	<i>LD1-PB3</i>	<i>uncultured bacterium</i>	1
			<i>Pedosphaerales</i>	<i>Pedosphaeraceae</i>	<i>DEV114</i>	-----	1
						<i>uncultured bacterium</i>	1
			<i>Verrucomicrobiales</i>	<i>Akkermansiaceae</i>	<i>Akkermansia</i>	<i>uncultured bacterium</i>	4

<sup>1</sup> Taxonomic assignment was conducted in Qiime 2 using the most recent SILVA database (SSU 138).

<sup>2</sup> The ASV represent those retained after quality filtering, chimera checking, and filtering low abundance, but prior to rarefaction for subsequent diversity analyses.

<sup>3</sup> Counts of individual ASV with a shared lineage.