Table S1. Examples of works in the literature studying the relation between fecal microbiota and health or disease at phylum, family, genus and species levels.

	Sleep apnea	Type 2 diabetes	Inflammatory bowel disease (IBD)	Irritable bowel syndrome (IBS)	Underweight, malnourished or anorexia	Overweight to obesity level	Colorectal cancer (CRC)	Alzheimer's disease	Autism spectrum disorder	Parkinson's disease	Depression	Hepatic encephalophaty
Phylum												
Actinobacteria	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Bacteroidetes	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
Firmicutes	[13]	[25]	[26]	[27]	[28]	[29]	[30]	[31]	[21]	[32]	[33]	[34]
Fusobacteria	[35]	[36]	[37]	[38]	[39]	[40]	[41]	[42]	[43]	[44]	[23]	[45]
Proteobacteria	[13]	[46]	[47]	[48]	[49]	[50]	[51]	[52]	[53]	[54]	[55]	[24]
Spirochaetes	[56]	[57]	[58]	[59]	[60]	[61]	[62]	[63]	[64]	[65]	[66]	[67]
Verrucomicrobia	[68]	[69]	[70]	[71]	[72]	[73]	[74]	[75]	[76]	[54]	[77]	[78]
Family												
Akkermansiaceae	[79]	[80]	[81]	[82]	[83]	[84]	[74]	[85]	[86]	[87]	[88]	[89]
Alcaligenaceae	[90]	[91]	[92]	[93]	[94]	[95]	[96]	[97]	[98]	[99]	[100]	[101]
Bacteroidaceae	[102]	[103]	[104]	[105]	[106]	[107]	[108]	[31]	[109]	[110]	[111]	[112]
Bifidobacteriaceae	[113]	[114]	[115]	[116]	[117]	[118]	[119]	[120]	[121]	[122]	[123]	[124]
Clostridiaceae	[13]	[2]	[125]	[126]	[127]	[128]	[129]	[130]	[131]	[44]	[132]	[133]
Coriobacteriaceae	[134]	[135]	[136]	[137]	[138]	[139]	[96]	[140]	[141]	[142]	[132]	[143]
Corynebacteriaceae	[144]	[145]	[146]	[147]	[148]	[149]	[150]	[151]	[53]	[152]	[153]	[154]
Desulfovibrionaceae	[13]	[155]	[92]	[156]	[157]	[158]	[159]	[160]	[161]	[162]	[163]	[89]
Enterobacteriaceae	[164]	[155]	[165]	[166]	[167]	[95]	[168]	[169]	[170]	[171]	[172]	[101]
Enterococcaceae	[173]	[174]	[175]	[156]	[109]	[176]	[177]	[178]	[109]	[171]	[179]	[180]
Erysipelotrichaceae	[181]	[182]	[104]	[183]	[184]	[185]	[186]	[187]	[161]	[188]	[189]	[190]
Eubacteriaceae	[13]	[191]	[192]	[193]	[167]	[194]	[195]	[196]	[43]	[197]	[123]	[101]
Fusobacteriaceae	[198]	[155]	[92]	[199]	[83]	[200]	[201]	[202]	[64]	[203]	[204]	
Geobacteraceae		[205]		[93]		[206]	[207]				[93]	
Helicobacteraceae	[208]	[209]	[210]	[211]	[212]	[213]	[214]	[215]	[216]	[217]	[218]	[89]
Lachnospiraceae	[219]	[220]	[221]	[156]	[222]	[223]	[224]	[8]	[225]	[226]	[88]	[45]
Lactobacillaeceae	[113]	[227]	[228]	[229]	[106]	[230]	[231]	[63]	[232]	[233]	[234]	[45]
Leptotrichiaceae	[235]	[236]	[237]	[147]		[238]	[239]	[240]		[241]	[242]	[243]
Leuconostocaceae	[244]	[245]	[246]	[156]	[247]	[248]	[244]	[249]	[161]	[250]	[251]	[101]
Methanobacteriaceae		[252]	[253]	[254]	[255]	[256]	[257]	[242]		[258]	[259]	[260]
Oscillospiraceae	[13]	[261]	[262]	[193]	[263]	[264]	[265]	[63]	[266]	[267]	[268]	[269]
Peptostreptococcaceae	[164]	[270]	[271]	[156]	[272]	[273]	[274]	[31]	[232]	[275]	[123]	[78]
Porphyromonadaceae		[276]	[277]	[71]	[157]	[278]	[186]	[279]	[280]	[281]	[282]	[283]

Prevotellaceae	[13]	[103]	[284]	[55]	[17]	[285]	[186]	[286]	[287]	[288]	[289]	[290]
Propionibacteriaceae		[155]	[291]	[291]	[292]	[293]	[294]	[242]		[295]	[296]	[297]
Pseudomonadaceae			[298]	[299]	[300]	[301]	[302]	[303]	[161]	[304]	[305]	[306]
Rhodospirillaceae		[307]	[308]	[309]	[310]	[278]	[311]	[312]			[313]	
Rikenellaceae	[314]	[227]	[15]	[315]	[316]	[278]	[214]	[317]	[280]	[318]	[319]	[180]
Ruminococcaceae	[219]	[227]	[277]	[320]	[321]	[322]	[129]	[323]	[287]	[122]	[123]	[45]
Sphingobacteriaceae		[324]	[146]	[325]	[326]	[95]	[327]	[249]	[328]	[329]	[330]	
Staphylococcaceae	[314]	[91]	[331]	[332]	[333]	[334]	[335]	[317]	[336]	[337]	[338]	[339]
Streptococcaceae	[164]	[340]	[298]	[341]	[148]	[342]	[343]	[344]	[345]	[318]	[346]	[347]
Succinivibrionaceae		[348]	[70]	[349]	[350]	[350]	[351]			[329]	[100]	[352]
Sutterellaceae	[13]	[353]	[354]	[156]	[355]	[355]	[356]	[357]	[358]	[329]	[289]	[124]
Tannerellaceae		[359]	[360]			[361]	[201]	[362]		[295]	[363]	[364]
Treponemataceae												
Veillonellaceae	[90]	[365]	[15]	[366]	[17]	[367]	[368]	[369]	[370]	[329]	[371]	[101]
Genus												
Akkermansia	[164]	[372]	[373]	[374]	[375]	[376]	[377]	[378]	[379]	[380]	[381]	
Alistipes	[382]	[383]	[360]	[384]	[50]	[385]	[386]	[130]	[21]	[281]	[172]	[78]
Alkaliphilus			[387]	[388]		[389]			[390]			[391]
Atopobium	[392]	[393]	[394]	[395]		[396]	[368]	[42]	[43]	[397]	[11]	[398]
Bacteroides	[13]	[399]	[400]	[401]	[402]	[403]	[177]	[279]	[404]	[258]	[405]	[133]
Barnesiella	[406]	[407]	[408]	[409]	[222]	[410]	[411]	[412]	[161]	[281]	[413]	[414]
Bifidobacterium	[392]	[415]	[416]	[320]	[417]	[418]	[419]	[75]	[358]	[420]	[421]	[422]
Bilophila	[164]	[423]	[424]	[425]	[417]	[426]	[427]	[160]	[21]	[428]	[429]	[414]
Blautia	[13]	[430]	[431]	[71]	[432]	[433]	[434]	[286]	[9]	[435]	[436]	[12]
Butyricicoccus	[437]	[438]	[439]	[440]	[272]	[441]	[214]	[196]	[442]	[443]	[436]	
Caloramator			[444]						[76]			
Catenibacterium		[445]	[92]	[183]	[402]	[446]	[427]	[447]	[448]	[449]	[100]	[450]
Clostridium	[392]	[2]	[451]	[452]	[167]	[453]	[377]	[454]	[455]	[456]	[457]	[422]
Collinsella	[392]	[458]	[459]	[460]	[461]	[462]	[463]	[447]	[21]	[464]	[123]	[465]
Coprococcus	[466]	[467]	[468]	[27]	[469]	[470]	[427]	[412]	[471]	[258]	[472]	[78]
Corynebacterium	[473]	[474]	[475]	[440]	[476]	[477]	[478]	[479]	[21]	[162]	[480]	[481]
Desulfovibrio	[208]	[482]	[92]	[483]	[402]	[484]	[427]	[485]	[486]	[487]	[488]	[489]
Dialister	[13]	[490]	[491]	[492]	[493]	[494]	[495]	[31]	[21]	[496]	[497]	[78]
Dorea	[173]	[498]	[431]	[384]	[499]	[500]	[302]	[501]	[9]	[502]	[503]	[504]
Eggerthella	[505]	[506]	[210]	[507]	[508]	[509]	[510]	[202]	[511]	[512]	[488]	[513]
Enterococcus	[392]	[514]	[515]	[516]	[517]	[518]	[519]	[12]	[345]	[520]	[521]	[522]
Escherichia	[164]	[523]	[524]	[525]	[526]	[527]	[419]	[528]	[529]	[530]	[531]	[532]
Eubacterium	[13]	[533]	[373]	[229]	[316]	[534]	[535]	[536]	[161]	[464]	[472]	[537]
Faecalibacterium	[13]	[538]	[539]	[540]	[316]	[541]	[542]	[543]	[544]	[502]	[545]	[546]
Fusobacterium	[35]	[69]	[547]	[548]	[39]	[549]	[550]	[551]	[64]	[44]	[23]	[532]
Geobacter		[552]							[448]			

Gordonibacter		[135]	[553]	[492]		[554]	[257]	[447]		[555]	[556]	
Helicobacter	[557]	[558]	[559]	[560]	[561]	[562]	[563]	[564]	[565]	[566]	[567]	[568]
Holdemania	[437]	[569]	[570]	[571]	[572]	[293]	[573]		[64]	[574]	[488]	[575]
Klebsiella	[13]	[482]	[576]	[577]	[578]	[579]	[580]	[581]	[582]	[583]	[584]	[465]
Lactobacillus	[392]	[585]	[586]	[460]	[316]	[418]	[377]	[587]	[588]	[258]	[421]	[589]
Leuconostoc	[590]	[61]	[586]	[16]		[554]	[591]	[592]	[593]	[594]	[595]	[532]
Marvinbryantia	[314]	[596]	[81]	[597]	[598]	[230]	[599]	[600]	[601]	[602]	[603]	
Methanobrevibacter	[604]	[605]	[606]	[607]		[418]	[608]	[609]	[610]	[267]	[611]	
Oscillibacter	[392]	[612]	[613]	[614]		[410]	[30]	[615]	[616]	[617]	[23]	[618]
Oscillospira	[619]	[620]	[387]	[621]	[578]	[578]	[622]	[623]	[624]	[258]	[625]	[143]
Parabacteroides	[382]	[626]	[360]	[627]	[526]	[628]	[629]	[630]	[624]	[22]	[631]	[101]
Peptostreptococcus	[392]	[2]	[632]	[507]		[633]	[274]	[634]	[131]	[635]	[123]	[481]
Prevotella	[636]	[637]	[638]	[639]	[272]	[403]	[640]	[641]	[404]	[642]	[584]	[643]
Propionibacterium	[392]	[644]	[291]	[374]	[645]	[646]	[377]	[75]	[161]	[22]		[504]
Pseudomonas	[382]	[445]	[647]	[648]		[649]	[650]	[651]	[652]	[653]	[654]	[12]
Rhodospirillum			[655]			[656]	[657]	[658]		[574]	[659]	
Roseburia	[392]	[14]	[660]	[483]	[661]	[662]	[663]	[75]	[588]	[664]	[665]	[504]
Ruminococcus	[208]	[372]	[666]	[384]	[499]	[667]	[411]	[8]	[668]	[258]	[669]	[78]
Sarcina		[670]	[671]			[672]	[573]		[345]		[673]	
Shigella	[164]	[674]	[277]	[388]	[675]	[509]	[650]	[378]	[21]	[435]	[488]	[12]
Slackia	[164]	[676]	[373]	[27]	[167]	[677]	[678]	[120]		[329]	[679]	
Sneathia		[680]	[681]	[374]		[682]	[463]	[587]				
Sphingobacterium		[683]	[684]	[254]		[95]	[685]	[686]		[687]	[330]	
Sporobacter				[492]		[688]	[689]		[232]		[690]	
Staphylococcus	[382]	[691]	[692]	[507]	[167]	[693]	[311]	[694]	[565]	[695]	[696]	[532]
Streptococcus	[392]	[697]	[698]	[699]	[417]	[534]	[274]	[279]	[700]	[701]	[346]	[45]
Succinivibrio	[702]	[703]	[704]	[705]	[432]	[706]	[351]	[501]		[687]	[100]	
Sutterella	[392]	[423]	[92]	[627]	[707]	[649]	[708]	[317]	[668]	[44]	[123]	[101]
Symbiobacterium			[709]			[710]						
Tannerella	[711]	[712]	[713]	[116]		[714]	[715]	[716]	[717]	[718]	[719]	
Treponema	[720]	[721]	[722]	[349]		[723]	[495]	[724]		[250]	[725]	
Veillonella	[164]	[61]	[726]	[395]		[727]	[728]	[447]	[729]	[329]	[730]	[481]
Xylanibacter		[731]	[732]	[699]		[733]	[734]					
Species												
Akkermansia muciniphila	[735]	[736]	[737]	[483]	[72]	[738]	[739]	[740]	[610]	[741]	[742]	
Alistipes finegoldii		[743]	[744]			[745]	[746]	[747]	[748]	[749]	[750]	
Bacteroides caccae	[751]	[752]	[638]	[753]		[754]	[755]		[266]		[405]	
Bacteroides fragilis	[13]	[340]	[475]	[116]	[756]	[757]	[758]	[8]	[759]	[397]	[760]	[761]
Bacteroides uniformis		[762]	[763]		[764]	[549]	[30]	[303]	[765]	[766]	[405]	[618]
Bacteroides vulgatus	[767]	[768]	[769]	[384]	[770]	[771]	[30]	[479]	[759]	[479]	[772]	[618]

Bifidobacterium adolescentis		[773]	[774]	[775]	[402]	[771]	[776]	[75]	[777]	[778]	[779]	[780]
Bifidobacterium bifidum		[781]	[416]	[782]	[499]	[693]	[783]	[784]	[785]	[786]	[421]	
Bifidobacterium catenulatum		[787]	[788]	[789]	[402]	[693]	[790]		[791]	[792]	[793]	
Bifidobacterium longum	[794]	[538]	[795]	[796]	[499]	[771]	[377]	[784]	[797]	[766]	[798]	[799]
Bilophila wadsworthia	[800]	[801]	[802]	[803]	[417]	[804]	[563]	[805]	[806]	[162]	[807]	
Clostridium coccoides		[393]	[475]	[452]	[808]	[809]	[810]	[811]	[455]	[397]	[812]	
Clostridium difficile			[451]	[395]	[813]	[814]	[815]	[811]	[816]	[530]	[817]	[818]
Clostridium histolyticum			[819]	[820]	[402]	[821]	[822]		[455]		[812]	[34]
Clostridium lituseburense			[823]	[820]		[824]			[825]			
Desulfovibrio intestinalis									[826]			
Dialister invisus	[827]	[182]	[769]	[828]		[829]	[830]		[759]		[831]	
Enterococcus faecium	[832]	[490]	[833]	[834]	[402]	[835]		[378]	[836]	[653]	[521]	[837]
Escherichia coli	[838]	[839]	[840]	[841]	[813]	[527]	[842]	[501]	[529]	[843]	[844]	[845]
Eubacterium rectale	[846]	[847]	[823]	[460]	[402]	[848]	[195]	[811]	[849]	[850]	[851]	[12]
Faecalibacterium prausnitzii	[13]	[538]	[852]	[853]	[417]	[848]	[542]	[854]	[797]	[855]	[851]	
Fusobacterium nucleatum	[856]	[857]	[858]	[388]		[168]	[739]	[551]	[859]	[520]	[654]	
Helicobacter pylori	[860]	[558]	[559]	[560]	[861]	[862]	[863]	[564]	[565]	[864]	[567]	[568]
Lactobacillus reuteri	[102]	[865]	[866]	[867]	[417]	[418]	[868]	[869]	[870]	[871]	[872]	[873]
Methanobrevibacter smithii		[874]	[606]	[875]	[876]	[418]	[608]	[651]		[855]		
Parabacteroides distasonis	[102]	[877]	[744]	[878]	[167]	[879]	[880]	[747]	[881]	[295]	[631]	
Roseburia hominis	[13]	[882]	[883]	[884]	[885]	[886]	[887]	[805]	[888]		[889]	
Roseburia intestinalis	[832]	[372]	[890]	[388]	[167]	[662]	[377]		[588]	[891]	[889]	[892]
Ruminococcus bromii		[372]	[893]	[894]		[470]	[755]	[895]	[896]	[435]	[346]	
Ruminococcus faecis			[897]	[898]	[432]	[899]			[64]			
Ruminococcus gnavus	[102]	[626]	[666]	[900]	[499]	[899]	[96]	[196]	[668]	[502]	[901]	[902]
Shigella flexneri		[903]	[904]	[905]	[906]	[907]	[908]	[909]	[700]	[910]		

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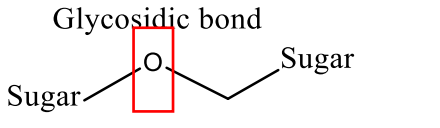
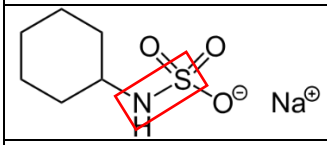
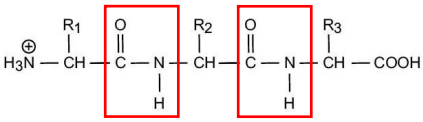
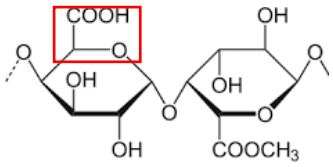
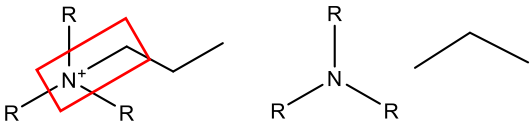
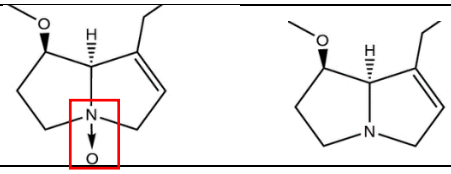
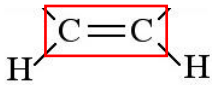
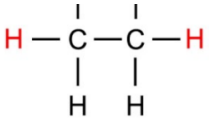
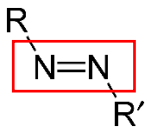
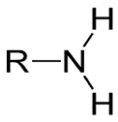
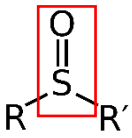
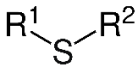
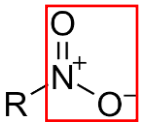
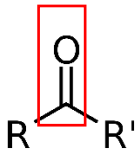
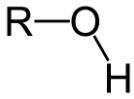
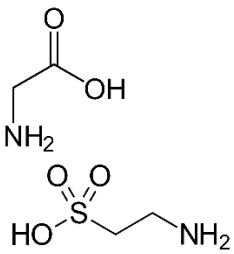
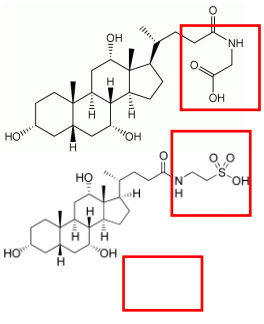
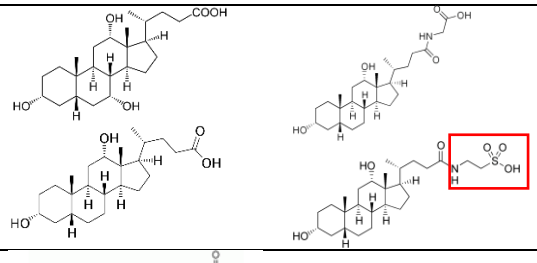
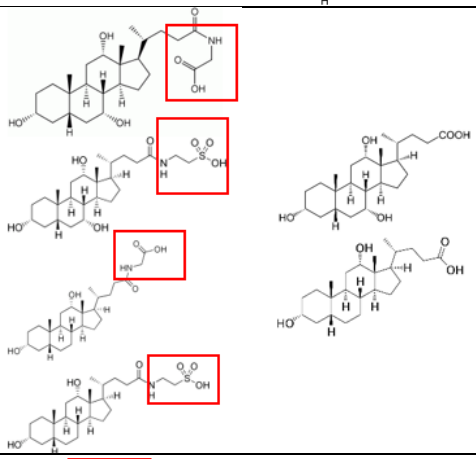
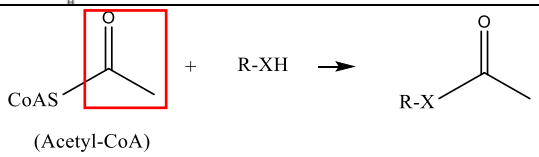
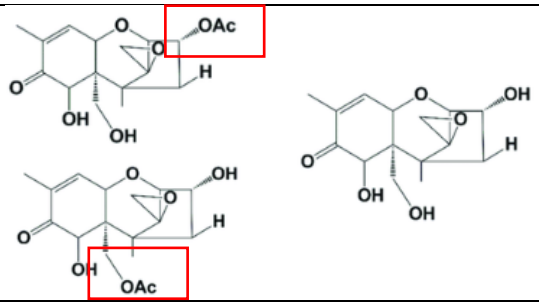
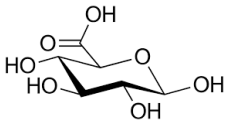
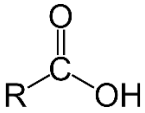
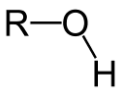
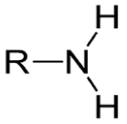
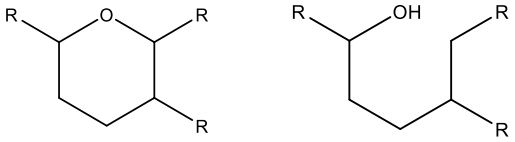
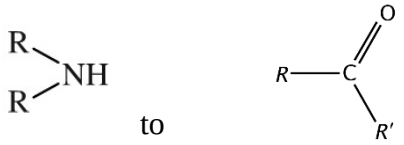
Table S2. Functionality reactions carried out by gut microbiota.

Reaction	Structural group	Examples of substrate	References
Hydrolysis		Amygdalin (i.e., plant toxin) to prunasin, to mandelonitrile and, finally, to acetonitrile and benzaldehyde.	[1, 2]
		Cyclamate (i.e., artificial sweetener) to cyclohexylamine.	[3, 4]
		Casein and bovine serum albumin (i.e., protein) to ammonium and volatile fatty acid (e.g., acetate, propionate, butyrate, 2-methylbutyrate).	[5, 6]
Lysis		Pectin (i.e., polysaccharide) to pyruvate, then to short-chain fatty acids (e.g., acetate, butyrate, propionate) and galacturonan.	[7]
Homolysis [i.e., radical bond breaking]		1] Choline [i.e., food nutrient] to trimethylamine and acetaldehyde. 2] L-tryptophan [i.e., amino acid] to products such as indole-3-propionic acid, tryptamine and indole.	[8, 9]
Reduction		Pyrrolizidine alkaloid N-oxides [i.e., plant toxin] to parent pyrrolizidine alkaloids.	[10, 11]

	 	1] Cholesterol [i.e., sterol] to coprostanol. 2] Digoxin [i.e., heart disease drug] to 20R-dihydrodigoxin.	[12, 13]
	 	1] Azo dyes to aniline and para amino phenol. 2] Prontosil [i.e., antibacterial drug] to sulphanilamide and benzene-1,2,4-triamine. 3] Sulfasalazine [i.e., drug for IBD] to sulfapyridine [SP] and 5-acetylsalycylic acid [5-ASA].	[14-16]
	 	1] Sulindac [i.e., nonsteroidal anti-inflammatory prodrug with sulfoxide functional group] to sulindac sulfide. 2] Sulphinpyrazone [i.e., gout drug] to sulphinpyrazone sulfide.	[17]
	 	1] Chloramphenicol [i.e., eye infection drug] to amino chloramphenicol. 2] Nitrobenzodiazepines [i.e., nitrazepam or seizure drug] to 7-amino-benzodiazepine. 3] Berberine [i.e., plant-based supplement] to dihydroberberine.	[18-20]
	 	1] Nabumetonen [i.e., nonsteroidal anti-inflammatory drug] to 6-methoxy-2-naphthylacetic acid [6-MNA]. 2] Doxorubicin [i.e., cancer chemotherapy drug] to 7-deoxydoxorubicinol and 7-deoxydoxorubicinolone. 3] Zearalenone [i.e., mycotoxin] to α-ZEL and β-ZEL.	[21-23]
Conjugation	 	1] Cholic acid [i.e., primary bile acid] can be conjugated with either glycine or taurine into glycocholic acid and taurocholic acid, respectively. 2] Deoxycholic acid [i.e., secondary bile acid] with	[24]

		glycine and taurine into glycodeoxycholic acid and taurodeoxycholic acid.	
Deconjugation		1] Glycocholic acid and taurocholic acid are deconjugated into cholic acid. 2] Glycodeoxycholic acid and taurodeoxycholic acid are deconjugated into deoxycholic acid.	[24]
Acetylation	 (Acetyl-CoA)	5-aminosalicylic acid (i.e., mesalamine, 5-ASA or IBD drug) to N-acetyl ASA.	[25]
Deacetylation		3-acetyl- deoxynivalenol and 15-acetyl-deoxynivalenol to deoxynivalenol [i.e., mycotoxin].	[26]
Deglucuronidation	 Glucuronic acid	2-amino-3-methylimidazo (4,5-*f*)-quinoline-N-glucuronide (IQ-N-glucuronide) to IQ.	[27]
Decarboxylation	 Carboxylic acid	1) p-hydroxyphenylacetate (i.e., tyrosine derived metabolite) to p-cresol. 2) Ellagic acid (i.e., plant secondary metabolites with antioxidant activities) to urolithins. 3) L-DOPA(i.e., amino acid) to dopamine.	[28-30]
Dehydroxylation	 Hydroxyl group	1) L-DOPA to m-tyramine or to hydroxyphenylacetic acid. 2) Secoisolariciresinol diglucoside (SDG, i.e., dietary lignan) to secoisolariciresinol (SECO), to 2,3-bis(3,4-dihydroxybenzyl)butene-1,4-diol, to enterodiol	[31-33]

		(ED), to enterolactone (EL). 3) Gallate esters and catechins to metabolites such as gallic acid.	
Deamination	 Amine functional group	Flucytosine (i.e., antifungals) to fluorouracil.	[34]
Ring opening		1] Epigallocatechin gallate [EGCG] and a series of downstream reactions to ring-opened metabolites. 2] Polyphenols ring opening to metabolites.	[35, 36]
Substitution	 to	Melamine [i.e., chemical for industrial usage] to ammonia and cyanuric acid.	[37]
Decomposition	n.a.	Xylitol and other sugars to short-chain fatty acids and CO_2.	[38]

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