Electronic Supplementary Material (ESI) for Environmental Science: Processes & Impacts.

SI Table 1. Predicted pathways for the biotransformation of diazepam and 2-amino-5-chlorobenzophenone (ACB) in aerobic systems, including the probability of degradation by named pathways and details of the mechanisms and enzymes involved. The predicted products are shown in Appendices A and B.

Diazepam

Rule	Probability	Comments	Enzymes
bt0391	Likely	This rule acts on all primary and cyclic imine groups not part of an aromatic system. Excludes thioamide S,S-oxide substrates	*trans*-ACOHDA hydrolase 1-aminocyclopropane-1-carboxylate deaminase 3-formiminopyruvate hydrolase 5-oxo-4,5-dihydropyrrole-2-carboxylate amidase
bt0063	Likely	Oxidative removal of an R group from an amine. An aldehyde is produced if the leaving R group is attached through a primary carbon. A ketone is produced if the leaving R group is attached through a secondary carbon. Rule will produce cis products in rings with double bonds	6-aminohexanoate transaminase, caffeine demethylase, cyclohexylamine oxidase, 2,6-diethyl-N-(methoxymethyl)aniline hydrolase, trimethylamine dehydrogenase, dimethylamine dehydrogenase, methylamine dehydrogenase, glyphosate dehydrogenase, hexadecyltrimethylammonium chloride monooxygenase, 6-hydroxy-L-nicotine oxidase, 6-hydroxy-D-nicotine oxidase, 6-hydroxypseudooxynicotine dehydrogenase, iminodiacetate dehydrogenase, methylamine dehydrogenase, N-methyltaurine dehydrogenase, heteroxanthine demethylase, nitrilotriacetate monooxygenase, nitrilotriacetate dehydrogenase, 3-nitrotyramine oxidase, 3-nitrotyrosine transaminase, paraxanthine demethylase, pyridoxamine-pyruvate transaminase, theobromine demethylase, trimethylamine N-oxide demethylase, tropine dehydrogenase, aromatic aminotransferase
bt0243	Neutral	Oxidative removal of an aliphatic R group from a secondary or tertiary urea or amide nitrogen. An aldehyde is produced if the leaving R group is attached through a primary carbon. A ketone is produced if the leaving R group is attached through a secondary carbon. Oxidative cleavage of the C-N bond in amides and ureas are covered by a single rule, since there is no chemical reason to divide them. Cleavage of urea derivatives occurs between the N and the C with the most positive partial charge. Rule will produce cis products in rings with double bonds	alachlor hydrolase, caffeine demethylase, 2-hydroxy-2',6'-diethyl-N-acetanilide hydrolase, hydroxymonomethylisoproturon dimethylaminedehydrogenase, N-isopropylacetaniline monooxygenase, isoproturon dimethylaminedehydrogenase, heteroxanthine demethylase, monodemethylisoproturon dimethylaminedehydrogenase, paraxanthine demethylase, theobromine demethylase, theophylline demethylase
bt0065	Neutral	There are separate rules for amide and urea hydrolysis. However, microbial amidases have been shown to also hydrolyze environmental urea compounds	*p*-Acetamidophenol amidohydrolase, N-acetylanthranilate amidase, 6-aminohexanoate-cyclic-dimer hydrolase, 6-aminohexanoate-dimer hydrolase, *epsilon*-caprolactam lactamase, N-cyclohexylformamide amidohydrolase, N-(2,6-diethylphenyl)-2-hydroxyacetamide hydrolase, formylaminopyrimidine amidohydrolase, isonicotinic acid hydrazide hydrolase, 5-oxo-4,5-dihydropyrrole-2-carboxylate amidase

2-amino-5-chlorobenzophenone

Rule	Probability	Comments	Enzymes
bt0065	Neutral	Also handles fused rings. All fused aromatic ring products with hydroxyl at 2,3 position are excluded	acetanilide 1,2-dioxygenase, 2-aminobenzenesulfonate 2,3-dioxygenase, 4-aminobenzenesulfonate 3,4-dioxygenase (deaminating), anthranilate 3-monooxygenase, 4-aminobenzoate 3,4-dioxygenase (deaminating), aniline dioxygenase, 2-chloro-N-isopropylacetanilide 1,2-dioxygenase, N-isopropylaniline 1,2-dixoxygenase
bt0353	Neutral	This rule handles the 2,3-dioxygenation of mono-substituted aromatics (bt0369) and subsequent oxidation to form the catechol derivative (bt0255). The substituents are based on "Reactions of Toluene Dioxygenase" and Hudlicky T, Gonzalez D, Gibson DT (1999) Aldrichimica Acta 32(2): 35-62. The aromatic hydrocarbon dioxygenases produce an activated dioxygen species that is thought to be sufficiently reactive to potentially functionalize most, if not all, aromatic ring carbon atoms	diphenyl ether 2,3-dioxygenase, 2-[(3-hydroxy(phenyl)methyl)phenyl]-propanoate dioxygenase
bt0351	Neutral	This rule handles extradiol (*meta*) ring cleavage for *vic*-dihydroxybenzenoids and 1-amino-2-hydroxybenzenoids, including, but not limited to, 2,3-dihydroxybiphenyl derivatives, many PCB congeners , 3- and 4-substituted chlorocatechols, 2-aminophenol, 2,3-dihydroxy DDT and its derivatives, 3- and 4-substituted alkyl catechols, diphenylether derivatives, and aromatized intermediates of steroid degradation (*e.g.*, testosterone)	No enzymes given
bt0254	Neutral	This rule does not handle 2,3-dihydroxy linear polyaromatics such as 2,3-dihydroxynaphthalene, 3-methylcatechol, 3-sulfocatechol, 3-fluorocatechol, 4-C-substituted catechol, 3,4-dihydroxyphenylacetate or 2,3,5-trihydroxytoluene derivatives. Though certain compounds are predicted as being cleaved exclusively by an intradiol or by an extradiol pathway, this does not mean that they can never be cleaved by the other pathway in certain environments or by certain organisms	anthracene-1,2-diol 1,2-dioxygenase, hydroxyquinol 1,2-dioxygenase, catechol 1,2-dioxygenase, 4,6-dichloro-3-methylcatechol 1,2-dioxygenase, 3,5-dichlorocatechol 1,2-dioxygenase, 3,6-dichlorocatechol 1,2-dioxygenase, 4,5-dihydroxybenzo(a)pyrene dioxygenase, protocatechuate 3,4-dioxygenase, 4,5-dihydroxypyrene dioxygenase, protocatechuate 3,4-dioxygenase type II