

**Table S1:** Results of approximately unbiased (AU) tests of alternative topologies for ACR2, ACR3, ARSB and ARSM gene trees. AU Topology Tests for a combination of topology constraints related to possible origin of arsenic resistance metabolism genes. P-AU represents the p-value of the topologies tested by the approximately unbiased (AU) criteria. Accepted trees are indicated in bold (> 0.05).

	Hypothesis tested	logL	p-AU
ACR2	<b>Unconstrained tree</b>	-43842.82091	<b>0.786</b>
	<b>Fungi monophyletic</b>	-43864.41782	<b>0.489</b>
	<b>Metamonada monophyletic</b>	-43857.63337	<b>0.455</b>
	<b>Discoba monophyletic</b>	-43897.62565	<b>0.158</b>
	<b>Amoebozoa monophyletic</b>	-43890.38004	<b>0.172</b>
	<b>Archaeplastida monophyletic</b>	-43870.00233	<b>0.387</b>
	<b>SAR monophyletic</b>	-43884.91836	<b>0.193</b>
	Fungi + Metamonada + Discoba + SAR + Archaeplastida + Amoebozoa monophyletic	-43980.45213	2.22E-019
ARSB	<b>Unconstrained tree</b>	-7,877,770,938	<b>0.926</b>
	Eukaryotic monophyletic	-7,927,148,607	0.000107
	<b>ARSB 2 monophyletic</b>	-7,879,461,563	<b>0.076</b>
	ARSB 1 + ARSB 2 monophyletic	-791,950,358	9.09e-06
	ARSB 1 + ARSB 3 monophyletic	-7,943,097,566	5.86e-05
	ARSB 2 + ARSB 3 monophyletic	-7,888,092,247	4.09e-06
ACR3 test (groups)	<b>Unconstrained tree</b>	-8,230,043,048	<b>0.881</b>
	Eukaryotic monophyletic	-8,264,627,396	8.85e-123
	ACR3 1 + ACR3 2 monophyletic	-8,256,999,753	2.26e-07
	ACR3 1 + ACR3 3 monophyletic	-8,261,617,522	8.48e-34
	<b>ACR3 2 + ACR3 3 monophyletic</b>	-8,234,837,386	<b>0.119</b>
ACR3 test (classification)	<b>Unconstrained tree</b>	-7,763,168,156	<b>1</b>
	Eukaryotic monophyletic	-7,796,133,918	3.01e-05
	Oomycetes monophyletic	-7,804,225,848	2.31e-07
	Archaeplastida monophyletic	-7,776,974,866	7.23e-05
	Fungi monophyletic	-7,804,238,927	1.17e-77
ARSM1	<b>Unconstrained tree</b>	-8,984,400,596	0.976
	Eukaryotic ARSM 1 monophyletic	-9,016,839,843	1.16e-75
	Eukaryotic ARSM 1.1 monophyletic	-9,007,446,498	0.00102
	Eukaryotic ARSM 1.1b monophyletic	-8,993,608,104	0.032
ARSM2	<b>Unconstrained tree</b>	-5,172,209,384	<b>1</b>
	Eukaryotic ARSM 2 monophyletic	-5,219,695,659	3.04e-13
	ARSM 2.3 + ARSM 2.5 monophyletic	-5,187,353,866	0.000119
	ARSM 2.1 + ARSM 2.3 + ARSM 2.5 monophy	-5,260,039,797	1.57e-48
	ARSM 2.2 + ARSM 2.4 monophyletic	-5,187,273,107	9.66e-07