

Supplementary Table 5. Amino acid and cofactor biosynthesis in Family Anaplasmataceae

Organisms ¹	NHO	NRI	NES	APH	ECH
Amino Acids: ²					
Alanine	+	+	+	+	+
Arginine	-	-	-	+ ³	+
Asparagine	-	-	-	+	+
Aspartate	+	+	+	+	+
Cysteine	-	-	-	-	-
Glycine	+	+	+	+	+
Glutamate ⁴	+	+	+	+	+
Glutamine	+	+	+	+	+
Histidine	-	-	-	-	-
Leucine	-	-	-	-	-
Lysine	- ⁵	-	-	-	+
Isoleucine	-	-	-	-	-
Methionine	-	-	-	-	-
Phenylalanine	-	-	-	-	-
Proline	-	-	-	-	-
Serine	-	-	-	-	-
Threonine	-	-	-	-	-
Tryptophan	-	-	-	-	-
Tyrosine	-	-	-	-	-
Valine	-	-	-	-	-
Cofactors:					
Biotin	+	+	+	+	+
FAD	+	+	+	+	+
Folate	+	+	+	+	+
Lipoate	+	+	+	+	+
NAD	+	+	+	+	+
CoA ⁶	+	+	+	+	+
Protoheme	+	+	+	+	+
Pyridoxine phosphate (Vitamin B6)	+	+	+	+	+
Thiamine	+	+	+	+	+
Ubiquinone	+	+	+	+	+

¹ Abbreviations: ECH, *Ehrlichia chaffeensis* Arkansas; APH, *Anaplasma phagocytophilum* HZ; NSE, *N. sennetsu* Miyayama; NRI, *N. risticii* Illinois; NHO, *N. helminthoeca* Oregon.

² *N. helminthoeca* encodes genes for 5 amino acids biosynthesis, which are converted from other AAs or metabolic intermediates.

³ Only partial enzymes are identified in Arginine biosynthesis pathway in APH.

⁴ *Ech* and *APH* can convert Pro to Glu through PutA (bifunctional proline dehydrogenase/pyrroline-5-carboxylate dehydrogenase). All Anaplasmataceae can convert Gln to Glu by CarA/B (carbamoyl phosphate synthase) or GS/PH (bifunctional glutamate synthase subunit beta/2-polyprenylphenol hydroxylase).

⁵ *N. helminthoeca* encodes complete pathways to synthesize meso-2,6-diaminopimelate (*mDAP*) from L-Asp, but lacks diaminopimelate decarboxylase (LysA) at the last step to produce lysine.

⁶ ECH and APH can synthesize CoA from pantothenate, however, all *Neorickettsia* spp. can only convert 4'-phosphopantetheine to CoA.