

# *Escherichia coli* and *Salmonella*

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TABLE 2 Residue composition of *E. coli* B/r protoplasm<sup>a</sup>

Residues	Amt ( $\mu\text{mol/g}$ of dried cells)	Residues	Amt ( $\mu\text{mol/g}$ of dried cells)
Protein amino acids <sup>b</sup>		Lipid components <sup>e</sup>	
Alanine	488	Glycerol	161
Arginine	281	Ethanolamine	97
Asparagine	229	C <sub>16:0</sub> fatty acid (43%)	
Aspartate	229	C <sub>16:1</sub> fatty acid (33%)	
Cysteine	87	C <sub>18:1</sub> fatty acid (24%)	
Glutamate	250	Average fatty acid	258
Glutamine	250	LPS components <sup>f</sup>	
Glycine	582	Glucose	16.8
Histidine	90	Glucosamine	16.8
Isoleucine	276	Ethanolamine	25.2
Leucine	428	Rhamnose	8.4
Lysine	326	Heptose	25.2
Methionine	146	KDO	25.2
Phenylalanine	176	Hydroxymyristic acid	33.6
Proline	210	Fatty acid (C <sub>14:0</sub> )	16.8
Serine	205	Peptidoglycan components <sup>g</sup>	
Threonine	241	N-Acetylglucosamine	27.6
Tryptophan	54	N-Acetylmuramic acid	27.6
Tyrosine	131	Alanine	55.2
Valine	402	Diaminopimelate	27.6
RNA nucleotides <sup>c</sup>		Glutamate	27.6
AMP	165	Glycogen components <sup>h</sup>	
GMP	203	Glucose	154
CMP	126	Polyamines <sup>i</sup>	
UMP	136	Putrescine	34.1
DNA nucleotides <sup>d</sup>		Spermidine	7.0
dAMP	24.6		
dGMP	25.4		
dCMP	25.4		
dTMP	24.6		

<sup>a</sup> Compiled and calculated for *E. coli* B/r in the growth conditions described in Table 1. This table is modified from data in Table 10. of reference 10.

<sup>b</sup> There is 550 mg of total protein per g of dried cells (Table 1). With an average residue molecular weight of 108, there is a total of 5,081  $\mu\text{mol}$  of amino acid residues. The amino acid composition is based on an analysis of *E. coli* B/r protein by T. A. Phillips, except that cysteine and tryptophan values are from reference 13, and no distinction is made between glutamate and glutamine and between aspartate and asparagine. The data have been corrected to exclude peptidoglycan (murein) amino acids. An alternative analysis is given in reference 13 and cited in reference 17.

<sup>c</sup> There is 205 mg of total RNA per g of dried cells (Table 1). This consists of 197 mg of stable RNA (167 mg of rRNA and 30 mg of tRNA) plus 8.3 mg of mRNA. With an average nucleotide residue molecular weight of 325, there is a total of 630  $\mu\text{mol}$  of nucleotide residues. The A/G/C/U ratios are based on the analysis in reference 12, corrected for DNA.

<sup>d</sup> There is 31 mg of DNA per g of dried cells (Table 1). With an average residue molecular weight of 309, there is a total of 100  $\mu\text{mol}$  of nucleotide residues. The ratios of individual residues are based on  $(S + T)/(G + C) = 0.97$ .

<sup>e</sup> There is 91 mg of total phospholipid exclusive of lipid A per g of dried cells (Table 1). With an average molecular weight of 705 (calculated as if all were phosphatidylethanolamine), there is 129  $\mu\text{mol}$  of total phospholipid. The simplifying assumption is made that, of the total, 97  $\mu\text{mol}$  is phosphatidylethanolamine and 32  $\mu\text{mol}$  is phosphatidylglycerol, ignoring the small amounts of cardiolipin and minor, unidentified lipids (1, 12). The fatty acid composition is based on the analysis in reference 14, corrected for myristic and hydroxymyristic acid from lipid A.

<sup>f</sup> There is 34 mg of lipopolysaccharide (LPS) per g of dried cells (Table 1). With an average molecular weight of 4,070, there is 8.4  $\mu\text{mol}$  of LPS, assuming the following structure for the rough LPS of strain B/r: lipid A (four hydroxymyristic residues, two saturated fatty acids assumed to be C<sub>14:0</sub>, two glucosamines, one phosphoryl group, and one ethanolamine in pyrophosphate linkage); inner core (three 2-keto-3-deoxyoctulosonic acid [KDO], one rhamnose, one phosphoethanolamine, three heptose, one phosphoryl, and one ethanolamine in pyrophosphate linkage); and an outer core (two glucose residues). This composition is compiled from information in several sources, including reference 2 (for lipid A) and reference 10 (for the polysaccharide portion). Different strains of *E. coli* differ slightly in LPS structure, particularly in the outer core. Many K-12 strains will have one galactose, one glucose, and one acetylglucosamine residue in the outer core in addition to the residues for B/r shown here (8).

<sup>g</sup> There is 25 mg of peptidoglycan per g of dried cells (Table 1). With an average molecular weight of 904 for a disaccharide subunit, there is 27  $\mu\text{mol}$  of subunits consisting of 1 N-acetylglucosamine, 1 N-acetylmuramic acid, 1 D-glutamate, 1 m-diaminopimelic acid, 1 D-alanine, and 1 L-alanine residue (for a review see reference 7).

<sup>h</sup> There is 25 mg of glycogen per g of dried cells (Table 1). With a glucosyl molecular weight of 162, there is 154  $\mu\text{mol}$  of glucosyl residues.

<sup>i</sup> There are 3 mg of putrescine (molecular weight, 88) and 1 mg of spermidine (molecular weight, 145) per g of dried cells, giving 34.1 and 7.0  $\mu\text{mol}$ , respectively (Table 1 of reference 9).