427s Ydgg (Renamed Sqsa) Controls Biofilm Formation in *Escherichia Coli* K12 by Altering Secretion of the Quorum-Sensing Signal Autoinducer-2

Moshe Herzberg, Andrés F. González Barrios, Youngsoon Um, William E. Bentley, Ian K. Kaye, and Thomas K. Wood

The putative transport protein YdgG (344 aa) was induced 5-fold in *Escherichia coli* JM109 biofilms (*Appl. Microbiol. Biotechnol.* **64**:515, 2004) and was confirmed here to control biofilm formation in complex and minimal media since deleting *ydgG* increased biofilm formation by 4- and 2-fold in complex and minimal media supplemented with glucose using a 96-well microtitre assay as well as increased biomass by 600-fold in flow chambers with minimal media supplemented with glucose. YdgG was also found to negatively modulate motility since transcription of flagella genes (*qseB, flhD, fliA,* and *fliC*) and a motility gene (*motA*) increased by 15- to 120-fold upon deletion of *ydgG*. Deletion of *ydgG* also decreased extracellular activity of autoinducer-2 by 4- to 13-fold and increased intracellular activity when glucose was added to the media by 10- to 17-fold. Using DNA microarrays and by comparing the biofilm mutant vs. the wild-type, we found deleting *ydgG* caused 31% of the bacterial chromosome to be differentially induced more than 2-fold, and 7.6% of the genes were repressed by more than 2-fold. YdgG not only negatively modulates expression of flagella- and motility-related genes but also all the other known products essential for biofilm formation: 4 known operons for flagella synthesis and motility (*flgABCDEFGHIJ*, *fliEFGHIJK*, *fliLMNOPQR*, and *motABcheAW*), adhesion determinants (type 1 fimbriae and the autotransporter protein Ag43), curli production, colanic acid production, and production of β-1,6-*N*-acetyl-D-glucoseamine polysaccharide adhesin. In addition, *acrEF* was induced 24-fold and this locus encodes for a known transporter of indole which is a stationary-phase, extracellular signal; indole has also been shown to influence biofilm formation. Through the microarrays, new genes related to biofilm formation were identified including transport proteins (*yihN* and *yihP*), polysialic acid production (*gutM* and *gutQ*), phage (*yjfR* and *alpA*), methionine biosynthesis (*metR*), biotin and thiamine biosynthesis (*bioF* and *thiDFH*), anaerobic metabolim (*focB*, *hyfACDR*, *ttdA*, and *fumB*), and genes with unknown function (*ybfG*, *yceO*, *yjhQ*, and *yjbE*). Hence, it appears *ydgG* controls the **s**ecretion of the **q**uorum **s**ensing signal AI-2 and so has been renamed *sqsA*.