Homeostatic control of the flagellar filament protein in *Bacillus subtilis*

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The flagellar filament protein Hag is transcribed from a strong promoter, translated from a strong Shine Dalgarno sequence, and as a consequence is produced in high abundance to complete the filaments of multiple flagella. In *Bacillus subtilis*, the Hag protein is both structural and regulatory, repressing its own translation by way of the protein FliW and the RNA binding protein CsrA. Autoinihition of Hag is thought to restrict Hag accumulation in the cytoplasm while permitting maximal synthesis to support filament assembly. Here we quantify each component of the homeostatic feedback loop, we show robust protein equanimity between Hag, FliW, and CsrA in the cytoplasm and obtain the number of Hag monomers per filament. We explore the regulation that maintains the observed balance between Hag and its regulators. Finally, we demonstrate that CsrA translational repression of Hag is required for optimal fitness and synergizes with FlgM transcriptional repression. We hypothesize that homeostatic regulation may be necessary for all highly abundant structural components of bacterial nanomachines and likely occurs at the post-transcriptional level.