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Hysteresis in transition between individual and collective behavior in suspension of swimming bacteria ANDREY SOKOLOV, IGOR ARANSON, Argonne National Laboratory — We present a new method for control of motility and tumbling rate of swimming bacteria Bacillus Subtilis via precise and rapid control of temperature of the bacterial suspension. Transitions between individual and collective behaviors in a response to cyclical temperature change in a range of temperatures between 5C and 35C with the rates from 0.1C/s to 1C/s were investigated. Temperature decrease typically results in a decrease of bacterial motility while preserving low tumbling rates. The temperature increase above 20C triggers a "heat shock": a significant jump in tumbling rate resulting in temporal decrease of the average swimming speed and termination of collective motion. At temperatures below 20C due to relative low tumbling rates we discovered a hysteresis in the transition between individual and collective swimming: velocity correlation length vs. average swimming speed of bacteria exhibits hysteric behavior.

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