MAR10-2009-004859

Abstract for an Invited Paper
for the MAR10 Meeting of
the American Physical Society

Thermal impulse response and the temperature preference of *Escherichia coli*

WILLIAM RYU, University of Toronto

From a broad perspective, exposure to environmental temperature changes is a universal condition of living organisms. Escherichia coli is a powerful model system to study how a biochemical network measures and processes thermal information to produce adaptive changes in behavior. E. coli performs thermotaxis, directing its movements to a preferred temperature in spatial thermal gradients. How does the system perform thermotaxis? Where biologically is this analog value of thermal preference stored? Previous studies using populations of cells have shown that *E.coli* accumulate in spatial thermal gradients, but these experiments did not cleanly separate thermal responses from chemotactic responses. Here we have isolated the thermal behavior by studying the thermal impulse response of single, tethered cells. The motor output of cells was measured in response to small, impulsive increases in temperature, delivered by an infrared laser, over a range of ambient temperature (23 to 43 degrees C). The thermal impulse response at temperatures $<$ 31 degrees C is similar to the chemotactic impulse response: both follow a similar time course, share the same directionality, and show biphasic characteristics. At temperatures $>$ 31 degrees C, some cells show an inverted response, switching from warm- to cold-seeking behavior. The fraction of inverted responses increases nonlinearly with temperature, switching steeply at the preferred temperature of 37 degrees C.