BiophysTO Lunchtime Talks

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Hearing the shape of life: Mathematical explorations of cell biology

Hidden inside of a single individual living cell there exists a dynamical system of multiple, interrelated, chemical processes. Collectively, it is these dynamics and chemical interrelations that define life. The difficulty is that, intracellular dynamics are intrinsically difficult to experimentally assay. While time lapse microscopy can directly visualize the levels of tagged a protein, this method remains blind to dynamics of intracellular phosphorylation kinetics or even the dynamics of cell mass increase. An alternative approach is bulk measurements on synchronized populations. This latter method, however, also suffers from drawbacks: the side effects of the synchronization procedure and the clouding effects of desynchronization. Thus, to appropriately understand intracellular process, new approaches are in demand. To answer this demand, we have relied on the ergodic principle from statistical physics to derive ergodic rate analysis (ERA) – a method that recovers temporal information on intracellular processes from a single snapshot image of fixed cells (Nature, 2013). The underlying notion is that in the ergodic state, the proportion of cells occupying any given molecular state can be mathematically related to the rate at which cells traverse this state. We then used ERA to study dynamics of animal cell growth during cell cycle. With this approach, we provide the first quantitative description of cellular growth. Surprisingly, our results show that – just as a thermostat specifies room temperature – rates of cell growth are precisely regulated to maintain cell size at its fixed target size value.

Host: Dr. Anton Zilman

Thursday, January 14, 2016 – 12:00 pm, noon
Davenport Room, Chemistry Building
(and via streaming to Davis Building 4001 UTM)