Needy RL: A normative theory for state-dependent homeostatic regulation of value driven behavior

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Efficient allostatic regulation of internal milieu in dynamic environments requires adaptive integration of contextual information, sensory information, and the internal state of the animal. By integrating the hypothalamus-based homeostatic regulation and dopamine-based reward learning systems into a simple unified model, we show that physiological stability and reward acquisition prove to be identical objectives. The model gives a normative definition of reward and accounts for anticipatory responding, in which collaboration between regulatory and learning systems is critical. Moreover, the model accounts for risk aversion, taste-induced overeating, and competition between motivational systems, and provides a normative rationale for delay discounting of reward.