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Sleep is a complex process in which many brain circuits participate. Recent experiments suggest that the newborn rat may serve as a simplified experimental model, with a basic sleep-switch circuit that cycles rapidly between wake and sleep states. The adult pattern of consolidated bouts of sleep and wakefulness develops during the first three weeks of life as other neuronal circuits develop and provide modulation. The nature of both the basic sleep-switch circuit and the modulatory circuits remain poorly understood. In this talk I will discuss a mathematical model for sleep in the maturing rat that combines probabilistic and geometric dynamical systems theory approaches to address questions concerning how these circuits generate and maintain sleep states. (Received August 28, 2006)