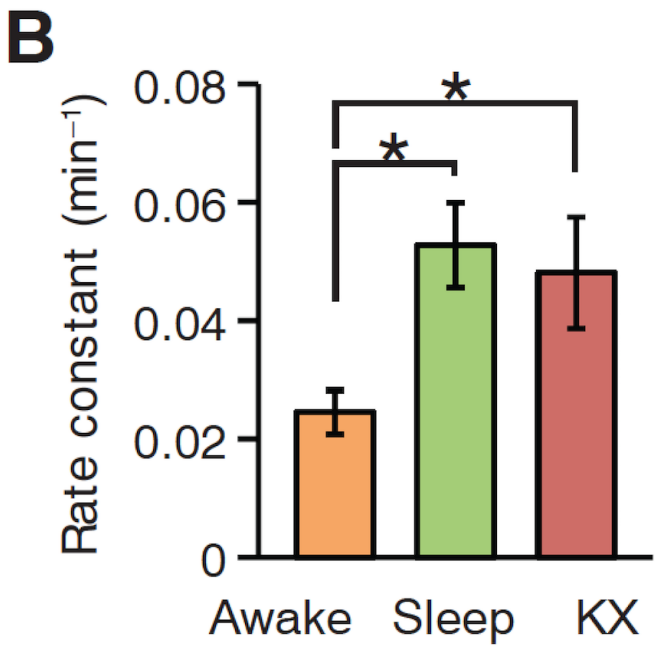

*Caption: The different rates at which ß-amyloid (Aß) was cleared from the brains of mice that were awake, asleep, or in an induced sleep state using the anesthetic ketamine/xylazine (KX). The * indicates a P value < 0.05, meaning that the differences in clearance rates are statistically significant in this study. The error bars represent standard error of the mean.*

BACKGROUND INFORMATION

Nearly all animals require sleep, though the reasons for this are not fully understood. However, the fact that sleep has been evolutionarily conserved suggests that it serves vital biological functions. Lack of sleep impairs brain function and, in prolonged cases, can cause dementia or death. Surprisingly, most of the mechanisms by which sleep preserves brain function remain a mystery. In this study, scientists set out to investigate whether sleep plays a role in removing metabolites (the molecules produced during normal metabolism) from the brain. Metabolites can impair neurological function when they accumulate at abnormally high levels. One such metabolite is a protein called β-amyloid (Aβ). During cell metabolism, it is deposited in the spaces between brain cells (called interstitial spaces) and then removed by circulating cerebrospinal fluid. The buildup of Aβ proteins in the brain is linked to neurodegenerative diseases like Alzheimer's disease (AD).

Previous research has shown that levels of Aβ are higher in the brains of animals that are awake than in those that are asleep, so the researchers in this study tested whether the rate of Aβ removal is higher during sleep. The scientists injected radioactively labeled Aβ into the brains of 25 awake mice, 29 that were sleeping naturally, and 23 that were anesthetized via a thin tube previously installed in the skull. The anesthetized mouse group was used to determine whether differences in Aβ clearance rates that may be seen between asleep and awake states are due to circadian rhythms, which do not occur under anesthesia. At several time points between 10 and 240 minutes post-injection, three to six mice per time point were humanely euthanized in order to measure the levels of labeled Aβ in their brains and determine the clearance rate.