

# Considering species-specific sleep-wake patterns in research: from cells to social structure

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The universality of sleep-wake patterns across the animal kingdom is demonstrated in detailed studies in species ranging from the round worm, fruit fly, zebrafish, and the laboratory rodents as well as in domestic and wild animals in their natural habitat. While waking behaviors are extensively mapped, and well characterized in the laboratory conditions (and increasingly so also in the wild) the same is unfortunately not true for sleep. The root causes for neglecting sleep stem from the scientific tradition of defining behavior as an observable action/movement; the false assumption that during sleep physiological processes are downregulated or turned off and the poor availability of tools for non-invasive or minimally invasive sleep monitoring in a large scale. Currently, it is evident that sleep is as multifaceted as waking, having multiple functional roles for instance in energy metabolism, immune function, and memory consolidation. Most importantly, there is a bi-directional relationship between sleep and waking: modifications in waking affect sleep and vice versa. Therefore, it is of utmost importance to understand: 1) the species-specific sleep phenotypes, 2) provide optimal conditions for healthy sleep and 3) consider using sleep as a sensitive “biomarker” for animal well-being and/or as an outcome measure for experimental procedures. Recent technical advantages in behavioral monitoring and implant technology allow for non-invasive or minimally invasive sleep monitoring also in social groups revealing important insights into sleep biology. The challenge for the future is to consolidate sleep monitoring as a standard practice in animal housing and promotion of welfare.