**Supplementary Data**

**[11C]carfentanil PET imaging for studying the peripheral opioid system in vivo: effect of photoperiod on mu-opioid receptor availability in brown adipose tissue**

**Running Head:** Seasonality in Peripheral Opioid System

Lihua Sun1,2, Richard Aarnio2, Erika Atencio Herre2, Salli Kärnä2, Senthil Palani2, Helena Virtanen2, Heidi Liljenbäck2,3, Jenni Virta2, Aake Honkaniemi2, Vesa Oikonen2, Chunlei Han2, Sanna Laurila2,4, Marco Bucci2,5,6,7, Semi Helin2, Emrah Yatkin8, Lauri Nummenmaa2,9, Pirjo Nuutila2,10,11, Jing Tang12, Anne Roivainen2,3,11

*1Department of Nuclear Medicine, Huashan Hospital, Fudan University, Shanghai, China; 2Turku PET Centre, University of Turku and Turku University Hospital, FI-20520 Turku, Finland; 3Turku Center for Disease Modeling, University of Turku, FI-20520 Turku, Finland; 4Heart Center, Turku University Hospital, FI-20520 Turku, Finland;5Division of Clinical Geriatrics, Center for Alzheimer Research, Department of Neurobiology, Care Sciences and Society, Karolinska Institute, SE-17177 Stockholm, Sweden; 6Theme Inflammation and Aging, Karolinska University Hospital, SE-14186 Stockholm, Sweden; 7Turku PET Centre, Åbo Akademi University, Turku, Finland; 8Central Animal Laboratory, University of Turku, FI-20520 Turku, Finland; 9Department of Psychology, University of Turku, FI-20520 Turku, Finland; 10Department of Endocrinology, Turku University Hospital, FI-20520 Turku, Finland; 11InFLAMES Research Flagship Center, University of Turku, FI-20520 Turku, Finland; 12Research Program in Systems Oncology, Faculty of Medicine, University of Helsinki, FI-00014 Helsinki, Finland;*



**FIGURE S1.** Metabolism of [11C]carfentanil in rat tissues after the intravenous injection of radiotracer.High-performance liquid chromatography measurements of the metabolism of [11C]carfentanil in (A) the blood and (B) peripheral organs. The measurements for a single rat are presented.

****

**FIGURE S2.** Plots of standardized uptake value (SUV) ratios and SUVs, demonstrating the effect of photoperiod on MOR availability. (A) Plot of the SUV ratios comparing BAT and muscle. (B) Separate plots of SUVs for brown adipose tissue (BAT) and muscle. Individual animals are represented by separate lines. The black dashed lines are the least-squares (LS) regression lines for the linear model, predicting the SUV ratios/SUVs for the entire group. Shaded areas represent the 95% confidence intervals for the LS curves.