

## Description of Additional Supplementary Files

File Name: Supplementary Movie 1

Description: Video showing voracious feeding upon LH<sup>Pdx1-ChR2</sup> → PVH photostimulation with 5Hz, 100 ms light pulses. Notice fast onset to feeding shortly after the light is turned on.

File Name: Supplementary Movie 2

Description: Video showing repetitive licking of cage upon LH<sup>Pdx1-ChR2</sup> → PVH photostimulation in the absence of food.

File Name: Supplementary Movie 3

Description: Repetitive self-grooming is induced by photostimulation of the LH<sup>Pdx1-ChR2</sup> → PVH circuit with 5Hz, 10 ms pulses of blue light.

File Name: Supplementary Movie 4

Description: Water spray strongly causes repetitive grooming, a behavior that is abruptly suppressed upon photostimulation of GABAergic LH<sup>Pdx1-ChR2</sup> → PVH circuit in exchange for feeding. *Pdx1-Cre::Vglut2<sup>flox/flox</sup>* mice were used to target the non-glutamatergic (i.e., GABAergic) component of the circuit.

File Name: Supplementary Movie 5

Description: Video showing photostimulation of PVH<sup>Sim1-ChR2</sup> neurons abruptly stops ongoing feeding and quickly promotes grooming in a mouse fasted ~24h.

File Name: Supplementary Movie 6

Description: Photostimulation of non-glutamatergic neurons in PVH (using *Sim1-Cre::Vglut2<sup>flox/flox</sup>* mice) fails to suppress feeding and promote grooming during the fasted state. Notice mice will continue feeding regardless of light epoch.