

Light-dependent Regulation of Chick Pineal Gene Expression and its Role in the Circadian System

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Among vertebrate circadian clock systems, the chicken pineal gland is unique in that it retains intrinsic phototransduction pathways for adjustment of the clock (entrainment) to the environmental 24-hr cycles. Therefore the chicken pinealocyte provides a prominent platform for studies on the light-entrainment mechanism, which is poorly understood. Here we performed a comprehensive analysis of light-inducible genes in the chicken pineal gland. Light stimulated expression of 62 genes and 40 ESTs by >2.5-fold, among which genes responsive to the heat shock and endoplasmic reticulum stress as well as their regulatory transcription factors HSF1, HSF2 and XBP1 were strongly activated when a light pulse was given at late subjective night. On the other hand, the light pulse given at early subjective night caused prominent induction of *E4bp4*, a key regulator in the phase-delaying mechanism of the pineal clock. In parallel it induced a subset of cholesterol biosynthetic genes that are targets of SREBP transcription factor. We found that the light pulse stimulated proteolytic formation of active SREBP-1 that in turn transactivated *E4bp4* expression, linking SREBP with the light-input pathway of the pineal clock. Interestingly light-activation of SREBP-regulated genes stimulated production of a neurosteroid, 7 α -hydroxypregnenolone, and this enhanced locomotor activities of the chicks.