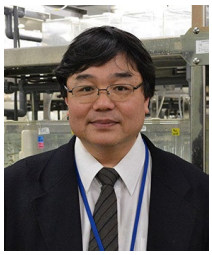
【Grant-in-Aid for Scientific Research (S)】

Integrated Disciplines (Complex Systems)



Title of Project : Neural circuit mechanisms controlling social conflicts

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Research Project Number : 16H06317 Researcher Number : 40183769
Research Area : Basic and Social Brain Science
Keyword : Social conflict, habenula, zebrafish, mouse, interpeduncular nucleus

【Purpose and Background of the Research】

All vertebrates fight among conspecifics for larger territories or better reproductive partners. Such social conflicts terminate not by killing of the loser but when one of the fighting pairs surrenders and both fighting animals accept the dominant-subordinate relationship between them. Until now, nothing has been known as to how the termination of social conflicts is regulated. We have obtained the evidence supporting that the two adjacent neural circuits connecting the habenula (Hb) to the interpeducular nucleus (IPN) are deeply involved in the regulation of this process. In this study, based on such discovery of our own, we will elucidate the neural mechanisms regulating the decision of the winner-loser relationship in the social conflicts of the vertebrates.

【Research Methods】

The lateral and medial subnuclei of the dorsal habenula in the zebrafish are evolutionary homologs of the dorsal and ventral subnuclei of the medila habenula, respectively. In this study, we use both zebrafish and mouse by taking advantage of this evolutionary conservation. We will also use various cutting-edge technology such as genetic manipulation, optogenetics and neural activity imaging to elucidate the functions of the neural pathways including the Hb-IPN connections in the regulation of the social conflicts.

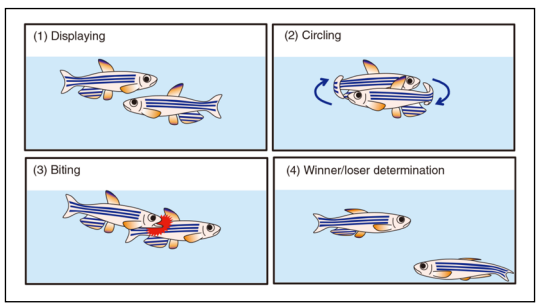

Figure 1 Social conflict of two male zebrafish

【Expected Research Achievements and Scientific Significance】

Social conflicts are common in any animals including human beings. It is also common between animals and humans that the losers defeated in the social conflicts increase the probability of loss in the successive fights. Therefore, the knowledge obtained through our study will cast important insights into human social behaviors and give clues for the treatment of the behavioral disorders such as social shut-in.

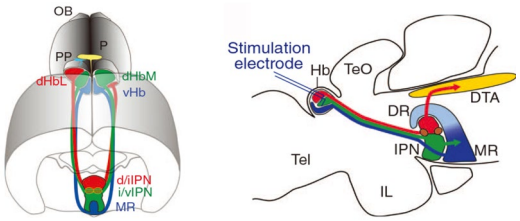

Figure 2. The habenulo-interpeduncular pathways and their efferents.
dHbL & dHbM, lateral and medial subnucleus of the dorsal habenula; vHb, ventral habenula; d/i/v IPN, dorsal/intermediate, ventral interpeduncular nucleus; MR & DR, medial and dorsal raphe; OB, olfactory bulb; P, pineal gland; PP, parapineal gland; Tel, telencephalon; IL, inferior lobe of the hypothalamus; TeO, optic tectum; DTA,

【Publications Relevant to the Project】

・Chou M, Amo R, Kinoshita M, and **Okamoto H** et al. (2016) Social conflict resolution regulated by two dorsal habenular subregions in zebrafish. Science 352:87-90
・Amo R, Fredes F, Kinoshita M, and Okamoto H et al. (2014) The habenulo-raphe serotonergic circuit encodes an aversive expectation value essential for adaptive active avoidance of danger. Neuron, 84:1034-1048.
・Agetsuma M, Aizawa H, and Okamoto H. et al. (2010) The habenula is crucial for experience-dependent modification of fear responses in zebrafish. Nat Neurosci. 13:1354-1356.

【Term of Project】 FY2016-2020

【Budget Allocation】 142,900 Thousand Yen

【Homepage Address and Other Contact Information】

http://www.brain.riken.jp/jp/faculty/details/37