

Regulation mechanism of behaviour of chickens: Elucidation and application

Tsuyoshi Shimmura (Faculty of Agriculture, Tokyo University of Agriculture and Technology)
shimmura@go.tuat.ac.jp

Animal welfare has become as global standard in 21 centuries, and conventional cages for laying hens has been banned. However, while the legal regulation has been rapidly progressed, the alternative housing systems not fully developed. I established a productive and welfare-friendly systems: regulation technology of behaviour of chicks and laying hens by interacting ethology, mechanical engineering and information science.

To develop the regulation technology of chick behaviour, firstly I focused on the chick-hen interaction and reported that brooded chicks increased their eating and familiarity to human and that these effects continued eternally after removal of the broody hens. In addition, I showed that these effects were induced by not only imprinting behaviour of chicks but also highly sophisticated sound communications between chicks and hen^{1, 2)}. To reconstruct these inductions artificially, I developed a technology to construct a virtual animal in a computer³⁾. Also I made this technology three-dimensional. When I presented broody hen-modified robot that shows mother-call while moving neck, surprisingly the chick behaviours could be induced by the robot. As above, I uncovered behavioural habits of birds, and by applying the habits, I developed interaction technology between chicks and broody hen-modified robot.

For the systems for laying hens, inspired by multi-factorial investigation of various housing systems, I focused on furnished cages equipped resources (e.g. dust bath) with cages. I reported that competition to the resource was increased by exclusive use of resources of a highest-ranking hen in the furnished cages. Also I developed a new furnished cage that reduced the aggressive interaction by dividing the resources. Moreover, focused on the circadian rhythm of behaviour, I developed a furnished cage that reduced introduction cost to 1/1,000 by space saving by proper use according to time. As above, redesigned the space design of housing system for laying hens, I developed highly useful furnished cages.

References

- 1) **Shimmura T**, Yoshimura T. Circadian clock determines the timing of rooster crowing. *Current Biology* 23, R231-R233 (2013). Selected for cover picture.
- 2) **Shimmura T**, Ohashi S, Yoshimura T*. The highest-ranking rooster has priority to announce the break of dawn. *Scientific Reports* 5, 1-9 (2015). Selected for Research Highlights and for press-released paper by Nature Publishing Group. Top 100 read *Scientific Reports* article in 2015.
- 3) **Shimmura T**, Nakayama T, Shinomiya A, Fukamachi S, Yasugi M, Watanabe E, Shimo T, Senga T, Nishimura T, Tanaka M, Kamei Y, Naruse K, Yoshimura T. Dynamic plasticity in the phototransduction pathway regulates seasonal changes in color perception. *Nature Communications* 8, 1-7 (2017).