

# Homeostasis, Cybernetics and Rehabilitation

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Human body, considered as a complex biological system, is under the control of negative feed-back and maintains a steady state of internal life activity. Cannon [1,2] called this quasi-steady state by negative feedback control system "Homeostasis". For instance, as is well known, serum glucose is maintained at about 100 mg / dl, and when it is increased by food intake, insulin is automatically secreted from the pancreas, and when it is decreased, it returns to about 100 mg/dl by the opposite acting hormones including glucagon.

The negative feedback system that maintains homeostasis consists of the autonomic and endocrine systems, the immune system, and other repair and cleaning mechanisms.

Extending the concept, homeostasis can include unconscious automatic maintenance of stationary positions such as standing posture. In mature youth, homeostasis is very strong and can withstand severe stresses such as hard work, malnutrition, lack of sleep, accidental injuries and illness.

However, congenital disorders, chronic diseases, sequelae, and aging result in deviations from homeostasis set point or weakening negative feedback that maintains homeostasis and proper behavioural control.

With regard to the appropriate control of behaviour, it is mainly controlled by the central nervous system, and in addition to negative feedback control, feed forward control such as output from cerebellum is also important, and Wiener [3] defines these action control systems as cybernetics.

If this idea is followed, rehabilitation can be regarded as a method of correcting aberrant or debilitated homeostasis and cybernetic system.

In this volume, articles dealing with various subjects were collected. Takagi focused on sarcopenia, which reduces the ability for daily living, and reported significant cross-correlation between upper extremity muscle mass and pinch strength [4], and the usefulness of measuring Limb circumference as a simple muscle mass estimation method [5].

Kamimura and Muramatsu [6] investigated fatigue from sustained isometric plantar flexion and reported that the central nervous and muscle derived factors were mixed in fatigue.

Oshiro et al. [7] reported that experimentally induced diabetes mellitus of rats causes significant decrease of the number and size of abdominal moto-neurons and muscle.

Komagata et al. [8] suggested, by cooling experiment of human median nerve, that contrary to the results of clinical diabetic neuropathy, a decrease in nerve conduction velocity may not significantly affect superficial sensation.

Tokunaga et al. [9] emphasise in their article the importance of the score at admission to assess favourable outcome of stroke patients by the score of functional independence measure at discharge.

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Ominato et al. [10] discussed the effectiveness of nutritional supplementation in treatment of osteoporosis, based on hospital experience.

In the previous issue, which I haven't mentioned yet, Nakagawa et al. [11] investigated possibility of injury preventive effect of the double task training in soccer performance.

Maeshima et al. [12] reported a retrospective cohort study of 1040 stroke patients and concluded that the lower limb orthosis therapy is indispensable for rehabilitation of stroke hemiplegic patients.

Kishi et al. [13] reported Kendo practitioners' back pain and possible preventive value of selective training of the multifidus muscle.

Research of Bengtsson-Lindberg et al. [14] is challenging in a sense. They focused on the possible relation of dementia progression and myokine/interferone level, and suggested usefulness of their measurement by a single exercise test to detect dementia protective effect of training.

As seen in these volumes, the scope of rehabilitation is expanding and will continue to expand. Therefore, to understand the whole of extended rehabilitation, it is necessary to find a central concept common to all. In this context, homeostasis and cybernetics are promising core concepts in defining rehabilitation as science, and extended rehabilitation itself can be defined as "recovery of homeostasis and cybernetic mechanisms".

## Competing Interests

The author declare that there is no competing interests regarding the publication of this article.

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