【Grant - in - Aid for Scientific Research on Innovative Areas(Research in a proposed research area)】
Biological Sciences

Title of Project : Spectrum of the sex: a continuity of phenotypes between female and male

Makoto Tachibana
(Tokushima University, Institute of Advanced Medical Sciences, Professor)

Research Project Number : 17H06423 Researcher Number : 80303915

【Purpose of the Research Project】

Sex has been considered as binary terms; the distinct phenotypes of male or female. However, when we examined gene modified animals, human patients of disordered sex development, and various wild animals, we frequently found the sex phenotypes that locate between typical male and female. We thus propose a novel concept of sex; continuous distribution between typical male and female (sex spectrum). Individual sex should be represented as a particular point in this spectrum (postioning). Furthermore, this point can be shifted to either direction (e.g. sex reversal in fish). We aimed to reveal molecular mechanisms controlling the "positioning" and "shifting" in the sex spectrum.

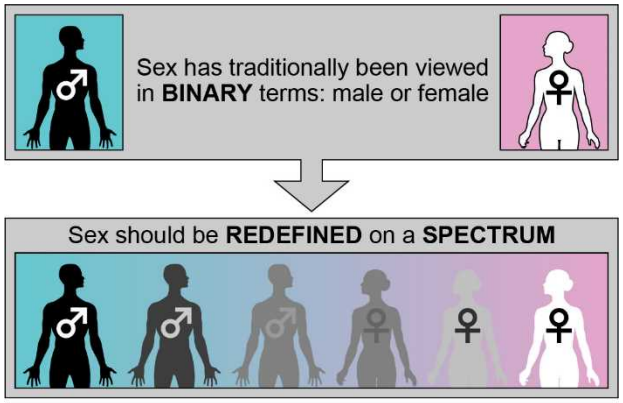

Figure 1. The sex spectrum

【Content of the Research Project】

We try to analyze sexual phenotype quantitatively using several parameters, such as the expression levels of the sex chromosome genes, these epigenome structure, amounts of the secreted sex steroids, activities of the sex steroid receptors, and metabolic activities. It is conceivable that "positioning/shifting" in the sex spectrum are controlled by genetic and endocrine factors and influenced by environmental factors. We therefore set three research objectives, genetic factors of the sex spectrum (A01), endocrine factors of the sex spectrum(A02), and environmental factors of the sex spectrum (A03). The sex spectrum is composed of hierarchical three layers; cellular, organ and organism. We aimed to reveal molecular mechanisms that control "positioning" and "shifting" in the sex spectrum of each layer.

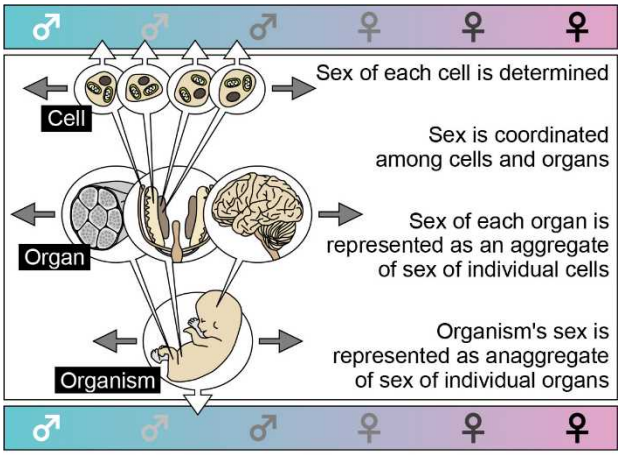

Figure 2. Hierarchical structure of the sex spectrum

【Expected Research Achievements and Scientific Significance】

We can explain various sex phenomena by adopting the view of the sex spectrum. For example, we might explain the sex reversal in fish quantitatively as a positional shift in the spectrum. We believe that quantitative analysis of sex might result in the re-definition of sex.

We propose two another significance of our research. First, it may enhance cultural and social understanding of human sex differences. Second, it may contribute to clinical medicine, such as understanding the onset mechanisms of disorders of sex differentiation and improving the gender-based medicine.

【Key Words】

A continuity of phenotypes between female and male
Spectrum of the sex

【Term of Project】 FY2017-2021

【Budget Allocation】 1,144,600 Thousand Yen

【Homepage Address and Other Contact Information】

http://park.itc.u-tokyo.ac.jp/sexspectrum/