Animal Environmental Science

Sangrak Lee; Youngjun Na

Last update: 2019-02-14

Contents

Welcome **5**

1 Introduction **7**

2 Animal and environment **9**

2.1 External environment 9

2.2 Internal environment 9

3 Thermoregulation **13**

4 Light **15**

5 Sound **17**

6 Air Quality **19**

7 Water Quality **21**

8 Cycles of Materials **23**

9 Manure **25**

10 Animal welfare **27**

11 Sustainable livestock industry **29**

Welcome

This is the website for **"Animal environmental science"**. To understanding individual animals, we have to understand the relationship they have with their environment. This book will introduce the interaction between animals and the environment.

This website is (and will always be) **free to use**, and is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 3.0 License. The book is written in RMarkdown with bookdown. All photographs used in this book was from Unsplash.com. If you click the download button up above, you can download the PDF version of the book.

(Snow Monkey Niseko, Kutchan-chō, Japan)

Chapter 1

Introduction

All living creatures constantly interact with the environment. To understanding individual animals, we have to understand the relationship they have with their environment. Basically, animals can find food, shelter, protection, and mates from the environment called **habitat**. The animal habitat includes both phisical (non-living) and biotic (livinig) components (see Table 1.1).

Animal habitat is constantly changed over time. Not only natural disasters (Eruption of volcano, earthquake, tsunami, and wildfire), also human activity can affect the animal habitat. Unlike the wildlife, the environment of domesticated animals (such as cow, pig, poultry, and dog) that raised in facility are controlled by the human. Because it's a very huge field, this book can't cover every topic of both wildlife and domesticated animal. Thus, from now on, we will deal with the topic for the domesticated animal.

Table 1.1: Components of habitat (physical and biotic)

Physical	Biotic
Temperature	Plant matter
Humidity	Predators
Oxygen	Parasites
Wind	Competitors
Soil	Individuals of the same species
Light intensity	
Elevation	

Chapter 2

Animal and environment

2.1 External environment

Animal never separates from the stimuli from outside. In the domestic animals, the external environment includes both physical (e.g. housing, feeder, paddock, fence, and noise) and biotic (e.g. human, mate, and feed ingredients) components like those of animal habitat 1.

2.2 Internal environment

> "The living body, though it has need of the surrounding environment, is nevertheless relatively independent of it." — Claude Bernard

Higher animals have complex organ systems that respond to stimuli to perform their essential body functions. When the animal recieves the signals from the sensory organs, they produce a local reflex action and/or react in the central nervous system. Weak signals produce no responses, but strong stimuli changes the physiological or behavioral status of the animal.

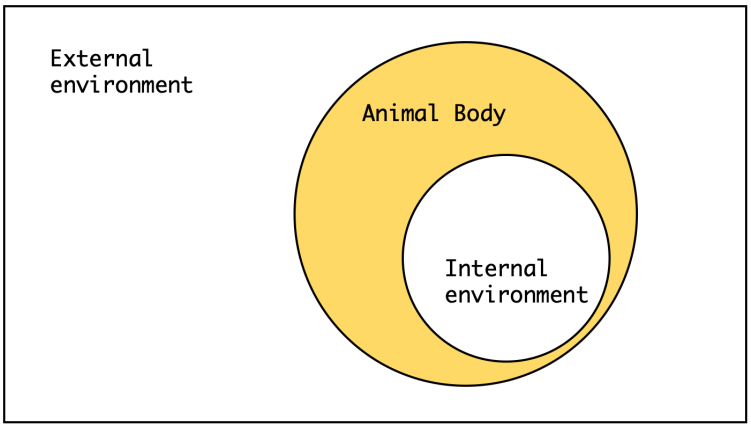

Figure 2.1:

Table 2.1: List of homeostatic control variables

Control variables
Core temperature; Blood glucose; Iron levels; Copper regulation; Levels of blood gases; Blood oxygen content; Arterial blo

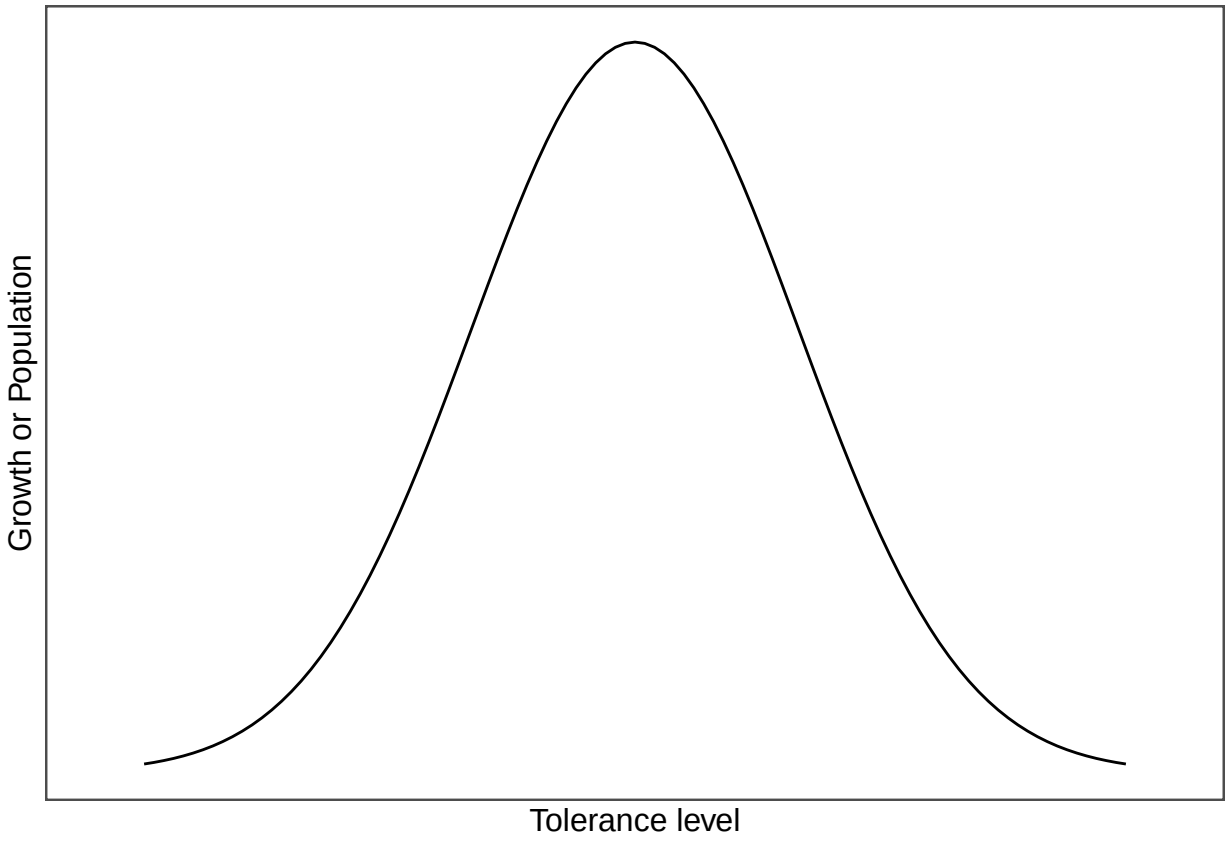

Figure 2.2: Shelford's law of tolerance

2.2.1 Law of tolerance

> "Each and every species is able to exist and reproduce successfully only within a definite range of environmental conditions." — Ronald Good

Although external environments are continuously changed, if animals in the normal status, **they keep the composition of the extracellular fluid (internal environment) constant to maintain their live**. We call it *homeostasis*.

However, the capacity of to maintain the homeostasis is broken when the animals let the harsh environments, and differ by their species. Animals may be limited in their growth and their occurrence by the minimum, maximum, and optimum condition (Shelford's law of tolerance; Fig. 2.2)).

The range of the optimum may differ for different processes within the same organism, and it is not necessarily fixed. They can change as:

- Seasons change.
- Environmental conditions change.

- Life stage of the organism changes.

2.2.2 Adaptation

Hafez (1968) define the adaptation as below.

> "Changes in morphological, anatomical, physiological, biochemical and behavioral characteristics of the animal which promote welfare and favor survival in a specific environment." — Hafez

Chapter 3

Thermoregulation

Here is a review of existing methods.

Chapter 4

Light

Here is a review of existing methods.

Chapter 5

Sound

Here is a review of existing methods.

Chapter 6

Air Quality

Here is a review of existing methods.

Chapter 7

Water Quality

Here is a review of existing methods.

Chapter 8

Cycles of Materials

Here is a review of existing methods.

Chapter 9

Manure

Here is a review of existing methods.

Chapter 10

Animal welfare

Here is a review of existing methods.

Chapter 11

Sustainable livestock industry

"In essence, the conflict between livestock and the environment is a conflict between different human needs and expectations." — Henning Steinfeld (FAO)