The remaining ten chapters discuss various aspects of biology that must be fully understood by anyone wanting to study the philosophy of biology. The conclusions reached in these chapters will strengthen the foundations of a genuine philosophy of biology.

Chapter 3 – Teleology 목적론

bona fide - 진실된(양심적인), 진짜의

Biology could not be accepted as a bona fide science until it eliminated cosmic teleology from its framework of theories. Therefore, it is essential to show that the word teleological has been used for five different kinds of phenomena or processes in nature, which must be carefully distinguished from each other. Satisfactory empirical explanations are available for four kinds of phenomena or processes that traditionally are referred to as teleological; these can be explained exhaustively by natural laws. Yet no evidence has ever been found for the existence of the fifth one, cosmic teleology.

Chapter 4 – Analysis or reductionism?

Until the middle of the twentieth century, an important philosophical belief of the physicalists was that a phenomenon had to be reduced to its smallest components to achieve a complete explanation. This was generally interpreted as meaning that explanation could be achieved only at the lowest level of organization. This conclusion was particularly disturbing for biologists, because at the lowest levels of organization such a reduction abandoned biology and dealt exclusively with physical phenomena. However, I will show in this chapter that such reduction is not only not necessary but indeed quite impossible. The support for reduction was in part the result of a confusion with the process of analysis. Analysis is and always will be an important methodology in the study of complex systems. Reduction, on the other hand, is based on invalid assumptions and should be removed from the vocabulary of science.

Reduction should be removed from the vocabulary of science?

I wonder what that means because the method of natural science is to perform reduction
But I skip considering at the moment

1

Science and Sciences

Biology is a science; there is no argument about this statement, or is there? Doubts about this claim have been suggested by important differences among various widely accepted definitions of science. A comprehensive, pragmatic definition of science might be "Science is the human endeavor to achieve a better understanding of the world by observation, comparison, experiment, analysis, synthesis, and conceptualization." Another definition might be "Science is a body of facts ('knowledge') and the concepts that permit explaining these facts," and there are numerous others. In a recent book (Mayr 1997:24–44) I have devoted a twenty-page chapter to a discussion of the question, "What is science?"

Difficulties arise because the term science also has been used for so many human activities beyond the natural sciences, such as the social sciences, political science, military science, and more distant areas such

Definition of science 1

Definition of science 2

How do you want to define science?

I personally have been considering the precise way of thinking
And it uses "nouns which indicate actually existing objects", "numbers", "symbols which only connect between nouns and numbers"
to describe mechanism of nature

And I think this type of thinking way can be a method of science and definition of science.

Human thinking can often be not precise due to 2 reasons
First comes from weakness of natural language like English as Ludwig Wittgenstein and Laozi pointed out
Second comes from the mechanism of the brain. Brain easily can create fake idea, for example, try to say and think "I have 3 arms" (false and fake idea)
It can be possible very easily even if you have 2 arms (true)

So, I think nouns, numbers, and symbols need to be used to prevent above not precise thinking

as Marxist science, Western science, feminist science, and even Christian Science and Creationist Science. In all these combinations, the word science is used in a misleadingly inclusive sense. Equally misleading, however, is the opposite extreme, the decision of some physicists and physicalist philosophers to restrict the word science to mathematically based physics. A vast literature shows how difficult, indeed impossible, it seems to be to draw a line between incontrovertible science and adjacent fields. This diversity is a heritage of history.

One can claim that science originated in preliterary times when people began to ask "how?" and "why?" questions about the world. Much of what philosophers were doing in Greece and the Ionian colonies in Asia Minor and southern Italy was rudimentary science. Aristotle's work was a very respectable beginning of the science of biology. However, it is rather generally accepted that the so-called scientific revolution of the sixteenth and seventeenth centuries, characterized by Galileo, Descartes, and Newton, was the real beginning of what is now called science. At that time most phenomena in the inanimate and the living world were not yet explained in terms of natural causes, and God was still considered the ultimate cause of everything. However, in due time secular explanations were ever more widely adopted and considered legitimate science. It dealt primarily with two branches of science, mechanics and astronomy. Not surprisingly, at that time the concept of science was the concept of these two physical sciences. For Galileo, mechanics was the dominant science and it remained so for hundreds of years.

When intellectual life revived after the Middle Ages, there was no word for what we now call science. Indeed, the English word science for what modern people call science was introduced by Whewell as late as 1840. However, at the time of the scientific revolution in the sixteenth, seventeenth, and eighteenth centuries, science was conceived very broadly by some authors and very narrowly by others.

The philosopher Leibniz was exemplary for the broad conception. For him and his followers, a "science was a body of doctrine that could

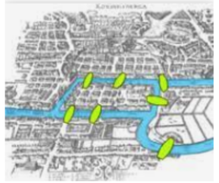
This looks like how difficult we can categorize the concept by natural language
The term "science" is mixed with different concepts like natural science, marxist science, etc..

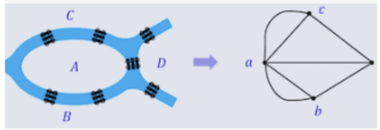
This comes from weakness of natural language
And people even didn't categorize concept precisely with the natural language through history

Abstracting (extracting common components from complicated structures into simple form) is one of interest because to make better programming code, abstract is necessary

Following is the example of abstract

Actual bridge structure → abstract1 → abstract2





Having no other sciences to compare mechanics with, he did not realize that his characterization of "science" (= mechanics) included two quite different sets of characteristics – those true for any genuine science and those true only for mechanics. For instance, he did not realize that mathematics plays a far greater role in mechanics than in most other sciences. Hence, mathematics played a dominant role in Galileo's image of science. He insisted that the book of nature "cannot be understood unless one first learns to comprehend the language and read the letters in which it is composed. It is written in the language of mathematics and its characters are triangles, circles, and other geometric figures without which it is humanly impossible to understand a single word of it; without these one wanders about in a dark labyrinth" (Galileo 1632). Nor, quite naturally, was any discrimination made by anyone else, because at first there were no other sciences with which to compare mechanics. Physics with a mathematical foundation became the exemplar of science for Galileo, Newton, and all the other greats of the Scientific Revolution. This physicalist interpretation dominated the thinking of the philosophers of science. And this remained so for the next three hundred fifty years. Curiously, it was quite generally ignored in discussions of science in those centuries that there were now also other sciences. Instead, these other sciences were squeezed into the conceptual framework of physics. Mathematics remained the earmark of true science. Kant certified this opinion by saying "there is only that much genuine [*richtig*] science in any science, as it contains mathematics." And this greatly exaggerated evaluation of physics and mathematics has dominated science until the present day. What would be the scientific status of Darwin's *Origin of Species* (1859), which contains not a single mathematical formula and only a single phylogenetic diagram (not a geometric figure) if Kant had been right? And this was also the philosophy of science of the leading philosophers (e.g., Whewell, Herschel) that affected Darwin's thought (Ruse 1979). Yet several recent philosophers of science have published

I think I can say Origin of Species is science in my point of view if the mechanism is described by diagram (symbols) to describe actually existing things (animals, plants, etc)
even if it has no math formula