

University of Groningen

On definitions

Reddingius, J.

Published in:
Acta biotheoretica

DOI:
[10.1007/BF00115928](https://doi.org/10.1007/BF00115928)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
1977

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):
Reddingius, J. (1977). On definitions. *Acta biotheoretica*, 26(1), 66-68. <https://doi.org/10.1007/BF00115928>

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LETTER TO THE EDITOR

On Definitions

Dear Sirs:

In this Journal, Vol. XXIV (1–2), pages 14–21, 1975, M. Jeuken writes on ‘the biological and philosophical definitions of life’. As I found many remarks in this article rather confusing, I hope you will allow me the following remarks in order to point out my problems.

1. There is, it seems to me, some confusion as to the definition of ‘definition’. In my experience it is useful, and even necessary, before starting a discussion or a treatise to start out defining the terms that will be used. This really means making an appointment concerning what we will be talking about. So if we must tell a group of students what biology is all about, we must try to tell which phenomena are, and which are not, studied by biology. Whether or not viruses will be taken to belong to the class of living entities is just a matter of definition in this sense.

Jeuken proposes a biological definition of life which, according to him, must be clearly distinguished from a philosophical definition and he proposes a biological definition. But then he states (p. 15): ‘This definition is confirmed by experiments, especially of modern research’. I don’t see how a *definition* in the above sense (which is only about the way in which we are going to use the terms in our language) can ever be confirmed, denied, falsified or verified by *experiments*. The only interpretation which might make sense is, that experiments have shown that the set of phenomena designated as ‘life’ by definition A (say Jeuken’s) is equivalent to the set of phenomena designated as ‘life’ by some other definition B. For example, suppose that one definition calls an object alive if it contains DNA, and another calls an object alive if it entertains a specified process called ‘metabolism’. Experiments might show that any object containing DNA has metabolism and vice versa, and then one might say that experiments have shown the two definitions to be equivalent in the sense that they refer to the same phenomena. But Jeuken does not quote the other definition of ‘life’ to which his definition should be equivalent; nor does he argue why we need his definition in addition to an other one.

I suspect that ‘definition’ may have a somewhat different meaning in certain contexts. This meaning might be something like this: there is a set of objects, or phenomena, and we all know them and give them a name. For

example, we need the poor viruses to show that it is not *always* obvious what we mean by 'a living being'. Now we wish to find a list of all properties of the objects and phenomena so designated, and which are not shared by objects or phenomena not so designated.

If we wish to define, e.g., 'living organism' in the first sense, we wish just a brief characterization which is necessary and sufficient to define how the term 'living organism' will be used, and what kind of things are being studied by biologists.

If we wish to define 'living organism' in the second sense, we strive at a *complete* characterization of living organisms. The first definition would define terminology; the second is only provisory, because it will never be completed. Its formulation might be called an aim of research. But in my opinion, in order to attain a 'definition' of the second kind, we need a definition of the first kind to start with. It makes no sense to ask for all properties of living organisms if we have not stated just what we mean by 'organisms'. I therefore propose to refrain from using the word 'definition' to designate the second type definition, but to use other words such as 'characterization' or 'description'.

2. The definition proposed by Jeuken is as follows:

'life is a definite dynamic structure of atoms and molecules, exhibiting self-regulation'.

I have grave objections against this definition, as it is not compatible with the sense in which 'life' is usually taken by biologists. 'The life of the Robin' is not a definite dynamic structure. The Robin itself might be called a definite dynamic structure, but its life is a sequence of more or less random phenomena. 'Life' as the object of study of biology is not a definite dynamic structure either, but a very varied set of phenomena. Furthermore, any computer designer will be able to build a contraption consisting of atoms and molecules which would exhibit self-regulation in any operational sense of the word and which might be said to be a definite dynamic structure in any operational sense of those words.

But Jeuken specifies: 'The term "definite" indicates the structure as it is found in the cell. In the term "self-regulation" all the functions are included'.

This specification does not help me, however, as the first part of it begs the question (what on earth is 'a cell'?) and the second leaves me in doubt whether we are supposed to possess a complete list of well-defined 'functions' which are not found with computers and such, or whether we have an example of the second kind of 'definition' alluded to above.

3. It may occur to you that my remarks miss the main point Jeuken wishes to make in his article. This may be so. I gather that this must have something to do with his opinion that 'Science can and must give inspiration to philo-

sophy, but no arguments, and the same holds *suo modo* for philosophy as regards its inspiration to science'. I am certainly not well enough acquainted with philosophy to be permitted a different opinion. But I think I may point out what it leads to. The fun of science lies exactly in the arguments. For a simple minded biologist it is not clear how a philosopher may be inspired by biology without taking the arguments seriously. He will be afraid that what the philosopher will borrow from biology is mainly speculative nonsense, and he will not be inclined to have anything to do with philosophy, let alone to be inspired by it.

Yours sincerely,

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Reply to Reddingius's letter

Reddingius' objections give me the opportunity to clarify some points and for this I wish to express my thanks to him.

a. There are various kinds of definitions. As an example of a system of definitions I refer to Arthur Pap's paper 'Theory of definition' (Phil. of Sc., 31, 1964, p. 49-54). One type of definition Pap distinguishes is the 'propositional definition', which can be built up either by empirical or by analytical propositions. A definition which is an empirical proposition can be theoretical, *i.e.* an empirical proposition about scientific objects. He gives the example 'water is a substance composed of molecules consisting of two hydrogen atoms and one oxygen atom (H_2O)'. Then he says that this statement 'must be justified by reference to experimental results interpreted by a scientific theory (atomic theory of matter)'. And a little further on, he says that the cited definition of water 'expresses the empirical generalization that anything which has the qualitative properties connoted by 'water' as the term is used in daily life also has that chemical structure, and conversely' (p. 50).

It is in this sense of a propositional definition with an empirical and theoretical definiens as indicated by Pap, that I have given my biological definition of life. And when I wrote that my definition 'is confirmed by experiments' it is the same as when Pap writes that such a definition 'must be justified by reference to experimental results'. Reddingius seems to think that definitions can be only