

## Classifying Life: The Astrobiological Challenge

**Dr Emma Tobin**

Department of Science and Technology Studies, University College London, U.K.  
[e.tobin@ucl.ac.uk](mailto:e.tobin@ucl.ac.uk)

### Abstract

This paper will discuss efforts to define life. I will address how astrobiological research might allow us to conceptualise extreme conditions for life and thus allow us to give a much more nuanced definition of life. I also look at why this has ethical implications for society and humankind.

### 1. Introduction

Efforts to define life have become increasingly topical in a number of disciplines in science such as synthetic biology, astrobiology, molecular biology and evolutionary biology. Each of these disciplines presents interesting new challenges for thinking about how to define life and no solid consensus has emerged on how to define it.

Philosophers have also become increasingly interested in the question of how we classify life. Philosophers of biology have been interested in this question from the perspective of the classification of species. For example, given the different pluralistic systems of classification that co-exist; e.g. cladism, morphological species concepts etc. is there a definitive way of classifying them?

Ethicists have been interested in defining what counts as a living thing for the purposes of determining rights and duties. This paper aims to bring together these disparate discussions to address the question as to how we ought to define life.

Research in astrobiology presents ever more interesting challenges; it not only suggests counterfactual scenarios where life might be possible, but extends the phase space for the classification of life. The study and classification of extremophiles in extreme environmental contexts on earth, further expand upon our concept of life in the earthly context. How important are the conditions we find for life on earth? How might these be challenged by the existence of alternative kinds of life under extreme conditions on Earth? This paper will examine some of these questions and assess the philosophical significance of these issues.

More particularly, this paper will take the possibilities of future discoveries in astrobiology as an interesting case study for thinking about the definition of life. I will show why defining life matters for thinking about what research we are entitled to do on other planets.

### Key factors

The definition of life from the astrobiological perspective will depend on a number of key factors, which I will discuss in detail in the paper:

### 1.1 Defining Life: Environmental Factors

I will suggest that the classification of extremophiles extends the phase space for thinking about life on Earth. It allows us to assess the importance of environmental conditions and stress test the tolerance of simple organisms to environmental factors.

The consideration of extreme factors on Earth allows us to think about the role of even more extreme factors which prevent life. Nevertheless, even where environmental factors are negative, fossils from ancient organisms may allow us to signify life. Equally, clear possibilities emerge such as the liquid water ocean on Europa, which might harbour a marine ecosystem. How might we compare this biology with our own and what would these discoveries do for our current concept of life?

### 1.2. Moral Considerations

There are clearly moral considerations to be taken on board. What 'rights' do we have to the use of other planets? Would we have the 'right' to terraform Mars if it does possess a biosphere? In order to establish our rights in these matters, the questions of how we establish the existence of life becomes of primary importance in supporting arguments for what we are entitled to do. Thus, such discoveries have real moral implications and the project of "defining life" has real implications for society and human kind.

## Summary

This talk will be part of a round-table discussion on what the immediate and long-term societal and cultural implications of the discovery of life will be. This discussion will focus on defining life and why providing a definition matters.

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