

Discussion Proposal

The Baas Becking and Beijerinck Hypothesis

Dave Hines, BIO 602

1 Background Information

Microbiologists have debated what factors control the distribution of microbes in the environment for over a century (Kluyver 1952). In the early twentieth century M. W. Beijerinck and L. G. M. Baas Becking became proponents of the hypothesis that “everything is everywhere, but the environment selects.” This concept was formalized in Baas Becking’s 1934 publication: *Geobiologie of Inleiding tot de Milieukunde*. The concept of ubiquitous distribution of microorganisms with selection by the environment became known as the Baas Becking and Beijerinck hypothesis and has since become a central tenant of microbial ecology (de Wit and Bouvier 2006).

Although the Baas Becking and Beijerinck hypothesis is often assumed by most microbiologists to be functionally true, it has been subject to criticisms from several current thinkers (O’Malley 2008), some of whom argue that the geographic distance between habitats has a greater influence over the species present than the environmental conditions. These criticisms are largely due to advances in technology, particularly in the field of molecular biology, which enable the detection of slight variations in samples from different geographic regions (O’Malley 2008). The results of molecular studies are, however, yet to be decisive in ending the debate over the Baas Becking and Beijerinck hypothesis.

Despite the previously mentioned criticisms, in recent years some microbiologists have sought to examine the limits of microbial ubiquity, affirming its status as a generally accepted tenant. One such study tests the limits of the microbial ubiquity as per the Baas Becking and Beijerinck hypothesis with regard to organismal size (Yang et al. 2010). This study found that smaller microorganisms may be more likely to have cosmopolitan distributions than larger microorganisms, but could neither confirm nor debunk the validity of the Baas Becking and Beijerinck hypothesis.

2 Readings

This proposal suggests readings to promote discussion about this currently accepted assumption in microbiology by focusing first on the history of the subject, then on modern interpretations and explorations. The first reading:

de Wit, R. and Bouvier, T. (2006). '*Everything is everywhere, but, the environment selects*'; what did Baas Becking and Beijerinck really say? *Environmental Microbiology*. 8(4), 755–758.

provides an overview of early ideas about microbial ubiquity that originated in Europe in the early nineteenth century. Although primary literature would have been preferable for this part of the proposal (the “historical” reading), the original writings of Baas Becking and Beijerinck are in Dutch and translations could not be obtained. The brief review by de Wit and Bouvier provides quotations and interpretations of the ideas presented by these pioneering microbiologists.

The second reading:

O'Malley, M. A. (2008). '*Everything is everywhere: but the environment selects*': ubiquitous distribution and ecological determinism in microbial biogeography. *Stud. Hist. Phil. Biol. & Biomed. Sci.* 39. 314–325.

provides a review of how the distribution and evolutionary development of microorganisms may relate to the Baas Becking and Beijerinck hypothesis. It also compares the biogeography of microorganisms that of larger organisms and considers the overall state of ideas about microbial ubiquity.

The final reading:

Yang J., Smith, H. G., Sherratt, T. N., Wilkinson, D. M. (2010). Is there a size limit for cosmopolitan distribution in free-living microorganisms? A biogeographical analysis of testate amoebae from polar areas. *Microb. Ecol.* 59:635–645.

is a meta-analysis of data collected from three geographic regions: the arctic, the antarctic, and the Tibet. These regions contain similar habitats despite the immense distance among them. The study (described briefly in “background information”) analyzes the size classes of shelled amoebas to examine how this might affect the ubiquity of their distribution.

3 Literature Cited

de Wit, R. and Bouvier, T. (2006). '*Everything is everywhere, but, the environment selects*'; what did Baas Becking and Beijerinck really say? *Environmental Microbiology*. 8(4), 755–758.

Kluyver, A. J. (1952). “The changing appraisal of the microbe.” Leeuwenhoek Lecture for Mem. R. S. Delivered 20 Nov., 1952.

O'Malley, M. A. (2008). '*Everything is everywhere: but the environment selects*': ubiquitous distribution and ecological determinism in microbial biogeography.

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Yang J., Smith, H. G., Sherratt, T. N., Wilkinson, D. M. (2010). Is there a size limit for cosmopolitan distribution in free-living microorganisms? A biogeographical analysis of testate amoebae from polar areas. *Microb. Ecol.* 59:635–645.