Mark E. Viney, Ph.D.

Professor of Zoology

University of Bristol

Born in 1963 in the United Kingdom

Studied Biology at the Imperial College, London, and Parasitology at the Liverpool School of Tropical Medicine and at the University of Liverpool

FOCUS

PROJECT

Plasticity and Heterogeneity in Changing Environments

Animals make decisions about how they develop, depending on their environment. For one animal (the worm Caenorhabditis elegans) there is a well-studied developmental choice in its life cycle; therefore, this animal's development is plastic. How plastic this response is varies in wild worm strains, suggesting that these different plasticities are adaptive. The genetic network that controls this developmental choice in this species is well known. The question I will consider is where in this network does this plasticity (and these differences in plasticity) exist? For example, is this plasticity an "automatic" emergent property of any such network? Understanding this is necessary to allow us to consider what we mean by phenotypic plasticity being adaptive. I will also develop this further by considering recent work that shows that variation in the heterogeneity of traits may also be adaptive.

A second theme that I will consider is how the concept of "plasticity" is used in different fields of biology (and beyond). Plasticity in developmental biology seems to be different from plasticity in immune systems or in neuroscience. Understanding the similarity and difference of these uses will, I hope, clarify how adaptive plasticity is.

Recommended Reading

Viney, M. E. (2011) "Life history plasticity and responses to host defence." In Parasitic Nematodes: Molecular Biology, Biochemistry and Immunology, edited by M. W. Kennedy and W. Harnett. Wallingford: CABI Publishing (2nd edition in press).

Harvey, S. C., G. L. A. Barker, A. Shorto, and M. E. Viney (2009). "Variation in gene expression in the early development of dauer larvae of Caenorhabditis elegans." BMC Genomics 10: 325.

Thompson, F. J., G. L. A. Barker, T. Nolan, D. Gems, and M. E. Viney (2009). "Transcript profiles of long- and short-lived adults implicate protein synthesis in evolved differences in ageing in the nematode." Strongyloides ratti. Mechanisms of Ageing and Development 130: 167-172.

COLLOQUIUM, 06.12.2011

Worms, Phenotypes and Plasticity

I aim to achieve two things during this colloquium : to introduce you to the wonderful world of worms and to how environments can affect organisms.

One. The most abundant and specious animals on the planet are nematode worms. If you wanted a single representative of extant animal life, it should probably be a nematode. You are in good company if you've never heard of them, nor knowingly seen them; they are often small and hard to see. Nematodes significantly impinge on humans because they are important parasites - of the animals and plants we eat, as well as of ourselves.

During nematode evolutionary history, the parasitic lifestyle (rather than being free-living) has evolved at least three (but, probably five) times. Therefore, there seems to be something that makes it evolutionarily easy for nematodes to become parasites. One notable feature of nematodes is how they use their environment to control what they "choose" to do, how they grow and develop etc.; perhaps this plasticity of their lives is useful for evolving a parasitic lifestyle.

I will introduce you to two species of nematode worms, one a parasite (Strongyloides), one free-living (Caenorhabditis). Both use their environment in sophisticated and complex ways to make developmental choices. For Strongyloides, the environment is its animal host, and the parasite uses the host's immune response to make developmental choices. For Caenorhabditis, the environment is how much food is available and how many other worms there are to eat it; it uses this information to make developmental choices too.

Two. Both these species of nematode worm use their environment to make developmental choices; these are both examples of phenotypic plasticity. The key concept in phenotypic plasticity is that while an organism's genes (its genotype) control an organism's characters (its phenotype), this is altered by the organism's environment. Therefore, there is not necessarily a one-to-one relationship between genotype and phenotype. The phenomena of phenotypic plasticity is universal among organisms.

Phenotypic plasticity occurs because the environment affects the expression of genes (i.e. whether they are on or off). Conceptually this is straightforward. However, realistically, the control of gene expression is complex and genes and gene products exist in complex networks, which therefore makes it harder to identify the molecular basis of phenotypic plasticity. However, thinking about the molecular mechanisms of phenotypic plasticity might also re-focus the questions we need to ask about the existence and evolution of phenotypic plasticity.

PUBLICATIONS FROM THE FELLOW LIBRARY

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Measures of immune function of wild mice, Mus musculus

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A genetic map of the animal-parasitic nematode Strongyloides ratti

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How did parasitic worms evolve?

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Immunological responses elicited by different infection regimes with Strongyloides ratti

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