Epigenetics and epidemiology -- hip, hype and science

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Epigenetics is the new hip science. Time Magazine's front cover and article, 'Why your DNA isn't your Destiny' from January 2010 explains why. Its more explicit subtitle provided the hook - 'The new science of epigenetics reveals how the choices you make can change your genes - and those of your kids'. Who wouldn't be interested in this?

Epigenetics is the study of ways in which the genetic code in our DNA is regulated - switching genes on and off, or amplifying or muting their expression - results in changes in metabolic pathways and in bodily functions. The exciting thing is that epigenetic marks that can be detected by new biotechnology are affected by modifiable environmental factors, like nutrition. This potential makes epigenetics an exciting field of research with important implications for disease mechanisms and of huge commercial interest to those in the business of generating new drugs.

Slightly more cautious in its approach than TIME magazine it has taken the International Journal of Epidemiology (IJE) another 2 years to produce an issue devoted to epigenetics. Sadly for those hopeful of imprinting the advantages of their environment on their genes to the benefit of their children and grandchildren, the picture presented in the March issue of the IJE is not so optimistic about the potential for environmentally induced epigenetic changes to persist across generations. While increasingly sophisticated genetic tests make it possible for parents to choose some specific traits of their baby, the epigenetic designer baby may prove to be a non-starter.

Given the huge range of epigenetic variation and the relatively small effect size of environmental influences on the epigenome, investigation at the level of the individual may produce little but random noise. However, the IJE is confident that, studied at the population level, epigenetics has much to offer to the understanding of disease aetiology and epidemiology has much to offer the field of epigenetics.

To begin at the beginning, the IJE has reprinted Conrad Waddington's seminal paper, which is brought up-to-date by commentaries from experts currently at the cutting edge of the field. This is followed by a series of papers on epigenetics that reflect the breadth and depth of current epidemiological contributions, ranging from studies of socio-economic differences in epigenetic patterns to new methods to determine the causal contribution of epigenetic processes. These empirical contributions are complimented by a stimulating and accessible commentary on the relationship between epidemiology and epigenetics by Bastiaan Heijmans and Jonathon Mill.

Further reflection is provided by a symposium based on a short book 'Plasticity, Robustness, Development and Evolution' by Patrick Bateson and Peter Gluckman, which covers the most recent developments at the intersection of developmental and evolutionary biology. A précis of the book, written by the authors, starts a debate that presents arguments in favour of the wider incorporation of epigenetics into epidemiology as well as cautioning against the dismissal of the genetic heritability in the rush to adopt new methods.

This epigenetics issue is edited by Caroline Relton and George Davey Smith. Caroline, from the Institute of Genetic Medicine at Newcastle University whose research focuses on understanding the effect of epigenetic variation on health, says "Epigenetics has begun to permeate many aspects of medical research, as well as many corners of the popular press, in a bid to explain how the environment and genome act

in concert to shape the biological processes that cause disease. Epidemiology – a discipline that aims to improve our understanding of the determinants of disease - has much to offer the field of epigenetics, not least in helping to distinguish those epigenetic events that are on the causal pathway to disease from those that are not. This information is crucial if epigenetics is to be incorporated into strategies to predict, prevent and treat disease – aspirations that are already widely proposed."

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