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PLASTICITY

Plasticity refers to the capacity of organisms or cells to alter their phenotype in response to changes in their environment. This property can be studied at the level of the genome (by analysing epigenetic modifications), the individual cell, and the organism (during development of the embryo or changes in behaviour in adults, for example).

In contrast to previously held views, recent studies show that cells are remarkably plastic. Revealing the molecular and cellular mechanisms that underlie this plasticity is a dynamic area of biology and one that holds great promise for developing new therapies.

This Insight brings together articles that explore biological plasticity at a variety of levels. Martin Pera and Patrick Tam look at how environmental signals shape embryogenesis and how these processes can be recapitulated in culture to generate stem cells with therapeutic potential. Pluripotent cells such as certain types of stem cell have a characteristic transcriptional program, which can be reactivated in 'terminally differentiated' cells in several ways, including by transcription-factor transduction (to generate induced pluripotent stem (iPS) cells). How these discoveries were made is detailed from a historical perspective by Shinya Yamanaka and Helen Blau.

For all of these observations, researchers needed to measure dynamic cellular processes in a precise and quantitative manner. Recent advances in experimental and computational approaches that are relevant to studying cellular plasticity are reviewed by Michael White and colleagues.

An attractive candidate for the molecular mechanism underlying plasticity is epigenetic modifications. Catherine Dulac discusses this topic at the cellular level and in the context of brain function and neural plasticity. Arturas Petronis uses the example of twins to explore how epigenetic changes can affect human complex traits, including disease.

We hope that both general readers and experts in the field will find these articles useful and informative.

Magdalena Skipper, Ursula Weiss, Noah Gray,
Senior Editors

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