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The *Nature Insight* 'Frontiers in biology' aims to cover timely and important developments in the broader field of biology, ranging from the subcellular to the organismal level, and including molecular mechanisms and biomedicine.

In the first review, Yoshiki Sasai discusses the principles and mechanisms by which organs and tissues form through self-organization from a homogeneous population of cells. He proposes future directions that integrate emerging technologies and mathematical modelling to allow quantitative analysis and a better understanding of self-organization and morphogenesis.

Autism spectrum disorder (ASD) is increasingly considered to be a disorder of synaptic function in neurons. Neural circuits are shaped by experience, and neural activity induces changes in synaptic genes and proteins. Many of the genes associated with ASD are components of activity-dependent neural signalling pathways. Daniel Ebert and Michael Greenberg explore the hypothesis that disruption of this signalling, and hence neural function and plasticity, may be a cause of ASD.

Simon Johnson, Peter Rabinovitch and Matt Kaeberlein then provide an account of research into mTOR's role in ageing and ageing-related disease. mTOR inhibition has been shown to extend lifespan in model organisms and to offer protection against various age-related pathologies. In the review, the authors explore if, when and how drugs that target mTOR could be used to slow ageing.

Highlighting the crucial role of cellular metabolism in regulating immune-cell function and, by extension, inflammatory diseases and autoimmunity, Luke O'Neill and Grahame Hardie discuss the signals and pathways by which immune cells shift their main energy mechanism during inflammation from mitochondrial oxidative metabolism to rapid glucose uptake and glycolysis, and speculate on how dietary restriction or drug-induced pseudo-starvation might help to promote an anti-inflammatory phenotype.

Finally, by describing how mouse models have provided insight into the possible endogenous source of DNA damage that results in the characteristic phenotypes of individuals with Fanconi anaemia, Molly Kottemann and Agata Smogorzewska discuss the role of Fanconi anaemia proteins in genomic stability, cancer susceptibility and stem-cell development.

Francesca Cesari, I-han Chou, Angela K. Eggleston, Marie-Thérèse Heemels, Barbara Marte & Ursula Weiss
Senior Editors

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