Developmental changes, represented by balloon dogs of various shapes and sizes, result from gene regulatory mechanisms altering gene expression patterns, denoted by heat maps.

FORCES BEHIND FORM

By Beverly A. Purnell, Steve Mao, and Laura M. Zahn
Presenting a balloon dog to a 4-year-old or a sonogram to an expectant mother elicits pure amazement at the developing body. For both, forces transform dividing structures into a recognizable form. Yet living creatures require more than simple twists and turns. Elegant and precise genetic programs guide the forces that allow seemingly identical starting cells to develop into highly specialized entities: a beating cardiomyocyte, an insulin-secreting pancreatic beta cell, a bone, or a light-sensing retina. But what factors and mechanisms are at play? Researchers are using new technology to tease out the details. It is clear that molecular associations are key, whether they are changes in the topological arrangement of chromosomal regions that bring one part of the genome closer to another or chemical modifications of nucleotides or proteins that recruit or repel protein binding to influence chromatin state. Histone chaperones and remodelers also contribute to the versatility of the genetic and epigenetic landscape to direct specific cell fate when cells are subjected to varied environmental conditions, metabolic changes, and even disease. This special issue highlights recent advances in our understanding of the role of gene regulation in development. By revealing the forces directing an organism’s form, we gain a better understanding of the normal developmental process, with potential for clinical intervention when things go awry.
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