



## INTRODUCTION

# Location, Location, Location

WHEN BUYING A HOUSE, ONLY THREE THINGS MATTER: LOCATION, LOCATION, location. In cell biology, a similar adage can be applied to the regulation of cellular and organismal physiology. The location of a cell within an organism and the location within the cell of its constituent parts will affect all it does, including the functions it is capable of performing, its signaling partners, and whether and how it grows and divides. Even in single-celled bacteria, spatial organization regulates cell division and other key developmental processes. In this special issue of *Science* we address a variety of topics that contribute to our understanding of spatial cell biology.

Chang (p. 1206) describes how position within the body affects a cell's differentiation and functional characteristics and how cells use specific gene expression programs to encode location. Pollard and Cooper (p. 1208) describe how a cell's internal actin cytoskeleton affects nearly all aspects of its biology, defining the cell's shape, controlling its movements, and contributing to cell motility and division. Holt and Bullock (p. 1212) go on to remind us that animal cells also regulate the intracellular localization of messenger RNAs, leading to localized translation of their encoded proteins. In metazoans, most cell types are housed within an extracellular matrix. Hynes (p. 1216) describes how the extracellular matrix and its constituent proteins do not simply act as passive supports but also actively influence their resident cells' physiology, integrating complex signals in space and time. Scott and Pawson (p. 1220) expand on this theme of regulation of signaling in space and time by examining the physical responses of intracellular signaling proteins as they transduce extracellular cues into intracellular effects. Finally, Shapiro, McAdams, and Losick (p. 1225) bring our attention to bacteria that also need to regulate their cellular anatomy by controlling the intracellular location of individual proteins and protein complexes during growth and division and in response to stress or other external cues.

Spatial cell biology affects all aspects of physiology in health and disease. For example, during limb development, the position of cells along a developmental axis regulates their differentiation to generate the appropriate appendage in the appropriate location. And as part of cancer metastasis, cancer cells develop the ability to escape their usual physical niche and set up residence elsewhere within the body, with often devastating consequences. In Victorian times, "knowing your place" was essential in the establishment and maintenance of social order. Within our bodies, this notion, outmoded for human societies, is essential for our physiological integrity.

— STELLA HURTLEY

## Spatial Cell Biology

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