Preface

Micropatterning refers generally to techniques which provide an experimental control over the chemical, physical, or geometrical properties of materials at the micron or submicron scale, and are thus used to produce spatial patterns of these properties. These techniques, which were often originally designed for application in microelectronics, have spread over most areas of science, including biology. They have proved particularly useful for cell biology, bridging the gap between the Petri-dish and complex 3D assays and tissues. At the level of single cells, many environmental parameters are entangled and assessing their individual contribution to cell physiology and behavior is often difficult. Micropatterned cell-culture substrates allow to specifically design tools to quantitatively control the cell microenvironment *in vitro* and to assess the effect of individual parameters, with devices which are almost as easy to handle as a regular Petri dish. Historically, printing of cell adhesion molecules, such as collagen or fibronectin, have allowed producing cell culture substrates on which cells have a well-defined shape and adhesion geometry. Such substrates have been crucial to demonstrate the role of cell shape, cell spreading area and of geometrical parameters of cell adhesion on cell survival, proliferation, differentiation, and polarity. The fabrication of micropatterned substrates initially required special expertise in surface chemistry and sophisticated devices, but their success lead to the development of much simpler methods accessible to almost any regular biology lab (see Chapters 1–6 for printing of proteins on various types of substrates, including printing of multiple proteins and of gradients). Efforts have also been made to make the process cheaper and more versatile (see maskless techniques in Chapters 7–11). Micropatterning now covers a large number of cell biology applications, from stem cell culture and differentiation (see e.g., Chapters 2 and 13) to printing of purified proteins or other biomolecules for *in vitro* assays (see Chapters 15 and 1–4 of vol. 120). Moreover, the size of the features which can be printed is now down to tens of nanometers (see Chapters 12–14). Current micropatterning techniques have developed further to implement the quantitative control of other aspects of the cell microenvironment such as 3D geometry (see Chapters 7–15 of vol. 121) and mechanical properties (see Chapters 16 of vol. 120, 3 and 6 of vol. 121). Importantly, some of these tools do not only allow building microcontrolled environments for cultured cells, but are also measurement tools, giving access to crucial parameters such as forces (see Chapters 13 of vol. 120 and 1, 2, 4 of vol. 121). Although the technical basis for most micropatterning methods is very generic, clever variations and adaptation are enough to produce tools for very specific applications, such as the study of collective cell behavior (see Chapter 15 of vol. 120), imaging of yeast cells from the tip (Chapter 14 of vol. 120), or local application of forces on individual cells (Chapter 12 of vol. 120). The latest evolutions of micropatterning are meant to implement temporal control of the micropatterned features (see Chapters 5–11 of vol. 120), to reach full spatio-temporal control of the cell microenvironment.

Matthieu Piel and Manuel Théry