Cell migration Methods and Protocols
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As the title suggests, this book presents several techniques to study cells migration *in vivo, in vitro, ex vivo* and with different model systems to dissect many of the biochemical and biophysical properties (at both molecular and cellular levels) involved in the dynamics of migration and cell-to-cell communication. The acquisition of the necessary knowledge to understand how cell migration is controlled, quantified and regulated is essential to many biological processes such as, for example, embryonic development, immune surveillance and wound healing.

The book consists of 28 chapters written by an outstanding team of contributors who analyze cells migration from different points of view.

In particular, the first chapter of this book wisely focuses on the randomly migrating cells and on the methods useful to measure and quantify single cell trajectories which can be affected by physical constrains or/and by the intrinsic properties of the cells. Two of the best studied cell migration assays are the scratch technique and the use of an insert creating a gap between two groups of cells which results to be the most advantageous because it does not damage cells and allows an easy comparison between the different cell types and treatments (Chapter 2). Interestingly, the following chapters focus on the mesenchymal-to-amoeboid transition and to the better known epithelial-mesenchymal transition in vitro which plays an important role in development and cancer progression (Chapters 3, 4 and 9). In the "omes" era a chapter on the migrasomes could not have been missed. The migrasome is a newly discovered migration-dependent membrane bound cellular organelle that can be visualized by fluorescence and electron microscopy (Chapter 5).

The following chapters describe more specific topics like an *in vitro* 3D method to follow the sprouting angiogenesis (Chapter 6), the migration of leukocytes through epithelial monolayers as often seen in several inflammatory conditions like Crohn's disease and asthma (Chapter 7) and the cell invasion assessment crucial in cancer metastasis research (Chapter 8). Interestingly, the authors of this chapter use the chick chorioallantoic membrane to evaluate cancer cell invasiveness *in vitro*.

Detailed step by step methods including the list of the necessary reagents, materials, instruments and useful troubleshooting suggestions are indicated in all the chapters of the book. Quantitative fluorescence microscopy is one of the most used techniques to follow cell migration and statistical methods, mathematical modeling of the results together with customized image analysis tools are also detailed (Chapter 10). Cell migration in the developing brain and in murine tissue explants derived from gut, intestinal carcinoma and liver are the topics of the following three chapters rich in details and informative images.

The study of cells migration to understand the metastatic process through the use of Zebrafish embryos is the topic of Chapters 15 and 16. This, in particular, can be a powerful model for cell and cancer biology and *in vivo* imagining analysis. Here the authors present very nice schematic illustrations and images useful to set up the software for a correct live imaging. Also, the dynamic of cell groups migrations can be tracked and quantified by 5D confocal imaging.

In my opinion, the editor of this book did a great job in collecting contributions where several animal models are presented. Not only mammals and little fishes but also Drosophila and *Caenorhabditis elegans* are the main players of the following papers. In particular, fruit fly is the animal model analyzed in Chapter 17. Drosophila macrophages represent an excellent system for the study of morphogenesis, immune and tissue damage responses. Informative illustrations enrich the chapter devoted to the migration of Q cells in *C. elegans*. *Amoeba proteus* and *Dictyostelium discoideum* are here used for electrotaxis experiments and for the analyses of the cell motility in unconfined and mechanically confined settings (Chapters 23 and 24).

Another fascinating aspect presented in this book regards the intricate actin-driven process modulating the cytoskeleton properties as a necessary pre-requisite to understand the triggering of the migratory cellular movements in fibroblasts (Chapter 19) and mesenchymal cells by means of an automated method named CorRecD able to quantify cell edge dynamics and protein recruitment (Chapter 20).

Single-protein tracking studies together with the possibility to optically control cell polarization and directional cell migration will satisfy the most demanding cyto- and histochemistry scientists (Chapters 21 and 22). The last chapters describe the microfluidic assays that can be used to monitor neutrophil chemotaxis, leukocyte migration with high throughput to determine the physical limits of this process in confined environments but always related to their biological origin. To conclude, Chapter 28 is entirely devoted to collective migration with two protocols dealing with the control of cell populations behavior over long times and the surface topology in three dimensions.

Many "extras" can be found online thus increasing the amount of information useful to reproduce the methods presented here in our own laboratories.

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