Cell Biology

Helmholtz Professorship

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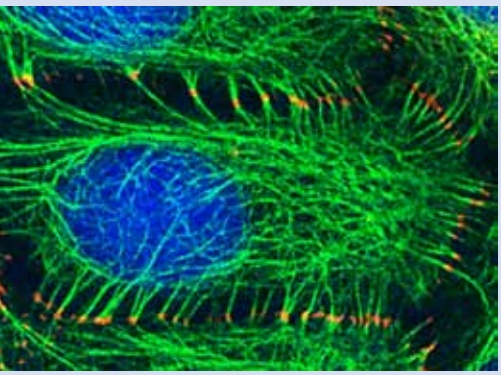
Cell morphology, character, function and interaction with other cells are established and predominantly determined by their architectonic organization, i.e. the cytoskeleton, in both normal and pathological states, in situ and in cell culture. In particular, our studies focus on the structural and molecular elements forming the cytoplasmic filament systems, notably the microfilament bundles as well as the intermediate-sized filaments and their anchorage structures, the dense plaques located on the cytoplasmic sides of the cell-cell connecting junctions, i.e. primarily the adhering junctions and the desmosomes. We are extending and completing our analyses of the major constituent molecules of these cell type-specific junctions using biochemical and immunological methods, including chemical cross-linking as well as high-resolution immunofluorescence and immunoelectron microscopy. To this end, we generate antibodies against cell type-specific cytoskeletal molecules and examine, in collaboration with pathologists, their diagnostic value for tumor cell typing, notably for the identification of the specific primary tumor of metastatic tumor cells. In addition, we have recently demonstrated spontaneous and cumulative syntheses of proteins that then can be assembled to certain novel and semistable structures, including cell-cell junctions, that are able to transform "out of histogenesis" a given tumor cell type directly to a novel different tumor cell type.

Future Outlook:
The ongoing and future work aims at the completion of the molecular composition of the cell-cell junctions and the identification of novel types of junctions; their specific functions and mode of formation; the elucidation of their value in tumor diagnosis; and of their roles in tumor spread and metastasis.

ESSENTIAL PUBLICATIONS:

(1.) Franke W.W. et al. (2013). Transmembrane protein PERP is a component of tessellate junctions and of other junctional and non-junctional plasma membrane regions in diverse epitheliail and epithelium-derived cells. ***Cell Tissue Res.*** 353, 99–115.
(2.) Franke W.W. & Pape U.-F. (2012). Diverse types of junctions containing tight junction proteins in stratifi ed mammalian epithelia. ***Ann. N. Y. Acad. Sci.***, 1257, 152–157.
(3.) Pieperhoff S. et al. (2012). The plaque protein myozap identified as a novel major component of adhering junctions in endothelia of the blood and lymph vascular systems. ***J. Cell. Mol. Med.***, 16, 1709–1719.
(4.) Franke W.W. & Rickelt S. (2011). Mesenchymal-epithelial transitions: Spontaneous and cumulative syntheses of epithelial marker molecules and their assemblies to novel cell junctions connecting human hematopoietic tumor cells to carcinomatoid tissue structures. ***Int. J. Cancer,*** 129, 2588–2599.



Double-label immunofluorescence microscopy of a monolayer culture of epithelial cells (human keratinocytes of line HaCaT) connected by cell-cell bridges with central desmosomes (red and yellow show the major molecule, desmoplakin) anchoring bundles of keratin filaments (green). For details see W.W. Franke (2009) Cold Spring Harb. Perspect. Biol. 1, a003061.