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## PROJECT "PHYSICAL FACTORS INFLUENCING THE CELL"

Coming from the experiments with light, infrared, temperature, electromagnetic fields (EMF) [3]), we (Dr. Özkuzur, S. Perikhe, J. Derix and Prof. Monsees now University of Kapstadt, South Africa) tried to find guidance and adhesion cues (e.g. to probe and construct implant surfaces [2, 4, 6]) in different cell types especially osteoblasts. To our great surprise we found that one of the most important cues for guiding cell adhesion are electric charges on the implant surface as well as the ionic composition in the medium between the cell and the surface [8].

Regarding ions and charges, a general change in paradigm took place concerning the endogenously produced static electric fields (EF) of cells and tissues [3, 5]. Now, the action of ion transporters and ion channels could be linked to the "electric" action of cells and tissues. Also, sensing of these ion gradients was demonstrated in studies of cell migration and wound healing. Furthermore, the triggers exerted by ion concentrations and concomitant electric field gradients have been traced along signalling cascades till gene expression changes. Interestingly, changes in ion concentrating can also be transmitted by real newly detected "tunneling nanotubes" [10].

We could also reveal that the pattern of NHE3 and Na/K ATPase accumulations on leading edges of the cells during EF-directed migration resemble to filopodia and focal adhesions, respectively [8]. Thus we suggest that there might be interactions between NHE3 and Na/K ATPase and cytoskeletal proteins related to these patterns such as  $\beta$  actin (locates in the leading edge of migrating cells) and vinculin (important protein for adhesion turnover) [8, 9].

In tail regeneration studies in the axolotl model we could reveal a sequential activation of different ions (protons, calcium, sodium, potassium) in the cells exposed to dcEF, assessed by ion-specific vital dyes [6].

Here, we have cooperation with the group of M. Levin (Harvard, Boston) with Prof. H.H. Epperlein (in our institute) and with Prof. E. Tanaka (CRTD).

For application of DC-EF we (together with the group of Prof. Gerlach, TUD) have developed a polymer-gel electrode [7].

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