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EDITORIAL

In focus in HCB

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Nuclear organization during differentiation of porcine mesenchymal stem cells into adipocytes

The differentiation of stem cells into specialized cell types is accompanied by significant structural and functional changes. It is known that during adipogenesis not only changes in cell morphology and of the organization of the extraxellular matrix occur but also in gene expression profiles (Charo et al. 2016; Moreno-Navarrete 2012). Stachecka et al. (2018) now performed a comparative analysis of nuclear organization during the in vitro differentiation of porcine mesenchymal stem cells derived from bone marrow or adipose tissue into adipocytes. The nuclear shape and various nuclear substructures were investigated at 0, 3, 5, and 7 days culture in adipogenic medium by combining confocal immunofluorescence and FISH with advanced image analysis. As expected, the nuclear shape changed from spherical in the stem cells to ellipsoid in adipocytes. The nuclear volume of adipocytes differentiated from mesenchymal stem cells from bone marrow or adipose tissue decreased by about 15%, the sphericity parameter by about 6%, and the nuclear section area by 32 and 28%, respectively. The changes in size and shape of the nuclei were accompanied by a 17% reduction of the lamin A/C level. A remarkable reorganization of the chromocenters was noticed, which was characterized by a significant clustering of telomers and a volume reduction and redistribution of the perichromatin component HP1α. A reduced number of PML bodies was also detected, whereas no changes in number, volume and distribution of nucleoli and SC-35 nuclear speckles were found. Because of the similarities with human tissue, the porcine adipogenesis model may be useful in studies of human obesity.

Prostaglandin E2 receptor EP1 in healthy and diseased human endometrium

The function of the endometrium and its structural changes during the menstrual cycle are well-regulated, and the prostaglandin system is involved in this process (Milnes et al. 2001). Zhu et al. (2018) studied by semiquantitative immunohistochemistry the expression pattern of the prostaglandin E2 receptor 1 (EP1) in human endometrium. EP1 immunostaining in the epithelium and stroma was higher during the proliferative phase compared to early and late secretory phase. EP1 immunostaining in the epithelium and stroma of endometriosis was observed to be stronger than in the proliferative phase of normal endometrium and was highest in stage IV endometriosis. Likewise, EP1 immunostaining was high in endometrial cancer epithelium, but the tumor stroma showed only weak immunostaining. No relation between EP1 immunostaining and histological type, as well as tumor stage and grade or progression-free survival and overall patient survival were detected.

Modified protocols for the detection of microplastics in paraffin-embedded tissues

Recently, environmental concerns about the sequestration of ocean debris in the form of micro-plastic pollutants in marine organisms have been expressed by environmental scientists and journalists alike. Bioassay monitoring of microplastic ingestion can be accomplished via histological techniques, though prolonged exposure to ethanols and xylenes during routine processing for paraffin wax embedding results in degradation of the plastics. Gonclaves et al. (2018) now present a modified method, based on early

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studies by Doxtader (1948) for routine histological processing, whereby isopropanol is substituted as a faster acting solvent replacing the standard ethanols and xylenes during dehydration and infiltration. Using this isopropanol-modified protocol, they show that 6-µm polystyrene spheres ingested by marine mussels could be visualized in hematoxylin and eosin-stained paraffin sections, whereas in sections deparaffinized using standard xylenes the beads were degraded. The method can be adapted to visualize prestained and fluorescent microparticles and should prove useful for studies or assays requiring the visualization of ingested microplastics in marine organisms.

Genotoxic properties of the herbicide pendimethalin in human and rat cells

Transitioning from the just-described aquatic-based to land- and air-based contaminants, Ansari et al. (2018) investigated multiple cellular effects resulting from exposure to the herbicide pendimethalin. This dintiroanaline herbicide is widely used to control the growth of grasses and crop-related broadleaved weeds (Tomlin 1994). Multiple studies and assessments in both animals and humans over the years have demonstrated a positive correlation between pendimethalin exposure and a variety of clinical maladies, including various cancers. To assess the cellular mechanisms perturbed by pendimethalin exposure, Ansari et al. (2018) have now studied two different experimental exposure models: cultured human lymphocytes and intact rats. Using multiple experimental techniques, their results showed that pendimethalin: (1) selectively binds to the minor groove with G-C nucleotides, likely resulting in chromosome fragmentation; (2) induces micronucleus formation and DNA damage; (3) exposure results in increased cellular reactive oxygen species and mitochondrial alterations manifested through altered membrane potential; (4) exposure leads to increased apoptotic activity in the human lymphocyte culture and in rat bone marrow cells; and (5) low dose oral exposure led to multi-organ toxicity in rats assessed by histological evaluation. Thus, using these two independent model systems, they showed that exposure to pendimethalin results in genotoxic consequences, and therefore precautions should be considered prior to widespread use of this herbicide in the agricultural sector.

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