

Proteome Biology of Stem Cells

A NEW JOINT HUPO AND ISSCR INITIATIVE

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The HUPO initiative “Proteome biology of stem cells” has been established as a collaborative platform bringing together stem cell biologists and researchers in proteomics. The aim is to effectuate the implementation of cutting edge proteomics technology in stem cell research to further our understanding of stem cell biology. This has been prompted primarily by the recent major breakthroughs in stem cell biology, the potential that stem cells have for biomedical application, and the awareness that proteomics has a role in accelerating this progress further or to open as yet unexplored areas.

The increasing interest in the characterization and function of stem cells is primarily related to the notion that human embryonic stem cells are highly flexible and have the unique property to form all cells in the human body. The control of this property *in vitro* potentially offers opportunities to develop treatments of diseases, especially in the area of regenerative medicine, or to design strategies for screening of drugs. Apart from these applications in the long term, molecular understanding of mechanisms controlling stem cell maintenance and differentiation would be of high value for obtaining a basic understanding of the distinctive properties of stem cells. Yet basic as well as clinically orientated research into stem cells is confronted with many challenges and open questions. For instance, cell surface proteins and signaling cascades (both for primitive stem cells as well as differentiated subpopulations) are largely unknown as are differentiation-specific proteins that can be used as benchmarks for the intermediate or terminal steps of differentiation of cells.

These are all areas where proteomics can contribute significantly, and given the current state of technology in proteomics, which has matured immensely in recent years (1,

2), it was realized that the time is right to join forces and start a collaborative platform between stem cell biologists and proteomics specialists. As such a common podium for discussion is much required because at present stem cell biology and proteomics communities rarely meet. Therefore, a worldwide alliance has been formed, consisting of leading proteomics and stem cell researchers, resulting in the foundation of an initiative supported by HUPO, named Proteome biology of stem cells early 2007, chaired by Albert Heck and co-chaired by the other authors of this paper (3). Importantly the International Society for Stem Cell Research (ISSCR) immediately recognized the significance of the alliance and has been highly supportive in establishing the initiative and providing a platform to convene, now making this a joint HUPO-ISSCR effort. The inaugural meeting of the consortium was at the annual conference of the ISSCR in Cairns, Australia (June 17–20, 2007). At that occasion, it was concluded that more frequent meetings would be necessary to define appropriate collaborative projects that would be biologically relevant, technically achievable, and productive within a reasonable time frame. Therefore, even at this early stage of the initiative, there have been several rounds of discussions at subsequent meetings of HUPO (Seoul, October 6–10, 2007) and of the International Stem Cell Initiative in Bar Harbor (October 19–21, 2007) attended by investigators from both HUPO and ISSCR organizations. So far, a number of areas have been defined on which collaborative projects could focus. These include the identification of new protein cell surface markers that may be used as fingerprints for stem cell lines or as characteristic marks for cells at specific stages of differentiation. In addition, in-depth analysis of stem cell-specific signaling, for instance through comprehensive phosphoproteomics analyses, would allow a more detailed understanding of stem cell-specific behavior. Over the next few months the discussion will focus on narrowing down specific questions, such as the number and identity of cell lines that should be included in such an initiative, the best growth media and culture conditions, the proteomics techniques that should be applied, and which laboratories would be interested in contributing to such studies. It was agreed that the next annual meeting of ISSCR (Philadelphia, June 2008) would be used to materialize these maturing ideas in a draft proposal, whereas more definitive decisions could be made at the annual HUPO meeting in Amsterdam (August 2008; www.hupo2008.com). A

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Website has been created to report on these activities (www.hupo.org/research/stemcells/) and to provide further background on the initiative.

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