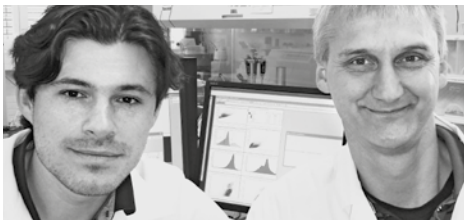
Stem cells to develop next generation therapeutics



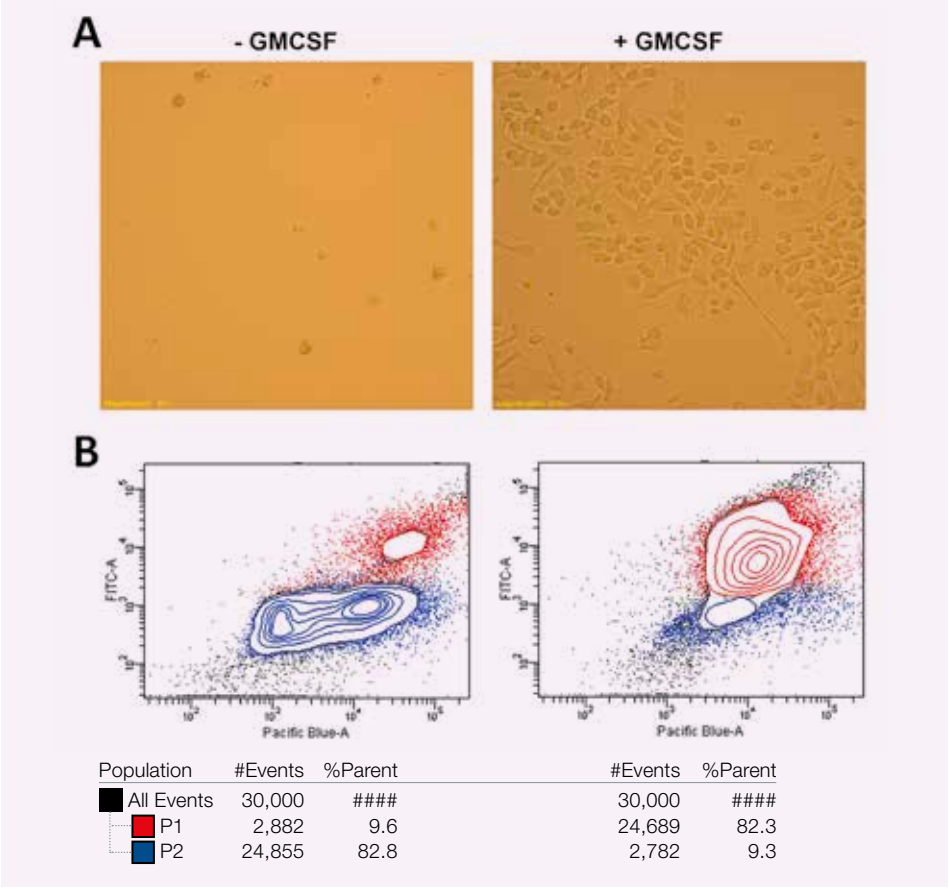
Dr. Bruno Filippi, Research Assistant, bruno.filippi@zhaw.ch,
Prof. Dr. Jack Rohrer, Lecturer, jack.rohrer@zhaw.ch

Stem cell biology offers a promising key to new innovations in the field of therapeutics and biotechnology. In collaboration with the group of pharmaceutical technology, the group of cell biology seeks to establish at the LSFM a new platform for the generation, manipulation, differentiation and analysis of human as well as animal stem cells. The aim is to translate recent academic developments in this fast growing field into applied projects for the industrial partners of ZHAW.

New stem cell platform in Wädenswil

Stem cells are special because they have the unique property to differentiate into any cell type under the appropriate stimuli. Although early work suggested that stem cells are only present in embryonic tissues, it has been demonstrated in the past years that they can be isolated from adult organisms as well. In addition, it has been shown recently that primary fibroblast cells can be reprogrammed into induced pluripotent stem cells (iPSCs). Original stem cells and their «synthetic» counterparts, the iPSCs, have the theoretical potential to form new biological tissues as well as entire complex organs. This unique property implies that the use of stem cells could enable breakthroughs in several therapeutic and biotechnological areas including regenerative medicine, personalized medicine or model organ systems for drug testing.

Therefore, stem cells raise the interest of a growing number of biotech companies. Our group is about to establish a stem cell platform at the department of LSFM in Wädenswil to transfer recent progress in stem cell research from the academia to applied technologies for industrial partners.



Population	#Events	%Parent	#Events	%Parent
All Events	30,000	####	30,000	####
P1	2,882	9.6	24,689	82.3
P2	24,855	82.8	2,782	9.3

Fig.: Hematopoietic precursor cells (blue) are either not stimulated (A, B left side) or stimulated with GMCSF (A, B right side) and the cells are analyzed for the presence of adherent effector cells of the immune system (red). A microscopic analysis (A) revealed that without stimulation there are few adherent cells but upon stimulation with GMSF there are many adherent cells. This is further confirmed by FACS analysis (B) for specific surface markers of the effector cells (9.6 % - GMCSF vs 82.3 % + GMCSF)

Bone marrow-derived cell line for a next generation cell-based immunization procedure

In an effort to exploit the unique properties of stem cells, we are currently working to develop a cell line from bone marrow (a tissue rich in hematopoietic stem cells) of New Zealand white rabbits. These cells retain the ability to differentiate into effector cells of the immune system to enable an effective cell-based immunization of rabbits to produce antibodies. Initial experiments demonstrate that we can successfully differentiate the precursor cells to effector cells as analyzed by FACS (see figure).

IPSCs

We are also taking advantage of the new level 2 bio-safety laboratory on the campus Reidbach to generate human iPSCs from primary human fibroblasts. To this end we have to transfect the primary cells using lentiviral particles containing reprogramming oncogenic DNA sequences. A future project will include this new technology to develop a panel of assays to test the effect of active cosmetic ingredients on the maintenance and the differentiation of human dermal stem cells.

Research project

Rabbit cell lines for cell vaccination

Lead:	Dr. Bruno Filippi; Prof. Dr. Jack Rohrer
Duration:	September 2014 – February 2015