

**[www.biotechnologie.de](http://www.biotechnologie.de) – PDF-Service**

# Table of Contents

<b>Molecule–mix to create brain stem cells.....</b>	<b>1</b>
Fact and Figures.....	2
People.....	2
Funded Projects.....	3

# Molecule–mix to create brain stem cells

27.03.2012 –

*Pluripotent stem cells, which can transform into any cell type, are a truly universal talent. For tissue–replacement therapy, they are an extremely interesting prospect. From heart attacks and strokes to Alzheimer's, destroyed tissue can be mended again through the gift of artificially bred cells. But even at a cellular level, there is a fine line between genius and folly. If the cell division programme of the pluripotent stem cells goes off the rails, then the obviously undesirable result is cancer. For this reason, many researchers consider the actual therapeutic use of pluripotent stem cells to be some way away. Now, two different German research groups ? working entirely independently ? have made progress on the search for solutions to alternative approaches. The different techniques have been presented in the journal *Cell Stem Cell* by two teams of stem cell researchers ? one headed by Hans Schöler from the Max Planck Institute for Molecular Biomedicine in Münster, and the other by Oliver Brüstle from the Life & Brain Center, University of Bonn.*

The research team from the Max Planck Institute for Molecular Biomedicine in Münster was led by Hans Schöler. For the first time anywhere in the world, the scientists succeeded in the direct breeding of somatic stem cells from mature body cells. To do this, it was previously necessary to take a detour via embryonic stem cells or their laboratory relatives, induced pluripotent stem cells (iPS cells). The most important difference is that while natural or artificial 'all–rounder' cells can differentiate into all possible cell types, so–called multipotent somatic stem cells have clear limits to their abilities. These can only differentiate into specific types of tissue. "With our approach, the regeneration of certain types of tissue can be carried out much more targetedly and safely," says Schöler. The researchers have described their technique in the journal *Cell Stem Cell* (2012, [online prepublication](#)).

## ***Brn4 takes skin cells under its command***

For the reprogramming of somatic cells into stem cells, the researchers at the Max Planck Institute used a unique combination of proteins that control cell growth in the body. "We have used the factor Brn4, which has never been used before in experiments of this kind," says Hans Schöler: "Brn4 has proven to be something of a captain: one who can bring his ship ? the skin cell ? very quickly and effectively under his command.

Essentially, it ensures that things progress in a clear direction, and that a neuronal somatic stem cell emerges from the skin cell." When the cells divide under the influence of growth factors and the proper culture conditions, then this transformation becomes all the more effective, comments Schöler: "The cells increasingly lose their molecular memory that they were once a skin cell." After several rounds of division, the induced neural somatic stem cells are barely distinguishable from their naturally occurring counterparts, and they do not lose their ability to divide in the process. "The so–called neural stem cells have 130 passages in a Petri dish behind them, meaning that they have divided more than 400 times," says Schöler. Next, the researchers in Munster want to investigate whether their results can be transferred to human cells. "Because the somatic stem cells are multipotent and the risk of tumor formation is dramatically reduced, the cells could, in a few years, be used for tissue regeneration in disease or in old age." However, considerable research efforts are still required before this becomes reality, thinks Schöler.

## ***Temporary switching on control factor Oct4***

The work by the team of scientists headed by Oliver Brüstle at the Life & Brain Center of the University of Bonn is also thoroughly basic research. The Bonn–based stem cell experts have previously focused on iPS cells. As team leader Frank Edenhofer has reported, this focus has now shifted. "We have very deliberately worked towards the production of neural stem cells or brain stem cells rather than the pluripotent all–rounder iPS cells," says Edenhofer. Specifically, the emphasis is on so–called somatic or adult stem cells that can be

converted into the kinds of neurons that are typical for the nervous system, oligodendrocytes and astrocytes. The four factors that also play a role in the classic production of induced pluripotent stem cells were also used in the experiments: Sox2, Klf4, c-Myc and Oct4. The decisive control factor is the Oct4 gene, the researchers have likewise reported in *Cell Stem Cell* (2012, [online prepublication](#)). "This initially prepares the connective tissue for reprogramming, but later prevents them from turning into a brain stem cell," explains the Bonn-based stem cell researcher. In the production of iPS cells, this factor is switched on for an extended period, while the scientists in Bonn have used targeted techniques to activate the gene only for a few days.

***More on this subject on [biotechnologie.de](#)***

***News:*** [ECJ prohibits patents on Stem cells](#)

***News:*** [Nervous disorders investigated using reprogrammed stem cells](#)

"When this switch molecule is turned on and limited in the time it can function, you result directly in brain stem cells, which we call induced neural stem cells," says Edenhofer. "Oct4 triggers the process, opens up the cells' genetic material, and turns on the green light for direct reprogramming." It appears that Oct4 should not be active for too long, or the transformation will progress to the embryonic stage. We still need to investigate the exact mechanism of the transformation," admits Edenhofer.

Nevertheless, the advantages of the new method are already clear. "Compared to the production of iPS cells, our method is faster by about two to three times because we don't need to reprogram the cells through to the embryo stage" emphasises Edenhofer. This means that the overall effort and costs are much lower. Furthermore, the new process being developed in Bonn is associated with a significantly reduced risk of tumours.

Whether the two different methods of producing stem cells differ meaningfully from one another is too early to say. This can only be demonstrated by experiments with human cells and with animal models.

© [biotechnologie.de/bk](#)

## Fact and Figures



Want to find out more about the biotech sector in Germany? In our *Background* section we present the *latest data* concerning *German biotech companies* as well as biotech related *factfiles* and *country studies*.

[Background](#)

## People



Want to find out how a researcher ticks and what drives him on? Have a look in the regularly updated *People* section. Portraits of *German scientists* working in the biotechnology research area will give you an insight on the people *at the heart of German biotechnology*.

[People](#)

## Funded Projects



Want to find out which *biotechnological research projects* are being funded by the German government? The *Funded Projects* section provides information about funded research projects and their focus of interest.

[Funded Projects](#)