Scientists develop safe and easy way to make stem cells

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Researchers in China announced in a paper published in the journal *Science* on Thursday that they have developed an "easy and safe" way to make stem cells that could rekindle the great hope for growing tissue and organs from stem cells to treat a range of diseases.

By using a cocktail of small molecules to chemically reprogram the adult tissue cells they say they can make induced pluripotent stem cells (iPSCs) as versatile as embryonic stem cells, without running the risk of dangerous mutations or cancer that occurs when gene insertion is used to make iPS cells.

Pluripotent stem cells are capable of giving rise to all the body's cell types - the stem cells in embryos are pluripotent. Inducing this embryonic-like state in adult cells is groundbreaking medical science.

The chemical insertion method of inducing cells used by these researchers is simpler and easier than the gene insertion approach, which, they note, has also tended to limit the clinical application of iPS cells.

How they did it

For their study, Deng Hongkui, a professor and stem-cell biologist at Peking University in Beijing, and colleagues, induced a pluripotent state in adult cells from mice using seven small-molecule compounds.

They started out by screening 10,000 small molecules. They were looking for a combination that would have the same effect as gene insertion.

They then had to work for another year fine-tuning the cocktail to achieve the hallmark of pluripotency and also to increase the efficiency of conversion.

They finally settled on a cocktail of seven small compounds, which they showed was able to convert 0.2% of the adult tissue cells into iPSCs, which is comparable to the gene insertion conversion rate.

They call the chemically induced pluripotent cells CiPSCs.

In their paper the team describes the many advantages of small molecules: they pass easily through cell walls, they don't affect the immune system, the are cost-effective, and they can easily be synthesized, preserved, and standardized.

"Moreover, their effects on inhibiting and activating the function of specific proteins are often reversible and can be finely tuned by varying the concentrations," note the authors.

Stem cells helped growth of heart, brain, liver, skin and muscle tissue

The researchers showed that the CiPSCs were pluripotent by introducing them into developing mouse embryos. As they grew and were born, the resulting mice showed signs that the CiPSCs had contributed to the formation of all tissue types, including heart, brain, liver, skin, and muscle.

> *Unlike mice bred using the gene insertion method, the mice generated from CiPSCs were "100% viable and apparently healthy for up to 6 months."*

One of the mice the team bred is called QingQing and has already "got its own 'babies' and they no longer need to worry about their health," Prof. Hongkui told the Chinese news agency Xinhua.

The team believes the study opens the possibility of making "functionally desirable cell types" for regenerative medicine by using specific chemicals or drugs to do the cell reprogramming instead of using gene manipulation and difficult and expensive biological procedures.

Work to do before human benefit

While the next logical step is to try using the CiPSC approach to make human stem cells, the team notes there is still some work to do before it is ready for such a step.

Sheng Ding, a reprograming researcher at the Gladstone Institutes in San Francisco, California, told Nature News that while Prof. Hongkui and colleagues have made "significant progress" in the field with this new study, the CiSPC approach is not likely to be widely used until they can show it works with human cells as well as mouse cells.

Earlier this month, scientists in Japan reported how they managed to grow functioning human liver tissue from stem cells, bringing the day closer when engineered tissue can be used to alleviate the acute shortage of donor tissue for transplants.

Written by Catharine Paddock PhD

References:
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