Stem cells: hope and reality

Alberto Consolaro
Full professor, Department of Pathology, School of Dentistry — University of São Paulo/Bauru.
Postgraduate Department, School of Dentistry — University of São Paulo/Ribeirão Preto.

"Chinese researchers generate teeth from stem cells!" "Spanish laboratory grows bone from stem cells!" "Hamburger meat is produced from bovine stem cells swallowed by volunteers in London!" In no time, we will come across the news: "Central Bank grows money from stem cells!" Or would they be "stem cents"?

Mental trips are free in Science, with gate-free pathways. In science fiction, there is no difference between expectation and imagination; they mingle and the distance between them is short. Fiction faces a creativity crisis. Interviews with renowned researchers describing brilliant ideas always end with the following: "Further studies and a few years of laboratory tests and clinical assays carried out in animals are necessary before applying the concept to human beings. Anyhow, the research will be published!"

Expectation is the waiting-room for frustration. Those who are anxious tend to eat more and grind their teeth. And there goes fitness and teeth!!! When the news of a scientific publication is spread, the mental trip has already been analyzed by the editors, the reports are approaching applicability and reality is within a few steps.

Many researchers speak up before publication, and a few years later, we find out that the outcomes of their research were not even sent to scientific journals, although they functioned as means to impress society and persuade their bosses, institutions and funding agencies. Without even mentioning family and friends. And that is what happens with stem cells: too much is published, but too little is practiced. There is only hope, but in science, hope is not enough!

Each embryo cell comprising 8 to 16 cells at a few days old is able to independently generate a new life. Due to being totipotent, it has full potential in generating one of the 206 types of cells. Embryo stem cells are capable of developing or differentiating into any type of cell, even after being inactive as frozen embryos for a long time.

Some cells do not multiply when they are mature. However, when cultured in laboratory, embryo stem cells reproduce thousands of them. When injected into damaged organs, such as the heart, kidneys and brain, stem cells may induce the formation of new cells, recovering the function of the organs. Nevertheless, additional studies are necessary to further investigate how to control proliferation and renovation of these cells in order to avoid malign neoplasm.

Mature tissues and organs present a low percentage of nearly embryonic reserve cells or "tissue stem cells". In tissues, those cells function to repair lesions caused by trauma, illnesses or aging, although in a very limited manner. For this reason,

as well as for ethical and moral issues, scientists collect adult tissue stem cells, which return to their embryonic stage by "dedifferentiation". Cultured in laboratory, they can be injected, even into their own donor, to reproduce tissues and organs.

"Adult stem cells" are limited because they are not capable of differentiating into all types of tissue. However, they can be genetically reprogrammed under laboratory conditions, in which case they are subjected to total regression and become totipotent cells known as induced pluripotent stem cells (iPSCs).

Many people strongly believe that injection of stem cells ensures tissues and organs recovery. That is not true. The origin and manipulation of cells, storage and treatment conditions as well as the situation of use are key to therapeutic success. Injecting tissue stem cells in humans is a serious procedure that offers several risks, including cancer. Undergoing authorized experimental protocols may be hazardous, but are certainly worth it. Nevertheless, some people have been subjected to illegal procedures performed by "professionals" who are not even doctors!

Practically speaking, no treatment or therapeutic protocol is authorized to employ stem cells in carriers of a certain disease. Only a few of existing protocols are experiences carried out for especial cases under supervision and authorization of ethic committees, Health Surveillance Agency, Ministry of Health and the Federal Council of Medicine. Stem cells offer hope and prospect, but are not yet a reality that can be applied to the general population: They are exceptionally authorized laboratory researches and occasional assays.

Let us be calm and patient!

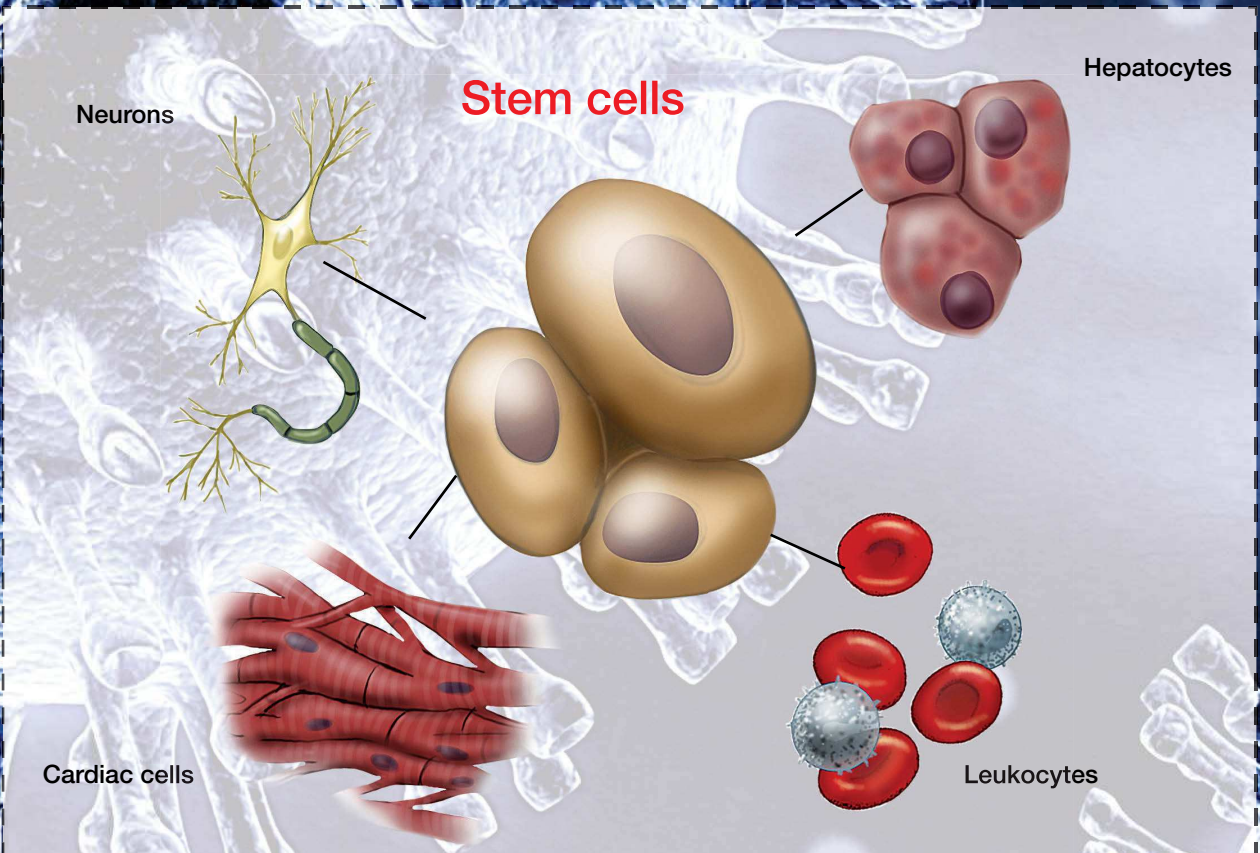

Figure 1: Embryo stem cells and iPSCs may generate any type of human beings cells.

Dentes “fabricados” por células-tronco

Pesquisadores do Instituto de Biomedicina e Saúde de Guangzhou, na China[1], isolaram células epiteliais da urina humana e, em laboratório, tornaram-nas *“células-tronco pluripotentes induzidas (iPSCs)”.* Ao colocar essas células no mesênquima dentário de ratos e inserir o conjunto nas cápsulas renais, Jinglei Cai e sua equipe conseguiram obter estruturas semelhantes a dentes humanos em três semanas. Os dentes apresentaram esmalte, dentina, cemento e polpa, com plena organização dos ameloblastos e odontoblastos, em fotografias muito bem apresentadas.

Na revista “**Cell Regeneration**”, de acesso livre (www.cellregenerationjournal.com/content/2/1/6), os resultados são impressionantes[1]. Os dentes têm vários tipos de tecidos e linhagens celulares que precisam, no tempo e espaço, interagir de forma muito precisa e intrincada. Alguns aspectos metodológicos não foram minuciosamente descritos e os resultados devem ser checados e reproduzidos em outros laboratórios, pela relevância apresentada.

Obs: Essa crônica foi publicada originalmente no Caderno de Ciências do Jornal da Cidade, editado em Bauru, na coluna Ciência no Dia a Dia, publicada semanalmente ha 4 anos.

Referências:

1. Cai et al. Generation of tooth-like structures from integration-free human urine induced pluripotent stem cells. Cell Regeneration 2013, 2:6. doi:10.1186/2045-9769-2-6.