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Cloning and its Applications

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Editorial

In mammalian fertilization process, female pronucleus share male pronucleus to form the zygote which undergoes mitotic division yielding totipotent cells. After morula compaction, the embryonic cells differentiate into two types of cells; the inner cell mass cells which have the pluripotent stemness criteria to form the embryo proper, and the trophectoderm which would share the placenta formation.

In vitro -without spermatozoa contribution and using somatic cells instead- the oocyte was found to has extraordinary astonishing capabilities to process the genetic materials of transferred somatic cells through different mechanisms;

1) Reprogramming the somatic cells even when it is enucleated, as in case of somatic cell nuclear transfer (cloning) which produces a copy of genetic materials of the somatic cell donor animal [1];

2) Enforcing the somatic cells nuclei to bypass an obligatory mitotic cell cycle checkpoints and undergo premature condensation [2]; and

3) Enforcing the somatic cells for entry of meiosis through the reduction division as known by semi-cloning or haploidization [3,4].

Moreover, it was found that the early meiotic ooplasm was able to induce initiation of a meiosis-like reducing division in mitotic nuclei originating from differentiated somatic cells [5]. Thus, the meiotic machinery property of the ooplasm can be helpful for generation of artificial oocytes or male germ cells through injecting male and/or female somatic cells into enucleated mature or immature oocytes [6-8].

Since the birth of Dolly the sheep, the first cloned mammal, an ever-growing number of studies worldwide have helped to substantiate the potential applications of somatic cell nuclear transfer (cloning) to overcome several problems in various biology fields such as:

Reproductive cloning: To generate copies of particular species including extinct or endangered species and for propagation of the livestock and elite animals.

Therapeutic cloning: The elite cloned embryos would be a suitable source for pluripotent embryonic stem cells that capable for differentiation into different organs for regenerative medicine purposes to avoid the transplant rejection.

Transgenesis: Production of genetically modified organisms for increasing production of specific merit (such as milk, wool and meat… etc); model animals for human diseases (Parkinson's disease and Alzheimer diseases..etc) and generating humanized organs for xenotransplantation purposes.

However, the use of this technique is limited owing to its low efficiency and several trials showed the improvement of cloning efficiencies [9].

Therefore, the current issue of "Cloning & Transgenesis" will focus on cloning and semi-cloning regarding the trials to improve their efficiency and to reveal their potential applications in biology and medicine.

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