Raja N.L.Khan Women's College

Botany

UG-SEM-VI Paper – C14T

Prepared by Dr. S.K.Maiti

Totipotency

Cell potency is a cell's ability to differentiate into other cell types. The more cell types a cell can differentiate into, the greater its potency. Potency is also described as the gene activation potential within a cell.

Definition : Totipotency (Lat. *totipotentia*, "ability for all [things]") is the ability of a single cell to divide and produce all of the differentiated cells in an organism. Spores and zygotes are examples of totipotent cells. In the spectrum of cell potency, totipotency represents the cell with the greatest differentiation potential,

It is possible for a fully differentiated cell to return to a state of totipotency. This conversion to totipotency is complex, not fully understood and the subject of recent research. Research in 2011 has shown that cells may differentiate not into a fully totipotent cell, but instead into a "complex cellular variation" of totipotency.

Types of totipotent

Research on *Caenorhabditis elegans* suggests that multiple mechanisms including RNA regulation may play a role in maintaining totipotency at different stages of development in some species.

The term "totipotent" has two basically different interpretations:

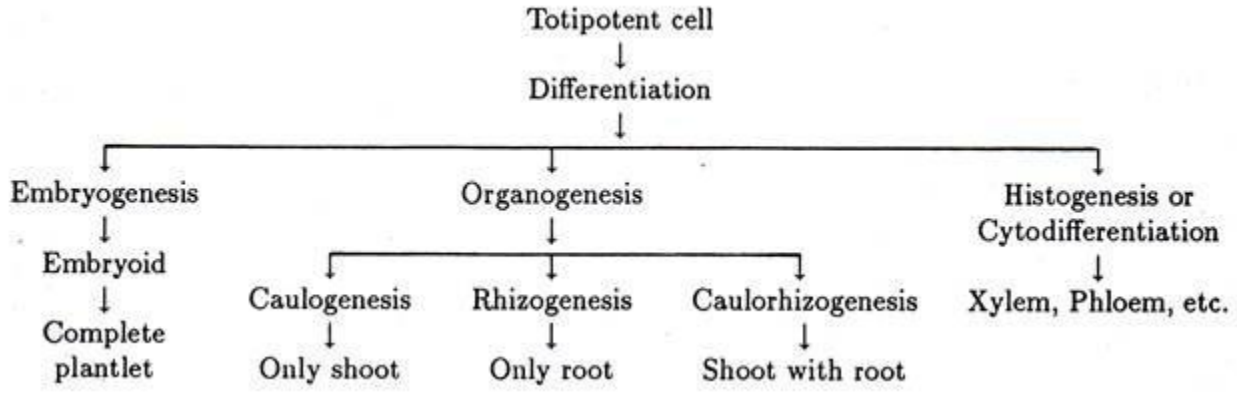
(i) capable of developing into a complete organism or

(ii) capable of differentiating into any cell types of an organism (Condic, 2014). In the first and stricter sense, only zygotes or one-celled embryos are totipotent. In the second and wider sense cells which can develop to all the various cell types of an organism but under different condition each, are also totipotent. Based on this second definition, embryonic animal stem cells that can produce a wide range (but not all!) cell types are often considered to be

totipotent (Condic, 2014). Since these definitions describe two significantly different developmental potencies, Condic recommended using the term "omnipotent" to suit to the second definition (Condic, 2014).

How totipotent cell regenerate a plant

After prolonged culture, it has been observed that calluses in some species (e.g. Ntcotiana tabacum, Citrus aurantifolia etc.) maybe- come habituated. This means that they are now able to grow on a standard maintenance medium which is devoid of growth hormones. The cells of habituated callus also remain totipotent and are capable to regenerate a plant without any major manipulation.



A typical crown gall tumour cell has the capacity for unlimited growth independent of exogenous hormones. It shows totally lack of organ genic differentiation. So such tissue is considered to have permanently lost the totipotentiality of the parent cells.

Importance of Totipotency in Plant Science:

- The ultimate objective in plant protoplast, cell and tissue culture is the reconstruction of plants from the totipotent cell. Although the process of differentiation is still mysterious in general, the expression of totipotent cell in culture has provided a lot of information's.

- On the other hand, the totipotentiality of somatic cells has been exploited in vegetative propagation of many economical, medicinal as well as agriculturally important plant species. Therefore, from fundamental to applied aspect of plant biology, cellular totipotency is highly important.

- Recent trends of plant tissue culture include genetic modification of plants, production of homozygous diploid plants through haploid cell culture, somatic hybridization,

mutation etc. The success of all these studies depends upon the expression of totipotency. In many cases, successful and exciting results have been obtained.

- Plant breeders, horticulturists and commercial plant growers are now more interested in plant tissue culture only for the exploitation of totipotent cells in culture according to their desirable requirement. Totipotent cells within a bit of callus tissue can be stored in liquid nitrogen for a long period. Therefore, for germplasm preservation of endangered plant species, totipotency can be utilized successfully.