GLOSSARY ON PLANT TISSUE CULTURE

Abiotic elicitors: Elicitors of non-organic nature eg. UV light, metal ions etc.

Absolute plating efficiency: Ratio of individual cells inoculated producing colonies to the total cells inoculated in a culture.

Acclimatization: A process by which micropropagated shoots are made to adjust to the outside culture condition after they are planted out.

Activated charcoal: Charcoal which has been treated to remove hydrocarbons and to increase its adsorptive properties is considered activated charcoal. The adverse factors such as phenolic compounds may be adsorbed to activated charcoal included in the medium.

Active polymerization: Entrapment of plant cells in some sort of gel or combination of gels which are allowed to polymerize around them.

Acute contamination: Contamination in cultures occuring at the time of culture initiation due to incomplete surface sterilization.

Adsorption filtration: A process by which organic contaminants and free chlorine are removed from water by activated carbon. Dissolved impurities are not removed by this method.

Adventitious budding. Formation of buds from places other than nodes.

Adventive embryogenesis: Development of embryos from cells that are not the product of gametic fusion.

Agar (Agar-Agar): A gelatinous polysaccharide obtained from red algae. It is used as a solidifying agent in the tissue culture media and is added at the rate of 0.6 to l.0%.

Agarified medium: Nutrient medium solidified with agar or medium in which agar is used as gelling agent.

Agarose bead type culture: Type of culture in which the protoplasts are first embedded in agrose beads, and then once the divisions have started, they are transferred to liquid medium.

Agarose disc type culture: Type of culture in which the protoplasts are embedded in agarose and plated in small droplets (disc) surrounded by liquid medium.

Agarose embedding: Embedding protoplasts in media solidified with low melting point agarose. The method increases plating efficiency of protoplasts. The aggregate formation of protoplasts as in liquid culture does not occur since the embedded protoplasts remain in a fixed position in the gel matrix throughout the culture period.

Agrobacterium mediated gene transfer: Transfer of foreign genes to new hosts using *Agrobacterium tumifaciens* and *A. rhizogenes* as vector systems.

Agroinfection: Transfer of viral DNA integrated into the T-DNA of the Ti plasmid to the host cell using Ti plasmid as the vector. The viral DNA entering the plant cells as part of the T-DNA will integrate into the plant genome.

Albino: An organism lacking normal pigmentation. In plants, the lacking pigments are chlorophylls.

Algenate gel: A block of co-polymer of D-manouronic and L-guloronic acids, in which the carbohydrate moisties are held together by ionic bridges formed between the carboxyl groups of the sugars and multivalent cations which are added as gelling agents.

Alien addition line: Line with an extrachromosome or chromosome pair from another species.

Alien gene introgression: Introgression of a gene from one species to another species.

Alien substitution line: Line in which chromosome or chromosome pair from a donor species replaces a chromosome or chromosome pair of recipient species.

Androgenesis: Formation of embryoids and plantlets from the pollen grains with the haploid set of chromosomes passing through typical stages simulating zygotic embryogenesis.

Aminoacids: Organic acids containing a basic amino group (NH_2) and an acidic carboxyl group (COOH). Some of the amino acids are added to plant tissue culture media, especially glycine and glutamine.

Amitosis: Division of nucleus into two parts without the formation of chromosomes, usually without cell division, so that the cell contians two or more nuclei.

Analogue resistance: Resistance to compounds related to, but slightly different structurally from, a biologically significant molecule.

Anergy: A process in which the exogenous application of hormones to culture medium will not alter the growth *i.e.,* the tissues grow without the exogenous application of hormones. Lack of an expected immune response.

Aneuploidy: A condition in which the cells will have chromosome number other than euploid number.

Aneusomaty: The occurrence of aneuploid cells in euploid tissues, organ or organism.

Anther: The pollen bearing part of a stamen.

Anther culture: Culture of anthers under *in vitro* conditions with an objective to produce monoploid plants.

Antiauxins: Compounds inhibiting the action of auxins. These compounds promote somatic embryo maturation by counteracting the effect of growth promoters. (*e.g.* 5-hydroxynitrobenzylbromide 7, azaindole).

Antibiotic: Complex chemical substance produced by microorganisms like fungi which are bactericidal or bacteriostatic.

Antibiotics: Substances that are toxic to microorganisms. They have the property to retard or arrest the growth of organisms in culture medium of the tissue to be cultured. A range of antibiotics are available for use to prevent microbial contamination in *in vitro* culture.

Antioxidants: Substances added to the medium to inhibit or prevent oxidative browning of the culture medium due to exhudation of phenolic compounds.

Antioxidant mixture: A mixture containing citric acid and ascorbic acid which prevents browning in plant tissue culture.

Anucleate protoplast: See cytoplast

Artificial seeds: Artificial seeds are novel analogues to botanic seed consisting of a somatic embryo surrounded by artificial seed coat.

Asexual embryogenesis: See adventive embryogenesis

Asexual reproduction: Reproduction which does not involve fertilization or fusion of dissimilar gametes.

Asymmetric hybrid: Somatic hybrid possessing asymmetric nuclear constitution due to the partial elimination of chromosomes from one species. In other words not possessing the exact haploid genomes of both the partners.

Autotrophy: Potentiality of organisms to manufacture their own food. The organisms may be photoautotrophs or chemoautotrophs.

Auxin habituation: The attainment of auxin autotrophy in prolonged cell cultures.

Auxotroph: An organism defective in synthesis of an essential metabolite and hence requiring a supply of that metabolite for growth, or an organism not capable of building up metabolites from the medium on which it grows.

Auxillary budding: Formation of buds from the axils of the leaves.

Auxillary bud breaking: Inducing the axillary buds in grow under *in vitro* conditions.

Auxins: A group of plant hormones inducing apical dominance, promote cell elongation, rather than cell division and increase cell wall plasticity. Auxins may be natural or synthetic.

Auxin synergists: The phenolic compounds specifically acting on the induction of roots in cultures synergetic to certain auxins.

Backcross: Cross between a hybrid and one of its parents.

Basal medium: Formulation of empirically constituted macronutrients, micronutrients, hormones, vitamins and other additives to culture plant tissues. Several basal media are available for culturing plant tissues of different plant species.

Batch culture: The cells are cultured in a finite volume of medium in which the growth of cells ceases when essential nutrients are exhausted.

Binary vectors: Vectors have a host Agrobacterium strain containing Ti plasmiddeleted of its T-DNA and a cloning vehicle containing the T-DNA repeats, a selectable marker active in plant cells, and a sequence containing multiple restriction sites. Generally these vectors have a wide host range.

Biochemical markers: Markers such as proteins, allozymes, isozymes and DNA level variation are used in inheritance and phylogenetic studies because of the lesser environmental influence on them.

Bioconversions: see Biotransformation

Biolistic method: See microprojectile bombardment.

Bioreactors: Facilities for the mass cultivation of plant cells as cell suspensions in volumes larger than those possible in shake flasks.

Bioregulants: See growth hormones.

Biosynthesis: Biological synthesis, the production of compunds by a living organism.

Biotic elicitors: Elicitors of organic nature obtained from biological organisms.

Biotransformation: Conversion of one compound into another in a biolgoical material by one or two actions (one or two step biotransofmration) or series of reactions (multistep biotranformation).

Broad host range: See host range.

Bud culture: *In vitro* culture of undeveloped or unemerged stem, leaf, or flower often enclosed by reduced or specialized leaves called leaf scales.

Calcium hypochlorite: Surface sterilant of explants used at 7% concentration (70 g of calcium hypochlorite in l litre of double distilled water).

Calcoflour white (CFW): A stain used to test viability of protoplasts 0.l% V/V solution is used. CFW stains newly formed cellwalls giving a ring of fluoscence around the plasmamembrane.

Callus: Undifferentiated mass of parenchymatous tissues from fresh wounds or tissues or cells cultured *in vitro.*

Callus culture: The cultivation of callus formed from explants on solidified or liquid medium.

Callus induction: Initiation of callus from explants under *in vitro* conditions using specific auxins.

Carrier material: Compound used as substrate or solidifying agent in culture media.

Caulimoviruses: Double stranded DNA viruses used as potential vectors for genetransfer. These viruses can be directly introduced into plants.

Caulogenesis: Formation of shoots from the explants or calli.

Cell: The fundamental unit of life with an outer boundary enclosing protoplasm and nucleus. In animals the outer boundary is plasma membrane. In plants it is cell wall followed by cell membrane.

Cell cooperativity: A phenomenon by which the autotrophic cells crossfeed (generally hormones) the non-autotrophic cells in the same culture.

Cell division: Division of a mother cell into daughter cells after karyokinesis and cytokinesis. The daughter cells will be two in mitosis and resemble the mother cells and four in meiosis and have half of the chromosomes of mother cells.

Cell generation time: Time interval between consecutive divisions of a cell.

Cell immobilization: Process of separation of growth phase of cells from production phase to prolong the use of cells in a stationary or very slow growing state so that the production of secondary metabolites is encouraged.

Cell isolation theory: Theory proposing that the embryogenesis is due to isolation of cells forming embryos from other surrounding cells.

Cell line : A heterogeneous group of cells derived from a primary culture. Any culture maintained in isolation constitutes an individual cell line.

Cell line divergence: Variation between independently maintained cell lines.

Cell line diversity: Variation between individually maintained cell lines.

Cell line selection: Selection of mutant cells *in vitro* from the callus or cell suspension cultures. Selection of potentially useful cell lines following culture-induced variation or mutagenization *in vitro*

Cell sorter: see flow cytometer cell sorter.

Cell sorting: Sorting out of cells, especially somatic hybrids from non hybrids by flow cytometry.

Cell strain: a cell line cloned from a primary culture or other cell line with specific properties differing from its source.

Cell typing: Identification specific cell types using probes such as lectins and antibodies.

Cellular cohesiveness: The degree of attachment of cells together to form clusters.

Chemical fusion: A method of inducing cell fusion by use of high concentration of various chemical fusogens such as PEG (polyethylene glycol) dextran, PVA (polyvinyl alcohol).

Chemical sterilization: Sterilization by using chemicals. It is adopted to sterilize working area, needles, and explants.

Chemostat culture system: Achieving steady state in culture by fixing the volume of biomass when biomass increases beyond a fixed limit, a control device operates and the new medium is added to the culture to dilute the biomass to the required value.

Chilling injury: Response of a tissue to reduction in temperature.

Chimeral callus: Callus composed of more than one kind genetically altered tissues. The alteration in genetic material may be at chromosome level or genome level.

Chlorinated lime: Calcium oychloride an unstable chlorine carrier; on exposure to air it becomes moist and rapidly decomposes.

Chromosome addition: Addition of chromosome(s) to the chromosome complement.

Chromosome rearrangement: Any structural change in chromosomes involving the gain or loss or relocation of chromosome segments.

Chromosome recombination: A condition resulting from the exchange of chromosome segments during the process of meiosis between homologous chromosomes.

Chromosome substitution: Replacement of one or a group of chromosomes by homologous or hemoeologous chromosomes from another strain of same species or related species.

Chromosomal aberrations: Irregularities in chromosome distribution structure or arrangement during cell division.

Chromosomal elimination: Elimination of chromosomes of any of the partners during the course of cell division, generally in the hybrid cells of unrelated species.

Chronic contamination: Contaminations in cultures with latent or symptom less types of viruses or mycoplasmas.

Clones: A population of cells derived from a single cell by mitoses or a group of plants propagated only by vegetative and asexual means, all members of which have been derived by repeated propagation from a single individual.

Coconut milk: The liquid endosperm of coconut used as an organic additive in tissue culture media. It is collected from several nuts, heated to 80°C with stirring filtered and stored frozen.

Coculture: Culture of protoplasts (2 to 3 days old) and *Agrobacterium* together for 36 to 48 hours. Then the cultures are washed with antibiotics to kill the bacteria followed by selection for transformants.

Co-immobilization: Immobilizing two different cell lines of which one could be a cell line with its ability to produce in quantity a precursor to a more valuable product synthesized by a second co-immobilized cell line lacking that synthetic capacity.

Colchicine: An alkaloid obtained from a plant species *Colchicum antumnale*. It inhibits the formation of spindles there by favouring chromosome doubling.

Cold shock: see chilling injury.

Cold storage: see low temperature storage.

Column bioreactor: An improved version of bioreactors in which instead of horizontal types, vertical type vessels are used to have better control over the supply of nutrients, a saving of space and greater suitability for scaling up to an industrial scale.

Column culture: Culture of cells using column bioreactors.

Competence: State of reactivity or capacity of cells to respond to specific stimuli. Competence refers to the transient state in which cells can be induced to be determined.

Competence loss: Loss in capacity of a cell to respond to specific stimuli.

Concanavalin A: A lectin derived from *Canavalia enoiformis*, chemical used to strengthen the attachment of protoplasts induced by polyethylene glycol. Abbreiviated as Con A.

Conditioned medium: Medium after supporting normal-high density growth for a period and harvested harvested medium is incorporated into fresh medium to increase the plating efficiency.

Continuous culture: Cells are cultured in medium throughout where the inflow of fresh medium is balanced by an outflow of the medium (closed continuous) or with the efflux of cells and spent medium (open continuous).

Cotransformation: The independent integration of two markers in one protoplast originally present in different DNA molecules added together to protoplast transformation medium. In other words,simultaneous transfer of two or more genes in a gene transfer system.

Cosmid: Plasmid into which lambda *cos* sites have been inserted as a result, the plasmid DNA can be packaged *in vitro* in the phage coat.

Counter selection: A method of selection wherein the variant cell lines are selected by using a counter selective agent. The counter selective agent kills the wild type cells and not the variant cell lines. For example,

CPW solutions: Composition of washing solutions.

Critical minimum inoculation density: A typical density (10^4 cells ml^{-1}) of cells below which cells in culture will not divide.

Cryobiology: Field of science dealing with ultra low temperature storage of cells and tissues.

Cryopreservation: Ultra low temperature storage of cells, tissues, embryos or organs. This storage is usually carried out using temperatures below -l96°C.

Cryoprotectant: A substance used in cryopreservation of cells and tissues. It prevents freezing and thawing damages to cells and tissues.

Cryoprotection: Stage of culture in ultra low temperature storage where cryoprotectants are added for the survival of high plant tissues.

Culture initiation: The initiation of proliferating cultures from tissue explants by providing suitable stimuli.

Cybrids: Hybrids having two different cytoplasms (cytoplasmic hybrids).

Cytodifferentiation: Differentiation of a cell as to its function and morphology from the parent or sister cells.

Cytokinins: A group of phytohormones having the properties of causing cell division, cell differentiation and suppression of apical dominance.

Cytokinin habituation: The attainment of cytokinin autotrophy in prolonged cell cultures. In other words, loss in requirement for the exogenous cytokinin in a prolonged culture.

Cytoplast: The cytoplasm surrounded by cell membrane but without nucleus.

Cytoplast-karyoplast fusion: Alteration in the nuclear or cytoplasmic genomes.

Cytovariant: Variant originated due to chromosomal alterations either in number or structure.

Deceleration phase: Phase in which the rate of cell division slows down.

Dedifferentiation: A process of formation of unorganized tissues from the highly organized tissue. The resumption of meristematic activity by mature cells.

Deionization: A method of water purification by which ionized impurities are removed from water by passing water through synthetic resins that exchange H^+ (cations) and OH^- (anions) for the ionized impurities. No sterilization or organic removal is accomplished.

Demineralization: See Deionization.

Determinate meristem: Meristems that are incapable of continuous proliferation and form organs of fixed size.

Determined tissue: A tissue destined to form a particular structure when placed in a new environment.

Differentiation: Development of physiologically and morphologically specialized cells from unspecialized cells. Refers to the formation of cells, tissues and organs or a process of conversion of simple tissues such as meristems into complex metabolically different tissues.

Differentiation medium: Medium used to regenerate plants from cells or callus. Usually has higher level of cytokinin.

Differentiation theory: Theory proposing that the embryogenesis cannot occur from the differentiated tissues. De-differentiation in cells is a prerequisite for the production of embryos *in vitro*.

Dihaploidy: A condition in which a cell, tissue or an organism will have diploid state derived from a haploid condition by chromosome doubling.

Dimethyl Sulfoxide (DMSO)): A cryoprotectant used as 1M DMSO in IM glecyrol and 2M sucrose (final concentrations are half of these values). DMSO gives an unpleasant penetrating odour and is best dispensed in a fume hood. Filter sterilization has to be adopted. Repeated freezing and thawing of DMSO is not recommended.

Diploid: A condition wherein the cells will have two sets of chromosomes.

Diplontic selection: Selection of cells or cell lines in diplophase.

Direct embryogenesis: Origin of embryos directly from the tissues cultured *in vitro* without any callus stage.

Direct gene transfer: Transforming cells with foreign DNA without any specialized vector.

Direct somatic embryogenesis: Embryogenesis without the intervention of a callus stage from explants.

Donor recipient method: A method adapted in cytoplasmic hybridization between two partners differing in respect to both nuclear and cytoplasmic characters.

Donor-recipient protoplast fusion: Fusion of protoplasts in which nuclear division has been arrested by X-or gamma irradiation in one and other remains normal. The fused heteroprotoplasts are regenerated into plants. In this system, the irradiated protoplasts serve as organelle donors, while the non-irradiated protoplasts act as recipients of the organelles.

Double fertilization: Fusion of male gametes one with egg to form embryo and other with polar nuclei to form endosperm.

Double layer technique: A technique developed to identify calli resistant to fungal toxins. In this technique respective fungus is grown in a layer of medium. After the growth, a second medium with

fungicide is overlaid on the fungus. The fungicide kills the fungus and the toxin diffuses to second layer medium on which callus culture is done.

Dry freezing: Storage of dehydrated tissues at low temperature.

Dry heat sterilization: Sterilization of media, solutions and water by high latent heat of steam. It is done under a steam pressure of 20 pounds per square inch at a temperature of 121°C for 20 minute.

Dye exclusion method: A staining method to estimate the viability of the protoplasts. The test depends on the ability of the plasmamembrane to block the entry of the dye. Live protoplasts will not be stained since the plasmamembrane does not allow the stain.

Electrofusion: Fusion of protoplasts by employing high DC electricfield pulses. Protoplast pairs are produced by an AC field induced dielectrophoresis. Also known as Zimmermann cell fusion.

Electrofusion mediated cell reconstitution: Fusion of a karyoplast and a cytoplast to reconstitute a cell by using microfusion.

Electroporation: A method of gene transfer in which solution containing protoplasts and foreign DNA is subject to electric pulses to induce gentle rupture of the membrane at places to form small reversible poes sufficient to take DNA molecules.

Elicitation: A process by which the production of secondary metabolites in culture is increased, because of the addition of bioproducts (fungal homogenates) or inorganic salts.

Embryo: An organism in the initial stages of development. In plants, the embryo is a miniature sporophyte derived from the zygote.

Embryo abortion: Prevention of further growth of formed embryo due to various postzygotic fertility barriers.

Embryo conversion: Successful germination of encapsulated somatic embryos into seedlings.

Embryo culture: The *in vitro* cultivation of embryos excised from ovules and seeds under aseptic conditions in a medium of known chemical composition.

Embryogenesis: The process of embryo initiation and development.

Embryo implantation: Implanting young hybrid embryos of one species into normal endosperms of another seed of the same or related species, to produce a plantlet *in vitro* later. The normal endosperm acts as nurse tissue. Also known as embryo-nurse endosperm transplant technique.

Embryo-nurse endosperm transplant technique: See embryo implantation.

Embryo rescue: A technique adopted to overcome the problem of post zygotic fertility barriers. In this technique, the embryos isolated immediately after fertilization are cultured *in vitro* to produce plants.

Embryo transplantation: See embryo implantation.

Embryogenic callus: Callus capable of forming embryos under cultural conditions.

Embryogenic cells: Cells capable of producing embryoids and inturn plants.

Embryoids: Small embryolike structures derived from tissue culture capable of producing individual plants.

Encapsulation: Wrapping an *in vitro* derived embryo by a suitable compound with an analogy to natural seed coat.

Endomitosis: Reduplication of chromosomes without the division of nucleus, thus the chromosome number is increased in a cell or chromosome duplication within intact nuclear membrane.

Endoreduplication: Duplication of chromatids of each chromosome during metaphase.

Endopolyploidy: Condition of polyploidy due to endomitosis.

Endopolyploidization: See endomitosis

Endosperm: A triploid nutritive tissue for the embryos in plants formed by the fusion of secondary nuclei and sperm nucleus.

End product inhibition: See Feedback Inhibition

Endosperm culture: *In vitro* culture of isolated endospersms.

Entrapment: A technique in cell immobilization see foam entrapment and gel entrapment.

Enucleated Microplast: See cytoplast

Enucleated Protoplast: See cytoplast

Enucleation: Removal of nucleus from a cell.

Enzymatic isolation: Isolation of protoplasts by digesting the cell walls with cellwall degrading enzymes.

Epigenesis: Developmental process whereby each successive stage of normal development is built upon the foundations created by the preceeding stages of development.

Epigenetic changes: Changes occurring regularly in response to specific inducers; potentially reversible; not transmitted meiotically.

Epigenetic variation: Phenotypic variability which has a non-genetic base.

Established cell lines: Cells that have been adapted to indefinite growth in culture.

Evacuolated protoplasts: See miniprotoplast

Evan's blue: 1% solution of Evan's blue is used for 5 minutes to stain the dead protoplasts (See dye exclusion method).

Exponential phase: Phase in which cells divide rapidly.

Expression vector: Cloning vector designed so that a coding sequence inserted at a particular site will be transcribed and translated into protein.

Fed-batch culture: The culture is established on a nutrient medium, and the nutrients are being added according to the cell growth during the period.

Feed back control: The switching off of any biosynthetic patway by its end product.

Feeder layer: A layer of mixture of protoplasts of different species inactivated but not killed by irradiation on which protoplasts to be cultured are plated.

Field gene banks. Long-term genetic conservation of plant species in the form of *in situ* or *ex situ* plantations and orchards, since the seeds from these species are recalcitrant.

Flatbed reactor: A cell immobilization system available wherein callus cultures are seated on a horizontal substratum of polypropylene fabric matting contained within a glass vessel. Liquid nutrient medium is supplied from a reservoir above the vessel.

Fluid drilling: A process of dispersing mature somatic embryos to suitable liquid carrier (eg. hydrogels) for germination.

Fluorescein diacetate (FDA): Chemical used to assess the cell or protoplast viability. The chemical actually measures the membrane bound esterase activity. FDA is prepared as a 5 mg/ml of acetone and stored at 4°C. To prepare a working solution 0.l ml of stock solution is diluted to 5 ml with distilled water.

Fluorescence activated cell sorting (FACS): In this process two parent protoplasts are separately labeled with vital stains: Fluorescin isothiocyanate (FITC) showing green fluorescence) and rhodamine isothiocyannate (RITC) showing red fluorescence). The hybrids are identified on the basis of showing two types of fluorescence.

Foam entrapment: Passive entrapment of cells in liquid suspensions in intrices of preformed polymers of meshes added to the cell suspension.

Formula weight: See gram molecular weight

Freeze preservation: See Cryopreservtion.

Freezing: Period of culture wherein cryoprotected specimens are usually transferred to a suitable container and maintained at sub zero temperature.

Friable callus: Callus of easily separable or fragmenting; preferred callus type to initiate cell suspension cultures.

Gametoclonal variation: Variation in clones regenerated from the cultures of haploid gametophytes.

Gametoclones: Plants regenerated from cell cultures derived from gametophytes.

Gameto-somatic hybrid: Hybrids between haploid protoplasts (from microspores microspecies) and a somatic cell protoplast.

Gel entrapment: See Active polymerization.

Gelling agents: Compounds used to solidify the culture media and in cell immobilization. (agarose, gelatin, carrageenan, copolymers of alginate or agarose and gelatin, Hypol 3000 (polyurethane) Polyphenyleneoixide.

Geminiviruses: Single stranded DNA viruses.

Gene banks: Long term storage facilities wherein representative stocks of seeds of crop species are stored. Periodic testing to detect any viability loss and replenishment by regrowth and harvesting are routine activities in these banks.

Gene expression: Manifestation of the genetic material of an organism as a collection of specific traits.

Gene transfer: Transfer of specific genes to a recipient cell lacking that gene by adopting *in vitro* culture and DNA technique.

Gene silencing: Expression of one gene is silenced or suppressed by the presence of other gene.

Gene targeting: Integration of a stretch of foreign DNA at a precise, pre determined site in the genome.

Genetic mutations: Mutations that are essentially irreversible.

Genetic variability: Phenotypic variability in individuals due to changes in genetic make up.

Generative cell: The smaller cell formed due to the division of pollen grain responsible for the production of male gametes.

Genome plastome incompatibility: Incompatibility between nuclear and cytoplasmic genes occurring in a somatic hybrid.

Genome segregation: Segregation of chromosomes according to the genomes, in a mitosis of polyploid.

Genomic shock: The shock exerted on the genomes of cultured cells during the culture period inducing mutation *in vitro.*

Genovariant: Variant originated due to mutation.

Germ plasm stores-active collections: Short term germplasm stores wherein the mateirals are multiplied, evaluated, indexed and then distributed.

Germplasm stores-base collections: Longterm germplasm stores wherein the materials are maintained and not distributed.

Gibbrellins (GAs): Plant growth hormones causing shoot elongation in intact plants.

Glassiness: See vitrification.

Globular embryo: Sixteen celled globular mass of cells from the zygote.

Gram molecular weight: Sum of the weights of the atoms in a substance expressed in grams.

Growth hormones: Organic substances in small amounts induce changes in plant growth and development eg. auxins and cytolicinins.

Gynogenesis: The development of haploid individual from female gametophyte.

Habituation: (See anergy)

Hairy root culture: Infection of plant roots with *Agrobacterium rhizogenes* produces abundant production of roots and is called hairy root disease. The abundant root production due *A. rhizogenes* is exploited in increased secondary metabolite synthesis *in vitro* and is called hairy root culture.

Hanging drop culture: The droplets of liquid culture are placed on the lid of petridish. The solution of culture medium is placed on the lower bottom of petridish. Then the upper dish with culture is oriented in such a way to touch the medium inverting the lid.

Haploid: A condition wherein the cells will have a single set of chromosomes.

Haploidy: A condition wherein cells possess only one set of chromosomes in their nucleus.

Haploid embryogenesis: see androgenesis

Hardening: See acclimatization

Heat sterilization: Destruction of microorganisms by using heat.

Heterokaryon: a cell having two genetically different nuclei.

Heteroploid: A condition wherein, the group of diplophase cells will have cells with varying chromosomes numbers of diplophase and the group of haplophase cells will have cells with varying chromosome number of haplophase.

Heterozygosity: A condition in higher organisms where the alleles at one or more loci will differ from each other.

Homokaryon: a cell having genetically identical nuclei.

Homogenetic induction: The process by which a cell induces a similar or identical phenotype in adjacent cells.

Homozygosity: A condition in higher organisms where alleles at one or more loci will be similar to their counterparts.

Hormone carry over: Carry over of hormones from one medium to another simply by adherance to the cells or as cellular pools.

Hormone habituation: Loss in requirement for the exogenous hormones in a aprolonged culture. In other words the capacity of cultured plant cells to continue their growth without the addition of exogenous hormones to the culture medium.

Hormone processing: A process by which the availability of hormones in plant cells is controlled. In this, conjugation of hormones to aminoacids and sugars occur controlling the availability.

Host range: The ability of the vectors to infect the hosts for an efficient gene transfer. Some vectors doo not have specific species barrier (Broad host range) while some are efficient vectors in certain species (narrow host range).

Hybridization: Crossing of two genetically different individuals to generate hybrid progenies.

Hybrid sorting: Selection of specific hybrid combinations for further doubling based on the array of variations available in the gametoclones.

Hybrid sterility: The inability of some hybrids to produce viable gametes or suppression of the reproductive capacity of F_1 between genetically different parents.

Iodoacetate: A chemical used for the inactivation of protoplasts. The pretreatment of protoplasts of with iodoacetate will cause the degeneration of non-fused and autofused protoplasts. This favours the selection of viable protoplasts hybrids.

Immobilization: A process by which the cells are made adhering to the matrices.

Indeterminate meristem: Meristems that are capable of indeterminate growth.

Indirect embryogenesis: Origin of embryos via callus stage.

Induced embryogeny determined cells (IEDC): The cells that need sosme induction to produce embryos.

Induced embryogeny: Potential of certain cells forming embryos *in vitro* only by the addition of suitable mitogeneic substances.

Induced fusion: Fusion of protoplasts induced by a variety of treatments.

Induction medium: Medium used to induce callus from explant.

Inoculam: Material introduced into a host or a medium.

Intra genome recombination: See mitotic crossing over.

Intraovarian pollination: See *In vitro* pollination.

Intergeneric hybridization: Crossing between two different genera.

Inter organelle competition: Competition between organelles of two

***In vitro* clonal propagation**: See *In vitro* micropropagation

***In vitro* culture**: Culture of cells or tissues under artificial conditions.

***In vitro* fertilization**: Effecting fertilization by introducing pollen grains directly to the ovary.

***In vitro* gene bank**: A facility for the storage of genetic materials where slow growth is adopted for short and medium term storage of shoot cultures and ultra low temperatures storage is followed for long term storage.

***In vitro* manipulation**: Manipulation of cells or tissues under artificial cultural conditions.

***In vitro* tuberization**: Production of mini tubers from explants to have better distribution of germplasm and seed tuber production.

***In vitro* ovular pollination**: Application of pollens to excised ovules.

***In vitro* placental pollination**: Application of pollens to ovules attached to the placenta.

***In vitro* pollination**: Pollinating *in vitro* cultured ovaries or ovules by introducing pollengrains.

***In vitro* propagation**: See micropropagation.

***In vitro* stigmatic pollination**: Application of pollen to the stigma *in vitro* cultured ovaries.

***In vitro* storage**: Storage of cells, tissues or organs under artificial storage conditions.

Isozymes: Enyzmes with the same function and some tissue with same activity but with different structure.

Karyoplasts: Sub-protoplasts containing nucleus and small volume of cytoplasm.

Lagphase: Phase in which cells regain the ability to divide in a fresh medium.

Leaf disc transformation: A method of transformation wherein leaf mesophyll cells that are still within the tissue of a leaf slice or disc are cocultivated with bacteria containing a transfer DNA.

Linear phase: Phase in which the rate of cell division is comparatively less than the rate in exponential phase.

Liposome: Microscopic lipid vesicle produced when phospholipids are dispersed in an aqueous phase.

Liposome coated DNA: The DNA coated with phospolipid vesicles. The possible advantage of liposome mediated delivery of DNA are low toxicity and protection of phospholipid coated DNA from degradation by nucleases present in the culture medium and cell.

Liposome encapsulation: Entrapment of DNA into phospholipids. The phospholipids from multilamellar vesicles (MLV) or unilamellar vesicles (ULV) depending upon the method of encapsulation.

Liposome fusion: Fusion of DNA containing liposomes with plasmamembrane of a protoplast to deliver the contents to the cytoplasm and nucleus.

Liposome injection: Delivery of liposome coated DNA into the vacuole. The vacuole delivered liposome fuses with the tonoplast and then passes to the cytoplasm.

Liquid shaken culture: Culture of stem cuttings with three to four nodes in liquid shaken culture to rapidly produce large numbers of nodes for single node cutting culture.

Low density growth media: Nutrient formulation which favours culture of protoplasts at low density.

Low oxygen storage: Growing plant tissues on a medium and covering the tissues with a thin layer of mineral oil. The tissues immersed in mineral oil continue to grow at a slow rate due to greater stability of oxygen.

Low pressure storage: Storage of plant tissues at reduced atmospheric pressure which results in increased gaseous exchange.

Low temperature storage: A method of *in vitro* germplasm storage at 9°C where the cultures are maintained at minimal growth conditions because of low temperature and minimal medium.

Macroinjection: Delivery of foreign DNA in the plant parts using injection needles.

Macronutrient: essential element normally required in concentrations more than 0.5 mmol.

Mass embryogenesis: The mass production of adventitious embryos in cell suspension cultures.

Mechanical isolation: Isolation of protoplasts by inducing plasmolysis and deplasmolysis to squeeze out the protoplasts through cut ends.

Membrane filtration: A method of sterilization by which most of the particulate materials and bacteria are removed. The membrane filters have pore size to the range of 0.20 pm .

Meristem: Cluster of small near isodiametric cells characterized by thin walls, high metabolic activity and the ability to divide sustainedly.

Meristemoids: Regions of high mitotic activity forming meristematic centres in a growing callus, later to form shoots or roots.

Meristerm culture: *In vitro* culture of meristematic dome tissue without adjacant leaf primordia or stem tissue.

Microcalli: Calli developed from individual protoplasts.

Microculture: The culture of fusion products obtained by microfusion. The fusion products are selected with the aid of the selection microcapillary connected to a microculture chamber.

Microfusants: Fusion between two subprotoplasts, a single cytoplast and a protoplast, a karyoplast and a protoplast, or a karyoplast and cytoplast.

Microinjection: Delivery of foreign DNA into defined plant cells using microcapillaries and microscopic devices.

Micromole (µmol or µM): One millionth of a mole or one thousandth of mmol.

Micronutrient: essential element required in concentrations less than 0.5 mmol.

Micronucleated protoplast: A micronucleus surrounded by some cytoplasm and a plasmamembrane.

Micronuclei: The treatment of cells with Amiprophos-methyl (APM) results in accumulation of metaphase chromosomes. The individual metaphase chromosome or groups of chromosomes, decondense and develop nuclear membranes. These are called micronuclei.

Microprojectible bombardment: Delivery of high density particles with DNA into cells by accelerating the particles to high velocity by a particle gun apparatus.

Microprotoplasts: Sub protoplasts containing minor fraction of cytoplasm and few chromosomes.

Micropropagation: Plant propagation by *in vitro* techniques by the application of nutritional and hormonal regimes under aseptic conditions.

Microspore: A haploid uninucleate male gametophyte formed from microspore mother cell.

Microspore culture: *In vitro* culture of microspore.

Millimole (mmol or mM): One thousandth of a mole.

Minimal cell density: Minimum number of cells needed to have favourable growth on a medium, since growth of cells is a function of an equilibrium between an inflow of substances from the medium to cell and an outflow of substances from the cells to the medium.

Minimum plating density: Inoculation of protoplasts to a certain level to achieve sustained growth of protoplasts in culture.

Miniprotoplast: Nucleus surrounded by some cytoplasm and a plasmamembrane.

Minoploidy: Occurence of more than one chromosome number in a group of cells.

Mitotic arrest: Preventing cell division.

Mitotic crossing over: A process occuring in mototic cells favouring recombination within a genome.

Mneomovariant: Variant originated due to Non-Mendelion but heritable change asymmetrically transmited in reciprocal crosses.

Mobile DNA elements: DNA elements such as plasmids, episome, insertion sequences or transposons. These can insert into mtDNA, cpDNA or nuclear DNA causing epigenic variation.

Molarity (M): Number of moles of a substance contained in one litre of a solution.

Molecular weight: See gram molecular weight

Monoploid: The basic number of a polyploid series.

Monohaploids: Progenies possessing half the numer of chromosomes from a diploid species.

Morphogenesis; Origin of form associated with differentiation of all internal cells and tissues.

Morphogenetic competence: Refers to the capacity of the cell to form an organised structure.

Morphogenetic potential: The ability of the cells to undergo differentiation to attain an organised from.

Multipolar spindle: Formation of spindles from different poles of a dividing cell, causing irregular segregation of chromosomes.

Multistep biotransformation: See biotransformation

Mutant: An individual resulting from a mutation.

Mutant cell lines: Cell lines differing genotypically from parental plant or cell culture.

Mutation: Any sudden detectable and heritable change in an organism.

Natural hormones: Hormones isolated from living organisms.

Narrow host range: See host range.

Net entrapment: See foam entrapment

Non-disfunction: Failure of chromatids to move to opposite poles during mitosis or meiosis.

Non-oncogenic vectors: Vectors that do not produce tumours in transformants which allow the regeneration of transformed phenotypically normal plants.

Non embryogenic callus: Callus which is not having the competence to form plantlets.

Novel variations: Variations either do not exist or rare in the natural gene pools.

Nuclear cytoplasmic incompatibility: See Genome plastome incompatibility.

Nucleoplast: See miniprotoplast.

Nucleate cytoplast: See miniprotoplast.

Nucleate microplasts: See miniprotoplast

Nucleated miniprotoplasts: See miniprotoplast

Nuclear fusion: Fusion of two or more nuclei to form polyploids.

Nuclear fragmentation: Nuclear division wherein the chromosome distribution was not equal resulting odd polyploid series (3n, 5n, 7n etc.).

Nurse callus: Callus of one species or variety used as a feederlayer to culture other species or variety.

Nurse culture: Culture of plant cells or tissues on already established callus layer of different species or variety with a filter paper in between them.

Nutritionmedium: Culture medium with all the macro and micro nutrients including all the other compounds including phytohormones. Used for in vtiro culture.

Oncogenic vectors: Vectors causing tumour growth in the transformants and phenotypically normal plants cannot be regenerated from such transformants.

One or two step biotransformation: See biotransformation

One to one microfusion: Predictable transfer of partial genomes by using subprotoplasts (cytoplasts and karyoplasts). See microfusion.

Organ cultures: The culture of isolated organs.

Organelle transfer: Transfer of organelles from one protoplast to another by protoplast fusion (see donor-recipient protoplast fusion).

Organic additives: Organic substances added to culture media such as aminoacids, nitrogenbases, organic acids, vitamins, sugars and sugar alcohols.

Organogenesis: De novo origin of organs, either shoots or roots from the cultured tissues.

Osmoticum: Compounds used in plant tissue culture to maintain a balanced osmotic pressure between cell interior and exterior to avoid stress on cells. The osmotic pressure is manipulated by adding various sugars or sugar alcohols.

Packed cell volume: Millilitre cell pellet per millilitre of culture. This can be determined by transfer of known aliquot of cells to a graduated tube, centrifuging the contents at 2000 g for 5 minutes.

Parafilm: Parafinned paper which comes in a sterile roll used to seal the culture vessels.

Parasexual cycle: Systems by which genetic recombinations can be achieved, i.e. without regular alternation of generations. In other words, life cycle enabling non-meiotic recombination.

Parasexual hybridization: Hybridization by means other than through fertilization of gametes, hybridization by non-sexual methods.

Particle gun method: See microprojectile bombondant.

Partitioned petridish technique: A petridish is made into 4 quarters. Fungus is grown in two opposite quarters. Medium supplemented with fungicide is added in other two opposite quarters. This prevents fungal growth. The fungal toxin diffuses from other two quarters and callus culture is done for screening.

Passage: see subculture

Passive entrapment: See foam entrapment

PEDC: The cells that are already committed to embryonic development.

PEG method: The DNA transformation procedure wherein protoplasts are incubated with polyethylene glycol followed by incubation at high calcium ion concentration.

Perfusion culture: A method of continuous culture in which, the volume of the medium is kept constant, with part being continuously replaced by fresh medium.

Periodic imersion culture: Suspension culture wherein the cells are alternatively submerged in culture solutions.

pH - Hydrogen ion concentration; (one litre ofpure water contains l/l0000000 moles of hydrogen ions or $l0^{-7}$ moles of hydrogen ions (=pH7).)

Phenosafranine: A stain used to test viability of protoplasts. A concentration of 0.00l% solution is used. The protoplasts preparation treated with 0.0l% phenosfranine red staining in dead ones and viable protoplasts will remain unstained.

Phenovariant: Variant originated due to epigenetic variation.

Phytohormones: Chemical substances produced by plants, which in low concentrations regulate plant physiological process.

Plasmids: Circular extra chroimosomal DNA molecules present in prokaryootes and some yeasts. Used as potential vectors in genetransfer.

Plasmone: Extrachromosomal genomes.

Plastome: Chloroplast genome.

Plating efficiency: Number of cell colonies formed to the total number of cells plated on a medium, expressed in percentage.

Phages: Cloning vehicles for genomic eukaryotic DNA.

Physiological variability: Phenotypic variations that are produced due to an altered environment and are ephemeral and will persist only in that environment, disappearing when normal conditions are restored.

Pollen embryogenesis: See androgenesis

Pollen embryogenic pathway: The developmental pathway of pollen embryos.

Pollen grain: Transformed microspore into uninucleate vacuolate structure with an spindy or sculptured exine and smooth intine.

Polyaccrylamide: A gelling agent for cell immobilization.

Polyethylene glycol: A chemical used to induce fusion between two protoplasts. The protoplasts are brought in physical contact by agglutination induced by polyethylene glycol.

Polyhaploids: progenies possessing half the number of chromosomes from a polyloid species.

Polyphenol oxidation: Oxidation of polyphenolic compounds in the explants by polyphenol oxidases making the explants brown or black. Addition of antioxidants will reduce this problem.

Polyploidy: The condition in which the somatic cells will have more than two sets of chromosomes.

Polysomaty: The condition in which the chromosomes in some of the somatic cells of a tissue are present in multiples of the somatic chromosome number.

Polyvinyl alcohol: A chemical used to increase the fusion frequency among protoplasts in combination with 0.05 M calcium chloride and 0.3M mannitol.

Population doubling time: Time taken to double a population of cells.

Post-fertilization barriers: See post zygotic barriers.

Post zygotic barriers: The processes preventing the zygote to form a viable embryo.

Precocious germination: Growth of cultured immature embryos into rudimentary weak seedlings in the medium.

Precursor feeding: Providing an initial or intermediate precursor of a secondary biosynthetic pathway to increase the final product *in vitro*.

Predetermination theory: Theory proposing that the embryogenesis is a predetermined phenomenon in specific cells. In other words, embryogenesis is an inherent potential of certain cells.

Predetermined embryogeny: Potential of certain cells forming embryos *in vitro* is determined before mitosis.

Prefertilization barriers: See prezygotic barriers.

Pregrowth: A period of culture after dissection of explant and before freezing.

Pregrowth medium: Medium used to culture the cells or tissues to be cryopreserved.

Prezygotic barriers: The processes preventing fertilization.

Primary culture: culture of cells or tissues directly from organisms in other words culture initiated first time.

Primary metabolism: The metabolic processes which are vital for the life of an organism and form the base for the other pathways in the body (e.g. Photosyntehsis and Respiration).

Proembryonic cluster: Cluster of cells determined to form an embryo.

Protoclones: Plantlets obtained from protoplasts.

Protoplast: A plant cell without cell wall.

Protoplast culture: The isolation and culture of plant protoplasts, *in vitro*.

Protoplast isolation: Isolation of protoplasts, i.e. cells without their cell walls by mechanical or enzymatic methods.

Protoplast plating efficiency: Ratio ofdividing protoplasts to initial number of plated protoplasts expressed in percentage or Proportion of initially plated protoplasts that proliferated to microcallus stage expressed in percentage.

Protoplast purification: Recovery of debris free protoplasts after the enzymatic treatment of cells by filtration, centrifugation and washing.

Prototroph: An organism capable of building up its metabolites from the medium on which it grows.

Rapid freezing method: The material in storage vials are directly plunged into liquid nitrogen.

Recovery medium: Medium used to regenerate cryoprotected cells or tissues.

Redifferentiation: The process of differentiation occuring in an undifferentiated tissues.

Regeneration: Genesis of an entire plant from cultured explants directly or via indirectly from a callus.

Relative plating efficiency: ratio of individual cells inoculated producing colonies to the cells producing colonies in a control culture.

Relative transformation frequency: Ratio of transformed clones surviving after selection to the number of clones in an unselected aliquot. (Gene Transfer).

Reporter genes: Genes those which encode easily detectable enzymatic activity and can supply information concerning the regulation or action of sequences from a different gene.

Resistance selection: The selection method where the variant phenotypes are selected based on the resistance to either an anti metabolite in the culture medium or adverse culture conditions as low temperature.

Restitution nucleus: Nucleus formed due to endomitosis wherein chromosome duplication occurs within intact membrane due to failure of spindle formation.

Reversibility: Reactivity of new phenotypes to attain original status.

Rhizogenesis: Formation of roots from the explants or calli.

RIM: Root inducing medium.

Ri plasmid: Circular DNA present in Agrobacterium rhizogenes responsible for causing abundant root growth (hairy root disease).

Rooting: Inducing root formation by subculturing regenerated shoots in medium without cytokinin or by treating the shoots as conventional cuttings after removal from sterile culture.

Rotary culture: Culture of cell suspensions involving slow rotation. The culture vessels are mounted on a circular tumble wheel-type platform. The culture vessels are either tuber (for a small volumes) or nipple flasks (for larger volumes).

Screenable markers: Transformants are screened based on the expression of the market gene to the specific compounds constructs. Both transformants and non-transformants survive in the media. Non-transformants do not show any expression of the gene construct e.g. gluco\uronidase and luciferase (GVS). In other words, markers which facilitate their detection by the presence of their gene products.

Scorable markers: see screenable markers.

Secondary culture: Culture established from cells of primary culture.

Secondary metabolism: The metabolic processes that are subpathways of primary pathways.

Secondary metabolites: The products resulted from the secondary metabolism.

Selectable marker: Markers (DNA level) expressed at a particular cellular stage t allow selection of transformed cells with a selectable change in the phenotype of the transformed organism.

Semi continuous culture: The cell culture system wherein, the medium is periodically drained and replaced with fresh medium.

Semisolid medium: Medium solidified with agar or other solidifying agents.

Sequential method: A method in enzymatic isolation of plant protoplasts wherein the cells are treated with pectinase first followed by cellulase.

Sexual sterility: Sterility that occur in the progenies of two parents (plants) due to preygotic and postzygotic fertilization barriers.

Shake culture: Culturing cell suspension on an orbital shaker at the speed of 60-70 rpm with an orbital movement of 2 to 5 cm range.

Simultaneous method: A method in enzymatic isolation of plant protoplasts wherein the cells are treated both pectinase and cellulase are mixed and used.

Single node cutting culture: Culture of single nodes with leaves excised from small *in vitro* plantlets. A method of micropropagation.

Slow growth: A phenomenon exhibiting slow growth in cultured cells when they are maintained at low temperature.

Slow freezing method: The tissues are brought to - l00^{O}C, with a cooling rate of 0.l to - l0^{O}C/minute and transferred to liquid nitrogen.

Sodium hypochlorite (0.5% to l0.0%) Surface sterilant of explants used at 0.5% to 20.0% concentration.

Solid phase cultures: Growth plant cells as callus.

Solidifying agent: The compound used to solidify the tissue culture media.

Somaclonal variation: Variation originating in cell and tissue cultures.

Somatic embryogenesis: De novo origin of embryos from the somatic tissues in culture by a developmental pathway resembling the zygotic embryo formation.

Somatic incompatibility: Incompatibility existing in somatic hybrids, leading to alteration in genetic constitution of a somatic hybrid.

Sonication method: Transfer of DNA is effected by subjecting the sonication buffer containing tissues and foreign DNA to ultrasonic pulse generator at 0.5 c/cm^2 acoustic intensity for 30 minutes.

Spheroplasts: The bacterial protoplasts with remains of cell wall after the lysosyme treatment. Te spheroplasts with recombinant plasmids are introduced into the plant protoplasts.

Spin culture: Culturing cell suspension in an arrangement inclined at 45^{o}C one or two culture vessels (bottles of l00 litre capacity) are rotated mechanically at the rate of 80-l20 rpm.

Spontaneous fusion: Fusion of protoplasts without any fusants or fusogens.

Stable gene expression: Consistent expression of the gene in the transformants.

Stable regenerating callus: Callus having sustained regeneration potential even after many subcultures.

Stability: Maintenance of new phenotypes obtained after determination in competent cells.

Stage 1: Selection of suitable starting materials and their sterilization and transfer to culture media in a tissue culture process.

Stage 2: Stage representing callus formation and proliferation.

Stage 3: Stage representing regeneration from cultured callus.

Stage 4: Stage representing transfer of regenerated plantlets for

Stationary phase: Phase in which the cells cease dividing.

Stepwise freezing method: Method involves slow cooling -20^{o}C-40^{o}C followed by rapid cooling to - l96^{o}C or rapid cooling to subzero/temperature followed by another rapid cooling to-196^{o}C with a gap between. (See slow cooling and rapid cooling).

Sterilization: Removal of microorganisms already present in explants, culture vessels, media, stock solutions etc.

Stir culture: Culture of large volume of suspension with stirring by magnetic stirners rotated at 200-300 rpm or supplying compressed air (5 to l0 lb/square inch) from the top through a sterile inlet.

Storage: A step in cryopreservation in which tissues are stored in liquid nitrogen cooled refrigerators.

Strain: Chemical or physical change in organisms due to a stress. The strain may be elastic (reversible) or plastic (permanent).

Stress: any environmental factor capable of eliciting a harmful chemical or physical change in organisms.

Stress avoidance: The capacity of the organisms to exclude the stress and thus avoiding its potential strain.

Stress tolerance: Increased ability of an organism to overcome the strain produced by the stress.

Subculture: Transfer of culture from one vessel to other.

Subculture interval: Interval between two subsequent subcultures.

Surface disinfectants: Compounds used to remove the organisms contaminating the explants.

Surface sterilant: A compound used to surface sterilize the explants.

Surface sterilization: Sterilization of explants to remove wide range of microbial contaminants from this surface.

Surfactants: see surface disinfectants.

Suspension cultures: The culture of isolated cells or very small cell aggregates remaining dispersed in liquid culture.

Synthetic hormones: Hormones synthesized from various synthetic compounds.

T-DNA: The DNA of Ti-plasmid transferred to plants resulting in tumour formation and opine synthesis (Homologous to T-region of Ti plasmid.

Ti plasmid: Circular DNA present in Agrobacterium turnifaciens responsible for causing tumurous growth (crown gall disease).

Tissue culture: Techniques involving aseptic culture of plant organs, tissue cells and protoplasts. Each type of culture requires slightly different methods but the principle of culture is the same.

Tissue grafting: Establishing cultures from non-responding tissues by grafting them to responding tissues such as cambium.

Torpedo shaped embryo: Embryo with the clearcut root apex with considerable cell differentiation and elongation in cotyledons and hypocotyl.

Total selection: Screening of large number of individual colonies, applying appropriate tests to establish their phenotype. It is generally a tedious approach.

Transient gene expression: Gene expression with an early maximum followed by a subsequent decline.

Transdetermination: Change in determination of tissues from one state of competence to another.

Transduction: Process of gene transfer that is mediated by a bacteriophage.

Transformation: Process by which the foreign naked DNA is introduced into cells to get an altered phenotype.

Transformation frequency: Ratio of transformed clones to the total number of clones in a culture.

Transgenosis: Phenotypic changes of plant cells brought about by transducing phages (Syn. Transduction of bacterial cells).

Triphenyultetrazoluim chloride (TTC): TTC is used to assess the viability of cell or protoplast. The viability is detected based on the colour development in line cells. The colourless TTC solution is reduced to water insoluble red formazan by dehydrogenase activity or mitochondual activity. The dead cell cannot reduce the TTC to red colour formazan since the above activities.

Tubular hollow fibre membrane bioreactors: Use of tubular hollow fibres (eg. cellulose acetate or silicon polycarbonate, organised in parallel bundles within the bioreactors.

Turbidostat culture system: Achieving steady state in culture by adjusting the rate of dilution or concentration of a limiting nutrient medium provided other factors are not limiting.

Two-stage culture: Culture method developed for the production of specific compounds *in vitro*. In the first stage maximum cell proliferation is achieved and then the cells are allowed to produce the compound at the maximum rate in the second stage tank.

Ultra-low temperature storage: Storage of seeds in liquid nitrogen (-l96°C). This eliminates the need for testing and replenishment.

Unidirectional sorting of organelles: Segregation of organelles belonging to a particular cytoplasm as a group during the further divisions of a somatic hybrid.

Variant: A variant cell line is one which differs in some observable respect, phenotypically from the normal population.

Variant cell lines: Cell lines differing phenotypically from the parent plant or cell culture.

Vectors: DNA molecules used as cloning vehicles to transfer passanger DNA. These DNA molecules in conjunction with the passanger DNA forms the recombinant DNA and are transferred to host cells. These vehicles possess autonomous replication, unique-cleavage sites to integrate foreign DNA and markers to select recombinants.

Vegetative cells: The larger cell formed due to the division of pollen grain. In normal cases, it forms pollen tube.

Vegetative propagation: Propagation of organisms without involving any sexual phenomenon.

Virus indexing: Process of assessing the presence or absence of viruses in the progenies of virus eradicated materials.

Visual selection: Selection of cell lines based on difference in phenotype.

Vitrification: A condition in which the regenerated plants in culture become irreversibly translucent with varying degrees of distortion and swelling, sometimes followed by necrosis and death otherwise called glassiness or water soaking.

Water soaking: See vitrification.

Zygotic embryo: The embryo formed from the zygote, a fusion product of egg cell with sperm nuclei.