OECD BIOECONOMY GLOSSARY (D – I)

The following glossary explains technical terms and abbreviations used in the reports compiled for the OECD Bioeconomy project and those found in the source documents cited in the reports. It is based on the following sources:

http://biotechterms.org/
http://www.ncbiotech.org/biotech101/glossary.cfm
http://stemcells.nih.gov/info/glossary.asp
http://www.agen.ufl.edu/~foodsaf/wi008.html
http://members.tripod.com/~bioremediation/
http://www.europabio.org/bi_glossary.htm
http://filebox.vt.edu/cals/cses/chagedor/glossary.html
http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/003/X3910E/X3910E00.htm

The magazine *Science* has a guide to online biotech and medical dictionaries and glossaries here (focusing on genetics and genomics):
http://www.sciencemag.org/feature/plus/sfg/education/glossaries.shtml

D

Dalton
A unit of measurement equal to the mass of a hydrogen atom, 1.67 x 10E-24 gram/L (Avogadro's number).

Death phase
The final growth phase, during which nutrients have been depleted and cell number decreases. See *Growth phase*.

Denature
To induce structural alterations that disrupt the biological activity of a molecule. Often refers to breaking hydrogen bonds between base pairs in double-stranded nucleic acid molecules to produce in single-stranded polynucleotides or altering the secondary and tertiary structure of a protein, destroying its activity.

Density gradient centrifugation
High-speed centrifugation in which molecules "float" at a point where their density equals that in a gradient of cesium chloride or sucrose. See *Centrifugation*.

Deoxyribonucleic acid
See *DNA*, *Nuclease*.

Diabetes
A disease associated with the absence or reduced levels of insulin, a hormone essential for the transport of glucose to cells.

Dideoxynucleotide (didN)
A deoxynucleotide that lacks a 3' hydroxyl group, and is thus unable to form a 3'-5' phosphodiester bond necessary for chain elongation. Dideoxynucleotides are used in DNA sequencing and the treatment of viral diseases. See *Nucleotide*.

didN
See *Dideoxynucleotide*.

Differentiation
The process whereby an unspecialized early embryonic cell acquires the features of a specialized cell such as a heart, liver, or muscle cell.

Digest
To cut DNA molecules with one or more restriction endonucleases.

Diploid cell
A cell which contains two copies of each chromosome. See *Haploid cell*.

Directed differentiation
Manipulating stem cell culture conditions to induce differentiation into a particular cell type.

Directional cloning
DNA insert and vector molecules are digested with two different restriction enzymes to create noncomplementary sticky ends at either end of each restriction fragment. This allows the insert to be ligated to the vector in a specific orientation and prevents the vector from recircularizing. See *Cloning*.

DNA (deoxyribonucleic acid)
An organic acid and polymer, DNA is the primary genetic material of which genes are made within chromosomes. Each DNA molecule consists of two connected spiral strands in the shape of a double helix. The biological "information tape" that stores genetic information in organisms and transmits it from generation to generation.

DNA analysis
See polymerase chain reaction (PCR) and RFLP mapping. Both PCR and RFLP analysis can be used in DNA fingerprinting for genealogical studies and forensics. See *DNA diagnosis*.

DNA diagnosis
The use of DNA polymorphisms to detect the presence of a disease gene.

DNA fingerprinting
Detecting patterns in DNA that indicate the presence of a gene for a trait. The pattern resembles a bar code printed on a commercial product so computers can scan the price. Forensics experts can use this distinct pattern to link or clear an individual suspected of being involved in a crime; breeders can use these patterns to find and select breeding stock with traits such as disease resistance. The technique also has applications in paternity testing, anthropology, conservation biology and ecological research.

DNA ligase
An enzyme that rejoins cut pieces of DNA.

DNA polymerase
See *Polymerase*.

DNA polymorphism
One of two or more alternate forms (alleles) of a chromosomal locus that differ in nucleotide sequence or have variable numbers of repeated nucleotide units. See *Allele*.

DNA probe
A molecule that has been labeled with a radioactive isotope, dye or enzyme and is used to locate a particular portion of a DNA molecule.

DNA sequence
The order of nucleotide bases in the DNA molecule.

DNA sequencing
Procedures for determining the nucleotide sequence of a DNA fragment.

DNase (deoxyribonuclease)
See *Nuclease*.

Dominant
An allele is said to be dominant if it expresses its phenotype even in the presence of a recessive allele. See *Allele, Phenotype, Recessive*.

Dominant(-acting) oncogene
A gene that stimulates cell proliferation and contributes to oncogenesis when present in a single copy. See *Oncogene*.

Dormancy
A period in which a plant does not grow, awaiting necessary environmental conditions such as temperature, moisture, nutrient availability.

Double helix
A term used to describe the configuration of a DNA molecule. The helix consists of two spiraling strands of nucleotides held together with chemical bonds.

Double-stranded complementary DNA (dscDNA)
A duplex DNA molecule copied from a cDNA template.

Downstream
The region extending in a 3' direction from a gene.

dscDNA
See *Double-stranded complementary DNA*.

Dual-Use
Initially used to refer to the aspects of certain material, information, and technology that are useful in both military and civilian spheres. It is increasingly being used to refer not only to military and civilian purposes, but also to criminal and terrorist activities.

Duplex DNA
Double-stranded DNA.

E

E. coli (Escherichia coli)
A bacterium commonly found in the intestinal tracts of most vertebrates. It is used extensively in recombinant DNA research both as a simple model of cell biochemical function and as a host for molecular cloning experiments because it has been genetically well characterized.

Ecology
The study of the interactions of organisms with their environment and with each other.

Ecosystem
The organisms in a plant population and the biotic and abiotic factors which impact on them. See *Abiotic factors, Biotic factors*.

Ectoderm
Upper, outermost layer of a group of cells derived from the inner cell mass of the blastocyst; it gives rise to skin nerves and brain.

Electrophoresis
Technique for analyzing and separating molecules based on the movement of charged particles in an electric field. See *Agarose gell electrophoresis, Polycrylamide gell electrophoresis*.

Electroporation
A method for transforrning DNA, especially useful for plant cells, in which high voltage pulses of electricity are used to open pores in cell membranes, through which foreign DNA can pass.

Embryo
Early stages of an animal's development that results when a sperm fertilizes an egg. In humans, the developing organism from the time of fertilization until the end of the eighth week of gestation, when it becomes known as a fetus.

Embryoid bodies
Clumps of cellular structures that arise when embryonic stem cells are cultured.

Embryonic germ cells
Cells found in a specific part of the embryo/fetus called the gonadal ridge that normally develop into mature gametes.

Embryonic stem cell line
Embryonic stem cells, which have been cultured under *in vitro* conditions that allow proliferation without differentiation for months to years.

Embryonic stem cells
Primitive (undifferentiated) cells from the embryo that have the potential to become a wide variety of specialized cell types.

Encapsidation
Process by which a virus' nucleic acid is enclosed in a capsid. See *Coat protein*.

Endoderm
Lower layer of a group of cells derived from the inner cell mass of the blastocyst; it gives rise to lungs and digestive organs.

Endonuclease
See *Nuclease*.

Endophyte
An organism that lives inside another.

Enzyme
A protein that accelerates the rate of chemical reactions. Enzymes are catalysts that promote reactions repeatedly, without being damaged by the reactions.

Epidemic
A fast spreading disease that affects many individuals in a population. Epidemics may be restricted to one locale, one region, or even the entire globe (pandemic). An epidemic, however, is not a characterization of how many members or what proportion of the population is infected but is defined by how fast it is growing. When each infected individual is infecting more than one other individual, so that the number of infected individuals is growing exponentially, the disease is in an epidemic state.

Ethidium bromide
A fluorescent dye used to stain DNA and RNA. The dye fluoresces when exposed to UV light.

Eukaryote
An organism whose genetic material is located within a nucleus. Yeast, fungi, protozoans, plants and animals are eukaryotes. Viruses, bacteria, and blue-green algae are not.

Exon
A DNA sequence that is ultimately translated into protein. See *DNA*.

Exonuclease
See *Nuclease*.

Express
To translate a gene's message into a molecular product. In genetics, manifestation of a characteristic specified by a gene. In industrial biotechnology, production of a specific protein by inserting a gene into a new host organism.

Expression library
See *Library*.

F

Feeder layer
Cells used in co-culture to maintain pluripotent stem cells. Cells usually consist of mouse

embryonic fibroblasts.

Feedstock
Raw material used for chemical or biological processes, such as polymers to produce plastics.

Fermentation
Chemical reaction induced by a living agent (yeast, bacterium or mold) that splits complex organic compounds to simple ones. For example, yeast converts sugar to alcohol and carbon dioxide. In biotechnology, the process of growing microbes to produce chemical or pharmaceutical compounds.

Flanking region
The DNA sequences extending on either side of a specific locus or gene.

Fungus
A microorganism that lacks chlorophyll.

Fusion
Joining the membrane of two cells of different origin to create a cell that contains the parent cells' nuclear material. Used in monoclonal antibody technology to make hybridomas - fusing an immortal cell (one that divides continuously) and an anti body-producing cell. See *Monoclonal antibody*.

Fusion gene
A hybrid gene created by joining portions of two different genes (to produce a new protein) or by joining a gene to a different promoter (to alter or regulate gene transcription).

G

Gamete
A haploid sex cell, egg or sperm, that contains a single copy of each chromosome.

Gasohol
Fuel, blend of ethanol and unleaded gasoline, usually 10 percent ethanol and 90 percent gasoline. See *Ethanol*.

GEM
A genetically engineered microorganism.

Gene
A section of a DNA molecule at a given locus on a chromosome that encodes a specific protein, enzyme or several related proteins. It is considered the functional unit of heredity. See *Dominant gene, Fusion gene, Gene amplification, Gene expression, Gene flow, Gene pool, Gene splicing, Gene translocation, Recessive gene, Regulatory gene*.

Gene amplification
The increase, within a cell, of the number of copies of a given gene. Amplification is one mechanism through which proto-oncogenes are activated in malignant cells.

Gene cloning
The process of synthesizing multiple copies of a particular DNA sequence using a bacteria cell or another organism as a host. See *DNA, Host*.

Gene expression
The process of producing a protein from its DNA- and mRNA-coding sequences.

Gene flow
The exchange of genes between different but (usually) related populations.

Gene frequency
The percentage of a given allele in a population of organisms. See *Allele*.

Gene insertion
The addition of one or more copies of a normal gene into a defective chromosome.

Gene linkage
The hereditary association of genes located on the same chromosome.

Gene mapping
Determining the relative locations of genes on a chromosome.

Gene modification
The chemical repair of a gene's defective DNA sequence. See *DNA.*

Gene pool
The totality of all alleles of all genes of all individuals in a particular population.

Gene splicing
Combining genes from different organisms into one organism by inserting new genetic information into a chromosome using recombinant DNA techniques.

Gene translocation
The movement of a gene fragment from one chromosomal location to another, which often alters or abolishes expression.

Genetics
See *Genetic analysis.*

Genetic analysis
Studying how traits and genes for traits are passed from generation to generation, and how genes and the environment interact to result in traits. See *Genetics.*

Genetic assimilation
Eventual extinction of a natural species as massive pollen flow occurs from another related species and the older crop becomes more like the new crop. See *Gene flow*.

Genetic code
The three-letter code that translates nucleic acid sequence into protein sequence. The relationships between the nucleotide base-pair triplets of a messenger RNA molecule and the 20 amino acids that are the building blocks of proteins. See *Base pair, Nucleic acid, Nucleotide*.

Genetic counselling
Providing current or prospective parents with information on the probabilities of inherited diseases occurring in their children, and on diagnosis and treatment of such diseases.

Genetic disease
A disease that has its origin in changes to the genetic material, DNA. Usually refers to diseases that are inherited in a Mendelian fashion, although noninherited forms of cancer also result from DNA mutation.

Genetic drift
Random variation in gene frequency from one generation to another.

Genetic engineering
Using recombinant DNA techniques and related methods to move one or several genes from one organism to another, to rearrange one or several genes within a cell, or to alter gene-controlled processes. Transferring a DNA segment from one organism and inserting it into the DNA of another organism to modify, amplify, transform and express genetic information. The two organisms can be totally unrelated. Genetic engineering changes the type or amount of proteins an organism is capable of producing. See *Recombinant DNA.*

Genetic linkage map
A linear map of the relative positions of genes along a chromosome. Distances are established by linkage analysis, which determines the frequency at which two gene loci become separated during chromosomal recombination. See *Mapping*.

Genetic marker
A gene or group of genes used to "mark" or track the action of microbes.

Genetically Modified Organisms (GMO)
GMOs are organisms wherein the genetic material (ADN) has been artificially altered, usually by replacing some of the host organism's genes with those of another related or unrelated species. GMOs are often irreproducible in nature. For example, plants can be crossbred with insecticides in order to be more resistant to insect damage.

Genome
The total hereditary material of a cell, contained in the chromosomes of a given organism, usually the haploid chromosome state.

Genomic library
A library composed of fragments of genomic DNA. See *Library*.

Genotype
The structure of DNA that determines the expression of a trait. The specific genetic makeup of an organism, as contrasted with the actual characteristics of an organism. See *Phenotype*.

Genus
Category of organisms including closely related species ranking above a species and below a family. Interbreeding between organisms within the same category can occur.

GEO
Genetically engineered organism.

Germ cell
Reproductive cell. See *Somatic cell*.

Germ cell (germ line) gene therapy
The repair or replacement of a defective gene within the gamete-forming tissues, which produces a heritable change in an organism's genetic constitution.

GMO
Genetically modified organism.

Growth curve
See *Growth phase*.

Growth factor
A serum protein that stimulates cell division when it binds to its cell-surface receptor.

Growth phase (curve)

The characteristic periods in the growth of a bacterial culture, as indicated by the shape of a graph of viable cell number versus time. See *Death phase, Lag phase, Logarithmic phase, Stationary phase*.

Guidelines
A statement or other indication of policy or procedure by which to determine a course of action. Guidelines may be developed by government agencies at any level, institutions, professional societies, governing boards, or by the convening of expert panels. Though not necessarily mandatory, the text is generally a comprehensive guide to problems and approaches in any field of activity.

H

Haploid cell
A cell containing only one set, or half the usual (diploid) number, of chromosomes.

Hematopoietic stem cell
A stem cell from which all red and white blood cells develop.

Heterochromatin
Dark-stained regions of chromosomes thought to be for the most part genetically inactive.

Heteroduplex
A double-stranded DNA molecule or DNA-RNA hybrid, where each strand is of a different origin.

Heterogeneous nuclear RNA (hnRNA)

The name originally given to large RNA molecules found in the nucleus, which are now known to be unedited mRNA transcripts, or pre-mRNAs. See *RNA*.

HGH
See *Human growth hormone*.

hnRNA
See *Heterogeneous nuclear RNA*.

Homologous chromosomes
Chromosomes that have the same linear arrangement of genes, a pair of matching chromosomes in a diploid organism. See *Chromosomes*.

Homologous recombination
The exchange of DNA fragments between two DNA molecules or chromatids of paired chromosomes (during crossing over) at the site of identical nucleotide sequences.

Homozygote
An organism whose genotype is characterized by two identical alleles of a gene. See *Allele, Genotype*.

Hormone
Chemical that acts as a messenger relaying instructions to start certain physiological activities. Hormones are synthesized in one type of cell, and released to direct the function of other cell types.

Host
An organism that contains another organism.

Human embryonic stem cell
A type of pluripotent stem cell derived from the inner cell mass of the blastocyst.

Human Genome Project
A project coordinated by the National Institutes of Health (NIH) and the Department of Energy (DOE) to determine the entire nucleotide sequence of the human chromosomes. See *NIH*.

Human growth hormone
Human somatotropin, a protein hormone made in the pituitary gland that stimulates the liver to produce somatomedins, which stimulate growth of bone and muscle. Lab-grown (HGH) bacteria given a copy of the gene for human growth hormone can then produce large amounts of HGH, which can be purified and used to treat certain kinds of human dwarfism, a pathological condition of growth arrested by various causes.

Hybrid
The offspring of two parents differing in at least one genetic characteristic (trait). Also, a heteroduplex DNA or DNA-RNA molecule.

Hybridization (breedeing)
Production of offspring, or hybrids, from genetically dissimilar parents. In selective breeding, it usually refers to the offspring of two different species.

Hybridization
The hydrogen bonding of complementary DNA and/or RNA sequences to form a duplex molecule.

See *Northern hybridization, Southern hybridization*.

Hybridoma
A type of hybrid cell produced by fusing a normal cell (B Iymphocyte) with a tumor cell. When lymphocytes (antibody-producing cells) are fused to the tumor cells, the resulting hybridomas produce antibodies and maintain rapid, sustained growth, producing large amounts of an antibody. Hybridomas are the source of monoclonal antibodies.

Hydrolysis
A reaction in which a molecule of water is added at the site of cleavage of a molecule to two products.

I

Immortalizing oncogene
A gene that upon transfection enables a primary cell to grow indefinitely in culture. See *Oncogene*.

Immunoassay
A technique for identifying substances, based on the use of antibodies.

Immunotoxin
The coupling of an antibody and a molecule that is toxic to the cell.

Influenza
Known commonly as "the flu", influenza is an acute contagious viral infection characterized by inflammation of the respiratory tract. It rapidly spreads around the world in seasonal epidemics. Influenza can mutate quickly and major genetic changes in the virus have caused three influenza pandemics in the 20th century, killing many millions of people. Asian flu (H2N2) and Avian Flu (H5N1) are types of influenzas. There are three types of influenzas:
- Influenza A viruses infect mammals and birds
- Influenza B viruses infect only humans
- Influenza C viruses infect only humans

In situ
Refers to performing assays or manipulations with intact tissues.

In vitro
Performed in a test tube or other laboratory apparatus.

In vitro fertilization
An assisted reproduction technique in which fertilization is accomplished outside the body.

In vitro selection
Selection at the cellular or callus stage of individuals possessing certain traits, such as herbicide resistance.

In vivo
In the living organism or cell.

Incomplete dominance
A condition where a heterozygous offspring has a phenotype that is distinctly different from, and

intermediate to, the parental phenotypes. See *Heterozygote, Phenotype*.

Initiation codon
The mRNA sequence AUG, coding for methionine, which initiates translation of mRNA.

Inner cell mass
The cluster of cells inside the blastocyst. These cells give rise to the embryonic disk of the later embryo and, ultimately, the fetus.

Inositol lipid
A membrane-anchored phospholipid that transduces hormonal signals by stimulating the release of any of several chemical messengers. See *Phospholipid*.

Insertion mutations
Changes in the base sequence of a DNA molecule resulting from the random integration of DNA from another source. See *DNA, Mutation*.

Insulin
Protein hormone that regulates blood sugar, made in cells of the pancreas. In the laboratory, microbes given a copy of the gene for human insulin can make insulin to treat diabetes mellitus, a shortage of insulin.

Interferon
A family of small proteins produced naturally cells. Interferons increase the resistance of surrounding cells to attacks by viruses. One type of interferon, alpha interferon, is effective against certain types of cancer. Others may prove effective in treating **autoimmune** diseases.

Intergenic regions
DNA sequences located between genes that comprise a large percentage of the human genome with no known function.

Interleukin
A protein produced naturally by the body to stimulate the immune system. There are at least 18 known kinds of interleukins.

Introgression
Backcrossing of hybrids of two plant populations to introduce new genes into a wild population.

Intron
A noncoding DNA sequence within a gene that is initially transcribed into messenger RNA but is later snipped out. See *Coding, DNA, Messenger RNA, Transcription*.

Invasiveness
Ability of a plant to spread beyond its introduction site and become established in new locations where it may provide a deliterious effect on organisms already existing there.

Ion
A charged particle.

Isotope
One of two or more forms of an element that have the same number of protons (atomic number) but differing numbers of neutrons (mass numbers). Radioactive isotopes are commonly used to make DNA probes and metabolic tracers.