OECD BIOECONOMY GLOSSARY (Q – Z)

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

R

Reading frame

A series of triplet codons beginning from a specific nucleotide. Depending on where one begins, each DNA strand contains three different reading frames. See *Open reading frame, Overlapping reading frames*.

Recessive gene

Characterized as having a phenotype expressed only when both copies of the gene are mutated or missing.

Recessive(-acting) oncogene, (anti-oncogene)

A single copy of this gene is sufficient to suppress cell proliferation; the loss of both copies of the gene contributes to cancer formation. See *Oncogene*.

Recognition sequence (site)

A nucleotide sequence composed typically of 4, 6, or 8 nucleotides that is recognized by a restriction endonuclease. Type II enzyrnes cut (and their corresponding modification enzymes methylate) within or very near the recognition sequence.

Recombinant DNA (rDNA)

The laboratory manipulation of DNA in which DNA, or fragments of DNA from different sources, are cut and recombined using enzymes as a means to isolate genes or to alter their structure and function.. This recombinant DNA is then inserted into the DNA of a cell. This technique includes taking copies of genes from one organism and inserting them in another organism. The two organisms can be totally unrelated. Recombinant DNA has a variety of uses, such as studying how genes work, and producing medicines such as human insulin and other commercial products. See *Genetic engineering*.

Recombinant

A cell that results from recombination of genes.

Recombination frequency

The frequency at which crossing over occurs between two chromosomal loci - the probability that two loci will become unlinked during meiosis.

Recombination

The formation of new combinations of genes. Recombination occurs naturally in plants and animals during the production of sex cells (sperm, eggs, pollen) and their subsequent joining in fertilization. In microbes, genetic material is recombined naturally during conjugation.

Regeneration

The process of growing an entire plant from a single cell or group of cells.

Regenerative or reparative medicine

A treatment in which stem cells are induced to differentiate into the specific cell type required to repair damaged or depleted adult cell populations or tissues.

Regulatory gene

A gene whose protein controls the activity of other genes or metabolic pathways.

Regulatory Oversight

The management or supervision of a group by an outside body in order to control or direct according to rule, principle, or law.

Relaxed circle plasmid

See *Plasmid*.

Relaxed plasmid

A plasmid that replicates independently of the main bacterial chromosome and is present in 10-500 copies per cell. See *Plasmid*.

Renature

The reannealing (hydrogen bonding) of single-stranded DNA and/or RNA to form a duplex molecule.

Replicon

A chromosomal region containing the DNA sequences necessary to initiate DNA replication processes.

Repressor

A DNA-binding protein in prokaryotes that blocks gene transcription by binding to the operator.

Restriction endonuclease (enzyme)

A class of endonucleases that cleaves DNA at very specific locations after recognizing a specific sequence.

Restriction enzymes

Bacterial enzymes that cleave DNA.

Restriction map

A diagram that shows restriction sites (i.e., where a restriction enzyme cleaves DNA) in relation to one another.

Restriction map

See *Mapping*.

Retrovirus

A member of a class of RNA viruses that utilizes the enzyme reverse transcriptase to reverse copy its genome into a DNA intermediate, which integrates into the hostcell chromosome. Many naturally occurring cancers of vertebrate animals are caused by retroviruses.

Reverse genetics

Using linkage analysis and polymorphic markers to isolate a disease gene in the absence of a known metabolic defect, then using the DNA sequence of the cloned gene to predict the amino acid sequence of its encoded protein.

Reverse transcriptase (RNA-dependent DNA polymerase)

An enzyme isolated from retrovirus-infected cells that synthesizes a complementary (c)DNA strand from an RNA template.

RFLP (restriction fragment length polymorphism)

RFLP mapping detects patterns in DNA that can indicate the presence of a gene for a trait. Both RFLP and polymerase chain reaction (PCR) analysis can be used in DNA fingerprinting for genealogical studies and forensics.

Rhizobia

Bacteria in a symbiotic relationship with leguminous plants that results in nitrogen fixation. See *Nitrogen fixation.*

Rhizosphere

The soils region on and around plant roots.

Ribosomal RNA (rRNA)

The RNA component of the ribosome. See *RNA.*

Ribosome

Cellular organelle that is the site of protein synthesis in the cytoplasm. See *Organelle, Translation.*

Ribosome-binding site

The region of an mRNA molecule that binds the ribosome to initiate translation.

Ribozyme

See *Catalytic RNA.*

RNA (ribonucleic acid)

Molecule similar to DNA that functions primarily to decode the instructions that genes carry for protein synthesis. There are three major types: messenger RNA, transfer RNA, and ribosomal RNA.

RNA polymerase

Transcribes RNA from a DNA template. See *Polymerase, RNA.*

rRNA

See *Ribosomal RNA.*

S

Satellite RNA (viroids)

A small, self-splicing RNA molecule that accompanies several plant viruses, including tobacco ringspot virus.

Select Agent

All of the viruses, bacteria, fungi, and toxins that, according to the US Center for Disease Control (CDC), the US Department of Health and Human Services, and the US Department of Agriculture, have the potential to cause substantial harm to humans, animals, or plants. Originally a list of 31 infectious agents and 12 biological toxins with additional provisions for recombinant organisms and drug resistant organisms and exemptions for research quantities and vaccine strains of organisms, the list is updated as necessary. The most current list can be obtained from the CDC's website in PDF format here .

Selectable marker

A gene whose expression allows one to identify cells that have been transforrned or transfected with a vector containing the marker gene. See *B-Lactamase, Kanr*.

Self-pollination

Pollen of one plant is transferred to the female part of the same plant or another plant with the same genetic makeup.

Semiconservative replication

During DNA duplication, each strand of a parent DNA molecule is a template for the synthesis of its new complementary strand. Thus, one half of a preexisting DNA molecule is conserved during each round of replication.

Sequence hypothesis

Francis Crick's seminal concept that genetic information exists as a linear DNA code; DNA and protein sequence are colinear.

Sequence-tagged site (STS)

A unique (single-copy) DNA sequence used as a mapping landmark on a chromosome.

Sexual reproduction

The process where two cells (gametes) fuse to form one hybrid, fertilized cell. See *Asexual reproduction, Gamete, Hybrid*.

Signal transduction

The biochemical events that conduct the signal of a hormone or growth factor from the cell exterior, through the cell membrane, and into the cytoplasm. This involves a number of molecules, including receptors, proteins, and messengers.

Signals

Internal and external factors that control changes in cell structure and function.

Site-directed mutagenesis

The process of introducing specific base-pair mutations into a gene.

Small nuclear RNA (snRNA)

Short RNA transcripts of 100-300 bp that associate with proteins to form small nuclear ribonucleoprotein particles (snRNPs), which participate in RNA processing. See *RNA*.

snRNA

See *Small nuclear RNA*.

Somatic cell

Cells other than sex or germ cells that compose the body of an organism and which possesses a set of multiploid chromosomes (diploid in most organisms). See *Gamete, Somatic cell gene therapy*.

Somatic cell gene therapy

The repair or replacement of a defective gene within somatic tissue. See *Somatic cell*.

Somatic stem cells

Another name for adult stem cells.

Somatotrophin

See *Human growth hormone*.

Southern blotting

See *Southern hybridization.*

Southern hybridization (Southern blotting)

A procedure in which DNA restriction fragments are transferred from an agarose gel to a nitrocellulose filter, where the denatured DNA is then hybridized to a radioactive probe (blotting). See *Hybridization.*

Species

Group of organisms with common or similar characteristics and capable of interbreeding.

Spore

A form taken by certain microbes that enables them to exist in a dormant stage. It is an asexual reproductive cell. See *Asexual reproduction, Dormant*.

Stationary phase

The plateau of the growth curve after log growth, during which cell number remains constant. New cells are produced at the same rate as older cells die. See *Growth phase.*

Stem cells

Cells with the ability to divide for indefinite periods in culture and to give rise to specialized cells.

Sticky end

A protruding, single-stranded nucleotide sequence produced when a restriction endonuclease cleaves off center in its recognition sequence.

Stop codon

See *Termination codon.*

Stringency

Reaction conditions, notably temperature, salt, and pH, that dictate the annealing of single-stranded DNA/DNA, DNA/RNA, and RNA/RNA hybrids. At high stringency, duplexes form only between strands with perfect one-to-one complementarity; lower stringency allows annealing between strands with some degree of mismatch between bases.

Stringent plasmid

A plasmid that only replicates along with the main bacterial chromosome and is present as a single copy, or at most several copies, per cell. See *Plasmid.*

Stromal cells

Non-blood cells derived from blood organs, such as bone marrow or fetal liver, which are capable of supporting growth of blood cells *in vitro.* Stromal cells that make this matrix within the bone marrow are also derived from mesenchymal stem cells.

STS

See *Sequence-tagged site.*

Subcloning

The process of tranferring a cloned DNA fragment from one vector to another. See *Cloning*.

Subculturing

The process of growing and replating cells in tissue culture for many months.

Subunit vaccine

A vaccine composed of a purified antigenic determinant that is separated from the virulent organism. See *Vaccine, Enzyme.*

Supercoiled plasmid

The predominant in vivo form of plasmid, in which the plasmid is coiled around histone-like proteins. Supporting proteins are stripped away during extraction from the bacterial cell, causing the plasmid molecule to supercoil around itself in vitro. See *Plasmid*.

Supergene

A group of neighboring genes on a chromosome that tend to be inherited together and sometimes are functionally related.

Supernatant

The soluble liquid fraction of a sample after centrifugation or precipitation of insoluble solids.

Surface markers

Surface proteins that are unique to certain cell types, which are visualized using antibodies or other detection methods.

Symbiosis

The close association of two or more dissimilar organisms where both receive an advantage from the association. See *Commensalism, Parasitism.*

Synapsis

The pairing of homologous chromosome pairs during prophase of the first meiotic division, when crossing over occurs.

Synthesis

The process whereby separate elements are combined to form a new complex product, synthetic chemical compound or material.

T

T lymphocytes (T cells)

White blood cells, produced in the bone marrow, that aid B cells in making antibodies to fight bacterial infections. They also are instrumental in rejection of foreign tissue, and may be important in the body's defense against cancer.

Taq polymerase

A heat-stable DNA polymerase isolated from the bacterium Therrnus aquaticus, used in PCR. See *Polymerase*.

TATA box

An adenine- and thymine-rich promoter sequence located 25-30 bp upstream of a gene, which is the binding site of RNA polymerase.

T-DNA (transfer DNA, tumor-DNA)

The transforming region of DNA in the Ti plasmid of Agrobacterium tumefaciens.

Telomere

The end of a chromosome.

Template

An RNA or single-stranded DNA molecule upon which a complementary nucleotide strand is synthesized.

Teratoma

A tumor composed of tissues from the three embryonic germ layers. Usually found in ovary and testis. Produced experimentally in animals by injecting pluripotent stem cells, in order to determine the stem cells' abilities to differentiate into various types of tissues.

Termination codon

Any of three mRNA sequences (UGA, UAG, UAA) that do not code for an amino acid and thus signal the end of protein synthesis. Also known as stop codon. See *Codon*.

Terminator region

A DNA sequence that signals the end of transcription.

Tetracycline

An antibiotic that interferes with protein synthesis in prokaryotes.

Thymidine kinase (tk)

An enzyme that allows a cell to utilize an alternate metabolic pathway for incorporating thymidine into DNA. Used as a selectable marker to identify transfected eukaryotic cells.

Ti (tumor-inducing) plasmid

A giant plasmid of Agrobacterium tumefaciens that is responsible for tumor formation in infected plants. Ti plasmids are used as vectors to introduce foreign DNA into plant cells.

Tissue culture

Growing or cloning plant or animal tissues or cells in test tubes or other laboratory glassware, without other contaminating organisms, for propagation, chemical production and medical research.

Toxicity

A measure of the degree to which something is toxic or poisonous, or a substances potential to exert a harmful effect on humans, animals, or plants and a description of the effect and the conditions or concentration under which the effect takes place.

Toxin

A complex and poisonous organic substance, especially a protein, that is produced by living cells or organisms and is capable of causing disease when introduced into the body tissues but is often also capable of inducing neutralizing antibodies or antitoxins.

Trait

See *Phenotype*.

Treaty

A treaty is a binding agreement under international law concluded by two or more sovereign nations. Treaties can be called by many names: treaties, international agreements, protocols, covenants, conventions, exchanges of letters, exchanges of notes, etc.; however all of these are equally treaties.

Transcapsidation

The partial or full coating of the nucleic acid of one virus with a coat protein of a differing virus. See *Coat protein.*

Transcription

The process of creating a complementary RNA copy of DNA.

Transdifferentiation

The observation that stem cells from one tissue may be able to differentiate into cells of another tissue.

Transducing phage

See *Transduction*.

Transduction

The transfer of DNA sequences from one bacterium to another via lysogenic infection by a bacteriophage (transducing phage).

Transfection

The uptake and expression of a foreign DNA sequence by cultured eukaryotic cells.

Transfer DNA. See *T-DNA.*

Transfer RNA (tRNA)

See *tRNA.*

Transformant

In prokaryotes, a cell that has been genetically altered through the uptake of foreign DNA. In higher eukaryotes, a cultured cell that has acquired a malignant phenotype. See *Transformation*.

Transformation

A change in the genetic structure of an organism as a result of the uptake and incorporation of foreign DNA. In higher eukaryotes, the conversion of cultured cells to a malignant phenotype - typically through infection by a tumor virus or transfection with an oncogene. See *Transformant, Transformation efficiency.*

Transformation efficiency

The number of bacterial cells that uptake and express plasmid DNA divided by the mass of plasmid used (in transformants/microgram). See *Transformation*.

Transforming oncogene

A gene that upon transfection converts a previously immortalized cell to the malignant phenotype. See *Oncogene.*

Transgene

See *Transgenic.*

Transgenic

An organism in which a foreign DNA gene (a transgene) is incorporated into its genome early in development. The transgene is present in both somatic and germ cells, is expressed in one or more tissues, and is inherited by offspring in a Mendelian fashion. See *Transgenic animal, Transgenic plant.*

Transgenic animal

Genetically enginnered animal or offspring of genetically engineered animals. The transgenic animal usually contains material from at least one unrelated organism, such as from a virus, plant, or other animal. See *Transgenic.*

Transgenic plant

Genetically engineered plant or offspring of genetically engineered plants. The transgenic plant usually contains material from at least one unrelated organisms, such as from a virus, animal, or other plant. See *Transgenic*.

Transition-state intermediate

In a chemical reaction, an unstable and high-energy configuration assumed by reactants on the way to making products. Enzymes are thought to bind and stabilize the transition state, thus lowering the energy of activation needed to drive the reaction to completion.

Translation

The process of converting the genetic information of an mRNA on ribosomes into a polypeptide. Transfer RNA molecules carry the appropriate amino acids to the ribosome, where they are joined by peptide bonds.

Translocation

The movement or reciprocal exchange of large-chromosomal segments, typically between two different chromosomes.

Transposable genetic element

See *Transposon.*

Transposition

The movement of a DNA segment within the genome of an organism.

Transposon (transposable, or movable genetic element)

A relatively small DNA segment that has the ability to move from one chromosomal position to another.

Transposon

A mobile genetic element that can move from one location in the gene and reinsert at another site.

tRNA (transfer RNA)

The class of small RNA molecules that transfer amino acids to the ribosome during protein synthesis. See *Transfer RNA.*

Trophoblast

The extraembryonic tissue responsible for implantation, developing into the placenta, and controlling the exchange of oxygen and metabolites between mother and embryo.

Tumor DNA

See *T-DNA*.

Tumor virus

A virus capable of transforming a cell to a malignant phenotype. See *Virus*.

Tumor-inducing plasmid

See *Ti plasmid*.

U

Undifferentiated

Not having changed to become a specialized cell type.

United Nations Resolution 1540

United Nations resolution 1540 (2004) was adopted by the Security Council in April 2004, calling on all states to develop and implement effective laws that establish domestic controls to prevent the proliferation of nuclear, chemical, or biological weapons and their means of delivery, including by establishing appropriate controls over related materials.

Upstream

The region extending in a 5' direction from a gene.

V

Vaccine

A preparation of dead or weakened pathogen, or of derived antigenic determinants, that is used to induce formation of antibodies or immunity against the pathogen. See *Polyvalent vaccine, Subunit vaccine*.

Vaccinia

The cowpox virus used to vaccinate against smallpox and, experimentally, as a carrier of genes for antigenic determinants cloned from other disease organisms.

Variable surface glycoprotein (VSG)

One of a battery of antigenic determinants expressed by a microorganism to elude immune detection.

Variation

Differences in the frequency of genes and traits among individual organisms within a population.

Vector

The agent used to carry new DNA into a cell. Viruses or plasmids are often used as vectors. Also living carriers of genetic material such as insects that carry pollen from plant to plant,.

Viral oncogene

A viral gene that contributes to malignancies in vertebrate hosts. See *Oncogene*.

Viroid

A plant pathogen that consists of a naked RNA molecule of approximately 250-350 nucleotides, whose extensive base pairing results in a nearly correct double helix. See *Satellite RNA*.

Virulence

The degree of ability of an organism to cause disease.

Virus

An infectious particle composed of a protein capsule and a nucleic acid core, but which must invade a cell to reproduce. A double-stranded DNA copy of an RNA virus genome that is integrated into the host chromosome during lysogenic infection. See *Coat protein, DNA, Genome, Host, Nucleic acid, RNA, Tumor virus*.

VSG

See *Variable surface glycoprotein*.

W

Wild type

An organism as found in nature; the organism before it is genetically engineered.

X

X-linked disease

A genetic disease caused by a mutation on the X chromosome. In X-linked recessive conditions, a normal female "carrier" passes on the mutated X chromosome to an affected son.

X-ray crystallography

The diffraction pattern of X-rays passing through a pure crystal of a substance.

Xenotransplantation

Z

Z-DNA

A region of DNA that is "flipped" into a lefthanded helix, characterized by alternating purines and pyrimidines, and which may be the target of a DNA-binding protein.

Zoonotic Agent

A pathogen that is, under normal conditions, communicable from animals to humans

Zygote