生物化學

※Glossary of Biochemical Terms

ARS

Autonomously replicating sequence; the origin of replication in yeast.

Autoradiography

The detection of radioactive molecules (eg, DNA, RNA, protein) by visualization of their effects on photographic film.

Bacteriophage

A virus that infects a bacterium.

Blunt-ended DNA

Two strands of a DNA duplex having ends that are flush with each other.

cDNA

A single-stranded DNA molecule that is complementary to an mRNA molecule and is synthesized from it by the action of reverse transcriptase.

Chimeric molecule

A molecule (eg, DNA, RNA, protein) containing sequences derived from two different species.

Clone

A large number of organisms, cells or molecules that are identical with a single parental organism cell or molecule.

Cosmid

A plasmid into which the DNA sequences from bacteriophage lambda that are necessary for the packaging of DNA (cos sites) have been inserted; this permits the plasmid DNA to be packaged in vitro.

Endonuclease

An enzyme that cleaves internal bonds in DNA or RNA.

Excinuclease

The excision nuclease involved in nucleotide exchange repair of DNA.

Exon

The sequence of a gene that is represented (expressed) as mRNA.

Exonuclease

An enzyme that cleaves nucleotides from either the 3' or 5' ends of DNA or RNA.

Fingerprinting

The use of RFLPs or repeat sequence DNA to establish a unique pattern of DNA fragments for an individual.

Footprinting

DNA with protein bound is resistant to digestion by DNase enzymes. When a sequencing reaction is performed using such DNA, a protected area, representing the "footprint" of the bound protein, will be detected.

Hairpin

A double-helical stretch formed by base pairing between neighboring complementary sequences of a single strand of DNA or RNA.

Hybridization

The specific reassociation of complementary strands of nucleic acids (DNA with DNA, DNA with RNA, or RNA with RNA).

Insert

An additional length of base pairs in DNA, generally introduced by the techniques of recombinant DNA technology.

Intron
The sequence of a gene that is transcribed but excised before translation.

Library
A collection of cloned fragments that represents the entire genome. Libraries may be either genomic DNA (in which both introns and exons are represented) or cDNA (in which only exons are represented).

Ligation
The enzyme-catalyzed joining in phosphodiester linkage of two stretches of DNA or RNA into one; the respective enzymes are DNA and RNA ligases.

Lines
Long interspersed repeat sequences.

Microsatellite polymorphism
Heterozygosity of a certain microsatellite repeat in an individual.

Microsatellite repeat sequences
Dispersed or group repeat sequences of 2～5 bp repeated up to 50 times. May occur at 50～100 thousand locations in the genome.

Nick translation
A technique for labeling DNA based on the ability of the DNA polymerase from *E coli* to degrade a strand of DNA that has been nicked and then to resynthesize the strand; if a radioactive nucleoside triphosphate is employed, the rebuilt strand becomes labeled and can be used as a radioactive probe.

Northern blot
A method for transferring RNA from an agarose gel to a nitrocellulose filter, on which the RNA can be detected by a suitable probe.

Oligonucleotide
A short, defined sequence of nucleotides joined together in .the typical phosphodiester linkage.

Ori
The origin of DNA replication.

PAC
A high capacity (70～95 kb) cloning vector based upon the lytic *E. coli* bacteriophage P1 that replicates in bacteria as an extrachromosomal element.

Palindrome
A sequence of duplex DNA that is the same when the two strands are read in opposite directions.

Plasmid
A small, extrachromosomal, circular molecule of DNA that replicates independently of the host DNA.

Polymerase chain reaction (PCR)
An enzymatic method for the repeated copying (and thus amplification) of the two strands of DNA that make up a particular gene sequence.

Primosome
The mobile complex of helicase and primase that is involved in DNA replication.

Probe
A molecule used to detect the presence of a specific fragment of DNA or RNA in, for instance, a bacterial colony that is formed from a genetic library or during analysis by blot transfer techniques; common probes are cDNA molecules, synthetic oligodeoxynucleotides of defined sequence, or antibodies to specific proteins.

Proteome
The entire collection of expressed proteins in an organism.

Pseudogene
An inactive segment of DNA arising by mutation of a parental active gene.

Recombinant DNA
The altered DNA that results from the insertion of a sequence of deoxynucleotides not previously present into an existing molecule of DNA by enzymatic or chemical means.

Restriction, enzyme
An endodeoxynuclease that causes cleavage of both strands of DNA at highly specific sites dictated by the base sequence.

Reverse transcription
RNA-directed synthesis of DNA, catalyzed by reverse transcriptase.

RT-PCR
A method used to quantitate mRNA levels that relies upon a first step of cDNA copying of mRNAs prior to PCR amplification and quantitation.

Signal
The end product observed when a specific sequence of DNA or RNA is detected by autoradiography or some other method. Hybridization with a complementary radioactive polynucleotide (eg, by Southern or Northern blotting) is commonly used to generate the signal.

Sines
Short interspersed repeat sequences.

SNP
Single nucleotide polymorphism. Refers to the fact that single nucleotide genetic variation in genome sequence exists at discrete loci throughout the chromosomes. Measurement of allelic SNP differences is useful for gene mapping studies.

SnRNA
Small nuclear RNA. This family of RNAs is best known for its role in mRNA processing.

Southern blot
A method for transferring DNA from an agarose gel to nitrocellulose filter, on which the DNA can be detected by a suitable probe (eg, complementary DNA or RNA).

Southwestern blot
A method for detecting protein-DNA interactions by applying a labeled DNA probe to a transfer membrane that contains a renatured protein.

Spliceosome
The macromolecular complex responsible for precursor mRNA splicing. The spliceosome consists of at least five small nuclear RNAs (snRNA; U1, U2, U4, U5, and U6) and many proteins.

Splicing
The removal of introns from RNA accompanied by the joining of its exons.

Sticky-ended DNA
Complementary single strands of DNA that protrude from opposite ends of a DNA duplex or from the ends of different duplex molecules (see also Blunt-ended DNA, above).

Tandem
Used to describe multiple copies of the same sequence (eg, DNA) that lie adjacent to one another.

Terminal transferase
An enzyme that adds nucleotides of one type (eg, deoxyadenonucleotidyl residues) to the 3' end of DNA strands.

Transcription
Template DNA-directed synthesis of nucleic acids; typically DNA-directed synthesis of RNA.

Transcriptome
The entire collection of expressed mRNAs in an organism.

Transgenic
Describing the introduction of new DNA into germ cells by its injection into the nucleus of the ovum.

Translation
Synthesis of protein using mRNA as template.

Vector

A plasmid or bacteriophage into which foreign DNA can be introduced for the purposes of cloning.

Western blot

A method for transferring protein to a nitrocellulose filter, on which the protein can be detected by a suitable probe (eg, an antibody).

A site.

Aminoacyl site. The site on a ribosome that is occupied during protein synthesis by an amino-acyl-tRNA molecule.

acceptor stem.

The sequence at the 5' end and the sequence near the 3' end of a tRNA molecule that are base paired, forming a stem. The acceptor stem is the site of amino acid attachment. Also known as the amino acid stem.

acidic phospholipids.

Anionic glycerophospholipids such as phosphoinositol.

acidosis.

A condition in which the pH of the blood is significantly lower than 7.4.

activation energy.

The free energy required to promote reactants from the ground state to the transition state in a chemical reaction.

active transport.

The process by which a solute specifically binds to a transport protein and is transported across a membrane against the solute concentration gradient. Energy is required to drive active transport. In primary active transport, the energy source may be light, ATP, or electron transport. Secondary active transport is driven by ion concentration gradients.

acyl carrier protein (ACP).

A protein (in prokaryotes) or a domain of a protein (in eukaryotes) that binds activated intermediates of fatty acid synthesis via a thioester linkage.

A-DNA.

The conformation of DNA commonly observed when purified DNA is dehydrated. A-DNA is a right-handed double helix containing approximately. 11 base pairs per turn.

affinity labeling.

A process by which an enzyme (or other macromolecule) is covalently inhibited by a reaction with a molecule that specifically interacts with the active site (or other binding site).

allosteric protein.

A protein whose activity is modulated by the binding of another molecule.

allosteric site.

See regulatory site

α helix.

A common secondary structure of proteins, in which the carbonyl oxygen of each amino acid residue (residue *n*) forms a hydrogen bond with the amide hydrogen of the fourth residue further toward the *C*-terminus of the polypeptide chain (residue $n + 4$). In an ideal right-handed a helix, equivalent positions recur every 0.54 nm, each amino acid residue advances the helix by 0.15 nm along the long axis of the helix, and there are 3.6 amino acid residues per turn.

aminoacyl-tRNA synthetase.

An enzyme that catalyzes the activation and attachment of a specific amino acid to the 3' end of a corresponding tRNA molecule.

amphibolic pathway.

A metabolic pathway that can be both catabolic and anabolic.

anaplerotic reaction.
A reaction that replenishes metabolites removed from a central metabolic pathway.

cascade.
Sequential activation of several components, resulting in signal amplification.

catabolite repression.
A regulatory mechanism that results in increased rates of transcription of many bacterial genes and operons when glucose is present. A complex between cAMP and cAMP regulatory protein (CRP) activates transcription.

catalytic constant (k_{cat}).
A kinetic constant that is a measure of how rapidly an enzyme can catalyze a reaction when saturated with its substrate(s). The catalytic constant is equal to the maximum velocity (V_{max}) divided by the total concentration of enzyme ($[E]_{total}$), or the number of moles of substrate converted to product per mole of enzyme active sites per second, under saturating conditions. Also known as the turnover number.

catalytic triad
The hydrogen-bonded serine, histidine, and aspartate residues in the active site of serine proteases and some other hydrolases. The serine residue is a covalent cafalyst; the histidine residue is an acid-base catalyst; and the aspartate residue aligns the histidine residue and stabilizes its protonated form.

Central Dogma.
The concept that the flow of information from nucleic acid to protein is irreversible. The term is often applied incorrectly to the actual pathway of information flow from DNA to RNA to protein.

ceramide.
A molecule that consists of a fatty acid linked to the C-2 amino group of sphingosine by an amide bond. Ceramides are the metabolic precursors of all sphingolipids.

cerebroside.
A glycosphingolipid that contains one monosaccharide residue attached via a β-gly-cosidic linkage to C-1 of a ceramide. Cerebrosides are abundant in nerve tissue and are found in myelin sheaths.

channel.
An integral membrane protein with a central aqueous passage, which allows appropriately sized molecules and ions to traverse the membrane in either direction. Also known as a pore.

channeling
See metabolite channeling

chaperone.
A protein that forms complexes with newly synthesized polypeptide chains and assists in their correct folding into biologically functional conformations. Chaperones may also prevent the formation of incorrectly folded intermediates, prevent incorrect aggregation of unassembled protein subunits, assist in translocation of polypeptide chains across membranes, and assist in the assembly and disassembly of large multiprotein structures.

chemiosmotic theory
A theory proposing that a proton concentration gradient established during oxidation of substrates provides the energy to drive processes such as the formation of ATP from ADP and P_i.

chitin
A linear homopolymer of *N*-acetylglu-cosamine residues joined by β-(l→ 4) linkages, Chitin is found in the exoskeletons of insects and crustaceans and in the cell walls of most fungi and many algae and is the second most abundant organic compound on earth.

chromatin.
A DNA-protein complex in the nuclei of eukaryotic cells.

chromatography.
A technique used to separate components of a mixture based on their partitioning between a mobile phase, which can be gas or liquid, and a stationary phase, which is a liquid or solid.

chromosome walking.

A technique for ordering DNA fragments in a genomic library. Chromosome walking involves hybridization, restriction mapping, and isolation of progressively overlapping recombinant DNA molecules.

chylomicron

A type of plasma lipoprotein that transports triacylglycerols, cholesterol, and cholesteryl esters from the small intestine to the tissues.

citrate transport system

A cyclic pathway that shuttles acetyl CoA from the mitochondria to the cytosol, with oxidation of cytosolic NADH to $NAD^{\oplus}$ and reduction of cytosolic $NADP^{\oplus}$ to NADPH. Between one and two molecules of ATP are consumed in each round of the pathway.

coenzyme

An organic molecule required by an enzyme for full activity. Coenzymes can be further classified as cosubstrates or prosthetic groups.

competitive inhibition

Reversible inhibition of an enzyme-catalyzed reaction by an inhibitor that prevents substrate binding.

complementary DNA (cDNA).

DNA synthesized from an mRNA template by the action of reverse transcriptase.

configuration

A spatial arrangement of atoms, which cannot be altered without breaking and reforming covalent bonds.

conformation.

Any three-dimensional structure, or spatial arrangement, of a molecule that results from rotation of functional groups around single bonds. Because there is free rotation around single bonds, a molecule can potentially assume many conformations.

conjugation.

The passage of genetic material from one bacterium to another through the sex pilus.

cooperativity.

1. The phenomenon whereby the binding of one ligand or substrate molecule to a protein influences the affinity of the protein for additional molecules of the same substance. Cooperativity may be positive or negative. 2. The phenomenon whereby formation of structure in one part of a macromolecule promotes the formation of structure in the rest of the molecule.

endocytosis.

The process by which matter is engulfed by a plasma membrane and brought into the cell within a lipid vesicle derived from the membrane.

endosomes.

Smooth vesicles inside the cell that are receptacles for endocytosed material.

enthalpy (*H*).

A thermodynamic state function that describes the heat content of a system.

entropy(*S*).

A thermodynamic state function that describes the randomness or disorder of a system.

epimers.

Isomers that differ in configuration at only one of several chiral centers.

essential amino acid.

An amino acid that cannot be synthesized by an animal and must be obtained in the diet.

essential fatty acid.

A fatty acid that cannot be synthesized by an animal and must be obtained in the diet.

excision repair

The reversal of DNA damage by excision-repair endonucleases. Gross lesions that alter the structure of

the DNA helix are repaired by cleavage on each side of the lesion and removal of the damaged DNA. The resulting single-stranded gap is filled by DNA polymerase and sealed by DNA ligase.

exocytosis.

The process by which material destined for secretion from a cell is enclosed in lipid vesicles that are transported to and fuse with the plasma membrane, releasing the material into the extracellular space.

facilitated diffusion

See passive transport

feedback inhibition.

Inhibition of an enzyme that catalyzes an early step in a metabolic pathway by an end product of the same pathway.

fermentation.

The anaerobic catabolism of metabolites for energy production. In alcoholic fermentation, pyruvate is converted to ethanol and carbon dioxide.

furanose

A monosaccharide structure that forms a five-membered ring as a result of intramolecular hemiacetal formation.

G protein.

A protein that binds guanine nucleotides.

ganglioside.

A glycosphingolipid in which oligosaccharide chains containing *N*-acetylneuraminic acid are attached to a ceramide. Gangliosides are present on cell surfaces and provide cells with distinguishing surface markers that may serve in cellular recognition and cell-to-cell communication.

intercalating agent.

A compound containing a planar ring structure that can fit between the stacked base pairs of DNA. Intercalating agents distort the DNA structure, partially unwinding the double helix.

intermediate filament.

A structure composed of different protein subunits, found in the cytoplasm of most eukaryotic cells. Intermediate filaments are components of the cytoskeletal network.

intron.

An internal nucleotide sequence that is removed from the primary RNA transcript during processing. The term intron also refers to the region of the gene that corresponds to the corresponding RNA intron. (cf. exon)

inverted repeat

A sequence of nucleotides that is repeated in the opposite orientation within the same polynucleotide strand. An inverted repeat in double-stranded DNA can give rise to a cruciform structure.

ion-exchange chromatography.

A chromatographic technique used to separate a mixture of ionic species in solution, using a charged matrix. In anion-exchange chromatography, a positively charged matrix binds negatively charged solutes, and in cation-exchange chromatography, a negatively charged matrix binds positively charged solutes. The bound species can be serially eluted from the matrix by gradually changing the pH or increasing the salt concentration in the solvent.

isoelectric focusing.

A modified form of electrophoresis that uses buffers to create a pH gradient within a polyacrylamide gel. Each protein migrates to its isoelectric point (pI), that is, the pH in the gradient at which it no longer carries a net positive or negative charge.

isoprene

A branched, unsaturated five-carbon molecule that forms the basic structural unit of all isoprenoids, including the steroids and lipid vitamins.

junkDNA.

Regions of the genome with no known function.

karyotype.
A set of chromosomes visualized by staining.

k_{cat}.
See catalytic constant

k_{cat}/K_m.
The second-order rate constant for conversion of enzyme and substrate to enzyme and product at low substrate concentrations. The ratio of k_{cat} to K_m, when used to compare several substrates, is called the specificity constant.

ketogenesis.
The pathway that synthesizes ketone bodies from acetyl CoA in the mitochondrial matrix in mammals.

ketogenic compound.
A compound, such as amino acid, that can be degraded to form acetyl CoA and can thereby contribute to the synthesis of fatty acids or ketone bodies.

ketone bodies.
Small molecules that are synthesized in the liver from acetyl CoA. During starvation, the ketone bodies β-hydroxybutyrate and acetoacetate become major metabolic fuels.

ketoses.
A class of monosaccharides in which the most oxidized carbon atom, usually C-2, is ketonic.

kinase.
An enzyme that catalyzes transfer of a phosphoryl group to an acceptor molecule. A protein kinase catalyzes the phosphorylation of protein substrates. Kinases are also known as phosphotransferases.

Klenow fragment.
The *C*-terminal 605-residuce fragment of *E. coli* DNA polymerase I produced by partial proteolysis. The Klenow fragment contains both the 5'→3' polymerase and 3'→5' proofreading exonuclease activities of DNA polymerase I but lacks the 5'→3' exonuclease activity of the intact enzyme.

K_m.
See Michaelis constant

lagging strand.
The newly synthesized DNA strand formed by discontinuous 5'→3' polymerization in the direction opposite replication fork movement.

LDL.
See low density lipoprotein

leader peptide.
The peptide encoded by a portion of the leader region of certain regulated operons. Synthesis of a leader peptide is the basis for regulating transcription of the entire operon by the mechanism of attenuation.

monocistronic mRNA.
An mRNA molecule that encodes only a single polypeptide. Most eukaryotic mRNA molecules are monocistronic.

motif.
A combination of secondary structure that appears in a number of different proteins. Also known as supersecondary structure.

M_r.
See relative molecular mass

multienzyme complex.
An oligomeric protein that catalyzes several metabolic reactions.

mutagen.
An agent that can cause DNA damage.

***N*-linked glycoprotein**

A glycoprotein in which one or more oligosaccharide chains are attached to the protein through covalent bonds to the amide nitrogen atom of the side chain of asparagines residues. The oligosaccharide chains of *N*-linked glycoproteins contain a core pentasaccharide of two *N*-acetyiglucosamine residues and three mannose residues.

noncompetitive inhibition.

Inhibition of an enzyme-catalyzed reaction by a reversible inhibitor that binds to either the enzyme or the enzyme-substrate complex.

nonessential amino acid.

An amino acid that an animal can produce in sufficient quantity to meet metabolic needs.

nonsense mutation.

An alteration in DNA that involves the substitution of one nucleotide for another, changing a codon that specifies an amino acid to a termination codon. A nonsense mutation results in premature termination of a protein's synthesis.

***N*-terminus.**

The amino acid residue bearing a free α-amino group at one end of a peptide chain. In some proteins, the *N*-terminus is blocked by acylation. The *N* -terminal residue is usually assigned the residue number 1. Also known as the amino terminus.

nucleosome.

A DNA-protein complex that forms the fundamental unit of chromatin. A nucleosome consists of a nucleosome core particle (approximately 146 base pairs of DNA plus a histone octamer), linker DNA (approximately 54 base pairs).and histone H1 (which binds the core particle and linker DNA).

Okazaki fragments

Relatively short strands of DNA that are produced during discontinuous synthesis of the lagging strand of DNA.

oligomer

A multisubunit molecule whose arrangement of subunits always has a defined stoichiometry and almost always displays symmetry.

***O*-linked glycoprotein.**

A glycoprotein in which one or more oligosaccharide chains are attached to the protein through covalent bonds, usually to the hydroxyl oxygen atom of serine or threonine residues.

oncogene.

A gene whose product has the ability to transform normal eukaryotic cells into cancer cells. Some oncogenes are carried by viruses.

open reading frame.

A stretch of nucleotide triplets that contains no termination codons. Protein-encoding regions are examples of open reading frames.

operator.

A DNA sequence to which a specific represser protein binds, thereby blocking transcription of a gene or operon.

operon.

A bacterial transcriptional unit consisting of several different coding regions cotranscribed from one promoter.

摘自 Harper's Biochemistry (2003)
及 Lehninger's Biochemistry (2005)