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Page 1 of 5

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coupling factor

is proportional to the magnitude of the **spin-spin coupling constant**.

coupling factor *abbr.*: CF; *archaic term* for either 1 any of the proteins functioning in the coupling of ATP synthesis to electron transport in mitochondria. CF1–CF4 are obsolete names for the α – δ subunits of mitochondrial **H⁺-transporting ATP synthase**. 2 any of the proteins required for the coupling of ATP synthesis to the photoinduced electron transport in chloroplasts during photosynthesis. The concept has been replaced by the **chemiosmotic coupling hypothesis**.

coupling membrane any biological membrane in which energy-yielding and energy-requiring biochemical processes occur together.

covalence or **covalency** nonionic valence between two atoms in a chemical compound, characterized by their sharing of one or more electrons. —**covalent** *adj.*

covalent bond a chemical bond formed between two atoms in a molecule by the sharing of electrons, usually in pairs, by the bonded atoms.

covalent catalysis the catalysis of any reaction in which the substrate is modified by forming a covalent bond with the catalyst (enzyme).

covalent chromatography any technique of **column chromatography** in which the substance of interest binds covalently with groups, e.g. –SH groups, on the support medium and is subsequently displaced by an appropriate reagent.

covalent (closed) circle (of DNA) or **covalently closed circular DNA** or **closed double-stranded DNA** *abbr.*: cccDNA; any double-stranded DNA molecule that is circular (but not necessarily geometrically circular) and in which both polynucleotide strands are completely continuous. *Compare* **Hershey circle**, **open circle**.

covalent modification any of a diverse group of processes in which the initially synthesized structures of biopolymers, especially enzymes, proenzymes, or structural macromolecules, are enzymically modified by the breakage of covalent bonds or the addition of new covalently linked groups. It includes **post-translational modification**. The term may sometimes be used in the more restricted sense of reversible interconversion of active and inactive forms of certain metabolic enzymes or other proteins by sets of control enzymes, often by phosphorylation–dephosphorylation.

covariance a measure of the association between two variables. For n pairs of values of two random variables, x and y , this is given by:

$$\text{Cov. } (x, y) = (x - \bar{x})(y - \bar{y}) / (n - 1)$$

where \bar{x} and \bar{y} are the means of the populations of x and y , respectively. *Compare* **correlation coefficient**, **regression coefficient**, **variance**.

covarian any of the codons in a given gene that may concomitantly vary, so resulting in favourable mutations or in mutations leading to amino-acid substitutions that have little or no effect. [From concomitantly variable codon.]

covirus any virus that exists as two or more separate particles all of which must be present together in the host organism for the complete replication cycle of the virus to occur.

covolume the amount by which the apparent volume of a molecule exceeds the sum of the volumes of the constituent atoms. It is usually 13–14 cm³ mol⁻¹ for protein molecules.

cozymase originally, the heat-stable, diffusible fraction of a crude aqueous extract of brewers' yeast that, if added to the heat-labile, nondiffusible fraction (zymase), would enable the alcoholic fermentation of glucose to occur in a cell-free system. The term was subsequently applied to one particular substance present in that fraction, now known as **nicotinamide adenine dinucleotide**.

C₃ pathway an alternative name for **reductive pentose phosphate cycle**.

C₄ pathway an alternative name for **Hatch–Slack pathway**.

CPBA *abbr.* for competitive protein-binding assay.

CPE *abbr.* for cytopathic effect.

C peptide 1 a the inactive polypeptide excised from **proinsulin** during its conversion to insulin. It contains 31 amino-acid residues in the human but shows greater species variability in both length and amino-acid sequence than does insulin. The structure of porcine C-peptide is (including the flanking basic residues):

RREAQNPAQAGAVELGGGLGGLQALALEGPPQKR.

It is released into the bloodstream concomitantly with insulin, hence the blood level is useful in evaluation of B-cell function.

b that segment of the amino-acid sequence of proinsulin lying between the two residues destined to become respectively the C-terminal residue of the B chain of insulin and the N-terminal residue of the A chain. It consists structurally of the above polypeptide plus two flanking pairs of basic residues. C peptide is named from connecting peptide, and perhaps also because, after A (chain) and B (chain), C (peptide) represents alphabetically the third major structural component of proinsulin. 2 an alternative name for C fragment (of β -lipotropin) (*see* **lipotropin**).

CpG island a region of 1–2 kb containing a high density of methylated cytosine residues and occurring immediately 5' to G residues, i.e. in the sequence CpG. CpG islands are frequently found in animal genomes at the 5' end of genes. In plants the methylated sequence is ...CpNpGp... where N can be any base. Methylation of DNA is a heritable phenomenon that reduces gene expression, probably by increasing the binding of a repressor. CpG islands are a site of high mutational frequency because spontaneous deamination of the methylated cytosine gives thymine, which is not recognized by DNA repair enzymes.

C₃ plant any plant in which fixation of carbon dioxide occurs predominantly by the **reductive pentose phosphate cycle**; i.e. by incorporation initially into the three-carbon compound 3-phosphoglycerate.

C₄ plant any plant in which fixation of carbon dioxide occurs predominantly by the **Hatch–Slack pathway**; i.e. by incorporation initially into the four-carbon compound oxaloacetate. Such plants are found usually in semiarid conditions with high light levels. They include sugar cane, corn (maize), and many weeds.

cpm or **c.p.m.** *abbr.* for counts per minute.

Cr symbol for chromium.

Crabtree effect the inhibition of respiration by glycolysis. The inhibition is small and occurs only in a few types of cells that possess a high glycolytic capacity, e.g. ascites tumour cells and other neoplastic tissues, renal medulla, leukocytes, and cartilage. *Compare* **Pasteur effect**.

Craig apparatus the most widely used type of apparatus for carrying out **countercurrent distribution** experiments. The earlier version (1944) was constructed of metal and the later version (1949) was of modular design and constructed of glass. [After Lyman Creighton Craig (1906–74).]

crambin a protein obtained from seeds of *Crambe abyssinica*. It comprises 46 amino acids, has a molecular mass of 4.73 kDa (database code CRAM_CRAAB), and is remarkable for its highly ordered crystals and very high resolution. Its 3-D structure is known.

cranin a form of **dystroglycan**.

CRE *abbr.* for cyclic AMP response element; a sequence,

GTGACGT[A/G][A/G],

that is present in many viral and cellular promoters. When it binds **CREB protein**, transcription of the genes regulated by such a promoter is turned on.

C-reactive protein *abbr.*: CRP; an acidic, crystallizable, heat-sensitive protein of \approx 118 kDa that is detectable in human or monkey blood serum early in the course of various infections or when there is inflammation, tissue damage, or necrosis. One of the so-called **acute phase proteins**, it is normally un-

Lig

Lig symbol for the lignoceroyl group, $\text{CH}_3\text{-(CH}_2\text{)}_{22}\text{-CO-}$.

ligancy a less common alternative name for **coordination number** (def. 1).

ligand **1** (in chemistry) (in a simple inorganic compound) any individual atom, group, or molecule that is attached covalently to the characteristic or central atom or moiety. **2** (in an organic compound) any individual atom or chemical group that is attached covalently to a specified carbon atom; *see also point ligand*. **3** (in biochemistry) (in a coordination entity) a any individual atom, ion, or molecule that is attached coordinately to one central metal atom (**unidentate ligand**). **b** an ion, molecule, or molecular grouping that has more than one coordinating group (**bi-**, **tri-**, or **multidentate ligand**). In both cases the ligand is an electron donor in the formation of one or more coordinate bonds. **4** an ion of either sign that can associate reversibly with one or more (charged or uncharged) atoms or characteristic molecular groupings in another (usually larger) molecule (as in the hydration of a conjugate base, the coordination of a metal cation by a protein, etc.). **5** a molecule (or a class of molecules) that has become linked covalently to another molecule to form a conjugate, whether in a single-step reaction or by stepwise addition of its components (e.g. an oligosaccharide moiety in a glycoprotein). **6** a molecule (or part of one) that is bound or is able to bind selectively and stoichiometrically, whether covalently or not, to one or more specific sites on another molecule (as in the combination of antigen with antibody, of hormone with receptor, of substrate with enzyme, etc.).

liganded bound by or as a ligand or ligands; ligated; *see ligate* (def. 2).

ligand exchange (chromatography) a column-chromatographic technique in which a cation-exchange resin is loaded with a complexable metal ion and the resulting loaded resin, which retains the capability of the metal ion to coordinate to an appropriate complexing agent or ligand, is used for the sorption of that ligand from a solution or a gas phase. Elution is then effected by displacement with, i.e. exchange for, another ligand. The resin is commonly a chelating resin (e.g. a styrene-divinylbenzene copolymer to which iminodiacetate groups are attached) and the ion is usually of a transition metal (e.g. copper or nickel), such ions tending to be bound strongly to these resins. Separation of components of mixtures occurs by virtue of the differences in the stabilities of the various metal-ligand complexes formed.

ligand-field theory (in inorganic chemistry) a theory, closely related to the valence-bond theory, that deals with the effects of ligands on the energy levels of the central atom or ion in complexes and crystals. It is especially useful in interpretation of the spectra of inorganic complexes.

ligand-gated describing an ion channel in a cell membrane that is caused to open by the action of an agonist binding to the receptor that governs the channel. Channel opening can be direct, when the receptor acts as an ionophore, or indirect, involving a second messenger regulated by a G-protein.

ligandin a name formerly given to a basic dimeric protein of ≈ 25 kDa per dimeric subunit (*see glutathione transferase*). It is abundant in rat and human liver, kidney, and small intestine. It binds with high affinity to heme, bilirubin, and other organic anions, polycyclic aromatic carcinogens, and various metabolites. In addition it catalyses the conjugation of glutathione with a variety of electrophilic substrates, shows selenium-independent glutathione-peroxidase activity and steroid isomerase activity, and covalently binds activated metabolites of several carcinogens. Ligandin corresponds to the α class of glutathione transferase. Ligandin is present in the pars recta of the proximal renal tubules but does not normally pass into the urine: its presence in the urine, **ligandinuria**, has been used to follow the evolution of various forms of kidney injury, while its presence in serum provides a sensitive indicator in liver injury. Also variously called Y protein, organic anion binding protein, basic azo-dye binding protein, cortisol

metabolite binding protein (binder protein 1), glutathione-transferase B.

liganding binding by or as a ligand or ligands; ligating; *see ligate* (def. 2).

ligandinuria *see ligandin*.

ligand-mediated chromatography a variant of **affinity chromatography** that employs an additional component, the affinity ligand, which is a ligand both for the reactive component attached to the insoluble matrix and for the substance to be purified. Because the ligand may readily be renewed after completion of each separation, the method is particularly useful when the substance used as the ligand easily becomes degraded or inactivated during the course of a purification.

ligand-receptor assay a form of **saturation analysis** for a hormone or other agonist wherein the specific binding agent used is an isolated preparation of the naturally occurring cellular receptor substance for the agonist. An advantage of the assay is that the values obtained are considered to be a direct reflection of the biological properties of the substance assayed.

ligase **1** or (formerly) **synthetase** the systematic class name for enzymes of class EC 6, all of which catalyse the ligation of molecules of two substances with concomitant breaking of a diphosphate linkage in a nucleoside triphosphate. The recommended names of particular ligases are formed in some instances, especially those of enzymes of subclass EC 6.4, by using the generic name carboxylase, e.g. pyruvate carboxylase, EC 6.4.1.1. In the remaining instances the generic names ligase (def. 2) or synthase are used, according to whether the name of an individual enzyme is to be based on the names of the reactants or on the name of the product, respectively. **2** a generic name for many enzymes of class EC 6 (*see ligase* (def. 1)); when added to the names of the two reactants whose ligation is catalysed by a particular enzyme it forms the recommended name of that enzyme; e.g. tyrosine-tRNA ligase (EC 6.1.1.1), acetate-CoA ligase (EC 6.2.1.1). *See also synthetase* (def. 2). **3** *see DNA ligase*.

ligate **1** to join together, especially with a ligature. **2** (in chemistry) to join (molecules or molecular fragments) together with a bond; to coordinate. **3** to bind as or to a **ligand** or ligands. **4** (in surgery) to tie off (a blood vessel or duct) with a ligature so as to occlude. —**ligation** *n.*; **ligatable** *adj.*; **ligative** *adj.*

ligatin a filamentous plasma membrane protein for the attachment of peripheral glycoproteins to the external cell surface. It acts as a trafficking receptor for phosphoglycoproteins, localizing them, after internalization, within endosomes. Example (fragment) from human: database code LIGA_HUMAN, 75 amino acids (8.47 kDa).

light **1** electromagnetic radiation capable of producing a visual sensation in the eye. It comprises wavelengths in the range 380–780 nm (frequencies 385–789 THz), although the term is sometimes loosely extended to include some ultraviolet and infrared radiation in adjacent parts of the spectrum. **2** (in chemistry) describing any (especially metallic) element whose density is relatively small (usually $< 5000 \text{ kg m}^{-3}$). **3** (in physics) of less than the usual mass. *Compare heavy*.

light band a region of a muscle **sarcomere** that stains less densely in light microscopy and low-magnification electron microscopy relative to the **dark bands**; together, these differentially staining bands give the striated appearance of skeletal muscle. The light bands are relatively isotropic in polarized light; they represent the regions occupied by **thin filaments**. *See also thick filament*, **Z line**.

light chain **1** or **L chain** or (formerly) **B chain** symbol: L; the shorter of the two main types of polypeptide chain of an **immunoglobulin** of any class. Of ≈ 22 kDa (human), each light chain is linked at its C-terminal cysteine residue by a disulfide bond to the constant region of a **heavy chain**. In any given animal species, light chains may be distinguished serologically into two types, κ and λ , which occur in immunoglobulin molecules of every class in proportions that vary only with the

peplos

of which project from the peplos (i.e. **envelope** (def. 3)) of an enveloped virus particle. Peplomers may have cell-receptor, hemagglutinating, or neuraminidase activity.

peplos *an alternative name for envelope* (def. 3).

pepsin **1** any of a small family of closely related aspartic proteinase enzymes of 31–36 kDa that together give rise to the principal proteinase activity of gastric juice of vertebrates. The family includes **pepsin A**, **pepsin B**, **pepsin C** (i.e. **gastricsin**), and **pepsin D**. Pepsins have maximal activity at pH values in the range 2–3; they preferentially catalyse hydrolysis of peptide bonds formed from hydrophobic amino-acid residues, the detailed specificity varying somewhat between the different pepsins. **2** *an alternative name for pepsin A*.

pepsin A or **pepsin abbr.** (in clinical chemistry): PPS; *the recommended name for the predominant enzyme* (EC 3.4.23.1) of the **pepsin** family. It is a single-chain phosphoprotein of (in the pig) 327 amino-acid residues, formed by limited proteolysis of pepsinogen A. It preferentially cleaves peptide bonds where the residues on either side are formed from hydrophobic amino acids; for example, in the B chain of insulin it cleaves Phe¹-|-Val², Gln⁴-|-His⁵, Glu¹³-|-Ala¹⁴, Ala¹⁴-|-Leu¹⁵, Leu¹⁵-|-Tyr¹⁶, Tyr¹⁶-|-Leu¹⁷, Gly²³-|-Phe²⁴, Phe²⁴-|-Phe²⁵, and Phe²⁵-|-Tyr²⁶ bonds (*compare pepsin B*). The unphosphorylated form of porcine pepsin A is called pepsin D.

pepsin B or **parapepsin I** a pig enzyme (EC 3.4.23.2) of the **pepsin** family. It is a single-chain phosphoprotein of 332 amino-acid residues, formed by limited proteolysis of pig pepsinogen B. It has little activity towards hemoglobin as substrate (*compare gastricsin*), but degrades gelatin. Its specificity on the B chain of insulin is more restricted than **pepsin A**; it does not cleave Phe¹-|-Val², Gln⁴-|-His⁵, or Gly²³-|-Phe²⁴.

pepsin C *an alternative name for gastricsin*.

pepsin D unphosphorylated pig **pepsin A**.

pepsinogen a precursor (i.e. zymogen) of a **pepsin** enzyme; pepsinogens A, B, and C give rise to **pepsin A**, **pepsin B**, and **pepsin C** (i.e. **gastricsin**) respectively. Pepsinogens are secreted by the chief cells of the gastric mucosa of vertebrates. In pepsinogen, the active site is conformationally masked at neutral pH, and exposed as the pH falls after secretion into the stomach. The first bond breakage causes the release of residues 1–16, leaving a peptide known as **pseudopepsin**. Thereafter, a further 28 residues are removed in stages to form the active enzyme. Pepsinogen C is also secreted by the mucosa of the proximal duodenum. Example from human: database code PEPA_HUMAN, 388 amino acids (41.93 kDa): this is the pepsinogen precursor with a signal peptide; pepsin is from residue 63 to the end.

pepstatin A *N*-isovaleryl-L-valyl-L-valyl-3-hydroxy-6-methyl-4-aminoheptanoyl-L-alanyl-3-hydroxy-6-methyl-4-aminoheptanoic acid; a peptide, isolated from broth cultures of *Streptomyces* spp., that inhibits pepsin and other aspartic proteinases, notably cathepsin D, renin, and fungal acid proteinases.

peptaibophol or **peptaibol** any of a group of peptide amide antibiotics, 15–24 residues long and containing up to 40% α -aminoisobutyric acid residues. The members of this group, emerimicin, zervamicin IIA, antiamebin I, sizukacillin A, and alamethicin, are all capable of altering the permeability of phospholipid bilayers. The N termini are acylated and the C-terminal carboxyl groups are in amide linkage with phenylalaninol.

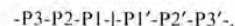
peptic **1** of, pertaining to, caused by, or containing **pepsin**. **2** of, pertaining to, or promoting digestion.

peptidase or **peptide hydrolase** or **protease** any enzyme that hydrolyses peptide bonds. The group includes the **exopeptidases**, such as the aminopeptidases and carboxypeptidases, (sub-subclasses EC 3.4.11–19) and the **endopeptidases** (sub-subclasses EC 3.4.21–99). The 1992 revision of *Enzyme Nomenclature* (published for IUBMB by Academic Press) should be consulted for more detail.

peptidase P-sites sites adjacent to or near the cleaved site in

peptidergic

peptidase substrates; in describing the specificity of peptidases, it is useful to have a convention for identifying the residues on either side of the cleaved bond; the following model is often followed (the cleaved, or scissile bond is indicated as -|-, and the N terminus is as usual to the left):



Compare peptidyl site.

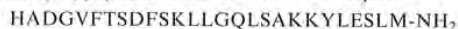
peptide any compound containing two or more amino-acid residues joined by amide bond(s) (*see peptide bond*) formed from the carboxyl group of one amino acid (residue) and the amino group of the next one. The term peptide usually applies to compounds in which the amide bond(s) are formed between C-1 of one α -amino acid (residue) and N-2 of another, but it includes compounds in which the residues are linked by other amide bonds. *See also oligopeptide, polypeptide*. —**peptidic** *adj.*

peptide antibiotic any member of a diverse group of antibiotics containing amino-acid residues, some of which are often of the D-form, linked to one another by peptide bonds, to hydroxy acids by depsipeptide bonds, and frequently also to additional components; the structure is often cyclic. The group includes the **bacitracins**, **gramicidins**, **polymyxins**, and **tyrocidins**.

peptide bond or **peptide linkage** any amide bond formed between two amino acids (or amino-acid residues). The term usually denotes the amide bond (sometimes called the **eupeptide bond**) formed between an α -amino group of one amino acid and an α -carboxyl group of another amino acid, but it also includes any amide bond (sometimes called an **isopeptide bond**) formed from an amino group and a carboxyl group either or both of which are in other positions in the contributing amino acids.

peptide chain or **polypeptide chain** any discrete linear sequence of amino-acid residues linked by eupeptide bonds, especially in a larger molecular structure. *See peptide bond*.

peptide HI *abbr.*: PHI; a 27-residue peptide amide, also known as PHI-27, found in intestinal tissue, brain, respiratory tract, and pancreas. It stimulates insulin secretion and pancreatic exocrine secretion, causes vasodilation, increases intestinal fluid transport, relaxes smooth muscle, and is a potent prolactin-releasing factor. It shows sequence homology with gastric inhibitory polypeptide, glucagon, secretin, and vasoactive intestinal polypeptide; human PHI has the sequence



(porcine PHI has Arg¹² and Ile²⁷; bovine has Tyr¹⁰, Arg¹², and Ile²⁷). It is named after the single-letter codes, H and I, for the histidine and isoleucine residues at the N and C termini respectively of the porcine and bovine peptides.

peptide histidine valine 42 *abbr.*: PHV 42; a peptide with N-terminal histidine and C-terminal valine, having 42 residues derived from residues 81–122 of prepro-vasoactive intestinal peptide.

peptide hormone or **polypeptide hormone** any peptide with hormonal activity in animals, whether endocrine, neuroendocrine, or paracrine. Such substances form a very diverse group physiologically, and the boundary between peptide hormones and protein hormones is somewhat indistinct.

peptide hydrolase *another name for peptidase*.

peptide linkage **1** *an alternative name for peptide bond*. **2** chemical linkage between structural components of a molecule by means of peptide bonds.

peptide map a pattern, characteristic of a particular polypeptide or protein, produced by partial hydrolysis followed by two-dimensional fractionation of the resultant peptides (and amino acids) by chromatography and/or electrophoresis.

peptide nucleic acid a synthetic DNA analogue with an *N*-(2-aminoethyl)glycine backbone that mimics DNA in forming a **heteroduplex**.

peptidergic **1** describing any nerve that is activated by a peptide agonist. **2** describing any nerve that acts by releasing a