

WORLD  BREWING ACADEMY

# GLOSSARY

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Term	Description
°B Degree Balling	Grams of extract in 100 gm. solution at 20°C., or pounds extract in 100 pounds of solution. Usually measured by determining specific gravity of the solution with a hydrometer (brewers use hydrometers which read directly in °B by referring to tables).
°P Degree Plato	Grams of extract in 100 ml at solution at 20°C (= kg extract per hL) 1°Plato = $[\text{sp. gravity} - 1] / 4 \times 1000$ Sp gravity = $[(\text{°Plato} \times 4) / 1000]$ A unit measuring sugar content, especially of the wort, the unfermented liquor from which beer is made. Named for a German chemist, one degree Plato represents a sugar content equivalent to 1% sucrose by weight. Not all the sugar in a wort is sucrose; the unit standardizes the measurement to the sucrose equivalent. The reading is made with a device called a saccharometer.
Absorption	The penetration of a liquid or solid into or through another liquid or solid, the particles that are absorbed being molecular or micellar in size. A few solid bodies have the power of taking up or absorbing gases, for instance, like charcoal or activated carbon.
Acid	A hydrogen containing substance, which will dissociate on solution in water to produce one or more hydrogen ions (H+).
Acrospire	The plumule in germinating grain.
Activated	(Also called active carbon). A form of carbon characterized by carbon high adsorptive capacity for gases, vapors and colloidal solids.
Adjunct	Unmalted grain, sugars or syrups used in brewing.
ADP	Adenosine diphosphate, abbreviated ADP, is a nucleotide. ADP consists of the pyrophosphate group, the pentose sugar ribose, and the nucleobase adenine. ADP is the product of ATP dephosphorylation by enzymatic action. It is an important energy transfer molecule in cells.
Adsorption	The adhesion, in an extremely thin layer of the molecules of gases, of dissolved substances, or of liquids, to the surfaces of solid bodies, with which they are in contact.
Aerobic	Referring to bacteria and other forms of life, which require oxygen to live.
Aerobic	Needing oxygen for growth.
Affinity	Chemical potential. Selective tendency to unite.
Agar-Agar	The water-soluble colloidal carbohydrate of the red seaweed, Gelidium, forms gels with as little as one part to 500 of water. It is used in preparing bacteriological media.
Aggregation	A total considered with reference to its constituent parts
Albumin	A class of simple proteins forming an important constituent of the serum of the blood, and found also in milk, muscle, egg and in many vegetable tissues and fluids. These proteins are soluble in water and coagulate on heating.
Alcohol	Any of a series of organic compounds containing one or more hydroxyl (OH) groups.

Alcohol by volume	<p>A measure of alcohol content of a solution as a percentage of the volume of alcohol per volume of beer. (Abbr. ABV). The formula is:</p> $ABV = ABW \frac{SP GR}{0.791}$ <p>(where ABW = alcohol by weight)</p>
Alcohol by weight	<p>A measure of alcohol content of a solution as a percentage of the weight of alcohol per volume of beer. (Abbr. ABW). The formula is:</p> $ABW = \frac{(RE - OG) \times 100}{(1.0665 \times OG) - 206.65}$ <p>(where OG = original gravity)</p>
Ale	Usually refers to malt beverages where the wort is fermented with strains of yeast, which tend to rise to the top of the vessel and form a yeast head at the end of fermentation.
Algae	Any plant of a group (Algae) comprising practically all seaweeds, and allied fresh-water or non-aquatic forms.
Alkalinity	The combining power of a base measured by the maximum number of equivalents of an acid with which it can react to form a salt.
Allele	Any of several alternative forms of a gene.
Alloy	The product formed by the mixing of a metal with other metals.
Alpha-acid	Any of three major hop acids (humulone, cohumulone, adhumulone) that are the major contributors to bitterness in beer
Amino acids	Building blocks of proteins. There are twenty common amino acids: alanine, arginine, asparagine, aspartic acid, cysteine, glutamic acid, glutamine, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, threonine, tryptophan, tyrosine, and valine.
Ammonia	A colorless, gaseous compound of nitrogen and hydrogen (NH <sub>3</sub> ) of extremely pungent smell. Used as a refrigerant.
Amylases	These are starch-degrading enzymes. (1) Alpha Amylase: Degrades starch to a mixture of dextrans and sugars. (2) Beta Amylase: Degrades starch to maltose and beta limit dextrin.
Amylodextrin	The first hydrolysis product of starch with amylase. It gives purple color with iodine.
Amylolytic	Conversion of starch to sugars by the action of enzymes or acids
Anaerobic	Referring to bacteria and other forms of life that do not require oxygen to live.
Anion	The charged particle in a solution of an electrolyte, which, under the influence of an electrical potential, moves toward the anode. It is the negatively charged ion.
Anode	The electrode at which an oxidation process occurs and to which electrons travel.

Antibiotic	Chemical substance formed as a metabolic by-product in bacteria or fungi and used to treat bacterial infections. Antibiotics can be produced naturally, using microorganisms, or synthetically.
Antiseptic	Destructive to microorganisms.
Aphid	Plant pests found in hops.
Apparent	The indication of the Balling or Plato hydrometer in Extract beer not de-alcoholized. Convenient for determining the degree of fermentation of beer with known original gravity.
Apparent extract	<p>The attenuation of beer containing alcohol but no carbon dioxide. It is "apparent" because it is not representative of the extract lost during fermentation as a result of a drop in gravity caused by the conversion of fermentable sugars to alcohol. Easier to measure than real extract, apparent extract is converted to real extract by the factor 0.819. (Abbr. AE). The formula is:</p> $A = \frac{B - b}{B \times 100}$ <p>(where A = apparent extract, %;  B = original gravity in °P (or °Plato);  and b = gravity of beer devoid of CO<sub>2</sub>.)</p>
Artesian Well	A well made by boring into the earth till water is reached, which, from internal pressure, flows spontaneously.
Aseptic	Free of living organisms in any form.
Ash	The solid residue left when combustible material is thoroughly burned at not too high a temperature.
Atom	The smallest particles to which an element can be reduced and still possess the properties of the element.
ATP	Adenosine triphosphate (ATP) is the nucleotide known in biochemistry as the "molecular currency" of intracellular energy transfer; that is, ATP is able to store and transport chemical energy within cells. ATP also plays an important role in the synthesis of nucleic acids.
Attemperator	Coil or jacket through which a refrigerant is circulated at a predetermined rate to control the temperature of fermenting wort.
Attenuation	The thinning down, decreasing the amount of extract. See also Degree of Fermentation.
Autolysis	Self-digestion of tissues, post mortem, often applied to yeast.
<b>B</b> acteriophage	Virus that lives in and kills bacteria. Also called phage.
Bacterium	Any of a large group of microscopic organisms with a very simple cell structure. Some manufacture their own food, some live as parasites on other organisms, and some live on decaying matter. (See Prokaryote)
Barley	The grain of <i>H. vulgare</i> or its varieties, used for livestock feed, malt production, and cereal
Barrel	a. Generic name for a cask or keg. b. Container for transporting draft beer. c. Unit of liquid volume measure: U.S. beer barrel = 31 U.S. Gallon Canada beer barrel = 25 Imp. Gallon British beer barrel = 36 Imp. Gallon
Base	Any compound which will dissociate on solution in water to produce one or more hydroxyl ions (OH <sup>-</sup> ).

Base	On the DNA molecule, one of the four chemical units that, according to their order and pairing, represent the different amino acids. The four bases are: adenine (A), cytosine (C), guanine (G), and thymine (T). In RNA, uracil (U) substitutes for thymine.
Base pair	Two nucleotide bases on different strands of the nucleic acid molecule that bond together. The bases can pair in only one-way: adenine with thymine (DNA) or uracil (RNA), and guanine with cytosine.
Beer haze	High-molecular-weight proteins and tannins present in beer, which have a tendency to combine slowly and form an insoluble colloidal haze.
Beer Stone	Grayish-brown deposit of calcium oxalate and organic matter on surface of equipment in prolonged contact with beer.
Beer turbidity	Measurable opaqueness in beer resulting from chill haze.
Beta-glucanase	Is an enzyme, which catalyzes the hydrolysis of Glucanase randomly placed internal links in the beta glucan chain.
Beta-acids	Group of hop acids (lupulone, colupulone, and adlupulone) with minor contributions to bitterness in beer
Biocatalyst	In bioprocessing, an enzyme or microorganism that activates or speeds up a biochemical reaction.
Bioconversion	Chemical restructuring of raw materials by using a biocatalyst.
Biodegradable	Capable of being broken down by the action of microorganisms or enzymes.
Biological oxygen demand (BOD)	The amount of oxygen used for growth by organisms in water that contains organic matter. Commonly used as an indicator of pollution levels.
Biology	The branch of knowledge, which treats all living organisms.
Biomass	The mass of biological material (e.g. microbial cells or plants) commonly used to refer to agricultural feedstocks. In microbiology, refers to mass of microbial cells in growth studies.
Bios	Vitamin necessary for yeast growth, found to be a mixture of i-inositol, vitamin (B1) and "biotin," and/or pantothenic acid.
Biosensor	Device in which powerful recognition systems of biological chemicals (enzymes, antibodies) are coupled to microelectronics to enable low-level detection of substances such as sugars and proteins in body fluids, pollutants in water and gases in air.
Biotechnology	Development of products by a biological process. Production may be carried out by using intact organisms, such as yeasts and bacteria, or by using natural substances (e.g. enzymes) from organisms.
Bitterness	The bitter substances in beer, which are mainly iso-alpha acids.
Bitterness Unit(BU)	A method of measuring the degree of bitterness in beer. The bitter substances are extracted from acidified beer with iso-octane and the absorbance measured with a spectrophotometer at 275 nm.
Bodyfeed	The dosing of kieselguhr, which is constantly added to unfiltered beer during filtration
Brilliancy	Property (of a beer) of being transparent and sparkling.
Brine	Water to which sodium chloride is added to lower its freezing point. Term can also be applied if calcium chloride, potassium carbonate, specially denatured ethyl alcohol or propylene glycol is added. Level of corrosion inhibitor and pH must be controlled.
British Thermal Unit	Amount of heat required to raise the temperature of one pound of water, Unit (BTU) one degree Fahrenheit.
Budding	The production of new yeast cells as buds from mother cells.

Buffer	Any substance, or combination of substances, which when dissolved in water produces a solution, which resists a change in its hydrogen ion concentration upon the addition of acid or alkali.
Bunging	To close a container with a bung or to connect a container to a pressure-regulating system to maintain a certain counter pressure of CO <sub>2</sub> .
Calorie	Amount of heat required to raise the temperature of one gram of water one degree Centigrade.
Carbohydrate	Any one of a group of compounds composed of carbon, hydrogen and oxygen with the ratio of hydrogen to oxygen usually as in water. viz., two H: one O. They are neutral compounds comprising the sugars, starches, celluloses, pentosans, galactans, etc.
Carbon Dioxide	A heavy, colorless, gas (CO <sub>2</sub> ). Two grams fermented wort extract will produce about 1 gram of alcohol and 1 gram of CO <sub>2</sub> .
Carbonate	A salt or an ester of a carbonic acid. To charge (a beverage, for example) with carbon dioxide gas
Carcinogen	Cancer-causing agent.
Carrageenan	Is the polysaccharide fraction of Irish Moss and is soluble in hot water.
Caryophyllene	Hop oil component
Cask	Originally an oak container (barrel) with a side bung hole and tap for holding, transporting and dispensing beer. Later versions similar in design and concept but made from aluminum or stainless steel. Ranging in size from a Pin (4.5 Imp. Gallons) to a Hogs Head (54 Imperial Gallons).
Catalyst	Any substance which, by virtue of its presence, affects the rate of a chemical reaction and which may be recovered practically unchanged at the end of the reaction.
Cathode	The electrode at which reduction occurs and from which electrons are repelled.
Cation	The charged particle in the solution of an electrolyte, which under the influence of an electrical potential, moves toward the cathode. It is the positively charge ion.
Cell	The smallest structural unit of living organisms that is able to grow and reproduce independently.
Cell culture	Growth of cells under laboratory conditions.
Cell fusion	See Fusion
Cellulose	C <sub>6</sub> H <sub>10</sub> O <sub>5</sub> ) <sub>x</sub> : a polysaccharide composed of D-glucopyranoside units. It forms the cell walls and fibrous structure of many plants, and is the chief constituent of paper and wood.
Celsius	Name of originator of the centigrade scale.
Celsius Scale	Thermometer scale having 100 divisions between Scale freezing and boiling temperature of water.
centrifuge	An apparatus consisting essentially of a compartment spun about a central axis to separate contained materials of different specific gravities, or to separate colloidal particles suspended in a liquid
Charcoal	A dark carbon prepared from vegetable or animal substances, as by charring wood in a kiln from which air is excluded.
Check	A stoppage or slowing up of the main fermentation before the beer is Fermentation completely attenuated.
Chemistry	The branch of knowledge that treats the compositions of substances and of the transformations, which they undergo.

Chemostat	Growth chamber that keeps a bacterial culture at a specific volume and rate of growth by continually adding fresh nutrient medium while removing spent culture.
Chill haze	The colloidal haziness in beer caused by the interaction of proteins and polyphenols in beer at cold temperatures. This reaction is reversible.
Chit Malt	Very short-grown malt.
Chromosomes	Threadlike components in the cell that contain DNA and proteins. Genes are carried on the chromosomes.
CIP	Clean-in-place
Clone	A group of genes, cells, or organisms derived from a common ancestor. Because there is no combining of genetic material (as in sexual reproduction), the members of the clone are genetically identical to the parent.
Coagulation	The act or state of becoming viscous, jelly-like or solid, or of uniting into a coherent mass. Especially the change from a liquid to a thickened, curd-like state by chemical reaction.
Codon	A sequence of three nucleotide bases that specifies an amino acid or represents a signal to stop or start a function.
Coenzyme	The non-protein portion of an enzyme that functions as an acceptor of electrons or functional groups
Coliform	Of or relating to the bacilli that commonly inhabit the intestines of humans and other vertebrates, especially the colon bacillus
Colloid	A state of subdivision of matter characterized by a particle size intermediate between molecular dispersion (true solution) and a size just about visible with an ordinary microscope.
Color	Beer color intensity on a sample free of turbidity is 10 times the absorbance of beer in a ½-in. cell measured spectrophotometrically at a wavelength of 430 nm and is reported as standard reference method (SRM) units.
Colorimeter	An instrument used to measure tristimulus values using three broad-band filters. As such, colorimeters cannot provide spectral reflectance data, but sometimes they are preferred over spectrophotometers due to lower cost.
Condensation	Condensation is a type of chemical reaction in which two molecules with -OH groups are joined with eliminating a water molecule from their -OH groups. An ester can be thought of as a product of a condensation reaction of an acid (usually an organic acid) and an alcohol (ethanol and higher alcohols), although there are other ways to form esters.
Cone	Any of several cone-like flower or fruit clusters, as in the hop.
Cooker	Vessel, which allows heating and boiling of mash.
Coolship	Shallow tank for aeration, clarification and cooling of hot wort. Presently usually replaced by Whirlpool tank.
Corrode	To eat away gradually, usually by electro-chemical action.
Couch	Barley in the stage of beginning to sprout. to couch means to follow-up with an after or secondary steep.
Coupling	A device that serves to connect the ends of adjacent parts or objects. Example: hose couplings.
Culture	As a noun, cultivation of living organisms in prepared medium as a verb, to grow in prepared medium.
Culture medium	Any nutrient system for the artificial cultivation of bacteria or other cells; usually a complex mixture of organic and inorganic materials.



Cytase	An enzyme, which has the power of dissolving the cellulose of the cell walls surrounding the starch granules.
Cyto-	Referring to cell or cell plasm.
Cytolysis	The dissolution of cells, esp. by the destruction of their membranes
Cytolytic Enzymes	These are enzymes which break down cell walls and in brewing this often refers to the breakdown of cell walls in the barley kernel
Cytometry	Flow cytometry is a technique for counting, examining, and sorting microscopic particles suspended in a stream of fluid such as yeast cells. It allows analysis of the physical and/or chemical characteristics of single cells (Such as: cell volume, shape of the nucleus, the amount and type of cytoplasmic granules or the membrane roughness) flowing through an optical and/or electronic detection apparatus.
Cytoplasm	Cellular material that is within the cell membrane and surrounds the nucleus.
D.o.	Dissolved oxygen
Decarboxylation	Decarboxylation is any chemical reaction in which a carboxyl group (-COOH) is split off from a compound as carbon dioxide (CO <sub>2</sub> ). One decarboxylation reactions would be pyruvate to acetyl-CoA.
Decoction	Mash method involving the boiling of parts of the mash and return of coagulation. It is characterized by a loss of solubility at the iso electric points, greater susceptibility to proteolytic enzymes, and a change in the specific rotation. It does not occur without the presence of water.
deculmed	Removal of rootlets and acrospires from germinated malts
Dehydrogenase	Refers to the removal of a hydrogen atom via an enzymatic reaction
denatured	To cause the tertiary structure of (a protein) to unfold, as with heat, alkali, or acid, so that some of its original properties, especially its biological activity, are diminished or eliminated, To change the nature or natural qualities of
Deoxyribonucleic acid (DNA)	The molecule that carries the genetic information for most living systems. The DNA molecule consists of four bases (adenine, cytosine, guanine, and thymine) and a sugar-phosphate backbone, arranged in two connected strands to form a double helix. See also Complementary DNA. Double helix. Recombinant DNA.
Dextrin	A soluble, gummy carbohydrate formed by the decomposition of starch by heat, acids or enzymes.
Dextrose	An important intermediate in carbohydrate metabolism. Also know as corn sugar; grape sugar
Dialysis	The separation of crystalloids and colloids in solution, by means of their unequal diffusion through certain membranes.
Diaphanous	Of such fine texture as to be transparent or translucent
Diastase	An enzyme mixture capable of gelatinizing and converting starch to dextrins and sugars.
Diatomaceous	Any of a class of microscopic unicellular or colonial algae, the silicified Silica skeletons of which form kieselguhr.
Diatomaceous earth	The skeletal remains of diatom plants, used as a filtration aid
Differentiation	The process of biochemical and structural changes by which cells become specialized in form and function.
Diffusion	The flow of molecules, usually, but not necessarily, through a membrane.

Dimethyl sulfide	A compound formed from thermal degradation of its precursor, S-methyl methionine, during wort boiling. It is also produced during malting as a by-product of organic chemical reactions that occur during germination. High levels are attributed to short-, covered-, or non-vigorous boiling of the wort, slow wort chilling, or, in extreme cases, bacterial contamination. It denotes a sweet creamed-corn-like aroma. (Abbr. DMS)
Diploid	A cell with two complete sets of chromosomes. Cf. Haploid.
Disaccharide	The sugar resulting from the condensation of two molecules of a monosaccharide, with the loss of water. Examples: sucrose, maltose, and lactose.
Disassociate	The splitting of a compound into two or more simpler molecules, atoms, ions, Radicals.
Disinfecting	To free from infection, especially destroying disease germs. To free from infesting insects.
Dispersion	Any mixture where one substance is very intimately intermingled with another. Most frequently a dispersion refers to a colloidal suspension.
Distillation	The process of heating a liquid to its boiling point, removing the vapors through a cooling and condensing apparatus, and finally collecting the condensed vapors, as a liquid, in a separate receiver. Method of separating liquids from solids or liquids having different boiling points from each other by evaporation and condensation of the more volatile component.
DMS	dimethyl sulfide
DNA cloning	The process whereby fragments of DNA from any source can be amplified many times by inserting them into a plasmid or a bacterial virus (bacteriophage) and then growing these in bacterial or yeast cells.
DNA sequence	The order of nucleotide bases in the DNA molecule.
Doubling	The addition of wort (without yeast) to beer in the first stage of the main fermentation.
Downstream processing	The stages of processing that take place after the fermentation or bioconversion stage. includes separation, purification, and packaging of the product.
Downward infusion mash	Mash in at 75°C. and cool gradually to 65°C. with cold water.
EA-value	The EA-Value is a laboratory term that indicates how much anti-oxidant ability there is in a certain sample. The test is done by what is called electron spin resonance (ESR) and in simple terms it is measuring the formation of OH-radicals. The value is reported as "Endogenous Antioxidant Activity" or "EA-Value" Electron Spin Resonance (ESR) is a spectroscopic technique, which detects species that have unpaired electrons, generally meaning that it must be a free radical, if it is an organic molecule. A 'free radical' is a molecule with unpaired electrons. This means this molecule would love to attract an oxygen molecule. The higher the EA-value, the more likely this sample would attract oxygen. That gives a brewer an idea of how well protected his wort or beer sample is. A low EA-value is indicates that oxidation has already occurred to the sample. In case you are interested in learning more about this lab test, Electron Spin Resonance (ESR) is also sometimes called Electron Paramagnetic Resonance (EPR).
Electrode	The pole or plate of an electrolytic cell by which the current enters or leaves the cell.
Electrolysis	Electrolysis is the process of the passage of an electric current through a solution with simultaneous chemical changes either in the electrodes or in the solutions in contact with the electrodes, or both.

Electron	The most elementary negatively charged particle, which is the constituent of all matter. It is the electrical opposite of the proton. Its mass is approximately 1/1845 of that of the proton. Electrons constitute cathode rays and beta rays, and are emitted by hot bodies.
Embryo	A young organism in the early stages of development used also to describe the part of the cereal grain from which plant and root originate.
Empirical	Depending on experience or observation alone.
Emulsion	The product of the dispersion of one liquid in another liquid, the dispersed phase particles being larger than colloidal size.
Endoenzyme	An enzyme that acts on or is retained within the cell producing it
Endogenous	Endogenous means 'arising from within', such as natural antioxidants in beer. The opposite of endogenous is exogenous.
Endonuclease	An enzyme that breaks nucleic acids at specific interior bonding sites, thus producing nucleic acid fragments of various lengths. Cf. Exonuclease.
Endosperm	The nutritive tissue formed within the embryo sac in seed plant.
Enzyme	A catalyst made by a living cell. The brewer often supplements the natural enzymes of malt and grist with industrial enzymes, which are extracted from plants or prepared by letting selected organisms "ferment", specially formulated media.
Equilibrium	A condition in which all acting influences are canceled by others, resulting in a stable, balanced, or unchanging system
Escherichia coli (E. coli)	A bacterium that inhabits the intestinal tract of most vertebrates. Much of the work using recombinant DNA techniques has been carried out with this organism because it has been genetically well characterized.
Essential	Any one of a class of odoriferous, volatile liquids, Oil insoluble in water, which are obtained from plants to which they impart odors and other characteristic properties.
Ester	Product of a reaction between an acid and alcohol.
Eukaryote	A cell or organism containing a true nucleus, with a well-defined membrane surrounding the nucleus. All organisms except bacteria, viruses, and blue-green algae are eukaryotic. Cf Prokaryote.
Evaporation	The loss of water or volatile substances from liquids or solids.
Exoenzyme	An enzyme, such as a digestive enzyme, that functions outside the cell from which it originates
Exon	In eukaryotic cells, the part of the gene that is transcribed into messenger RNA and encodes a protein. See also intron, splicing.
Exonuclease	An enzyme that breaks down nucleic acids only at the ends of polynucleotide chains, thus releasing one nucleotide at a time, in sequential order. Cf. Endonuclease
Expression	In genetics, manifestation of a characteristic that is specified by a gene. With hereditary diseases, for example, a person can carry the gene for the disease but not actually have the disease. In this case, the gene is present but not expressed. In industrial biotechnology, the term is often used to mean the production of a protein by a gene that has been inserted into a new host organism.
Extract	The total solids contained in a liquid, (e.g., wort).
Facilitated diffusion	The diffusion of substances across a biological membrane by means of membrane-spanning carrier molecules that transport substances that otherwise would diffuse slowly or not at all. Also called enhanced diffusion across membranes.

Fahrenheit	Thermometer scale having 180 divisions between Scale freezing (32°F.) and boiling (212°F.) of water.
False	The slotted or perforated, liftable plates in the Bottom straining tank, forming a support for the grains, a few inches above real bottom of strainer. the diffusion of substances across a biological membrane by means of membrane-spanning carrier molecules that transport substances that otherwise would diffuse slowly or not at all
Fermentation	A process of growing microorganisms for the production of various chemical or pharmaceutical compounds. Microbes are normally incubated under specific conditions in the presence of nutrients in large tanks called fermenters
Filter Mass	Prepared cotton used for beer filtration, at times containing synthetics.
Finings	Materials to clarify beer, for instance, isinglass.
Flocculation	The process by which small particles of fine soils and sediments aggregate into larger lumps
Flow Cytometry	Flow cytometry is a technique for counting, examining, and sorting microscopic particles such as yeast cells suspended in a stream of fluid. It allows analysis of the physical and/or chemical characteristics of single cells (Such as: cell volume, shape of the nucleus, the amount and type of cytoplasmic granules or the membrane roughness) flowing through an optical and/or electronic detection apparatus.
Flue	An enclosed passage for a current of air, gases, etc., as in a chimney.
Forcing	Unordinary speeding up of process, especially the germinating process.
Forcing Test	Method of estimating the shelf stability of packaged beer by measuring the increase in chill haze caused by 5-7 day storage at elevated (40-60°C.) temperatures. Results should be used with caution estimates should be checked against shelf-stability in the field.
Fore Masher	Device to moisten the crushed malt before entering the mash tank also called "Pony" masher.
Free Amino Nitrogen (FAN)	Also known as free alpha-amino nitrogen. A term used to describe the collective group of amino acids and small peptides in wort. Used as an index of the amount of nitrogenous nutrient available for yeast growth during fermentation. (Abbr. FAN).
Free Radical	An atom, which possesses one unpaired electron. Also know as a "radical".
Friability	Ease of pulverizing, mellowness.
FTU	Formazin turbidity units, used for the measurement of beer turbidity
Fungal enzymes	Enzymes created by a fungus
Fungi	Eukaryotes possessing a cell wall. Fungi cannot conduct photosynthesis and they feed on organic matter. Fungi include mushrooms and molds.
Fungus	(Plural: Fungi) A Eukaryote possessing a cell wall. Fungi cannot conduct photosynthesis and they feed on organic matter. Fungi include mushrooms and molds.
Fusel Oil	A mixture of amyl alcohol, isoamyl alcohol and some lower alcohol and their esters.
Fusion	Joining of the membrane of two cells, thus creating a daughter cell that contains the nuclear material from parent cells. Used in making hybridomas. (See Protoplast)
Gallon	Liquid volume measure: One U.S. gallon = 3.785 liters. One British (Imperial) gallon = 4.546 liters

Gas	A state in which the volume of a substance changes in direct proportion to its absolute pressure and its absolute temperature. In the gaseous state a given volume of any substance contains the same number of atoms or molecules.
Gas Volume	Volume of carbon dioxide in beer compared to beer of Beer liquid volume.
Gelatinize	To bring the starch into a jelly-like consistency during mashing.
Gene	A segment of chromosome. Some genes direct the synthesis of proteins, while others have regulatory functions.
Gene mapping	Determination of the relative locations of genes on a chromosome.
Gene sequencing	Determination of the sequence of nucleotide bases in a strand of DNA.
Gene therapy	The replacement of a defective gene in an organism suffering from a genetic disease. Recombinant DNA techniques are used to isolate the functioning gene and insert it into cells. Over three hundred single gene disorders have been identified in humans. A significant percentage of these may be amenable to gene therapy.
Genetic code	The mechanism by which genetic information is stored in living organisms. The code uses sets of three nucleotide bases (codons) to make the amino acids that, in turn, constitute proteins.
Genetic engineering	A technology used to alter the genetic material of living cells in order to make them capable of producing new substances or performing new functions.
Genome	The total hereditary material of a cell, comprising the entire chromosomal set found in each nucleus of a given species.
Genotype	Genetic make-up of an individual or group. Cf. Phenotype.
Genus	A group of related species.
Germination	Beginning of vegetation or growth in seeds.
Gibberellic Acid	Is an additive often used in malting to assist the penetration of water into the grain.
Globulins	In the American classification of proteins, the globulins are simple proteins, insoluble in water, but soluble in dilute neutral solutions of salts of strong acids and strong bases. Example: serum globulin and edestin of hemp seed.
Glucose	A monosaccharide; occurs free or combined and is the most common sugar. Also know as cerelese; D-glucopyranaseC <sub>6</sub> H <sub>12</sub> O <sub>6</sub> .
Gluten	The viscid substance which gives adhesiveness to dough. an insoluble protein.
Glycogen	A white, amorphous, tasteless carbohydrate, related to starch and dextrin. One of the constituents of the yeast cell.
Glycolysis	Glycolysis is the term referring to the breakdown of sugars and in the case of brewing it gives us pyruvate and the release of energy in the form of ATP. Glycolysis converts one molecule of glucose into two molecules of pyruvate, along with "reducing equivalents" in the form of the coenzyme NADH. The overall reaction of glycolysis is: Glucose + 2 NAD <sup>+</sup> + 2 ADP + 2 Pi --> 2 NADH + 2 pyruvate + 2 ATP + 2 H <sub>2</sub> O + 2 H <sup>+</sup> So, for simple fermentations, the metabolism of 1 molecule of glucose has a net yield of 2 molecules of ATP.
Grant	A horizontally placed vessel between straining tank and brew kettle, to facilitate the straining of the wort.
Grist	Grain to be, or that has been, ground
Grits	Hulled and coarsely ground grain. especially coarse hominy.
Gruit	Gruit is an old-fashioned herb mixture used for bittering and flavoring beer, popular before the extensive use of hops. Gruit or grut ale may also refer to the beverage produced using gruit.

Gum	Any one of a class of colloidal substance exuded by, or extracted from, gum plants.
Gum Arabic	A mixture of several gums, the best being that obtained from Acacia Senegal. it is usually completely soluble in water.
Gushing	A sudden copious outflow of foam from beer upon opening of the container
Gypsum	Sulfate of lime combined with water forms gypsum. Plaster of Paris is burnt gypsum, or gypsum freed from one half of its water content.
Haploid	A cell with half the usual number of chromosomes, or only one chromosome set. Sex cells are haploid. Cf. diploid.
Hardness (of)	Water's component of soluble calcium and magnesium salts equals water) hardness. It is usually expressed in terms of calcium carbonate equivalents. Some calcium in the brewing water is desirable for the protection and stimulation of malt enzymes. Elsewhere in the brewery, hardness results in the deposition of hard scale when water is heated or evaporated, and is therefore undesirable.
Head (of beer)	The foam on beer.
Hefeweizen	Hefeweizen is a cloudy, light, fruity wheat ale.
Helical structures	Of or having the shape of a helix. spiral
Heredity	Transfer of genetic information from parent cells to progeny.
Hexane	A colorless flammable liquid, $C_6H_{14}$ , derived from the fractional distillation of petroleum and used as a solvent and as a working fluid in low-temperature thermometers
Hogs Head	54 Imperial Gallons
Hominy	A dry corn product made by breaking the kernel into particles of even size, larger than those usually called "grits" in brewing.
Homologous	Corresponding or alike in structure, position, or origin.
Hoop	A circular band, of metal, wire or wood, used to hold the staves of a barrel together.
Hop Jack	A hop strainer.
Hop Nose	The fragrant odor of hops in beer.
Hop Petals	The small leaves projecting from the spindle of the hop cone, consisting of bracts and bracteoles.
Hormone	A chemical which is secreted by an endocrine gland in small amounts directly into the blood stream and greatly influences the functions of some specific organ and frequently of the body as a whole. Hormones are also secreted in plants.
Hormone	A chemical, often a polypeptide, that acts as a messenger, relaying instructions to stop or start certain physiological activities. Hormones are synthesized in one type of cell and then released to direct the function of other cell types.
Host	A cell or organism used for growth of a virus, plasmid, or other form of foreign DNA, or for the production of cloned substances.
Host-vector system	Combination of DNA-receiving cells (host) and DNA-transporting substance (vector) used for introducing foreign DNA into a cell.
Humidity	a. The absolute humidity is the amount of vapor actually present in the air and is expressed either in its expansive force, or in its weight per given volume. b. Relative humidity is the ratio of the quantity of vapor actually present, to the greatest amount possible at the given condition. Complete saturation of the air by a vapor is designated as Humidity 100.
Humulene	An essential hop oil

Humulones	Hop bittering compound
Hybridization	Production of offspring, or hybrids, from genetically dissimilar parents. The process can be used to produce hybrid plants (by cross-breeding two different varieties) or hybridomas (hybrid cells formed by fusing two unlike cells, used in producing monoclonal antibodies). The term is also used to refer to the binding of complementary strands of DNA or RNA.
Hybridoma	The cell produced by fusing two cells of different origin. In monoclonal antibody technology, hybridomas are formed by fusing an immortal cell (one that divides continuously) and an antibody-producing cell. See also Monoclonal antibody. Myeloma.
Hydration	A special case of solvation, where water is the solvent.
Hydrogen	An element commonly isolated as a colorless, tasteless, odorless gas, inflammable and lighter than any other element.
Hydrogen Ion	The concentration of hydrogen ions in a solution in Concentration gramionic weights per liter. See pH.
Hydrolysis	A chemical process of decomposition involving addition of water.
Hydrolytic	Decomposition of a chemical compound by reaction with water, such as the dissociation of a dissolved salt or the catalytic conversion of starch to glucose
Hydrolyze	To subject to or undergo hydrolysis
Hydrometer	A floating instrument for determining specific gravities. especially of liquids and solutions. It is usually a hollow glass or metal instrument, weighted at one end so as to float upright. The stem of the instrument is graduated so as to indicate the gravity of the liquid. Many instruments, for use with specific solutions, have arbitrary scales and are usually known by the names of the inventors, such as Balling and Plato.
Hydrophilic	Having an affinity for water; readily absorbing or dissolving in water
Hydrophobic	Repelling, tending not to combine with, or incapable of dissolving in water
Hygrometer	An apparatus for measuring the degree of moisture of the atmosphere.
Hygroscopic	Readily absorbing, becoming coated with, and retaining moisture, but not enough to make a liquid.
Immunity	Non-susceptibility to a disease or to the toxic effects of antigenic material.
Impregnate	To infuse particles of one substance into the mass of another substance.
In vitro	Literally, "in glass". Performed in a test tube or other laboratory apparatus.
In vivo	In the living organism.
Indicator	A substance, which by some visible change, such as a change of color, indicates the condition of a solution as to the presence of free acid, alkali, or other substances. Indicators are employed in volumetric (titrimetric) analysis to indicate the end points of reactions.
Infection	The presence of undesired or foreign micro-organisms in a culture medium or system.
Infusion	1. Infusion refers to the steeping in liquid to extract some qualities. Example is: Steeping samples of diatomaceous earth or brewing salts in warm water and doing a quality check on the resultant aromas and/ or taste. 2. When mashing malt and water there may be reference to an "Upward Infusion". This is a mashing process where heating is accomplished via additions of boiling water or by increasing heat via steam heating jackets
Initial Mashing	The temperature at which malt and water are brought together at Temp commencement of mashing.

Inoculation	The introduction of minute organisms, like yeast or bacteria to culture media.
Inorganic	Designating, or pertaining to, the branch of chemistry which deals with substances of earthy or mineral matter. It includes the treatment of all substances with the exception of those classed as organic.
Iodine	A non-metallic element of the halogen group.
Iodine Test	In brewing this test is generally used to check on the degradation of starch to dextrans and malt sugar. Iodine turns from a yellow to dark blue, purple or red with various starches and dextrans, but not with sugars.
Ion	A particle bearing an electric charge which is formed when a neutral atom, or group of atoms, loses or gains one or more electrons. Loss of electrons results in positive charges producing a cation. gain of electrons results in the formation of an anion with negative charges.
Ion-exchangers	The giving and receiving of ions between an ion exchange material and a process liquid
Irish Moss	Is dried red marine algae <i>Chondrus crispus</i> . Irish Moss is a seaweed derivative that is used as a clarifying agent. It is added to the kettle and boiled for the duration of the boil. It enhances the coagulation of proteins and their complexes. It becomes part of the trub in the hot wort tank
Isinglass	A semi-transparent, whitish and very pure form of gelatine, prepared from the air-bladders of certain fish, originally sturgeons, now largely cod, ling and carp.
iso-alpha-acids	Primary hop bittering compound in beer
Iso-electric Point	pH value at which the electrical charge of an amino acid is zero.
Isohumulones or Iso-alpha Acid	Isomerized form of alpha acids from hops. Isohumulone content is related to the hop bitterness of beer.
Isomerization	In the case of hops, this is the transformation from an insoluble to a soluble form of the alpha acids under boiling conditions. For example humulone is transformed into isohumulone
Keg	A single concentric aperture container in aluminum and stainless steel, ranging in size from 5 liters (1.1 Imp. Gallon) to 170 liters (36 Imp. Gallon). Originally designed for automated processing, improved dispensing and extending the shelf life of filtered beers by dispensing under inert gas (CO <sub>2</sub> and/or N <sub>2</sub> ) pressure.
Kernel	The whole grain or seed of a cereal or the inner portion of a seed.
Kieselguhr	Natural diatomaceous earth.
Kiln	A stove or furnace for hardening, burning or drying materials, such as bricks, grains, or hops.
Krauesen	Used to refer to the foamy head that builds on top of the beer during fermentation at about the third day. Krauesening refers to the addition of actively fermenting wort to a previously fermented beer at about 10% of the latter's volume. The fermenter containing the combined worts is bunged to retain CO <sub>2</sub> gas. Also an advanced method of priming. The word is pronounced as "kroy-zen".
Laboratory	A place to test the raw, intermediate and finished products.
Lager	To age, to store, frequently while a slow after or secondary fermentation process under bunging pressure is taking place. Lager means storage in German.
Lauter Tub	Vertical and usually cylindrical, straining tank having a false bottom for separating the wort from the spent grains.
Lautering	The separation of sweet wort from spent grains



Leaching	Removal of dissolvable matter from its mixture with an insoluble solid. major part occurring during mashing
Library	A set of cloned DNA fragments.
Ligase	An enzyme used to join DNA or RNA segments together. They are called DNA ligase or RNA ligase, respectively.
Lignin	A plant material which, in conjunction with cellulose, forms the cell walls and the cementing material between them in woods and many plants.
Lime	A caustic, highly infusible solid, white when pure, chemically $\text{CaO}$ , obtained by calcining limestone shells or other forms of calcium carbonate. called also quicklime, burnt lime, caustic lime. quicklime develops great heat when treated with water. forming slacked lime.
Linkage	The tendency for certain genes to be inherited together due to their physical proximity on the chromosome.
Lipase	Any of a class of enzymes that accelerate the hydrolysis of fats to fatty acids and glycerol.
Lipid oxidation	Lipids in biological systems that have oxidized, leading to deterioration
Lipids	Any of a group of organic compounds, including the fats, oils, waxes, sterols, and triglycerides, that are insoluble in water but soluble in nonpolar organic solvents, are oily to the touch, and together with carbohydrates and proteins constitute the principal structural material of living cells
Liquefaction	The act or process of transforming any substance into a liquid, especially the conversion of a solid into a liquid by heat, or of a gas into a liquid by cooling or pressure.
Lupulin	The fine, yellow, resinous powder on the strobile of hops.
Lupulone	A hop beta-acid
Luster	Fact or quality of shining with reflected light. shine or sheen. gloss.
Lysis	Breaking apart of cells.
<b>M</b> aize	Indian corn.
Malting	Steeping, germinating and drying grains, particularly barley.
Maltose	A crystalline sugar $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ formed from starch by the action of amylase. It is dextrorotatory and the main source of fermentable extract in brewing.
Mash tun	Vessel used for mashing
Medium	Medium is a term in brewing microbiology. It is a growth medium or culture medium designed to support the growth of microorganisms or cells. The most common growth media for microorganisms are nutrient broths and agar plates.
Meiosis	Process of cell reproduction whereby the daughter cells have half the chromosome number of the parent cells. Sex cells are formed by meiosis. Cf. Mitosis.
Melanoidan	Melanoidans can exist in both an oxidized and a reduced state. The key is the extent to which the hot wort has been aerated before cooling. Excessive agitation or turbulent transfer of hot wort will oxidize most of the melanoidins. Properly prepared wort, in contrast will leave most of the melanoidins in a reduced state. In their reduced state, melanoidins act as powerful anti-oxidants. In their oxidized state, the melanoidins have the exact opposite effect. Because dark malts are rich in melanoidins, some dark beers have extraordinary flavor stability. However a high melanoidins content is very much a double edged sword and dark beers prepared using poor wort production procedures can be highly unstable.

Messenger RNA (mRNA)	Nucleic acid that carries instruction to a ribosome for the synthesis of a particular protein.
Metabolism	The sum of the processes concerned in the building up of protoplasm and its destruction incidental to life. the chemical changes in living cells, by which the energy is provided for the vital processes and activities and new material is assimilated to repair the waste.
Metabolism	All biochemical activities carried out by an organism to maintain life.
Microbial herbicides/pesticides	Microorganisms that are toxic to specific plants/insects. Because of their narrow host range and limited toxicity, these microorganisms may be preferable to their chemical counterparts for certain pest control applications.
Microbiology	Study of living organisms that can be seen only under a microscope.
Micron	0.001 millimeter.
Microorganism	Any organism that can be seen only with the aid of a microscope. Also called microbe.
Micro-organisms	Microscopic forms of life such as bacteria, yeast and molds.
Mildew	A thin, whitish growth produced on organic matter and on plants by fungi (as of the families Peronosporaceae).
Mineral	Any element or compound occurring naturally in the mineral kingdom as distinguished from occurrence in either the vegetable or animal kingdom.
Mineral Oil	Any oil of mineral origin as distinguished from plant and animal oils. The mineral oils include such materials as petroleum, shale oil, or oil obtained from them by distillation. They are essentially mixtures of hydrocarbons.
Mitosis	Process of cell reproduction whereby the daughter cells are identical in chromosome number to the parent cells. Cf. Meiosis.
Modification	The extent to which the barley endosperm breaks down during malting
Mold	A growth, often wooly in appearance, produced by saprophytic fungi on various forms of organic matter, especially when damp or decaying.
Molecule	Two or more atoms bound together chemically.
monomer	A molecule that can combine with others to form a polymer
morphology	The branch of biology that deals with the form and structure of organisms without consideration of function
Mutagen	A substance that induces mutations.
Mutant	A cell that manifests new characteristics due to a change in its DNA.
Mutation	A sudden random change in the genetic material of a cell.
Mycelium	The mass of interwoven filaments of a fungus forming the vegetative portion of the thallus.
<b>NAD</b>	Nicotinamide adenine dinucleotide (NAD) and nicotinamide adenine dinucleotide phosphate (NADP) are two important organic coenzymes found in cells. NADH is the reduced form and NAD <sup>+</sup> is the oxidized form of NAD.
NADH	NADH is the reduced form of NAD
Nitrogen	A colorless, gaseous element, tasteless and odorless, constituting about four-fifths of the atmosphere by volume and a constituent of all living tissues.
N-nitrosodimethylamine	A chemical formed by direct-fire kilning of malt by the reaction of nitrogen oxides in the drying air with amines in green malt. It is generally anticipated to be a human carcinogen. FDA action levels for N-nitrosodimethylamine in barley malt beverages range from 5 to 10 ppb. (Abbr. NDMA)
Nuclease	An enzyme that, by cleaving chemical bonds, breaks down nucleic acids into their constituent nucleotides. See also Exonuclease.

Nucleic acids	Large molecules, generally found in the cell's nucleus and/or cytoplasm, that are made up of nucleotide bases. The two kinds of nucleic acid are DNA and RNA.
Nucleotide base	See Base.
Nucleotides	The building blocks of nucleic acids. Each nucleotide is composed of sugar, phosphate, and one of four nitrogen bases. The sequence of the bases within the nucleic acid determines which proteins will be made.
Nucleus	The structure within eukaryotic cells, bounded by a membrane, that contains an organism's chromosomes.
Oligonucleotide	A polymer consisting of a small number (about two to ten) of nucleotides.
Opalescent	Reflecting an iridescent light. having a milky iridescence.
Operator gene	A region of the chromosome, adjacent to the operon, where a repressor protein binds to prevent transcription of the operon.
Operon	Sequence of genes responsible for synthesizing the enzymes needed for biosynthesis of a molecule. An operon is controlled by an operator gene and a repressor gene.
Organic	Basically the chemistry of natural or synthetic carbon compounds with Chemistry carbon combining mainly with O, H, N, S, P.
Original extract	The percentage, by weight, of the total dissolved solids in wort. It is measured by a Balling scale that relates specific gravity to percent extract by weight. Each °Balling (or °Plato) unit represents 1.0% w/w dissolved extract in wort. In a beer, original extract is the amount of extract (dissolved solids) that was originally in the wort before fermentation and is roughly proportional to the sum of the carbohydrate and alcohol fractions of a beer. (Abbr. OE)
Original Gravity	The specific gravity of wort as calculated from the alcohol content and real extract of the beer. (Abbr. OG). The formula is :  $OG = \frac{[(ABW \times 2.0665) + RE] \times 100}{(ABW \times 1.0665) + 100}$ <p>(where ABW = alcohol by weight and RE = real extract)</p>
Osmotic	The pressure differential that exists between two solutions of different Pressure concentration when placed on opposite sides of a semi-permeable membrane.
Oxidases	Respiratory enzymes which catalyze oxidation changes.
Oxidation	In a broad sense, oxidation is the increase in positive valence or decrease in negative valence of any element in a substance. On the basis of the electron theory, oxidation is a process in which an element loses electrons. In a narrow sense, oxidation means the chemical addition of oxygen to a substance.
Oxygen	An element occurring free as a colorless, odorless, tasteless gas in the atmosphere, of which it forms about 23% by weight and 21% by volume, being slightly heavier than nitrogen.
Papain	A proteolytic enzyme obtained from the latex of papaya used by brewers to increase the stability of their beer.
Pasteurization	Exposure of coldest point in packaged beer to 140°F or 60°C., for one Unit (PU) minute.
Pathogen	Disease-causing organism.

Pectin	A group of substances which consists entirely of a long chain of galacturonic acid units, some of which are esterified with methyl alcohol. water dispersible. In the presence of acids and sugar, pectin forms the basis of household jellies.
Pentosan	Any one of a group of anhydro-pentose residues which generally occur as polysaccharides in plant materials and which can be hydrolyzed by acid to pentose sugars.
Pepsin	A proteolytic enzyme secreted in the stomach of higher animals, used as a digestive.
Peptide	Two or more amino acids joined by a linkage called a peptide bond.
Peptize	To bring into colloidal solution.
Peptonize	To digest or dissolve by a proteolytic ferment.
Permease	Any of a group of enzymes which mediate the phenomenon of active transport. For example in the case of yeast, it refers to those enzymes which allow nutrients to be brought into the cell across the cell membrane
Peronospora	A hop disease, see "mildew."
peroxidase	Any of a group of enzymes that occur especially in plant cells and catalyze the oxidation of a substance by a peroxide
pH	The negative logarithm of the hydrogen ion concentration. pH values range from 0 to 14, below 7 being the acid range and above 7 the basic range.
Phenol	Any one of a series of aromatic hydroxyl derivatives which has the OH group directly attached to the benzene ring. Specifically the term phenol is applied to carbolic acid, C <sub>6</sub> H <sub>5</sub> OH.
Phenolic Off Flavor (POF)	Phenolic Off Flavor (POF) is a medicinal, clove like, spicy flavor that is actually not considered an off flavor in some beers, like Bavarian wheat beers. Wild yeast and some top fermenting yeasts carry the gene that converts ferulic acid to 4-vinyl guaiacol.
Phenotype	Observable characteristics, resulting from interaction between an organism's genetic make-up and the environment. Cf. Genotype.
phosphate	A salt or ester of phosphoric acid
Phosphates	Source of phytic acid created during malting and during the decoction or step-infusion mashes. Phosphates contribute to the acidulation of the mash.
Phosphorylation	Phosphorylation is the addition of a phosphate (PO <sub>4</sub> ) group to a protein or a small molecule.
Photochemical	The chemistry of the effects of light on chemical systems
Photometer	An instrument which measures the intensity of light. (See Spectrophotometer).
Photosynthesis	Conversion by plants of light energy into chemical energy, which is then used to support the plants' biological processes.
Pin	4.5 Imp. Gallons
Pitching	To add yeast to wort.
Plasma	The fluid (noncellular) fraction of blood.
Plasmid	A small circular form of DNA that carries certain genes and is capable of replicating independently in a host cell.
Plastic	A substance capable of or the property of being deformed continuously and permanently in any direction without rupture, under a stress greater than the yield value.
Polyclonal	Derived from different types of cells. Cf. Monoclonal.
Polymer	A long molecule of repeated subunits.
Polymerase	General term for enzymes that carry out the synthesis of nucleic acids.

Polymerization	The bonding of two or more monomers to form a polymer
Polypeptide	Long chain of amino acids joined by peptide bonds.
Polyphenols	Water soluble phenolic compounds
Polysaccharides	Polysaccharides are non-charged polymers with more than 10 sugar units bound through their acetal functional groups
Precipitate	To separate in solid form, as from a solution. A substance separated from a solution.
Precipitation	The process of separating a substance from a solution as a solid
Preserve	To keep from decaying.
Prokaryote	An organism (e.g. bacterium, virus, blue-green alga) whose DNA is not enclosed within a nuclear membrane. Cf. Eukaryote.
Promoter	A DNA sequence that is located in front of a gene and controls gene expression. Promoters are required for binding of RNA polymerase to initiate transcription.
Propagate	To be produced or multiplied by generation. To cause to spread, to multiply as by seeds, cuttings, etc.
Protease	Proteolytic enzyme which breaks down high molecular weight proteins into lower molecular weight. Proteases in malt are active during the protein rest at 40°C.-55°C. in the mash. Commercial proteases of plant, fungi, or bacterial origin are used in the brewhouse to supplement malt protease and more prominently in the cellar to chillproof the beer.
Protein	Any one of a class of naturally occurring compounds containing carbon, hydrogen, oxygen, nitrogen, often sulfur, phosphorus, occasionally iron and a few other elements. They are essentially very complex combinations of amino acids and are constituents of all living cells, both animal and vegetable. Since most proteins contain about 16% nitrogen, it is customary in analytical chemistry to multiply the total nitrogen by the factor 6.25 in computing the percent of protein in a sample.
Protein	A molecule composed of amino acids. There are many types of proteins, all carrying out a number of different functions essential for cell growth.
Proteolytic	Relating to, characterized by, or promoting proteolysis
Protoplasm	The essential substance both of the cell body and nucleus of cells of animals and plants. Protoplasm ordinarily is a viscous translucent material, holding fine granules in suspension.
Protoplast	The cellular material that remains after the cell wall has been removed.
Pure culture	In vitro growth of only one type of microorganism.
Pycnometer	Narrow mouth flask used to determine the specific gravity of wort or beer.
Pyruvate	Pyruvate (or sometimes pyruvic acid) is a major intermediary organic compound in the pathway that takes us from sugars to alcohol.
Pyruvic acid	Pyruvic acid (or sometimes pyruvate) is a major intermediary organic compound in the pathway that takes us from sugars to alcohol.
Radical	An atom which possesses one unpaired electron. Also know as a "free radical" .
Radicle	The lower portion of the axis of an embryo seedling.
Rancid	Having a smell or taste of stale fats or oils.
Real degree of fermentation	A measure of the extent to which the extract (dissolved solids) in a wort has been fermented. It is roughly the difference between the extract in the original wort and the real extract of the beer, divided by the original extract. (Abbr. RDF)

Real Extract	The actual extract (dissolved solids) of a beer devoid of alcohol and carbon dioxide. It is proportional to the carbohydrate content of beer. (Abbr. RE). The formula is:  $RE = \frac{G \times \text{sp gr of dealcoholized beer}}{\text{sp gr of beer}}$ <p>(where G = g extract in 100 g solution of dealcoholized beer)</p>
Reaumur	Thermometric scale in which 0° marks the freezing point and 80° the boiling point of water.
Recombinant DNA (rDNA)	The DNA formed by combining segments of DNA from different types of organisms.
Reducing	A chemical reagent which brings about the reduction of some other Agent substance and is itself simultaneously oxidized. See reduction and oxidation.
Reducing sugars	Yeast-fermentable carbohydrates, including glucose, maltose, maltotriose, fructose, and sucrose. These sugars make up less than 2% of barley malt and adjunct grains, yet they compose the entire family of yeast-fermentable carbohydrates in wort.
Reduction	In a narrow sense reduction means the decrease in the oxygen content, or in the increase in the hydrogen content of a substance. In a broad sense, reduction is the decrease in positive valence or the increase in negative valence of an element.
Refractive index	A property of a material that changes the speed of light, computed as the ratio of the velocity of light in a vacuum to that through the material.
Refractometer	An optical instrument for measuring the refractive index of a substance. Invented by German physicist Ernst Abbe in 1869, the current instrument is very similar to the refractometer first described and illustrated by Abbe in 1874.
Refrigerant	Substance such as ammonia, fluorocarbons (e.g., Freon) and less frequently CO <sub>2</sub> and SO <sub>2</sub> capable of removing heat from their surroundings by boiling at the desired temperature under economical and safe operating conditions. Also see "Brine."
Regulatory gene	A gene that acts to control the protein-synthesizing activity of other genes.
Replication	Reproduction or duplication, as of an exact copy of a strand of DNA.
Repressor	A protein that binds to an operator adjacent to a structural gene, inhibiting transcription of that gene.
Resin	A solid or semi-solid, amorphous (non-crystalline) organic substance which does not soften at any definite temperature. The natural resins are chiefly of plant origin usually yellowish to brown in color, soluble in alcohol. They are chiefly excretion products and exude from plants alone or as mixtures with essential oils, with gums, etc.
Respiration	1 The sum total chemical reactions in living cells which release energy. 2. The aggregate of those processes by which oxygen is introduced into the system and carbon dioxide removed.
Restriction enzyme	An enzyme that breaks DNA in highly specific locations, creating gaps into which new genes can be inserted.
Ribonucleic acid (RNA)	A molecule similar to DNA that functions primarily to decode the instructions for protein synthesis that are carried by genes. See also Messenger RNA. Transfer RNA.
Ribosome	A cellular component, containing protein and RNA, that is involved in protein synthesis.

Ribozyme	An enzyme made of RNA rather than protein. "Designer" ribozymes which can cut RNA molecules at specific points are known as "gene shears".
RNA	Ribonucleic acid.
Roasted Malt	Malt used for coloring purposes.
Rousing	Turbulent action in a liquid caused by mechanical agitation or introduction of a gas.
Ruh (G)	Period of storage after main fermentation.
Rust	A parasitic fungus on plants. Also the oxidation of iron.
Saccharometer	Any device for measuring the amount of sugar in a solution. A specially calibrated hydrometer.
Saladin System	Compartment malting system as designed by Saladin.
Salt	A class of compounds formed when the hydrogen of an acid is partly or wholly replaced by a metal or a metallic radical. Specifically, the term salt is applied to sodium chloride, NaCl.
Saponifi-	The treatment of a fatty acid with an inorganic base (caustic soda) to form a salt (soap) and an alcohol (glycerin).
Sarcina	Undesirable microorganism from brewing standpoint. Classified as <i>Pediococcus cerevisiae</i> .
Saturated	A solution which contains any constant temperature as much dissolved substance as it can possibly hold in presence of solid solute.
Seed Yeast	Yeast used to start fermentation in a brew.
Silicates	Compound of metal(s), silicon, and oxygen
Silo	A tower shaped structure for storage of materials.
Slurry	A thin mixture of water and insoluble solids.
Soap	A sodium or potassium salt of a fatty acid of high molecular weight.
Solid	A state of matter as distinguished from liquid or gas.
Solubility	The quantity of solute present in a given amount of the saturated solution, at a certain temperature, is called the solubility of the solute.
Solute	When a solid is dissolved in a liquid, the solid is termed the solute, the liquid the solvent. When one liquid is dissolved in a second liquid, the liquid present in the smaller amount is usually called the solute. In this case, the designation is arbitrary, particularly when the liquids are completely miscible.
Solution	A homogeneous mixture formed by the process in which a substance, whether solid, liquid or gaseous is dissolved into a liquid (or by extension, with a solid, or gas) called the solvent. The term is usually associated with liquids, but may include solids, as in alloys, or gaseous mixtures.
Solvents	A liquid substance capable of dissolving other substances
Sorghum	Any representative of the genus (sorghum) or tropical cereal grasses.
Sparge	To distribute water over grains or hops in order to wash out extract.
Species	A subdivision of a genus.
Specific gravity	A measure of the density of a liquid or solid compared to that of water (1.000 at 4°C). (Abbr. sp gr)
Spectrophotometer	A photometer (a device for measuring light intensity) that can measure color intensity as the function of the wavelength of light.
Spigot	A faucet used to regulate the flow of liquids from the bung hole of a barrel.
Spiles	Small, wooden pegs or plugs, used to close vent holes in barrels.

Splicing	The removal of introns and joining of exons to form a continuous coding sequence in RNA.
Starch	A white, odorless, tasteless, granular or powdery complex carbohydrate. It gives a deep blue color with iodine.
Steam Beer	Top fermenting beer of very high carbon dioxide content, originated in California.
Steam jacket	Enclosed structure through which steam is circulated, surrounding a tank or kettle
Steeping	To prepare grain for germination by soaking in water, usually to 45% moisture.
Sterile	Free from living microorganisms, as bacteria, or their visible spores.
Streptococci	A bacterium
Structural gene	A gene that codes for a protein, such as an enzyme.
Substrate	The substance upon which an enzyme acts.
Substrate	Material acted on by an enzyme.
Sugar	Any of a group of carbohydrate compounds of relatively low molecular weight and comprised of not to exceed three monosaccharide units. They may be monosaccharide such as dextrose, disaccharide such as maltose or trisaccharide such as raffinose.
sulfhydryl groups	Also called thiol, is contained in a reduced state within coenzyme A, lipoamide, glutathione, cysteine, and mercaptans
Suppressor gene	A gene that can reverse the effect of a mutation in other genes.
Suspension	The state of a solid when its particles are mixed with, but undissolved in, a fluid or another solid. a two-phase system consisting of a finely divided solid dispersed in a solid, liquid or gas.
Synthesis	Artificial production of (esp. organic) substances from simpler ones
Tannin	A strongly astringent substance obtained from gall nuts, sumac, etc., used in chillproofing of beer. Also present in hops and malt in small amounts.
Template	A molecule that serves as the pattern for synthesizing another molecule.
Tensile	The greatest longitudinal stress a substance can withstand without rupture.
Thermo-	Two bars or wires of dissimilar metals joined at one extremity which Couple develop a current (thermoelectric current) when heated.
Thermo-Bacteria	Heat resistant microorganisms undesirable in brewing.
Titration	A method, or the process, of using a standard solution to determine the strength of another solution.
Total acidity	Also known as "titratable acidity," total acidity is the total amount of all hydrogen ions in a solution or beverage (such as beer, wine, must, or juices). It is the measure of all aggregate acids and the sum of all volatile and fixed acids.
Toxin	A poisonous substance produced by certain microorganisms.
trans-2-nonenal	Chemical producing a papery or cardboard-like flavor in beer
Transcription	Synthesis of messenger (or any other) RNA on a DNA template.
Transfer RNA (tRNA)	RNA molecules that carry amino acids to sites on ribosomes where proteins are synthesized.
Transformation	Change in the genetic structure of an organism by the incorporation of foreign DNA.



Transgenic organism	An organism formed by the insertion of foreign genetic material into the germ line cells of organisms. Recombinant DNA techniques are commonly used to produce transgenic organisms.
Translation	Process by which the information on a messenger RNA molecule is used to direct the synthesis of a protein.
triploid	Having three times the haploid number of chromosomes in the cell nucleus
Tristimulus analysis	A method for the determination of packaged beer color, based on the CIE system (the universally accepted standard for color specifications and measurement) developed by the Commission Internationale de l'Eclairage of France. The CIE system
tRNA	Transfer RNA.
Trub (G)	The haze or flock appearing in wort by boiling or cooling.
Try Cock/Test Cock	Sampling device.
Tubing	A term sometimes referring to the 'transfer' of beer
Turbidity	Sediment; particles stirred up or suspended in beer.
<b>U</b> nderdough	The sludge contained between the false bottom and the real bottom of a straining tank. It consists of rather hard parts of the mash and contains at times considerable amounts of starch.
Upperdough	The sludge on top of the layer of grains in a straining tank, consisting of finely divided light particles, mostly coagulated protein.
<b>V</b> acuole	A cavity or vesicle in the protoplasm of a cell, containing a watery fluid.
Vat	Usually a fermenting or storage vessel.
Vector	The agent (e.g. plasmid or virus) used to carry new DNA into a cell.
Vegetable Oil	Any oil from plant origin.
Vent Hole	A small hole to allow air to escape.
Vicinal diketones (VDK)	Diacetyl and pentanedione together are called vicinal diketones because they contain two ketone (oxo-) groups on adjacent (vicinal) carbon atoms. They occur as two significant by-products of fermentation because their oxohydroxy precursors can pass through the yeast cell membrane into the beer. The precursor of diacetyl is alpha-acetolactate, and the precursor of 2,3pentanedione is alpha-ketobutyrate. These hydroxyl acid precursors are produced as intermediates in the biosynthesis of the amino acids valine (for diacetyl) and isoleucine (for pentanedione).
Virulence	Ability to infect or cause disease.
Virus	A submicroscopic organism that contains genetic information but cannot reproduce itself. To replicate, it must invade another cell and use parts of that cell's reproductive machinery.
Viscosity	The resistance offered by a fluid (liquid or gas) to flow. The viscosity is a characteristic property and is a measure of the combined effects of adhesion and cohesion.
Vitamin	Any one of a group of constituents of most foods in their natural state which are essential for normal nutrition.
Volatile	In chemistry, any one of those acids which can be distilled from an Acid aqueous solution at atmospheric pressure, such as acetic, and butyric acid. Fixed acids such as tartaric, phosphoric, etc., cannot be removed by distillation.
Vortex	A mass of fluid, especially of a liquid, having a whirling or circular motion tending to form a cavity or vacuum in the center of the circle, and to draw in towards the center bodies subject to its action

<b>W<sub>ax</sub></b>	Any one of a class of substances of plant or animal origin, insoluble in water, partly soluble in alcohol, ether, etc., and miscible in all proportions with oils and fats. They consist of esters and often, in addition, free fatty acids, free alcohols and higher hydrocarbons.
Weevil	Any numerous (mostly small) beetles of a group (Rhynchophora) with snout-like heads. The larvae eat out the interior of nuts, fruits and grains.
Whirlpool	Round cylindrical flat bottom tank into which hot Tank wort from the brew kettle is pumped at high velocity and tangentially to its straight wall. This high speed stream causes the wort in the tank to rotate slowly and to deposit its trub in a more or less compact cone in the center of the tank.
Wort	The liquid obtained when malt enzymes attach a heated aqueous slurry of ground endosperm of malted and unmalted cereal.
<b>X-Ray</b>	Rays of short wavelengths ranging from 0.06 to 2 Angstrom units, which are emitted by suddenly changing the velocity of a moving electric charge by impact of a cathode ray on a target in a vacuum tube and by the changes in the atoms of the target caused by the impact. Also called Roentgen rays.
<b>Yeast</b>	A general term for single-celled fungi that reproduce by budding. Some yeasts can ferment carbohydrates (starches and sugars), and thus are important in brewing and baking.
Yeast Brink	Often used in larger breweries; a glycol cooled, agitated yeast brink has many advantages over other collection vessels. The agitation of glycol cooled slurry offers precision temperature control. A yeast brink allows for easy yeast washing and QC sampling as well as propagation. A yeast brink can either be mounted on a scale or fitted with a flow meter for delivering accurate and consistent re-pitching volumes.
Yeast Crop	Yeast collected from fermenters during or after the fermentation.
Yeast fermentable extract	The fractions of wort carbohydrates that yeast can use as sources of energy and carbon skeletons for anabolic purposes. For pure culture lager and ale yeasts, these are limited solely to mono-, di-, and trisaccharides, including fructose and glucose, taken up by passive diffusion; sucrose via extracellular hydrolysis into glucose and fructose; and maltose and maltotriose, both by active transport. The definition of "fermentable extract" can also be expanded to include starch and dextrans for yeast strains capable of producing extracellular amyolytic enzymes. Such strains include wild yeasts in lager or ale fermentations, beer styles naturally including such yeasts, or lager/ale yeasts genetically modified to produce amyolytic enzymes. (Abbr. YFE)
Yield of	Number of pounds of extract, obtained from 100 pounds of brewing material, given in percent. Also kilos extract per kilo brewing material. Distinguish between laboratory yield of malt and adjunct which is determined by standard ASBC methods and brewhouse yield, which depends on equipment and operating conditions. Brewhouse yield ranges from 92 to 98% of laboratory yields.
<b>Zwickel (G)</b>	A sampling port designed for ease of sample withdrawal from brewery tanks.
Zymase	A group of enzymes (originally found in yeasts and bacteria) which, in the presence of oxygen, convert glucose and a few other carbohydrates into carbon dioxide and water or, in the absence of oxygen, into alcohol and carbon dioxide or into lactic acid.