APPENDIX 9
GLOSSARY

Acronyms, objects, tools and other terms referred to in the chapters or appendixes of this caNanoLab User's Guide are described in this glossary.

Term	Definition
2D-circle	A ring-shaped structure with every point equidistant from the center.
2D-diamond	The shape has four distinct sides making a parallelogram with two inner obtuse angles and two inner acute angles.
2D-ellipse	A closed plane curve resulting from the intersection of a circular cone and a plane cutting completely through it, especially a plane not parallel to the base.
2D-parallelogram	A quadrilateral whose opposite sides are both parallel and equal in length.
2D-polygon	A closed plane figure bounded by straight sides.
2D-rectangle	A parallelogram with four right angles. A square is a special rectangle with four equal sides.
2D-square	A plane rectangle with four equal sides and four right angles; a four-sided regular polygon.
2D-trapezoid	A four-sided polygon with only two parallel sides.
2D-triangle	A three-sided polygon.
3D-cone	A shape whose base is a circle and whose sides taper up to a point.
3D-cube	An object that is comprised of six regular, solid, congruent square faces and has three equal axes at right angles to each other.

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Term	Definition
3D-cylinder	A surface formed by circles of a given radius that are contained in a plane perpendicular to a given axis, whose centers align on the axis.
3D-disc	A flat circular plate or anything with a similar shape.
3D-fibril	A small slender fiber or filament
3D-hexadron	Any polyhedron having six plane faces.
3D-needle	The geometry of an object that resembles a needle, meaning that it has a long slender cylindrical shape.
3D-oblate spheroid	The geometry of an object that is shaped like a spheroid compressed at the poles.
3D-polyhedron	A solid figure bounded by plane polygons or faces.
3D-prolate spheroid	A spherical shape that has a polar diameter that is longer than its equatorial diameter.
3D-rod	An object resembling a slender bar.
3D-sphere	A solid or hollow three-dimensional object bounded by a closed surface such that every point on the surface is equidistant from the center.
3D-tetrahedron	The geometry of an object which is comprised of a polyhedron containing four faces.
3D-tetrapod	The geometry of an object that consists of four rods in a tetrahedral arrangement.
activation effect	The result of having the sample undergo the process of activation. (i.e. cleavage of a bond, release from quenching or encapsulation)
activation method	The process that allows the sample to realize its intended functionality.
agent	An active power or cause (as principle, substance, physical or biological factor, etc.) that produces a specific effect.
antibody	A type of protein made by B-lymphocytes in response to a foreign substance (antigen). Each antibody only binds to a specific antigen, helping to destroy the antigen directly or by assisting white blood cells to destroy the antigen.
antigen	Any substance, generally a protein that stimulates the immune system and elicits an immune response. Recognition by the immune system elicits either a T-lymphocyte response, recognizing processed antigens, or a B-lymphocyte response, producing antibodies that bind to unprocessed antigens.

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Term	Definition
apoptosis	An active process of selective destruction of differentiated cells in multicellular organisms, apoptosis is one of two mechanisms by which cell death occurs (the other being necrosis, a pathological process). Important in ontogenesis, tumorigenesis, tissue turnover, lymphocyte selection and function, hormone-induced atrophy, etc., it serves as a balance to mitosis in regulating the size of animal tissues and in mediating pathologic processes associated with tumor growth. Apoptosis is responsible for physiological deletion of cells and appears to be intrinsically programmed. It is characterized by distinctive morphologic changes in the nucleus and cytoplasm, including chromatin cleavage at regularly spaced sites and endonucleolytic cleavage of genomic DNA (DNA fragmentation) at internucleosomal sites.
aspect ratio	The ratio between the longest and shortest dimension of an object.
associated element	An entity in the sample that is chemically associated with another entity in the sample.
attachment	The act of affixing one thing to another.
average diameter	The mean diameter of the fullerene component of a sample.
bioluminescence	The emission of light in an organism through a physiological process or in an experimental system that mimics the physiological conditions.
biopolymer	A type of polymer produced by living organisms.
blood contact	Assays that examine how the sample interacts with whole blood, blood-borne molecular components, platelets or red blood cells.
bulk phase	The substance in an emulsion that usually makes up the largest portion of the emulsion and contains another substance suspended within.
CFU_GM	A functional (qualitative) as well as quantitative assay that is utilized as an indicator of granulopoiesis reconstitution.
caspase 3 activation	Involves the induction of the activity of intracellular cysteine endopeptidase family members kept inactive by mitochondrial surface proteins (BcL-2 Family) and involved in initial signaling and downstream proteolytic cleavages (at P1 aspartic acids) in inflammation and apoptotic cell death when signals block BcL-2 function and activators initiate caspase cascades.
cell death method	The indication of how the cells died in a cytotoxicity experiment (necrosis or apoptosis).
cell viability	A cellular process that directly affects the ability of a cell to proliferate, grow, divide, or repair damaged cell components. (NCI)
chemical association	Any process of combining chemical entities that is dependent upon chemical forces.

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Term	Definition
charge	The quantity of unbalanced electricity in a body (either positive or negative) and construed as an excess or deficiency of electrons.
chemotaxis	The characteristic directional movement or orientation of an organism or cell along a chemical concentration gradient either toward or away from the chemical stimulus.
coagulation	The clotting of blood.
coat	A thin outer layer or film covering something.
colloid	A mixture of microscopic particles suspended in some sort of liquid medium.
colloid-emulsion	A suspension of liquid within another liquid or a dispersion consisting of two or more liquid phases.
colloid-gel	Jelly like material formed by the coagulation of a colloidal liquid.
colloid-sol	A colloid that has a continuous liquid phase in which a solid is suspended in a liquid.
complement activation	The complement system consists of more than 30 proteins engaged in host defense. It provides both an independent immune system capable of attacking microbes as well as other foreign material and an adjunct to the antibody system. Once activated, the complement system fires in a cascade-like fashion in which one component activates the next. Both swift and powerful, millions of complement components can deposit on an invading microbe within only a few minutes. Such a potent system requires strict regulation to avoid host injury. Membrane cofactor protein (MCP) is one critical regulator aimed at controlling inadvertent complement activation on host cells and nearly every cell examined expresses MCP on its cell membrane.
composing element	A distinguishable part of an entity. (i.e. a monomer found in a polymer, a terminal group for a dendrimer)
composition	The way in which the particle is made, especially in terms of its different parts; its constituents.
core	The center of an object; indispensable
covalent bond	A physical connection between two atoms or radicals in which a chemical bond is formed by sharing electrons.
critical concentration	The concentration of a solute or dispersion above which spontaneous aggregation or precipitation occurs.
cytokine induction	A class of soluble glycoproteins, which act nonenzymatically through specific receptors to regulate immune responses. Cytokines are derived from both immune and non-immune cells and are intercellular mediators that differ from hormones in that they are produced by a number of tissue or cell types rather than by specialized glands.
cytotoxicity	Examines the cell destruction and/or death caused by nanoparticles. It can be dependent upon the nanoparticle itself, the agent and dosage it carries, the target cell type, etc.

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Term	Definition
DNA	A long linear double-stranded polymer formed from nucleotides attached to a deoxyribose backbone and found in the nucleus of a cell; associated with the transmission of genetic information.
diagnostic imaging	Nanoparticles can be directed to exact regions of the body with agents, such as radioactive isotopes that display under imaging techniques.
diagnostic reporting	When nanoparticles are directed to particular regions in the body, such as tumors, they can be used for diagnostic reporting.
dispersed phase	The substance in an emulsion that is suspended or dispersed within another substance of greater volume.
electrostatic	The attraction between dissimilar exposed charges on two or more molecules.
emulsifier	A chemical substance that functions to stabilize an emulsion.
encapsulation	The process or condition of being enclosed.
enzyme induction	Involves initiation of function of a biological molecule (usually protein, RNA, or DNA) that possesses catalytic activity.
enzymatic cleavage	The breaking of chemical bonds in the sample by an enzyme.
fab	Part of an immunoglobulin antibody that binds a specific antigen and consists of both a light chain and part of a heavy chain. By comparison, natural antibodies consist of two heavy and two light chains. An FAB (fragment antibody) offers the advantages of smaller size and lower cross-reactivity compared to the complete antibody.
fluid	A continuous amorphous substance that tends to flow and to conform to the outline of its container (i.e., a liquid or a gas). Also used as an adjective to describe something with properties like that of a fluid.
fluid-gas	A fluid in the gaseous state having neither independent shape nor volume and being able to expand indefinitely.
fluid-liquid	A substance in the fluid state of matter having no fixed shape but a fixed volume.
fluid-vapor	The gaseous state of matter that is a solid or liquid at normal room temperature.
fluorescence	Fluorescence is a luminescence (i.e., optical phenomenon) in cold bodies, in which a molecule absorbs a high-energy photon, and re-emits it as a lower-energy (longer-wavelength) photon. The energy difference between the absorbed and emitted photons ends up as molecular vibrations (heat).
full summary	Where all the characterizations within the category appear as individual detailed tables in one window.

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Term	Definition
function	The characteristic behavior of a nanoparticle that results from the composition and properties of the entity.
functionalizing entity	Any component of the sample that has been added to a nanoparticle and imparts a function on the sample.
hemolysis	Disruption of the integrity of the erythrocyte membrane causing release of hemoglobin.
hydrogen bond	The physical association between an electronegative atom and a hydrogen atom that is directly bound to a second, relatively electronegative atom.
IgA	IgA is the immunoglobulin subclass that is associated with antibody-mediated mucosal immunity. It is secreted as dimers into the mucosa and is the most effective isotype at fixing complement by the alternative pathway, even though it lacks the ability to fix complement by the classical pathway. There are two subtypes in the human - IgA1 and IgA2.
IgD	An immunoglobulin isotype (subclass). This isotype is expressed on naive B cells along with IgM. Little is known about its physiologic role.
IgE	An immunoglobulin isotype (subclass). This isotype has the unique ability to bind with high affinity to IgE receptors (FceRI) on mast cells and basophils and induce degranulation and cytokine production by these cells when they are crosslinked by antigen. In addition to a central role in atopy and allergic responses, it has been speculated that IgE-mediated mast cell degranulation, by its release of mediators that increase vascular permeability, has an important role in the initiation of immune response in general.
IgG	An immunoglobulin isotype (subclass) that characterizes secondary immune responses. This isotype is further broken down into several smaller subclasses (IgG1, IgG2a, IgG2b, IgG3 in the mouse; IgG1-4 in the human), and each subclass is differentially synthesized and secreted into the serum upon differential immune stimuli.
IgM	The major immunoglobulin secreted during a primary immune response. IgM binds with low affinity but high avidity (multiple binding sites) because it not only occurs as monomers but also as pentamers and hexamers.
image contrast agent	Substances administered during diagnostic procedures that allows delineation of internal structures. Contrast agents appear opaque due to the difference in absorption of X-rays or other electromagnetic waves and surrounding tissue.
imaging function	An element that allows the sample to function as an imaging agent.
immune cell function	A set of laboratory assays that examine the responses of lymphoid or myeloid cells after exposure to an experimental material.

Table 9.1 Glossary of caNanoLab terms

Term	Definition
immunotoxicity	Adverse effects to the immune system.
infrared	Electromagnetic radiation with wavelengths between 750 nanometers and 1 millimeter, between those of visible light and microwaves. This portion of the electromagnetic spectrum can usually be sensed as heat.
in vitro assay	Assay conducted in an artificial environment, such as in a test tube, under a defined and controlled set of solvent and solute conditions.
in vitro characterization	The determination of the effect of nanoparticles on living cells in an artificial laboratory environment outside of the living organism.
in vivo assay	The appraisal of the biological properties or activities of a substance by testing its effect on an organism.
ionic bond	Formation of a chemical bond following a transfer of electrons between two ions with opposite charges.
isotype	The genetic or structural type for the constant region of an antibody.
LC50	The concentration of a chemical or biologic preparation that is likely to cause death in 50% of the animals or cells being tested.
leukocycte proliferation	The growth and reproduction of white blood cells. Refers to a blood cell that does not contain hemoglobin. White blood cells include lymphocytes, neutrophils, eosinophils, macrophages, and mast cells. These cells are made by bone marrow and help the body fight infection and other diseases.
linkage	Involves temporary, non-covalent binding of two or more molecules as a result of intermolecular physical forces and often involves spatial complementarity between the interacting objects.
lipid	A class of hydrocarbon-containing organic compounds. Lipids are insoluble in water but soluble in nonpolar solvents and play important roles in living organisms: these roles include functioning as energy storage molecules, serving as structural components of cell membranes, and constituting important signaling molecules. Lipids can be subdivided into 2 groups: fatty acids and glycerides.
MRI	Imaging that uses radiofrequency waves and a strong magnetic field rather than x-rays to provide amazingly clear and detailed pictures of internal organs and tissues. The technique is valuable for the diagnosis of many pathologic conditions, including cancer, heart and vascular disease, stroke, and joint and musculoskeletal disorders.
modality	The specific method used for capturing images when the sample is able to function as an image contrast agent.

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Term	Definition
modifier	A chemical that influences the properties of another chemical or biological function.
molecular weight	The sum of the relative atomic masses of the constituent atoms of a molecule.
monomer	A chemical subunit that can undergo polymerization by bonding to other subunits.
NCI	National Cancer Institute
NCICB	National Cancer Institstute Center for Bioinformatics
NK Cell Cytotoxic Activity	The interaction with virus-infected or transformed cells by diverse adhesion or co-stimulatory molecules and release of cytokines, chemokines, and lethal chemicals from granules.
NMR	A physical phenomenon involving the interaction of atomic nuclei placed in an external magnetic field with an applied electromagnetic field oscillating at a particular frequency. Magnetic conditions within the material are measured by monitoring the radiation absorbed and emitted by the atomic nuclei. It is the underlying principle of Magnetic Resonance Imaging (MRI).
nanoparticle characterization	Describing distinctive characteristics or essential features of the nanoparticle determined through analytical methods is necessary to record information associated with nanoparticle synthesis and properties.
nanoparticle entity	The component of a sample that is a nanoparticle.
nanoparticle sample	A nanoparticle-containing sample used in experimental studies.
necrosis	The pathologic localized death of living cells, as from infection or interruption of the blood supply, generally associated with severe cellular trauma caused by progressive degradation by enzymes. Characterized by mitochondrial swelling, nuclear flocculation, and uncontrolled cell lysis, it is unprogrammed death of living tissue and cells.
neutron scattering	Radiation of neutrons during radioactive decay.
oxidative burst	A process that consists of the rapid release of reactive oxygen species. The process frequently occurs in cells when superoxide radical and hydrogen peroxide species are released.
oxidative stress	A disturbance in the prooxidant-antioxidant balance in favor of the former, leading to potential damage. Indicators of oxidative stress include damaged DNA bases, protein oxidation products, and lipid peroxidation products. The damage to biological tissues is caused by superoxide and other free radicals generated by many factors, including exposure to alcohol, medications, trauma, cold, toxins, and radiation or by antimicrobial cellular immunity, metabolic abnormality, or "normal" aging; not synonymous with hypoxia or hyperoxia.

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Term	Definition
PDI	Polydispersity_Index A measure of the distribution of molecular weights in a given polymer sample. The PDI calculated is the weight average molecular weight divided by the number average molecular weight. It indicates the distribution of individual molecular weights in a population of polymers.
PET	A technique for measuring the gamma radiation produced by collisions of electrons and positrons (anti-electrons) within living tissue. In positron emission tomography (PET), a subject is given a dose of a positron-emitting radionuclide attached to a metabolically active substance (for example, 2-fluoro-2-deoxy-D-glucose (FDG), which is similar to a naturally occurring sugar, glucose, with the addition of a radioactive fluorine atom). When living tissue containing the positron emitter is bombarded by electrons, gamma radiation produced by collisions of electrons and positrons is detected by a scanner, revealing in fine detail the tissue location of the metabolically-active substance administered.
peak1	???
peptide	Organic compound composed of amino acids linked together chemically by peptide bonds. The peptide bond always involves a single covalent link between the alpha-carboxyl (oxygen-bearing carbon) of one amino acid and the amino nitrogen of a second amino acid.
pH	Quantity of dimension one used to express on a scale from 0 to 14 the amount-of-substance concentration of hydrogen ion of dilute aqueous solution, calculated as the logarithm of the reciprocal of hydrogen-ion concentration in gram atoms per liter.
phagocytosis	Endocytosis of particulate material, such as microorganisms or cell fragments, into membranous phagosomes that fuse with lysosomes and result in digestion of the ingested material.
physical assay	A procedure for evaluating the physical properties of the sample.
physical characterization	The determination of the material and structural properties of a nanoparticle.
physical state	The indication that a chemical form is solid, liquid, or gas.
plasma protein binding	An assay that measures the interaction of plasma proteins with the nanoparticle sample.
platelet aggregation	The accumulation and adherence of platelets to form a clot or thrombus. When injury or bleeding occurs, platelets clump together at the site of injury; they expand and adhere to the injured area, thereby acting as a plug to reduce the bleeding. Platelet dysfunction can result in blood clotting and bleeding disorders.

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Term	Definition
probe	General term for a piece of DNA or RNA corresponding to a gene or sequence of interest, that has been labeled either radioactively or with some other detectable molecule, such as biotin, digoxygenin or fluorescein. As stretches of DNA or RNA with complementary sequences will (hybridize), a probe will label viral plaques, bacterial colonies or bands on a gel that contain the gene of interest. |On-line Medical Dictionary.
protein	A group of complex organic macromolecules composed of one or more chains (linear polymers) of alpha-L-amino acids linked by peptide bonds and ranging in size from a few thousand to over 1 million Daltons. Proteins are fundamental genetically encoded components of living cells with specific structures and functions dictated by amino acid sequence.
purity	In the context of caNanoLab, refers to the degree of being free of contaminants or heterogeneous components.
radio labeling	A laboratory procedure that results in the incorporation of a radioactive isotope into a molecule of interest.
RMS-size	The root mean square size is the square root of the mean value for the squares of the sizes measured for particles in the sample.
Raman spectroscopy	Emission of electromagnetic energy with a shorter frequency (longer wavelength) than that of the incident monochromatic light. Arises from the low probability absorption of quanta with a higher energy than that required for a transition: the difference in energy is emitted as a lower frequency (energy) photon. Allows analysis of vibrational and rotational energy levels using visible incident light.
receptor	Cell surface proteins that bind signaling molecules external to the cell with high affinity and convert this extracellular event into one or more intracellular signals that alter the behavior of the target cell (From Alberts, Molecular Biology of the Cell, 2nd ed, pp693-5). Cell surface receptors, unlike enzymes, do not chemically alter their ligands.
repeat unit	The simplest chemical structure that is identical to all of the other units in a polymer.
RNA	A nucleic acid molecule similar to DNA but containing ribose rather than deoxyribose. RNA is formed upon a DNA template. There are several classes of RNA molecules. They play crucial roles in protein synthesis and other cell activities.
SMARTS	A linear notation used to specify the substructural patterns in a molecule.
SMILES	Specification for unambiguously describing the structure of chemical molecules using short ASCII strings. SMILES strings can be imported by most molecular editors for conversion back into two-dimensional drawings or three-dimensional models for the molecules.

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Term	Definition
SPECT	A type of tomography in which gamma photon-emitting radionuclides are administered to the patient and then detected by one or more gamma cameras rotated around the patient. From the series of two-dimensional images produced, a three-dimensional image can be created by computer reconstruction.
safety	The state of being certain that adverse effects will not be caused by some agent under defined conditions.
sample composition	The elements that make up the experimental sample
sample preparation	The act or process of making a substance ready for further study.
ScFv	A genetically engineered antibody consisting of both the variable heavy chain (VH) and the light chain (VL) of an immunoglobulin. These entities are joined together by a flexible peptide linker.
shape	The spatial arrangement of a nanoparticle as represented in its external surface or outline of specific form or figure.
shell	A rigid covering that envelops an object.
size	The physical magnitude of a nanoparticle.
solid	The state in which a substance has no tendency to flow under moderate stress; resists forces (such as compression) that tend to deform it; and retains a definite size and shape.^^
solid-crystal	A solid formed by the solidification of a chemical and having a highly regular atomic structure.
solid-fibril	A small slender fiber or filament.
solid-glass	A brittle transparent solid with irregular atomic structure.
solid-granule	Any small grainlike particle.
solid-powder	A solid substance in the form of tiny loose particles; a solid that has been pulverized.
solubility	In the context of caNanoLab, refers to the ability and then the quantity of a nanoparticle to dissolve in a particular solvent (yielding a saturated solution).
small molecule	A molecule with a low molecular weight that is not determined by a genome sequence.
summary	A view where all the characterizations within the category appear in one table.
surface	The extended two-dimensional outer boundary of a nanoparticle.
surface area	A measurement of the extended two-dimensional outer boundary of a three-dimensional object.
surface chemistry	The chemical properties of the surface of the sample.

Table 9.1 Glossary of caNanoLab terms

Term	Definition
synthesis	The process of producing a chemical compound, usually by the union of simpler chemical compounds.
targeting	Nanoparticles can be designed to target tumors, or other areas of interest.
targeting function	An element that allows the sample to function as an targeting agent.
terminal group	A chemical structure found at the ends or on the surface of a larger molecule or chemical entity.
therapeutic	The use of nanoparticles for therapeutic applications in a clinical setting. This method entails the attachment of a drug to the surface of nanoparticles. The role of the nanoparticle is to facilitate delivery of the drug to a cellular target that it would not reach in its free form.
therapeutic function	An element that allows the sample to function as an therapeutic agent.
toxicity	The finding of bodily harm due to the poisonous effects of something.
type	The indication that a whole antibody or an antibody fragment is a component of the sample.
ultrasound	Very high frequency sound
ultraviolet	The invisible ultraviolet spectrum makes up one specific portion of sunlight. This unique portion accounts for three percent of all solar radiation reaching the earth. UV radiation causes many health problems.
units of measurement	% = percent %mole = percent of total moles %vol = percent of total volume %wt/vol = percent weight per volume a.u. = atomic units aC = attocoulomb Ah = ampere hour C = coulomb esu = electrostatic unit of charge Fr = Franklin g = gram g/ml = grams per milliliter kDa = kiloDaltons mg = milligram mg/ml = milligrams per milliliter mV = millivolt nm = nanometer nm^2 = square nanometer statC = statcoulomb ug = microgram ug/ml = micrograms per millilieter ug/ul = micrograms per microliter ul = microliter

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Term	Definition
van der Waals	The weak attraction between two or more chemical entities that is caused by the polarization of adjacent atoms or molecules.
whole	Including all components without exception; being one unit or constituting the full amount or extent or duration; complete.
x-ray	Gamma rays and X-rays are similar forms of electromagnetic radiation. Gamma rays are distinguished from X rays by their origin. Gamma rays are produced by nuclear transitions while X-rays are produced by energy transitions due to accelerating electrons. Because it is possible for some electron transitions to be of higher energy than nuclear transition, there is an overlap between low energy gamma rays and high energy X-rays. Gamma rays are considered to be electromagnetic radiation with wavelengths of 1 nanometer or shorter while x-rays are between approximately.01 nanometers and 200 nanometers.
Z-average	A parameter used for calculations involving mechanical properties. The parameter is measured by using dynamic light scattering to obtain the intensity weighted mean hydrodynamic size of a collection of particles.
zeta potential	The magnitude of the electrical potential as generated by ion accumulation at the particulate surface. This surface consists of two layers, the Stern layer and the diffuse layer, which comprise an electrical double-layer. The measurement of the electrical potential provides important information regarding the dispersion mechanism, the degree of particle dispersion and the electrostatic potential of the sample.

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