

Science SOS: A few definitions

About molecules

Compound – A chemical

Binding – When two or more compounds interact with one another. Think of it as two compounds becoming ‘stuck’ together

Conjugate – A compound that is created through the binding of two or more molecules (for example, a drug and a protein may form a drug-protein conjugate)

Molar mass – Molar mass is equal to the mass (weight in grams) of one mole (6.02×10^{23} molecules) of a chemical – expressed in g/mol, as a standardized way to convert between quantities of different compounds

Small molecule – Most drugs and medications are considered *small molecules*, which have a molar mass of less than about 1,000 g/mol

Large molecule – Many biological molecules (proteins, enzymes, antibodies) are *large molecules*, with a molar mass often over 10,000 g/mol

Morphine (a small molecule) is 10,000x smaller than an anti-morphine antigen (a large molecule)

Antigen – Any substance that causes an immune response. Antigens can include chemicals, bacteria, viruses, etc. In this case, a drug can be used as an antigen, though it’s not a ‘natural’ antigen (do you get an allergic reaction when you take Adderall or diazepam, for example?)

Antibody – A protein produced by your immune system to help target and eliminate a specific antigen. They are massive – several thousand times larger than ‘small molecules’ (drugs). Due to their complexity, antibodies are typically represented as a ‘Y’ shape, when used in figures

Epitope – The specific part of an antigen that an antibody binds to

Protein – Very large biomolecules that are made up of strings of amino acids (called residues). Proteins can easily contain from a couple hundred, to several thousand residues. Antibodies and enzymes are proteins that have a specific function

Isoform – Two proteins with the same function, but different structures, are *isoforms*. They have the same role, but may recognize different epitopes on the antigen

Polyclonal antibodies – The rapid screening tests done at a health care provider’s office typically involve *polyclonal antibodies* – many different isoforms present in the same test

Monoclonal antibodies – Some tests use *monoclonal antibodies*, which are *exact* replicas of the same protein (antibody), rather than a mixture of isoforms. Tests that use monoclonal antibodies are usually more expensive and more specific, but may not be as sensitive

Types of tests

Lateral Flow Assay (LFA) – The type of low-cost, rapid screening tests that are done at a health care provider's office

Gas Chromatography-Mass Spectrometry (GC-MS) and High-Performance Liquid Chromatography—Tandem Mass Spectrometry (HPLC-MS/MS) – Lab tests that identify and measure how much of each component is in a sample

About tests

Analyte – In a test, the analyte is the 'target', i.e. the thing you are trying to detect

Matrix – The part of the body or bodily fluid being tested; could be saliva, blood, hair, sweat, or in this case, urine

Quantitative test – A test that can detect *exactly* how much of an analyte is present

Semi-quantitative test – A test that can tell which compounds are present in higher concentrations than others, but cannot give specific quantities (concentrations)

Qualitative test – A test that cannot identify concentrations. It can only identify whether the target analyte is present or not

Detection cutoff – The lowest concentration (usually in nanograms per millilitre – ng/mL) of a drug that needs to be present for it to be detectable by a specific test. Lab tests almost always have much lower (better) detection cutoffs than the rapid screening tests done at a health care provider's office

Specificity – Ability of a test to *only* identify its target antigen and nothing else. A highly specific test only gives a positive when the target analyte is actually present. A poorly specific test will give false-positives

Sensitivity – Ability of a test to identify the target antigen. A (perfect) highly sensitive test will detect *all* samples that contain its target analyte

Assay – A testing technique to detect the presence of a certain compound in a sample

Immunoassay – An assay that uses antibodies (produced from the immune system) to collect its results; Immuno = immune system, assay = test for a substance

Experimental Control – Something that remains unchanged or unaffected by the experiment being conducted. It serves as a 'standard' to refer to in an experiment. In LFA, the control line ALWAYS shows up – regardless of whether the test is positive or negative for the analyte – and is used to be certain that the test is working properly