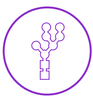
Lectins
Powerful Multipurpose Research Tools

Gaining deeper insights into biological applications

All cells—and most macromolecules – carry an array of covalently attached sugars or sugar chains termed "glycans". Since many of these glycans are extracellular, altered glycoprotein patterns found on the surface of cells and secreted macromolecules are often linked to pathologies (e.g., cancer).(1)

Over the last few decades, the development of high-quality, purified lectins has held important implications for many research areas. This infographic will explore examples of how lectins are effectively used by investigators to answer important scientific questions.

What are lectins?



Lectins are proteins that bind carbohydrate structures and are found within numerous plant tissues and organisms. The presence of at least one non-catalytic domain allows them to reversibly recognize and bind to specific carbohydrates, without altering their molecular properties.(2) As a result, lectins are a valuable tool for biological research, with various applications including virology, cancer, neuroscience, and immunology.

Lectins are classified based on their carbohydrate specificity, overall structure, or family. The subtle yet distinct differences in their properties are important to consider when selecting which to use in your application.(2)(3)

How are lectins used for research?

Various techniques use lectins, including immunohistochemistry (IHC) and immunofluorescence (IF), flow cytometry, affinity chromatography, enzyme-linked immunosorbent assays (ELISAs), and western blotting.

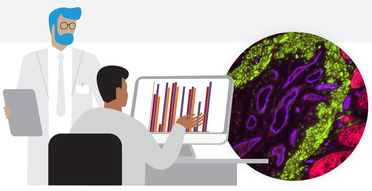
1. Exploring tissue microstructure

Molecular imaging of tissues reveals a wealth of information about specific biomolecules in their native environment.(4)

Lectins are widely used to visualize the distribution of glycans in specimens; a library of lectins and lectin conjugates compatible with IHC/IF protocols are used as markers for pathogenic infections and disease diagnosis and prognosis. Equally, lectins are often conjugated to various fluorescent dyes to visualize proteins and glycans, and isolate distinct cellular populations with IF.

Techniques: IHC, IF

2. Characterizing cellular subpopulations

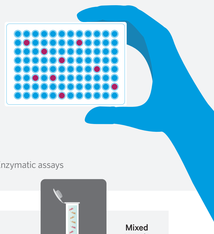


Cell surface glycosylation patterns serve as markers for different populations of cells and specific cell lineages. Distinguishing cell lineages within a sample reveals insights into cell maintenance, proliferation, and differentiation.

Flow cytometry and SUrface-protein Glycan And RNA-seq (SUGAR-seq) can be used to characterize cellular subpopulations. For example, flow cytometry was used to differentiate lectin binding profiles in human embryonic stem cell research.(5) SUGAR-seq is a newly developed method, used to detect and analyze N-linked glycosylation, extracellular epitopes, and the transcriptome, at the single-cell level. Although it has previously been used for clonal identification, it is also used to typify cells exhibiting divergent glycan levels.(6)

Techniques: IHC, IF, Flow cytometry, SUGAR-seq

3. Population Profiling

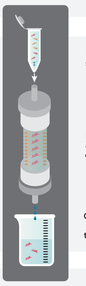


Lectin-based molecular markers are often used to distinguish cell subpopulations and there are many techniques that can be used for population profiling.(7)

For example, lectin-ELISAs are used to screen protein glycosylation states,(8) western and lectin blots help determine the glycosylation of specific proteins,(9) and enzymatic assays resolve the activity of recombinantly expressed proteins.(10)

Techniques: Western blot, Lectin Arrays, ELISA, Enzymatic assays

4. Purifying compounds



Lectin specificity is used as a tool to probe glycans within complex biological systems. However, since most proteins are glycosylated, compounds must be enriched or purified to produce effective results.(11)(12)

Lectin-affinity chromatography is a separation technique which is used to separate glycoproteins or glycolipids. The technique has been successful in the clinical diagnosis of pathological conditions, both by itself and with other techniques.(11)

Techniques: Lectin-affinity chromatography

5. Screening

Lectins have defined carbohydrate recognition properties; this makes them an effective screening tool for any biological system with altered glycan structures. Lectins have previously proved invaluable to screen for cancer pathology (13) mutant cells, and protein glycosylation states.14

Many lectin based methods are used for screening, for example, in ELISAs to evaluate protein glycosylation states.(8) Additionally, lectin blotting, a lectin-probe western blot technique, is used to detect glycoconjugates. This technique has been used for comprehensive profiling of glycosylated proteins in biofluids in cancer research.(13)

Techniques: ELISA, flow cytometry, western blotting, arrays

Lectins are powerful tools in research laboratories, and they are utilized in a vast number of applications.

Explore how you can unlock deeper biology insights with glycobiology.

References

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