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PLANTPROBES

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Monoclonal antibodies to plant cell wall components

FOR RESEARCH PURPOSES ONLY

After over 20 years of distributing cell wall monoclonal antibodies (Mabs) from our laboratory, the **PlantProbes activity will be ceasing at the end of June 2021**. We appreciate all the interest that researchers around the world have shown in our cell wall antibodies and we are pleased that they continue to be useful.

The Mabs will continue to be available from other sources including [Kerafast](#) and [Megazyme](#). The BAM- antibodies to fucans and alginates are available from [SeaProbes](#) in Roscoff. Additional outlets for selections of these reagents are currently being explored.

If you are interested in CBMs, please note that [NZYTech](#) in Lisbon has large number of CBMs available with a wide range of specificities

The rat Mabs have been generated & characterised by the **Paul Knox Cell Wall Lab** at the University of Leeds.

See right: Costs of supply of rat hybridoma cell culture supernatants. A shipping and handling charge of 30 GBP will be added to all orders. Express shipment by courier will cost an additional 60 to 90 GBP dependent on territory. To order please let us know by email the items required, delivery and invoice addresses and a purchase order number if appropriate.

Contact : antibodies@plantprobes.net

See below : Details of available rat Mabs.

Our **rat Mabs** are supplied as **1 ml** or **5 ml** units of hybridoma cell culture supernatants.

# units	1 ml	5 ml
1	150	300
2	260	550
3	360	750
4	450	900
5	500	1000

Prices in GBP/£

Rat Mab supernatants contain sodium azide as a preservative, are shipped at ambient temperature & should be stored at 4°C.

RAT MONOCLONAL ANTIBODIES

Heteroxylan probes

LM10

MONOCLONAL ANTIBODY to XYLAN / LM10 (Rat IgG2c)

SPECIFICITY: Generated using a neoglycoprotein (xylopentaose-BSA). It can recognise unsubstituted and relatively low-substituted xylans in several species. It has no cross-reactivity with wheat arabinoxylan.

► [McCartney et al. \(2005\) J. Histochem. Cytochem 53, 543-546](#)

LM11

MONOCLONAL ANTIBODY to XYLAN / ARABINOXYLAN / LM11 (Rat IgM)

SPECIFICITY: Generated using a neoglycoprotein (xylopentaose-BSA). It can recognise unsubstituted and relatively low-substituted xylans in several species. It can also accommodate more extensive substitution of a xylan backbone and binds strongly to wheat arabinoxylan. ► [McCartney et al. \(2005\) J. Histochem. Cytochem 53, 543-546](#)

LM28

MONOCLONAL ANTIBODY to GLUCURONOXYLAN / LM28 (Rat IgM)

SPECIFICITY: Generated using a complex pectic immunogen. The monoclonal antibody can recognise glucuronosyl substituted xylans in several species and MeGlcA is not required for recognition.

► [Cornuault et al. \(2015\) Planta 242, 1321-1334.](#)

LM27

MONOCLONAL ANTIBODY to GRASS XYLAN PREPARATIONS / LM27 (Rat IgM)

SPECIFICITY: Generated using a complex pectic immunogen. Epitope is unknown but LM27 binds strongly to preparations of grass xylan/glucuronoxylan and is likely to be an epitope of a complex substitution of grass heteroxylan or an associated molecule. ► [Cornuault et al. \(2015\) *Planta* 242, 1321-1334.](#)

Xyloglucan probes

LM15

MONOCLONAL ANTIBODY to XYLOGLUCAN / LM15 (Rat IgG2c)

SPECIFICITY: Generated using a neoglycoprotein incorporating the xylosylated heptasaccharide from tamarind xyloglucan (XXXG-BSA). It recognises the XXXG motif of xyloglucan in several species and can accommodate to some extent a single galactosyl residue. ► [Marcus et al. \(2008\) *BMC Plant Biology* 8:60](#)

LM24

MONOCLONAL ANTIBODY to XYLOGLUCAN / LM24, (Rat IgG2a),

SPECIFICITY: Generated using a neoglycoprotein incorporating the xylosylated/galactosylated oligosaccharides from tamarind xyloglucan (XXLG & XLLG). It binds preferentially to the galactosylated XLLG oligosaccharide motif. ► [Pedersen et al. \(2012\) *J. Biol Chem.* 47, 39429–39438](#)

LM25

MONOCLONAL ANTIBODY to XYLOGLUCAN / LM25, (Rat IgM),

SPECIFICITY: Generated using a neoglycoprotein incorporating the xylosylated/galactosylated oligosaccharides from tamarind xyloglucan (XXLG & XLLG). It recognises a range of xyloglucan-specific oligosaccharide motifs in several species. ► [Pedersen et al. \(2012\) *J. Biol Chem.* 47, 39429–39438](#)

Heteromannan probes

LM21

MONOCLONAL ANTIBODY to HETEROMANNAN / LM21 (Rat IgM)

SPECIFICITY: This antibody recognises β -linked mannan polysaccharides of plant cell walls. It has no known cross-reactivity with other polymers and can recognise heteromannan polysaccharides in several species. LM21 binds effectively to β -(1→4)-manno-oligosaccharides from DP2 to DP5. LM21 displays a wide recognition of mannan, glucomannan and galactomannan polysaccharides. ► [Marcus et al. \(2010\) *Plant Journal* 64, 191-203](#)

LM22

MONOCLONAL ANTIBODY to HETEROMANNAN / LM22 (Rat IgM)

SPECIFICITY: This antibody recognises β -linked mannan polysaccharides of plant cell walls. It has no known cross-reactivity with other polymers and can recognise heteromannan polysaccharides in several species. LM22 binds effectively to β -(1→4)-manno-oligosaccharides from DP2 to DP5. LM22 displays recognition of mannan and glucomannan polymers although the basis of its lack of recognition of galactomannan polysaccharides is not clear. ► [Marcus et al. \(2010\) *Plant Journal* 64, 191-203](#)

Pectin probes

JIM5

MONOCLONAL ANTIBODY to HOMOGALACTURONAN / JIM5 (Rat IgG)

SPECIFICITY: The antibody recognises the homogalacturonan domain of pectic polysaccharides. It has no known cross-reactivity with other polymers. It can recognise pectic polysaccharides in several species. The antibody recognises partially methyl-esterified epitopes of homogalacturonan and can also bind to un-esterified homogalacturonan. We now recommend the use of LM19 in the place of JIM5 as LM19 binds more effectively to unesterified HG. ► [Knox et al. \(1990\) *Planta* 181, 512-521](#) ► [Clausen et al. \(2003\) *Carbohydr. Res.* 338, 1797-1800](#) ► [Verhertbruggen et al. \(2009\) *Carbohydr. Res.* 344, 1858–1862](#)

JIM7

MONOCLONAL ANTIBODY to HOMOGALACTURONAN / JIM7, (Rat IgA)

SPECIFICITY: The antibody recognises homogalacturonan polysaccharides and has no known cross-reactivity with other polymers. The antibody recognises partially methyl-esterified epitopes of homogalacturonan but does not bind to un-esterified homogalacturonan. We now recommend the use of LM20 as an antibody probe for methyl-esterified homogalacturonan. JIM7 can be a good general probe for pectic homogalacturonan. ► [Knox et al. \(1990\) *Planta* 181, 512-521](#) ► [Clausen et al. \(2003\) *Carbohydr. Res.* 338, 1797-1800](#) ► [Verhertbruggen et al. \(2009\) *Carbohydr. Res.* 344, 1858–1862](#)

LM7

MONOCLONAL ANTIBODY to HOMOGALACTURONAN / LM7 (Rat IgM)

SPECIFICITY: The antibody recognises the homogalacturonan domain of pectic polysaccharides. It can recognise pectic polysaccharides in several species. The antibody recognises a partially methyl-esterified epitope of HG that results from non-blockwise de-esterification processes. It does not bind to un-esterified homogalacturonan.

► [Willats et al. \(2001\) *J. Biol. Chem* 276, 19404-19413](#) ► [Clausen et al. \(2003\) *Carbohydr. Res.* 338, 1797-1800](#)

LM18

MONOCLONAL ANTIBODY to HOMOGALACTURONAN / LM18 (Rat IgG2c)

SPECIFICITY: The antibody recognises the homogalacturonan domain of pectic polysaccharides. It has no known cross-reactivity with other polymers. It can recognise pectic polysaccharides in several species. The antibody has some preference for partially methyl-esterified homogalacturonan but can also bind to un-esterified homogalacturonan. ► [Verherbruggen et al. \(2009\) *Carbohydr. Res.* 344, 1858–1862](#)

LM19

MONOCLONAL ANTIBODY to HOMOGALACTURONAN / LM19 (Rat IgM)

SPECIFICITY: The antibody recognises the homogalacturonan domain of pectic polysaccharides. It has no known cross-reactivity with other polymers. It can recognise pectic polysaccharides in several species. The antibody recognises a range of homogalacturonan samples but appears to have a preference for and binds strongly to un-esterified homogalacturonan. We now recommend the use of LM19 in the place of JIM5 as LM19 binds more effectively to unesterified HG. ► [Verherbruggen et al. \(2009\) *Carbohydr. Res.* 344, 1858–1862](#)

LM20

MONOCLONAL ANTIBODY to HOMOGALACTURONAN / LM20 (Rat IgM)

SPECIFICITY: The antibody recognises the homogalacturonan domain of pectic polysaccharides. It has no known cross-reactivity with other polymers. It can recognise pectic polysaccharides in several species. The antibody requires methyl-esters for recognition of homogalacturonan and does not bind to un-esterified homogalacturonan. We now recommend the use of LM20 in the place of JIM7 as LM20 binding is more effectively lost by high pH treatments that remove HG methyl esters. ► [Verherbruggen et al. \(2009\) *Carbohydr. Res.* 344, 1858–1862](#)

LM8

MONOCLONAL ANTIBODY to XYLOGALACTURONAN / LM8 (Rat IgM)

SPECIFICITY: The antibody recognises a specific epitope of a xylogalacturonan pectic polysaccharide that is associated with cell detachment and separation in a wide range of species. It has no known cross-reactivity with other polymers. This antibody does NOT bind to all xylogalacturonans. ► [Willats et al. \(2004\) *Planta* 218, 673-681](#)

LM5

MONOCLONAL ANTIBODY to (1-4)- β -D-GALACTAN / LM5 (Rat IgG),

SPECIFICITY: The antibody was generated using a neoglycoprotein (galactotetraose-BSA). It recognises a linear tetrasaccharide in (1-4)- β -D-galactans. It has no cross-reactivity with (1-3)- β -D-galactans or (1-6)- β -D-galactans. It can recognise pectic polysaccharides in several species. In competitive inhibition ELISA, antibody binding to (1-4)- β -D-galactan was inhibited (50%) by 58 μ g/ml (1-4)- β -D-galactotetraose and by 0.7 μ g/ml lupin (1-4)- β -D-galactan.

► [Jones et al. \(1997\) *Plant Physiol.* 113, 1405-1412](#)

LM26

MONOCLONAL ANTIBODY to BRANCHED-GALACTAN / LM26 (Rat IgG)

SPECIFICITY: The antibody was isolated from a wide screen of cell lines obtained subsequent to immunization with cell wall polysaccharides. Glycan microarrays indicated that LM26 recognises a (1-6)-galactosyl substitution in (1-4)-beta-D-galactans and that it has no recognition of linear (1-4)-beta-D-galactan. LM26 can recognise pectic polysaccharides in several species and in a wide range of plant organs the LM26 epitope can be specifically detected in cell walls of phloem sieve elements. ► [Torode et al. \(2018\) *Plant Physiol.* 176, 1547-1558](#)

LM9

MONOCLONAL ANTIBODY to FERULOYLATED-(1-4)- β -D-GALACTAN / LM9 (Rat IgM)

SPECIFICITY: The antibody recognises a specific epitope of a feruloylated-(1-4)- β -D-galactan that is a structural feature of the pectic polymers of plant species of the Amaranthaceae/Chenopodiaceae. It has no known cross-reactivity with other polymers. In competitive inhibition ELISAs, antibody binding to sugar beet pectin was inhibited (50%) by 15 μ g/ml O-[6-O-(*trans*-feruloyl)- β -D-galactopyranosyl]-(1 \rightarrow 4)-D-galactopyranose.

► [Clausen et al. \(2004\) *Planta* 219, 1036-1041](#)

LM6

MONOCLONAL ANTIBODY to (1-5)- α -L-ARABINAN / LM6 (Rat IgG)

SPECIFICITY: Generated using a neoglycoprotein (arabinoheptaose-BSA). Recognises a linear pentasaccharide in (1-5)- α -L-arabinans. It can recognise pectic polysaccharides in several species. It has no cross-reactivity with gum

arabic but it may recognize arabinogalactan-proteins (AGPs) in some species. In competitive inhibition ELISAs, antibody binding to (1-5)- α -L-arabinan was inhibited (50%) by 40 ng/ml (1-5)- α -L-arabinopentaose and 19 ng/ml (1-5)- α -L-arabinohexaose.

► [Willats et al. \(1998\) Carbohydr. Res. 308, 149-152](#)

LM6-M

MONOCLONAL ANTIBODY to (1-5)- α -L-ARABINAN / LM6-M (Rat IgM)

SPECIFICITY: LM6-M was generated using a preparation of sugar beet RG-I oligosaccharides. LM6-M has a similar specificity to LM6 and binds to a linear (1-5)- α -L-arabinan. Unlike LM6 (which is an IgG immunoglobulin) LM6-M is of the IgM isotype. In competitive inhibition ELISA, LM6-M binding to (1-5)- α -L-arabinan was inhibited (50%) by 7.9 μ g/ml (1-5)- α -L-arabinopentaose and 3.2 μ g/ml (1-5)- α -L-arabinohexaose. LM6-M can recognise pectic polysaccharides in several species. It has no cross-reactivity with gum Arabic but it may recognize arabinogalactan-proteins (AGPs) in some species. ► [Cornuault et al. \(2017\) BioRxiv](#)

LM13

MONOCLONAL ANTIBODY to (1-5)- α -L-ARABINAN (linear) / LM13 (Rat IgM)

SPECIFICITY: Isolated from a high throughput screen of antibodies generated subsequent to immunization with a pectic fraction. Recognises a linear epitope in (1-5)- α -L-arabinans. Antibody recognition of arabinans increases with arabinofuranosidase action. This antibody binds to a specific subset of pectic arabinans, and to longer stretches of 1,5-linked arabinosyl residues that are likely to be more abundant in unbranched arabinans. The binding of LM13 is highly sensitive to arabinanase action.

► [Moller et al. \(2007\) Glycoconjugate J. 25, 37-48](#) ► [Verhertbruggen et al. \(2009\) Plant J. 59, 413-425](#).

LM16

MONOCLONAL ANTIBODY to PROCESSED ARABINAN RG-I / LM16 (Rat IgM)

SPECIFICITY: Generated subsequent to immunization with a pectic fraction. Recognises an epitope associated with arabinans and can be generated by arabinofuranosidase action and the loss of arabinosyl residues. The binding of LM16 is sensitive to galactosidase action and the epitope may involve galactosyl residue(s) on RG backbones.

► [Verhertbruggen et al. \(2009\) Plant J. 59, 413-425](#)

Other Glycan Probes

Cat. No. **LM12**

MONOCLONAL ANTIBODY to FERULOYLATED POLYMERS / LM12 (Rat IgG2c)

SPECIFICITY: The antibody recognises an epitope containing ferulic acid that is a structural feature of the pectic polymers of plant species of the Amaranthaceae/Chenopodiaceae AND also of the heteroxylan polymers of commelinid monocotyledons. It has no known cross-reactivity with non-feruloylated polymers outside these taxonomic groups. ► [Pedersen et al. \(2012\) J. Biol Chem. 47, 39429–39438](#)

Cat. No. **LM23**

MONOCLONAL ANTIBODY to XYLOSYL / LM23 (Rat IgM)

SPECIFICITY: The antibody recognises non-acetylated xylosyl residues in a range of polysaccharide contexts including both pectic xylogalacturonan and xylan. ► [Manabe et al. \(2011\) Plant Physiol. 155, 1068-1078](#) ► [Pedersen et al. \(2012\) J. Biol Chem. 47, 39429–39438](#)

Glycoprotein probes

LM1

MONOCLONAL ANTIBODY to EXTENSIN / LM1 (Rat IgM)

SPECIFICITY: Generated to rice extensin hydroxyproline-rich glycoproteins (HRGPs). The antibody recognises an epitope that is carried by a range of HRGPs of the extensin class in a wide range of angiosperm species. The LM1 epitope most likely includes glycan components of extensins. ► [Smallwood et al. \(1995\) Planta 196, 510-522](#)

LM2

MONOCLONAL ANTIBODY to ARABINOGALACTAN-PROTEIN / LM2 (Rat IgM)

SPECIFICITY: Generated to rice arabinogalactan-proteins (AGPs). Recognises a carbohydrate epitope containing β -linked glucuronic acid. It can recognise AGPs in several species. In competitive inhibition ELISAs antibody binding to gum arabic was inhibited (50%) by 70 mg/ml 1-O-methyl- β -D-GlcA. The binding of the antibody to AGPs can be fully inhibited by 10 mM 1-O-methyl- β -D-GlcA.

► [Smallwood et al. \(1996\) Planta 198, 452-459](#) ► [Yates et al. \(1996\) Glycobiology 6, 131-139](#)

LM14

MONOCLONAL ANTIBODY to ARABINOGLACTAN-PROTEIN / LM14, (Rat IgM)

SPECIFICITY: Isolated from a high throughput screen of antibodies generated subsequent to immunization with a pectic fraction. Recognizes arabinogalactan-proteins and will also bind to larch arabinogalactan. It can recognise AGPs in several species. ► [Moller et al. \(2007\) *Glycoconjugate J.* 25, 37-48](#)

LM30

MONOCLONAL ANTIBODY to ARABINOGLACTAN-PROTEIN / LM30 (Rat IgM)

SPECIFICITY: Isolated subsequent to immunization with a preparation of arabinogalactan-protein (AGP) obtained from wheat grain. LM30 recognizes a glycan epitope of the wheat AGP and the recognition is highly sensitive to the action of arabinofuranosidase. ► [Wilkinson et al. \(2017\) *Journal of Cereal Science* 74, 155-164](#)

JIMs

PlantProbes also maintains the cell lines, and can supply hybridoma cell culture supernatants, for a range of JIM-designated anti-arabinogalactan-protein (AGP) and anti-extensin rat Mabs that were isolated in the John Innes Institute from 1986-1991. These include: anti-AGP: **JIM4 JIM8, JIM13, JIM14, JIM15 & JIM16** and anti-extensin: **JIM11, JIM12, JIM19 & JIM20**. Details of these Mabs can be found in the [List & Short Guide to Antibody Probes](#) on our website and are also available from [Kerafast](#).

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