Manchester Microscopical & Natural History Society

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A Perusal of the Research Slides (Lectin Cytochemistry) of the Late Dr Bob Stoddart (Pathology, Manchester University)

Lectin Cytochemistry

Mike Mahon, *October 25th 2025*

Questions

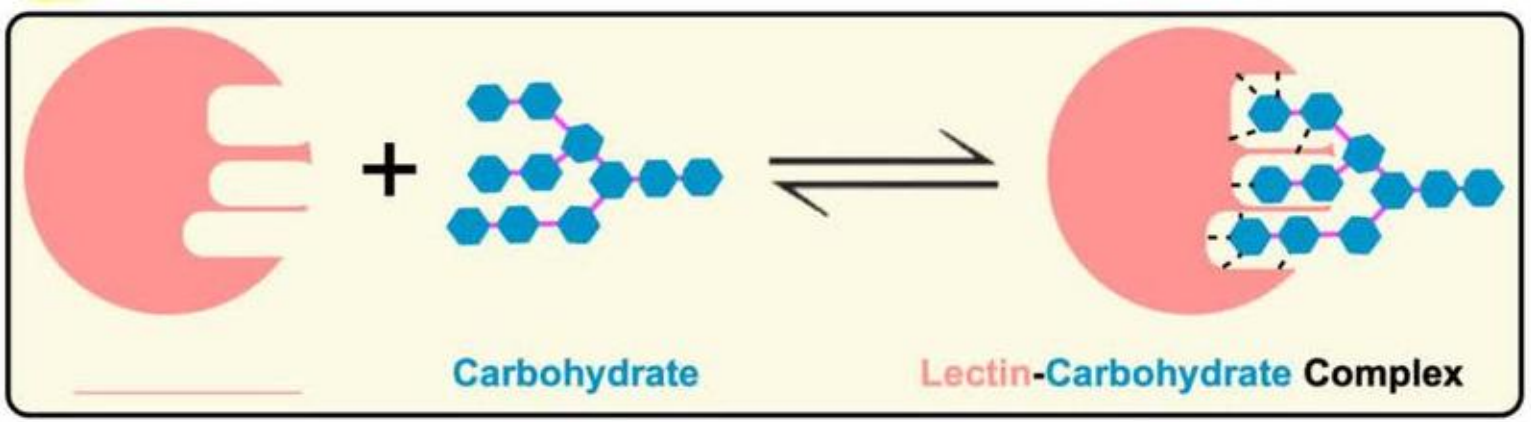
- What is Lectin Cytochemistry ?
- What research did Dr Stoddart do ?
- What is in the slide collection ?

What is a Lectin ?

A lectin is a type of protein, found in nearly all plants and animals, that binds to carbohydrates and serves as a plant defense mechanism against insects and other pests.

Google AI

Legere = to choose or pick out



MICROSCOPY

Staining (Visualising) Thin Specimens

1. None > Microscopies	Physical properties R,Pol,Ph
2. Vital Staining	Live activities
3. Histological dyes	Morphology
4. Metallic trappers	Fibres, Membranes
5. Histochemistry	Enzymes, Cell Storage
6. Immunocytochemistry	Proteins
7. Lectin Cytochemistry	**Carbohydrates, Surfaces**
8. In Situ Hybridisation	Gene localisation
9. Autoradiography, BrdU, Ca^{++}	Tracers, Cell Activity
10. Transgenic, TUNEL	Gene tracers
11. DISCO, CLARITY	3D

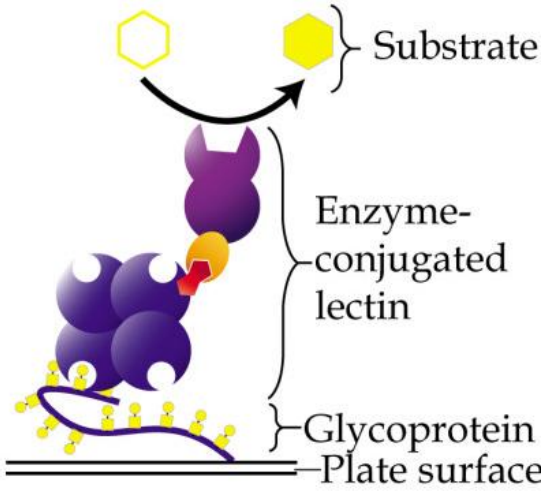
Google AI ….

- **Lectin cytochemistry** is a technique that uses labeled lectins to identify and localize specific carbohydrate structures (glycoconjugates) in cells and tissues, providing insights into processes like glycosylation, cell recognition, and disease mechanisms. Lectins, proteins that bind to particular sugars, are conjugated to markers such as colloidal gold or horseradish peroxidase to visualize their binding sites under a microscope.

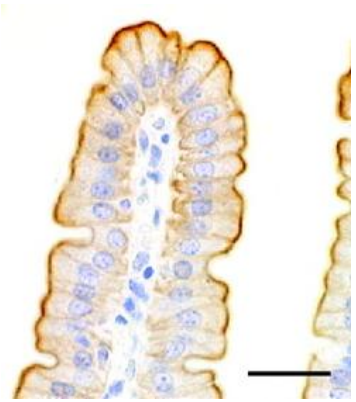
+ Fluorescent markers
+ Developmental Biology

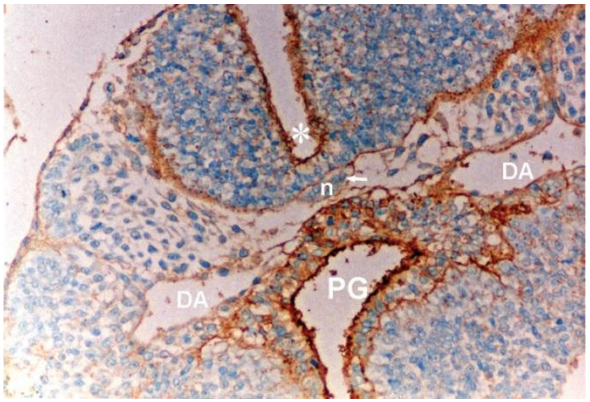
Lectin Cytochemistry

- 1974 Etzler & Branstrator used Lectins (Plant products) as cytochemical tool
  - Bean, Pea, Wheatgerm, Peanut
  - Use Enzymes, Fluorescent markers, Gold, Ferritin



- Detects Specific Carbohydrates
  - Cell Surface
  - Secretions
- Applications
  - Developmental Biology
  - Epithelial Cell markers





Common Lectins and their Specificities

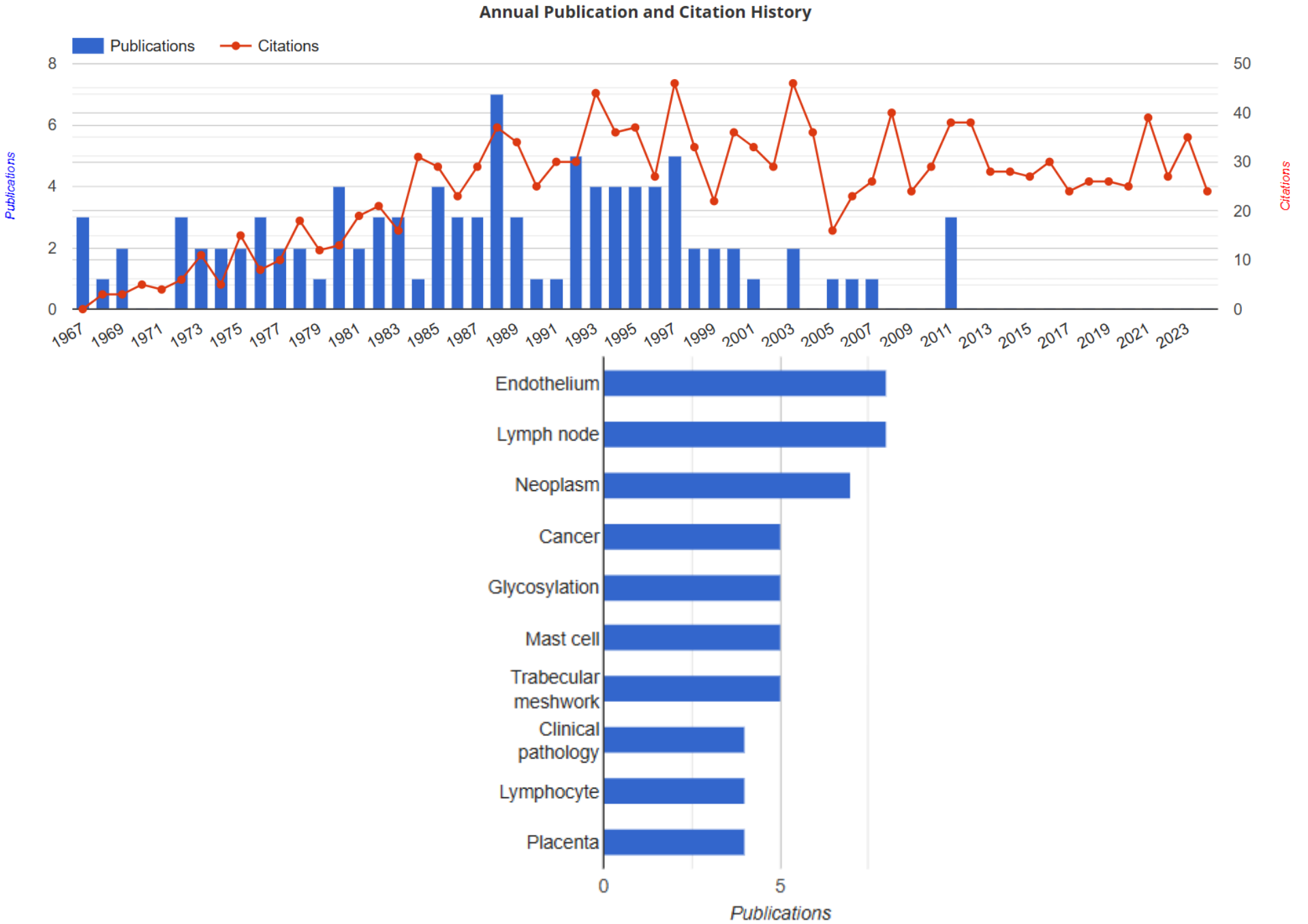
- **Wheat Germ Agglutinin (WGA)**: Binds to N-acetylglucosamine (GlcNAc) and sialic acid.
- **Concanavalin A (Con A)**: Binds to mannose and glucose.
- **Peanut Agglutinin (PNA)**: Binds to galactose and N-acetylgalactosamine.
- **Ricinus Communis Agglutinin (RCA)**: Also known as Castor bean lectin, it binds to galactose and N-acetylgalactosamine.
- **Maackia amurensis agglutinin (MAA)**: Binds to sialic acid.
- **Aleuria Aurantia Lectin (AAL)**: Binds to fucose.
- **Jacalin (from Artocarpus integrifolia)**: Binds to galactose and GalNAc.

Lectin Symbol	Lectin Name	Source	Ligand motif
Mannose binding lectins			
Con A	Concanavalin A	*Canavalia ensiformis*	branched α-mannosidic structures; high-mannose type, hybrid type and biantennary complex type N-Glycans
LCH	Lentil lectin	*Lens culinaris*	Fucosylated core region of bi- and triantennary complex type N-Glycans
GNA	Snowdrop lectin	*Galanthus nivalis*	α 1-3 and α 1-6 linked high mannose structures
Galactose / N-acetylgalactosamine binding lectins			
RCA	Ricinus communis Agglutinin, ricine, RCA_{120}	*Ricinus communis*	Galβ1-4GlcNAcβ1-R
PNA	Peanut Agglutinin	*Arachis hypogaea*	Galβ1-3GalNAcα1-Ser/Thr (T-Antigen)
AIL	Jacalin	*Artocarpus integrifolia*	(Sia)Galβ1-3GalNAcα1-Ser/Thr (T-Antigen)
VVL	Hairy vetch lectin	*Vicia villosa*	GalNAcα-Ser/Thr (Tn-Antigen)
Sialic acid / N-acetylglucosamine binding lectins			
WGA	Wheat Germ agglutinin	*Triticum vulgaris*	GlcNAcβ1-4GlcNAcβ1-4GlcNAc, Neu5Ac (sialic acid)
SNA	Elderberry lectin	*Sambucus nigra*	Neu5Acα2-6Gal(NAc)-R
MAL	Maackia amurensis lectin	*Maackia amurensis*	Neu5Ac/Gcα2-3Galβ1-4GlcNAcβ1-R
Fucose binding lectins			
UEA	Ulex europaeus agglutinin	*Ulex europaeus*	Fucα1-2Gal-R
AAL	Aleuria aurantia lectin	*Aleuria aurantia*	Fucα1-2Galβ1-4(Fucα1-3/4)Galβ1-4GlcNAc; R2-GlcNAcβ1-4(Fucα1-6)GlcNAc-R1

Edible Plant	Lectin	Lectin Content (% of Total Protein)	Ref.
Lentil (*Lens culinaris*)	LcA	2.5%	[18]
Pea (*Pisum sativum*)	PsA	2.5%	[19]
Soybean (*Glycine max*)	SBA	2%	[20]
Peanut (*Arachis hypogaea*)	PNA	1.5%	[21]
Horse gram (*Dolichos biflorus*)	DbA	10%	[22]
Kidney bean (*Phaseolus vulgaris*)	PHA	1%	[23]
Wheat (*Triticum aestivum*)	WGA	3%	[24]
Garlic (*Allium sativum*)	ASA	10%	[25]
Black elderberry (*Sambucus nigra*)	SNA-I	3%	[25]
Banana (*Musa acuminata*)	Mus a 2	2.3%	[26]

Dr RW (Bob) Stoddart

- 116+ Publications at Manchester
- Co workers Carolyn Jones, John McClure, Emyr Benbow, Ray McMahon
- The Glycoprofile Patterns of Endothelial Cells in Usual Interstitial Pneumonia
- Glycophenotype of bone metastases of prostatic carcinomas
- Lectin and other histochemical studies of the articular cartilage and the chondro-osseous junction of the normal human knee joint
- Changes in glycan distribution within the porcine interhaemal barrier during gestation
- Lectin histochemistry and cytochemistry-light microscopy : avidin-biotin amplification on resin-embedded sections.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Neoplasm
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Glycosylation
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Publications

Glycophenotype of bone metastases of prostatic carcinomas

Mohamad Nidal Khabaz · John McClure · Sheena McClure · Robert William Stoddart

Received: 15 December 2009 / Accepted: 4 February 2010 / Published online: 23 February 2010

Abstract The significant morbidity and mortality associated recognised by AAA and UEA-1). The prostatic cancer cells

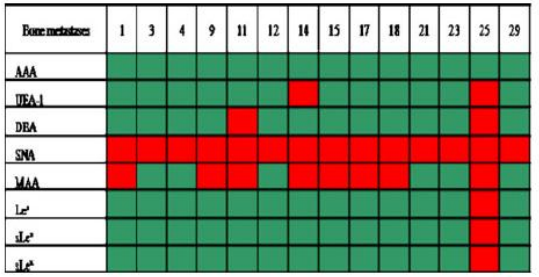


Fig. 2 Glycoprofile of bone metastases of prostatic carcinomas. *Red colour* presence of binding; *Green colour* absence of binding

Table 1 Specificities of lectins (agglutinins) and monoclonal antibodies

Abbreviation	Marker name	Carbohydrate specificity
AAA	*Anguilla anguilla agglutinin*	α-L-fucosyl termini and fucosylated type I chains
UEA-I	*Ulex europaeus agglutinin*	L-Fucα1,2Galβ1,4GlcNAcβ1-
DBA	*Dolichos biflorus agglutinin*	GalNAcα1,3(L-Fucα1,2) Galβ1,3/ 4GlcNAcβ1-
LTA	*Tagonolobus purpureus agglutinin*	α-L-fucosyl termini (especially where clustered) and fucosylα1, 6 links on *N*-acetyl chitobiosyl core sequences of *N*-glycan
SBA	*Glycine max/soybean agglutinin*	GalNAcα1- more than Galα and GalNAcβ1-
SNA	*Sambucus nigra agglutinin*	NeuAcα2,6Gal/GalNAc-
MAA	*Maackia amurensis agglutinin*	NeuAcα2,3Galβ1-
MAb Le^a	Monoclonal antibody against $Lewis^a$ antigen	Galβ1-3 (Fuc α1-4) GlcNAcβ1-3Gal-
MAb sLe^a	Monoclonal antibody against sialyl $Lewis^a$ antigen	NeuAc(α2-3) Galβ1-3 (Fuc α1-4) GlcNAcβ1-3Gal-
MAb sLe^x	Monoclonal antibody against sialyl $Lewis^x$ antigen	NeuAcα2-3Galβ1-4 (Fucα1-3)GlcNAcβ1-3Gal-

Fuc fucose, *Gal* galactose, *GlcNAc* 2 deoxy, 2 acetamidoglucosyl residue, *GalNAc* 2 deoxy, 2 acetamidogalactosyl residue, *NeuAc* sialic acid

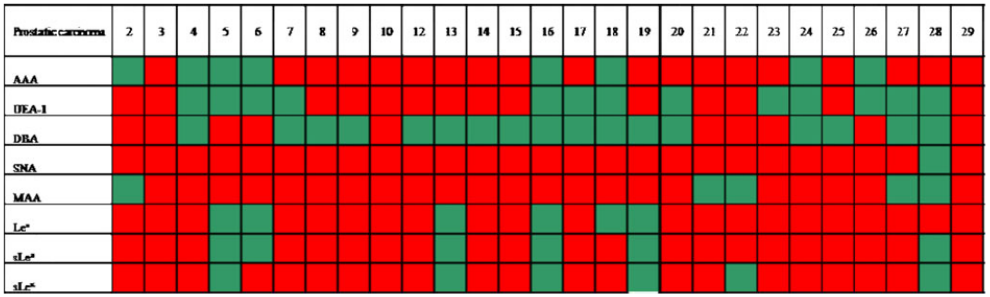
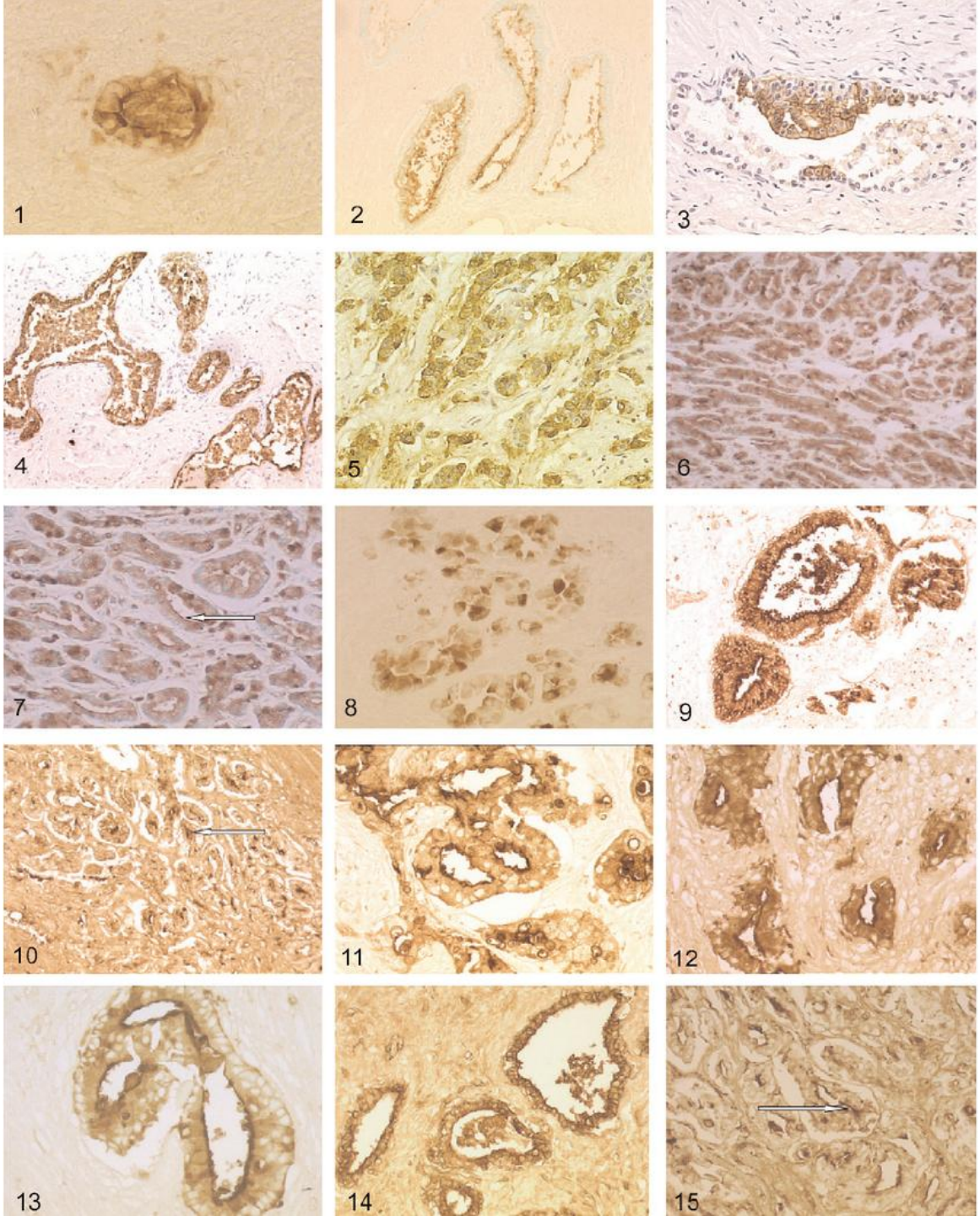


Fig. 1 Glycoprofile of prostatic carcinomas. *Red colour* presence of binding; *Green colour* absence of binding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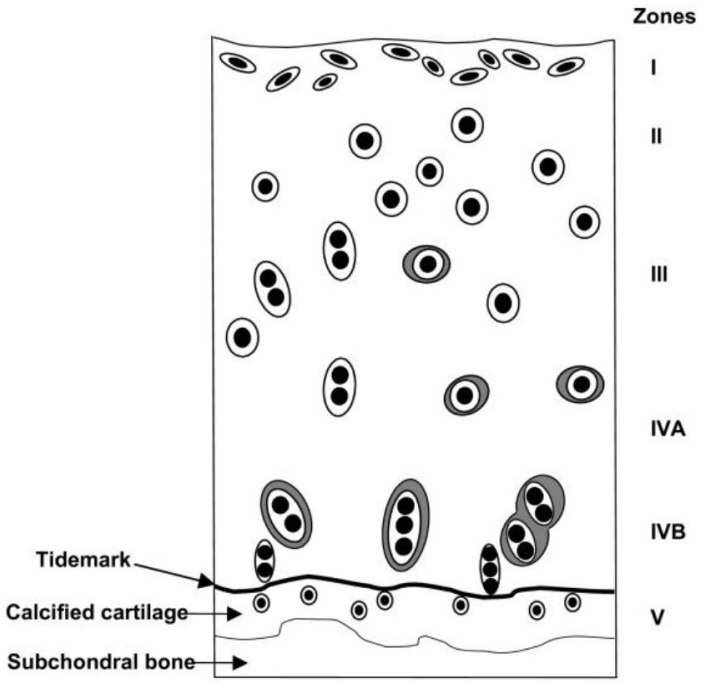
Zones
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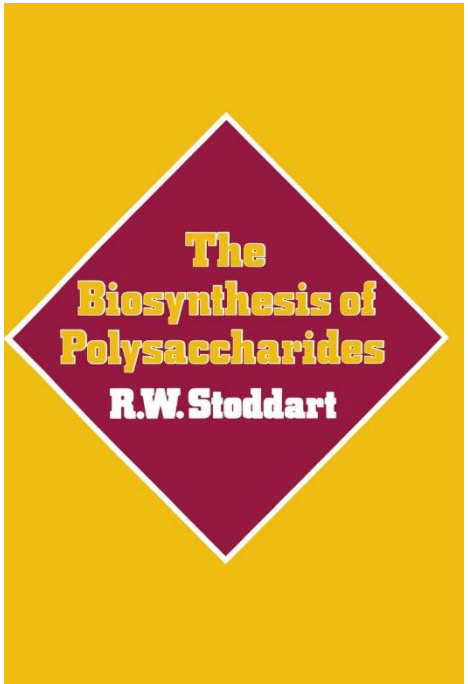
II
III
IVA
IVB
V
Tidemark
Calcified cartilage
Subchondral bone


The
Biosynthesis of
Polysaccharides
R.W. Stoddart

Glycobiology

- Within the last 25 yr, the study of glycans, their structures, and their distribution in tissues has emerged from relative obscurity to become a major theme of molecular and cellular biology: “glycobiology” (1).
- Glycans are major components of cellular surfaces (2,3), extracellular matrices (4,5), and secretions (6), and play important roles in cell—cell and cell—matrix recognition and adhesion (7,8). They regulate the surface environment of cells by influencing the structure of water (6,9), by modulating diffusion, by sequestering metabolites such as metal ions, by presenting various growth factors to their receptors (10,11), by acting as ligands in recognition-adhesion systems (11–13), and by making major contributions to cell surface charge (2,14). In secretions, they are variously determinants of molecular folding (15), hydration, interaction, and targeting, and they serve in the mechanisms that monitor the aging of glycoconjugates in circulation (6,9,16,17).

- They are now implicated in mechanisms of molecular targeting and segregation within the endomembrane systems of cells (18-20), in calcium transport in mitochondria (21), the handling of mRNA and its export from the nucleus, the regulation of transcription (19), and in then classical role as energy stores. In all of this, the association of anatomical or ultrastructural localization with biological function is of paramount importance. specific glycans occur in specific places (22,23). The challenge for the histochemist is to reconcile the achievement of sufficiently precise anatomical localization of glycans with the maximum of chemical information about their nature.

- The lectins have been the main means of accompllshing this, since their first application as fluorochrome-labeled probes to paraffin sections in the early 1970s (2,24). More recently, fluorescence has been largely supplanted by nonfluorescent disclosing systems, such as biotin-avidin-peroxidase and, though paraffin sections are still widely used, resin-embedding of specimens has proved advantageous in terms of resolution and economy of material at the light microscopic level.

Also …

Britain's oldest battlefield?

Detective work on skeletons has helped Manchester Museum experts uncover the earliest known battlefield in the UK.

The skeletons were excavated at Heronbridge, near Chester, in 1931 but have lain in store at the Museum since the 1950s.

Recent radiocarbon-dating work shows that it's likely they are the remains of men who died in the Battle of Chester in AD 616.

The evidence of trauma – severe injuries inflicted by swords, axes and other weapons – on the skeletons, shows that the men died in extremely violent circumstances.

A literary reference to a major battle of the early 7th century can be found in Bede's Ecclesiastical History of the English People. A Northumbrian army, led by King Aethelfrith, defeated a force of northern Welsh Britons at Chester.

With the assistance of the University's Dr Robert Stoddart and other experts, the Museum is examining the remains (pictured) and putting together a more detailed picture of events on the battlefield.

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The Slide Collection

There are 11 wooden boxes containing this list of slides:

1. Porcine lymphomata 30 slides
2. Hepatomata 35 slides
3. Rat bladder tumour 24 with controls
4. Atheroma (Human) 37
5. Tumours 54
6. Histology of pigs 152
7. Sections of pigs intestines 79
8. Pigs - blind loop and controls 68
9. Newborn and neonatal pigs ?
10. Intestines ?
11. More pigs intestine 156

12. Plus 7 empty wooden slide boxes

Practical

1. **Slides**