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PROVISIONAL

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

and

INTERNATIONAL UNION OF BIOCHEMISTRY

JOINT COMMISSION ON BIOCHEMICAL NOMENCLATURE*

POLYSACCHARIDE NOMENCLATURE

Comments on these recommendations are welcome and should be sent within 8 months from August 1982 to the Secretary of the Commission

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Comments from the viewpoint of languages other than English are especially encouraged. These may have special significance regarding the publication in various countries of translations of the nomenclature eventually approved by IUPAC.

*Membership of the Commission for 1979-81 was as follows:

Chairman: P. KARLSON (FRG); *Secretary:* H. B. F. DIXON (UK); *Members:* B. L. HORECKER (USA); Y. JEANNIN (France); C. LIÉBECQ (Belgium — as Chairman of IUB Committee of Editors of Biochemical Journals); B. LINDBERG (Sweden); K. L. LOENING (USA); G. P. MOSS (UK); J. REEDIJK (Netherlands); S. F. VELICK (USA); J. F. G. VLIEGENTHART (Netherlands).

Additional contributors to the formulation of these recommendations:

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Expert Panel: B. LINDBERG (Convener, Sweden); D. HORTON (USA); late W. KLYNE (UK); K. L. LOENING (USA); D. J. MANNERS (UK); W. G. OVEREND (UK); H. PAULSEN (FRG); D. A. REES (UK); R. S. TIPSON (USA).

PROVISIONAL

Polysaccharide Nomenclature

Recommendations 1980*

IUB-IUPAC JOINT COMMISSION ON BIOCHEMICAL NOMENCLATURE (JCBN)

CONTENTS

Polysaccharide nomenclature follows the general principles of established organic (1) and carbohydrate (2) nomenclature. For abbreviated nomenclature, see either *Abbreviated Terminology of Oligosaccharide Chains*, a document being published at the same time as this one, for a symbolism that explicitly gives all structural features known, or its Appendix (alternatively Section Lip-3 of Nomenclature of Lipids (3)) for a more condensed symbolism. Examples of both symbolisms are given herein.

1. Polysaccharide (glycan) is the name given to a macromolecule consisting of a large number of monosaccharide (glycose) residues joined to each other by glycosidic linkages. The term poly(glycose) is not quite a synonym for polysaccharide (glycan) (*cf.* Nomenclature of Regular Single Strand Organic Polymers (4)), because it includes macromolecules composed of glycose residues joined to each other by nonglycosidic linkages.

Note—Polysaccharides may be linear, branched, or cyclic. Although most polysaccharides bear a reducing monosaccharide residue at one end, and are, therefore, reducing polysaccharides, some polysaccharides have nonreducing residues at both ends.

For polysaccharides containing a substantial proportion of amino sugar residues, the term polysaccharide is adequate, although the term glycosaminoglycan may be used where particular emphasis is desired.

Polysaccharides composed of only one kind of monosaccharide are described as homopolysaccharides (homoglycans). Similarly, if two or more different kinds of monomeric unit are present, the class name of heteropolysaccharide (heteroglycan) may be used.

The term oligosaccharide is commonly used for carbohydrates comprised of 2 to about 10 monosaccharide residues.

2. A polysaccharide (glycan) composed of a single type of monosaccharide residue will be named, as a general term, by replacing the ending "ose" of the sugar by the suffix "an."

Note—Examples of established usage of the "an" ending are: xylan for polymers of xylose, mannan for polymers of mannose, and galactan for polymers of galactose. Cellulose and starch are both glucans, as they are composed of glucose residues.

3. When the configurational series of the monomer residues is shown, "D" or "L" may be included in the name of the polysaccharide.

Examples:

-4)DGlc(α1-3)DGlc(α1-4)DGlc(α1-3)DGlc(α1-

A D-glucan (nigeran)

→5)-α-L-Ara*f*-(1 → 5)-α-L-Ara*f*-(1 → 5)-α-L-Ara*f*-(1 → 5)-α-L-Ara*f*-(1→

3 3

↑ ↑

1 1

α-L-Ara*f* α-L-Ara*f*

An L-arabinan[1] (from mustard seeds)

4. Names assigned to newly discovered polysaccharides should end in "an."

Example:

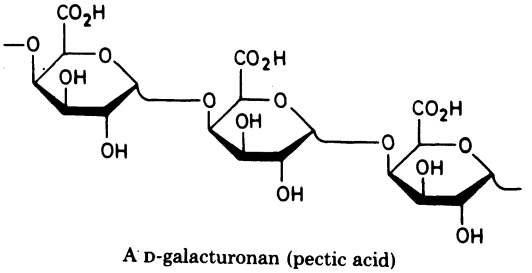
-6)Glc(β1-6)Glc(β1-6)Glc(β1-

Pustulan (a glucan from the lichen *Umbilicaria pustulata*)

Note—The name ending in "an" refers to the unsubstituted polysaccharide. Thus xylan occurs in nature in unacetylated and partially acetylated forms. Xylan designates unacetylated xylan, and xylan acetate an acetylated xylan.

5. A polysaccharide (glycan) composed entirely of glycuronic acid residues is named by replacing "ic acid" by "an." The generic name for this group is "glycuronan."

Example:



A D-galacturonan (pectic acid)

Note—The term glycuronan is used instead of "polyuronide," as the latter term is incorrect.

6. A polysaccharide composed entirely of amino sugar residues is named by the systematic nomenclature pertinent to the amino sugar.

[1] Several of the polysaccharides in the examples have less-ordered structures. In the structural formulas given for these, the main sugar components and linkages are given, but not their proportions.

* Document of the IUB-IUPAC Joint Commission on Biochemical Nomenclature (JCBN) whose members are P. Karlson (Chairman), H. B. F. Dixon, Y. Jeannin, C. Liébecq (as Chairman of the IUB Committee of Editors of Biochemical Journals), B. Lindberg, K. L. Loening, G. P. Moss, and S. F. Velick, in consultation with J. F. G. Vliegenthart and the Nomenclature Committee of IUB, whose additional members are H. Bielka, W. B. Jakoby, B. Keil, and E. C. Webb. Comments or suggestions for modifications may be sent to the secretary of JCBN, H. B. F. Dixon, Department of Biochemistry, Tennis Court Road, Cambridge, United Kingdom CB2 1QW, or to any member. JCBN thanks the expert panel of B. Lindberg (convener), D. Horton, the late W. Klyne, K. L. Loening, D. J. Manners, W. G. Overend, H. Paulsen, D. A. Rees, and R. S. Tipson for drafting these proposals.

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Example:

-4)GlcNAc(β1-4)GlcNAc(β1-4)GlcNAc(β-

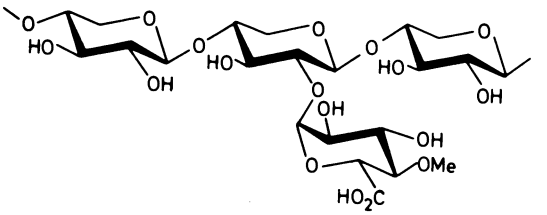
A 2-acetamido-2-deoxy-D-glucan (chitin)

7. A heteropolysaccharide (heteroglycan) is a polymer containing two or more kinds of sugar (glycose) or modified sugar (for example, aminodeoxyglycose or glycuronic acid) residue. When the polysaccharide has a principal chain ("backbone") composed of only one type of sugar residue, this sugar residue should be written last, with the other sugar residues present listed in alphabetical order. However, when no single type of sugar residue constitutes the principal chain, all sugar residues should be given alphabetically, and the name terminated with the suffix glycan.

Examples:

9. When substitution occurs in a polysaccharide (glycan), each substituted type of residue is made part of the name and placed in alphabetical order.

Examples:



(4-*O*-Methyl-α-D-glucurono)-D-xylan (from birch, *Betula*)

→4)-β-D-Man*p*-(1 → 4)-β-D-Man*p*-(1 → 4)-β-D-Man*p*-(1 → 4)-β-D-Man*p*-(1→
6 6
↑ ↑
1 1
α-D-Gal*p* α-D-Gal*p*

A D-galacto-D-mannan (guaran)

(A less branched D-galacto-D-mannan could be shown in the condensed system as: [4Manβ1-]$_n$4(Galα1-6)Manβ1-[4Manβ1-]$_n$4(Galα1-6)Manβ1-. Note that in the condensed system repeating units are in square brackets and branches in parentheses.)

→6)-α-D-Gal*p*-(1 → 6)-α-D-Gal*p*-(1 → 6)-α-D-Gal*p*-(1 → 6)-α-D-Gal*p*(1→
2 2
↑ ↑
1 1
α-L-Fuc*p* α-L-Fuc*p*
3
↑
1
α-D-Man*p*

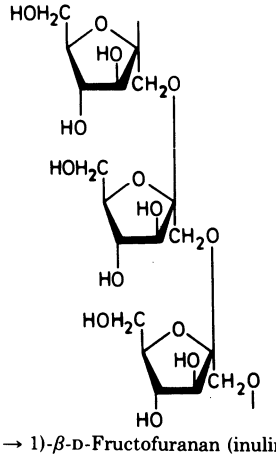
An L-fuco-D-manno-D-galactan (from a fungus)

-4Manβ1-4Glcβ1-4(Galα1-6)Manβ1-4Manβ1-

A D-galacto-D-gluco-D-mannoglycan (from softwood)

8. When the major linkage contained in a homopolysaccharide is known, an indication of it may be included in the name. The linkage designation shows the carbon atoms involved in the glycosidic bonds. When specific sugars are designated, notation for glycosidic linkages should precede the symbols designating the configuration of the sugar; thus, (1 → 4)-α-D-glucan.

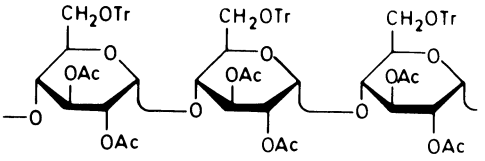
Examples:



(2 → 1)-β-D-Fructofuranan (inulin)

→4)-α-D-Glc*p*-(1 → 4)-α-D-Glc*p*-(1 → 4)-α-D-Glc*p*(1→

(1 → 4)-α-D-Glucopyranan (amylose)



2,3-Di-*O*-acetyl-6-*O*-tritylamylose

10. Polymers containing covalently bound monosaccharide and amino-acid residues are termed glycoproteins, proteoglycans, and peptidoglycans.

Note—It is not possible to give precise distinctions between these polymers. In general terms, glycoproteins are conjugated proteins containing either oligosaccharide groups or polysaccharide groups having a fairly low relative molecular mass. Proteoglycans are proteins linked to polysaccharides of high molecular mass. Peptidoglycans consist of polysaccharide chains covalently linked to peptide chains. Such products are components of bacterial cell walls.

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