

Etymology of Main Polysaccharide Names

2

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Abstract

This chapter deals with the etymology and history of names of the main polysaccharides and of some of their constitutive saccharides. The considered languages are mainly those which are used by the 16 academic EPNOE members, which are also the founders of EPNOE Association. Most of these nine languages belong to the Indo-European family (which includes also Greek and Latin), and they are distributed among the Germanic group (English, German, Dutch, Swedish), the Roman group (French, Romanian), and the Slavic group (Polish, Slovenian). Among the nine languages, the only non-Indo-European one is Finnish, which belongs to the Finno-Ugrian family.

2.1 Introduction: Etymology

Etymology studies the origin and history of words. The interest of this approach lies in the fact that the etymology (from Greek *etimos* “true”) of a given word generally tells something about the reality which lies under this word. The present chapter deals with the etymology of the names given to the main saccharides and polysaccharides consumed and used by people.

For instance, the common name of a chemical substance is often related to the name of a plant from which the substance has been first isolated. That is true for saccharides like *sorbose* or

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rhamnose. The name of a substance can also be related to a specific part of plants, like cell wall for *cellulose* or fruit for *fructose*. In other cases, it can be related to an animal component, like liver for *heparin*, insect carapace for *chitin*, and milk for *lactose* and *galactose*. However, the link between the substance and its name can be quite different when it involves a particular property, like sweetening for *glucose*, stiffening for *starch*, and thickening for *pectin*. In any case, the common names of polysaccharides as chemicals are officially retained by IUPAC organization. Besides the names of some important mono or disaccharides, the complete list of which is huge, the following chapter will insist more on the well-known polysaccharides: **cellulose**, **starch**, **chitin**, **carrageenan**, **inulin**, **pectin**, **heparin**, and **pullulan**.

Let's begin this exploration with the name *polysaccharide* itself.

2.2 Saccharide and Sugar: One Origin for Two Synonyms

A polysaccharide is a polymer (from Greek *polu* “many” and *meros* “part”). A monomer is made of only one part, a dimer of two parts, and a polymer of many parts. Polysaccharides are sometimes called *polymerized sugars*. In other words, *saccharide* and *sugar* are roughly synonyms: the former being a scientific term, while the latter is also used in chemistry (for instance, in the phrase *sugar unit*) but mainly in common language, for ordinary *table sugar* in tea or coffee.

- The word (or element) *saccharide* is made of *sacchar-*, which means “sugar,” and the suffix *-ide* (from Greek *eidos* “species”), which indicates the belonging to a family: a saccharide is a molecule of the family of sugars. It is the same name as English in German and French and nearly the same in Dutch (*sacharide*), Swedish (*sackarid*), Finnish (*sakkaridi*), Polish (*sacharyd*), Slovenian (*saharid*) and Romanian (*zaharid*).
- Both *saccharide* and *sugar* are derived from Sanskrit *çarkarā* “gravel,” and later “sugar” (originally, granulated sugar):

- *Saccharide* was recently derived, in scientific language, from the Latin word *saccharum*, continuing Greek *sakkharon*, which was the name of a product imported from India during antiquity. As a matter of fact, this product was something like cane sugar used only in small quantities and mainly for medicinal uses. At that time in Europe, the general way of sweetening food and beverages was with honey.
- *Sugar* was derived, through Old French, from Arabic *sukkar*, when the cultivation of sugar cane was introduced in southern Europe by the Arabian agronomists around the Middle Ages. Indeed, Arabic *sukkar* is, directly or indirectly, the origin of most European names for sugar, like Spanish *azucar* (from Arabic *al sukkar* “the sugar”), Italian *zucchero*, itself continued by German *Zucker*, Swedish *socker*, or French *sucre*, while English *sugar* and Dutch *suiker* are derived from Old French. We recognize the same Arabic origin in Polish *cukier* and Finnish *sokeri* (borrowed from Swedish), while in Romanian, *zahăr* is related to Modern Greek *zakharê* “sugar”.

N.B.: the Slovenian name *sladkor* “sugar” as well as the verb *sladkati* “to sweeten” belongs to a Balto-Slavic family of words (including Polish *śłodki* “sweet”) related to the Old Norse *saltr* “seasoned, salted” (Buck 1988), itself related to the Indo-European root meaning “salt.” This shows that seasoning can be done with salt or with sugar!

2.2.1 Sugar, Saccharide, or -ose

We know *monosaccharides*, like *glucose*, *disaccharides*, like *lactose*, and *polysaccharides*, like *cellulose* where we see the suffix *-ose*, which is still another way for designating a sugar or a sugar derivative. This suffix comes from the name *glucose* itself, attested in a French publication in 1838. The decision has been to name the other sugars after *glucose*, like *fructose* (from Latin *fructus* “fruit”), *lactose* (from Latin *lac*, *lactis* “milk”), *galactose* (from Greek *gala*,

galactos “milk”), etc. Glucose, fructose, lactose, galactose, etc., were called *oses* in French, the word *ose* itself becoming another synonym for *sugar* and *saccharide*. Then *polyose* will be roughly a synonym of *polysaccharide*. But we still have to explain *glucose*.

2.2.2 Mildness, Sweetness in Chemistry

The name *glucose* is borrowed from the Greek name *gleukos* meaning, in Aristotle’s works, “mild wine” or, in a figurative sense, “mildness.” Then, *gleukos* itself is derived from the Greek adjective *glukus* “mild, sweet, delicious” in the literal as well as the figurative sense. From these names, we have many derivatives with the prefix *glyc(o)-* or *gluc(o)-*.

- The prefix *glyc(o)-* is used for a sweet substance, like *glycine* itself, or *glycerin* (made from the Greek adjective *glukeros*, nearly a synonym of *glukus*), and then derivatives like *glycol*.
- The prefix *glyc(o)-* or *gluc(o)-* represents glucose or any glucose-like molecules; for instance (cf. terminology in Chap. 3):
 - *Glycan*, as a synonym of *polysaccharide*, or oligosaccharide, is made only of sugar units.
 - *Glycogen* is a polymer of glucose, which can deliver (generate) *glucose*.
 - But *glucan* is a polysaccharide made only of glucose units, like cellulose and starch for instance.
 - In French food terminology, *glucide* is the word for *carbohydrate*.

To conclude this paragraph, we can say that *glucose* is a sort of pleonasm because *gluc-* means “sweet, mild as sugar” and, in chemistry, suffix *-ose* is a synonym of *sugar*! In the same way, the name *saccharose* (or *sucrose*) is a pleonasm as well!

2.3 A Large Variety of “-oses”

Starting from *glucose*, the suffix *-ose* is added, for designating different sugar units, to several elements related to:



Fig. 2.1 *Sorbus domestica*. Sorb tree, or service tree, or rowan. BotBln, Feb. 17, 2012 via Wikipedia, Creative Commons Attribution

- A chemical structure as for *hexose* (six carbons) and *pentose* (five carbons), or *aldose* (aldehyde function) and *ketose* (ketone function)
- An optical activity as for *dextrose* (Latin *dexter* “right”) and *levulose* (Latin *loevus* “left”)
- And, more frequently, the vegetal or animal origin of the molecule, as in *fructose*, *lactose*, and *galactose* already mentioned, or *xylose* (Greek *xulon* “wood”), *maltose* (from *malt*), and *fucose* (from Latin *fucus* “red alga”).

The name *sorbose* is derived from the genus name *Sorbus* of several plants like sorb trees or rowans (Fig. 2.1).

The *rhamnose* was isolated from the buckthorn, a plant belonging to genus *Rhamnus*, created by Linnaeus in 1753 after the Greek name of this plant, *rhamnos* (Fig. 2.2).

The origin of *apiose* is not obvious. Could it be Latin *apis* “bee”? Indirectly yes, since the *apiose* has been extracted from parsley, and then *apiose* comes from Latin *apium* “parsley.” But Latin *apium* originally is the name of celery, so named from *apis* “bee,” because it was considered in antiquity as the *herb of bees*.

The origin of *mannose* is still more enigmatic: it comes from *manna*, the Hebraic name in the Bible for the miraculous food appearing in the desert but, in reality, a sweet secretion provided by some trees or bushes in favorable conditions.

Arabinose was extracted from *gum arabic*, an excretion of several species of *Acacia*, mainly in



Fig. 2.2 *Rhamnus frangula*. Alder buckthorn. David Perez, Feb. 17, 2012 via Wikimedia. Creative Commons Attribution

Arabic-speaking regions of northern Africa. Later on, the name *ribose* was used (in 1892) for a new isomer of arabinose, the change of letters from *arabinose* to *ribose* being a sort of literal representation of the chemical isomerization (likewise, in the same period, an isomer of xylose was named *lyxose*).

In the following decade, researchers of the Rockefeller Institute of Biochemistry (RIB in New York City) showed the crucial role of ribose in the chemistry of life (as part of ribonucleic acid or RNA). By chance, the initials RIB could then also be read in *ribose*.

We come now to a polymer of “-oses” of major importance.

2.4 Cellulose

Roughly speaking, cellulose is polymerized glucose, and this is the reason of the suffix *-ose* of *cellulose*. The first part of the name means that this natural polymer is an important constituent of vegetal cells, namely, the main constituent of cell walls. The French name *cellulose* is originally attested in a botanic course of Antoine de Jussieu

in 1840, after French *cellule* “cell,” derived earlier from Latin *cellula* “small room,” diminutive of *cella* “room” (the etymology of which is perhaps related to the Latin verb *celare* “to hide”). In other Roman languages, the name of a cell is also linked to the Latin diminutive *cellula*, like Italian *cellula*, Spanish *célula*, Romanian *celulă*, but in other languages, the name comes directly from *cella*: English and Swedish *cell*, German *Zelle*, Dutch *cel*, as well as in Finnish *solu* or Polish *cela* (Slovenian is different with the diminutive *celica* “cell”). Nevertheless, in all languages, the name of cellulose is equivalent to the French word: Italian *cellulosa*, Spanish *celulosa*, Romanian *celulosă*, as well as English *cellulose*, German *Zellulose*, Swedish *cellulosa*, Dutch *cellulose* (besides *celstof*, which, in Dutch, means “constituent of cell”), Polish and Slovenian *celuloza*, and Finnish *selluloosa*.

Now, before coming to starch, the other important natural polysaccharide in terms of volume, let’s examine different ways of expressing sweetness in European tongues.

2.5 Indo-European Representation of Mildness or Sweetness

We have seen the Greek adjective *glukus* “mild, sweet.” Its Latin equivalent is *dulcis*, becoming *dulce* in Spanish, *dolce* in Italian, or *édulcorant* “sweetener” and *doux* “mild” in French. Can we relate *glukus* to *dulcis*? Yes, if we consider (Ernout and Meillet 1985) the probable existence of an Indo-European root, **dluku-*, and if we admit that its initial *d* becomes *g* in Greek (by attraction of *k*, since *g* is closer to *k* than *d*) while the element *-lu-* of **dluku-* becomes *-ul-* in Latin (in linguistics, such an exchange of letters is called *metathesis*, and it happens that the same word, *metathesis*, designates a chemical reaction exchanging one atom group of one molecule with one atom group of another molecule). However, we see that English *sweet* is quite different, as well as *mild*. First, we have another Indo-European root, **swad-* “mild, pleasant,” which explains:

- English *sweet*, German *süß*, Dutch *zoet*, Swedish *söt*

- But also Latin *suavis* “mild, pleasant,” then *suave* in French, borrowed as such by English, *soave* in Italian, more in the figurative meaning

Now, we have to deal with the adjective *mild*, which belongs to a completely different family of words.

2.5.1 From Millstone to Mildness?

As a matter of fact, there are connections (Onions 1992), even if they are not firmly established, between:

- Greek *mulê*, Latin *mola* “millstone,” Latin verb *molere* “to grind, to mill,” then in English *to mill*, and result of milling which is *meal* “flour,” like in *wheatmeal*, for instance (nothing to do with *meal* “lunch or dinner”, which is related to *measure*), and in Dutch *meel* “meal, flour” and in German *Mehl* “flour.”
- Latin *mollis* “soft,” because a milled product is no longer hard, then French *mou* “soft” and *mild* “not hard,” in English as well as in German, Dutch, and Swedish.
- The Germanic root represented by English *to melt* “to become liquid” (and the variant *to smelt* “to fuse” in metallurgy, Dutch *smelten* “to melt,” German *schmelzen* “to melt”) since both melted and milled substances are fluid.
- Finally, English *malt* (then French *malt*, German *Malz*, Dutch *mout*) has something to do with *melt*, since the malt is produced by a digestion of barley grains in water, resulting in a sort of syrup.

In this process, barley starch is depolymerized by amylase: this leads us to the history of starch names in different languages.

ing from *amulos*, the first meaning of which is “not ground, not milled.” Indeed, *amulos* is made (Chanteraine 1990) of the privative prefix *a-* “without” and the name *mulê* “millstone.” The reason of this etymology is that starch was prepared with fresh grains, without any milling, as opposed to flour. Pliny the Elder (first century), in his *Natural History* (Liber XVIII, 76), explains it as follows: “*The invention of starch happened in Chios island, and still today the most estimated one is coming from there. It is so named because it is prepared without the use of any millstone.*” Of course, the production of starch has been much improved all along times: some crushing or grinding of the grains has been added in the process, and even milling, since the wheat starch can be produced today from flour. Nevertheless, the etymology of Latin *amylum* derivatives retains the footprint of the ancient process. In the medieval period, this name *amylum* was altered to *amidum*, whence the names of starch in Roman languages, like French and Romanian *amidon*, Italian *amido*, or Spanish *almidón*.

Let’s make two remarks:

- (1) The late Latin word *amidum* “starch” has nothing to do with the much more recent name *amide*. While *amidum* must be understood as *a + midum*, the name *amide* is made of *am + ide*, where *am-* is the beginning of *ammoniac*, since a molecule of amide is built around an atom of nitrogen. In the scientific nomenclature, no confusion can happen with *amide* since the starting point for expressing a relation with starch remains classical Latin in the prefix *amyl(o)-*, like in *amylose*, *amylase*, *amyloplast*, or, in French, *amylacé* “starchy.”
- (2) *Amyl-* is also synonym of *pentyl-*, like in *amyl alcohol*, probably because this alcohol can be produced from starch.

But then, what is the origin of *starch* in English, which is so different from the Latin form?

2.6 Starch

2.6.1 Starch in Greek, Latin, and Roman Languages

This product was named *amylum* in classical Latin, itself borrowed from Greek *amulon*, com-

2.6.2 Starch in Germanic Languages and in Finnish

The English name of *starch*, as well as its equivalent in German, *Stärke*, or in Swedish, *Stärkelse*,

is not related, as in Greek, to its manufacturing process but to its utilization. As a matter of fact, those names are related to the same Indo-European root as the adjective *stark*, in English “rigid, stiff” and in German and Swedish “solid, resistant,” and this relation is due to the stiffness which is given to fabrics and clothes by the application of starch. Even more unexpected, the name of a famous bird, the *stork* in English and Swedish, *Storch* in German, is related to the same Indo-European root, just because this bird, so elegant while flying, looks stiff when it is landing and then walking on its nest. The name of the stork is totally different in Latin (*ciconia*, probably an onomatopoeic name, for this clattering bird), and then in the Roman languages (as *cigogne* in French). Coming back to starch, its name in Finnish, *tärkkelys*, is borrowed from Swedish *stärkelse*, with the fall of the initial *s* (cf. *Tukholma*, the Finnish name of Stockholm). Even if Finnish is not a Germanic language, and even not an Indo-European language, many borrowings happened between Finnish and Swedish all along the history of Finland.

N.B.: In this case, the Dutch names (van Veen 1989) are completely different from other Germanic languages:

- *Zetmeel* “starch” is made of *zet-*, meaning “making thick, setting,” which is logical for starch in food use and of *-meel* “meal, flour,” but the other Dutch name *stijfsel* “starch for nonfood use” is a derivative of *stijf* “stiff,” which is logical for a stiffening product.
- *Ooievaar* “stork” is somewhat isolated and originally means “bringing luck.”

2.6.3 Starch in Slavic Languages

The name of starch in Polish, *skrobia*, comes from the verb *skrobać* “to scrape,” because starch has been produced from grated wheat grain and later on from grated potato or maize. In Slovenian, the name *škrob* “starch” is of the same origin. After cellulose and starch, a third important polysaccharide is chitin.

2.7 Chitin

The name *chitin* is attested (*chitine* in French in 1821) for designating the main constituent of the carapace of insects. This name, with the suffix *-in*, comes from Greek *khitôn*, which was used, in secondary meanings, for naming hard envelopes in anatomy and in botany.

This Greek name itself, probably of Semitic origin, designated originally a sort of tunic, generally short for men and long for women, still named *chiton* (in French too) in texts relating to antiquity. However, this Greek word took several derivatives and other meanings, such as any item of clothing, an armored coat for a soldier, and, as we just said, the skin of animal organs, of snakes, or of fruit, or else the cork of some trees or the shell of mollusk shellfish.

Today, it is well known that chitin is the main constituent of carapace, not only of insects but of all arthropods, including particularly crustacean shellfish, and that it is also the main constituent of cell walls of fungi. Chitosan is obtained from chitin by partial deacetylation, resulting in the fact that chitosan is water soluble while chitin is not.

2.8 Other Polysaccharides

The last paragraph of this chapter will deal with the names of the following polysaccharides: *carrageenan*, *inulin*, *pectin*, *heparin*, *pullulan*, *hyaluronan*, *murein*, and *levan*.

2.8.1 Carrageenan

Carrageenan is extracted from red seaweed known under the common, and misleading, name of *Irish moss* or *carrageen moss* or *curly moss* (Fig. 2.3).

This English name *carrageen* (in French *carrageen*) probably comes from the old names (*Carrageen*, *Carragheen*) of the city now named *Carrigeen* (originally, in Irish *Carraigín*,

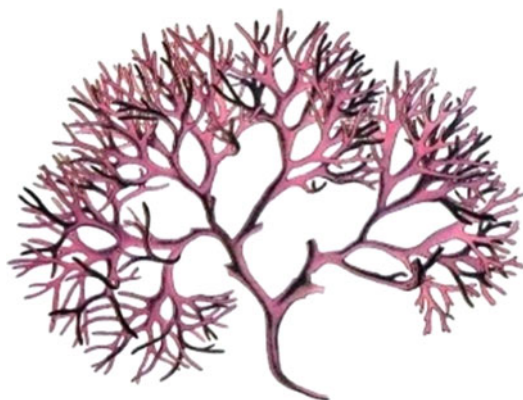


Fig. 2.3 Carrageen moss, *Chondrus crispus*. (from Greek *khondros* “cartilage” and Latin *crispus* “curly”). Franz Eugen Köhler, Feb. 17, 2012 via Wikimedia, Creative Commons Attribution

which means “little rock,” from *carraig* “rock”). This city is located near Waterford, on the south-east coast of Ireland, a region where this Irish moss was historically cropped and exploited for producing a sort of vegetal equivalent of the animal gelatin.

N.B.: There is another product similar to carrageenan: the *agar* or *agar-agar* (from its Indonesian or Malayan name), which is also extracted from a red seaweed. Purified agar-agar is a polysaccharide called *agarose*.

2.8.2 Inulin

Inulin is extracted from a large yellow-flowered plant called *elecampane* in English (Fig. 2.4). Since antiquity, this plant has been known for its medical properties. Pliny the Elder describes it under the name *inula*, itself derived from Greek *helenion*, which designates a plant supposed to be dedicated to the legendary, famous, and beautiful *Helen of Troy*. Namely, *helenion* was borrowed in primitive Latin as *elena*, or *enula*, due to the permutation of *l* and *n* (i.e., metathesis, as mentioned earlier in this chapter), and then *inula* in classical Latin. At the same time, *elena* (*alena*) evolved to *aunée* in French, *alant* in German and



Fig. 2.4 *Inula helenium*. Elecampane. Eugene van der Pijll, Feb. 17, 2012 via Wikipedia, Creative Commons Attribution

Dutch, *eolone* in Old English, and *elecampane* in Modern English, with Latin *campaneus* “living in the fields.”

In 1753, Linnaeus established the genus *Inula* and named its main species *Inula helenium*, combining the Greek and Latin names. The name *inulin* is of course derived from *Inula*, with the suffix *-in*.

2.8.3 Pectin

This polysaccharide is known for its jelling properties, particularly in the composition of jams and jellies. Its name is made of the suffix *-in* after the element *pect-*, itself derived from the Greek adjective *pēktos* “coagulated,” related to the irregular verb *pēgnumi* “to stick in, to fix, to solidify.” In the same family, there is the adjective *pēgos* “compact, thick.” It is interesting to note that the root *peg-* or *pek-* is also present in Latin words with the adjective *compactus* “compact,” from the verb *pingere* “to stick in, to fix, to solidify” in the literal as well as the figurative sense, and even with the verb *pacere* “to pacify” in relation with *pax*, *pacis* “peace” because peace, thanks to a *pact*, brings stability and solidity to a human community. What a surprising semantic link between *pectin* and *peace*!

N.B.: In Dutch, pectin is called *pectine*, or *geleisuiker*, made of *gelei* “jelly” and *suiker* “sugar.” The name *jelly* or *gel* (cf. *gelatin*) comes from the Latin verb *gelare* “to freeze,” because of the analogy between solidification of water by freezing, resulting in translucent ice, and its solidification by gelling, with pectin, for example, resulting in some soft translucent gel. The link between the two concepts remains transparent in Roman languages, as in French where there are the following homonyms: *gel* “frost” and *gel* “gel, jelly.” But this link is not obvious in a language where the verb meaning “to freeze” is not related to Latin *gelare*.

2.8.4 Heparin

This product has been discovered in extracts of liver showing antithrombosis effect. It is the reason why *heparin* is composed of the suffix *-in* after the element *hepar-*, from Greek *hêpar*, *hêpatos* “liver.” However, the link between *heparin* and the name of liver is only historical since this polysaccharide is present in many organs and is produced today from other animal organs than liver.

About Liver: The designation of this organ is another case where we find very different names in all Europe. Greek *hêpar*, like Latin *jacur*, belong to the same Indo-European origin, linked to the role of this organ in religious prediction, while Polish *wątroba* and Slovenian *jetra* are related to Greek *entera* “entrails.” But English *liver*, German *Leber*, and Dutch and Swedish *lever* are probably related to the Greek *lipos* “fat,” perhaps because of the *foie gras* of goose, which was already popular in antiquity. This link between *foie gras* and the name of liver is still more certain in Roman languages: Italian *fegato*, Spanish *higado*, French *foie*, and Romanian *ficat* are all derivatives of Latin *ficatum* “foie gras,” from *figus* “fig, fig tree,” because, already in ancient Greece, the geese were force-fed with figs, and also because liver was often cooked with figs. Even in Modern Greek, *sukôti* “liver” comes from *suko* “fig.”

Let’s end this list with the Finnish *maksa* “liver,” which is linked to a very old Finno-Ugrian root (cf. Hungarian *máj* “liver”) (Häkkinen 2007).

2.8.5 Pullulan

It is a polysaccharide which is produced from starch by a yeastlike filamentous fungus named *Aureobasidium pullulans*. The species name *pullulans* means “pullulating,” from the Latin verb *pullulare* “to pullulate,” because this fungus does pullulate in various environments. Then *pullulan* comes from a species name, unlike the different names seen until now, derived from a genus name, like *Sorbus*, *Rhamnus*, or *Inula*.

2.8.6 Hyaluronan, Murein, and Levan

These three last polysaccharides are also dealt with in Chap. 3:

- *Hyaluronan* is made of Greek *hualos* “glass,” because this molecule is present in the vitreous humor of the eye and of *uronic (acid)* from Greek *ouron* “urine.”
- *Murein* is a derivate of Latin *murus* “wall” (cf. French *mur* “wall”), because this molecule is present in cell walls of specific bacteria.
- *Levan* is made from Latin *laevus* “left,” as opposed to *dextran*.

Conclusion

The huge biodiversity on the earth is partly visible in the large diversity of saccharides and polysaccharides which are provided by nature. The names of these products are linked to their natural origin, to their properties, or to some elements of their history, generally going back over antiquity. Apart from the case of starch, most of these names are very similar in all languages since they are generally derived from the same Greek or Latin words. For instance, the vernacular names of liver are quite different in different languages (*liver*, *foie*, *ficat*, *wątroba*, *maksa*), but the

name of *heparin* remains the same, or nearly the same (*heparin*, *héparine*, *heparina*, *heparyna*, *heparini*), since it is derived from the Greek word *hépar* “liver.” Another example is the name of *inulin*, derived from the genus name *Inula* of a plant, regardless of the vernacular names of this plant, which are quite varied in Europe. Unfortunately, the Greek and Latin languages are less and less present in the education programs of European countries, but fortunately, they remain a sort of Esperanto, very useful for international communication in many scientific fields.

Acknowledgments Jan van Dam is thanked for the fruitful discussions that took place about the content of this chapter.

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The European Polysaccharide Network of Excellence
(EPNOE)

Research Initiatives and Results

Navard, P. (Ed.)

2012, XII, 401 p., Hardcover

ISBN: 978-3-7091-0420-0