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COMMENTARY

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Proposal for a systematic naming convention for liamocins

Dear Editor,

Precisely naming chemical compounds is essential in various scientific fields, including pharmaceuticals, agriculture, and the chemical industry. Accurate nomenclature ensures clear communication among researchers and promotes scientific rigor and therewith progress. Random or improper naming practices can create confusion, hinder standardization efforts, and impede the advancement of research in these areas.

Ambiguous naming in the medical field, such as with thalidomide, has caused detrimental effects. Thalidomide was initially marketed under different trade names like Contergan in Germany, Softenon in other European countries, and Distaval in the UK and Australia. This drug was originally intended as a sedative but was later discovered to cause congenital disabilities (Annas & Elias, 1999; Vargesson, 2015). Another example is the similarity between chlorpromazine and chlorpropamide. This similarity has led to medication mix-ups, which can have detrimental effects on patients and result in ineffective treatment outcomes (Filik et al., 2006). These examples highlight the adverse effects of inconsistent naming of chemical compounds. In turn, systemic names following IUPAC guidelines (https://iupac.org/what-we-do/nomenclature/) offer unambiguous identification while ensuring consistency and avoiding mix-ups.

Here, we propose to replace the name liamocin with the descriptive name polyol lipids, reflecting its molecular structure and showcasing the amphiphilic nature of the compound. Liamocins are a group of glycolipids with surface active properties produced by fungi from the genus *Aureobasidium* (Kurosawa et al., 1994). They were discovered in the 1990s (Kurosawa et al., 1994; Nagata et al., 1993) but have not been named liamocin until 2013 (Price et al., 2013). The headgroup can be composed of different polyols/sugar alcohols like mannitol, arabitol, glycerol, and others (Figure 1). Therefore, a more precise nomenclature would involve specifying the particular compound in the name, for example, mannitol lipids (see below).

Polyol lipid synthesis in *Aureobasidium* is accompanied by a drastic lowering of the pH value (Saur et al., 2019) and involves an intricate biosynthetic pathway with several identified enzymes. Mannitol and arabitol, the primary head groups, are derived from pentoses. The central enzyme, an iterative type I polyketide synthase (PKSI), plays a crucial role in synthesizing the monomers for the lipid structure of the polyol lipids: 3,5-dihydroxydecanoic acids. The PKS is activated by a phosphopantetheinyl transferase and uses acetyl-CoA and malonyl-CoA as substrates. Genomic co-localization of genes coding for key enzymes like Est1 and Gal1 with PKSI suggests coordinated regulation. Esterase Est1 is reported to attach the polyol head group to the backbone (Garay et al., 2018; Kang et al., 2022; Price et al., 2013; Price et al., 2017).

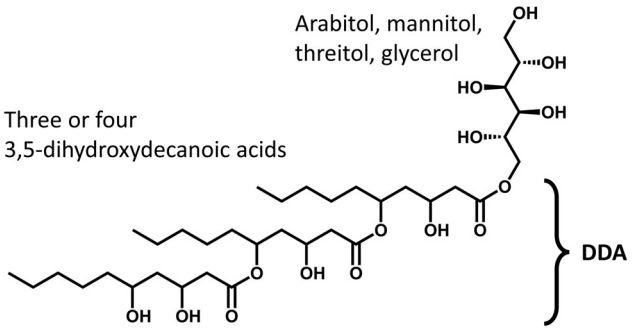

FIGURE 1 Molecular structures of polyol lipids and oligo-dihydroxydecanoic acid (DDA).

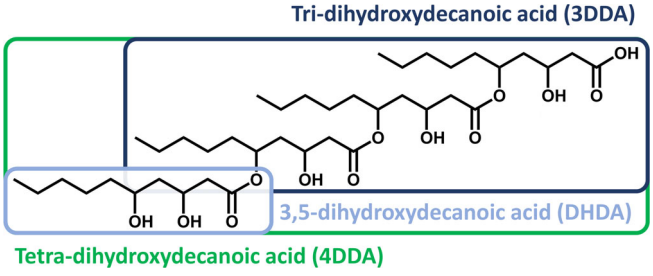

FIGURE 2 New denominations for the aglycones of the polyol lipids. We propose to denote this group of molecules (oligo-) dihydroxydecanoic acid or just DDA.

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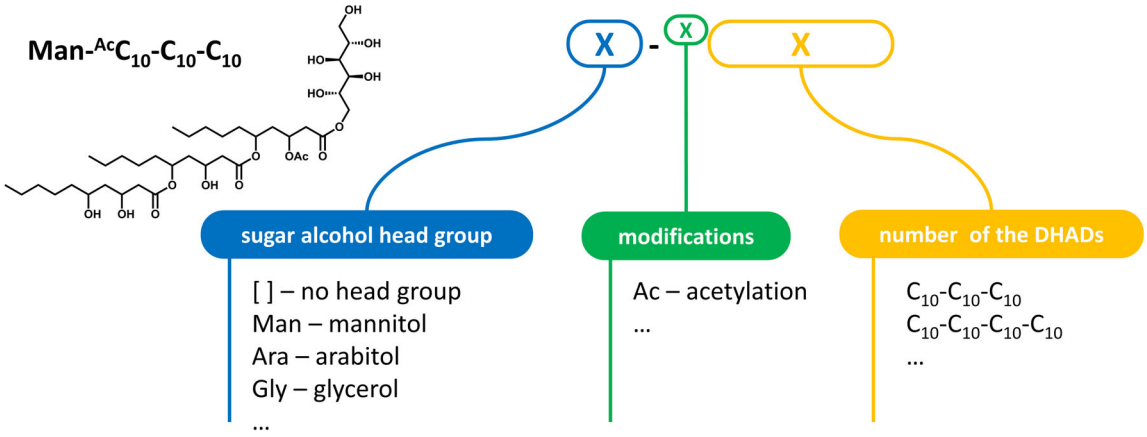

FIGURE 3 The proposed detailed notation of polyol lipids and DDA with an example in the top left corner.

Notably, the denomination of the aglycon exophilin in the polyol lipid biosynthesis pathway is even more ambiguous, again highlighting the importance of systematic naming. The word "exophilin" is used to describe two distinct groups of molecules that are entirely different from each other: (1) A group of proteins and (2) the mentioned biosurfactant, which is addressed here. The proteins are involved in the transport and secretion of vesicles in mammalian cells (Gibbs et al., 2004; Nagashima et al., 2002), while the biosurfactant was first discovered to be secreted by the marine microorganism *Exophiala pisciphila* (Doshida et al., 1996), hence the name. Exophilins are composed of only the hydrophobic part of the polyol lipids without the polyol headgroup (Figure 1). We propose using a more descriptive name for the biosurfactant and deriving its trivial name from its IUPAC name instead of the non-descriptive and ambiguous exophilin. Exophilin variants can contain three or four 3,5-dihydroxydecanoic acids (DHDA). For the congeners consisting of three DHDA we suggest the shorter trivial name tri-dihydroxydecanoic acid (or 3DDA in short), which is derived from the IUPAC denomination "5-((5-((3,5-dihydroxydecanoyl)oxy)-3-hydroxydecanoyl) oxy)-3-hydroxydecanoic acid." When four DHDAs are present, we suggest tetra-dihydroxydecanoic acid (or 4DDA in short). Further, to refer to all exophilins, we propose the name (oligo-)dihydroxydecanoic acid (DDA) (Figure 2).

In the context of their natural biosynthesis, polyol lipids and DDA are invariably synthesized as mixtures comprising various congeners differing in the type of head group and the number of DHDA units they contain (Scholz, Lipphardt, et al., 2020). To address the complexity arising from this mixture and to streamline nomenclature, we propose the collective term "*Aureobasidium* surfactants" to encompass this array of polyol lipids and DDA. This term acknowledges their shared biosynthetic origin from *Aureobasidium* fungi and reflects the compounds' heterogeneous nature.

The nomenclature for these glycolipids and their derivatives presented here has been developed with a focus on the building blocks of the overall molecular architecture. A detailed nomenclature for describing single congeners was proposed earlier (Scholz, Seyfried, et al., 2020), and we recommend its adoption to ensure clarity and consistency in future research and publications. The detailed notation proposes to use codified denominations according to the glycolipid's structures (Figure 3). The first position marks the sugar alcohol (Man—mannitol, Ara—arabitol, etc.). The following superscript indicates acetylation or related modifications to the 3-hydroxy group of the individual DHDAs. For acetylation, this is already implemented. Possible other modifications, such as esterification with, e.g., butanoic or propanoic acid, can be easily included. The last part indicates the number of the DHADs (mainly C_{10}-C_{10}-C_{10} and C_{10}-C_{10}-C_{10}-C_{10}). If no sugar alcohol is indicated, the molecule is a DDA.

Our proposed denominations (on both a macroscopic molecular and a more detailed level) based on molecular structures aim to eliminate ambiguity in the scientific discourse. This standardized approach will promote communication and research on these remarkable biosurfactants, impacting fields ranging from science to industry. A unified naming system for this intriguing class of natural compounds is essential for safety, innovation, and the exploration of their application.

AUTHOR CONTRIBUTIONS

T.T. conceived and conceptualized the letter and wrote the first draft, G.W. helped conceptualize and drafted parts of the letter, A.L. critically reviewed the letter, D.F.S. contributed knowledge in organic chemistry and reviewed the letter, Z.C. critically reviewed the letter,

L.M.B. critically reviewed and edited the letter, and H.H. helped to conceptualize, critically reviewed, and edited the letter. All authors contributed to and approved the final draft of the manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

ETHICS STATEMENT

No human or animal subjects were used in the research for this study.

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